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Big Thorne Project
Thorne Bay Ranger District, Tongass National Forest

Draft Environmental Impact Statement

Volume I

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File Code: 1950
Date: September 25, 2012

Dear Planning Participant:

Here is your copy of the Draft Environmental Impact Statement (DEIS) for the Big Thorne project on the Thorne Bay Ranger District, Tongass National Forest. This document analyzes a no-action alternative and four action alternatives. The alternatives would harvest from 93 to 189 million board feet (MMBF) of sawlog plus utility timber volume, and propose 1.7 to 17.5 miles of new NFS road construction, from 13.8 to 38.6 miles of temporary road construction, and from 15.6 to 39.0 miles of road reconstruction. Proposed harvest systems include both clearcutting and single-tree or group selection, and proposed logging systems include both conventional and helicopter.

Please review all alternatives since any alternative, combination of alternatives, or a new alternative within the range of these alternatives may be selected in the final decision for this project.

It is important to this planning process that you as a reviewer provide comments. Comments should be submitted prior to the close of the comment period and should clearly articulate your concerns (40 CFR 1503.3).

Comments received in response to this document, including names and addresses of those who comment, will be part of the public record for this proposed action. Comments submitted anonymously will be accepted and considered, but will not provide the respondent with standing to participate in subsequent administrative or judicial review.

The 45-day comment period for the DEIS will begin on the day the Notice of Availability (NOA) is published in the Federal Register. A public notice will also be placed in the Ketchikan Daily News (the newspaper of record) and the Island News (the weekly newspaper on Prince of Wales Island, Alaska). The submission of untimely comments can affect your ability to participate in subsequent administrative or judicial review.

Please send written comments to James Kelly, IDT Leader POW Planning, ATTN: Big Thorne Project, Thorne Bay Ranger District, P.O. Box 19001, Thorne Bay, AK 99919. Comments may also be mailed to: comments-alaska-tongass-thornebay@fs.fed.us with Big Thorne Project in the subject line.

If you would like additional information please call the Thorne Bay Ranger District at (907) 828-3220 during regular business hours, Monday through Friday, 8 am to 4:30 pm.

The document can also be accessed online at: http://www.fs.fed.us/rl0/tongass/projects/projects.shtml.

Sincerely,

FORREST COLE
Forest Supervisor

Enclosure

Big Thorne Project

Draft Environmental Impact Statement

United States Department of Agriculture, Forest Service Alaska Region

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Abstract: The Forest Service proposes to harvest timber, build new roads, and reconstruct roads in the Big Thorne project area on north-central Prince of Wales Island. The project area includes the community of Thorne Bay and is adjacent to Coffman Cove. The actions analyzed in this EIS are designed to implement the Tongass Land and Resource Management Plan (Forest Plan). The EIS describes and analyzes in detail five alternatives, which provide differing outputs and responses to the issues identified for this project. None of the alternatives include entry into inventoried roadless areas.

Alternative 1 (No Action) proposes no harvest or roadbuilding activities in the project area at this time. Current and on-going management activities would continue.

Alternative 2 (Proposed Action) proposes to harvest about 123 MMBF of timber on about 4,944 old-growth acres, build 35 miles of National Forest System (NFS) and temporary road and reconstruct 19 miles of NFS road. No commercial thinning is included.

Alternative 3 proposes to harvest about 189 MMBF of timber on about 6,909 old-growth and 2,572 young-growth acres, build 56 miles of NFS and temporary road and reconstruct 39 miles of NFS road. Commercial thinning of young growth is included.

Alternative 4 proposes to harvest about 93 MMBF of timber on about 4,223 old-growth and 2,160 young-growth acres, build 19.5 miles of NFS and temporary road and reconstruct 21.5 miles of NFS road. Commercial thinning of young growth is included.

Alternative 5 proposes to harvest about 133 MMBF of timber on about 5,012 old-growth and 2,081 young-growth acres, build 15.5 miles of NFS and temporary road and reconstruct 16 miles of NFS road. Commercial thinning of young growth is included.

SUMMARY

Introduction

The Forest Service has prepared this Draft Environmental Impact Statement (Draft EIS) to analyze the potential impacts of timber harvesting and road management in the Big Thorne project area. This Draft EIS is in compliance with the National Environmental Policy Act 42 U.S.C. 4321 et seq. (NEPA), the National Forest Management Act of 1976, and all other relevant Federal and State laws and regulations.

Project Area

The Big Thorne project area is located in Southeast Alaska on Prince of Wales Island, around the community of Thorne Bay and south of Coffman Cove (see Figure 1-1) and covers approximately 232,000 acres of lands, including about 14,000 acres of State and private lands (non-National Forest System [NFS]) and 218,000 acres of NFS lands. Three land use designations (LUDs) comprise 84 percent of the project area; these consist of Old-Growth Habitat, Timber Production, and Modified Landscape, in descending order of abundance. The Scenic River LUD along the Thorne River-Hatchery Creek system also comprises significant acreage. The remaining LUDs consist of Scenic Viewshed, Recreational River, Research Natural Area, and miscellaneous small acreages. Combined, the three primary timber management LUDs (Timber Production, Modified Landscape, and Scenic Viewshed) comprise about 124,000 of the 218,000 acres of NFS lands in the project area. A fairly extensive road system already exists and an operating medium-sized sawmill exists on the island along with numerous small mills.

These conditions make the area more likely to produce economic and long-term sales. Longer-term sales are the best way to provide sufficient assurance of timber supply to support the necessary investment in new and upgraded manufacturing facilities by the timber industry.

In implementing Forest Plan direction in accordance with the Council of Environmental Quality regulations (40 CFR 1500-1508), this Draft EIS answers the following eight questions:

1 – What action is proposed?

The proposed action for the Big Thorne Project is to harvest timber on approximately 4,944 acres of forested lands using various sizes of timber sales, offered over multiple years, within the roaded land base on Prince of Wales Island. This harvest would include approximately 569 acres in Phase 2 lands of the Tongass Timber Sale Program Adaptive Management Strategy (USDA Forest Service 2008b), which would be reserved for small timber sales. These Phase 2 lands are included because they are not roadless and are very close to Thorne Bay. Approximately 35 miles of NFS and temporary roads would be constructed and about 19 miles of existing roads would be reconstructed. No harvest or road construction/reconstruction would occur within Inventoried Roadless Areas (IRAs). An estimated 107 million board feet (MMBF) of sawtimber and 16 MMBF of utility

volume could be made available to industry for harvest. Existing log transfer facilities would be used as needed. Harvest would include helicopter, ground-based, and cable yarding systems and could include even-aged and uneven-aged harvest prescriptions to achieve stand objectives. The proposed action and the action alternatives would meet the standards and guidelines and accomplish the goals and objectives of the Tongass National Forest Land and Resource Management Plan (Forest Plan) (USDA Forest Service 2008a).

Site-specific descriptions and resource considerations for each potential harvest unit are included as unit cards in Appendix B of the Draft EIS. All roads have been located and will be designed to avoid or minimize effects on wetlands. Resource considerations for each proposed new system road are included in the road cards in Appendix C of the Draft EIS. (40 CFR 1502.4(a); 1508.23; 1502.14; and 1502.5)

2 – Why is the project being proposed?

The Big Thorne Project is proposed at this time to respond to goals and objectives of the Forest Plan (USDA Forest Service 2008a), to help move the project area toward the desired conditions described in that plan, and to meet the needs of Southeast Alaska timber operators and residents. The Forest Plan includes both forest-wide goals and objectives and area-specific (LUD) goals, objectives, and desired conditions. The Big Thorne Project would respond to the following Forest Plan goals and objectives:

Timber—Goal (USDA Forest Service 2008a, 2-7)

- Provide for the continuation of timber uses and resources by the timber industry and Alaska residents.

Timber—Objectives (USDA Forest Service 2008a, 2-7)

- Seek to provide an economic timber supply sufficient to meet the annual market demand for Tongass National Forest timber, and the market demand for the planning cycle, up to a ceiling of this Plan's allowable sale quantity, which is 2.67 billion board feet in the first decade.
- Manage young growth to improve habitat for wildlife and commercial timber products.
- Provide 2-3 years supply of volume under contract to local mills and then establish shelf volume to maintain flexibility and stability in the sale program.
- Review the timber sale program and work with State and other partners to implement changes that will keep an "economic timber" perspective throughout the process and monitor the implementation of these reforms to ensure they are consistently employed across the Forest.

Local and Regional Economy—Goal (USDA Forest Service 2008a, 2-5)

- Provide a diversity of opportunities for resource uses that contribute to the local and regional economies of Southeast Alaska.

Local and Regional Economy—Objective (USDA Forest Service 2008a, 2-5)

- Support a wide range of natural resource employment opportunities within Southeast Alaska communities.

Seeking to meet timber demand for the Tongass National Forest is required by Section 101 of the 1990 Tongass Timber Reform Act (TTRA) which states that, "...to the extent consistent with providing for the multiple use and sustained yield of all renewable forest resources, seek to provide a supply of timber from the Tongass National Forest.." The interdisciplinary team (IDT) for the Big Thorne project found that the timber resources in the project area have potentially high value for local economies.

Southeast Alaska, and locally the Prince of Wales Island area, has experienced a significant decline in timber industry employment, with employment dropping sharply in the 1990s, following the closure of the region's two pulp mills, and continuing to decrease over the past decade. This decline has been mirrored by a decline in regional sawmill production and reduced harvest levels Forest-wide. Allowing the use of renewable timber resources would provide Southeast Alaska timber operators with the opportunity to generate and support jobs and income in the region (see Issue 1 – Timber Supply and Economics in Chapter 1 and Chapter 3).

In addition, given the relevant Forest Plan goals and objectives and based on analysis of existing conditions in the project area, the interdisciplinary team found that the roaded landscape, tree species composition, and tree quality of the Big Thorne project area provides opportunity for economic timber harvest. Further, because of its central location on the Prince of Wales Island road system, the Big Thorne project area has economic transportation connections to the largest active sawmill and one of the highest concentrations of small operators in Southeast Alaska. Therefore, the Big Thorne project is proposed at this time to respond to the underlying need for a reliable, economic, and long-term timber supply, as well as to respond to the goals and objectives identified for the project area by the Forest Plan and to move the project area toward the desired condition described in the Forest Plan.

The purpose of and need for project action is further explained in Chapter 1 and in greater detail in Appendix A of this document (40 CFR 1502.13).

3 – Alternatives: What other action would meet the same need?

The proposed action, three action alternatives, and a "No Action" alternative have been analyzed in detail. Each action alternative provides a different response to key issues while still meeting the stated purpose and need of this EIS. Each of these action alternatives represents a site-specific proposal developed through an intensive, field-verified, interdisciplinary team evaluation of timber harvest unit and road design.

All action alternatives to the proposed action are consistent with the Forest Plan. All applicable Forest Plan Standards and Guidelines have been incorporated into the design of the proposed units and alternatives. While some alternatives have been designed to provide a greater measure of protection than is required by the Forest Plan for some resources (e.g., spreading out units and modifying prescriptions to reduce effects on

wildlife in Alternative 4), all alternatives were designed to meet Forest Plan Standards and Guidelines for all other resources. Additional direction comes from applicable laws and Forest Service manuals and handbooks. Each alternative complies with the Tongass Conservation Strategy designed to ensure the maintenance of viable populations of all vertebrate species on the Tongass by means of a comprehensive approach based on principles of conservation biology (see Issue 2 – Wildlife and Subsistence Use in Chapter 3). Forest Plan Standards and Guidelines for riparian areas are applied to all streams within the project area.

The following is a brief discussion of how the alternatives respond to the key issues identified for the Big Thorne project. A detailed comparison of these issues by project alternative is summarized in Chapter 2, and a full examination of effects of each alternative relative to key issues as well as other resource concerns is provided in Chapter 3. None of the action alternatives include harvest or road construction in IRAs.

Alternative 1

Alternative 1 is the No Action Alternative in the EIS. Under this alternative, no timber harvest or road building would take place at this time. As a result, this alternative would not meet the purpose and need for the project.

Alternative 2

Alternative 2 (see "1 – What action is proposed?") addresses Issue 1 – Timber Supply and Sale Economics, while limiting effects on other issues and resources. It would produce 107 MMBF of sawtimber plus 16 MMBF of utility volume (123 MMBF total volume) by harvesting 4,944 acres of old growth, building 35 miles of new roads (including formerly decommissioned roads), and reconstructing 19 miles of stored roads. It completely avoids harvest or road construction in IRAs. Alternative 2 would meet the purpose and need for the project.

Alternative 3

This alternative gives greatest priority to Issue 1 by emphasizing timber production and addressing timber sale economics. As such, it maximizes the amount of cable and shovel clearcut prescriptions among the alternatives, and includes commercial thinning of 50+ year-old stands. This alternative also adjusts the boundaries of small old-growth reserves (OGRs) outside of IRAs so that more of these OGRs are placed inside IRAs and the vacated roaded portions would be designated as Timber Production or Modified Landscape and made available for timber management. It completely avoids harvest or road construction in IRAs. Alternative 3 would meet the purpose and need for the project.

It would produce 167 MMBF of sawtimber and 22 MMBF of utility volume (189 MMBF total volume) by harvesting 6,909 acres of old growth, 2,572 acres of young-growth thinning, building 56 miles of new roads (including formerly decommissioned roads), and reconstructing 39 miles of stored roads.

Alternative 4

The primary objective of Alternative 4 is to address Issues 2 and 3, by maintaining landscape connectivity, protecting important wildlife corridors, and reducing impacts to sensitive plants and wildlife. Under this alternative, impacts to biodiversity and wildlife

were minimized by selecting harvest methods and prescriptions that would have a lighter touch on the landscape (i.e., resulting in less old-growth removal and less road construction); deferring or modifying boundaries of proposed units that could impact habitat connectivity or impact sensitive plant populations; and positioning legacy forest structure requirements to protect important wildlife habitats.

This alternative also adjusts the boundaries of small OGRs by incorporating the biologically preferred alternative based on an interagency review of small OGRs. Areas vacated by small OGR modifications would be designated as Timber Production or Modified Landscape and made available timber harvest. It completely avoids harvest or road construction in IRAs. Alternative 4 would meet the purpose and need for the project.

Alternative 4 would produce about 83 MMBF of sawtimber and 11 MMBF of utility volume (93 MMBF total volume) by harvesting 4,223 acres of old growth, thinning 2,160 acres of 50+ year-old young growth, building 19.5 miles of new roads (including formerly decommissioned roads), and reconstructing 21.5 miles of stored roads.

Alternative 5

Alternative 5 addresses watershed effects (Issue 4) and other issues raised by minimizing road construction, road-stream crossings, reducing cable or shovel logging, and reducing harvest in watersheds with high levels of harvest within the past 30 years. This alternative increases harvest volume by including commercial thinning units in young-growth stands 50 years of age or older to benefit watershed function. It completely avoids harvest or road construction in IRAs. Alternative 5 would meet the purpose and need for the project.

This alternative would produce about 117 MMBF of sawtimber and 16 MMBF of utility volume (133 MMBF total volume) by harvesting 5,012 acres of old growth, thinning 2,081 acres of 50+ year-old young growth, building 15.5 miles of new roads (including formerly decommissioned roads) and reconstructing 16 miles of stored roads. Only 1.7 miles of the new roads would be NFS roads; the remaining 13.8 miles would be temporary roads.

4 – What would it mean not to meet the need for project action?

Not meeting the need for timber production in the project area would mean that Forest Plan requirements for continuous yield of timber would have to be met in other areas (see Appendix A – Reasons for Scheduling the Environmental Analysis of the Big Thorne Project). Harvest from micro-sales would continue to occur in the Big Thorne project area if this project does not go forward. However, harvest in this manner does not include a landscape-level approach, does not provide a balanced view of resource needs, and would contribute only a minimal amount of wood fiber to the local and regional economies of Southeast Alaska. In the absence of a long-term (i.e., multi-year) stable supply of economic timber from the Big Thorne Project or elsewhere, the future viability of existing mill operators on Prince of Wales Island and elsewhere in the region would be adversely affected (see Issue 1 – Timber Supply and Economics in Chapter 3) ((40 CFR 1508.25(b)(1); and 1502.14(d)).

Summary

5 – What are the effects of the proposed action, and alternative actions — in comparative format?

The following four issues were determined to be potentially key or significant and within the scope of the project decision. The IDT developed the alternatives to the proposed action to address these issues. Chapter 2, Alternatives, introduces how the alternatives meet the purpose and need for the project, and compares outputs, objectives and effects of the alternatives in terms of the key issues (see Table 2-1, Comparison of Alternatives by Issue). Chapter 3 examines the existing condition and analyzes the effects or consequences of the project as it relates to these issues. The following summarizes these effects:

ISSUE 1 – Timber Supply and Timber Sale Economics

Each of the four action alternatives is designed to be responsive to the need for a reliable, economic supply of sawtimber to meet market demand. These alternatives also have the potential to support timber industry employment and benefit local and regional economies. Alternative 3 would produce the largest volume of timber, followed by Alternatives 5, 2, and 4 in that order. Assuming constant job/MMBF ratios, the alternatives with more volume would have a higher potential to support employment and income in local economies. Total estimated direct employment ranges from 391 to 455 jobs (annualized job-years) under Alternative 4 to 792 to 915 jobs under Alternative 3, reflecting the relative volumes that would be made available under each alternative. The project would also support indirect jobs within the region.

For timber volume to contribute to the stated purpose, it must also be economically viable. Current indicated bid values are positive for three of the four action alternatives, ranging from about $7/MBF under Alternative 5 to almost $56/MBF under Alternative 2, the proposed action. The indicated bid value for Alternative 4 is negative at -$8/MBF under current economic assumptions. The quantity of economically viable timber volume available at project implementation would depend on a number of factors. Changes in regional and global timber markets and other factors such as fuel costs can dramatically affect stumpage values and logging costs at the time of implementation and harvest. The full economic benefits of a given alternative may not be available under poor market conditions.

Under Alternative 1 (No Action), there would be no timber volume available for sale through the Big Thorne Project. The project would not meet the purpose and need, which is to contribute to a supply of economic timber to industry on Prince of Wales Island and Southeast Alaska, in general (including both large and small operators), in a manner that is consistent with the multiple-use goals and objectives of the Tongass Forest Plan. The Big Thorne project is intended to provide a supply of economic timber and designed to include sufficient units and volume to allow the Forest Service to adjust future timber sale offerings from the project area to meet fluctuating market conditions, to the extent possible.

A stable and economic timber supply is intended to support local operators and encourage investment in the wood products industry as it transitions to include more young-growth harvesting and restoration activities. Timber from the Big Thorne project would represent

a portion of the timber supply available to Southeast Alaska's economy. A stable timber supply in Southeast Alaska depends on the success of many timber sales across the forest. As noted above, in the absence of a long-term (i.e., multi-year) stable supply of economic timber from the Big Thorne project or elsewhere, the future viability of existing mill operators would be adversely affected. Closure of one or more of the existing mills would result in a reduction in direct jobs and could also affect local businesses that support the sawmill sector.

ISSUE 2 – Old-growth Habitat LUD Modifications

Modifications to small old-growth reserves (OGRs) are proposed under Alternatives 3 and 4. Alternative 3 would exchange roaded portions of small OGRs (making these acres available for timber harvest) for substitute acres in IRAs. Alternative 4 would modify the current locations of small OGRs so that they correspond with biologically preferred locations, as identified by an interagency OGR review team. Alternatives 1, 2, and 5 would not modify small OGR boundaries.

Both Alternatives 3 and 4 would result in a net gain in old-growth reserve acres (590 acres in Alternative 3 and 4,288 acres in Alternative 4); though Alternative 3 would reduce the total amount of POG in small OGRs by 849 acres. Alternative 3 would increase the amount of suitable forest land available for timber production by 1,331 acres and Alternative 4 would reduce suitable and available forest land by 1,541 acres.

All existing and modified small OGRs would be consistent with Forest Plan acreage requirements. About half of the small OGR modifications under Alternative 3 would result in a tradeoff between a reduction in the amount of roads and early seral forest included in small OGRs for a reduction in the amount of POG habitats (e.g., deer winter range, goshawk and marbled murrelet nesting habitat, and low elevation old-growth), and sometimes a decrease in areas important for connectivity, included in the OGRs. Modifications in all small OGRs under Alternative 3 would increase the timber available to the Big Thorne project. Generally, small OGR modifications under Alternative 4 would increase inclusion of POG habitats in the OGRs and encompass important travel corridors, while decreasing forest land available for timber production.

ISSUE 3 – Wildlife and Subsistence Use

Alternative 1 (No Action) would have no direct, indirect, or cumulative effects on wildlife or subsistence use that are associated with the Big Thorne Project. All action alternatives would result in a decrease in productive old-growth (POG) habitat, resulting in a reduction of 4 to 7 percent from current amounts within the project area. Resulting impacts to biodiversity and landscape connectivity (fragmentation) would be greatest under alternatives that harvest the most POG. However, impacts would be reduced under alternatives that incorporate more uneven-aged harvest prescriptions. Likewise, impacts would be less under alternatives that incorporate more helicopter logging than conventional logging systems. Based on acres of POG harvested, the increase in number of POG patches, and the proportion of harvest that would be uneven-aged, Alternative 3 would have the greatest adverse effects to biodiversity, followed by Alternatives 2, 5, 4, and 1.

Reductions in POG would reduce habitat available for marten, goshawks, Prince of Wales flying squirrel, snag-dependent species (red-breasted sapsucker, hairy woodpecker, and brown creeper), spruce grouse, endemic species, migratory birds, and other old-growth associated species. Habitat for these species is maintained by Forest Plan standards and guidelines, riparian buffers, beach and estuary fringe, OGRs, other non-development LUDs, and other aspects of the Forest Plan conservation strategy. Local reductions in populations may occur for these species, either through disturbance, habitat removal, or fragmentation (reduced dispersal and/ or population isolation), under all action alternatives.

Removal of low elevation POG under all alternatives would reduce the amount of available deer winter habitat, and thus would reduce deer habitat capability. Currently, deer habitat capability in all of the Wildlife Analysis Areas (WAAs) coinciding with the project falls below the Forest Plan standard of 18 deer per square mile considered necessary to maintain a sustainable wolf population and meet human harvest demands. Further reductions in deer habitat capability resulting from the action alternatives may result in local declines in the deer population, reducing the number of deer available to wolves and subsistence hunters. However, wolves are highly mobile within their territories and adjacent WAAs with higher deer densities would continue to support wolves in the vicinity of the project.

All action alternatives would increase road density. Current road densities in all the WAAs coinciding with the project are higher than the Forest Plan recommended threshold of 0.7 to 1.0 mile per square mile for areas where wolf mortality has been identified as a concern. Resulting total road densities (NFS and non-NFS lands) range from 1.7 to 2.8 miles per square mile depending on the WAA and alternative. Increased road density indirectly affects wolves, as well as other harvested species (marten and black bears), by increasing human access which may lead to increased harvest rates.

ISSUE 4 – Cumulative Watershed Effects

Alternative 1 (No Action) would have no direct, indirect, or cumulative watershed effects associated with the Big Thorne Project. All action alternatives would result in minor (effects would be measurable, with only small, localized changes to the site, lasting less than a week) to moderate (effects would be measurable at the stream reach or subwatershed scale, and last more than a week) effects on sedimentation and aquatic habitat. Alternative 3 would have the most effects, followed by Alternative 2. Compared to Alternatives 3 and 5, Alternatives 2 and 4 are similar to each other, and would have less effect on sedimentation and aquatic habitat than Alternative 3, but more effect than Alternative 5. Alternative 5 proposes the least amount of roads, substantially less road miles than Alternatives 2 or 3, and the fewest Class I, II, and III stream crossings, and would result in the least effects of all action alternatives.

(40 CFR 1502.14;1508.8;1502.16)

6– What factors will be used when making the decision among alternatives?

The factors that will influence the decision among alternatives include design and location of timber harvest, road construction and reconstruction, social and economic factors: see Issue 1 - Timber Supply and Sale Economics; Issue 2 – Old-Growth Habitat LUD Modifications; Issue 3 - Wildlife Habitat and Subsistence Use; Issue 4 – Cumulative Watershed Effects; and other resource concerns (also see the section Decision Framework in Chapter 1).

(40 CFR 1502.23)

7 – Are there any ways to mitigate adverse effects?

Possible adverse impacts may occur from implementing the actions proposed under each alternative. Measures have been formulated to mitigate or reduce these impacts, guided by direction in the Forest Plan. Entire units and partial units have been deleted from further consideration so that impacts can be avoided, because of resource concerns. Adverse effects, such as risks from windthrow to standing timber after harvest, have been evaluated, and means to minimize windthrow, such as windfirm buffers, are incorporated into all harvest unit prescriptions, where needed. If any previously undocumented goshawk nests are discovered at any time prior to or during the implementation of this project, the appropriate protection measures (nest buffers) would be enacted.

Resource specialists from the ID Team used on-the-ground inventories, computer (GIS) data, and aerial photographs to prepare unit cards (Appendix B) for each harvest unit in the unit pool for the project, and road cards (Appendix C) for each segment of road. The cards describe site-specific concerns, and how these concerns would be mitigated or avoided in the design of each unit and road segment.

Resource concerns and mitigation measures may be refined further during final layout, when specialists have another opportunity to refine their unit and road card recommendations.

Some general mitigation common to all alternatives is described in Chapter 2. A more detailed discussion by issue and resource is in Chapter 3 (40 CFR 1508.25(b)(3); 1502.14(f);1502.16(h); 1508.20; and 1500.2(e)).

8 – What monitoring is necessary?

Routine implementation monitoring is part of the administration of a timber sale contract. The sale administrators and road inspectors ensure that the prescriptions contained on the unit and road cards, and the unit silvicultural prescriptions, are incorporated into contract documents; they then monitor performance relative to contract requirements. The unit cards and road cards for this project are included in Appendices B and C to this Draft EIS, respectively. Input by resource staff specialists, such as fisheries biologists, soil scientists, hydrologists, and engineers, would be regularly requested during this implementation monitoring process. These specialists provide technical advice when questions arise during project implementation.

Summary

Tongass National Forest staff annually conducts a review of Best Management Practice (BMP) implementation and effectiveness. The results of this and other monitoring are summarized in a Tongass National Forest Annual Monitoring and Evaluation Report. This report provides information about how well the management direction of the Forest is being carried out and measures the accomplishment of anticipated outputs, activities and effects.

Draft EIS Organization

This Draft EIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. All numbers in this document are approximate. The document is organized into four chapters:

- Chapter 1 explains the purpose and need for the proposed action, discusses how the Big Thorne Project relates to the Forest Plan, and identifies the significant, or key, issues driving the Draft EIS analysis.
- Chapter 2 describes the proposed action, compares alternatives to the proposed action including a No-action Alternative, and summarizes the significant environmental consequences by issue.
- Chapter 3 describes the natural and human environments potentially affected by the proposed action and alternatives, and discloses what potential effects are anticipated.
- Chapter 4 contains the list of preparers, the Draft EIS distribution list, literature cited, a glossary, and an index.
- Appendices provide additional information on specific aspects of the proposed project.

Copies of this Draft EIS may be obtained from the Thorne Bay Ranger District office at Thorne Bay, Alaska. Additional documentation, including more detailed analyses of project area resources, may be found in the project record located at the Thorne Bay Ranger District office.

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Chapter 1

PURPOSE AND NEED FOR ACTION

CHAPTER 1 – PURPOSE OF AND NEED FOR ACTION

Document Structure

The U.S. Department of Agriculture, Forest Service (Forest Service) has prepared this Draft Environmental Impact Statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives for the Big Thorne Project. The document is organized into four chapters:

- *Chapter 1. Purpose of and Need for Action:* The chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- *Chapter 2. Alternatives, including the Proposed Action:* This chapter provides a more detailed description of the agency's proposed action as well as alternative methods for meeting the stated purpose and need. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- *Chapter 3. Affected Environment and Environmental Consequences*: This chapter discloses the environmental effects of implementing the proposed action and other alternatives. This analysis is organized with the three issues examined in detail presented first, followed by other resources for which effects may occur.
- *Chapter 4. References and Lists:* This chapter provides a list of preparers, the distribution list for the EIS, a glossary, and references used in EIS development. The last section of this chapter is an index.
- *Appendices:* The appendices provide more detailed information to support the analyses presented in the environmental impact statement.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Thorne Bay Ranger District.

Background

On September 17, 2008, the Under Secretary of Agriculture for Natural Resources and Environment directed the Forest Service to develop a work plan and proposed budget necessary to offer four 10-year timber sales, each with the capability of providing an average annual harvest of 15 to 20 million board feet (MMBF) per year for 10 years. The Chief's reply to the Under Secretary identified five areas that could meet the requirements

for a 10-year timber sale. Prince of Wales Island was among those areas listed, and the Big Thorne Project is one of the first two of these larger scale projects under study.

A Project Plan for the Big Thorne Project was completed in April 2010 in response to the above direction. The Forest Supervisor reviewed the Big Thorne Project Plan and determined that the proposed project is feasible to prepare, that it will be consistent with the 2008 Tongass National Forest Land and Resource Management (Forest Plan), and that further investment of resources and capital was warranted.

A fairly extensive road system already exists in the project area and an operating medium-sized mill along with many small mills exist on the island. These conditions make the area more likely to produce economic timber sales. Sales with higher volume provide more assurance to support any necessary investment in new equipment and upgraded manufacturing facilities by the timber industry.

After the Project Plan was completed, changes occurred to the management of the Tongass timber program. These included the shift from three mid-sized mills to one mid-sized mill and many smaller mills, a transition strategy to young-growth forest management and more emphasis on the use of stewardship contracting. For these reasons, the proposed action was designed to be more flexible as a "…multi-year timber sale component of a larger stewardship effort that will include opportunities such as restoration and enhancement activities that will be identified through other environmental analyses."

The proposed action was developed and public scoping began in February 2011. To respond to the comments on this project, continuing emphasis on the transition to the young-growth harvest, and the court decision that vacated the exemption to the 2001 Roadless Rule, alternatives were developed to the proposed action. This included adding commercial thinning of young-growth timber to the alternatives. The proposed action and the alternatives to the proposed action are described in Chapter 2.

Project Area

Prince of Wales Island is one island among a group or chain of islands in the southeastern Alaska panhandle known as the Alexander Archipelago. At approximately 2,577 square miles, Prince of Wales Island is one of the largest islands in the United States —third in size only to Hawaii (the Big Island) and Kodiak Island, AK—and is about the size of the State of Delaware.

The Big Thorne project area encompasses roughly 232,000 acres of north Prince of Wales Island in Southeast Alaska near Thorne Bay and Coffman Cove. The elevation ranges from sea level to over 3,000 feet (Figure 1-1). Annual precipitation may exceed 100 inches, with the highest rainfall occurring during October and the lowest in June. Individual storms vary dramatically and can produce intense rainfall and high winds.

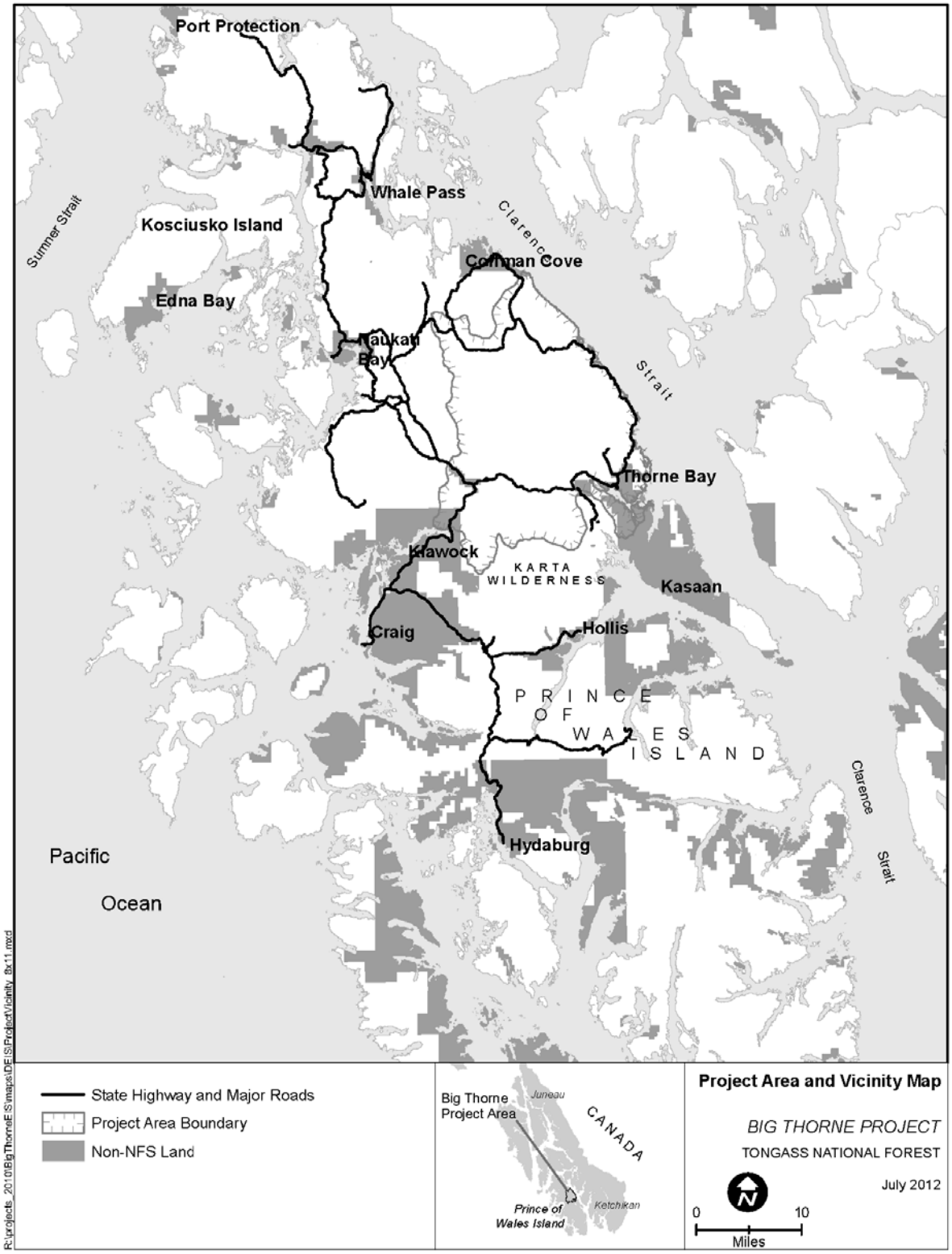

Figure 1-1. Project Area and Vicinity Map

1 Purpose and Need

The Tongass National Forest including Prince of Wales Island is covered primarily by temperate rainforest consisting of Sitka spruce and western hemlock, with lesser amounts of mountain hemlock, western redcedar, Alaska yellow cedar, and lodgepole pine. Red alder is locally abundant. The majority of the forest is old-growth forest (older than 150 years), but about 33 percent of the productive forest land in the project area is in young-growth forest, mostly the result of past timber harvest. The project area includes approximately 48,477 acres mapped as forest land that is suitable for timber production, including 22,387 acres of old-growth and 26,090 acres of young growth. Forest regeneration is rapid after timber harvest and most logged areas in the project area are covered by dense stands of 10- to 50-year-old trees.

Purpose and Need for Action

The purpose and need for the Big Thorne Project is to contribute to a long-term supply of economic timber for the timber industry on Prince of Wales Island and on the Tongass National Forest in general (including both large and small operators), in a manner that is consistent with the multiple-use goals and objectives of the Tongass Land and Resource Management Plan (Forest Plan). This would contribute to the timber supply that would help sustain the current timber industry while transitioning to a sustainable forest industry based on young-growth management. The purpose for the project and its underlying need are described in greater detail in the following subsections. The detailed rationale for scheduling a large sale in the Big Thorne project area is presented in Appendix A of this EIS.

Purpose

The purpose of a project can be defined in terms of the goal(s) and objective(s) to be achieved. The Forest Plan (USDA Forest Service 2008) contains multiple-resource goals and objectives, including timber management for commercial use, and defines the desired conditions to be attained through the multiple-use goals and objectives (see USDA 2008, especially Chapter 2). It is the purpose of this project to implement Forest Plan direction and work toward achieving its goals and objectives, including, but not limited to, the following:

Timber—Goal (USDA Forest Service 2008, 2-7)

- Provide for the continuation of timber uses and resources by the timber industry and Alaska residents.

Timber—Objectives (USDA Forest Service 2008, 2-7)

- Seek to provide an economic timber supply sufficient to meet the annual market demand for Tongass National Forest timber, and the market demand for the planning cycle, up to a ceiling of this Plan's allowable sale quantity, which is 2.67 billion board feet in the first decade.
- Provide 2-3 years supply of volume under contract to local mills and then establish shelf volume to maintain flexibility and stability in the sale program.
- Review the timber sale program and work with State and other partners to implement changes that will keep an "economic timber" perspective throughout

the process and monitor the implementation of these reforms to ensure they are consistently employed across the Forest.

Local and Regional Economy—Goal (USDA Forest Service 2008, 2-5)

- Provide a diversity of opportunities for resource uses that contribute to the local and regional economies of Southeast Alaska.

Local and Regional Economy—Objective (USDA Forest Service 2008, 2-5)

- Support a wide range of natural resource employment opportunities within Southeast Alaska communities.

Need

The Forest Service is under national direction to provide for multiple use of the national forests (Organic Administration Act of 1897, Multiple-Use Sustained Yield Act of 1960, and National Forest Management Act [NFMA] of 1976). In addition, the Tongass National Forest, specifically, is under national direction to provide a timber supply as a result of the Alaska National Interest Lands Conservation Act (ANILCA) and the Tongass Timber Reform Act (TTRA). These statutes identify that it is the Forest Service's obligation, subject to applicable law, "to seek to provide a supply of timber" from the Tongass that meets market demand annually and for the planning cycle. The Forest Plan, which was prepared under the direction of NFMA, was amended in 2008 and incorporates this direction.

The Big Thorne Project is proposed at this time to respond to the underlying need for a reliable, economic, and long-term timber supply, as well as to respond to the goals and objectives identified for the project area by the Forest Plan and move the project area toward the desired condition described in the Forest Plan (see Appendix A to this EIS and pages 2-1 and 2-2 of the Forest Plan). In recent years, Southeast Alaska and, more locally, the Prince of Wales Island area have experienced a significant decline in manufacturing and natural resource employment. This decline has been mirrored by a decline in sawmill industry production and harvest levels. Therefore, an underlying need exists for a reliable economic supply of sawtimber for Southeast Alaska mills to help support the timber industry and employment through the transition years until the industry can switch to a stable supply of young growth.

Given the relevant Forest Plan goals and objectives, the interdisciplinary team (IDT) found, based on analysis of existing conditions in the project area, that the roaded landscape, tree species composition, and tree quality provides opportunity for economic timber harvest. Further, because of its central location on the Prince of Wales Island road system, the Big Thorne project area has economic transportation connections to the largest active sawmill and one of the highest concentrations of small sawmill operators in Southeast Alaska.

Proposed Action

The proposed action is defined early in the planning process. It serves as a starting point for the IDT and gives the public and other agencies specific information on which to focus

comments. Using these comments and information from preliminary analysis, the IDT develops alternatives to the proposed action, which are described in detail in Chapter 2.

The proposed action for the Big Thorne Project is to harvest timber using a variety of prescriptions on approximately 4,944 acres of forested lands using various sizes of timber sales, offered over multiple years, within the roaded land base on Prince of Wales Island. Approximately 35 miles of NFS and temporary roads would be constructed and about 19 miles of existing stored roads would be reconstructed.

An estimated 107 MMBF of sawtimber could be made available to industry for harvest. This proposal would include timber harvest of approximately 569 acres (12.9 MMBF) in Phase 2 lands of the Tongass Timber Sale Program Adaptive Management Strategy, which would be managed in accordance with Forest Plan direction (see subsection titled Timber Sale Program Adaptive Management Strategy later in this chapter). The proposed Phase 2 lands are all outside of 2001 inventoried roadless areas. Existing log transfer facilities would be used as needed. Harvest would include helicopter, ground-based, and cable yarding systems using even-aged and uneven-aged harvest prescriptions to achieve stand objectives. All proposed activities would meet the standards and guidelines of the Forest Plan (USDA Forest Service 2008).

Decision Framework

Based on the environmental analysis in this EIS and in accordance with Forest Plan goals, objectives, and desired conditions, the Tongass Forest Supervisor will decide whether to make timber available from the Big Thorne project and the design and location of timber harvest units, as well as road construction and reconstruction. The decision will include, but is not limited to, the following items:

- the estimated timber volume to make available from the project, as well as the location, and design of timber harvest, road construction and reconstruction, and silvicultural practices used;
- road management objectives for all roads in the project area;
- any necessary project-specific mitigation measures and monitoring requirements;
- whether or not to enter Phase 2 areas for small sales;
- whether or not to modify small old-growth reserves (OGR) within the project area, which would require a Forest Plan amendment; and
- whether there may be a significant possibility of a significant restriction on subsistence uses.

Public Involvement

Public involvement is a key component of the planning process. The following paragraphs describe the public involvement activities that have occurred for the project area analysis.

Scoping

The Council on Environmental Quality (CEQ) defines scoping as "an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action" (40 Code of Federal Regulations [CFR] 1501.7). Among other things, the scoping process is used to invite public participation, to help identify public issues, and to obtain public comment at various stages of the environmental analysis process. Scoping begins early and is a process that continues until a decision is made.

The following is a summary of the letters, contacts, and meetings that have taken place during the planning of this project:

- April 1, 2010: Project first listed in the 3rd quarter of the Schedule of Proposed Actions for the Tongass National Forest.
- February 9, 2011: Scoping letter describing the proposed action, preliminary issues, possible alternatives, NEPA schedule, and the location and timing of scoping meetings was mailed to over 400 individuals, groups, and agencies. The 22 responses to this mailing, plus comments received during the scoping meetings, identified a range of issues and concerns.
- February 11, 2011: Notice of Intent to prepare an EIS published in the Federal Register (Vol. 76, No. 29).
- February 28 to March 3, 2011: Open house scoping meetings were held in Thorne Bay, Naukati, Coffman Cove, and Craig. The project background, proposed action, unit pool, and resource information was presented.
- 2010-2012: Informal meetings with individuals from the public or stakeholder groups.

Consultation with Federally Recognized Tribal Governments and Tribal Corporations

The following Federally recognized tribal governments and organizations have been consulted about this project:

- Central Council of the Tlingit and Haida Indian Tribes of Alaska
- Craig Community Association (CCA)
- Klawock Cooperative Association (KCA)
- Hydaburg Cooperative Association (HCA)
- Organized Village of Kasaan (OVK)
- Wrangell Cooperative Association (WCA)
- Ketchikan Indian Community
- Haida Corporation
- Kavilco, Inc.

- Klawock – Heenya Corporation
- Sealaska Corporation
- Shaan – Seet, Inc.

Tribal governments and organizations have not expressed any concerns about the Big Thorne Project during discussions to date. Regular consultation will continue during the planning of this project and beyond.

Other Agency Involvement

The Forest Service is committed to working closely with other agencies at all stages of planning and is responsible for coordinating project reviews by several other agencies. In some cases, the reviews are required because another agency has the authority to issue permits for a specific activity proposed by the Forest Service. In other cases, the reviews provide a time for dialogue with agencies responsible for ensuring that certain environmental conditions are met, such as clean water or healthy wildlife populations. This interagency communication helps provide information about area resources. This information is used to meet laws and regulations, develop alternatives and to identify ways to avoid or mitigate environmental effects. In many cases, an ongoing professional dialogue is maintained with these agencies throughout the planning process.

U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) provides a general review in accordance with their responsibilities under NEPA, Section 309 of the Clean Air Act, and Section 402 of the Clean Water Act.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (Corps) is responsible for approving proposals to dredge or place fill materials in the coastal waters of the United States under Section 404 of the Clean Water Act. The Corps also has administrative authority over activities associated with wetlands. Any road construction in wetlands is of interest to the Corps and the Forest Service must consider and reduce effects on those areas.

A 404 permit from the Corps is not necessary because roads constructed as part of this project are for silvicultural purposes and will follow the 33 CFR 323 guidelines and State-approved Best Management Practices (BMPs) to avoid and minimize impacts to wetlands.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) administers the Endangered Species Act. The Forest Service has ongoing consultation with the USFWS to determine if the proposed project will affect threatened or endangered species.

National Marine Fisheries Service

The National Marine Fisheries Service (NMFS) has jurisdiction over threatened or endangered marine life and for all anadromous salmon. The Forest Service consults with NMFS concerning possible effects to these species.

State of Alaska

The State of Alaska was involved in the development of the Forest Plan and entered into a Memorandum of Understanding (MOU) with the Tongass National Forest in March 2009, to promote cooperation between the Tongass and the State in implementing the Forest Plan and related environmental analyses and work associated with managing the land and resources of the Tongass. Several departments in the State of Alaska were asked to participate in the planning of the Big Thorne Project. They provided general comments and suggestions, as well as specific reviews.

These departments include:

Alaska Department of Environmental Conservation

The Alaska Department of Environmental Conservation (ADEC) participates in cooperative water quality management through Section 319 of the Clean Water Act and a Memorandum of Agreement with the Forest Service.

ADEC also issues a certificate of compliance with Alaska Water Quality Standards under Section 401 of the Clean Water Act for log transfer facilities and would be responsible for issuing any permits under Section 402 of the Clean Water Act, including those for stormwater discharge from forest roads, if necessary.

Currently, there is uncertainty as to whether a National Pollutant Discharge Elimination System (NPDES) permit would be required for stormwater discharges from logging roads associated with this project. This uncertainty is due to recent, ongoing court cases, a one-year Congressional moratorium on permitting, pending legislation, and proposed EPA rulemaking. Should it be determined that a NPDES permit is required for this project, the Forest Service will comply with any applicable NPDES permitting requirements."

Alaska Department of Fish and Game

The Alaska Department of Fish and Game (ADF&G) and the Forest Service have an MOU to reach concurrence prior to conducting any instream activities. A Title 16 concurrence must be reached before any work occurs below the ordinary high water for fish-bearing water bodies that will use, divert, obstruct, pollute, or change the natural flow or bed of water bodies.

An MOU is also in place between ADF&G and the Forest Service that covers wildlife research and monitoring and fisheries stream classification programs.

The ADF&G is especially interested in stream activities and other fish, water, wildlife, and subsistence issues. Discussions focused on wildlife habitat in regards to this project have occurred between representatives from the ADF&G and the Forest Service. ADF&G

staff participated in issue identification and alternative development during a 3-day Forest Service IDT meeting for this project.

Alaska Department of Natural Resources

The Alaska Department of Natural Resources (ADNR) Division of Forestry assisted in reconnaissance and consultation with the Big Thorne IDT regarding economic timber harvest. The ADNR issues tideland permits and the lease or easement necessary for the log transfer site. ADNR staff participated in issue identification and alternative development during a 3-day Forest Service IDT meeting for this project.

Office of Project Management and Permitting

The Office of Project Management and Permitting office provides overall coordination for the State's comments for large projects.

Alaska Office of History and Archeology

The Forest Service archeologist determined that no historic properties will be affected by any of the proposed alternatives. Under the terms of the existing Programmatic Agreement with the Alaska State Historic Preservation Officer and the Advisory Council on Historic Preservation (USDA Forest Service 2010), "the Forest may proceed with the undertaking in lieu of a consensus determination of eligibility pursuant to 36 CFR 800.4."

Issues

The IDT used an issue identification process to analyze comments received during scoping. This process was used to ensure that all significant issues were identified, and that all other issues were meaningfully addressed in the analysis. Comments were received from individuals, organizations, State agencies, and other Federal agencies. Each of the 300+ comments received during scoping was considered a potential issue, and was evaluated to determine in which of the following ways the comment was resolved or addressed:

- Determined to be outside the scope of the project (not site-specific)
- Already addressed by Forest Plan LUDs, Standards and Guidelines, or BMPs
- Already decided by law, regulation, or other higher-level decision
- Can be resolved through project-specific mitigation
- Can be addressed during processes or impact analyses routinely conducted by the IDT
- Can be addressed through spatial modification of actions during alternative design
- Used to drive or partially drive an alternative
- Support for the project
- Opposition to the project

NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail (40 C.F.R. § 1500.1(b)). This ensures that the analysis and documentation are focused primarily on the issues that are most important to the Big Thorne project area and the decision to be made. Other concerns, listed under Other Resource Considerations, are listed below and are summarized in Chapter 3.

After analysis of scoping comments, the following four issues were determined by the IDT to be potentially key or significant and within the scope of the project decision. The IDT developed alternatives to the proposed action to address these issues; Chapter 2 of this Draft EIS discusses and compares the alternatives. Additional concerns were considered but did not form a basis for an alternative to be analyzed in detail; these concerns are discussed in Chapter 2 under Alternatives Considered but Eliminated from Detailed Analysis.

Units of measure were defined to identify how each alternative responds to a significant issue. Measures were chosen that were quantitative where possible; predictable; responsive to the issue; and linked to cause and effect relationships. These measures describe how the alternative affects the resource or resources central to the issue. The following issues were used for the alternative development for the Big Thorne project.

Issue 1 – Timber Supply and Timber Sale Economics

Issue statement: *Timber supply and timber sale economics affect the stability of Southeast Alaska's forest products industry and the ability of the industry to contribute to the local and regional economies.*

This issue concerns both the financial efficiency and the salability of the proposed project. It also relates to the potential local employment and revenues generated for communities in the local area. Project design affects the viability of sales and the ability to offer them. Optimizing volume and net return on timber harvest will provide for flexibility over the life of the project and the ability to offer economically viable timber sales across fluctuating market conditions. The amount of timber available for sale from national forests and a stable supply affects local employment and revenues. It is also critical to match the range in the size of sales offered to the range in sizes of industry operators. Operators need economical timber to stay in business and loss of those operators would have an adverse impact on local economies.

Units of Measure

- Timber volume (old growth and young growth) by species
- Acres of harvest by logging system and prescription
- Miles of road construction and reconstruction
- Logging and road costs
- Indicated bid value ($$ per thousand board feet)
- Number of annualized direct jobs

Issue 2 – Old-Growth Habitat LUD Modifications

Issue statement: *Old-Growth Habitat LUD modifications for the small old-growth reserves (OGRs) are proposed to expand the suitable timber base within the roaded land base and also to modify the reserves for the biologically preferred locations within the project area. This may affect the amount and quality of wildlife habitat protected by the small OGRs, the amount and quality of suitable timber available in the project area, and other resources including fisheries, sensitive plants, scenery, and recreation.*

Two alternatives were developed and are evaluated that include Old-Growth Habitat LUD modifications. As a result, changes were made to the unit pool and the development of two alternatives discuss Old-Growth Habitat LUD modification.

As a result of these modifications, there are concerns about effects on the old-growth reserve system and the suitable forest land base. Effects on other resources, including fisheries, subsistence uses, sensitive plants, recreation, and scenery, are also of concern. All modifications are limited to the small OGRs; no changes were proposed to medium or large OGRs.

Units of Measure

- LUD acreage changes;
- Comparison to Forest Plan Appendices D and K criteria;
- Acres and volume suitable for timber production;
- Numbers of sensitive plant populations within OGRs;

Issue 3 – Wildlife Habitat and Subsistence Use

Issue statement: *The proposed action combined with past timber harvest would affect old-growth habitat and increase road density, which may affect a range of wildlife, including deer and wolves, and subsistence use of deer.*

Public and agency comments expressed concerns about wildlife and subsistence use in the project area. Concern was noted relative to deer, wolf, goshawk, black bear, marten, and other species. Of special concern are project effects on deer because of their importance to wolves and subsistence users. Because of its proximity to residents of Thorne Bay, Coffman Cove, Klawock, Craig, and Naukati, the Big Thorne project area is considered an important deer hunting area for these communities. The cumulative effects on old-growth habitat associated with additional harvest combined with past harvest and increasing road density were noted concerns.

Units of Measure

- Total, high-volume, and large-tree productive old growth (POG) acres by value comparison unit (VCU), wildlife analysis area (WAA), project area, and biogeographic province;
- Connectivity/fragmentation (qualitative analysis of corridors; reduction of POG acres; patch size analysis);

- Road density in miles per square mile (all roads [open and closed]) by WAA below 1,200 ft and for all elevations;
- Deer habitat capability by WAA and biogeographic province in deer per square mile;
- Deer winter habitat acres harvested by WAA;
- Goshawk habitat acres harvested by VCU;
- Marten deep snow winter habitat acres harvested by WAA (acres); and
- Abundance and distribution of, access to, and competition for known subsistence resources.

Issue 4 – Cumulative Watershed Effects

Issue statement: *The proposed action combined with past timber harvest would increase the percentage of each watershed area covered by timber harvest and would increase road densities in each watershed, potentially resulting in higher rates of sedimentation and/or other effects on aquatic habitats.*

Concern was expressed regarding the intensity of past harvest and road construction in the project area, and the potential cumulative effects on watersheds and fish associated with additional harvest. The project area includes a number of streams with high fisheries value.

Units of Measure

- Watersheds with more than 20 percent of basin area in young growth less than or equal to 30 years, including reasonably foreseeable future harvest.
- Watersheds with more than 2.5 percent of basin area in roads, including reasonably foreseeable future roads.
- Proposed numbers of Class I, II, and III stream crossings.

Other Resource Considerations

Other resource concerns are important, but were not used to drive alternative development. A more detailed discussion of these important resources and the protection measures used for them can be found in the specialist's resource reports and is summarized in Chapter 3.

Other resources considered in this analysis are listed below. Detailed discussions for each resource and protection measures can be found in specialist resource reports located in the project record and in Chapter 3 of this EIS.

- Karst
- Soils
- Climate Change
- Fisheries

- Wetlands
- Botany
- Invasive Species
- Timber and Vegetation
- Transportation
- Heritage
- Recreation
- Scenery
- Inventoried Roadless Areas and Wilderness
- Wild and Scenic Rivers
- Socioeconomics
- Environmental Justice

Relationship to the Forest Plan

The Forest Plan is an extensive forest-level analysis. It provides land and resource management direction for the Tongass National Forest. The Big Thorne Project analysis and subsequent implementation is designed to achieve the management direction of the Forest Plan as outlined in the purpose and need statement.

The Big Thorne Project DEIS is a project-level analysis; its scope is confined to addressing the significant issues and possible environmental effects of the project. It does not attempt to address decisions made at higher levels. However, it does implement direction provided at those higher levels. Where appropriate, the Big Thorne DEIS tiers to the Forest Plan Final Environmental Impact Statement (FEIS), as encouraged by the 40 CFR 1502.20.

Forest Plan Land Use Designations

The Forest Plan uses Land Use Designations (LUD) to guide the management of NFS lands within the Tongass. Each designation provides for a unique combination of activities, practices and uses. The Big Thorne project area includes seven LUDs, shown in Figure 1-2 and in Table 1-1. The goals and other aspects of each LUD are summarized below. Chapter 3 of the Forest Plan contains a detailed description of each LUD. Figure 1-2 also shows the locations of inventoried roadless areas for the 2001 Roadless Rule in relation to project area LUDs since commercial timber harvest and road construction is not allowed within inventoried roadless areas in all LUDs, including development LUDs.

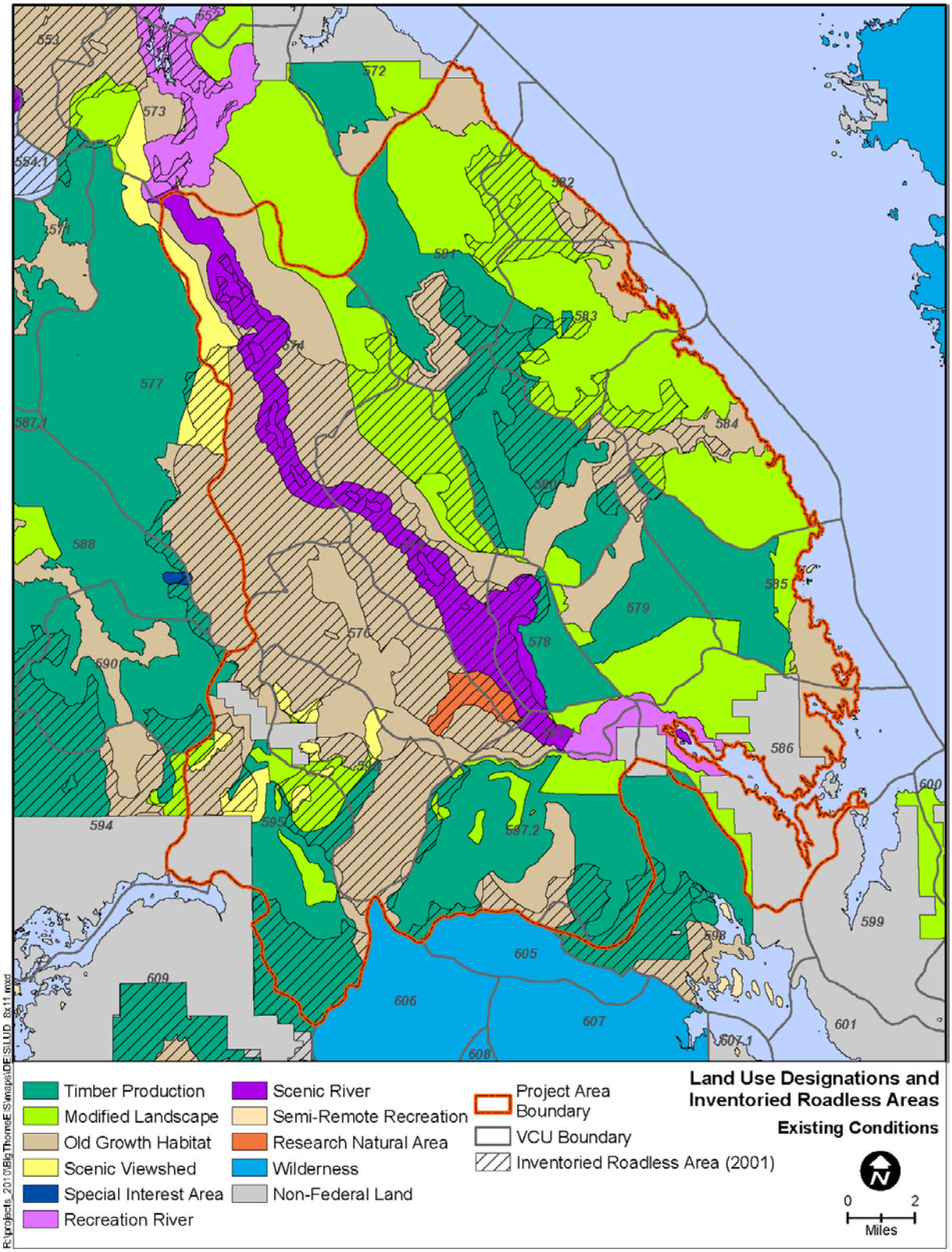

Figure 1-2. Big Thorne Project Area Land Use Designations and Inventoried Roadless Areas – Existing Conditions

Table 1-1. Forest Plan Land Use Designations and Acreages in the Project Area

Land Use Designation (LUD)	Acres	Percentage of Project Area
Non-Development LUDs [1/]		
Research Natural Area	1,621	1%
Old-growth Habitat	74,949	32%
Scenic River	14,180	6%
Recreational River	2,932	1%
Subtotal	**93,682**	**40%**
Development LUDs [2/]		
Timber Production	60,686	26%
Modified Landscape	58,885	25%
Scenic Viewshed	4,426	2%
Subtotal	**123,997**	**54%**
Total NFS Lands	**217,679**	**94%**
Non-NFS Lands	**14,169**	**6%**
Total (NFS + Non-NFS) Lands	**231,848**	**100%**

[1/] Non-development LUDs generally do not permit timber harvest or road construction.
[2/] Development LUDs allow timber harvest and road construction under certain conditions.

Research Natural Area LUD

The project area includes the Rio Roberts Research Natural Area (RNA), which covers 1 percent of the project area. This RNA was established in 1997 and is adjacent to the Thorne River Scenic River LUD. The focus of this LUD is to preserve areas of ecological importance in their natural condition for the purposes of research, monitoring, education, and/or to maintain natural diversity. Harvest is not proposed in this LUD.

Old-growth Habitat LUD

Approximately 32 percent of all lands in the project area are allocated to the Old-growth Habitat LUD. This allocation is represented by 10 small OGRs and the Honker Divide large OGR. The focus of this LUD is to maintain areas of old-growth forests and their associated natural ecological processes to provide habitat for old-growth associated resources. See pages 3-57 through 3-62 of the Forest Plan for an expanded description of this LUD. Harvest is not proposed in this LUD; however, boundary adjustments of small OGRs are proposed under two alternatives and thinning is proposed in some alternatives in specific young-growth stands.

Scenic River LUD

Approximately 6 percent of the project area is allocated to the Scenic River LUD along the Thorne River-Hatchery Creek corridor. The focus of this LUD is to manage river segments, recommended by the Forest Plan for Scenic River designation, to maintain their outstandingly remarkable values and classification eligibility until Congress designates the segments or decides not to designate them. Timber harvest on suitable forest land is allowed if adjacent lands are being managed for that purpose. See pages 3-81 through 3-87 of the Forest Plan for an expanded description of this LUD. No timber harvest is proposed in this LUD.

Recreational River LUD

Approximately 1 percent of the project area is allocated to the Recreational River LUD along the lower Thorne River. The focus of this LUD is to manage river segments, recommended by the Forest Plan for Recreational River designation, to maintain their outstandingly remarkable values and classification eligibility until Congress designates the segments or decides not to designate them. Timber harvest on suitable forest land is allowed if adjacent lands are being managed for that purpose, with consideration given to scenery. See pages 3-88 through 3-94 of the Forest Plan for an expanded description of this LUD. Most of the Recreational River LUD in the project area meets the adjacent LUD criterion. As a result, some timber harvest is proposed in this LUD.

Timber Production LUD

The Timber Production LUD makes up approximately 26 percent of the project area. The focus of the Timber Production LUD is to emphasize sustained, long-term timber production. Timber harvest activities are located and designed to meet timber objectives. See pages 3-116 through 3-121 of the Forest Plan for an expanded description of this LUD. Harvest is proposed in this LUD.

Modified Landscape LUD

Approximately 25 percent of the project area is allocated to the Modified Landscape LUD. Management within this LUD focuses on sustained, long-term timber production while minimizing the visibility of development in the foreground distance zone. This recognizes the scenic values of forested lands as viewed from identified Visual Priority Travel Routes and Use Areas (Forest Plan, Appendix F) and provides for modifying timber harvest practices accordingly by reducing the effects to scenery. See pages 3-109 through 3-115 in the Forest Plan for an expanded description of this LUD. Harvest is proposed in this LUD.

Scenic Viewshed LUD

Approximately 2 percent of the project area is allocated to the Scenic Viewshed LUD. Management within this LUD focuses on providing a sustainable yield of timber and a mix of resource activities while minimizing the visibility of developments as seen from Visual Priority Routes and Use Areas (Forest Plan, pages 3-101 through 3-108). Harvest is proposed in this LUD.

Timber Sale Program Adaptive Management Strategy

In an effort to balance competing demands for timber production and preservation of undeveloped areas, the Timber Sale Program Adaptive Management Strategy was approved in the 2008 Forest Plan Record of Decision (USDA Forest Service 2008b). Under this strategy, the operation of the timber sale program will be implemented in three phases, as determined by actual timber harvest levels. The majority of the project area suitable lands are identified as Phase 1 lands. Phase 1 includes most of the roaded portion of the ASQ land base, along with most of the lower value inventoried roadless areas. The Phase 1 portion of the land base could sustain a level of timber harvest of about 150 MMBF. The scheduled timber sale program will generally be confined to this land base

until such time as the level of timber harvest reaches at least 100 MMBF for 2 consecutive years. Until that time, personal use of timber, micro sales, salvage sales, small commercial timber sales generally less than 1 MMBF, young-growth management projects, and the roads associated with these activities, would be allowed in development LUDs outside of the Phase 1 portion of the ASQ land base within Phase 2 lands.

Approximately 569 acres of timber harvest is being considered for Phase 2 lands (see Chapter 2). This area includes the Timber Production LUD portion of VCU 5760, which occupies an area of land along the southeastern edge of the Honker Divide large OGR and the eastern edge of the Scenic River LUD along the Thorne River, and a very small patch of VCU 5780 near Control Lake at the south end of the large OGR, which is Scenic Viewshed LUD. None of the areas proposed for harvest in either Phase 1 or Phase 2 lands are in 2001 inventoried roadless areas.

Other Related Efforts

Stewardship Opportunities in the Project Area

Under Section 323 of Public Law 108-7, the Forest Service has been granted authority, until September 30, 2013, to enter into stewardship contracting projects. Stewardship contracting helps achieve land management goals while meeting local and rural community needs, including contributing to the sustainability of rural communities and providing a continuing source of local income and employment. On May 26, 2011 the Regional Forester approved the Big Thorne Project area as a stewardship area.

Stewardship contracting may be implemented using receipts generated by the Big Thorne Timber Sale; however, the Forest will identify potential stewardship projects separately from this environmental analysis. The cumulative effects of these reasonably foreseeable restoration and enhancement projects has been considered in this analysis for resources within the analysis area to the extent possible, but are not part of this proposed action.

A collaborative process is ongoing to identify restoration and enhancement projects in the Big Thorne project area and elsewhere on Prince of Wales Island. The projects from this collaborative effort could be integrated with timber harvest from the Big Thorne Project during implementation to develop an Integrated Resource Timber Contract. Direction specific to stewardship planning can be found in Forest Service Handbook 2409.19 Chapter 61.

The restoration and enhancement activities will be identified through other planning, including but not limited to, the Cobble Landscape Assessment, Luck Lake Watershed Restoration Plan, the Prince of Wales and Surrounding Islands Access Travel Management Plan. Appropriate environmental analysis will be done prior to inclusion in a stewardship contract. In addition, because this project extends over multiple years, the Forest Service may integrate the project during implementation with future restoration and enhancement projects not yet identified.

Examples of specific restoration and enhancement opportunities include (but are not limited to) roads and transportation activities (e.g., repairing ‘‘red pipes’’ or bridges, erosion control, vegetation removal, road closures after firewood or other biomass

removal, or road relocation); recreation activities (e.g., campground and trails improvements, picnic sites, or vegetation management); young-growth stand improvement; and wildlife and fisheries habitat improvement projects (e.g., beach fringe thinning, or placement of large woody debris in streams).

Relationship to the Access Travel Management Plan

The Big Thorne EIS incorporates by reference the Environmental Assessment for the Prince of Wales Access Travel Management Plan (POW ATM) (USDA Forest Service 2009). The POW ATM project considered the access management objectives for the existing NFS roads for the entire Prince of Wales Island. The Big Thorne Project considers the road management recommendations for the existing NFS roads and any proposed NFS roads needed to access timber for the Big Thorne project area, as described in Chapter 3. The Big Thorne Project also analyzes the temporary roads needed for timber access.

Currently, the road management objectives for the existing NFS roads within the Big Thorne project area are the same as in the POW ATM, and have been analyzed that way. Analyses conducted for the POW ATM Environmental Assessment have been used for the Big Thorne Project, as noted in this EIS, and included in the project record.

Applicable Laws and Executive Orders

Shown below is a partial list of Federal laws and executive orders pertaining to project-specific planning and environmental analysis on Federal lands. While most pertain to all Federal lands, some of the laws are specific to Alaska.

- Alaska Native Claims Settlement Act of 1971
- Alaska National Interest Lands Conservation Act of 1980
- American Indian Religious Freedom Act of 1978
- Archeological Resource Protection Act of 1980
- Bald and Golden Eagle Protection Act of 1940 (as amended)
- Cave Resource Protection Act of 1988
- Clean Air Act of 1970 (as amended)
- Clean Water Act of 1977 (as amended)
- Coastal Zone Management Act of 1972 (as amended)
- Endangered Species Act of 1973 (as amended)
- Executive Order 11593 (cultural resources)
- Executive Order 11988 (floodplains)
- Executive Order 11990 (wetlands)
- Executive Order 12898 (environmental justice)
- Executive Order 12962 (aquatic systems and recreational fisheries)

- Executive Order 13007 (Indian sacred sites)
- Executive Order 13112 (Invasive Species)
- Executive Order 13175 (government-to-government consultation)
- Executive Order 13443 (hunting heritage and wildlife conservation)
- Forest and Rangeland Renewable Resources Planning Act of 1974 (as amended)
- Magnuson-Stevens Fishery Conservation and Management Act of 1996
- Marine Mammal Protection Act of 1972
- Migratory Bird Treaty Act of 1918 (amended 1936 and 1972)
- Multiple-Use Sustained-Yield Act of 1960
- Native American Graves Protection and Repatriation Act of 1990
- National Environmental Policy Act of 1969 (as amended)
- National Forest Management Act of 1976 (as amended)
- National Historic Preservation Act of 1966 (as amended)
- National Invasive Species Act of 1996
- National Transportation Policy (2001)
- Organic Act of 1897
- Rivers and Harbors Act of 1899
- Tongass Timber Reform Act of 1990
- Wild and Scenic Rivers Act of 1968, amended 1986

Availability of the Project Record

An important consideration in preparing this Draft EIS is reduction of paperwork specified in 40 CFR 1500.4. This Draft EIS provides sufficient site-specific information to demonstrate a reasoned consideration of the environmental impacts of the alternatives and ways to mitigate the impacts. The project record contains supporting material that documents the NEPA process and analysis from the beginning of the project through project implementation.

The project record is located at the Thorne Bay Ranger District office in Thorne Bay, Alaska. Reference documents, such as the Forest Plan and the TTRA, are available for review at public libraries and Forest Service offices throughout Southeast Alaska, including the Forest Supervisor's Office in Ketchikan. The Forest Plan and its Final EIS are also available on CD-ROM and on the Internet (http://tongass-fpadjust.net/).

Map and Number Qualification

All map products in this document are reproduced from geospatial information prepared by the Forest Service. Geographic information system (GIS) data and product accuracy

may vary. Using GIS products for purposes other than those for which they were created may yield inaccurate or misleading results. The Forest Service reserves the right to correct, update, modify, or replace GIS products without notification. For more information, contact the Thorne Bay Ranger District.

In addition, the accuracy of calculations made from GIS layers varies with the quality of the mapping itself. Numbers presented in tables in this document may not sum correctly due to rounding. Other slight anomalies due to rounding may also occur. Therefore, all numbers should be considered as approximate.

Chapter 2
Alternatives

CHAPTER 2 – ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Introduction

This chapter describes and compares the alternatives considered by the Forest Service for the Big Thorne Project. It includes a discussion of how the alternatives were developed, a description of each alternative considered, and a map of each alternative considered in detail. In addition, it includes a description of monitoring and other features common to all action alternatives. This chapter also presents the alternatives in comparative form, focusing on the key, or significant issues, with the goal of sharply defining the differences among the alternatives and providing a clear basis for choice among options by the decision-maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative (e.g., helicopter logging versus ground-based and cable logging) and some of the information is based upon the environmental, social, and economic effects of implementing each alternative (e.g., the amount of soil disturbance caused by helicopter logging versus ground-based and cable logging). For a discussion and analysis of site-specific, project-level effects, consult Chapter 3, "Environment and Effects."

Alternative Development

An alternative is a set of activities designed to accomplish the goals described in the purpose and need section of Chapter 1. The proposed action (Alternative 2) is one of a number of possible approaches to accomplishing these goals by harvesting timber in the project area. It was developed during the early planning phase of this project. The planning phase included completing a Logging System and Transportation Analysis (LSTA) for the project area. During this analysis, the suitable timber in the project area was divided into logical harvest settings. These groups of settings were used to create the harvest unit pool. In addition, the roads needed to access the harvest unit pool were mapped. These units and the roads were surveyed in 2010 and 2011. During this field verification, the shape of the units and the locations of roads were modified to reflect on-the-ground conditions and many units and roads were modified or dropped from consideration because they were determined to be inconsistent with the Tongass Land and Resource Management Plan (Forest Plan) (e.g., they had unstable soils).

The IDT considered the significant issues and identified various alternatives to the proposed action to provide a reasonable range of options for meeting the purpose and need of this project. In addition to addressing the issues identified during scoping (see Chapter 1), these alternatives were designed to meet Standards and Guidelines defined in the Forest Plan (USDA Forest Service 2008) and applicable laws. Within this range, various combinations of alternatives can be considered in determining the selected alternative.

In addition to units and roads modified or dropped for reasons related to consistency with the Forest Plan, in early 2011 it was determined that all units and roads would be in the

roaded landbase outside 2001 inventoried roadless areas. As a result of using the roaded landbase outside roadless areas, exchanging the roaded portions of small Old-Growth Habitat LUD polygons (OGRs) for development LUDs in roadless areas was investigated. In order to maximize available timber, the feasibility of modifying the OGRs to be entirely within the roadless areas and still meet Forest Plan criteria was investigated. Additional field work was conducted to field verify the shape and location of these units and roads and their consistency with Forest Plan standards and guidelines. Then alternatives were developed that included units and roads in these roaded portions of Forest Plan OGRs).

In addition, an interagency team (including biologists from the Forest Service, U.S. Fish and Wildlife Service, and Alaska Department of Fish and Game) reviewed the locations of the OGRs with regard to roadless areas and their biologically preferred locations. As a result, modifications to OGR locations were identified and additional units and roads were added to the unit pool. An alternative was developed that incorporated the biologically preferred locations for OGRs.

Alternatives Considered in Detail

The Forest Service developed five alternatives, including the no action, the proposed action, and three action alternatives (alternatives to the proposed action). These action alternatives were developed in response to significant issues and to provide a reasonable range of alternatives.

Alternative 1 (No Action)

Under the no action alternative, no timber harvest or road construction would be implemented to accomplish Big Thorne Project goals. Current management plans would continue to guide management of the project area. Vegetation management activities including pre-commercial thinning of young stands (both riparian and wildlife thinning) would continue. Road maintenance, culvert replacement, and timber micro-sales would continue, and road closures prescribed by the Access Travel Management Plan would continue as funding allows. In addition, at some time in the future, a new timber project could be developed in the project area that incorporates commercial thinning of young-growth and/or old-growth harvest. A large-scale, color map of the existing conditions (Alternative 1) showing existing roads, existing productive old growth, and past harvest in the project area is provided in the map packet and on the CD accompanying this EIS.

Alternative 1 is analyzed to provide a baseline for evaluation of the effects associated with the action alternatives. Unlike the action alternatives, Alternative 1 does not meet the purpose and need for this project because it fails to address the timber supply and economics concern.

Alternative 2 (Proposed Action)

Alternative 2 meets the purpose and need of this project and balances short-term timber supply/economic aspects (Issue 1) with the wildlife habitat/subsistence (Issue 3) and watershed issues (Issue 4). This alternative implements Forest Plan direction and works

toward attaining its goals and achieving its objectives. A large-scale, color map for Alternative 2 showing proposed roads and harvest units along with existing roads and past harvest is provided in the map packet and on the CD accompanying this EIS.

Timber Harvest: This alternative would produce approximately 107 million board feet (MMBF) of old-growth sawtimber, plus 16 MMBF of utility volume. Sales would include both moderate to large and small sales and would be spread over about 10 years. This alternative includes clear-cutting (even-aged management) and partial harvest (uneven-aged management) silvicultural prescriptions, using cable, shovel, and helicopter logging systems to harvest old-growth timber from approximately 4,944 total acres (including 14 percent partial harvest). Helicopter-yarding would be conducted on approximately 33 percent of the acres. No thinning of young growth is included in this alternative. No changes to OGRs are proposed. Old-growth harvest would include 569 acres in Phase 2 lands of the Timber Sale Program Adaptive Management Strategy.

Per the wildlife Forest Plan standards and guidelines, legacy forest structure is incorporated into harvest units greater than 20 acres in value comparison units (VCUs) 5790, 5810, 5830, 5840, 5850, 5860, and 5972. Acres and volumes presented in this document account for reductions due to legacy areas within units. Preliminary locations for legacy are shown on the unit card maps (Appendix B).

Roads: Alternative 2 proposes approximately 35 miles of new road construction (includes 5 miles constructed on previously decommissioned road beds). Most of the new roads would be temporary and would be decommissioned after timber harvest and hauling is completed; 12 miles of the new roads would be system roads and would remain seasonally open for 1 to 5 years after harvest to allow firewood gathering, prior to being stored. Approximately 19 miles of existing stored roads would be reconstructed; these would also remain open for 1 to 5 years after harvest prior to being stored again.

Alternative 3

Alternative 3 was developed to address the timber supply and economics issue (Issue 1). This alternative would provide the most timber volume of all alternatives considered in detail. Under this alternative, unit design is such that volume and economic efficiency are emphasized within Forest Plan constraints. Alternative 3 meets the purpose and need of this project, implements Forest Plan direction, and works toward attaining its goals and achieving its objectives.

Alternative 3 includes modifications to some of the small OGRs in the project area. These modifications relocate portions of the small OGRs to be within the 2001 Roadless Rule inventoried roadless areas as much as possible from the current locations where there are existing roads. These roaded portions of the existing OGRs would then be allocated to LUDs where timber harvest would be allowed: i.e., Timber Production, Modified Landscape, and Scenic Viewshed (see Issue 2 in Chapter 1). Determination of which LUD to allocate to each individual parcel is based on the adjacent LUDs and Visual Priority Travel Routes and Use Areas.

Commercial thinning of older young-growth stands on medium to high sites was incorporated into Alternative 3. This would provide more volume and respond to the emphasis on transitioning to young-growth harvest.

The LUD modifications associated with the changes to OGRs are displayed in the revised LUD map for Alternative 3 in Figure 2-1. The net change in the area of Old Growth Habitat LUD within the project area would be an increase of about 590 acres (1 percent). Among the development LUDs, Timber Production would decrease by 1,105 acres (2 percent), Modified Landscape would increase by 886 acres (2 percent), and Scenic Viewshed would decrease by 372 acres (8 percent). A large-scale, color map for Alternative 3 showing proposed roads and harvest units along with existing roads and past harvest is provided in the map packet and on the CD accompanying this EIS.

Timber Harvest: This alternative would produce approximately 167 MMBF of old-growth and young-growth sawtimber, plus 22 MMBF of utility volume. Sales would include both moderate to large and small sales and would be spread over about 10 years. The majority of the harvest would be from old-growth timber (approximately 150 MMBF) on approximately 6,910 acres (including 16 percent partial harvest), after taking legacy areas within units into account. It includes clear-cutting and partial harvest (uneven-aged management) silvicultural prescriptions, using conventional cable, shovel, and helicopter logging systems. Helicopter yarding would be used on 37 percent of the old-growth acres. In addition, Alternative 3 includes commercial thinning of 50 to 65 year-old young growth using ground and cable logging systems on approximately 2,572 acres, producing approximately 17 MMBF (based on volume at time of harvest, ≥ 50 years old). Old-growth harvest would include 569 acres in Phase 2 lands of the Timber Sale Program Adaptive Management Strategy.

Per the wildlife Forest Plan standards and guidelines, legacy forest structure is incorporated into harvest units greater than 20 acres in VCUs 5790, 5810, 5830, 5840, 5850, 5860, and 5972. Acres and volumes presented in this document account for reductions due to legacy areas within units (see unit card map introduction in Appendix B and unit cards in accompanying volumes for preliminary legacy locations).

Roads: This alternative proposes approximately 56 miles of new road construction (including 15 miles constructed on previously decommissioned road beds). Most of the new roads would be temporary and would be decommissioned after timber harvest and hauling is completed; 18 miles of new roads would be system roads and would remain seasonally open for 1 to 5 years after harvest to allow for firewood gathering, prior to being stored. Approximately 39 miles of existing stored roads would be reconstructed; these would also remain open for 1 to 5 years after harvest prior to being stored again.

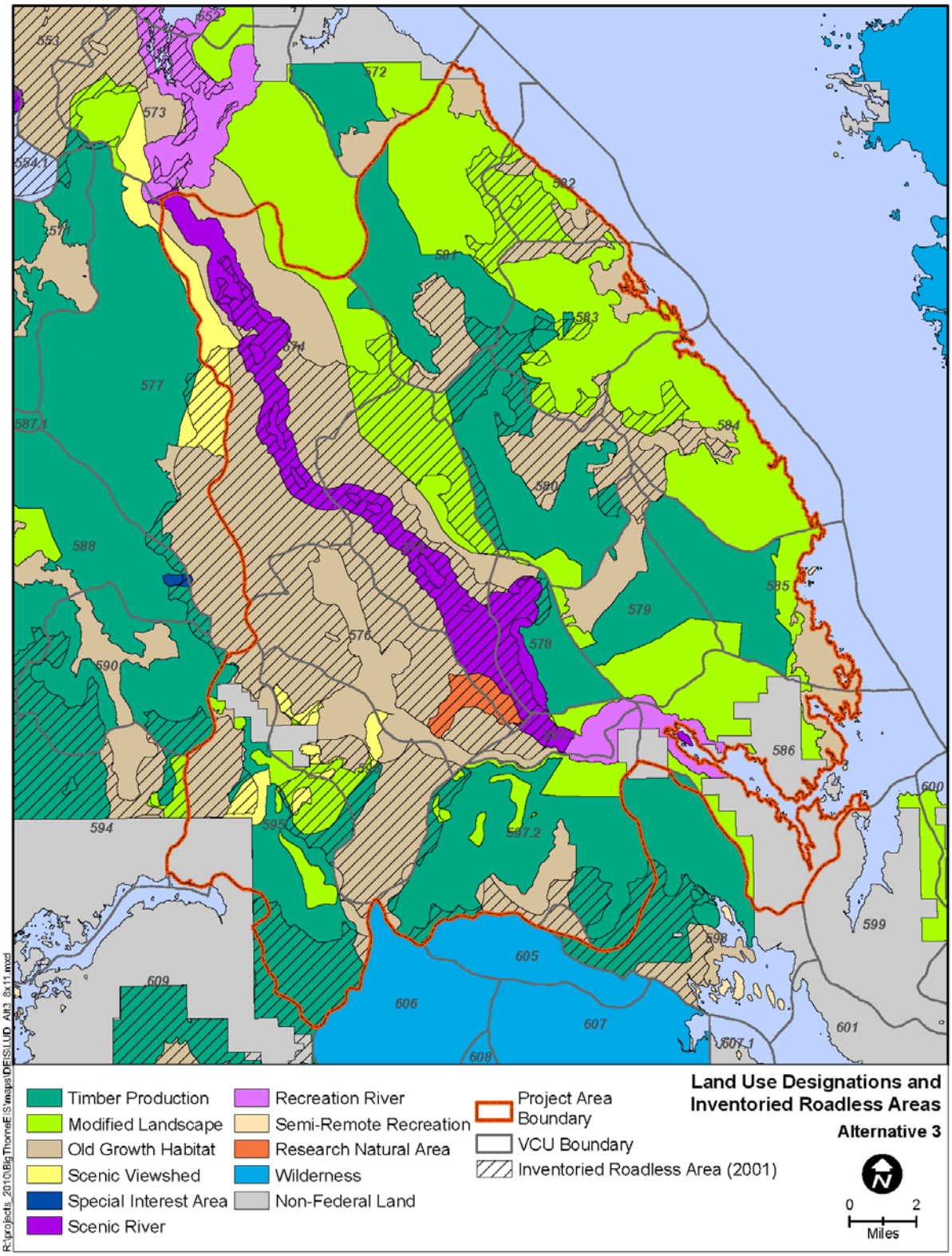

Figure 2-1. Alternative 3 LUD Map and Inventoried Roadless Areas after OGR Modifications (compare with Figure 1-2, the Existing LUD Map).

Alternative 4

Alternative 4 emphasizes the wildlife and subsistence issue (Issue 3), but also considers each of the other three issues. It emphasizes landscape connectivity and the protection of key wildlife travel corridors and minimizing impacts to sensitive plants and wildlife species, including wolves, goshawks, black bears, deer, and marten. Under this alternative, impacts to biodiversity and wildlife were minimized by selecting harvest methods and prescriptions that would have a lighter touch on the landscape (i.e., resulting in less old-growth removal and less road construction) and deferring or modifying boundaries of proposed units that could impact habitat connectivity or impact sensitive plant populations. Alternative 4 includes commercial thinning as a mechanism for achieving desired timber volumes while having the benefit of improving habitat quality in closed canopy stands. It completely avoids harvest or road construction in inventoried roadless areas. Alternative 4 meets the purpose and need of this project, implements Forest Plan direction, and works toward attaining its goals and achieving its objectives.

A component of this alternative is the incorporation of the biologically preferred alternative for small OGRs in the project area as recommended by the interagency review team (including biologists from the Forest Service, U.S. Fish and Wildlife Service, and Alaska Department of Fish and Game). This resulted in portions of some small OGRs being allocated to a Modified Landscape or Timber Production designation, as appropriate, based on the adjacent LUDs and viewshed boundaries. The net change in the area of Old Growth Habitat LUD within the project area would be an increase of about 4,288 acres (6 percent). Among the development LUDs, Timber Production would decrease by 1,073 acres (2 percent), Modified Landscape would decrease by 2,299 acres (4 percent), and Scenic Viewshed would decrease by 916 acres (21 percent). The LUD modifications associated with these changes to OGRs are displayed in the revised LUD map for Alternative 4 in Figure 2-2. A large-scale, color map for Alternative 4 showing proposed roads and harvest units along with existing roads and past harvest is provided in the map packet and on the CD accompanying this EIS.

Timber Harvest: This alternative would produce approximately 83 MMBF of old-growth and young-growth sawtimber, plus 11 MMBF of utility volume. Sales would include both moderate to large and small sales and would be spread over about 10 years. This alternative would harvest approximately 69 MMBF of old-growth timber on 4,223 acres (including 55 percent partial harvest), after taking legacy areas within units into account. It includes clear-cutting and partial harvest (uneven-aged management) silvicultural prescriptions, using cable, shovel, and helicopter logging systems. Helicopter yarding would be used on 56 percent of the old-growth acres. In addition, Alternative 4 includes commercial thinning of young growth using ground and conventional logging systems on approximately 2,161 acres of 50- to 65-year-old stands (including 72 acres in small OGRs), producing approximately 14 MMBF (based on volume at time of harvest, ≥ 50 years old). Old-growth harvest would include 431 acres of partial harvest (group selection) in Phase 2 lands of the Timber Sale Program Adaptive Management Strategy.

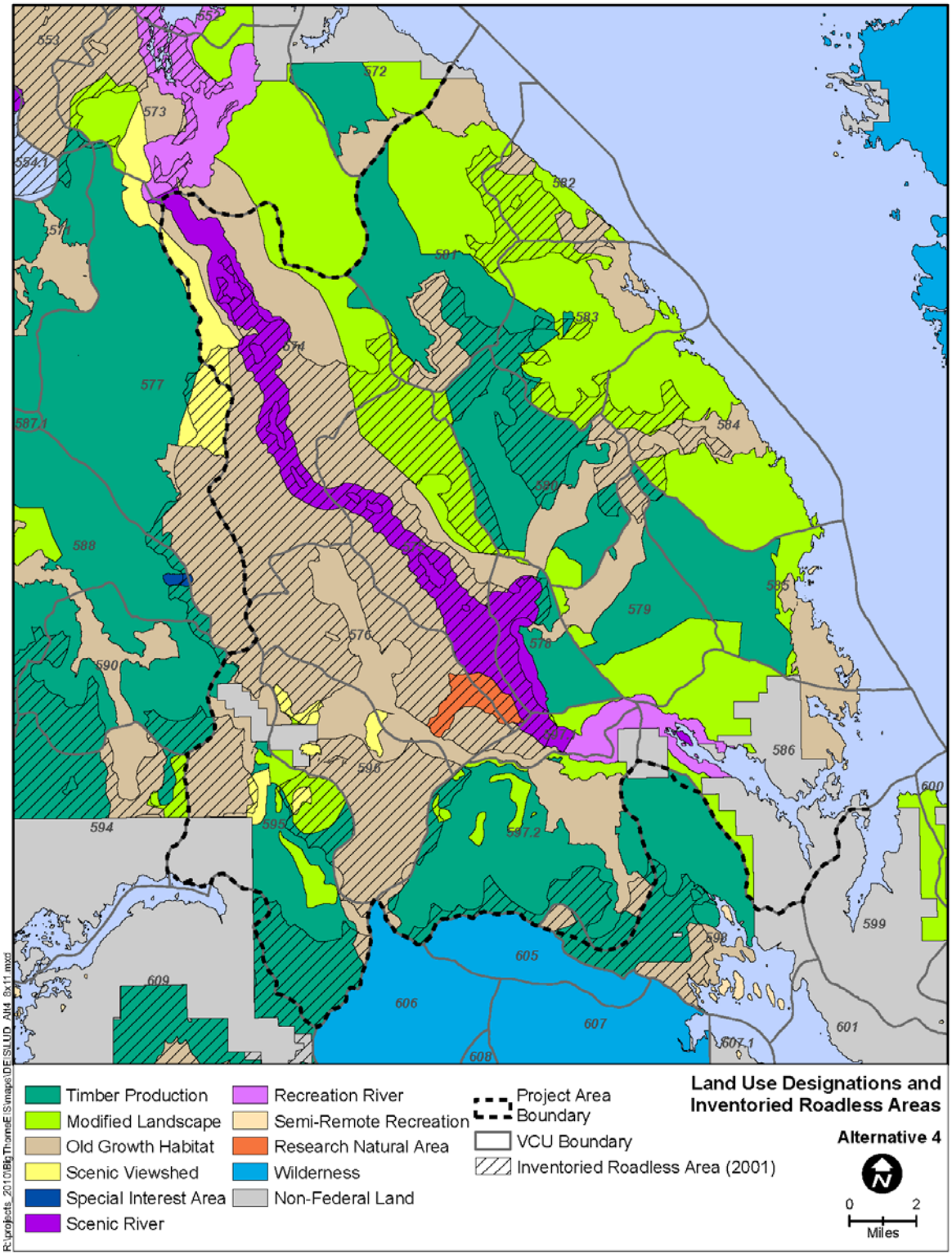

Figure 2-2. Alternative 4 LUD Map and Inventoried Roadless Areas after OGR Modifications (compare with Figure 1-2, the Existing LUD Map).

Per the wildlife Forest Plan standards and guidelines, legacy forest structure is incorporated into harvest units greater than 20 acres in VCUs 5790, 5810, 5830, 5840, 5850, 5860, and 5972. Acres and volumes presented in this document account for reductions due to legacy areas within units (see unit card map introduction in Appendix B and unit cards in accompanying volumes for preliminary legacy locations).

Roads: This alternative proposes approximately 20 miles of new road construction (includes 8 miles constructed on previously decommissioned road beds). Most of the new roads would be temporary and would be decommissioned after timber harvest and hauling is completed; 3 miles would be system roads and would remain seasonally open for 1 to 5 years to allow for firewood gathering, prior to being stored. Approximately 22 miles of existing stored roads would be reconstructed; these would also remain open for 1 to 5 years after harvest prior to being stored again.

Alternative 5

Alternative 5 addresses watershed effects (Issue 4) and other issues by minimizing road construction, road-stream crossings, ground-based logging, and reducing harvest in watersheds with high levels of harvest within the past 30 years. Given these primary considerations, this alternative attempts to maximize timber supply. Alternative 5 includes commercial thinning units in older young-growth stands where thinning could improve watershed function, benefit wildlife, and contribute to harvest volume.

Alternative 5 completely avoids harvest or road construction in inventoried roadless areas and does not adjust OGR boundaries. Alternative 5 meets the purpose and need of this project, implements Forest Plan direction, and works toward attaining its goals and achieving its objectives.

A large-scale, color map for Alternative 5 showing proposed roads and harvest units along with existing roads and past harvest is provided in the map packet and on the CD accompanying this EIS.

Timber Harvest: This alternative would produce approximately 117 MMBF of old-growth and young-growth sawtimber, plus 16 MMBF of utility volume. It includes clear-cutting (even-aged management) and partial harvest (uneven-aged management) silvicultural prescriptions, using cable, shovel, and helicopter logging systems to harvest approximately 104 MMBF of old-growth timber on 5,012 total acres (including 21 percent partial harvest), after taking legacy areas within units into account. Helicopter yarding would be conducted on approximately 64 percent of the acres. In addition, this alternative includes commercial thinning of older young-growth stands (50 to 65 years old) using ground and conventional logging systems on approximately 2,081 acres (including 72 acres in small OGRs), producing approximately 13 MMBF (based on volume at time of harvest, ≥ 50 years old). No changes to OGRs are proposed in this alternative. Old-growth harvest would include 485 acres in Phase 2 lands of the Timber Sale Program Adaptive Management Strategy.

Per the wildlife Forest Plan standards and guidelines, legacy forest structure is incorporated into harvest units greater than 20 acres in VCUs 5790, 5810, 5830, 5840, 5850, 5860, and 5972. Acres and volumes presented in this document account for

reductions due to legacy areas within units (see unit card map introduction in Appendix B and unit cards in accompanying volumes for preliminary legacy locations).

Roads: This alternative proposes approximately 16 miles of new road construction (includes 6 miles constructed on previously decommissioned road beds). Most of the new roads would be temporary and would be decommissioned after timber harvest and hauling is completed; 2 miles would be system roads and would remain seasonally open for 1 to 5 years to allow for firewood gathering, prior to being stored. All new construction would begin from the existing road system. Approximately 16 miles of existing stored roads would be reconstructed; these would also remain open for 1 to 5 years after harvest prior to being stored again.

Design Criteria and Mitigation Common to all Action Alternatives

All alternatives are designed to be consistent with the Forest Plan and all applicable Forest Plan standards and guidelines have been incorporated into the design of the proposed units and alternatives. While some alternatives have been designed to provide a greater measure of protection than is required by the Forest Plan for some resources, such as limiting road construction to reduce the impacts to sensitive watersheds (see Alternative 5), all alternatives were designed to meet Forest Plan standards and guidelines for these and all other resources. Additional direction comes from applicable laws and Forest Service manuals and handbooks.

The analysis documented in this Draft EIS discloses the possible adverse impacts that may occur from implementing the actions proposed under each alternative. Timber harvest and road construction design measures have been formulated to mitigate or reduce these impacts. These measures were guided by direction from the Tongass Forest Plan previously described (in this chapter and in Chapter 1). Resource specialists from the IDT used on-the-ground inventories, computer (geographic information system) data, and aerial photographs to prepare unit cards (Appendix B) for each harvest unit in the unit pool for the project. Cards are also prepared for each segment of system road (Appendix C).

Site-specific descriptions and resource considerations for each potential harvest unit are included as unit cards (see unit card introduction in Appendix B). Unit cards, along with supporting documents (e.g., detailed silvicultural prescription cards), serve as the prescription or design narrative for implementation of this project after the National Environmental Policy Act (NEPA) process is complete. Design elements for the construction of new system roads are described in detail in the road cards (see Appendix C). Resource specialists have included site-specific concerns on the cards and have described how these concerns would be mitigated (if not completely avoided) in the design of each unit and road segment. Resource concerns and mitigation measures may be refined further during final layout.

Road Management

All temporary roads would be decommissioned after timber harvest. All new system roads (new roads and new road construction over decommissioned road grades) and reconstructed ML1 stored roads would remain seasonally open for firewood gathering for 1 to 5 years after timber harvest, with seasonal closures between November 30 and May 1 (as designated on the Motor Vehicle Use Map). At the end of 1 to 5 years, all new system roads and reconstructed ML1 stored roads would be designated as not for public motor vehicle use and would be placed in a self-maintaining hydrologic status (stored).

Windthrow and Reasonable Assurance of Windfirmness Buffers

Windthrow can affect riparian areas that are otherwise buffered for fish habitat protection, in Class I, II, and III streams. In addition to mitigation measures found on unit and road cards, each harvest prescription considers the addition of a reasonable assurance of windfirmness (RAW) buffer to each Forest Plan minimum buffer in Class I, II, and III streams. This would provide additional protection to riparian management areas (RMAs) that may be affected by windthrow. As the first step in this consideration for RAW buffers, the IDT conducted a review of each stream using maps and local knowledge of the wind patterns for the area, and those streams recommended for field RAW review were identified. The unit cards (Appendix B) identify the buffers that need additional review for windfirmness. These RAW buffers would be applied with interdisciplinary consultation during sale layout on a case-by-case basis, because some areas would benefit from these additional buffers, while others would have no need for this additional measure. The need for this additional measure is most often apparent at the time of implementation.

In addition to RAW buffers along streams, some units include visual buffers for screening views from visual priority routes. In the unit cards for these units, it is stated that these buffers also need to be reviewed for RAW buffers during implementation.

Legacy Forest Structure

The intent of the Legacy Standard and Guideline is to ensure that sufficient residual trees, snags, and clumps of trees remain in timber harvest units within VCUs that have had concentrated past timber harvest activity and are at risk for not providing the full range of matrix functions, in order to meet the intent of the conservation strategy while providing flexibility to address on-the-ground implementation issues. In the project area, VCUs 5790, 5810, 5830, 5840, 5850, 5860, and 5972 require legacy forest structure. As a result, 30 percent of the original reconnaissance area is incorporated into legacy areas for harvest units greater than 20 acres. The reconnaissance area is defined as the original logging system/transportation analysis (LSTA) boundary prior to field verification. Legacy areas are shown on the unit cards. Acres and volumes presented in this document account for reductions due to legacy areas within units. Legacy placement in a unit sometimes varied by alternative, depending on the logging system, prescription, and alternative emphasis.

Invasive Plants

There will be mitigating actions to reduce the risk of increasing invasive plant introduction and spread. Mitigation measures include cleaning of equipment that is imported from outside Prince of Wales Island, use of approved rock sources, treatment of new introductions of high-priority invasives, and control of specific existing infestations in the project area (see Invasive Species in Chapter 3).

Watersheds and Fisheries

Rock sources will be examined for potential acid rock drainage (ARD) and questionable sources will not be used. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the Forest geologist will provide on-site inspection during excavation and construction to identify potential mineralized zones. If rock with potential for ARD is disturbed, mitigation will include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction. See the discussion of Water Quality in Issue 4: Cumulative Watershed Effects in Chapter 3 for a more-detailed discussion.

In order to minimize any effects of harvest on stream flow in the North Big Salt Lake (Steelhead Creek) subwatershed, annual harvest levels will be limited to ensure that less than 20 percent of the subwatershed is in previously harvested areas that are 30 years old or younger at any point in time. To do this, harvest will be limited as follows:

- Up to 151 acres can be harvested in 2015 and no harvest is allowed prior to 2015;
- Up to 226 additional acres can be harvested in 2016 (plus any remainder from 2015);
- Up to 114 additional acres can be harvested in 2017 (plus any remainder from 2015 and 2016);
- Up to 171 additional acres can be harvested in 2018 (plus any remainder from 2015, 2016, and 2017);
- No limitation in 2019 or later.

Marine Access Facility (MAF)

A marine access facility (MAF) is used to transfer materials and equipment from land to saltwater or vice versa and that contains a structure such as a mooring buoy, dock, log transfer facility (LTF), boat ramp, or a combination of these. An LTF is used to transfer logs and timber products from land-based transportation forms to water-based transportation forms (or vice versa). Two existing LTFs may be used for the timber sale. These are located in Coffman Cove and Thorne Bay.

Road Management Objectives

All Big Thorne alternatives have been analyzed using the same road management objectives for existing National Forest System (NFS) roads as the Prince of Wales Access Travel Management Plan Environmental Assessment analysis.

Sort Yards

The Forest Service has a log sorting facility at Thorne Bay that may be used for this project.

Best Management Practices and Monitoring

Best management practices (BMPs) are methods, measures, or practices to prevent or reduce water pollution, including but not limited to structural and non-structural controls, operation and maintenance procedures, other requirements and scheduling and distribution of activities (Forest Service Handbook 2509.22, Region 10 Soil and Water Conservation Handbook). They are the result of extensive efforts between the Forest Service and the State of Alaska to identify practices that will ensure that timber harvest activities minimize soil erosion and protect aquatic habitat. BMPs as applied to unit harvest and roads are in the unit and road cards (see Appendices B and C). The Forest Service recently issued National Core BMPs (USDA Forest Service 2012). Directives for using these BMPs are currently in development. The Big Thorne Final EIS will include the National Core BMPs and the project will implement the most up-to-date BMP guidance.

Monitoring

Monitoring activities can be divided into Forest Plan monitoring and project-specific monitoring. The National Forest Management Act requires that national forests monitor and evaluate their forest plans (36 Code of Federal Regulations [CFR] 219.11). Chapter 6 of the Forest Plan includes the monitoring and evaluation activities to be conducted as part of Forest Plan implementation.

The Forest Service is developing a National BMP Monitoring Program that addresses implementation and effectiveness of BMPs. Directives for using the monitoring protocols are expected in 2013. The Tongass National Forest has tested the national protocols for timber harvest and road activities and will adopt these protocols as part of Forest Plan Monitoring. Results will be reported in the Annual Monitoring and Evaluation Report.

Implementation (Forest Plan) Monitoring

Implementation monitoring assesses whether the project was implemented as designed and whether or not it complies with the Forest Plan. The information on the unit and road cards for the project decision is used to prepare the timber sale on the ground. Any adjustments are documented in a Change Analysis document and reviewed to see if a further NEPA analysis is needed.

The sale administrators and road inspectors ensure that the prescriptions contained on the unit and road cards, and the unit silvicultural prescriptions, are incorporated into contract documents; they then monitor performance relative to contract requirements. Input by resource staff specialists, such as fisheries biologists, soil scientists, hydrologists and engineers, is regularly requested during this implementation monitoring process. These specialists provide technical advice when questions arise during project implementation.

Possible effects to heritage resources are monitored as specified in the Programmatic Agreement (2002) with the State Historic Preservation Office by selecting areas of direct impact during and/or after actual ground disturbance.

Project-specific Effectiveness Monitoring

Project-specific effectiveness monitoring is designed to determine how well specific design features or mitigation measures work in protecting natural resources and their beneficial uses. Monitoring for prescription implementation would take place through required reforestation surveys and harvest inspection. Monitoring second-growth condition class would take place through periodic field surveys and treatment needs assessment. Monitoring for new infestations of invasive species and monitoring of infestation treatments would occur with project implementation.

The types of monitoring listed above are used to determine if the measures were implemented and if they are effective in mitigating the effects of the project or if they need to be revised. Information derived from monitoring can be used to develop improved or additional treatments to ensure that these safeguards will be effective in the future.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the proposed action provided suggestions for alternative methods for achieving the purpose and need. Some of these alternatives may have been outside the scope of this project, duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary environmental harm. Therefore, a number of alternatives were considered but dismissed from detailed consideration for reasons summarized below.

No Roads Alternative

The IDT considered a no roads alternative but decided that a Minimal Roads Alternative would satisfy the objectives of this alternative, while coming closer to satisfying the purpose and need. This alternative would minimize road construction and the number of fish-stream crossings, while maximizing harvest through helicopter-based logging. It would not restrict the reconstruction of roads that are in storage or the construction of new roads on previously decommissioned roadbeds. This alternative emphasizes aspects of the cumulative watershed effects and wildlife and subsistence issues and specifically responds to scoping comments by limiting changes in the surface area covered by roads within project area watersheds and by limiting any increase in wildlife analysis area (WAA) road densities.

The following alternative design criteria were used to develop an initial version of this alternative:

- Minimize road construction throughout the project area; very short spur roads (<0.1 mile) are allowed;

- Minimize the number of new road-stream crossings; and
- Maintain timber volume by converting cable or shovel settings requiring new roads to helicopter settings in units within 1 mile of existing roads.

Timber Harvest: This alternative includes mostly clear-cutting and partial cut (uneven-aged) management prescriptions using conventional cable and shovel logging systems and helicopter yarding to harvest approximately 100 MMBF of timber on about 5,800 total acres. Helicopter yarding would be conducted on approximately 4,500 of these acres (77 percent). No harvest would occur within inventoried roadless areas.

Roads: This alternative proposes to construct less than 2 miles of new road. These short spurs would be temporary roads and would be decommissioned after timber harvest and hauling is completed. All new construction would begin from the existing road system. Approximately 8 miles of existing stored roads would be reconstructed.

While the Minimal Roads alternative responds to watershed and wildlife issues associated with road densities, the high percentage of helicopter harvest indicates that the economics of this alternative would be very poor. It was decided that the Watershed emphasis alternative (Alternative 5) should be modified to reduce road densities further and increase the percentage of helicopter harvest, and due to the poor economics, the Minimal Roads alternative was moved into the Alternatives Considered, but not in Detail category.

Modification of Small and Large OGRs

This alternative is the same as Alternative 3 in all aspects, except that it also included modification of the large OGR in the Honker Divide area. It was developed to address the timber supply and economics issue. This alternative would increase the amount of available timber by modifying the roaded portions of both small and large OGRs.

Under this alternative, the large OGR would be reduced from approximately 178,000 acres in size to 163,000 acres in size (about 92 percent of original acres). The amount of productive old growth inside the large OGR would be reduced from approximately 92,000 acres to approximately 85,000 acres (about 92 percent of original acres). Both of these figures are well above the size criteria for large OGRs. In addition, there is potential for the addition of acreage from within adjacent roadless areas.

The total volume produced by this alternative was estimated at 233 MMBF. Approximately 208 MMBF would come from harvest of old growth and approximately 25 MMBF would be derived from young-growth thinning. The alternative would require construction of about 81 miles of new road and reconstruction of about 58 miles of roads that are currently in storage.

Because of the importance and spatial limitations for large and medium OGRs, as designated as part of the Tongass Conservation Strategy, this alternative was not carried forward for detailed analysis.

Yellow-Cedar Alternative

In response to public comments, related to yellow cedar and yellow cedar decline, an alternative that would avoid the harvest of healthy yellow cedar stands was considered.

Yellow cedar is commonly found in mixed-conifer stands and as a component of POG within the project area. Over 50,000 acres of POG occurs within non-development LUDs in the project area. This does not include the POG acreage in beach and estuary buffers, riparian buffers, and other POG identified as unsuitable for timber production by the Forest Plan. Therefore, no timber harvest, including that of yellow cedar, would occur in these areas. In addition, yellow cedar is a component of many stands of unproductive old growth, which is also not subject to timber harvest. As a result, this alternative was not carried forward for detailed analysis.

Comparison of Alternatives

This section compares outputs and provides a summary of the effects of each alternative in terms of the significant issues. Table 2-1 presents a direct comparison of the alternatives. This table is summarized from Chapter 3, which should be consulted for a full understanding of these and other environmental consequences.

Table 2-1. Comparison of Alternatives by Issue

Indicator	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
ISSUE 1: TIMBER SUPPLY AND TIMBER SALE ECONOMICS					
Timber Volume Estimates (MMBF)					
Sawlog (Net) Volume by Species					
Sitka Spruce	0	26.7	44.5	24.5	32.7
Western Hemlock	0	53.3	82.0	42.9	59.7
Western Redcedar	0	18.3	27.2	10.0	17.0
Alaska Yellow-Cedar	0	8.3	12.9	5.3	8.0
Total Sawlog Volume	**0**	**106.6**	**166.6**	**82.6**	**117.4**
Total Utility Volume	**0**	**16.3**	**22.3**	**10.8**	**15.7**
Total Old Growth Sawlog Volume	**0**	**106.6**	**150.0**	**68.7**	**103.9**
Total Young Growth Sawlog Volume	**0**	**0**	**16.6**	**13.9**	**13.5**
Total Volume (Sawlog + Utility)	**0**	**122.9**	**188.9**	**93.4**	**133.1**
Acres of Harvest by Logging System and Prescription (acres)					
Old-Growth (acres)					
Shovel, Even-age harvest	0	1,918	2,441	690	1,064
Shovel, Uneven-age harvest	0	15	15	330	0
Cable, Even-age harvest	0	1,383	1,871	699	730
Cable, Uneven-age harvest	0	0	0	145	0
Helicopter, Even-age harvest	0	931	1,474	510	2,148
Helicopter, Uneven-age harvest	0	696	1,108	1,849	1,070
Subtotal Even-age Harvest-clearcut	**0**	**4,232**	**5,786**	**1,899**	**3,942**
Subtotal Uneven-age Harvest-partial cut	**0**	**711**	**1,123**	**2,324**	**1,070**
Total Old Growth	**0**	**4,944**	**6,909**	**4,223**	**5,012**
Young-Growth (acres)					
Cable, Uniform Thin	0	0	556	418	406
Cable, Strip Thin	0	0	1,174	955	959
Ground-based, Uniform Thin	0	0	842	787	716
Total Young Growth	**0**	**0**	**2,572**	**2,160**	**2,081**
Total Treated Acres	**0**	**4,944**	**9,481**	**6,383**	**7,093**

Table 2-1. Comparison of Alternatives by Issue (continued)

Indicator	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
ISSUE 1: TIMBER SUPPLY AND TIMBER SALE ECONOMICS (continued)					
Miles of Road Construction and Reconstruction					
New NFS Road	0	10.5	15.2	2.5	1.7
New NFS Road (Constructed on Decommissioned Road Grade)	0	1.5	2.3	0.6	0
New Temporary Road Construction	0	19.2	26.0	9.1	7.7
New Temporary Road (Constructed on Decommissioned Road Grade)	0	3.8	12.6	7.3	6.1
Total New Road Construction	**0**	**35.0**	**56.1**	**19.5**	**15.5**
Reconstruction of Stored NFS Roads	**0**	**19.3**	**39.0**	**21.5**	**15.6**
Costs and Benefits					
Logging Costs ($/MBF) [1/]	$0	$243	$262	$298	$309
Haul Cost ($/MBF) [2/]	$0	$47	$51	$52	$49
Road Construction/Maintenance Costs ($/MBF) [3/]	$0	$59	$58	$44	$27
Indicated Bid Value ($/MBF)[5/]	$0	$55.59	$22.31	($7.51)	$6.56
Total Indicated Bid Value ($)	$0	$5,926,000	$3,717,000	($621,000)	$770,000
Jobs Related to Logging [4/5/6/]	0	241	377	187	265
Jobs Related to Sawmilling [4/5/6/]	0	156 - 275	242 - 429	117 - 214	169 - 304
Total Annualized Direct Jobs[4/5/6/]	**0**	**507 - 585**	**792 -915**	**391 - 455**	**557 - 646**
Direct Income ($million)	0	25.9 - 27.4	40.5 - 42.8	20.0 - 21.3	28.5 - 30.2
ISSUE 2—OLD GROWTH HABITAT LUD					
LUD Modifications (acres)					
Change in Old Growth Habitat LUD	0	0	+590	+4,288	0
Change in Development LUDs	0	0	-590	-4,288	0
Change in Suitable Timber (acres)					
Change in Mapped Suitable Timber	0	0	+1,331	-1,541	0
Small OGR Modifications Metrics					
# Small OGRs Consistent with Forest Plan Acreage Requirements	11 of 11	11 of 11	11 of 11	11 of 11	11 of 11
Net change in POG in Small OGRs (acres)	0	0	-849	+1,906	0
Sensitive Plants					
% of Project Area Lesser Round-leaved Orchid Individuals and Alaska Rein Orchid Individuals within OGRs	42%/35%	42%/35%	21%/24%	67%/43%	42%/35%

Table 2-1. Comparison of Alternatives by Issue (continued)

Indicator	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
ISSUE 3—WILDLIFE AND SUBSISTENCE USE					
Acres of Productive Old Growth (POG) Remaining					
Total POG					
Acres Remaining in Project Area	98,748	93,956	92,052	94,639	93,900
% Change from Existing	0%	-5%	-7%	-4%	-5%
Acres Remaining in North Central POW Biogeographic Province	564,306	562,402	564,989	564,250	564,306
% Change from Existing	0%	-1%	-1%	-1%	-1%
High-volume POG					
Acres Remaining in Project Area	43,902	41,399	40,182	41,483	41,290
% Change from Existing	0%	-6%	-8%	-6%	-6%
Acres Remaining in North Central POW Biogeographic Province	248,359	245,856	244,639	245,940	245,747
% Change from Existing	0%	-1%	-1%	-1%	-1%
Large-tree POG					
Acres of Remaining in Project Area	22,128	20,810	20,184	20,918	20,822
% Change from Existing	0%	-6%	-9%	-5%	-6%
Acres Remaining in North Central POW Biogeographic Province	127,306	125,988	125,362	126,096	126,000
% Change from Existing	0%	-1%	-2%	-1%	-1%
Number of POG Patches by Size Category Remaining (in the Project Area)					
0-25 acres	302	793	901	641	788
26-100 acres	95	104	105	97	103
101-500 acres	35	39	40	40	37
500-1,000 acres	6	5	6	5	6
1,000+ acres	9	10	9	9	9
Number of POG Patches by Size Category Remaining (all patches intersecting Project Area)					
0-25 acres	302	834	923	700	818
26-100 acres	95	102	103	96	102
101-500 acres	35	38	40	42	40
500-1,000 acres	7	6	6	5	6
1,000+ acres	8	10	10	9	9
Total change in no. patches (%)	0%	+120%	+140%	+89%	+117%
Deer Winter Habitat Capability Change at Project Completion & After 25 Years (% of 2012 value)					
WAA 1315	0%/-7%	-4%/-10%	-7%/-13%	-3%/-10%	-4%/-10%
WAA 1318	0%/-4%	-4%/-8%	-5%/-8%	-3%/-7%	-4%/-7%
WAA 1319	0%/-4%	-1%/-8%	-6%/-10%	-4%/-8%	-4%/-8%
WAA 1420	0%/-11%	-5%/-15%	-9%/-19%	-5%/-15%	-5%/-16%
North Central Prince of Wales Biogeographic Province	0%/-5%	0%/-5%	0%/-5%	0%/-5%	0%/-5%

Table 2-1. Comparison of Alternatives by Issue (continued)

Indicator	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
ISSUE 3—WILDLIFE AND SUBSISTENCE USE (continued)					
Acres of Deer Winter Range Harvest					
Acres of deep-snow deer winter range harvest proposed (WAAs 1315, 1318, 1319, 1420)	0	1,484	2,306	1,208	1,518
% Change from Existing	0%	-5%	-7%	-4%	-5%
Goshawk Habitat Harvest					
Acres of POG & High Volume POG harvest (WAAs 1315, 1318, 1319, 1420)	0/0	4,792/2,503	6,699/3,720	4,109/2,419	4,848/2,612
Marten Deep Snow Winter Habitat Harvest					
Acres of harvest (WAAs 1315, 1318, 1319, 1420)	0	1,485	2,306	1,208	1,519
% Change from Existing	0%	-3% to -6%	-5% to -13%	-2% to -6%	-3% to -6%
Road Density by Wildlife Analysis Area (WAA) Below 1,200 feet					
Road density—Open & Closed Roads (NFS and non-NFS lands)					
WAA 1315	2.7	2.8	2.8	2.8	2.8
WAA 1318	2.4	2.5	2.5	2.5	2.5
WAA 1319	1.6	1.7	1.8	1.7	1.7
WAA 1420	2.4	2.5	2.5	2.5	2.5
Road density—Open & Closed Roads (NFS lands only)					
WAA 1315	2.1	2.3	2.3	2.2	2.2
WAA 1318	0.7	0.8	0.8	0.8	0.8
WAA 1319	1.6	1.7	1. 6	1.6	1.7
WAA 1420	2.5	2.6	2.6	2.6	2.5

Table 2-1. Comparison of Alternatives by Issue (continued)

Indicator	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
ISSUE 4—CUMULATIVE WATERSHED EFFECTS[7/]					
Subwatersheds with more than 20% of Basin Area Harvested from 1981 to present (young growth 30 years of age or younger) including reasonably foreseeable projects.	• North Big Salt Lake • Pin[8/] • Thorne Bay	• North Big Salt Lake • Pin [8/] • Thorne Bay	• Goose Cr. • Luck Lake • North Big Salt Lake • Pin • Thorne Bay	• North Big Salt Lake • Pin [8/] • Thorne Bay	• North Big Salt Lake • Pin [8/] • Thorne Bay
Total miles of new road construction	0	35	56	19.5	15.5
Subwatersheds with more than 2.5% of basin area in roads (includes reasonably foreseeable and Big Thorne proposed roads)	• Deer Creek • Pin[8/] • Ratz Harbor • Salamander • Slide Creek • Thorne Bay • Thorne R. Intertidal [9/] • Torrent	• Deer Creek • Pin[8/] • Ratz Harbor • Salamand.[8/] • Slide Creek • Thorne Bay • Thorne R. Intertidal [8,9/] • Torrent	• Deer Creek • Pin • Ratz Harbor • Salamander • Slide Creek • Thorne Bay • Thorne R. Intertidal [9/] • Torrent	• Deer Creek • Pin[8/] • Ratz Harbor • Salamd.[8/] • Slide Creek • Thorne Bay • Thorne R. Intertidal [9/] • Torrent	• Deer Creek • Pin[8/] • Ratz Harbor[8/] • Salamd.[8/] • Slide Creek[8/] • Thorne Bay • Thorne R. Intertidal [9/] • Torrent
New Class I & II stream crossings[10/]	0	9	19	4	1
New Class III stream crossings[10/]	0	14	28	10	6

Notes:
1/ The harvesting costs for an operator of average efficiency.
2/ Haul Cost: Cost of round-trip truck transport to Klawock or Goose Creek, based on average distance and speed for alternative.
3/ Estimated average cost of new road construction, existing road reconstruction and maintenance.
4/ Memo Employment Coefficients and Indirect Effects, for NEPA planning: 2011 Update Source: Susan Alexander, Alaska Region Economist
5/ Sawmilling employment is based on a range, from maximum possible shipment out of state (50% of hemlock and Sitka spruce, and export of all Alaska yellow cedar), to no shipment of hemlock and Sitka spruce and export of 50% Alaska yellow cedar. Although all Alaska yellow cedar sold from the Tongass National Forest can be exported to foreign markets, regional sawmills often manufacture the species into high value lumber.
6/ Sawmill income is based on the same assumptions as employment and is presented as a range
7/ Analysis conducted at both the watershed and subwatershed scales. Cumulative effects presented in table are for subwatersheds.
8/ No harvest or roads constructed under this alternative. Threshold exceedences are due to past and reasonably foreseeable actions.
9/ Clipped to land area and does not contain marine areas.
10/ Includes both proposed new roads and proposed new construction on decommissioned roadbed.

Chapter 3
Environment and Effects

CHAPTER 3 – ENVIRONMENT AND EFFECTS

Introduction

This chapter provides a description of the existing environment in the Big Thorne project area and potential environmental effects of the alternatives. It also presents the scientific and analytical basis for the comparison of alternatives presented in Chapter 2.

Following each resource description is a discussion of the potential environmental effects associated with the implementation of each alternative. All significant or potentially significant effects, including direct, indirect, and cumulative effects, are disclosed. Effects are quantified where possible; qualitative discussions are also included. The means by which potential adverse effects will be reduced or mitigated are described in the unit and road cards in Appendices B and C of this Draft Environmental Impact Statement (EIS), respectively.

The discussions of resources and potential effects includes existing information documented in the 2008 Tongass Land and Resource Management Plan (Forest Plan) Final EIS (USDA Forest Service 2008c), other project EISs, project-specific resource reports, the results of field investigations, and other sources as indicated.

Land Divisions

The land area of the Tongass National Forest has been divided in several different ways to describe the resources. These divisions vary by resource since the relationship of each resource to geographic conditions and zones varies. The allocation of Forest Plan land use designations (LUDs) is one such division. Other divisions important for the effects analysis are described briefly here.

Project Area

The project area is identified by the interdisciplinary team (IDT) to define the boundary around the area in which the project will occur. The Big Thorne project area is approximately 232,000 acres in size; 48,500 acres are considered suitable for timber production. The project area includes approximately 14,000 acres of non-National Forest System (NFS) (state and private) land (see Figures 1-1 and 1-2).

Value Comparison Units

Value comparison units (VCUs) are distinct geographic areas, each encompassing a drainage basin containing one or more large stream systems. The boundaries usually follow major watershed divides. The Big Thorne project area includes 16 VCUs. Figure 1-2 in Chapter 1 shows VCU boundaries and numbers.

Game Management Units

Game management units (GMUs) are geographical areas defined by the Alaska Department of Fish and Game (ADF&G) to manage wildlife populations. Legal hunting and trapping regulations govern each unit. There are 26 GMUs in the State of Alaska, 5 of which are in Southeast Alaska. Prince of Wales Island is GMU 2.

Wildlife Analysis Areas

Wildlife analysis areas (WAAs) are land divisions used by the ADF&G for wildlife analysis and regulating wildlife populations. The project area includes portions of five WAAs, but project activities affect the following four WAAs: 1315, 1318, 1319, and 1420 (Figure 3-1). Information estimated by WAA is used in the wildlife and subsistence analyses.

Watershed

Watershed refers to the area that contributes water to a drainage or stream and to the portion of a forest in which all surface water drains to a common point. Watersheds can range from tens-of-acres that drain a single, small intermittent stream, to many thousands-of-acres for a stream that drains hundreds of connected intermittent and perennial streams. There are 21 watersheds and 48 subwatersheds with at least a portion of their drainage areas within the project boundary. The EIS analyzed 13 watersheds and 37 subwatersheds with proposed ground disturbing activities (see Figures WTR-1 and WTR-2 under Issue 4–Cumulative Watershed Effects).

Inventoried Roadless Area

Inventoried roadless areas (IRAs) are undeveloped areas typically exceeding 5,000 acres that met the minimum criteria for wilderness consideration under the Wilderness Act and that were initially inventoried during the Forest Service's Roadless Area Review and Evaluation (RARE II) process, subsequent assessments, or Forest planning. These areas have been modified since that review due to road construction and timber harvest. The inventory used for this project is the 2001 Roadless Rule inventory; the IRAs are identified in the set of inventoried roadless area maps contained in the Forest Service Roadless Area Conservation, Final Environmental Impact Statement Volume 2 dated November 2000. This is the inventory used for analysis for the Big Thorne Project. The Big Thorne project area includes portions of four roadless areas: the Kogish (#509), Karta (#510), and Thorne River (#511) IRAs are partially within the project area and the Ratz (#512) IRA is entirely within it (see Figure IRA-1 under Roadless Areas).

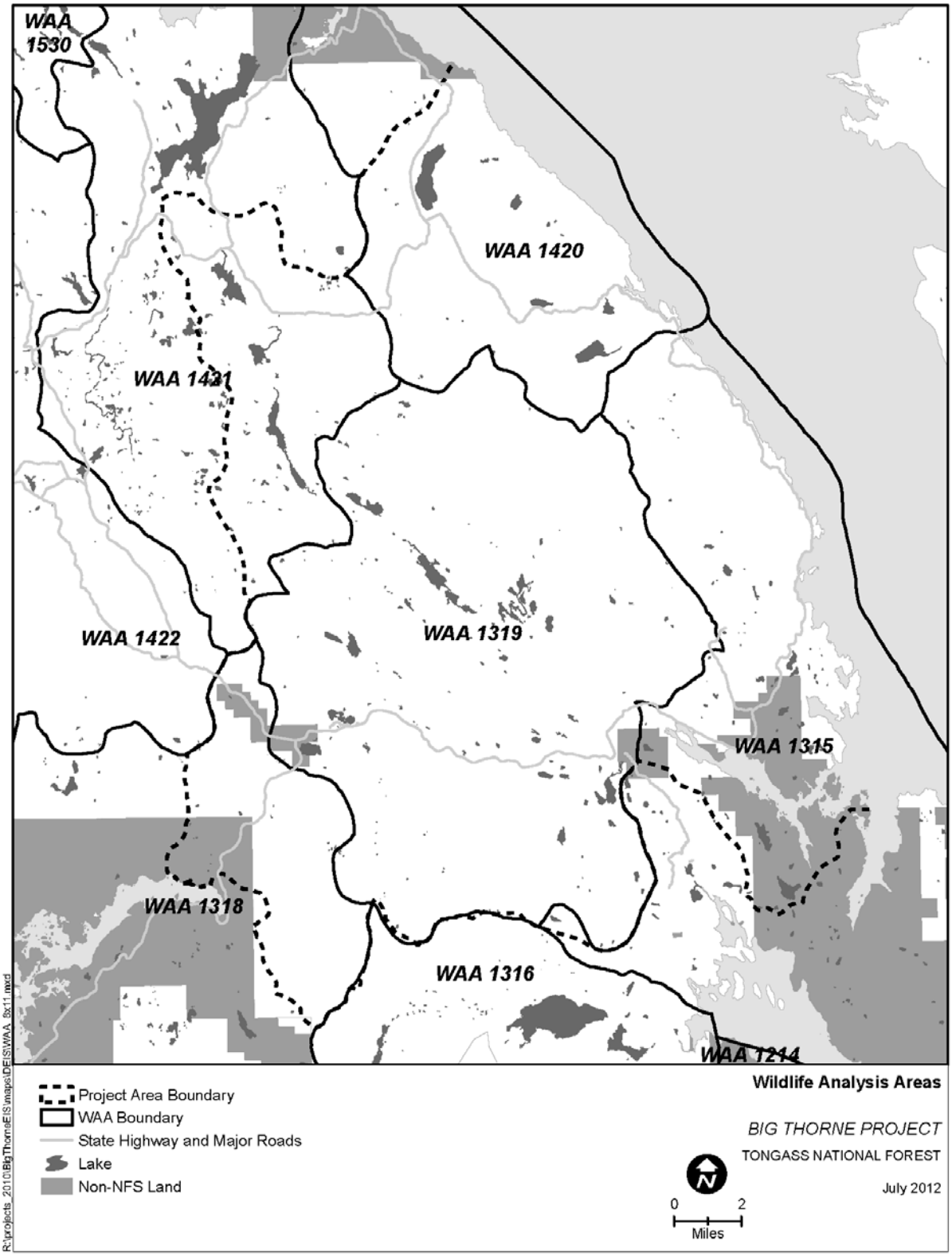

Figure 3-1. Wildlife Analysis Areas (WAAs) in the Big Thorne Project Area

Biogeographic Province

A biogeographic province designation refers to 21 ecological subdivisions of Southeast Alaska that are identified by generally distinct ecological, physiogeographic, and biogeographic features (See map in the Forest Plan FEIS, p. 3-132). Plant and animal species composition, climate, and geology within each province are generally more similar within than among adjacent provinces. Historical events (such as glaciers and uplifting) are important to the nature of the province and to the barriers that distinguish each province. The Big Thorne project area is located in Biogeographic Province 14, the North Central Prince of Wales province. Effects of management at this scale were analyzed during the Forest Plan analyses and are also conducted for some analyses in this document.

Analyzing Effects

Environmental consequences are the effects of implementing an alternative on the physical, biological, social, and economic environment. The Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act (NEPA) include the following specific categories to use for the analysis of environmental consequences.

Direct, Indirect, and Cumulative Effects

Direct environmental effects are those occurring at the same time and place as the initial cause or action. Indirect effects are those that occur later in time or are spatially removed from the activity. Cumulative effects result from incremental effects of actions, when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such actions. Reasonably foreseeable actions are those that are currently planned or scheduled to occur. The 5-year timber sale plan is the instrument through which future timber sales are scheduled. Therefore, for the purpose of this analysis, reasonably foreseeable future actions are generally considered to be those that are expected to occur within the next 5-10 years.

In the Environmental Consequences sections, the direct and indirect effects are presented first, followed by cumulative effects. For the purpose of evaluating cumulative effects, the IDT considered all lands in the project area. For some resources, an expanded boundary was evaluated. The cumulative analysis area for each resource is described in the appropriate section later in this chapter.

Under CEQ regulations and for the purposes of this analysis, “impacts” and “effects” are synonymous and interchangeable.

Past, Present and Reasonably Foreseeable Projects

Past Projects

Past projects considered in cumulative effects analysis generally are physically located on the landscape, such as roads. The past projects combined with the natural environment,

represent the affected environment that is described for each resource in this chapter. These projects include timber harvest, thinning of harvested stands, recreation developments, road construction and LTF construction; housing and building development in towns of Thorne Bay and Coffman Cove, and dispersed private lands,; and highway construction. The past timber harvest projects are cataloged in Appendix D – Part I, which lists acres of harvest by year, by stand, by VCU, and by ownership within the project area.

Present and Reasonably Foreseeable Projects

The following projects are either present actions or are considered reasonably foreseeable actions and are combined with past projects to be considered in the cumulative effects analysis. They include timber harvest, thinning, road construction, restoration activities, recreation improvements, and others. Reasonably foreseeable future projects are those with a developed proposed action. These are analyzed quantitatively if they can be identified spatially and qualitatively if the location is not definite. The following subsections describe the present and reasonably foreseeable projects and Appendix D – Part II presents a summary of these projects and identifies to which analysis areas they apply.

Timber Harvest on NFS Lands inside Project Area

Micro-sales from the Roadside Salvage Environmental Assessment (EA) will continue to occur throughout the project area along existing roads. These sales are limited to down, dead, or dying trees and usually involve only a few trees per sale. They are reviewed by resource specialists and are subject to the same standards and guidelines as the Big Thorne Project. In Fiscal Years 2011 and 2012, Roadside EA micro-sales amounted about 7 to 10 acres per year. Locations cannot be accurately predicted in advance; cumulative harvest would likely involve no more than a few acres in each watershed for micro-sales in the foreseeable future. No new roads would be constructed. It is assumed that up to 50 acres would be harvested in the project area.

Free Use timber harvest is also expected to occur. This can be up to 10 thousand board feet (MBF) of saw timber and up to 25 cords of wood per person per year (for Alaska residents only). Green sawtimber must also be evaluated and approved by the Forest Service prior to their removal. Free Use removal is expected to have similar effects as micro-sales, although they may include more live standing trees. It is assumed that up to 10 acres would be harvested in the project area

Previously NEPA-approved projects that include unharvested units, also account for reasonably foreseeable future harvest. These unharvested units were approved by the decision on the Control Lake EIS (1998). Harvest of these units could include up to approximately 351 harvest acres and approximately 1.2 miles of road construction. These units are all within the southwestern portion of the project area with 58 acres in VCU 595 (Steelhead drainage), 83 acres in VCU 596 (Control Lake area), and 211 acres in VCU 597.2 (Rio Beaver and Goose Creek subwatersheds).

Timber Harvest on NFS Lands outside Project Area

Timber harvest and road construction on NFS lands outside the project area but within Biogeographic Provinces 14 and 18 are considered since this analysis area is used for some resource cumulative effects analyses. The projects included here are those that have been NEPA-approved. In addition, as this Draft EIS goes to press, there are two other timber harvest projects that are getting closer to this stage and are likely to be deemed reasonably foreseeable for the Final EIS. These are the Kosciusko Vegetation Management and the Dargon Point Thinning projects. Neither of these projects yet have a published draft NEPA document. The Kosciusko project (on Kosciusko Island) proposes 180 acres of old-growth harvest using clearcutting, up to 6,000 acres of young-growth thinning, 2 miles of new road construction, 16 miles of road reconstruction, and 15 miles of decommissioned roads being used as forwarder beds for thinning access. The Dargon Point project proposes about 70 acres of commercial thinning or clearcutting and about 1 mile of road construction. It is located northwest of the Big Thorne project area near Naukati.

For Biogeographic Province 14 the NEPA-approved projects with remaining harvest units include the Logjam (2009) and Soda Nick (2007) projects. The Logjam project is adjacent to the Big Thorne project area on the northwest side. It was approved for 73 MMBF of old-growth timber harvest from 3,422 acres. It included 5 miles of NFS road and 17 miles of temporary road construction and 3 miles road reconstruction. The Soda Nick project is another previously NEPA-approved project located south of the project area and southeast of Craig and Klawock. It includes an estimated 257 acres of timber harvest. For Biogeographic Province 18, only one additional NFS timber sale project is included. The Chasina project (1998) has mostly been harvested but includes approximately 300 unharvested acres near Chasina Point southeast of Cholmondeley Sound.

In addition, in Biogeographic Province 14, two other timber harvest projects are under consideration and reasonably foreseeable. These are the Kosciusko Vegetation Management and the Dargon Point Commercial Thinning projects. Neither of these projects yet has a published NEPA document.

The Kosciusko project (on Kosciusko Island) currently proposes 180 acres of old-growth harvest using clearcutting and up to 6,000 acres of young-growth thinning. To access this harvest, there would be 2 miles of proposed road construction, 16 miles of road reconstruction, and 15 miles of reconstructed decommissioned roads. The 180 acres of proposed old growth harvest on Kosciusko Island would not likely result in any measurable change to deer model results for Biogeographic Province 14 (greater than 1.5 million acres). The commercial thinning of older young growth acres would likely be considered a benefit to deer by improving forage availability.

The Dargon Point project proposes about 70 acres of commercial thinning or clearcutting and about 1 mile of road construction. It is located northwest of the Big Thorne project area near Naukati. The Dargon Point project is also expected to improve forage availability for deer.

Timber Harvest on State Lands inside Project Area

Small to large harvest units totaling about 635 acres and 4 miles of road construction are scheduled on state lands in 2011 to 2015; these are identified as the North Thorne Bay/Beach Road Area timber sales and the South Thorne Bay Area timber sales (ADNR 2011). Small sales may occur in the North Thorne Bay area, and are included in the total harvest and road figures. Harvest unit acres and road miles were estimated from the current state Five-Year Schedule of Timber Sales (ADNR 2011). These timber sales would occur in the Pin, Thorne, Thorne Bay, Salamander, and Deer Creek subwatersheds. No other harvest or roads are reasonably foreseeable on state lands in the project area. State land harvest must comply with the Alaska Forest Resources and Practices Act and Regulations, rather than the Tongass Forest Plan standards and guidelines.

Timber Harvest on State Lands outside Project Area

Timber harvest and road construction on state lands outside the project area but inside Biogeographic Provinces 14 and 18 is listed here because this analysis area is used for some resource cumulative effects analyses. These harvest units and road miles are derived from the state's Five-Year Schedule of Timber Sales (ADNR 2011). They include an estimated 2,170 acres of old-growth harvest, 400 acres of older young-growth harvest, and 13.3 miles of new road construction. State land harvest must comply with the Alaska Forest Resources and Practices Act and Regulations, rather than the Tongass Forest Plan standards and guidelines.

Road Management on NFS Lands

As a result of the Prince of Wales Island Access Travel Management Plan (ATM) road storage, decommissioning, motorized trail development and other roadwork will be implemented in the foreseeable future as funding is available. The ATM was completed in 2009 (USDA Forest Service 2009b). The Prince of Wales Island Road Storage contract has been awarded and includes approximately 25 miles of road storage work within the project area. This contract is scheduled for completion in 2012.

Maintenance and reconditioning of existing NFS roads is an ongoing process that occurs on a periodic basis. Normally this type of work is determined to fit the category of routine repair and maintenance of roads that do not individually or cumulatively have a significant effect on the quality of the human environment and may be categorically excluded (Forest Service Handbook [FSH] 1909.15, 31.12). The maintenance and reconditioning of NFS roads in the project area may occur before, during, and after the project analysis. This work is done through separate service contracts to reduce the backlog of deferred maintenance, recondition roads to comply with BMPs, and maintain the existing infrastructure for National Forest Management activities. The timing of this work may coincide with this projects analysis, but is not part of this project. Any effects from ongoing road maintenance and reconditioning work are included in the cumulative effects analysis for this project.

Young-growth Treatments on NFS Lands

Pre-commercial thinning of even-age young-growth stands will occur across the Big Thorne project area in the future. Currently there are approximately 12,300 acres that are expected to need pre-commercial thinning (PCT) over the next 10 years. This includes about 2,450 acres in non-development LUDs including Old-Growth Reserves and Scenic River (Thorne River Corridor), 75 acres in beach and estuary buffer, 4,980 acres in development LUDs (identified by the project wildlife biologist as priority), 950 acres within riparian management areas (RMAs) and 3,850 acres in Timber Production LUDs without a wildlife priority (R. Sheets, Prince of Wales zone silviculturist, personal communication, February 2012).

About 1,500 acres of PCT of project area young-growth stands is scheduled in the next 5 years, and has been NEPA-cleared for the Naukati, Coffman Cove, and Thorne Bay areas (B. Case, Young Growth Coordinator-Silviculture, personal communication, October 2011).

The only commercial thinning that has occurred in the project area to date is 6 acres near Gravelly Creek. The no action and the proposed action alternatives do not include commercial thinning; three of the action alternatives do include commercial thinning.

Restoration Activities in the Project Area

Ongoing replacement of culverts in the project area is reasonably foreseeable and will be conducted as funding allows. In addition, there is currently a separate and ongoing collaborative process to identify stewardship projects in the Big Thorne area. These activities include watershed and wildlife restoration planning. Activities are likely to include young-growth thinning for wildlife habitat and stand improvement which help, to achieve older forest conditions at a younger age; riparian young-growth thinning to enhance large-woody debris (LWD) recruitment; LWD placement in streams; fish passage remediation (culvert replacement or removal for “red pipes”); erosion control; road relocation due to resource concerns; road storage and decommissioning; recreation site improvements; and invasive species control. These activities would be subject to Forest Plan standards and guidelines, including BMPs to ensure water quality standards are achieved.

A number of documents are at various stages of planning and will identify past, current, and future restoration efforts. These include:

- **Cobble Landscape Assessment (2004)** – Outlined/described overall landscape condition and described opportunities for moving the landscape towards desired future condition.
- **Cobble Watershed Restoration Plan (2006)** – Detailed description of restoration opportunities. Some terrestrial and riparian thinning occurred primarily in the Ratz and Cobble Creek watersheds and instream habitat improvements occurred in Sal Creek and small tributaries of Big Lake, as a result of this effort. Most of this work occurred in the middle to late 2000s.
- **Luck Lake/Eagle Creek Watershed Restoration Plan (2011)** – This document thoroughly describes and prioritizes riparian, instream, and road

restoration/improvement opportunities for the watershed. Approximately 98 percent of the area covered by the Watershed Restoration Plan (WRP) is within the Big Thorne project boundary. The WRP restoration goals and objectives are tiered to Desired Future Conditions and restoration objectives defined in the 2008 Tongass Forest Plan. High priority projects include five stream restoration projects, six road closures, and four riparian thinning projects. Approximately 65 acres of riparian thinning and a landslide restoration project will occur in the Luck/Eagle watershed in 2012. Most instream habitat improvements would occur in 2013-2014. Upland habitat improvements, road storage/decommissioning, and red pipe removal/replacements would be ongoing. This project is the Fish, Watershed, and Wildlife program's watershed restoration focus starting in 2012 and will likely continue through 2015.

- **North Thorne River Watershed Restoration Plan (2011)** – This plan was recently completed, but is still in draft form. It primarily outlines riparian restoration/improvement and road storage/decommissioning opportunities in the North Thorne watershed. The area covered by the WRP is entirely within the Big Thorne project boundary. Of the WRP identified actions, the highest priority actions include 84 acres of riparian thinning; 12.4 miles of road stormproofing, storing, and decommissioning; restoring access to 3.5 miles of stream; and instream structure placement and channel restoration at three sites. Project work would be ongoing.
- **National Watershed Condition Framework (2011)** – This nation-wide Forest Service program and its website (http://www.fs.fed.us/publications/watershed/) depicts and describes watershed condition on NFS lands at a national scale. It provides a means to identify and prioritize restoration opportunities. Luck Lake watershed is identified as a Tongass priority watershed. The database also depicts the "frontal" watersheds between Thorne Bay and Coffman Cove as "functioning at risk" (i.e., focus areas for watershed restoration opportunities). The Forest Service program has not yet fully assessed the project-specific restoration opportunities in this area at this time.

Outfitter Guide EA

In early 2011, the Forest Service initiated scoping for the Prince of Wales Island Outfitter Guide Management Plan EA. The management plan identifies the allocation of commercial recreational use on Prince of Wales Island and it would affect the amount of outfitter and guide use in a specific area. It does not set use levels for unguided visitors.

Recreation Projects

The Forest Service has a number of recreation projects proposed for completion in the next 5 years, subject to funding. These projects include six projects at or near existing developed recreation sites and one new cabin proposed for the beach near Sal Creek (see below). They are considered in the analysis of cumulative effects for recreation and scenery.

- **Gravelly Creek Trail** – This project would extend the Gravelly Creek Trail 0.5 mile from the Gravelly Creek Picnic Area to the Falls Creek Pull-off on the Thorne Bay Highway. This project would improve the existing primitive access to the Thorne River.
- **Honker Divide Canoe Route** – This project would improve the portages along the canoe route by constructing boardwalk, step-and-run stairways, and by hardening some surfaces with gravel. A new shelter on Thorne Lake is also proposed as part of this project.
- **Balls Lake Trail** – The plan is to complete the trail by hardening the natural tread sections with step and run stairways and gravel. Bridges also need to be replaced.
- **Luck Lake Day Use Area** – A shelter is proposed on Luck Lake near Eagle Creek.
- **Boyscout Multiuse Trail (3017-3018 Roads)** – This project would install two new bridges along this stored road system to expand off-highway vehicle (OHV) use of the area by an additional 17 miles. The bridges would be placed on Lava Creek and Slide Creek.
- **Control Lake Cabin** – This project involves reconstruction of the small dock at the Control Lake Cabin.
- **Sal Creek Cabin** – The Forest Service proposes to construct a new cabin on the beach near Sal Creek. This project would include the re-opening of a small road, construction of less than 0.5 mile of trail, and construction of a young-growth cabin.

Mineral Exploration Activities in Southern Prince of Wales Island

For Sensitive plants, the cumulative effects analysis area includes Biogeographic Province 18 (southern Prince of Wales Island) and includes the Niblack and Bokan Mountain areas, which have had mineral exploration and some extraction for 50-100 years. Current activities on NFS lands are limited to exploration drilling using helicopter access; small wooden platforms are constructed at the drill sites. A continuation of these exploration activities is reasonably foreseeable.

Sealaska Remaining Land Entitlement and Land Legislation

In 2011, land legislation (S.730/HR1408) was introduced into Congress; these bills would allow Sealaska Corporation to acquire 65,000-80,000 acres of roaded, managed NFS land parcels, which they have identified on Prince of Wales, Kosciusko, Kuiu, and Tuxekan Islands in place of their final Alaska Native Claims Settlement Act of 1971 (ANCSA) entitlements for which they filed for conveyance in June 2008 with the Bureau of Land Management (BLM). Previous iterations of this controversial bill, introduced since 2007, have been opposed by the public, nearby communities, and various user groups. The Big Thorne project area is not among the NFS lands included in this bill. However, appropriation of NFS lands by the Corporation would have overall implications for the future of public land management on Prince of Wales Island and in Southeast Alaska and implementation of the Forest Plan.

While the Sealaska land legislation bill could be considered reasonably foreseeable., However, because of the variable nature of this proposal and a lack of certainty about its passing Congress, as of the date of printing the Draft EIS, the effects of harvesting timber on the identified lands was not considered reasonably foreseeable. Nonetheless, the effects on wildlife associated with the transfer of the parcels identified in S.730 within Biogeographic Province 14 was evaluated as a separate cumulative effects scenario for deer in the Wildlife and Subsistence resource report (Woeck 2012) and acknowledged that this may affect the old growth reserve system. Should this bill be enacted after the Draft EIS is printed and prior to the Final EIS and ROD, the effects analysis will be updated.

Incomplete and Unavailable Information

Much of the Tongass National Forest resource data resides in an electronic database formatted for a geographic information system (GIS). The Forest uses GIS software to assist in the analyses of these data. GIS data are available in tabular (numerical) and map formats. For this Draft EIS, all the maps, and most of the numerical analyses, are based on GIS resource data supported by field inventories. Some field investigations are still underway and the results of some studies are still being incorporated.

Further, it should be noted that there is incomplete knowledge about many of the relationships and conditions of wildlife, fish, forests, climate change, jobs, and communities. The ecology, inventory, and management of a large forest area is a complex and developing science. The biology of fish and wildlife species prompts questions about population dynamics and habitat relationships; and the interaction of resource supply, the economy, and communities is the subject matter of an inexact science. However, the basic data and central relationships are sufficiently well-established in the respective sciences for the deciding official to make a reasoned choice between the alternatives, and to adequately assess and disclose the possible adverse environmental consequences.

Other Resources

Several resources and uses of the project area are likely to remain unaffected by the proposed action or alternatives, or will not be affected to a significant degree. Even though significant effects are not anticipated, these resources can be discussed in the sections of this chapter that follow the introduction, to the extent that measurable effects or differences between alternatives are present. Resources or uses for which no measurable effects were identified are discussed briefly here.

Air Quality

No significant effects on global carbon sequestration levels are expected under any of the alternatives considered for the 2008 Forest Plan Final EIS. Therefore, it is reasonable to conclude that small changes (project-level) in carbon sequestration on the Tongass, whether beneficial or adverse, would have a minor effect on atmospheric carbon levels. All of the action alternatives proposed for this timber sale would have limited, short-term effects on ambient air quality. Such effects, in the form of vehicle emissions and dust, are likely to be indistinguishable from other local sources of airborne particulates, including other motor vehicle emissions, dust from road construction and motor vehicle traffic,

residential and commercial heating sources, marine traffic, and emissions from burning at sawmills. The action alternatives could result in short-term supplies of raw wood products to local mills. It is the responsibility of the mill owner or sort yard operator to ensure that mill emissions are within legal limits. Air quality is discussed in the Old Growth and Biodiversity resource report in the project record.

Land Status

With the exception of 11,343 acres of state land and 2,826 acres of private land the vast majority (94 percent) of the lands within the project area are owned by the United States and managed by the Forest Service as part of the Tongass National Forest. The non-National Forest lands are near Thorne Bay, Control Lake, and Coffman Cove and were mostly conveyed to the state under the terms of the 1958 Alaska Statehood Act; some of these lands are now in private ownership. These lands, while within the project area, are excluded from the proposed project and alternatives.

There are no project area lands encumbered by unconveyed state selections or by claims filed under the ANCSA or the 1906 Native Allotment Act. The Forest Service has issued recreation special use permits to outfitter-guides and others in the project area.

Sealaska Corporation's final ANCSA entitlements could affect land status when the lands are conveyed. As described above, land legislation was introduced into Congress in 2011 to allow Sealaska Corporation to acquire specific NFS lands it has identified, in lieu of selecting lands from its entitlement areas. None of these proposed legislation lands are included in the project area.

Community Profiles

The primary social and economic area of influence for the Big Thorne Project includes those communities located in close proximity to the project area and communities whose residents use the project area for subsistence, recreation, and other activities. It also includes local communities with economic activities that could be affected by the proposed timber sale, primarily wood products operations that could use the timber from the project area and recreation and tourism businesses. The communities that fall into one or more of these categories are Thorne Bay, Coffman Cove, Klawock, Craig, Hollis, Kasaan, and Naukati Bay. Thorne Bay, located within the project area boundary, is the closest community to the project.

Unless otherwise noted, most of the information presented in the following community profiles is from the Alaska Department of Commerce Community and Economic Development's (ADCCED) Alaska Community Database (ADCCED 2011) and the 2008 Forest Plan EIS (USDA Forest Service 2008).

Thorne Bay

Thorne Bay is located at the head of Thorne Bay on eastern Prince of Wales Island, approximately 40 air miles northwest of Ketchikan. Petroglyphs and other archaeological remains indicate occupation and use of the area by Alaska Natives dating back at least

3,000 years. Post-contact development began in the early 1900s with construction of a saltery on the south shore of Thorne Bay.

Thorne Bay developed as a result of the long-term timber sale contract between the Forest Service and the Ketchikan Pulp Company. In 1960, a floating logging camp was built in Thorne Bay, and, in 1962, a shop, barge terminal, log sort yard, and camp were built to replace facilities at Hollis. Thorne Bay was incorporated as a second-class city in 1982, making it one of Alaska's newest cities.

Thorne Bay had a total population of 471 in 2010, approximately 86 or 15 percent fewer residents than a decade earlier in 2000 (U.S. Census Bureau 2000, 2011). The population of Thorne Bay is predominantly White (91 percent), with Alaska Native's accounting for 2 percent of the total population (U.S. Census Bureau 2011).

The Thorne Bay economy is primarily based on the timber industry and the Forest Service management of the National Forest. A number of small sawmills are located close to town along the Kasaan Road on the southwest side of Thorne Bay (Goose Creek Industrial Subdivision). In addition, the offices of the Forest Service's Thorne Bay Ranger District are located in town. Other sources of employment in Thorne Bay include recreation and tourism-related activities, including fishing lodges, commercial fishing, and state and local government (Dugan et al. 2009). Thorne Bay is located in the Big Thorne project area and local residents use the area for subsistence and recreation.

Coffman Cove

Coffman Cove is located on northeast Prince of Wales Island. Settlement of Coffman Cove began in 1956 with development of a logging camp. A road connecting Coffman Cove to the larger community of Craig was built in the 1980s. The city was incorporated in 1989.

Coffman Cove had a total population of 176 in 2010, approximately 23 or 12 percent fewer residents than a decade earlier in 2000 (U.S. Census Bureau 2000, 2011). The population of Coffman Cove is predominantly White (93 percent), with Alaska Native's accounting for 4 percent of the total population (U.S. Census Bureau 2011).

Logging support services historically provided the majority of employment in Coffman Cove. One of the major log transfer sites on Prince of Wales Island is located at Coffman Cove. Logging support services still provide some employment, but most employment is now recreation and tourism-based. Tourism facilities include fishing lodges, bed and breakfast inns, apartment/bunkhouse facilities, and rental cabins, as well as fishing day charter operations (Dugan et al. 2009). Commercial fishermen also operate out of the cove and local school system, library, general store, and gas station also provide employment, as well as services to community residents and the north part of the island. Local residents use the area for subsistence and recreation.

Craig

Craig is situated on a small island connected to the west coast of Prince of Wales Island by a causeway and is the largest community on Prince of Wales Island. Tlingit fish camps and seasonal villages originally occupied the present location of Craig. The city is named

for its contemporary founder, Craig Miller, who in 1907, with the help of local Haidas, established a saltery at Fish Egg Island. The Forest Service established a permanent ranger station here around 1919. The city of Craig was incorporated in 1922 as a second-class city under the laws of the territory of Alaska and became a first-class city in 1973. Shaan-Seet Inc. (the village corporation established under the ANCSA) received an interim conveyance of 20,852 acres in 1979 (ADF&G 1994).

Craig had a total population of 1,201 in 2010, approximately 196 or 14 percent fewer residents than a decade earlier in 2000 (U.S. Census Bureau 2000, 2011). Alaska Natives comprise about 19 percent of the local population, with 64 percent of the population identifying as White in the 2010 Census (U.S. Census Bureau 2011).

The Craig economy is primarily based on the fishing and timber industries with commercial fishing, fish processing, logging, sawmill operations, and government and commercial services providing the majority of employment. Craig's increased role as a service and transportation center for the Prince of Wales Island communities has largely been responsible for its growth. Columbia Wards Fisheries, a fish buying station, and a major cold storage plant are located in Craig and 151 residents hold commercial fishing permits. Shan-Seet Village Corporation timber operations is a major employer of local residents. Viking Lumber, the largest sawmill presently operating in Southeast Alaska, is located between Craig and Klawock. There are also a number of fishing lodges in and near town, as well independent operators offering package trips that include guided fishing, meals, and lodging (Cerveny 2005; Dugan et al. 2009).

Hollis

Hollis is located on the east side of Prince of Wales Island on Twelvemile Arm. Initially settled as a mining camp at the turn of the century, Hollis developed into a logging camp in the mid-1950s. In 1960, when Thorne Bay became center of the logging industry on central Prince of Wales Island, most Hollis residents moved to Thorne Bay. In recent years, Hollis has grown as a community, due in part to the state ferry terminal there. Roads now connect Hollis with most other communities on Prince of Wales Island.

Hollis had a total population of 112 in 2010, approximately 27 or 19 percent fewer residents than a decade earlier in 2000 (U.S. Census Bureau 2000, 2011). The population of Hollis is predominantly White (88 percent), with Alaska Native's accounting for 4 percent of the total population (U.S. Census Bureau 2011).

Support services for the timber industry, the Inter-Island Ferry, and the Forest Service provide the majority of employment to the residents of Hollis.

Kasaan

Kasaan is a small village located on the eastern side of Prince of Wales Island. Originally Tlingit territory, Kasaan gets its name from the Tlingit word meaning "pretty town." Haidas migrated north from the Queen Charlotte Islands in the early 1700s to the Island and established the village known as "Old Kasaan." In 1898 the Copper Queen mine, camp, sawmill, post office, and store were built on Kasaan Bay, and the Haida people subsequently relocated to this new site in 1904.

A Federally recognized tribe—the Organized Village of Kasaan—is located in the community. Traditionally a Haida village, the population now includes Tlingits, Eskimos, and non-Natives, as well as Haidas. The community had a total population of 49 in 2010, approximately 10 or 26 percent more residents than a decade earlier in 2000 (U.S. Census Bureau 2000, 2011). Alaska Natives comprise about 35 percent of the local population, with 53 percent of the population identifying as White in the 2010 Census (U.S. Census Bureau 2011).

The majority of local residents are employed in the public sector. Two residents held commercial fishing permits and most villagers participate in subsistence for food sources, harvesting deer, salmon, halibut, shrimp, and crab. One tourism-related business operates in the village, providing meals and lodging for visitors (Dugan et al. 2009). Local residents use parts of the project area for subsistence and recreation activities.

Klawock

Klawock, located on the west coast of Prince of Wales Island, is the second largest community on the island. The mouth of the Klawock River, where the village of Klawock is now located, has been the site of Tlingit occupation for at least the past 600 years and now serves as the center of the Tlingit population on west Prince of Wales Island. A trading post and salmon saltery were established in the community in 1868, and the first cannery in Alaska was built here by a San Francisco firm in 1878. Klawock was incorporated as a first-class city in 1929.

A Federally recognized tribe—the Klawock Cooperative Association—is located in the community. The community had a total population of 755 in 2010, approximately 99 or 12 percent fewer residents than a decade earlier in 2000 (U.S. Census Bureau 2000, 2011). Alaska Natives comprise about 48 percent of the local population, with 37 percent of the population identifying as White in the 2010 Census (U.S. Census Bureau 2011).

The community has been historically dependent on fishing and cannery operations; however, the timber industry has increased in importance with a relatively large number of residents employed in logging and ship loading in the Klawock and Craig area (ADCCED 2011). As noted above, Viking Lumber is located between Klawock and Craig. A total of 44 residents hold commercial fishing permits.

Retail trade and services are also important to the economy of Klawock. Many residents of communities on northern Prince Wales, as well as recreationists and tourists shop at the shopping center located in Klawock. There are also three sport fishing lodges that provide charter and accommodation packages, as well as an independent operator offering day charters. Klawock also has two recreational vehicle (RV) parks that mostly serve long-term visitors (Dugan et al. 2009).

Naukati Bay

Naukati Bay is located on the northwest coast of Prince of Wales Island. The area was named “Naukatee Nay” in 1904 after the local Native name for the area. The community of Naukati Bay was initially developed as a logging camp, but was later settled as an Alaska Department of Natural Resources land disposal site.

Naukati Bay had a total population of 113 in 2010, approximately 22 or 16 percent fewer residents than a decade earlier in 2000 (U.S. Census Bureau 2000, 2011). The population of Naukati Bay is predominantly White (88 percent), with Alaska Native's accounting for 6 percent of the total population (U.S. Census Bureau 2011).

The Naukati Bay economy is dependent on the timber industry and employment is largely seasonal. The Naukati Logging camp provides log transfer services for several smaller camps on Prince of Wales Island. Three residents held commercial fishing permits in 2010. Local businesses also include a cabin rental business and one sport fish charter operation (Dugan et al. 2009).

Environment and Effects of Significant Issues

The CEQ issues guidance to Federal agencies to determine the significant issues concerning any proposal, and to eliminate those issues that are not significant, or that are outside the scope of this document (40 Code of Federal Regulations [CFR] 1508.27). With the help of the public and other agencies, the IDT identified four issues to be examined in detail for the proposed project. The following sections describe the environmental effects of each of the alternatives as they relate to these four issues. Other resources for which effects may occur are also discussed in this chapter. The environmental effects of timber harvest and road construction on water quality, hydrological function, fish habitat, wildlife habitat, visual quality, soils, wetlands and other resources within the project area are summarized in the sections below, and discussed and analyzed in the specialist reports located in the project record for the Big Thorne EIS. All resource reports prepared for this project are incorporated herein by reference.

Issue 1: Timber Supply and Timber Sale Economics

Issue statement: *Timber supply and timber sale economics affect the stability of Southeast Alaska's forest products industry and the ability of the industry to contribute to the local and regional economies.*

The Big Thorne Project is intended to provide a stable supply of economic timber over an approximate 10-year period. In order to meet this objective, the Project is intended to include sufficient units and volume to allow the Forest Service to adjust future timber sale offerings from the project area to meet fluctuating market conditions, to the extent possible. This long-term stable and economic timber supply is intended to support local operators and encourage investment in the wood products industry as it begins to transition to young growth harvesting and restoration activities. Timber purchasers and others are concerned about the quantity and quality of timber volume offered by the Forest Service, the cost of road construction, as well as the logging costs associated with the proposed logging systems and silvicultural prescriptions.

Units of Measure

- Timber volume (old-growth and young-growth) by species
- Acres of harvest by logging system and prescription
- Miles of road construction and reconstruction
- Logging and road costs
- Indicated bid value ($ per MBF)
- Number of annualized direct jobs

Analysis Methods

The Logging System and Transportation Analysis (LSTA) for the Big Thorne project area is based on the Forest-wide LSTA completed in 2006. The Forest-wide LSTA was developed using existing information including topographic maps, aerial photographs, and data from past timber sales; it was not field verified. The LSTA for the project area was initially revised by the Forest Service IDT based on their local knowledge of the project area. Field surveys were conducted in 2010 and 2011 to verify and collect information in the project area and harvest units were reviewed for consistency with the 2008 Forest Plan (USDA Forest Service 2008a). The LSTA was subsequently updated to incorporate the findings of these surveys and project review. In addition, in early 2011 all units and roads that entered 2001 IRAs were dropped and revisions were made to incorporate this change, as well as potential changes to small old-growth reserve (OGR) boundaries. This process is discussed further in Chapter 2, under Alternative Development.

The Financial Analysis Spreadsheet Tool - RV (FASTR) version October 31, 2011 (run February 2012) was used to compare alternatives for the Big Thorne Project. On March 28, 2011, FASTR was approved by the Regional Forester to replace the NEPA Economic Analysis Tool Residual Value (NEAT_R) version 2.16 as the Forest Service, Alaska Region, financial efficiency and economic analysis tool for use in timber planning. The

FASTR model uses the same logging and manufacturing costs developed for the Alaska Region timber sale appraisal program. Costs reflect production studies and data collected from timber sale purchasers in Southeast Alaska.

The harvest volumes, indicated value, costs, and net stumpage values used in this document are current estimates (run February 2012 and based on the latest Official RV Update Bulletin October 31, 2011). Values and costs derived from FASTR are based on data collected in recent years and represent a snapshot in time. Changes in regional and global timber markets and other factors such as fuel costs can dramatically affect stumpage values and logging costs at the time of implementation and harvest. These estimates are useful primarily for comparing the relative differences among alternatives. FASTR is a tool developed for financial analysis and alternative comparisons. It does not provide an actual sale appraisal. Project economics can vary greatly depending on the quality of timber that is being harvested. FASTR assumes regional averages in regards to stand quality and characteristics and, therefore, may not provide an accurate estimate of the actual stand conditions.

At the time of project implementation, merchantable timber within units and any road right-of-way located on NFS lands will be cruised to determine the quantity, quality, and value of timber for the contract under which that volume of timber is offered. The final sale appraisal would be based on the current appraisal bulletin, current cost information, and a normal profit and risk allowance to determine the minimum advertised stumpage value at the time of offering.

Detailed information about the methodology employed in the following analysis is presented in the Timber Economics Resource Report (Barnhart and Hitner 2012a) prepared for this project.

Affected Environment

The overall analysis area for timber supply and timber sale economics is Southeast Alaska because this is the area that could be potentially affected by changes in timber supply. Southeast Alaska had an estimated population of 71,664 in 2010, with slightly more than two-thirds (67 percent) of that total concentrated in three cities: Juneau, Ketchikan, and Sitka (Alaska DOL 2011a). The remaining population is distributed throughout the region in more than 30 small communities, most with populations of less than 1,000 residents. The communities of Southeast Alaska depend on the Tongass National Forest in various ways, including employment in the wood products, commercial fishing and fish processing, recreation, tourism, and mining and mineral development sectors. Many residents also depend heavily on subsistence hunting and fishing to meet their basic needs. Federal lands comprise about 95 percent of Southeast Alaska, with 80 percent of the region located on the Tongass National Forest. Appropriate management of the forest's natural resources is, therefore, important for local communities and the overall regional economy.

The Big Thorne project area is located on Prince of Wales Island, which has historically played an important role in the region's forest products industry. The population of Prince of Wales Island is distributed among many small communities, most of which are connected by an extensive road system. Communities located in the vicinity of the Big

Thorne project area include Thorne Bay, Coffman Cove, Klawock, Craig, Hollis, Kasaan, and Naukati Bay. Thorne Bay, located within the project area boundary, is the closest community to the project.

Forest Products Industry in Southeast Alaska

The forest products industry has historically been an important part of the economy of Southeast Alaska. Timber employment in Southeast Alaska peaked at the end of the 1980s, with slightly more than 3,500 jobs in 1989 and 1990. Timber employment dropped sharply in the 1990s following closure of the large pulp mills in Sitka (1993) and Ketchikan (1997) and has continued to decline over the past decade, falling from a recent high of 561 jobs in 2003 to 247 jobs in 2010 (Table TSE-1). Tongass National Forest–related employment in logging and sawmilling declined from 199 jobs in 2003 to 107 in 2010, a drop of about 50 percent. Non-Tongass timber employment also declined over this period, falling from a recent high of 362 jobs in 2003 to 140 in 2010, a decrease of 61 percent (Table TSE-1). Sawmill employment has historically been supported by Forest Service timber sales, with a small contribution from state timber harvest. Logging employment is generated from all ownerships, including Native Corporation lands.

Table TSE-1. Timber Industry Employment in Southeast Alaska, 2002–2010

Year[1/]	Tongass Logging[2/]	Tongass Sawmill[2/]	Total Tongass-Related Employment[2/]	Other sawmill	Other Logging	Total Other Timber Employment	Total Industry Employment
2002	63	110	173	40	299	339	512
2003	108	91	199	64	298	362	561
2004	82	95	177	53	220	273	450
2005	88	96	184	52	263	315	499
2006	81	77	158	46	217	263	421
2007	44	70	114	63	225	288	402
2008	52	70	122	24	118	142	265
2009	48	39	87	19	110	129	216
2010	61	46	107	7	133	140	247

Notes:
1/ Data are presented by calendar year.
2/ Tongass-related employment estimates are based on the ratio of Tongass timber harvest to total timber harvest in Southeast Alaska.
Source: USDA Forest Service 2011a.

Timber harvest in Southeast Alaska also peaked in the late 1980s, with harvest levels slightly below 1,000 million board feet (MMBF) in 1989 and 1990. Total harvest in 2010 was 112.3 MMBF, about 11.2 percent of peak levels. Harvest on the Tongass accounted for 32 percent (35.4 MMBF) of this total, with 59 percent (66.4 MMBF) of the total provided by Native Corporation lands (Table TSE-2).

Table TSE-2. Timber Harvest in Southeast Alaska by Ownership, 2002–2010

Year	Tongass[1/]	State of Alaska[1/]	Alaska Native Corporations[1/]	Total[1/]
2002	33.8	57.3	101.7	192.8
2003	50.8	34.8	105.7	191.3
2004	46.3	24.2	98.9	169.4
2005	49.5	42.9	103.9	196.3
2006	43.1	44.6	71.2	158.9
2007	18.7	44.6	50.0	113.3
2008	28.0	11.9	52.3	92.2
2009	28.4	13.5	51.8	93.7
2010	35.4	10.5	66.4	112.3

Note:
1/ Harvest volumes are in million board feet (MMBF)
Source: USDA Forest Service 2011a

The wood products industry in Southeast Alaska in its current form consists of individual- and family-owned sawmills and independent logging businesses. The Tongass Sawmill Capacity and Production Report for calendar year 2010 identified 10 active and 3 inactive sawmills in Southeast Alaska, with a total installed production capacity of 155.9 MMBF (Alexander and Parrent 2012). The mills included in the survey were those assessed in previous survey years. The original list of mills to be surveyed, initially identified in 2001, consisted of the 20 largest and/or most active sawmills at that time. Of these 20 mills (increased to 22 in 2007), 10 were active in 2010, 3 were inactive, and the other 9 had been dismantled (Alexander and Parrent 2012).

Estimated total production for the mills included in the annual mill survey decreased over the past decade from 87.1 MMBF in 2000 to a low of 13.4 MMBF in 2009, a net reduction of 73.7 MMBF or 85 percent. Production increased somewhat between 2009 and 2010, with total estimated production of 15.8 MMBF in 2010. This total (15.8 MMBF) represented 13.9 percent of total active processing capacity in 2010, and 10.1 percent of total active and idle capacity. The Tongass National Forest supplied about 13.7 MMBF or 87 percent of this total, with state lands responsible for the remaining 13 percent (Alexander and Parrent 2012). The Tongass share of timber processed locally (13.7 MMBF) comprised just 39 percent of the total volume harvested (35.4 MMBF) on the Tongass in 2010.

Various purchasers had an estimated total of 92.6 MMBF of uncut timber under contract with the Forest Service in July 2012. Alcan Forest Products LLP accounted for 52 percent (48.3 MMBF) of this total, followed by Pacific Log & Lumber Ltd with 16 percent (15.0 MMBF), Icy Straits Lumber & Mill with 11 percent (9.7 MMBF), and Viking Lumber with 8 percent (7.8 MMBF) (USDA Forest Service 2012). Viking Lumber was the only one of these four purchasers operating a mill in Southeast Alaska in 2011. The Pacific Log & Lumber mill in Ketchikan was idle and the Icy Straits Mill in Hoonah was damaged in a fire in July 2010 (Alexander and Parrent 2012). The Icy Straits Mill is now operating again. Alcan Forest Products, based in Ketchikan, does not operate a processing facility on the Tongass, but must follow the regional export policy, and sell logs that cannot be exported to a processing facility in the state. Twenty-four other purchasers had

uncut volume under contract; in all cases but two, the amount under contract was less than 1 MMBF (USDA Forest Service 2012).

Forest Products Industry – Prince of Wales Island

The timber industry has historically played an important role on Prince of Wales Island. As noted above, regional timber harvest and employment peaked around 1990. At that time, the timber industry accounted for about 470 jobs in the Prince of Wales-Outer Ketchikan Census Area (CA).[1] By 2000, timber employment in the Prince of Wales-Outer Ketchikan CA had declined to 281 jobs, a drop of close to 60 percent (USDA Forest Service 2008b). Timber employment declined by a further 174 jobs (62 percent of the 2000 total) between 2000 and 2010 (Alaska DOL 2011b). In 2010, there were 59 jobs in the forestry and logging sector in the Prince of Wales-Hyder CA, with local sawmills accounting for about 48 jobs (Alaska DOL 2011b, Alexander and Parrent 2012). Together, these jobs represent about 6 percent of total employment in the Prince of Wales-Hyder CA, down from 15 percent of total jobs in 2000.

There are a number of wood-processing facilities on Prince of Wales Island in or near the Big Thorne project area, including Viking Lumber. In 2010, Viking Lumber accounted for 52 percent of total sawmill employment in Southeast Alaska, and 88 percent (13.9 MMBF) of the sawlog volume processed, which was equivalent to 17.4 percent of the mill's estimated processing capacity (Alexander and Parrent 2012).

The number of active mills and timber operators on Prince of Wales Island varies at any given time. Data compiled by the Forest Service and the State of Alaska identified 25 mills and timber operators on the island, including six of the active sawmills and two inactive sawmills identified in the 2010 mill survey (Alexander and Parrent 2012), Peterson 2012, USDA Forest Service 2012). In addition, a review of the forestry-related businesses in the Alaska Department of Commerce's business license database identified an additional 19 forestry-related businesses on Prince of Wales Island (Alaska Department of Commerce, Community & Economic Development [ADCCED] 2012). The other, smaller mills on the island produce sawtimber, as well as other value-added products. The highest concentration of small mills is in the Goose Creek Industrial Subdivision of Thorne Bay, but there are also operators in Craig, Klawock, Coffman Cove, and Edna Bay.

Six of the 10 active facilities included in the 2010 mill survey are located on Prince of Wales Island, as are two of the three inactive facilities that were included. The active facilities are the Porter Lumber Company, Thuja Plicata Lumber Company, Thorne Bay Wood Products, and Western Gold Cedar Products located in Thorne Bay, St. Nick Forest Products (formerly W.R. Jones and Son Lumber Company) located in Craig, and Viking Lumber. Excluding Viking Lumber, these mills had a combined installed production capacity of 22.5 MMBF and together processed about 1.2 MMBF in 2010, employing about 16 people in the process (Alexander and Parrent 2012). The mill survey also

[1] CAs are statistical units that are generally recognized as county equivalents from a data reporting standpoint. Data for 1990 and 2000 are for the Prince of Wales-Outer Ketchikan CA. Parts of this area were annexed in May 2008 by the Ketchikan Gateway Borough and the newly formed Wrangell City and Borough. The remaining area was renamed the Prince of Wales-Hyder CA.

identified two inactive mills in Thorne Bay: Northern Star Cedar Products and Thorne Bay Enterprises.

Viking Lumber had an estimated 7.8 MMBF of uncut timber under contract with the Forest Service in July 2012. Other timber operators on Prince of Wales Island had a combined total of 3.9 MMBF of uncut timber under contract with the Forest Service (USDA Forest Service 2012).

Timber Supply and Market Demand

Detailed explanations of the rationale for considering timber harvest in the Big Thorne project area and market demand for wood products are presented in Appendix A to this document. The 2008 Forest Plan EIS Volume 1 and Appendix G describe the latest timber demand analyses and projections prepared for the Tongass National Forest (USDA Forest Service 2008b).

Factors Affecting Timber Sale Economics

There are many factors that can increase the cost of timber sale offerings and increase the economic risk for potential purchasers. Factors affecting costs include logging systems, harvest methods, silvicultural prescriptions, haul/tow time and distances, and the miles and extent of road construction, reconstruction, and maintenance. The value of the timber for sale must be sufficient to cover this cost and offer a potential for profit to purchasers. Under current Congressional direction (Public Law 112-74, House Report 2055-257, Section 414) no timber sale in the Alaska Region shall be advertised if the indicated rate is deficit. Sales with volumes under 500 MBF currently do not require a residual value appraisal and can be advertised using established standard rates.

The existing road system in the Big Thorne project area allows a large portion of the available timber to be harvested using relatively inexpensive shovel or cable yarding systems without requiring large amounts of new road construction that would offset the economic benefits of using these systems. All of the units in the project area are within 65 road miles of most Prince of Wales Island mills including those in Klawock and the Goose Creek Industrial Subdivision near Thorne Bay. Although individual harvest units may not be economical to harvest by themselves, the management of less-productive land or land containing a higher percentage of defective timber helps to increase future timber yields by removing the defective or diseased trees. This reduces the spread of disease throughout the forest and allows the regeneration of a new rotation of less defective trees that can contribute to a more economic future harvest entry. Harvesting units with higher value along with lower value units can provide more timber volume by allowing the units with lower logging costs to balance those with higher logging costs.

Environmental Consequences

Direct, indirect, and cumulative effects for timber supply and timber sale economics are estimated using quantifiable measures or indicators, as supported by the FASTR financial analysis tool, version October 31, 2011. Effects are also discussed in qualitative terms, as appropriate.

Timber Volume by Species

Project volume levels affect the Forest Service's ability to offer economically viable timber sales. The volume made available from the project is intended to allow the Forest Service to respond to fluctuating market conditions when packaging timber sales. Also, the larger the timber sale volume, the greater the ability an operator has to respond to market conditions with the volume they have under contract. Larger timber sales occur over a larger geographic area and usually include a range of species and timber products. This allows the operator to focus harvest on the areas that provide the timber products that have higher market demand at that particular time.

Timber volume estimates by species were developed for each harvest unit based on a combination of site-specific and project area stand exam information collected in and around the planned units (Table TSE-3). These volume estimates are based upon basal area plot data collected during the walk-through stand exams along with volume/basal area ratios (V-BAR) developed from existing stand exam data plots located within the project area. These volumes include a breakout of live and dead volume by species, but do not include estimates of the defect or potential product quality of logs. The breakout of live and dead volume by species is included in the silvicultural prescription cards prepared for the project.

Western hemlock accounts for about half of the total volume under all of the action alternatives, with Sitka spruce ranging from 25 percent (Alternative 2) to 30 percent of total volume (Alternative 4). Total estimated sawlog volumes range from 82.6 MMBF under Alternative 4 to 166.6 MMBF under Alternative 3. Young-growth ranges from 0 percent (Alternative 2) to 17 percent (Alternative 4) of these total sawlog volumes (Table TSE-3).

The timber volumes proposed for harvest under the action alternatives would help meet the purpose and need for the Big Thorne Project, which is to contribute to a long-term supply of economic timber for the timber industry on Prince of Wales Island and the Tongass National Forest in general (including both large and small operators), in a manner that is consistent with the multiple-use goals and objectives of the Tongass Forest Plan. The purpose and need for the Project is discussed in Chapter 1.

Table TSE-3. Timber Volume Estimates by Species and Alternative

Species	Volume (MMBF)				
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Sitka Spruce	0	26.7	44.5	24.5	32.7
Western Hemlock	0	53.3	82.0	42.9	59.7
Western Red Cedar	0	18.3	27.2	10.0	17.0
Alaska Yellow Cedar	0	8.3	12.9	5.3	8.0
Total Sawlog Volume	0	106.6	166.6	82.6	117.4
Total Old-growth Sawlog Volume	0	106.6	150.0	68.7	103.9
Total Young-growth Sawlog Volume	0	0	16.6	13.9	13.5
Utility Volume	0	16.3	22.3	10.8	15.7
Total Sawlog and Utility Volume	0	122.9	188.9	93.4	133.1

Trees to be maintained in uneven-aged management would represent all species formerly in the stand. Large diameter trees maintained may be of low timber value but of high wildlife value. Smaller diameter trees of good form and vigor, particularly spruce and cedar, would also be maintained. These trees would be left to grow into the next timber crop.

Acres of Harvest by Logging System

All action alternatives propose the use of shovel, cable, and helicopter logging systems for the harvest of the old-growth units. Alternatives 3 through 5 include commercial thinning units using ground-based and cable logging systems. The logging equipment used for old-growth timber is typically not operationally or economically efficient for young-growth commercial thinning operations. Old-growth harvest equipment is designed to handle large log sizes and operate in even-aged harvest units where all the trees are removed. Harvest systems used for thinning need to be suitable for yarding small logs while operating around the trees that will remain. Large cable-yarding systems designed for old-growth harvest are particularly unsuitable for young-growth thinning. Cable-logging systems designed for old-growth harvest generally cannot be moved easily enough to be economically feasible for thinning young-growth.

Although some old-growth logging equipment, such as shovel loaders, may be functionally capable of harvesting young growth, it may not be economically efficient and may result in higher amounts of damage to the remaining trees. Table TSE-4 identifies the number of acres by planned logging system and silvicultural system or intermediate treatment (for young growth).

Table TSE-4. Proposed Logging System and Silvicultural System by Alternative

	Alternative (acres)				
Harvest System	**1**	**2**	**3**	**4**	**5**
Old-Growth Logging Systems					
Shovel, Even-aged harvest	0	1,918	2,441	690	1,064
Shovel, 67% Retention Group Selection	0	15	15	330	0
Cable, Even-aged harvest	0	1,383	1,871	699	730
Cable, 67% Retention Group Selection	0	0	0	145	0
Helicopter, Even-aged harvest	0	931	1,474	510	2,148
Helicopter, 75% Retention Single-Tree Selection	0	393	674	792	596
Helicopter, 50% Retention Single-Tree Selection	0	304	434	887	474
Helicopter, 67% Retention Group Selection	0	0	0	170	0
Total Old Growth	**0**	**4,944**	**6,909**	**4,223**	**5,012**
Young-Growth Logging Systems					
Cable, Uniform Thin	0	0	556	418	406
Cable, Strip Thin	0	0	1,174	955	959
Ground-based, Uniform Thin	0	0	842	787	716
Total Young Growth	**0**	**0**	**2,572**	**2,160**	**2,081**
Total Treated Acres	**0**	**4,944**	**9,481**	**6,383**	**7,093**

Old-Growth Harvest Methods

Shovel and cable are referred to collectively as conventional systems and are generally less costly than helicopter yarding. Conventional systems require adjacent road access and are most efficient using even-aged harvesting methods. Costs increase due to the

extra time and care needed to protect residual trees when uneven-aged silviculture prescriptions are used. In areas that cannot be accessed cost effectively using conventional methods due to high road construction costs or inadequate log suspension, helicopter is the assigned yarding system. Helicopter is also used where resource concerns, such as road density, preclude the use of conventional logging systems. All of these harvest systems are commonly used on Prince of Wales Island.

All of the proposed action alternatives include a mix of even-aged and uneven-aged individual tree selection silvicultural prescriptions. Both helicopter and conventional systems are used for even-aged and uneven-aged management in the proposed units. Uneven-aged management with group selection is also used with conventional logging systems in some settings, particularly in Alternative 4. This was primarily done in units that have uneven-aged management silvicultural prescriptions, and do not require enough new road construction to offset additional cost of helicopter yarding. Table TSE-5 shows the increased conventional logging costs with uneven-aged prescriptions.

Table TSE-5. Old-growth Stump to Truck Average Logging Costs

Old-growth Logging System	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Shovel Even-Aged Harvest	0	$131	$131	$137	$132
Shovel Uneven Aged Harvest	0	$158	$157	$167	0
Cable Even-Aged Harvest	0	$256	$256	$273	$258
Cable Uneven Aged Harvest	0	0	0	$305	0
Helicopter	0	$397	$398	$387	$387

Silvicultural prescriptions are designed to address resource concerns related to Forest Plan standards and guidelines, as well as other land management objectives including economics. Even-aged management in harvest units proposed for conventional logging allows for lower overall logging and road costs for the volume removed. Uneven-aged management prescriptions allow for certain classes of trees to be maintained to meet resource objectives while harvesting trees with high timber value that are not necessary to meet these objectives. Uneven-aged management using the helicopter logging system allows access to areas that are inaccessible or uneconomical for access by road.

Single-tree selection and group selection were both developed as uneven-aged management prescriptions. Single-tree selection would result in a residual stand that is well dispersed across the landscape and generally has the least effect on other resources. A retention amount of either 50 percent of 75 percent is used depending on windthrow risk, wildlife objectives, or scenery requirements. This prescription is operationally and economically difficult to implement with conventional harvest systems due to insufficient operating room. Group selection creates small harvest openings up to 2 acres in size and allows enough room for operation of conventional logging systems. A retention amount of 67 percent is used with this prescription.

See the Timber and Vegetation section of this chapter and the corresponding resource report prepared for this project for more information on silvicultural prescriptions.

Shovel yarding is usually the least costly yarding method, as shown in Table TSE-5, and is best suited for gentle terrain (generally slopes less than 25 percent) and yarding distances less than 800 feet. Shovel yarding involves moving logs from stump to landing

by repeated swinging of logs by a hydraulic, track-based log loader. Depending on slope and ground conditions, shovel yarding on steeper ground or over longer distances may be possible, but may increase the cost. The well drained and gentle terrain found in much of the project area is well suited for shovel yarding. When used with uneven-age management, swing corridors would be used to allow room for equipment operation. The size and distribution of corridors would be dependent on the terrain and road locations.

Cable yarding is best suited for steeper slopes and allows longer yarding distances. This process involves moving logs from stump to landing using a configuration of cables. The logs are transported across the landscape, with one or both ends suspended from cables while they are moved to the landing. This method is limited in that a clear path is required to the landing. Cable yarding costs increase substantially with increased amount of timber retention because the tower must be moved more often and cables need to be pulled in and out of each yarding corridor. Yarding over long distances increases the time it takes the logs to reach the landing and, therefore, also increases the costs. This method is generally more costly than shovel yarding. When used with group selection, cable yarding would be conducted using yarding corridors. The distribution and shape of corridors would be dependent on the topography and landing locations. Some lateral yarding may be required to remove trees between yarding corridors.

Helicopter yarding is the most costly yarding method, as shown in Table TSE-5, and is most often used in Southeast Alaska to access harvest units where it is a more cost-effective approach than road construction and conventional yarding. This process involves moving logs, fully suspended, from stump to landing using a helicopter. This yarding method causes the least amount of ground disturbance and reduces the need for new road construction. Although helicopter yarding requires roads to be near enough to allow economic feasibility, it does not require direct access to the units. Yarding distance, turn time (the time it takes the helicopter to make a round trip from the landing to the unit and return), residual canopy closure, and the value of timber yarded influence the economics of helicopter yarding.

Helicopter yarding is the most flexible in the selection of trees to be harvested making it more suitable for uneven-aged harvest prescriptions. Although helicopter yarding costs increase with higher levels of stand retention and crown closure, the increase is not as pronounced as it is for conventional systems, and it can be offset by using harvest prescriptions that expand stand value for all resources by leaving the majority of trees uncut while focusing harvest on trees with the highest timber value and lowest wildlife and other resource values.

Young-Growth Harvest Methods

Two experimental thinning contracts that involved operating in young-growth stands were completed on Prince of Wales Island in 2009 and 2010. Most of the logging equipment and equipment operators used to complete these contracts were brought to Prince of Wales and surrounding islands from the Pacific Northwest and only remained in the area for the duration of the contract. To implement the Big Thorne alternatives that include young-growth commercial thinning (Alternatives 3, 4, and 5), equipment designed for young-growth thinning operations will likely need to be imported into the area. Although old-growth logging equipment may be operationally feasible in some circumstances, it will

likely be less economically efficient. A lack of consistent young-growth timber sales has made it difficult to build or maintain an equipment base specialized for operating in young-growth. Young-growth thinning volume provided under the Big Thorne project is expected to help establish an equipment base for operating in young-growth in Southeast Alaska.

The following sections describe the harvest methods that will need to be developed for young-growth thinning in the Big Thorne project area. Young-growth logging costs were calculated using the Region 10 Log Cost Calculator tool using stand exam data from the Prince of Wales Young-growth Feasibility Study (Table TSE-6).

Table TSE-6. Young-growth Stump to Truck Average Logging Costs

Young-growth Logging System	Cost per MBF
Ground-based, Uniform Thin	$227
Cable, Uphill Uniform Thin	$450
Cable, Downhill Uniform Thin	$569
Cable, Downhill Strip Thin	$325

Ground-based uniform thinning operations are planned for areas with slopes up to 35 percent with a prescription of a uniform thin. Ground-based young-growth thinning can be conducted on steeper ground than old-growth shovel yarding because the equipment commonly used in young-growth thinning is more suited for steeper terrain. Timber felling will typically be completed using feller-buncher machines or cut-to-length harvesters, although hand felling may be used when necessary. These machines will allow the pre-bunching of logs or trees and the placement of these bunches in an orientation that allows them to be yarded to the road system efficiently in a manner that causes minimal residual stand damage. Yarding equipment options in these areas include small- to medium-size tracked bulldozers, forwarders, clam-bunk skidders, and track-based log loaders.

Due to the low bearing capacity of most soil types in the project area, ground-based thinning may be a less desirable yarding method and may prove to be less cost effective than cable yarding. Forwarders have not been widely used in Southeast Alaska and it is expected that the soil conditions, undulating terrain, and remaining old-growth stumps and logs may inhibit their use. There are a few units in the Big Thorne project area that have external yarding distances over 800 feet and would, as a result, likely require some form of forwarding equipment.

The uniform thin treatment is being used with a “crown thinning” treatment where most cut trees will consist of poor quality trees from the middle and upper crown. High quality dominant and co-dominant trees will be retained with the exception of trees that need to be removed for yarding corridors and skid trails.

Ground-based thinning is generally the method with the lowest logging cost (see Table TSE-6). The lower cost allows settings that can be harvested with ground-based equipment to improve the overall economics of the project. This equipment does not require straight corridors to operate within, which allows more flexibility to retain high-quality trees that will be of greater future economic value.

Cable uniform thinning operations are planned for all uphill settings with slopes that exceed 25 percent and downhill settings where full suspension can be achieved. Straight yarding corridors that are typically 12 to 15 feet in width will need to be located and marked during implementation. Settings will consist of a combination of parallel corridors that are typically spaced between 150 and 200 feet apart, and corridors that radiate from a single landing with a spacing of approximately 150 to 200 feet at the back end of the units. The specific design would depend upon topography and road location and alignment.

Hand felling methods will likely be required in these units; however, opportunities for mechanical felling will also likely exist, which will increase the efficiency of the yarding operation. Directional felling methods will be critical to the efficiency of these operations. Cable yarding production is significantly increased in units where harvesters are used to fell and pre-bunch logs making it a viable economic option. Multi-span cable systems can also extend the range of operation beyond what can be efficiently yarded with ground-based equipment. Cable yarders will typically be small machines with tower heights between 30 and 55 feet, capable of using intermediate support jacks, with skyline carriages capable of passing over intermediate support jacks and pulling line from the yarder to the choker setters. Appendix B to the Timber Economics Resource Report (Barnhart and Hitner 2012a) prepared for this project is a case study of a cable thinning operation in Oregon that involved thinning stands similar in tree size to what is planned for the Big Thorne project area.

The uniform thin treatment is being used with a “crown thinning” treatment where most cut trees will consist of poor quality trees from the middle and upper crown. High-quality dominant and co-dominant trees will be retained with the exception of trees that need to be removed for yarding corridors and skid trails.

Uniform cable thinning has the highest logging cost of the harvest methods utilized (Table TSE-6). This method is used only in areas where ground-based equipment is not operationally or economically feasible. Although it has a higher logging cost than strip thinning, it is preferred where operationally feasible because uniform cable thinning focuses on removal of poorer-quality trees, which increases the potential future value of the stand. Strip thinning, as noted below, removes all trees within the strips, and therefore does not have the flexibility to select trees for removal that will increase the future stand value.

Cable systematic “strip” thinning operations are planned for downhill units where full suspension cannot be achieved. Although uniform thinning is the preferred treatment, systematic or strip thinning may be used in some settings to reduce residual tree damage, allow operational feasibility, or reduce treatment costs. The strip thins will harvest a 20- to 60-foot-wide strip of timber and then leave a strip of timber approximately 60 to 120 feet in width (matrix area). The corridor width would depend on operational feasibility, visual concerns, and/or windthrow risk. The matrix area will be thinned where operationally feasible. These strips will preferably be placed perpendicular to the slope and be parallel to each other.

Hand felling will be used for most of these operations; however, opportunities for mechanical felling will also likely exist, which will increase the efficiency of the yarding

operation. Cable yarders in these operations will generally need to have at least three drums in order to operate a haulback line to pull the carriage up the corridor to the choker setters. Small- to medium-size towers and swing yarders that are easy to move would be ideal for these operations. Some settings may facilitate the use of high-lead yarding and would, therefore, only require yarders with two drums; however, these systems face operational difficulties with thinning, and are more prone to trees hanging up in other trees. They may be used in occasional situations that allow suspension requirements to be achieved, but they are not expected to be feasible in most settings.

Although cable strip thinning is more expensive than ground-based thinning, it is less expensive than uniform cable thinning. This is due to the fact that strip thinning removes all trees within the strip. Trees in uniform thinning are more dispersed among residual trees and therefore have greater yarding difficulties and costs.

Road Costs

Road construction, reconstruction, and maintenance involve substantial costs, as shown in Table TSE-7, and strongly affect timber sale economics. By using the most cost-effective transportation system while maintaining the appropriate design standards to meet resource requirements, these costs can be reduced. All of the new road construction currently proposed in the action alternatives is designed to provide access to the old-growth units. Access development to young-growth units is currently limited to reconstruction of currently decommissioned roads and the opening of roads currently in storage. These roads cost less to construct than new roads and subsequently improve the economics of young-growth treatments. Decommissioned roads often provide sufficient access to young-growth units because roads were constructed to harvest the previous stand. Although not currently planned, some new construction may be determined to be necessary in these areas during presale implementation.

Road costs for the economic analysis are taken from the Transportation Resource Report (Barnhart and Hitner 2012b) prepared for this project. Construction costs for NFS roads are higher than the costs of building temporary roads. New road construction was designated either as NFS or temporary based on future access needs. Road crossings over fish streams can add substantial costs at approximately $20,000 per crossing. Average road costs in the project area may be summarized by road construction type as follows:

- New NFS road construction — $175,000/mile
- NFS road constructed over decommissioned road grade — $30,000/mile
- New temporary road construction — $110,000/mile
- Temporary road construction over decommissioned road grade — $20,000/mile
- Reconstruction of stored NFS roads — $30,000/mile
- Storage and decommissioning of roads — $4,000/mile
- Decommissioning of temporary roads — $3,000/mile
- Additional cost for fish stream crossings (temp. bridges) — $20,000/bridge

Table TSE-7 provides a summary of road construction requirements for each alternative. Table TSE-8 shows the resulting road storage and decommissioning cost for each alternative.

Table TSE-7. Proposed Road Construction and Reconstruction by Alternative

Road Construction/ Reconstruction		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
NFS Road Construction	Miles	0	12	17	3	2
	Cost	$0	$1,869,000	$2,788,000	$455,000	$301,000
Temporary Road Construction	Miles	0	23	39	16	14
	Cost	$0	$2,312,000	$3,268,000	$1,182,000	$992,000
NFS Stored Road Reconstruction	Miles	0	19	39	22	16
	Cost	$0	$1,319,000	$2,411,000	$1,265,000	$1,009,000
Total	**Miles**	**0**	**54**	**95**	**41**	**32**
	Cost	**$0**	**$5,500,000**	**$8,467,000**	**$2,902,000**	**$2,302,000**

Table TSE-8. Road Storage and Decommissioning Costs by Alternative

Storage/Decommissioning	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Storage of NFS Roads After Use	$0	$124,000	$225,000	$98,000	$69,000
Decommission Temporary Roads	$0	$69,000	$115,000	$49,000	$42,000
Total Storage and Decommissioning	**$0**	**$193,000**	**$330,000**	**$147,000**	**$111,000**

Haul Costs

Haul costs used in the analysis presented in this document are based on round-trip truck haul to Viking Lumber near Klawock for all Phase 1 harvest units and truck haul to the Goose Creek Industrial Subdivision (near Thorne Bay) for all Phase 2 harvest units. Phase 2 harvest units would likely be offered as small sales that could be purchased by smaller operators located at the Goose Creek Industrial Subdivision. Transporting logs by raft or barge to a mill off the Prince of Wales Island road system would incur additional expense. Truck haul to the Coffman Marine Access Facility (MAF) and Thorne Bay MAF, with water tow costs to mills in other locations was considered. However, with the improved highways on Prince of Wales Island, preliminary analysis showed the total costs to be higher for all harvest units in all alternatives. Average costs for haul to the Coffman and Thorne Bay MAFs are lower than those for haul to Klawock for some settings; however, barging and rafting costs would be incurred from Coffman Cove and Thorne Bay and would more than offset the savings in trucking. Assumed average travel speeds for each road class are identified in Table TSE-9.

Table TSE-9. Average Truck Speeds Used for Analysis

Road Class	Avg. Travel Speed (mph)
Highway	38
Arterial	22.5
Collector	15
Local	11
Temporary	9

Pond Log Values

Pond log values are the price a buyer would pay for a log at the mill site (selling value minus manufacturing costs). These values depend primarily on species and log quality and are strongly affected by regional and global fluctuations in markets. The FASTR financial analysis tool has very limited log quality inputs and relies primarily on regional averages. Actual log quality may deviate from the regional averages and cause variations in the log values. There are some measures that can be taken, such as single tree selection, to increase average pond log values at implementation and create more economically viable timber sale offerings. Trees that currently have less economic value but have potential for higher future values can be retained to allow economically feasible future entries. This could be most effectively applied to helicopter settings because the retention trees pose operational difficulties to equipment trying to operate within the stand. A contract provision for optional removal of utility wood can also increase overall values by allowing the operator to leave utility wood in the harvest unit even though the purchaser must pay for the wood. FASTR-generated estimates of average pond log values are presented for each alternative in Table TSE-10.

Table TSE-10. Pond Log Values by Species and Alternative

	Alternative				
Pond Log Value $/MBF	**1**	**2**	**3**	**4**	**5**
Sitka Spruce	$0	$862	$809	$781	$804
Western Hemlock	$0	$409	$391	$368	$382
Western Redcedar	$0	$303	$303	$303	$303
Alaska Yellow-Cedar	$0	$680	$680	$680	$680
Weighted Average Pond Log Value	$0	$525	$511	$502	$509

FASTR-generated log values vary between alternatives depending on the composition of young growth and the amount of volume going to domestic or export markets. FASTR assumes that all western redcedar is processed domestically and that all Alaska yellow cedar is sent to markets outside of Alaska. Therefore, the assumed pond log values for these species do not change among alternatives. All young-growth timber is appraised for export. The volume of export versus domestic processing is adjusted for the FASTR program until the volume appraised for export is equal to 50 percent as explained in the Limited Interstate Shipment Policy section below. The pond log values for these species vary by alternative, as shown in Table TSE-10, depending on these adjustments. More accurate log values would be used at the time of appraisal based on the cruise information for the project area, which units are in the sale, silvicultural prescriptions, and logging systems.

Limited Interstate Shipment Policy

In March 2007, the Regional Forester approved the limited interstate shipment policy, which allowed certain unprocessed spruce and hemlock logs to be appraised for shipment to the Lower 48 states. This policy was expanded to allow foreign export in 2008 for existing contracts if a premium was paid for certain species. The policy was expanded in November 2009 for all contracts. At that time, a foreign market appraisal was established for use on timber sales to reflect export values for spruce and hemlock (USDA Forest Service 2012). The 2009 policy allows export of 50 percent of total sawlog volume

applied to spruce and hemlock logs. Western redcedar and Alaska yellow cedar may also be exported.

The limited shipment policy enhances opportunities for local supply to manufacturers who depend on Tongass timber by increasing the probability that sales will appraise positive as required by Public Law 112-74, House Report 2055-257, Section 414.

The limited shipment policy is reviewed on an annual basis. A recent briefing paper (April 2012) stated that given current economic conditions, specifically, the housing market slump and low wood products prices, the limited shipment policy will likely be needed for at least 2 more years.

Opportunities for Small Sales

The project area's geographic location places it within easy reach of most of the existing small mills on Prince of Wales Island. These mills typically rely on nearby, road-accessible timber for their wood supply and, individually, tend to process less than 1 MMBF a year. This was the case with estimated volumes processed by the small mills in Thorne Bay included in the 2010 mill survey, with annual volumes ranging from 30 MBF (Porter Lumber Co) to 600 MBF (Thorne Bay Wood Products) (Alexander and Parrent 2012). Small timber sales generally require lower variable logging costs to be economically viable because fixed costs are distributed over a smaller volume of timber. Costs associated with transporting timber are reduced in cases where timber is road-accessible and involves shorter hauls to local mills.

Each action alternative includes harvest units of suitable size, design, and species composition for timber sale offerings of less than 1 MMBF. The extent of these opportunities for each alternative is strongly correlated to the total harvest acres and, more specifically, to those acres proposed for harvest using conventional logging systems. The timber volume in any of the action alternatives could be administratively separated into several smaller sales.

Timber Sale Program Adaptive Management Strategy

The Forest Plan ROD defined a Timber Sale Program Adaptive Management Strategy that restricts timber sales and associated road construction to a specified portion, or phase, of the allowable sale quantity (ASQ) land base until actual timber harvest indicates the need for a larger land base (USDA Forest Service 2008c). This strategy divided the ASQ land base into three phases (Phases 1 through 3). The Forest is currently offering timber sales on lands designated as Phase 1 under the Adaptive Management Strategy. Timber from lands designated as Phase 2 under the Adaptive Management Strategy cannot be offered for sale until the total harvest of timber on the Tongass exceeds 100 MMBF for two consecutive years. At this time, timber from these lands can be offered as microsales[2], salvage sales, or commercial timber sales less than 1 MMBF, which could potentially benefit the small mills on Prince of Wales Island.

[1] Micro sales of down or dead trees are limited to no more than 50 MBF and are intended to supply small niche-market timber processors.

The Big Thorne project area includes three VCUs that are designated Phase 2; units in the Big Thorne alternatives are in two of these VCUs. These units are included to be offered for sale at this time as small sales less the 1 MMBF to benefit the small mills on Prince of Wales Island. The proposed acres and volumes in Phase 2 lands by alternative are displayed in Table TSE-11. Phase 2 harvest units include only old growth timber. The number of Phase 2 units ranges from 16 under Alternative 4 to 30 under Alternative 3 (Table TSE-11).

Table TSE-11. Proposed Harvest Acres and Volumes in Phase 2 Lands

Acres/Volume	Alternative				
	1	2	3	4	5
Number of Phase 2 Harvest Units	0	21	30	16	18
Phase 2 Harvest Acres	0	571	776	433	487
Percent of Total Acres[1/]	0	12%	8%	7%	7%
Sitka spruce (MMBF)	0	1.0	2.7	0.3	1.1
Western hemlock (MMBF)	0	6.6	8.2	1.9	6.2
Yellow cedar (MMBF)	0	0.0	0.8	0.0	0.0
Western redcedar (MMBF)	0	5.3	5.9	1.3	3.7
Total Phase 2 Harvest (MMBF)	0	12.9	17.6	3.6	11.0
Percent of Total Harvest Volume[2/]	0	12%	11%	4%	9%

Notes:
1/ Total acres are presented by alternative in Table TSE-4.
2/ Total estimated harvest volumes are presented by alternative in Table TSE-3.

Phase 2 lands range from 7 percent of total proposed harvest acres under Alternatives 4 and 5 to 12 percent under Alternative 2. As a share of total estimated harvest, Phase 2 lands range from 4 percent under Alternative 4 to about 12 percent under Alternative 2 (Table TSE-11).

Timber Economics Alternative Comparison

The FASTR model was used to provide an indication of bid value for each of the action alternatives. As currently allowed under the limited shipping policy, a mix of foreign and Alaska markets were used to perform the financial analysis for each alternative (USDA Forest Service 2011b). All yellow cedar and young-growth thinning timber (western hemlock and Sitka spruce) were appraised to export markets. All western redcedar and old-growth Sitka spruce timber volume was appraised to Alaska markets. Different levels of old-growth western hemlock volume (ranging from 2 to 17 percent) were appraised to Alaska markets with the remainder being appraised to foreign markets, depending on the alternative. The level of old-growth western hemlock appraised to foreign markets was adjusted to achieve the maximum percent of foreign export volume for each alternative allowed under the current limited shipping policy.

Overall, young-growth thinning had an adverse effect on the economics of Alternatives 3, 4, and 5. This was due to the higher logging costs, and lower overall pond log values achieved by young-growth. Although the young-growth thinning on its own would have resulted in negative indicated bid values, positive values were achieved in Alternatives 3 and 5 due to the better economics of old-growth harvest.

When a timber sale is prepared for sale, the Alaska region appraises the sale using the Residual Value method to arrive at fair market value for timber sold. Revenues (final

product selling values) used in the Residual Value appraisal are determined from a sample of timber purchaser's records. Revenues are brought back to Alaska mills (subtracting freight from point of sale) and are converted to log scale ($/MBF). Operational cost or the cost of logging and transportation ($/MBF) are subtracted to estimate value on the stump. An amount for normal profit and risk is subtracted to determine the stumpage value. The remainder is the indicated advertised rate or amount per MBF the Forest Service thinks that a purchaser with average costs and markets can pay for the project volume, while still maintaining profitability.

The FASTR model uses current revenues and costs, estimates of volume and regional averages to derive an estimate of value for comparison of alternatives. Estimates are presented by alternative in Table TSE-12. These values are current estimates and useful for comparing relative differences between alternatives. Values at the time the timber sale is offered may be different, depending on markets, configuration of the sale, and cruised volume. Under current Congressional direction (Public Law 112-74, House Report 2055-257, Section 414) no timber sale in the Alaska Region shall be advertised if the indicated rate is deficit. Stumpage rates must be at least the established minimum rates for any timber of merchantable size and quality (FSM 2431.31b). Under current estimates of volume and value, Alternative 4 currently appraised at a deficit and could not be offered. Parts of this alternative could be redesigned into a more positive offer. In addition, as noted, while these values are suitable for a comparison of alternatives, actual values will not be determined until the time of sale, and will be based on cruised volume and values based on current market conditions at that time.

Table TSE-12. Costs and Values by Alternative

Cost Types	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Average Pond Log Value Weighted by Species ($/MBF)[1/]	$0	$525	$511	$502	$509
Delivered Logging Cost ($/MBF)[2/]	$0	$243	$262	$298	$309
Haul Cost ($/MBF)[3/]	$0	$47	$51	$52	$49
Road Construction/Maintenance ($/MBF)[4/]	$0	$59	$58	$44	$27
Profit & Risk Margin ($/MBF)	$0	$115	$113	$111	$112
Indicated Bid Value ($/MBF)[5/]	$0	$55.59	$22.31	($7.51)	$6.56
Total Indicated Bid Value	**$0**	**$5,926,000**	**$3,717,000**	**($621,000)**	**$770,000**

1/ Pond Log Value: Final product (lumber) values minus production costs (milling) or what a mill of average efficiency can pay for delivered logs
2/ Delivered Logging Cost: The harvesting costs for an operator of average efficiency
3/ Haul Cost: Cost of round-trip truck transport to Klawock or Goose Creek, based on weighted average distance and speed
4/ Road Cost: Estimated average cost of new road construction, existing road reconstruction and maintenance
5/ Indicated Advertised Value: Pond Log Value minus stump to mill costs and other associated costs (camp, lodging, P&R margin, etc.)

Projected Employment and Income

In accordance with the purpose and need for the proposed action, the action alternatives would contribute to a long-term supply of timber for the wood products industry in Southeast Alaska. The action alternatives would harvest old-growth timber from approximately 4,200 to 6,900 acres and Alternatives 3 through 5 would commercially thin young-growth forest on 2,100 to 2,600 acres using various sizes of timber sales

(Table TSE-4). There would be no commercial thinning under Alternative 2. The sawlog volumes available under the action alternatives (ranging from 82 to 167 MMBF) would be used to offer economically viable timber sales and would be adjusted to reflect changing market conditions as needed. Timber harvest would support direct jobs in the wood products industry, as well as indirect jobs in other local and regional economic sectors.

Direct employment and income estimates are presented as a range in Table TSE-13. These estimates are for employment that would take place in Southeast Alaska. Although estimates of value for timber in the various alternatives are based on maximizing shipment out of state of timber sold in the plan area, purchasers have the choice to sell as much as they can to other markets as allowed under the limited shipment policy, or process part or all of the material in local sawmills. Actual employment and income in southeast Alaska would depend on choices made by purchasers; those choices may change as markets and prices shift. Under current market conditions, purchasers are likely to export as much as they can while processing enough material locally to keep manufacturing facilities open, and take advantage of opportunities to produce high value sawn material in Southeast Alaska.

Table TSE-13. Estimated Timber Volume, Employment, and Income by Alternative

Volume/Jobs/Income	Alternative				
	1	2	3	4	5
Total Sawlog Volume (MMBF)	0	106.6	166.6	82.6	117.4
Utility Volume (MMBF)	0	16.3	22.3	10.8	15.7
Jobs Related to Logging[1/]	0	241	377	187	265
Jobs Related to Sawmilling[1/2/]	0	156 - 275	242 - 429	117 - 214	169 - 304
Jobs Related to Transportation and Other Services[1/2/3/]	0	70 - 110	109 - 173	54 - 87	76 - 122
Total Direct Jobs[1/2/]	**0**	**507 - 585**	**792 -915**	**391 - 455**	**557 - 646**
Direct Income ($ million)[4/]	0	25.9 - 27.4	40.5 - 42.8	20.0 - 21.3	28.5 - 30.2

Notes:
1/ Memo Employment Coefficients and Indirect Effects, for NEPA planning: 2012 Update Source: Susan Alexander, Alaska Region Economist
2/ Local sawmilling and transportation-related employment estimates are based on a range, from maximum possible shipment out of state (50% of hemlock and Sitka spruce, and export of all Alaska yellow cedar), to no shipment of hemlock and Sitka spruce and export of 50% Alaska yellow cedar. Although all Alaska yellow cedar sold from the Tongass National Forest can be exported out of state, regional sawmills often manufacture the species into high value lumber.
3/ Transportation and other services include water transportation, independent trucking, stevedoring, scaling, and export marking and sort yard employment for export volume, and water transportation, scaling, and independent trucking for locally sawn volume. Export employs more workers in transportation and other services per MMBF harvested than domestic production. This is reflected in the range of values presented above.
4/ Sawmill and transportation-related income estimates are based on the same assumptions as employment and are presented as a range.

Jobs are presented in Table TSE-13 as “annualized” job-years. Annualized jobs are employment estimates adjusted to be based on a full year even though the employment may be seasonal. The resulting employment estimates would not all occur in one year and estimated job-years do not directly translate into numbers of affected workers. The job and income estimates presented in Table TSE-13 are approximate numbers based on average jobs per MMBF ratios that were estimated using harvest and employment data from 2007 to 2010. These numbers allow a comparison of the different alternatives based on total volume harvested. Actual numbers would vary under each alternative as timber

offerings are packaged to include some or all of the units, and individual sales targeted for different sized operators are developed.

Indirect employment effects are not estimated in Table TSE-13 because, while indirect employment coefficients can be estimated and are applicable at large scales, such as regional or statewide assessments, they are less useful at small local scales and can in fact be misleading. Indirect effects include jobs and income associated with industries that supply inputs to the harvest and processing sectors, as well as those supported by spending elsewhere in the local economy.

Forest Service Costs

Forest Service Financial Efficiency Analysis as required by FSH 2409.18 compares estimated Forest Service direct expenditures with estimated financial revenues. Estimates are presented for sale preparation, sale administration, and engineering support costs in Table TSE-14, using average costs per MBF calculated from multiple years. Sale preparation costs include unit layout, cruising, appraisal, and contract development. Sale administration consists of administering the timber sale contract from the time the sale is awarded until the sale is completed. Engineering support consists of planning and timber sale contract administration activities associated with new facility and road construction, use of existing facilities and road maintenance.

The cost estimates presented below are, as noted, based on average costs per MBF. There are a number of factors that could cause actual costs to be higher or lower than regional averages. Sale preparation costs increase when implementing uneven-aged harvest units, as compared to even-aged harvest units. Implementation and administration of several small sales could cost more than one or two large sales. Accessibility to the units is another major cost factor. The numbers presented in Table TSE-14 are useful to compare relative differences among alternatives

Table TSE-14. Estimated Forest Service Financial Costs and Revenues by Alternative

Forest Service Costs[1/]	Alternative				
	1	2	3	4	5
Sale Preparation	$0	$2,452,000	$3,832,000	$1,901,000	$2,700,000
Sale Administration	$0	$960,000	$1,500,000	$744,000	$1,057,000
Engineering Support	$0	$2,985,000	$4,665,000	$2,314,000	$3,287,000
Total Financial Costs	$0	$6,397,000	$9,997,000	$4,959,000	$7,044,000
Indicated Advertised Rate	**$0**	**$5,926,000**	**$3,717,000**	**($621,000)**	**$770,000**
Net Value[2/]	$0	($471,000)	($6,280,000)	($5,580,000)	($6,274,000)

1/ Based on Alaska Region's average budget allocation for cost centers. These costs are as follows: Sale Preparation $23/MBF; Sale Administration $9/MBF, and Engineering Support $28/MBF.
2/ Indicated bid value minus total project costs.

In addition to the costs identified in Table TSE-14, the Forest Service also incurs environmental analysis and documentation costs including field inventory, data analysis, public involvement, and preparation of documents that satisfy the requirements of NEPA. These costs are not included in Table TSE-14 because they are considered sunk costs that apply across all alternatives, including the no action alternative. An average cost of $41/MBF for environmental analysis and documentation was used to determine feasibility at the project proposal stage. The total cost for this project calculated for Alternative 2 was estimated to be $2.5 million.

The above financial efficiency analysis compares those costs and benefits for each alternative that can be quantified in terms of actual dollars spent or received in the project area. This type of analysis does not account for non-market benefits, opportunity costs, individual values, or other values, benefits, and costs that are not easily quantifiable. This is not to imply that such values are not significant or important, but to recognize that non-market values are difficult to represent by appropriate dollar figures. Financial efficiency should not be viewed as a complete answer but as one tool decision-makers can use to gain information about resources, alternatives, and trade-offs between costs and benefits.

Alternative 1 – No Action

Direct and Indirect Effects

Under this alternative, there would be no timber volume available for sale through the Big Thorne Project. The project would not meet the purpose and need, which is to contribute to a supply of economic timber industry on Prince of Wales Island and on the Tongass National Forest in general (including both large and small operators), in a manner that is consistent with the multiple-use goals and objectives of the Tongass Forest Plan. The Big Thorne Project is intended to provide a supply of economic timber. In order to meet this objective, the project is designed to include sufficient units and volume to allow the Forest Service to adjust future timber sale offerings from the project area to meet fluctuating market conditions, to the extent possible. A stable and economic timber supply is intended to support local operators and encourage investment in the wood products industry as it transitions to include more young growth harvesting and restoration activities.

This alternative would not support any direct annualized jobs (Table TSE-13). There would be no estimated Forest Service financial costs or revenues under this alternative (Table TSE-14). However, as noted above, the Forest Service has incurred sunk costs related to satisfying the requirements of NEPA that apply to all the alternatives including No Action.

Cumulative Effects

Past timber sales have contributed to the development of the existing roaded infrastructure that would be used for each action alternative. Timber harvest has been conducted in the Big Thorne project area for more than 70 years. Industrial-scale logging activity began in the 1960s. More detailed information on past harvest in the project area is provided in the Catalog of Events in Appendix D of this EIS.

Under Alternative 1, timber operators on Prince of Wales Island and elsewhere in Southeast Alaska would not be able to bid on future timber offerings made available through the Big Thorne Project, and would need to obtain timber for processing from other sources, as available. Other potential sources of timber in Southeast Alaska include timber that will be made available through other timber sales on the Tongass National Forest and timber from other lands, primarily State of Alaska and Native Corporation lands, as well as existing timber sales already under contract. Sawmill employment in Southeast Alaska has historically been supported by Forest Service timber sales, with a small contribution from state timber harvest (USDA Forest Service 2011a).

Recent and reasonably foreseeable timber management projects identified for the cumulative effects analysis are summarized in Appendix D, Part II of this EIS. These include projects located within and near the Big Thorne project area. Identified projects on NFS lands are included in the volume under contract discussed in the preceding paragraph or involve limited volume, such as the Roadside Micro Timber Sales (Appendix D). State timber harvest projects in the Big Thorne project area include an estimated 635 acres of harvest and approximately 19 MMBF of volume. Other reasonably foreseeable projects on state lands on Prince of Wales and surrounding islands involve an estimated 2,700 acres, including 840 acres on Kosciusko Island (440 acres old-growth; 400 acres young growth). Using an average of 1 MMBF/40 acres, this could result in a further 67 MMBF being available to purchase on state lands in the future.

The Big Thorne Project is an important component of the Forest Service's plan to meet the goals of the Forest Plan and provide an orderly flow of timber to local industry. The reasons why the Big Thorne project area was selected are discussed in Appendix A and include the well-developed road system within the project area and its proximity to a substantial infrastructure of existing saw mills, which included two-thirds of the existing processing capacity identified in the most recent mill capacity survey (Alexander and Parrent 2012). Other Forest Service projects on the Tongass that include more than 20 MMBF for commercial harvest and are as far or further along in the planning process than the Big Thorne Project are limited to the proposed Tonka Timber Sale on Kupreanof Island on the Petersburg Ranger District, which includes 38.5 MMBF from 2,065 acres of forest land. The Record of Decision for the Tonka Timber Sale Project was signed in March 2012.

In the absence of a multiple-year stable supply of economic timber from the Big Thorne Project or elsewhere, the future viability of existing mill operators could be negatively affected. Closure of one or more mills could result in a further reduction in jobs in the logging and sawmilling industries and could also affect local businesses that provide goods and services to these industries.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Alternative 2 has the highest estimated pond log value of any alternative ($525/MBF) because it includes only old-growth units and also has the lowest estimated logging costs ($243/MBF), which are achieved by utilizing more conventional logging systems than helicopter logging (Table TSE-12). In addition, with the exception of 15 acres of shovel, uneven-aged harvest, only even-aged management prescriptions are used with conventional systems under this alternative, which further reduces the logging cost. This alternative has the lowest estimated haul costs ($47/MBF) because a large portion of the units in this alternative are located near Klawock.[3]

[3] The logging costs used in the analysis summarized in this document are based on truck haul to Klawock for all Phase I harvest units. Costs for all Phase 2 harvest units are based on truck haul to Goose Creek (near Thorne Bay).

This alternative has the highest estimated road costs per MBF harvested of any alternative ($59/MBF). Fewer roads would be built under this alternative than under Alternative 3, but the total volume harvested would be lower resulting in slightly higher costs per MBF ($59/MBF versus $58/MBF) (Table TSE-12).

Overall, Alternative 2 achieves the highest total indicated advertised value of any alternative at $55.59/MBF (Table TSE-12). It utilizes low cost logging systems and has the highest log values. It does not treat any young-growth stands and subsequently treats the fewest total acres of any action alternative (Table TSE-4).

Under Alternative 2, a total of 106.6 MMBF of sawlog volume would be available for harvest (Table TSE-3). Assuming all units and volume were harvested, this alternative would support an estimated 241 logging jobs and 126 to 275 jobs in the sawmill sectors, generating an estimated $16.7 million to $22.3 million in direct income (Table TSE-13). This employment would not all occur in one year and estimated job-years do not directly translate into numbers of affected workers.

Total Forest Service financial costs, excluding costs for environmental analysis, would exceed the indicated advertised rate estimated for the entire sale volume under this alternative by approximately $471,000 (Table TSE-14).

Cumulative Effects

Timber harvest under this alternative and other reasonably foreseeable projects on the 5-year plan would contribute to meeting projected market demand for timber in Southeast Alaska and support logging and sawmill or export jobs. Reasonably foreseeable projects are on the 5-year plan which is periodically updated to add projects. Timber projects listed in Appendix D, Part II and discussed under Alternative 1 would also contribute to the timber supply. Compared to the other action alternatives, Alternative 2 would contribute the third highest volume (less than Alternatives 3 and 5, more than Alternative 4) and has the highest indicated bid rate.

Alternative 3

Direct and Indirect Effects

This alternative has an estimated pond log value of $511/MBF, lower than Alternative 2 and higher than Alternatives 4 and 5 (Table TSE-12). Alternative 3 has the highest percentage of western redcedar volume, which has the lowest pond log value. This causes a decrease in the average pond log value and negatively affects the economics of the alternative.

The estimated logging cost for this alternative is $262/MBF, which is slightly higher than the estimated cost for Alternative 2 at $242/MBF, but substantially lower than for Alternatives 4 and 5 at $298 and $309, respectively (Table TSE-12). Estimated logging costs are higher than those under Alternative 2 because this alternative includes young-growth thinning units. Thinning has a higher associated cost than even-aged harvesting. This alternative also includes a small amount of conventional old-growth logging settings assigned an uneven-aged management prescription. Conventional logging costs increase when operating in an uneven-aged prescription, as shown in Table TSE-5.

Alternative 3 has the second highest estimated haul costs ($51/MBF). Hauling costs are higher than under Alternative 2 because more units are located farther to the north of Klawock resulting in longer average haul distances. This alternative has the highest total estimated road costs of any action alternative because substantially more roads would be built under this alternative, with roads being built to access smaller or low volume units. However, viewed per MBF, road costs under this alternative are slightly lower than under Alternative 2 ($58/MBF versus $59/MBF) (Table TSE-12).

Alternative 3 has the second highest estimated indicated advertised value at $22.31/MBF, less than half the highest value ($55.59/MBF), which is estimated under Alternative 2 (Table TSE-12). Although it has a lower estimated pond log value and higher average logging cost than Alternative 2, this alternative treats the largest amount of acres. It also includes young-growth thinning units, which could increase future timber values.

Under Alternative 3, a total of 166.6 MMBF of sawlog volume would be available for harvest (Table TSE-3). Assuming all units and volume were harvested, this alternative would support an estimated 377 logging jobs and 197 to 429 jobs in the sawmill sector, generating an estimated $26.1 million to $34.8 million in direct income (Table TSE-13). This employment would not all occur in one year and estimated job-years do not directly translate into numbers of affected workers.

Alternative 3 would treat more total acres (old growth and young growth) than the other action alternatives (Alternatives 2, 4, and 5), ranging from 1.3 times (Alternative 5) to 1.9 times as many (Alternative 2) and generate sawlog volumes that range from 1.4 times (Alternative 5) to twice as many (Alternative 4) as the other action alternatives. These higher volumes are reflected in the job and income estimates, which are based on average jobs/MMBF ratios (Table TSE-13).

Total Forest Service financial costs, excluding costs for environmental analysis, would exceed the indicated advertised rate estimated for the entire sale volume under this alternative by approximately $2.6 million (Table TSE-14).

Cumulative Effects

Timber harvest under this alternative and other reasonably foreseeable projects on the 5-year plan would contribute to meeting projected market demand for timber in Southeast Alaska and support logging and sawmill or export jobs. Reasonably foreseeable projects are on the 5-year plan which is periodically updated to add projects. Timber projects listed in Appendix C, Part II and discussed under Alternative 1 would also contribute to the timber supply. Compared to the other action alternatives, Alternative 3 would contribute the highest volume and has the second highest indicated bid rate.

Alternative 4

Direct and Indirect Effects

This alternative has the lowest estimated pond log value ($502/MBF) among the action alternatives (Table TSE-12). This is primarily because young-growth thinning comprises a larger share of total harvest than under any of the other alternatives. Alternative 4 has the second highest logging costs ($298/MBF). This alternative includes a high number of

helicopter logging units, which have higher logging costs. Alternative 4 also includes a large amount of uneven-aged management prescribed in shovel and cable logging units. This prescription is more difficult to implement for conventional logging systems than even-aged management, and subsequently has a higher cost.

This alternative has the highest estimated haul costs of any action alternative ($52/MBF) because a higher percentage of units being harvested are in the northern part of the project area, resulting in a longer average haul distance to Klawock.

The road costs for Alternative 4 ($44/MBF) are lower than under Alternatives 2 and 3 because this alternative includes more helicopter logging. Helicopter logging systems typically require less road construction and timber can often be flown to the nearest existing roads.

Alternative 4 has the lowest indicated advertised value of any action alternative. It is the only alternative to have a negative estimated value (-$7.51/MBF) (Table TSE-12). Based on this value, this alternative would not be saleable at this time. Parts of this alternative could be redesigned into a positive offer.

Under Alternative 4, a total of 82.6 MMBF of sawlog volume would be available for harvest (Table TSE-3). Assuming all units and volume were harvested, this alternative would support an estimated 187 logging jobs and 100 to 214 jobs in the sawmill sector, generating an estimated $13.2 million to $17.3 million in direct income (Table TSE-13). This employment would not all occur in one year and estimated job-years do not directly translate into numbers of affected workers.

Total Forest Service financial costs, excluding costs for environmental analysis, would exceed the indicated advertised rate estimated for the entire sale volume under this alternative by approximately $5.6 million (Table TSE-14).

Cumulative Effects

Timber harvest under this alternative and other reasonably foreseeable projects on the 5-year plan would contribute to meeting projected market demand for timber in Southeast Alaska and support logging and sawmill or export jobs. Reasonably foreseeable projects are on the 5-year plan which is periodically updated to add projects. Timber projects listed in Appendix D, Part II and discussed under Alternative 1 would also contribute to the timber supply. Compared to the other action alternatives, Alternative 4 would contribute the lowest amount of volume and as the only alternative with a negative estimated value has the lowest indicated bid rate.

Alternative 5

Direct and Indirect Effects

Alternative 5 has the second lowest estimated pond log value of any action alternative (Table TSE-10). It includes a lower percentage of high-value spruce than Alternative 4, but a higher percentage than Alternative 3. This alternative also includes a small amount of conventional old-growth logging settings assigned an uneven-aged management prescription. Conventional logging costs increase when operating in an uneven-aged

prescription, as shown in Table TSE-5. This alternative includes young-growth treatment units, which explains the lower pond log value compared to Alternative 2.

This alternative has the highest estimated logging cost of the action alternatives ($309/MBF) (Table TSE-12). This alternative minimizes the amount of roads required for harvest activities, but, as a result, many units are required to be harvested with a helicopter logging system, which has higher average costs than conventional systems. The reduction in roads also creates longer yarding distances for helicopter operations.

Estimated haul costs under this alternative ($49/MBF) are lower than for Alternatives 3 and 4, and higher than for Alternative 2. Road costs under this alternative ($27/MBF) are substantially lower, less than half the values per MBF under Alternatives 2 and 3, because fewer miles of roads are proposed than under the other alternatives, resulting in lower road building and maintenance costs (Table TSE-12).

This alternative has a lower positive indicated advertised value of $6.56/MBF than Alternatives 2 and 3. This value is primarily the result of higher logging costs. The higher cost of using helicopter yarding for more units is not offset by the costs of less road construction. This alternative could be still offered because the indicated advertised value is above the current established minimum rate (FSM 2431.31b). Parts of the alternative could also be redesigned into a more positive offer.

Under Alternative 5, a total of 117.4 MMBF of sawlog volume would be available for harvest (Table TSE-3). Assuming all units and volume were harvested, this alternative would support an estimated 265 logging jobs and 141 to 304 jobs in the sawmill sector, generating an estimated $18.6 million to $24.6 million in direct income (Table TSE-13). This employment would not all occur in one year and estimated job-years do not directly translate into numbers of affected workers.

Total Forest Service financial costs, excluding costs for environmental analysis, would exceed the indicated advertised rate estimated for the entire sale volume under this alternative by approximately $6.3 million (Table TSE-14).

Cumulative Effects

Timber harvest under this alternative and other reasonably foreseeable projects on the 5-year plan would contribute to meeting projected market demand for timber in Southeast Alaska and support logging and sawmill or export jobs. Reasonably foreseeable projects are on the 5-year plan which is periodically updated to add projects. Timber projects listed in Appendix D, Part II and discussed under Alternative 1 would also contribute to the timber supply. Compared to the other action alternatives, Alternative 5 would contribute the second highest volume (less than Alternative 3, more than Alternatives 2 and 4) and has the third highest indicated bid rate.

Issue 2: Old-Growth Habitat LUD Modifications

Issue statement: *Old-Growth Habitat LUD modifications for the small old-growth reserves (OGRs) are proposed to expand the suitable timber base within the roaded land base and also to modify the reserves for the biologically preferred locations within the project area. This may affect the amount and quality of wildlife habitat protected by the small OGRs, the amount and quality of suitable timber available in the project area, and other resources including fisheries, sensitive plants, scenery, and recreation.*

Alternative 3 includes modifications to relocate the small OGRs within the 2001 Roadless Rule inventoried roadless areas. The purpose is to allocate the portions of the OGRs that contain existing roads and harvest units to development LUDs where timber harvest is allowed.

Alternative 4 includes modifications to the small OGRs to the biologically preferred locations identified by the interagency biologists' team. This team included biologists from the Forest Service, U.S. Fish and Wildlife Service, and Alaska Department of Fish and Game).

The portions of existing OGRs that were relocated under Alternatives 3 and 4, were reallocated to Timber Production, Modified Landscape, and Scenic Viewshed LUDs, based on the adjacent LUDs and Visual Priority Travel Routes and Use Areas to address scenery concerns.

Units of Measure

The comparison of alternatives for this issue focuses on the following units of measure:

- LUD acreage changes;
- Comparison to Forest Plan small OGR criteria (Appendices D and K);
- Acres and volumes suitable for timber production;
- Numbers of sensitive plant individuals and populations within OGRs;

Analysis Area

The analysis area for direct and indirect effects related to Old-Growth Habitat LUD modifications consists of the VCUs coinciding with the project area. The VCU scale was used since the criteria for small OGRs are based on VCUs (Forest Plan Appendix K) and they were used during the analysis of the Forest Plan to design and evaluate small OGRs. The project area was the analysis area generally used to evaluate the cumulative effects of the small OGR modifications. The cumulative effects analysis area for timber resources was the Thorne Bay and Craig Ranger Districts (which includes all of Prince of Wales Island and the adjacent islands within the district boundaries).

The Big Thorne EIS tiers to the analysis of cumulative effects at the Forest scale in the 2008 Forest Plan Final EIS (USDA Forest Service 2008b). This analysis fully considered the levels of past and likely future harvest and associated development on NFS and non-NFS lands accounting for projects such as Big Thorne.

Affected Environment

Land Use Designations

As described in Chapter 1, the Forest Plan uses LUDs to guide the management of NFS lands within the Tongass. Each designation provides for a unique combination of activities, practices, and uses. The Big Thorne project area includes the seven LUDs, shown in Table 1-1 and Figure 1-2. The goals and other aspects of each LUD are summarized in Chapter 1.

Tongass Conservation Strategy and Old-growth Reserves

Forest Plan Conservation Strategy

The Forest Plan Conservation Strategy was developed to maintain the integrity of the old-growth forest by retaining intact, largely undisturbed habitat. This strategy, initially incorporated into the 1997 Forest Plan, was reviewed and amended for incorporation into the 2008 Forest Plan. The conservation strategy includes two major components: (1) a forest-wide network of large, medium and small OGRs allocated to the Old-Growth LUD plus all small islands less than 1,000 acres, and (2) a series of standards and guidelines applicable to lands where timber harvest is permitted (the matrix; USDA Forest Service 2008a, 2008b).

The OGR system was designed to maintain habitats of the species that have the most viability concerns (USDA Forest Service 2008b). The reserve network also includes other non-development LUDs such as Wilderness, LUD II, Remote and Semi-Remote Recreation that essentially maintain the old-growth ecosystem. The intent of the reserve system was to help ensure the maintenance of well-distributed viable populations of all old-growth associated wildlife species across the Tongass, with focus on those species that are most sensitive to habitat loss and fragmentation. In general, the home range and dispersal capabilities of old-growth associated species of concern were considered in determining the size, number and spacing of reserves. For a complete review of the Forest Plan Conservation Strategy, including assumptions underlying the design of the OGR system, refer to Appendix D of the 2008 Forest Plan Final EIS (USDA Forest Service 2008b).

Within the matrix (areas outside of reserves), components of the old-growth ecosystem are maintained through standards and guidelines designed to provide for important ecological functions such as dispersal of organisms, movement between forest stands, and maintenance of ecologically valuable structural components such as down logs, snags, and large trees (USDA Forest Service 2008b). Matrix lands include Experimental Forest, Modified Landscape, Scenic Viewshed, and Timber Production LUDs. Matrix management complements the reserve system by providing habitat at smaller spatial scales, increasing the effectiveness of reserves, and improving landscape connectivity (USDA Forest Service 2008b). Standards and guidelines applicable to these lands include maintenance of the 1,000-foot beach buffer, variable-width stream buffers, and project-level legacy forest structure retention requirements (see Chapter 2). In addition, other Forest-wide standards and guidelines preclude or limit timber harvest in areas of high-hazard soils, steep slopes, karst terrain, and visually sensitive travel routes and use areas.

Finally, a number of species-specific standards and guidelines, such as raptor nest and wolf den buffers, set aside old growth, sometimes temporarily, to avoid impacts to the species in question. Additional detail on the rationale behind the standards and guidelines within the matrix is provided in Appendix D of the 2008 Forest Plan Final EIS (USDA Forest Service 2008b).

Old-growth Reserves

The Big Thorne project area includes small OGRs located in VCUs 5790, 5800, 5810, 5820, 5830, 5840, 5850, 5860, 5950, 5960, and 5972 (Figure OGR-1; Figure 1-2 in Chapter 1 displays the locations of the Old-Growth Habitat LUDs in relation to other LUDs and roadless areas). The project area also incorporates other VCUs or portions of VCUs (Table WLD-1). A substantial portion of the Honker Divide large OGR complex, which spans several VCUs and is made up of several different LUDs, is within the project area. Only VCUs with small OGRs and proposed project activities were considered for modifications. Medium OGRs have been designated in adjacent VCUs to the north and west. Under the Forest Plan conservation strategy, small OGRs were intended to facilitate functional connectivity (i.e., connectivity through disconnected patches of old-growth forest) between larger reserves and help ensure well-distributed wildlife populations.

During the 2008 Forest Plan Amendment process, an interagency biologist review team (2008 IRT) conducted a forest-wide review of small OGRs because small OGR locations had not been finalized under the 1997 Forest Plan. For each VCU, the 2008 Interagency review team evaluated consistency with Forest Plan OGR acreage requirements (outlined in Appendix K of the Forest Plan). All existing small OGRs meet or exceed the Forest Plan acreage requirements (this includes exceptions for VCUs that are partially designated as very large, large, or medium OGRs where acreage from these reserves count toward the total). This evaluation formed the basis for the biologically preferred small OGR locations recommended by the 2008 IRT, which was one of several factors taken into account by the Forest Supervisor in finalizing the small OGR locations under the 2008 Forest Plan. Appendix D of the Forest Plan FEIS includes design criteria that were used in the development of the reserve system (see the Wildlife and Subsistence resource report for additional detail).

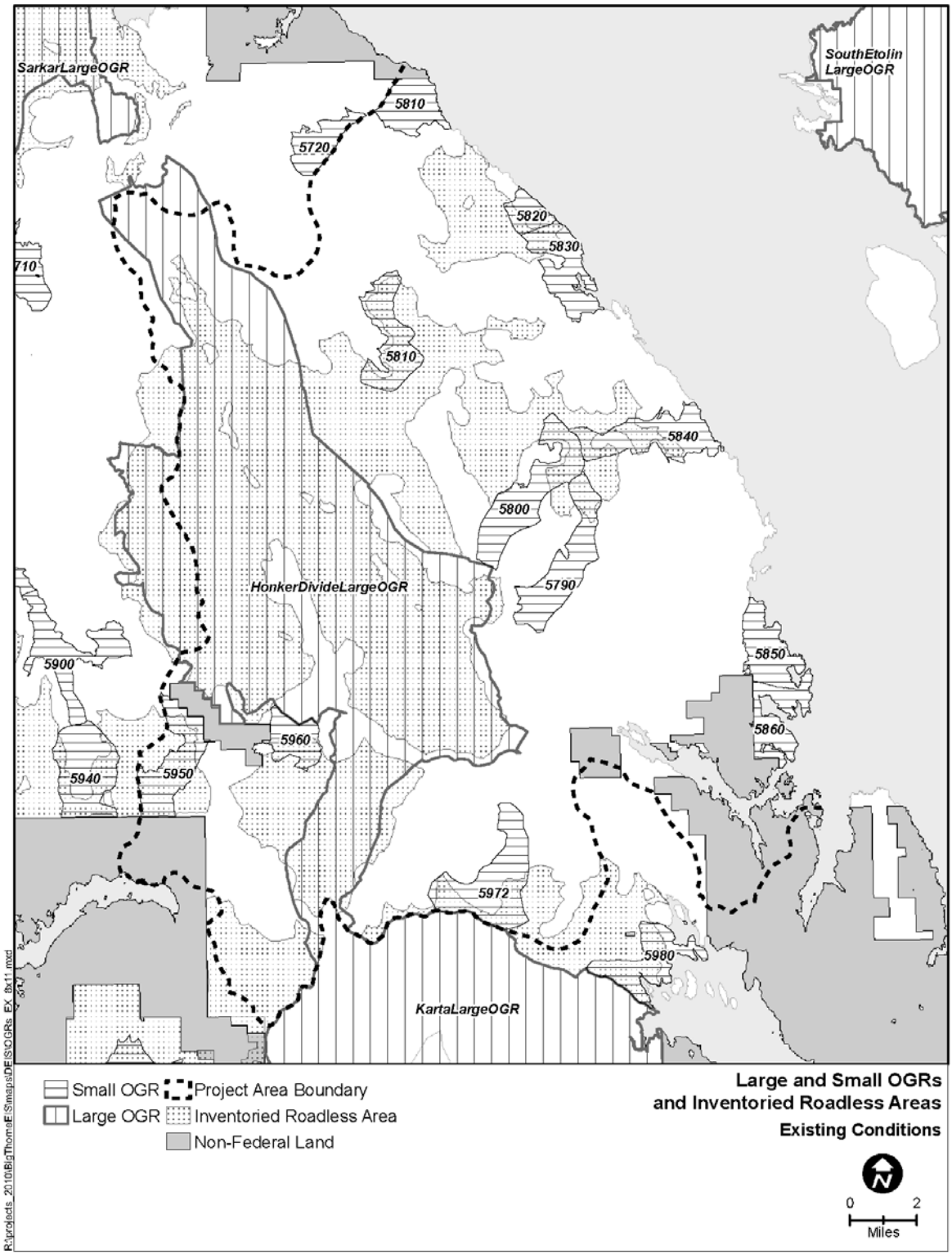

Figure OGR-1. Existing Old-growth Reserves in the Big Thorne Project Area

Existing Small Old-growth Reserves by VCU

This section provides a summary-level description for each of the small OGRs in the project area.

VCU 5790 (Gravelly Creek/Falls Creek) – This small OGR is linear, running southwest to northeast through VCU 5790, connecting to the small OGR in VCU 5800, and approaching to within 3,500 to 4,500 feet of the Honker large OGR. Without a connection through a non-development LUD to the Honker large OGR complex through VCU 5780, the existing biological functionality of the complex of small OGRs in VCUs 5790, 5800, and 5840 is diminished due to the high level of previous harvest and natural fragmentation between these VCUs and the Honker large OGR which may preclude dispersal if additional harvest occurs in the future. Minimum Forest Plan acreage requirements are met.

VCU 5800 (North Thorne River) – This small OGR is located to the west of the North Thorne drainage. It provides connectivity from the Honker large OGR complex to salt water in the east (Clarence Strait) via the small OGR in VCU 5840, and includes the largest remaining blocks of POG in the VCU. Forest Plan minimum acreage requirements are met by the existing small OGR.

VCU 5810 (Luck Lake) – This VCU contains two disconnected small OGRs. The northern piece, located north of Luck Lake, is entirely roaded but connects to the shoreline and includes deer winter range and large-tree POG (SD 67). The larger, southern piece, located southwest of Luck Creek, is sufficiently sized to meet Forest Plan total and POG acreage requirements. The existing small OGR (the northern and southern pieces combined) acres in this VCU includes low elevation POG, high value deer winter range, and maintenance of shoreline connectivity.

VCU 5820 (Baird Peak) –This small OGR is located along the coastline, east of Baird Peak. The existing small OGR meets Forest Plan minimum acreage requirements. It includes some of the remaining contiguous blocks of low elevation POG in the VCU.

VCU 5830 (Ratz Harbor) – This small OGR is split between VCUs 5820 and 5830 (approximately 30 and 70 percent of its acreage located in each, respectively). The existing small OGR meets Forest Plan minimum acreage requirements. Some important wildlife habitats (salmon, black bear, wolf, deer, and bald eagle habitat) which exist around Ratz Harbor and Trumpeter Lake and low elevation, high-volume POG stands in the VCU are excluded from the OGR.

VCU 5840 (Sal Creek) – This small OGR is linear, running east-west between the shoreline and the small OGR in VCU 5800. It meets Forest Plan minimum acreage requirements for small OGR acres in this VCU, includes the largest remaining blocks of POG in the VCU, and provides elevational connectivity to saltwater between the Honker Large OGR via OGRs in VCUs 5790 and 5800.

VCU 5850 (Sandy Beach) – This small OGR is located south of Sandy Beach and consists entirely of low elevation POG. Inclusion of POG in this OGR is important due to the high level of fragmentation from previous harvest, and the limited remaining blocks of POG in this VCU. The existing small OGR also includes coastline that provides important salmon, waterfowl, and black bear habitat and has documented high recreational

use; however, it excludes a large block of POG to the north outside the beach buffer (near the Sandy Beach Recreation Area). It meets Forest Plan minimum acreage requirements for small OGR acres in this VCU.

VCU 5860 (Thorne Bay/Snug Anchorage) – This small OGR is located adjacent to Snug Anchorage. It meets Forest Plan minimum acreage requirements for small OGRs, includes the last remaining low elevation POG in the VCU, and provides connectivity to the small OGR in VCU 5850.

VCU 5950 (Steelhead Creek) – This small OGR is located west of Control Lake, north of the Steelhead Drainage and south of the highway. Considered by itself, the existing small OGR does not meet minimum acreage requirements; however, the VCU also includes a small portion of the Honker large OGR (Figure OGR-1). Taken together, Forest Plan minimum acreage requirements are met. Under the Forest Plan, in VCUs partially designated as very large, large, or medium OGRs, there are no requirements for small OGRs (Forest Plan FEIS Appendix D; USDA Forest Service 2008b). The existing small OGR also includes habitat for wolves, deer, black bears, marten, flying squirrels, and goshawks while providing connectivity to OGRs in adjacent VCUs.

VCU 5960 (Control Lake) – This small OGR is located south of the paved highway and east of Control Lake. It is contiguous with the Honker large OGR. Although by itself it does not meet Forest Plan minimum acreage requirements, it is contiguous with, and functions as part of, the Honker large OGR complex (Figure OGR-1). Therefore, it does not by itself need to meet small OGR acreage requirements (Forest Plan FEIS Appendix D; USDA Forest Service 2008b). The OGR in this VCU complements and adds value to the Honker large OGR complex, which provides a significant north/south connectivity corridor across the central Prince of Wales Island region connecting the Sarkar reserve to the Karta reserve.

VCU 5972 (Angel Lake) – This small OGR is adjacent to the Karta wilderness, extending north toward Angel Lake. A small portion of this OGR (south of Rush Peak) overlaps VCU 5980. The current small OGR location includes a large block of POG; however, it is predominantly high-elevation, high-gradient topography that provides relatively low value wildlife habitat. It does not include low elevation connectivity to salt water or known wolf dens (although active wolf dens are protected by other Forest Plan standards and guidelines), but Forest Plan minimum acreage requirements are met in this VCU.

Timber Resources

Reallocating areas within the Old-growth Habitat LUD (a non-development LUD) to development LUDs, and vice versa, would result in acreage changes to lands considered suitable and available for timber management, since OGRs are classified as not available for timber management. The small OGRs of the project area contain approximately 6,977 acres of forest land that would be considered suitable for timber production if it were in a development LUD.

Under existing conditions, the project area includes approximately 48,477 acres of suitable forest land, including 22,387 acres of old growth timber and 26,090 acres of young growth timber. Overall, this land base represents about 16 percent of the mapped suitable land base on the Thorne Bay and Craig Ranger Districts.

Fish Resources

The existing small OGRs of the project area contain an estimated 47 miles of Class I streams, 27 miles of Class II streams, and 101 miles of Class III streams. Part of the objectives of the Old-Growth Habitat LUD (USDA Forest Service 2008) is to provide old-growth forest habitats, in combination with other LUDs, to maintain viable fish populations, contribute to habitat capability of fish resources, and support sustainable human subsistence and recreational uses. Timber harvest and road construction would be allowed only under specific circumstances because, according to the Forest Plan, forest land is classified as unsuitable for timber production and new road construction is generally considered inconsistent with LUD objectives. However, even with development LUD designation, the riparian and other standards and guidelines and BMPs in place for timber harvest to protect riparian habitats and fish resources will be adequate to ensure that no additional adverse effects occur to fish resources in the project area.

Sensitive and Rare Plant Resources

Although there are no threatened or endangered plant species on the Tongass National Forest, a number of sensitive and rare species inhabit the Tongass (see Botany section later in this chapter). Many of these plants find habitats within OGRs and grow in or adjacent to old-growth forest stands. Modifying OGR boundaries may change the number of known populations included within OGRs.

Three species of sensitive plants are known to exist in the project area: lesser round-leaved orchid (*Platanthera orbiculata*), Alaska rein orchid (*Piperia unalascensis*), and a lichen (*Lobaria amplissima*). The first two species have populations in OGRs within the project area; *Lobaria* is not known in OGRs of the project area, but occurs in a small OGR on nearby Kosciusko Island.

Two rare species are known to exist in the project area: western meadowrue (*Thalictrum occidentale*) and lance leaf grapefern (*Botrychium lanceolatum*). Two populations of western meadowrue occur within small OGRs in the project area, but no population of lance leaf grapefern occur within small OGRs. An estimated 3,923 lesser round-leaved orchid plants in 110 populations are known to occur in the project area. Combined, the OGRs of the project area (including all non-development LUDs that make up an OGR) contain an estimated 42 percent of the individual plants and 30 percent of the known populations, in whole or in part.

An estimated 867 Alaska rein orchid plants in 24 populations are known to occur in the project area. Combined, the OGRs of the project area contain an estimated 35 percent of the individual plants and 38 percent of the known populations, in whole or in part.

Three populations of the lichen, *Lobaria amplissima*, are known in the project area, containing an estimated 20 individuals. However, none of these known populations occur fully or partially in OGRs.

Subsistence Resources

The existing small OGRs provide deer winter habitat within the reserve system and roads within the OGRs provide access for subsistence uses; thus modifications have the

potential to affect the abundance and distribution of, access to, and competition for deer depending on whether or not these areas are available for harvest. The existing small OGRs in the project area include 3,325 acres of deep snow deer winter habitat (high-volume POG below 800 feet elevation). See Issue 3 for a description of existing subsistence resources.

Scenery Resources

Scenery resources are maintained to a high degree within OGRs; they are assigned a scenic integrity objective (SIO) of high. Development LUDs, such as Modified Landscape and Timber Production, maintain the value of scenery resources to a lesser degree. Among the development LUDs, Scenic Viewshed generally has the highest SIOs, followed by Modified Landscape, which is followed by Timber Production; however, they are assigned in consideration of the scenery resources present in the area. Therefore, modification of OGR boundaries may change the degree of to which scenic values are maintained in several areas.

Recreation Resources

Recreation and tourism use in OGRs is managed to meet the Old-growth Habitat LUD objectives for fish and wildlife resources and habitat, with recreation-related structures designed to be compatible with the needs of old-growth associated species. The Old-growth Habitat LUD is intended to generally provide Semi-Primitive ROS settings, but the Forest Plan recognizes that more developed settings may be present due to authorized activities, existing use patterns, and activities in adjacent LUDs. Together, the 11 potentially affected small OGRs in the Big Thorne project area include approximately 25,500 acres. About 36 percent of this total is allocated to Semi-Primitive ROS settings, with the remaining 64 percent allocated to Roaded settings, primarily Roaded Modified (RM) (63 percent). ROS settings are discussed in more detail in the separate Recreation section later in this chapter.

Thirteen developed recreation sites are located in the Big Thorne project area (see the Recreation section). None of these sites are located within the potentially affected small OGRs.

Environmental Consequences

Land Use Designations

The modification of OGR boundaries in the project area would result in changes in the total acreage of each LUD. Table OGR-1 presents a summary of the LUD acreages in the project area for each alternative, and compares them with the acreage available under existing conditions.

Table OGR-1. Forest Plan Land Use Designation Acreage in the Project Area by Alternative

Land Use Designation (LUD)	Alt 1, 2, and 5 (acres)	Alt 3 (acres)	% change from Alt 1	Alt 4 (acres)	% change from Alt 1
Non-Development LUDs 1/					
Research Natural Area	1,621	1,621	-	1,621	-
Old-growth Habitat	74,949	75,539	+1%	79,237	+5%
Scenic River	14,180	14,180	-	14,180	-
Recreational River	2,932	2,932	-	2,932	-
Subtotal	**93,683**	**94,273**	**+1%**	**97,970**	**+5%**
Development LUDs 2/					
Timber Production	60,686	59,581	-2%	59,613	-2%
Modified Landscape	58,884	59,772	+1%	56,587	-4%
Scenic Viewshed	4,426	4,054	-8%	3,510	-20%
Subtotal	**123,997**	**123,407**	**-1%**	**119,709**	**-3%**
Total NFS Lands	217,679	217,679	-	217,679	-
Non-NFS Lands	14,169	14,169	-	14,169	-
Total (NFS + Non-NFS) Lands	**231,848**	**231,848**	-	**231,848**	-
2001 IRA 3/ included in Non-Development LUDs	**56,574**	**62,942**	**+11%**	**58,723**	**+4%**
2001 IRA 3/ included in Development LUDs	**35,659**	**29,292**	**-18%**	**3,510**	**-6%**

1/ Non-development LUDs generally do not permit timber harvest or road construction.
2/ Development LUDs allow timber harvest and road construction under certain conditions.
3/ 2001 IRA = 2001 Roadless Rule inventoried roadless area

Alternatives 1, 2, and 5

Under Alternatives 1, 2, and 5 no modifications to small the Old-growth Habitat LUD are proposed.

Alternative 3

Under Alternative 3, changes to the Old-growth Habitat LUD would occur through modifications of most small OGR boundaries in the project area. Emphasis was to move more of these reserves into inventoried roadless areas to further protect these areas and to increase the amount of roaded areas allocated to development LUDs. The overall net effect would be that the total acreage in the Old-growth Habitat LUDs of the project area would increase by 1 percent, and the total acreage in development LUDs would decrease by 1 percent.

Alternative 4

Under Alternative 4, changes to the Old-growth Habitat LUD would occur through modifications of several small OGR boundaries in the project area. Emphasis was to locate these reserves in the most biologically preferred areas based on habitats and connectivity to the large and medium OGRs. The overall net effect would be that the total acreage in the Old-growth Habitat LUDs of the project area would increase by 5 percent, and the total acreage in development LUDs would decrease by 3 percent.

Old-Growth Reserves

Evaluation and modification of small OGRs during project-level environmental analysis are addressed under Old-growth LUD Standard and Guideline WILD1(B). Small OGRs may be modified so that they meet the minimum criteria specified in Appendix K of the Forest Plan (pp. K-1 through K-3); reserve location, composition, and size may be also be adjusted provided that the modified OGR meets the minimum criteria and provides comparable achievement of Old-growth LUD goals and objectives (Forest Plan p. 3-62). Forest Plan goals and objectives for Old-Growth Habitat LUDs (Forest Plan p. 3-57) include:

Goals

- Maintain areas of old-growth forests and their associated natural ecological processes to provide habitat for old-growth associated resources.
- Manage early seral conifer stands to achieve old-growth forest characteristic structure and composition based upon site capability.

Objectives

- Provide old-growth forest habitats to maintain viable populations of fish and wildlife species and subspecies that are closely associated with old-growth forests.
- Contribute to the habitat capability of fish and wildlife resources to support sustainable human subsistence and recreational uses.
- Maintain biodiversity and ecological processes associated with old-growth forests.
- Limit roads, facilities, and permitted uses to those compatible with old-growth forest habitat objectives.
- Allow existing natural or previously harvested early seral conifer stands to evolve naturally to old-growth forest habitats, or apply silvicultural treatments to accelerate forest succession to achieve old-growth forest structural features.

Determination of comparable achievement of Old-growth LUD goals and objectives is subjective, but is supported by a review of additional OGR design criteria provided in Appendix D of the 2008 Forest Plan Final EIS (USDA Forest Service 2008b). Pursuant to Forest Plan Appendix K, an IRT comprising USFWS, ADF&G, and Forest Service biologists met in Thorne Bay on June 2–3, 2011, to review the existing small OGRs in the project area. The 2011 IRT evaluated the potential for moving small OGRs into 2001 roadless areas and the biological values of the current small OGR locations. A comparison of existing small OGRs (Alternatives 1, 2, and 5) and small OGR modifications proposed under Alternatives 3 and 4 based on Appendices K and D design criteria is summarized below and in Table OGR-2. Modifications to small OGRs that do not maintain comparable achievement of Old-growth LUD goals and objectives have the potential to reduce the functioning of the reserve system, either through reductions in the habitat elements maintained within the reserve system or connectivity provided by the reserve system.

Alternative 1, 2, and 5

Direct and Indirect Effects

Under Alternatives 1, 2, and 5 no modifications to small OGRs are proposed. Therefore, the LUD acreages would remain the same as under existing conditions. All existing small OGRs meet Forest Plan minimum acreage requirements (Forest Plan Appendices D and K), either alone or in conjunction with other OGRs or non-development LUDs (USDA Forest Service 2008b; Table OGR-2).

Cumulative Effects

Alternatives 1, 2, and 5 would not change the cumulative effects to the old-growth reserve system as analyzed by the Forest Plan Final EIS because no modifications to small OGRs are proposed. No other present or reasonably foreseeable projects in the analysis area would modify LUDs, and effects of individual development projects that might involve small OGR modifications are expected to be within the limits allowed by the Forest Plan, and would be analyzed separately and cumulatively as they are proposed.

Alternative 3

Direct and Indirect Effects

Alternative 3 involves an exchange of 5,873 acres within roaded portions of small OGRs that would become available for timber harvest, for 6,462 acres within Inventoried Roadless Areas that would be designated as Old-growth Habitat LUD (Figure OGR-2; Table OGR-2). Detailed maps showing the specific changes for each LUD and OGR are provided in Figures OGR-3, OGR-4, and OGR-5. No modifications are proposed in VCU 5960.

Table OGR-2. Comparison of Old-growth Reserves Based On Forest Plan Design Criteria

	5790-Gravelly Creek/Falls Creek			5800-North Thorne River		5810-Luck Lake		5820-Baird Peak		
	Alt 1, 2, 5	Alt 3	Alt 4[7/]	Alt 1, 2, 4, 5	Alt 3	Alt 1, 2, 4, 5	Alt 3	Alt 1, 2, 5	Alt 3	Alt 4
Forest Plan Appendix K Criteria										
Required OGR (acres)[1/]	1,714			2,462		3,210		657		
Required POG (acres)[2/]	857			1,321		1,605		328		
OGR acres	2,745	3,058[8/]	2,980[9/]	3,117	3,658	3,749	3,443	766	902	936
POG acres	872	1,026[8/]	1,027[9/]	1,594	2,093	2,273	1,720	587	687	672
Acreage requirements met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Appendix D General Design Criteria										
Circular rather than linear to maximize interior habitat/minimize fragmentation effects	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Minimizes roads (total road miles)	3.1	-0.8	+0.5	5.5	-5.2	6.3	-5.5	0.0	+0	+0
Minimizes early seral habitat (acres)	128	-4	+27	279	-255	166	-100	0	+0	+0
Riparian/beach/estuary habitats (Class I stream miles)	15.0	+1.1	+1.9	23.9	+5.1	23.0	-5.9	6.0	+0.6	-1.7
Includes largest remaining block of POG in VCU?	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rare/Underrepresented features (large tree POG acres) [3/]	14	+4	+38	368	+132	630	-242	287	+4	-37
Deep snow deer & marten habitat (acres)[4/]	57	-25	+41	225	-141	513	-390	213	+8	-16
Goshawk & murrelet nesting habitat (acres)[5/]	179	-28	+23	841	+530	1321	-374	402	+28	+2
Other Considerations										
Maintains Connectivity	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes
Low elevation POG (acres)[6/]	58	-23	+147	748	-659	945	-563	368	+64	+115

1/ 16% of VCU acres
2/ 50% of OGR acres
3/ SD67 type
4/ High-volume POG ≤ 800 ft elevation
5/ High-volume POG all elevations (indicative of optimal goshawk and marbled murrelet nesting habitat due to presence of large trees and snags, though both species may use all POG types; see Issue 3)
6/ All POG ≤ 800 ft elevation (representative of low-elevation travel corridors important for many species)
7/ Most changes under alternative 4 made in VCU 5780;
8/ Includes acreage addition in VCU 5850 (274 acres total; 112 acres POG)
9/ Includes acreage addition in VCU 5780 (235 acres total; 154 acres POG)

Table OGR-2. Comparison of Old-growth Reserves Based On Forest Plan Design Criteria (cont.)

	5830-Ratz Harbor			5840-Sal Creek		5850-Sandy Beach			5860-Thorne Bay/Snug Anchorage	
	Alt 1, 2, 5	**Alt 3**	**Alt 4**	**Alt 1, 2, 4, 5**	**Alt 3**	**Alt 1, 2, 5**	**Alt 3**	**Alt 4**	**Alt 1, 2, 4, 5**	**Alt 3**
Forest Plan Appendix K Criterion										
Required OGR (acres)[1/]	1,998			2,226		1,680			1,131	
Required POG (acres)[2/]	999			1,113		840			565	
OGR acres	2,039[7/]	2,386	1,921	2,650	2,864	1,906	1,703	2,185	1,645	1,204
POG acres	945[7/]	989	806	1,487	1,277	1,049	870	1,262	1,311	921
Acreage requirements met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Appendix D General Design Criteria										
Circular rather than linear to maximize interior habitat/minimize fragmentation effects	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Minimizes roads (miles)	8.0	-1.5	+0.8	5.6	-5	4.2	-2.8	+1.8	5.1	-5.1
Minimizes early seral habitat (acres)	659	-74	+9	147	-83	23	-6	+44	66	+0
Riparian/beach/estuary habitats (Class I stream miles)	9.4	-0.8	+1.8	25.5	-2.3	10.6	-0.7	+1.3	11.2	-4.1
Includes largest remaining block of POG in VCU?	No	No	Yes	Yes	No	Yes	No	Yes	Yes	No
Rare/Underrepresented features (large tree POG acres) [3/]	158	-34	-69	292	-193	24	-23	+26	248	-146
Deep snow deer & marten habitat (acres)[4/]	132	-78	-21	281	-260	248	-50	+60	742	-273
Goshawk & murrelet nesting habitat (acres)[5/]	311	-6	-69	685	-193	248	-50	+60	743	-273
Other Considerations										
Maintains Connectivity	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No
Low elevation POG (acres)[6/]	636	-169	+80	562	-497	1,041	-179	+212	1,304	-388

1/ 16% of VCU acres
2/ 50% of OGR acres
3/ SD67 type
4/ high-volume POG ≤ 800 ft elev.
5/ High-volume POG all elevations (indicative of optimal goshawk and marbled murrelet nesting habitat due to presence of large trees and snags, though both species may use all POG types; see Issue 3)
6/ All POG ≤ 800 ft elevation (representative of low-elevation travel corridors important for many species)
7/ Approximately 30% of acreage mapped in VCU 5820 (386 acres total; 299 acres POG) and 70% mapped in VCU 5830 (1,654 acres total, 646 acres POG).

Table OGR-2. Comparison of Old-growth Reserves Based On Forest Plan Design Criteria (cont.)

	5950-Steelhead Creek			5960-Control Lake		5972-Angel Lake		
	Alt 1, 2, 5	Alt 3	Alt 4	Alt 1, 2, 3, 5	Alt 4	Alt 1, 2, 5	Alt 3	Alt 4
Forest Plan Appendix K Criteria								
Required OGR (acres)[1/]	2,836			1,974		3,405		
Required POG (acres)[2/]	1,418			987		1,702		
OGR acres	2,294	2,563	3,480	1,251	2,569	3,663[7/]	3,380	4,736
POG acres	1,406	1,449	2,157	394	1,068	1,892[7/]	1,584	1,935
Acreage requirements met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Appendix D General Design Criteria								
Circular rather than linear to maximize interior habitat/minimize fragmentation effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minimizes roads (miles)	3.6	-1.1	+1.1	3.7	+1.0	6.3	-3.1	+11.5
Minimizes early seral habitat (acres)	267	-63	+2	6	+0	316	-24	-125
Riparian/beach/estuary habitats (Class I stream miles)	29.3	+0.4	+17.0	11.9	+12.6	24.6	-7.4	-9.4
Includes largest remaining block of POG in VCU?	No	No	Yes	Yes	Yes	Yes	No	Yes
Rare/Underrepresented features (large tree POG acres) [3/]	472	-30	+422	77	+357	562	-86	-369
Deep snow deer & marten habitat (acres)[4/]	474	-31	+420	91	+346	349	-162	+82
Goshawk & murrelet nesting habitat (acres)[5/]	848	-67	+524	134	+425	986	-237	-511
Other Considerations								
Connectivity	Yes	Yes	Yes	No	Yes	No	No	Yes
Low elevation POG (acres)[6/]	730	-67	+471	314	+501	696	-428	+1062

1/ 16% of VCU acres
2/ 50% of OGR acres
3/ SD67 type
4/ high-volume POG ≤ 800 ft elev.
5/ High-volume POG all elevations (indicative of optimal goshawk and marbled murrelet nesting habitat due to presence of large trees and snags, though both species may use all POG types; see Issue 3)
6/ All POG ≤ 800 ft elevation (representative of low-elevation travel corridors important for many species)
7/ split between VCUs 5972 and 5980 (357 acres total, 144 acres POG)

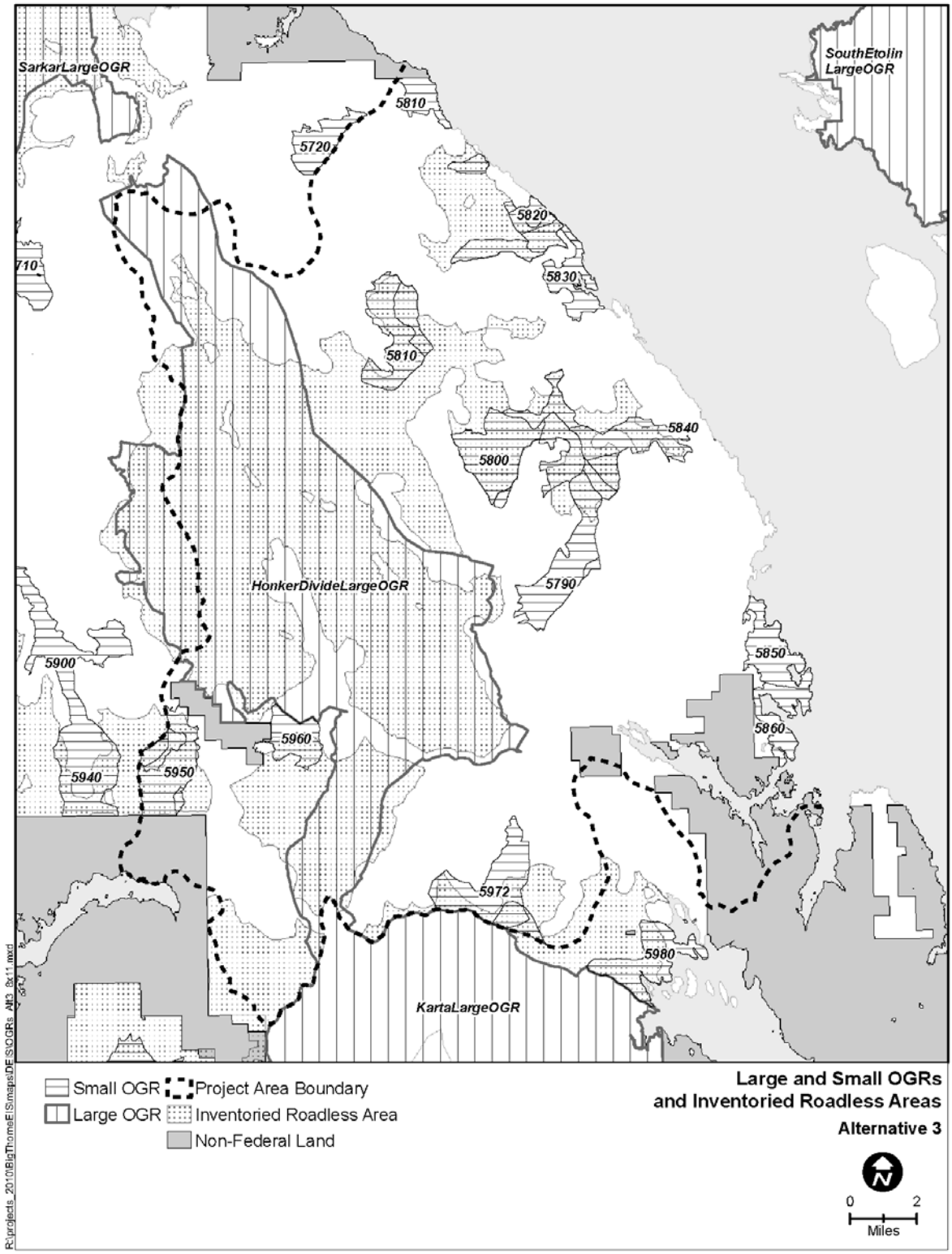

Figure OGR-2. Old-growth Reserves under Alternative 3 in the Big Thorne Project Area

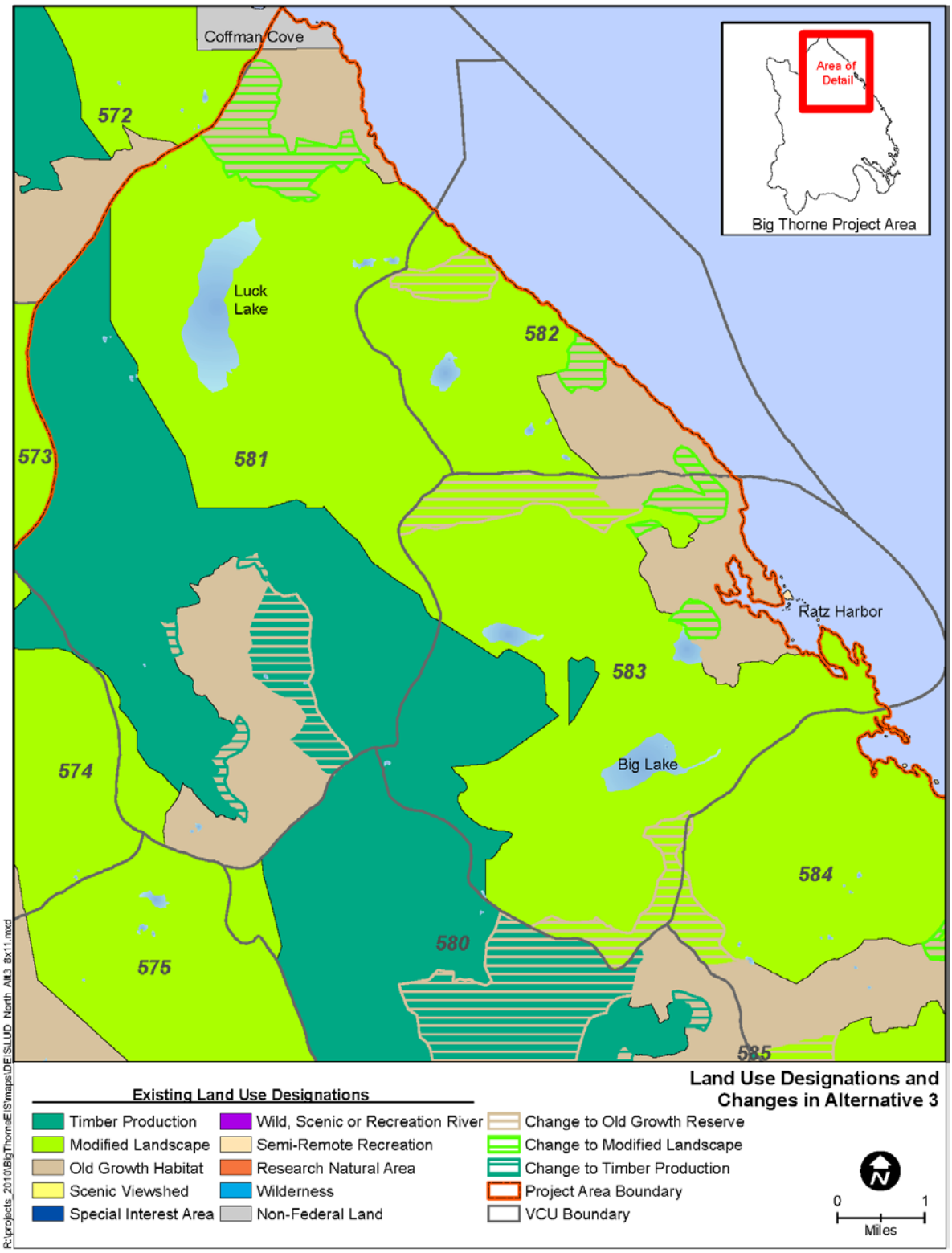

Figure OGR-3. Small Old-growth Reserves under Alternative 3 in the North Portion of the Big Thorne Project Area Showing LUD Changes

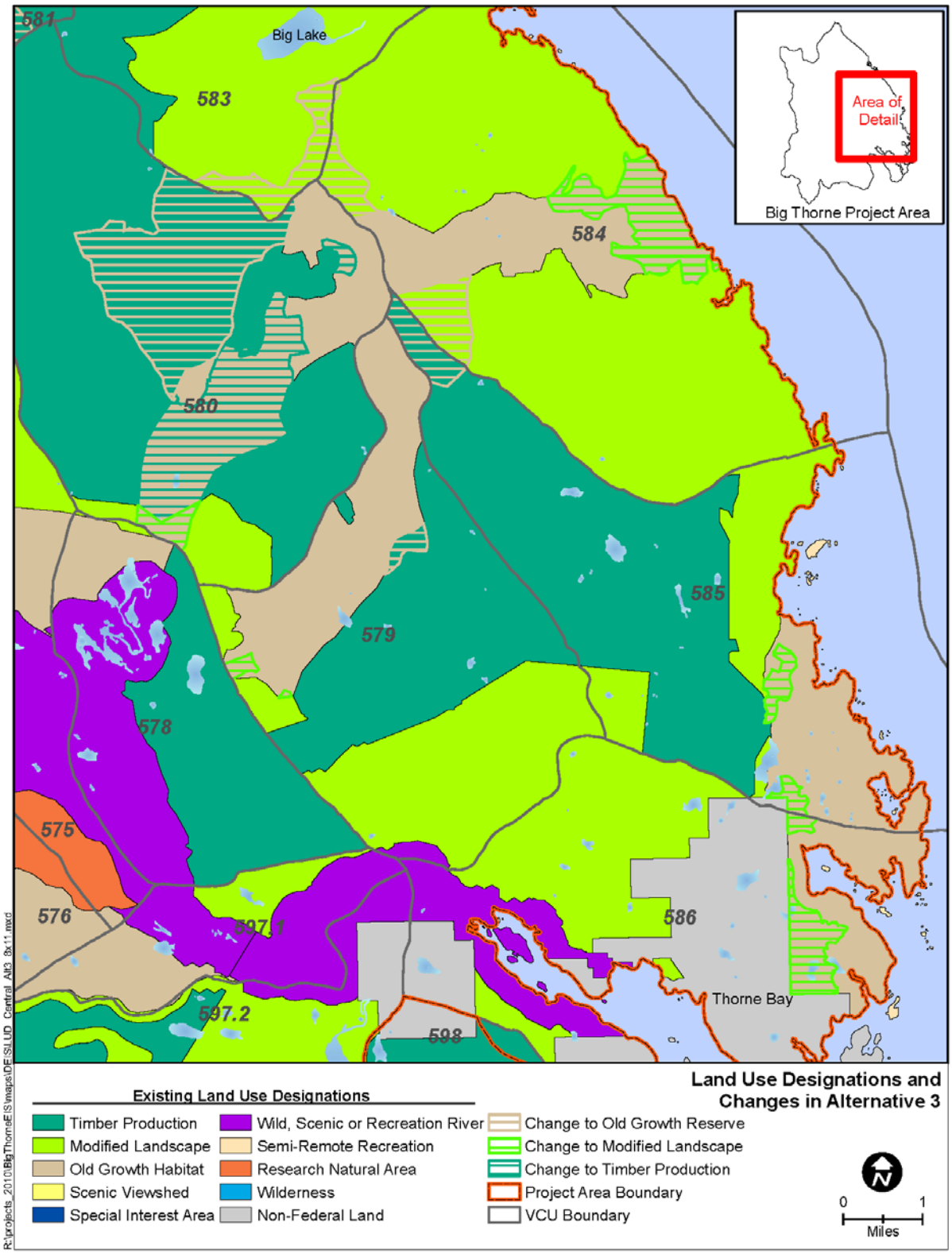

Figure OGR-4. Small Old-growth Reserves under Alternative 3 in the Central Portion of the Big Thorne Project Area Showing LUD Changes

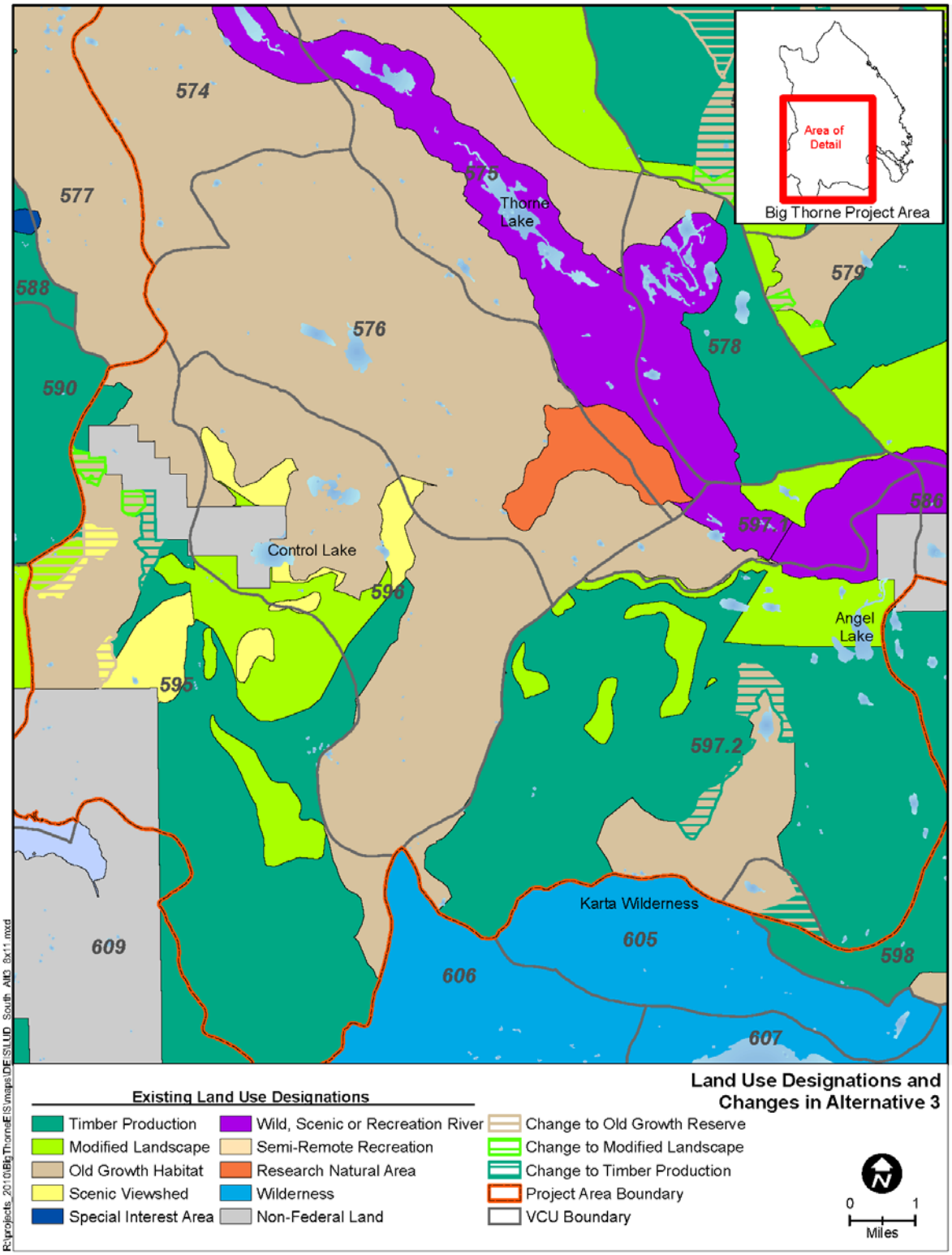

Figure OGR-5. Small Old-growth Reserves under Alternative 3 in the South Portion of the Big Thorne Project Area Showing LUD Changes

All modified small OGRs proposed under Alternative 3 would meet minimum Forest Plan acreage requirements (Table OGR-2). Alternative 3 would increase the total acres of small OGRs within VCUs 5790, 5800, 5820, 5830, 5840, and 5950. POG would also increase in these VCUs with the exception of VCU 5840, in which POG would be reduced. Modifications in VCUs 5810, 5850, 5860, and 5972 would reduce total OGR and POG acreages. The remaining small OGRs in the project area would not change (Table OGR-2).

Most of the proposed small OGR modifications under Alternative 3 reduce the miles of roads and early seral habitat included in the small OGR, and also increase the amount of suitable timber available for harvest. However, these modifications also reduce the amount of POG (including large-tree POG and low elevation POG), goshawk and marbled murrelet nesting habitat, and deer and marten winter habitat in some small OGRs. The following paragraphs describe the effects for each VCU individually. For a discussion of effects on suitable timber acres and timber volume see the Timber Resources subsection below.

VCU 5790 (Gravelly Creek/Falls Creek) – Modifications under Alternative 3 would remove acreage from the western edge of the VCU and add acreage (all roadless) along Slide Creek in VCU 5850 to enhance the connection between small OGRs in VCUs 5840 and 5790. Acres would also be added along Gravelly Creek. This would result in an overall increase in small OGR acres (313 acres) and POG acres (154 acres) (Table OGR-2). This would exceed Forest Plan Appendix K small OGR acreage requirements and would also provide connectivity through the VCU between the Honker large OGR and saltwater, although through a higher-elevation corridor.

Alternative 3 would reduce the amount of road miles (0.8 mile; 26 percent) and early seral habitat (4 acres; 3 percent), and increase the miles of Class 1 streams (1.1 miles; 7 percent) and the amount of under-represented features (large-tree POG; 4 acres; 29 percent) included in the small OGR. Alternative 3 would decrease the amount of deep snow marten habitat/deer winter range (25 acres; 44 percent), potential goshawk and marbled murrelet nesting habitat (28 acres; 16 percent), and would no longer include the largest block of POG in the VCU within the small OGR. However, only 12 percent of the deep snow marten habitat/deer winter range and 7 percent of the potential goshawks and marbled murrelet nesting habitat currently in VCU 5790, respectively, were encompassed by the existing small OGR. Additionally, the modified OGR would be more linear rather than circular, but this is consistent with the existing small OGR.

VCU 5800 (North Thorne River) – Modifications under Alternative 3 would remove acreage from the low-elevation river drainage comprising the southwestern portion of the OGR and add higher-elevation acreage (all within roadless) to the north, adjacent to VCU 5830. This would result in an overall increase in small OGR and POG acres, exceeding Forest Plan Appendix K small OGR acreage requirements (Table OGR-2).

Alternative 3 would reduce the number of road miles (5.2 miles; 95 percent) and early seral habitat (255 acres; 91 percent), and increase the amount of Class I streams (5.1 miles; 21 percent), under-represented features (large-tree POG; 132 acres; 36 percent), and potential goshawk and murrelet nesting habitat (530 acres; 3 percent; Table OGR-2) included within the small OGR. The exchange of lower-elevation acreage would reduce

the amount of low elevation POG (659 acres; 88 percent) and deep snow deer and marten habitat (141 acres; 63 percent; OGR-2) included in the OGR. Alternative 3 would also remove the current low elevation connection between the Honker large OGR complex and the shoreline; however, the 2011 IRT felt that the current connectivity to saltwater would be maintained through a different route via VCU 5840.

VCU 5810 (Luck Lake) – This VCU contains two disconnected small OGRs, one in the northern portion of the VCU and one in the southern portion. Modifications proposed under Alternative 3 include removal of acreage along the western edges of the northern and southern piece of this OGR, and the addition of acreage along the eastern edge of the southern piece. This modification would reduce the overall number of small OGR and POG acres but the resulting acreage would continue to exceed Forest Plan Appendix K acreage requirements (Table OGR-2). Under Alternative 3 approximately 25 percent of the total POG in VCU 5810 would be encompassed by the small OGR, compared to 33 percent within the existing small OGR.

Alternative 3 would reduce the amount of roads (5.5 miles; 87 percent) and early seral forest (100 acres; 60 percent) included in the small OGR; however it would also reduce the amount of Class I stream miles (5.9 miles; 26 percent), under-represented features (large-tree POG; 242 acres; 38 percent), deep snow deer and marten habitat (390 acres; 76 percent), and potential goshawk and marbled murrelet nesting habitat (374 acres; 28 percent) included. Although some low-elevation POG, including deep snow marten habitat/deer winter range would be maintained by a Class I stream buffer along Eagle Creek, Alternative 3 would reduce connectivity to the shoreline.

VCU 5820 (Baird Peak) – Under Alternative 3, the roaded portion of this small OGR along the shoreline would be removed and acreage would be added in a separate, disconnected location to the north. This would increase the overall number of small OGR and POG acres, continuing to exceed Forest Plan Appendix K acreage requirements (Table OGR-2). Additional modifications to VCU 5820 would occur in association with the Ratz Harbor small OGR (split between VCUs 5820 and 5830). These modifications would result in a net increase in OGR and POG acres (136 total acres and POG acres; Table OGR-2). See discussion under VCU 5830 below for additional discussion.

Alternative 3 would result in no change in the number of road miles or acres of early seral forest included in the small OGR, and would result in minor increases in the amount of Class I stream miles (0.6 mile; 10 percent), under-represented features (large-tree POG; 4 acres; 1 percent), deep snow deer winter range and marten habitat (8 acres; 4 percent), potential goshawk and marbled murrelet nesting habitat (28 acres; 7 percent), and low-elevation POG (64 acres; 17 percent; Table OGR-2) included. The modified OGR would continue to include one of two remaining patches of deer winter range and the largest contiguous block of POG in the VCU.

VCU 5830 (Ratz Harbor) – Modifications under Alternative 3 would remove acres in VCUs 5820 and 5830 near Ratz Point, and add acres in VCU 5830 along the northern and southern VCU boundaries. This would in result in a net increase in OGR acres (347 acres) and in POG acres (44 acres) (Table OGR-2).

Alternative 3 would reduce the amount of roads (1.5 miles; 19 percent) and early seral forest (74 acres; 11 percent) and increase the amount of under-represented features (large-tree POG; 34 acres; 23 percent) included in the small OGR. However, it would reduce the amount of Class I streams (0.8 mile; 9 percent), deep snow deer winter range and marten habitat (78 acres; 60 percent), potential goshawk and marbled murrelet nesting habitat (6 acres; 2 percent), and low-elevation POG (169 acres; 27 percent; Table OGR-2).

VCU 5840 (Sal Creek) – Modifications under Alternative 3 would remove acres along the shoreline, and add acres adjacent to the western portion of the existing OGR to broaden the connection to OGRs in VCUs 5790 and 5800. However, this would eliminate the connection provided by the current small OGR between the Honker large OGR complex and coastal habitats and would eliminate protection of the largest remaining blocks of POG in the VCU. This would result in an increase in OGR acres but a decrease in POG acres, though both would continue to exceed Forest Plan Appendix K acreage requirements (Table OGR-2).

Alternative 3 would reduce the amount of roads (5 miles; 89 percent) and early seral forest (83 acres; 56 percent) included in the small OGR, but would also reduce the amount of Class I stream miles (2.3 miles; 9 percent), under-represented features (large-tree POG; 193 acres; 66 percent), deep snow winter range and marten habitat (260 acres; 95 percent), potential goshawk and marbled murrelet nesting habitat (193 acres; 28 percent), and low-elevation POG (497 acres; 88 percent; Table OGR-2) included. High-volume and large-tree POG are already limited in this VCU, comprising 44 and 28 percent of the original (1954) POG (see Table WLD-1 under Issue 3).

VCU 5850 (Sandy Beach) – Modifications under Alternative 3 would result in a decrease in total acreage and POG acreage from the western boundary of this small OGR. Because the existing small OGR exceeds minimum acreage requirements, and would continue to do so under Alternative 3, no replacement acres would be required (Table OGR-2).

Alternative 3 would reduce the amount of roads (2.8 miles; 66 percent) and early seral forest (6 acres; 26 percent) included in the small OGR, but would also reduce the amount of Class I streams (0.7 mile; 7 percent), under-represented features (large-tree POG; 23 acres; 96 percent), deep snow deer winter range and marten habitat (50 acres; 20 percent), potential goshawk and murrelet nesting habitat (50 acres; 20 percent), and low-elevation POG (179 acres; 17 percent; Table OGR-2) included. This would exacerbate the condition of limited amounts of POG in this VCU. Currently, 41, 18, and 10 percent of the total original (1954) total, high-volume, and large-tree POG remain in VCU 5850 (see Table WLD-1 under Issue 3).

VCU 5860 (Thorne Bay/Snug Anchorage) – Modifications under Alternative 3 would remove acreage and POG acreage along this small OGRs western edge and south of Snug Anchorage. Because the existing small OGR exceeds the minimum acreage requirements, and would continue to do so under Alternative 3, no replacement acres would be required (Table OGR-2).

Alternative 3 would reduce the amount of road miles (5.1 miles; 100 percent) included in the small OGR, would result in no change to the amount of early seral habitat included, but would also decrease the amount of Class I streams (4.1 miles; 37 percent), under-

represented features (146 acres; 59 percent), deep snow deer winter range and marten habitat (273 acres; 37 percent), potential goshawk and marbled murrelet nesting habitat (273 acres; 37 percent), and low-elevation POG (388 acres; 30 percent; Table OGR-2) included. Modifications would also eliminate inclusion of the largest remaining blocks of POG in the VCU. The majority of the POG contained in the resulting small OGR consists of beach fringe. Because POG is already limited in this VCU (currently 54, 48, and 39 percent of original (1954) total, high-volume, and large-tree POG remain, respectively; see Table WLD-1 under Issue 3), additional reductions in the inclusion of POG in the reserve system under Alternative 3 would exacerbate these conditions.

VCU 5950 (Steelhead) – Modifications under Alternative 3 would remove acreage from the northeastern fringes adjacent to state land and add acreage along the western and southeastern flanks of the existing small OGR. This would result in an increase in OGR and POG acreage. Although the small OGR alone would not meet Forest Plan Appendix K acreage requirements, in combination with acres from the portion of the Honker large OGR located in VCU 5950, as allowed under the Forest Plan (Appendix D; USDA Forest Service 2008b), minimum acreage requirements would be met. As noted above, due to the presence of the large OGR in this VCU, there are no requirements for a separate small OGR. The shape of the small OGR under Alternative 3 would also now be more circular than linear, increasing the amount of interior forest habitat (Table OGR-2).

The proposed modifications would maintain connectivity to OGRs in adjacent VCUs and would result in reduction in the amount of road miles (1.1 miles; 31 percent) and early seral forest (63 acres; 24 percent; Table OGR-2) included in the small OGR. Alternative 3 would also result in a minor reduction in the amount of under-represented features (large-tree POG; 30 acres; 6 percent), deep snow deer winter range and marten habitat (31 acres; 7 percent), potential goshawk and marbled murrelet nesting habitat (67 acres; 8 percent), and low-elevation POG (67 acres; 9 percent; Table OGR-2).

VCU 5960 (Control Lake) – No modifications to the small OGR in VCU 5960 are proposed under Alternative 3.

VCU 5972 (Angel Lake) – Modifications under Alternative 3 would remove acres from the northern and western edges of the existing small OGR, and add acres to its southeastern lobe (in VCUs 5972 and 5980). This would decrease the amount of OGR and POG acres, which would now be less than Forest Plan Appendix K acreage requirements for a separate small OGR in this VCU. However, a portion of the Honker large OGR is located in the northern end of the VCU; therefore, the small OGR does not by itself need to meet Forest Plan Appendix K acreage requirements (Forest Plan FEIS Appendix D; USDA Forest Service 2008b).

Alternative 3 would reduce the amount of roads (3.1 miles; 49 percent) and early seral forest (24 acres; 8 percent) included in the small OGR, but would also reduce the amount of Class I streams (7.4 miles; 29 percent), under-represented features (large-tree POG; 86 acres; 15 percent), deep snow deer winter range and marten habitat (162 acres; 46 percent), potential goshawk and murrelet nesting habitat (237 acres; 24 percent), and low-elevation POG (428 acres; 61 percent; Table OGR-2) included. Alternative 3 would also eliminate inclusion of the largest remaining block of POG in the VCU.

Cumulative Effects

Alternative 3 would result in a net gain of 590 acres in the Old-growth Habitat LUD; however, there would be a net reduction of 849 acres of POG included in small OGRs (Tables OGR-1 and OGR-2). There would be a corresponding net increase in suitable and available timber (see Timber Resources section for a VCU by VCU discussion of suitable and available timber acres and volumes). However, this does not take into account old-growth habitats maintained by other elements of the Forest Plan conservation strategy including other non-development LUDs. It should be noted that under the current roadless rule, there are roadless acres in development LUDS which may not be harvested and which provide habitat and facilitate connectivity across the landscape.

Past and ongoing timber harvest is discussed below by VCU. No other present or reasonably foreseeable projects in the analysis area would modify LUDs, and effects of individual development projects that might involve small OGR modifications are expected to be within the limits allowed by the Forest Plan, and would be analyzed separately and cumulatively as they are proposed.

VCU 5790 (Gravelly Creek/Falls Creek) – VCU 5790 currently maintains 40 percent of the original total POG present in 1954, of which 32 percent would be included in the modified OGR (an decrease of less than 1 percent). This does not include the 274 acres which would be added to the reserve system in adjacent VCU 5850 through this modification (approximately 4 percent of the existing POG in that VCU). Therefore, the exchange in amounts of various habitats and features, identified as design criteria in Appendix D of the Forest Plan FEIS, between the existing small OGR and the modified small OGR has potential to result in additional loss of these habitats should these vacated areas be harvested in the future. Moreover, there are no large ongoing or reasonably foreseeable projects in VCU 5790.

VCU 5800 (North Thorne River) – VCU 5800 currently maintains 72 percent of the original total POG present in 1954, of which 30 percent would be included in the modified OGR (an increase of 7 percent). Moreover, there are no large ongoing or reasonably foreseeable projects in VCU 5800.

VCU 5810 (Luck Lake) – VCU 5810 currently maintains 50 percent of the original total POG present in 1954, of which 25 percent would be included in the modified OGR (a decrease of 8 percent). Therefore, the exchange in amounts of various habitats and features (Forest Plan Appendix D design criteria) between the existing small OGR and the modified small OGR under Alternative 3 has potential to result in additional loss of these habitats should these vacated areas be harvested in the future (see the Timber Resources section below). There are no large ongoing or reasonably foreseeable projects in VCU 5810.

VCU 5820 (Baird Peak) – VCU 5820 currently maintains 100 percent of the original total POG present in 1954 of which 28 percent would be included in the modified OGR (an increase of 4 percent). It is considered an intact landscape as defined in the Forest Plan FEIS (i.e., maintaining more than 95 percent of its original POG; USDA Forest Service 2008b). Moreover, there are no large ongoing or reasonably foreseeable projects in VCU 5820.

VCU 5830 (Ratz Harbor) – VCU 5830 currently maintains 56 percent of the original total POG present in 1954, of which 15 percent would be included in the modified OGR (an increase of 1 percent). This OGR is split between two VCUs, so this does not include modifications in adjacent VCU 5820 which would result in 10 percent of the original POG in VCU 5820 being included in this small OGR (a decrease of 2 percent). Moreover, there are no large ongoing or reasonably foreseeable projects in VCU 5830.

VCU 5840 (Sal Creek) – VCU 5840 currently maintains 59 percent of the original total POG present in 1954, of which 22 percent would be included in the modified OGR (a decrease of 3 percent). Therefore, the exchange in amounts of various habitats and features (Forest Plan Appendix D design criteria) between the existing small OGR and the modified small OGR under Alternative 3 has potential to result in additional loss of these habitats should these vacated areas be harvested in the future. There are no large ongoing or reasonably foreseeable projects in VCU 5840.

VCU 5850 (Sandy Beach) – VCU 5850 currently maintains 41 percent of the original total POG present in 1954, of which 28 percent would be included in the modified OGR (a decrease of 6 percent). In addition, a small amount of harvest (22 acres) would occur in this VCU under the North Thorne Bay state timber harvest project. Therefore, the cumulative effects of the exchange in amounts of various habitats and features (Forest Plan Appendix D design criteria) under Alternative 3 has potential to result in additional loss of these habitats should these vacated areas be harvested in the future.

VCU 5860 (Thorne Bay/Snug Anchorage) – VCU 5860 currently maintains 54 percent of the original total POG present in 1954, of which 14 percent would be included in the modified OGR (a decrease of 7 percent). In addition, approximately 455 acres within this VCU is planned for harvest on state lands (North Thorne Bay). Therefore, the exchange in amounts of various habitats and features (Forest Plan Appendix D design criteria) between the existing small OGR and the modified small OGR under Alternative 3 has potential to result in additional loss of these habitats should these vacated areas be harvested in the future.

VCU 5950 (Steelhead) – VCU 5950 currently maintains 70 percent of the original total POG present in 1954, of which 20 percent would be included in the modified OGR (an increase of less than 1 percent). In addition, approximately 65 acres could be harvested in VCU 5950 under the Control Lake timber harvest project.

VCU 5960 (Control Lake) – No small OGR modifications are proposed in VCU 5960 under Alternative 3; therefore, there would be no cumulative effects.

VCU 5972 (Angel Lake) – VCU 5972 currently maintains 66 percent of the original total POG present in 1954, of which 17 percent would be included in the modified OGR (a decrease of 2 percent). This small OGR is split between two VCUs, so this does not take into account modifications in adjacent VCU 5980 which would result in less than 1 percent of the original POG in VCU 5980 being included in this small OGR (a reduction of close to 3 percent). In addition, approximately 256 acres could be harvested in VCU 5972 under the Control Lake timber harvest project. Therefore, the exchange in amounts of various habitats and features (Forest Plan Appendix D design criteria) between the existing small OGR and the modified small OGR under Alternative 3 has potential to

result in additional loss of these habitats should these vacated areas be harvested in the future.

Alternative 4

Direct and Indirect Effects

Under Alternative 4, the small OGR locations and/or boundaries would be adjusted in accordance with the biologically preferred alternative developed by the 2011 IRT (Figure OGR-6). Detailed maps showing the specific changes for each LUD and OGR are provided in Figures OGR-7, OGR-8, and OGR-9. This review took into account Forest Plan Appendix K criteria and biologically preferred locations identified during previous small OGR reviews. Areas vacated by small OGR modifications would be designated as Timber Production or Modified Landscape and made available for timber harvest. All alternative OGRs, as proposed under Alternative 4, would meet Forest Plan minimum acreage requirements (Table OGR-2). The following paragraphs describe the effects for each VCU individually. For a discussion of suitable timber acres and timber volume see the Timber Resources subsection below.

VCU 5790 (Gravelly Creek/Falls Creek) – Alternative 4 would add acreage to the western end of the existing small OGR, providing a direct connection to the Honker large OGR complex through VCU 5780. Note that no actual changes are proposed to the existing OGR in VCU 5790, but rather all changes are in adjacent VCU 5780. This would improve the biological functionality of the complex of small OGRs in VCUs 5790, 5800, and 5840 while continuing to meet minimum acreage requirements (Table OGR-2).

Although Alternative 4 would slightly increase the amount of roads (0.5 mile; 16 percent) and early seral forest (27 acres; 21 percent) in the small OGR, Alternative 4 would substantially increase the amount of under-represented features (large-tree POG; 38 acres; 271 percent), deep snow deer winter range and marten habitat (41 acres; 72 percent), and low-elevation POG (147 acres; 253 percent; Table OGR-2) included. Smaller increases would also occur in the amount of Class I streams (1.9 miles; 13 percent) and potential goshawk and marbled murrelet nesting habitat (58 acres; 32 percent; Table OGR-2).

VCU 5800 (North Thorne River) – There is no change proposed under Alternative 4 for VCU 5800.

VCU 5810 (Luck Lake) – There is no change proposed under Alternative 4 for VCU 5810.

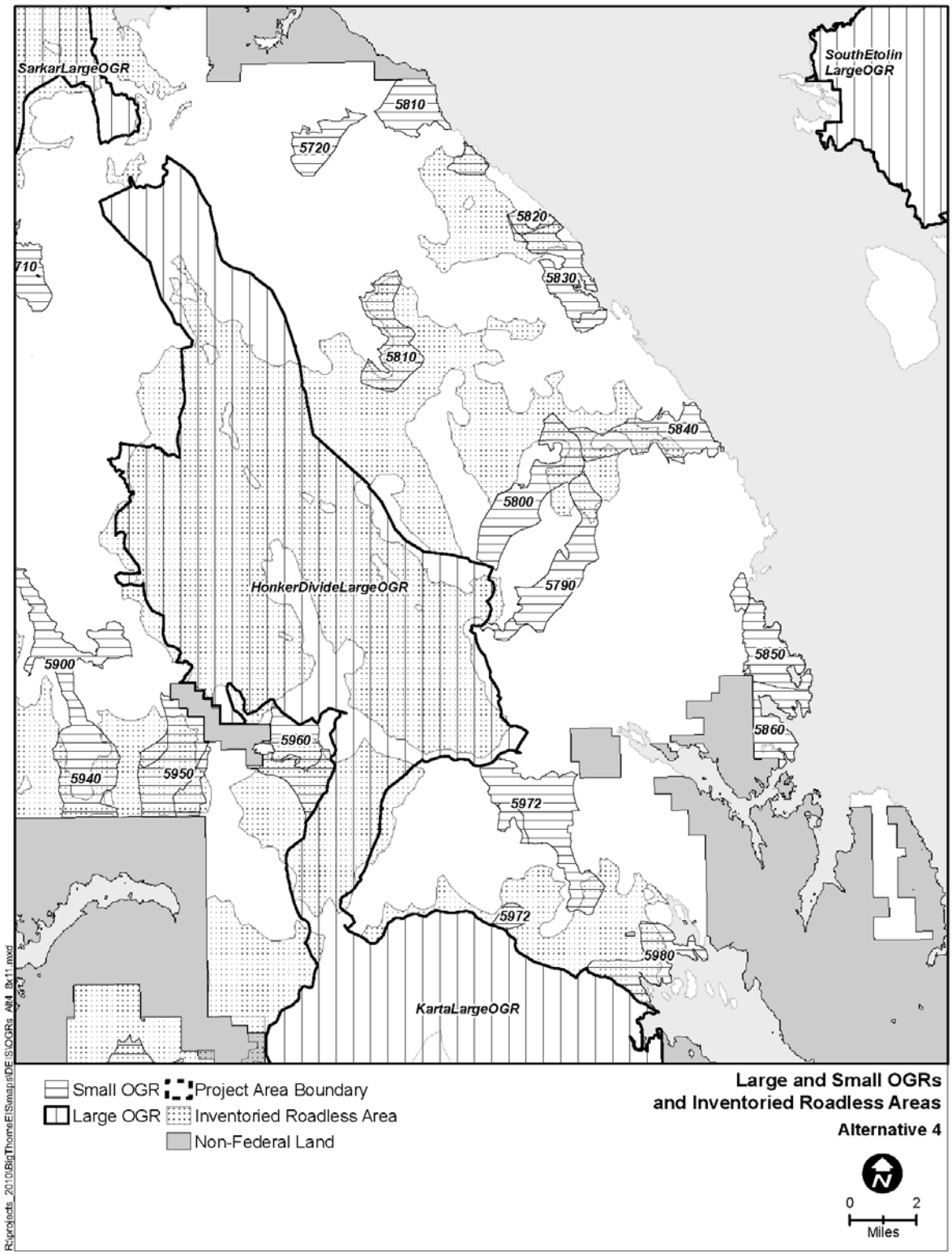

Figure OGR-6. Old-growth Reserves under Alternative 4 in the Big Thorne Project Area

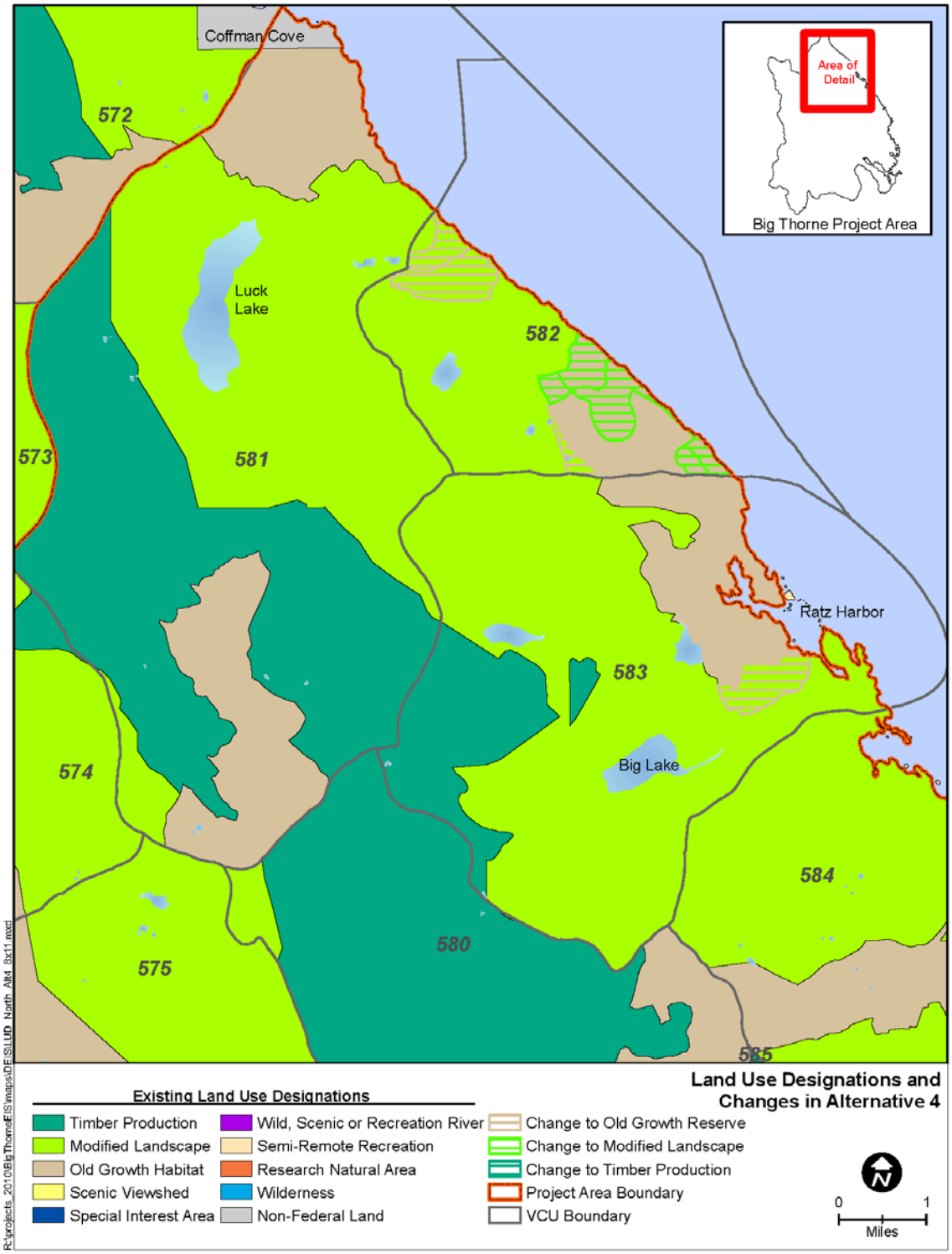

Figure OGR-7. Small Old-growth Reserves under Alternative 4 in the North Portion of the Big Thorne Project Area Showing LUD Changes

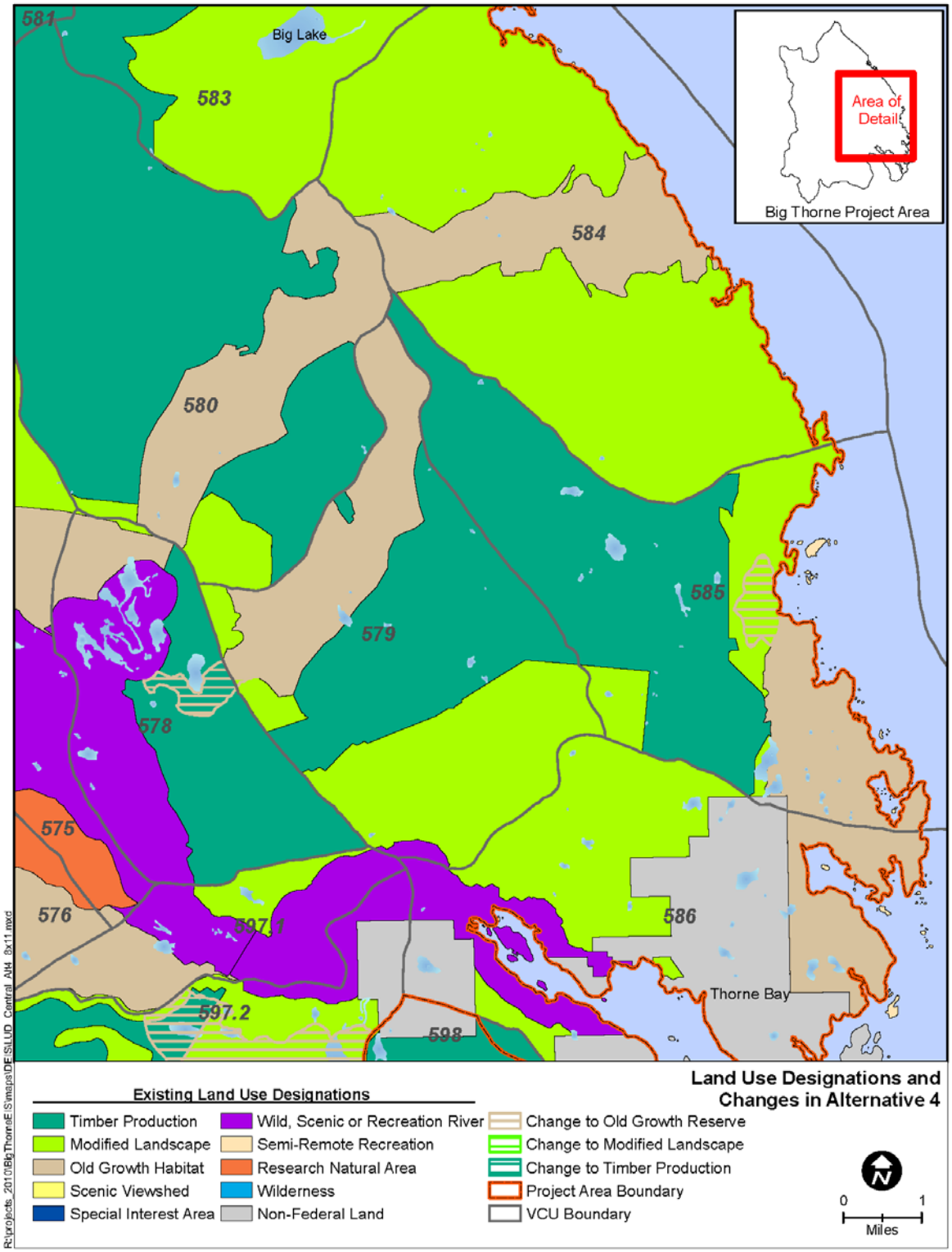

Figure OGR-8. Small Old-growth Reserves under Alternative 4 in the Central Portion of the Big Thorne Project Area Showing LUD Changes

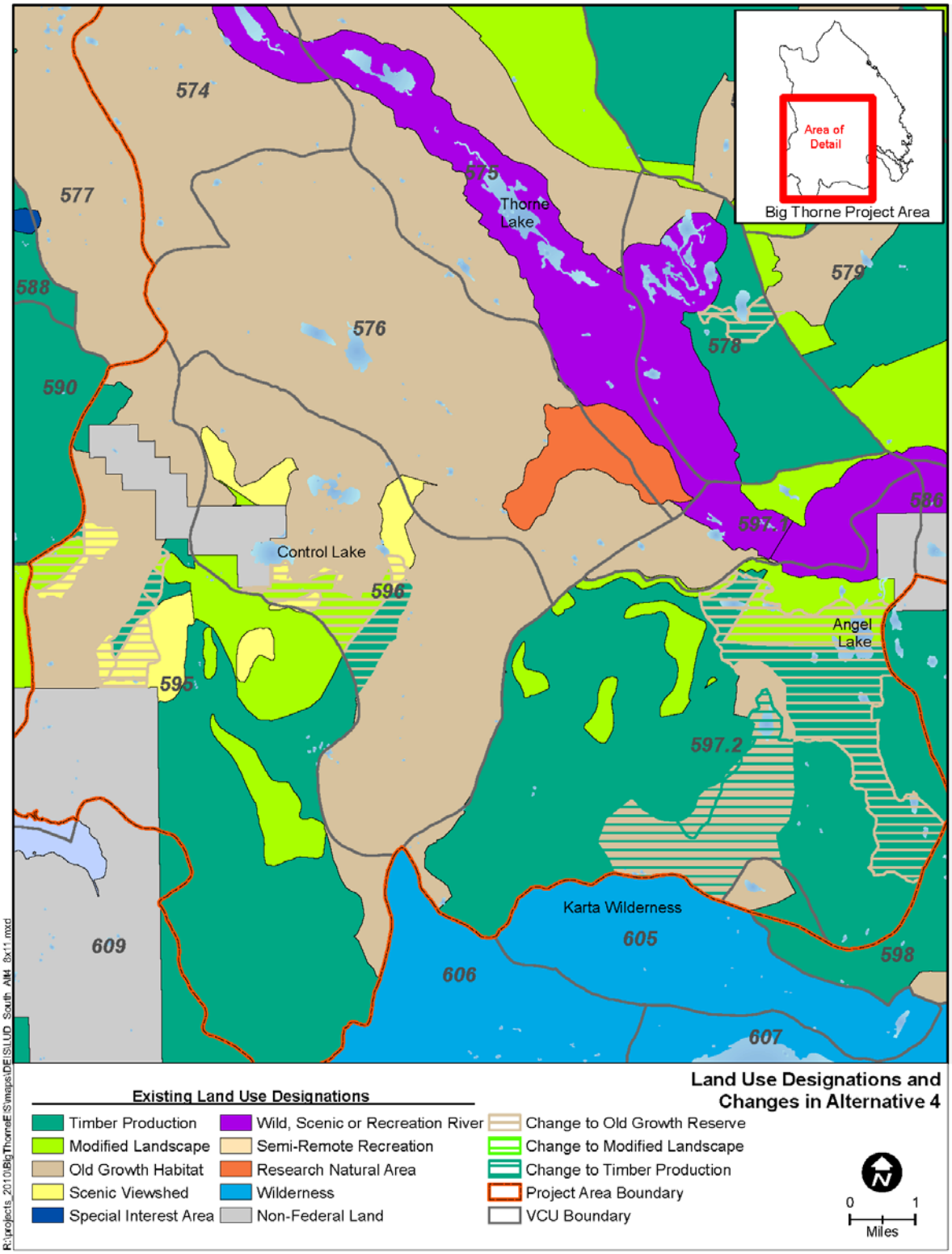

Figure OGR-9. Small Old-growth Reserves under Alternative 4 in the South Portion of the Big Thorne Project Area Showing LUD Changes

VCU 5820 (Baird Peak) –To better meet the Forest Plan Appendix K criterion that small OGR boundaries should follow recognizable features, Alternative 4 shifts the boundary shared by the adjacent small OGRs in VCUs 5820 and 5830 (which is currently in VCU 5820) to follow the VCU boundary. Thus, under Alternative 4 some acreage currently counted towards the small OGR in adjacent VCU 5830, would now count toward the small OGR in VCU 5820. Also, Alternative 4 would remove acres along the eastern side of the OGR and add acres in a disconnected piece to the north. This would increase protection of low elevation POG (115 acres; 31 percent), while continuing to meet acreage requirements (Table OGR-2). Alternative 4 would make no measureable change in the amount of roads or early seral forest included in the small OGR, but would result in a decrease in the amount of Class I streams (1.7 miles; 28 percent), under-represented features (large-tree POG; 37 acres; 13 percent), deep snow deer winter range and marten habitat (16 acres; 8 percent) included. There would be an increase in the amount of potential goshawk and marbled murrelet nesting habitat included (2 acres; less than 1 percent; Table OGR-2).

VCU 5830 (Ratz Harbor) –To better meet the Forest Plan Appendix K criterion that small OGR boundaries should follow recognizable features, Alternative 4 shifts the boundary shared by OGRs in VCUs 5820 and 5830 (which is currently in VCU 5820) to follow the VCU boundary. Thus, under Alternative 4 OGR acreage in VCU 5820 formerly counted towards VCU 5830, would count toward VCU 5820. Alternative 4 also adds acres south of Trumpeter Lake. With these modifications the small OGR in VCU 5830 would include the largest remaining block of POG in the VCU. It also includes an area that, based on ADF&G data, supports high bear use. Alternative 4 would also increase the amount of Class I streams (1.8 miles; 19 percent) and low elevation POG (80 acres; 13 percent) in the small OGR. This was a tradeoff for a slight increase in the amount of road miles (0.8 mile; 10 percent), and decreases in the amount of under-represented features (large-tree POG; 69 acres; 44 percent), deep snow deer winter range and marten habitat (21 acres; 16 percent) and potential goshawk and marbled murrelet nesting habitat (69 acres; 22 percent) included in the OGR (Table OGR-2). Because these modifications place OGR acres in the biologically preferred location this tradeoff was deemed acceptable by the 2011 IRT.

VCU 5840 (Sal Creek) – There is no change proposed under Alternative 4 for VCU 5840.

VCU 5850 (Sandy Beach) –Alternative 4 would add acreage to the north to include a large block of POG outside the beach buffer. This would increase the OGR and POG acres, continuing to exceed Forest Plan Appendix K acreage requirements. Alternative 4 would increase the amount of roads (1.8 miles; 43 percent) and early seral forest (44 acres; 191 percent) included in the small OGR. This was a tradeoff for increased inclusion of POG habitats which are currently limited in this VCU which maintains 41, 18, and 10 percent of the original total, high-volume, and large-tree POG remaining, respectively (see Table WLD-1 under Issue 2). Alternative 4 would increase the amount of under-represented features (large-tree POG; 26 acres; 108 percent), deep snow deer winter range and marten habitat (60 acres; 24 percent), potential goshawk and marbled murrelet nesting habitat (60 acres; 24 percent), and low-elevation POG (215 acres; 21 percent; Table OGR-2) included in the OGR. Because these modifications place OGR

acres in the biologically preferred location this tradeoff was deemed acceptable by the 2011 IRT.

VCU 5860 (Thorne Bay/Snug Anchorage) – There is no change proposed under Alternative 4 for VCU 5860.

VCU 5950 (Steelhead) – Alternative 4 would expand the small OGR in VCU 5950 to the east to include the entire contiguous block of POG habitat currently straddling the eastern boundary of the existing small OGR. The shape of the small OGR under Alternative 4 would now be more circular than linear, increasing the amount of interior forest habitat (Table OGR-2).

Alternative 4 would increase the amount of roads (1.1 miles; 31 percent) and early seral habitats (2 acres; less than 1 percent) included in the small OGR, but it would substantially increase the amount of Class I streams (17.7 miles; 60 percent), under-represented features (large-tree POG; 422 acres; 89 percent), deep snow deer winter range and marten habitat (420 acres; 89 percent), potential goshawk and marbled murrelet nesting habitat (524 acres; 62 percent), and low-elevation POG (471 acres; 65 percent; Table OGR-2).

VCU 5960 (Control Lake) –Alternative 4 would add acres to the south of the existing small OGR (south of Control Lake) to improve connectivity and encompass areas of high quality wolf and goshawk habitat. Alternative 4 would result in no change the amount of early seral habitat and a minor increase in roads (1 mile; 27 percent) included in the small OGR; however, it would result in substantial increases in the amount of Class I streams (13 miles; 106 percent), under-represented features (large-tree POG; 357 acres; 464 percent), deep snow deer winter range and marten habitat (346 acres; 380 percent), potential goshawk and marbled murrelet nesting habitat (425 acres; 317 percent), and low-elevation POG (501 acres; 160 percent). With the addition of these acres, this OGR now directly connects to the Honker large OGR along both the north and south boundaries.

All additions to the existing OGR are within roadless. Therefore modifications proposed under Alternative 4 would not affect the amount of suitable timber available for harvest.

VCU 5972 (Angel Lake) –Alternative 4 would relocate the small OGR to the east, surrounding Angel Lake. In this location, the small OGR would protect known wolf dens (however wolf dens are already provided protection under the Forest Plan) and the only low elevation wildlife travel corridor leading from the Honker large OGR (through VCUs 5972 and 5980) to saltwater at Salt Chuck. Alternative 4 would also increase the amount of roads (12 miles; 183 percent), early seral forest (125 acres; 40 percent), Class I streams (9 miles; 37 percent). Alternative 4 would decrease the amount of under-represented features (large-tree POG; 369 acres; 66 percent), potential goshawk and marbled murrelet nesting habitat (511 acres; 52 percent), but would increase the amount of deep snow deer winter range and marten habitat (82 acres; 23 percent) and low-elevation POG (1,062 acres; 153 percent) included in the small OGR. The 2011 IRT felt that the exchange of some wildlife habitat values for the low elevation corridor connecting the large Honker OGR complex with saltwater was beneficial overall.

Cumulative Effects

Alternative 4 would result in a net gain of 4,288 acres in the Old-growth Habitat LUD, including a net increase of 1,906 acres of protected POG, through the implementation of the biologically preferred adjustments to small OGRs (Tables OGR-1 and OGR-2). These modifications were intended to include the largest remaining blocks of POG within each VCU, and important wildlife habitats within the reserve system, and provide functional connectivity between OGRs and other non-development LUDs.

No other present or reasonably foreseeable projects in the analysis area would modify LUDs, and effects of individual development projects that might involve small OGR modifications are expected to be within the limits allowed by the Forest Plan, and would be analyzed separately and cumulatively as they are proposed.

VCU 5790 (Gravelly Creek/Falls Creek) – VCU 5790 currently maintains 40 percent of the original total POG present in 1954, of which 31 percent would be included in the modified OGR (a reduction of 1 percent). Additional POG would be included in the reserve system under this modification in adjacent VCU 5780 (4 percent of the original POG in VCU 5780). Additionally, the exchange in amounts of various habitats and features (design criteria in Appendix D of the Forest Plan FEIS) between the existing small OGR and the modified small OGR under Alternative 4 would substantially increase the inclusion of POG habitats in the reserve system, reducing the proportion available for harvest. Moreover, there are no large ongoing or reasonably foreseeable projects in VCU 5790.

VCU 5800 (North Thorne River) – No small OGR modifications are proposed in VCU 5800 under Alternative 4; therefore, there would be no cumulative effects.

VCU 5810 (Luck Lake) – No small OGR modifications are proposed in VCU 5810 under Alternative 4; therefore, there would be no cumulative effects.

VCU 5820 (Baird Peak) – VCU 5820 currently maintains 100 percent of the original total POG present in 1954, of which 32 percent would be included in the modified OGR (an increase of 8 percent). It is considered an intact landscape as defined in the Forest Plan FEIS (i.e., maintaining more than 95 percent of its original POG; USDA Forest Service 2008b). There are no large ongoing or reasonably foreseeable projects in VCU 5820, and modifications would result in a minor exchange in the amounts of various habitats and features (design criteria in Appendix D of the Forest Plan FEIS).

VCU 5830 (Ratz Harbor) – VCU 5830 currently maintains 56 percent of the original total POG present in 1954, of which 21 percent would be included in the modified OGR (an increase of 7 percent). However, the existing small OGR was split between VCUs 5820 and 5830, and it should be noted that this modification would reduce the amount of POG included in the reserve system in adjacent VCU 5820 (12 percent of the original POG in VCU 5820). Moreover, there are no large ongoing or reasonably foreseeable projects in VCU 5830.

VCU 5840 (Sal Creek) – No small OGR modifications are proposed in VCU 5810 under Alternative 4; therefore, there would be no cumulative effects.

VCU 5850 (Sandy Beach) – VCU 5850 currently maintains 41 percent of the original total POG present in 1954, of which 41 percent would be included in the modified OGR (an increase of 7 percent). A small amount of harvest (22 acres) would occur in this VCU under the North Thorne Bay state timber harvest project.

VCU 5860 (Thorne Bay/Snug Anchorage) – No small OGR modifications are proposed in VCU 5860 under Alternative 4; therefore, there would be no cumulative effects.

VCU 5950 (Steelhead) – VCU 5950 currently maintains 70 percent of the original total POG present in 1954, of which 31 percent would be included in the modified OGR (an increase of 11 percent). Approximately 65 acres could be harvested in VCU 5950 under the Control Lake timber harvest project.

VCU 5960 (Control Lake) – VCU 5960 currently maintains 98 percent of the original total POG present in 1954, of which 12 percent would be included in the modified OGR (an increase of 5 percent). It is considered an intact landscape as defined in the Forest Plan FEIS (i.e., maintaining more than 95 percent of its original POG; USDA Forest Service 2008b). Approximately 88 acres could be harvested in VCU 5960 under the Control Lake timber harvest project.

VCU 5972 (Angel Lake) – VCU 5972 currently maintains 66 percent of the original total POG present in 1954, of which 21 percent would be included in the modified OGR (a decrease of less than 1 percent). This modification would also result in the inclusion of approximately 3 percent of the original POG in adjacent VCU 5980 in the reserve system (an increase of less than 1 percent). Approximately 256 acres could be harvested in VCU 5972 under the Control Lake timber harvest project.

Timber Resources

Modifications of the small OGRs resulted in changes in LUD allocations (see Table OGR-1). If an area was reallocated to a development LUD, that area was then considered for possible timber harvest. A LSTA (logging system and transportation analysis) was done to determine logical logging settings using aerial photos and GIS information as described in the Alternative Development section in Chapter 2. This resulted in the potential mapped suitable and available acres shown in Table OGR-3. These acres were then field-verified to identify proposed timber harvest units. During field verification, some of these acres were found to be unsuitable for timber production for resource concerns usually related to soils. Other acres not mapped during the original LSTA development were found to be suitable. In addition, access may have improved to some areas that were originally allocated to development LUDs but were not included in the proposed action and units were identified in these areas. Proposed units were identified and added to the alternatives; this information is shown on Table OGR-4.

Alternatives 1, 2, and 5

Direct and Indirect Effects

Under Alternatives 1, 2, and 5, there would be no change in OGR boundaries. Therefore, there would be no change in the acreage classified as suitable forest land (Table OGR-3). About 124,181 acres of the project area are currently in development LUDs and available for timber production (see Table 1-1). Within these development LUDs, 48,477 acres are

mapped as suitable for timber production. The small OGRs of the project area contain approximately 6,977 mapped acres that would be considered suitable for timber production if it were in a development LUD (Table OGR-3).

Cumulative Effects

No other present or reasonably foreseeable projects on Thorne Bay and Craig Ranger Districts would modify LUDs; therefore, there would be no cumulative effect on the amount of suitable forest land in the project area or on the Thorne Bay and Craig Ranger Districts. The project area would continue to provide about 16 percent of the mapped suitable land base on the Thorne Bay and Craig Ranger Districts.

Alternative 3

Direct and Indirect Effects

Under Alternative 3, OGR boundaries would be modified. As a result, the lands available for timber production in development LUDs of the project area would decrease by 590 acres, but there would be a net increase of approximately 1,331 acres in mapped suitable forest lands (including both old growth and young growth). If all mapped suitable lands were verified to be suitable, an estimated 40.8 MMBF of additional timber volume (including an assumption of 10 MBF per acre for young growth) could be produced. Under Alternative 3, the small OGRs of the project area would contain approximately 5,646 mapped acres that would be considered suitable for timber production if it were in a development LUD (Table OGR-3).

Alternative 3 includes 50 harvest units in previous OGRs and several portions of units covering 1,360 acres and producing about 39.2 MMBF of gross volume. The following paragraphs describe specific Big Thorne project effects for each VCU individually.

VCU 5790 (Gravelly Creek/Falls Creek) – Modifications to this small OGR would result in a net increase of 3 acres in mapped suitable forest land that is available for timber production. After field verification and LSTA refinement, one 20-acre cable-yarding unit was added to Alternative 3 in this VCU, producing about 0.9 MMBF of gross volume. Additional road construction required for this unit is limited to about 1,000 ft.

VCU 5800 (North Thorne River) – Modifications to this small OGR would result in a net decrease of 175 acres in mapped suitable forest land that is available for timber production. However, after field verification and LSTA refinement, nine harvest units covering about 208 acres and producing about 7.6 MMBF of gross volume were added to Alternative 3 in this VCU. About half of this volume would be harvested using helicopter yarding and the remainder by cable and shovel, requiring about 1.1 miles of new road construction and 1.3 miles of reconstruction.

VCU 5810 (Luck Lake) – Modifications to this small OGR would result in a net increase of 551 acres in mapped suitable forest land that is available for timber production. After field verification and LSTA refinement, nine harvest units covering about 276 acres and producing about 10.3 MMBF of gross volume were added to Alternative 3 in this VCU. About half of this volume would be harvested by helicopter and the remainder by cable and shovel, requiring about 1.1 miles of new road construction and 0.7 mile of reconstruction.

Table OGR-3. Acres and Volume of Potential Mapped Suitable Timber[1/] Within Each Small OGR by Alternative, Change in Mapped Suitable and Available Timber[2/], and Summary Statistics

VCU	Alternatives 1, 2, and 5		Alternative 3		Alternative 4	
	Potential Mapped Suitable Forest Land in Small OGRs	Change in Mapped Suitable & Available Forest Land	Potential Mapped Suitable Forest Land in Small OGRs	Change in Mapped Suitable & Available Forest Land	Potential Mapped Suitable Forest Land in Small OGRs	Change in Mapped Suitable & Available Forest Land
Mapped Suitable Forest Land Acres						
5790	390	0	387	+3	530	-140
5800	649	0	824	-175	649	0
5810	984	0	433	+551	984	0
5820	201	0	272	-72	250	-50
5830	616	0	438	+178	668	-51
5840	593	0	405	+188	593	0
5850	368	0	208	+161	500	-132
5860	314	0	121	+192	314	0
5950	1,223	0	1,166	+57	1,695	-472
5960	212	0	212	0	649	-437
5972	1,427	0	1,178	+249	1,688	-260
Subtotal	**6,977**	**0**	**5,646**	**+1,331**	**8,518**	**-1,541**
Mapped Suitable Timber Volume (Gross in MMBF)[3/]						
5790	13.9	0	13.3	+0.6	37.8	-23.9
5800	22.2	0	35.3	-13.0	10.0	12.2
5810	37.8	0	17.8	+20.1	15.2	22.6
5820	8.6	0	11.2	-2.6	22.1	-13.5
5830	14.0	0	9.5	+ 4.5	22.2	-8.2
5840	22.1	0	14.9	+7.2	18.3	3.8
5850	13.6	0	7.7	+5.9	63.3	-49.7
5860	12.0	0	4.5	+7.5	26.9	-14.9
5950	43.1	0	42.0	+1.1	18.6	24.5
5960	8.3	0	8.3	0	12.0	-3.7
5972	51.1	0	41.7	+9.4	52.6	-1.5
Subtotal	**246.8**	**0**	**206.1**	**+40.8**	**299.0**	**-52.2**

Net Changes to Big Thorne Alternatives[4/]			
	Alts 1, 2, & 5	**Alt 3**	**Alt 4**
Net Change in Number of Harvest Units due to OGR Modification	**0**	**+50**	**-7**
Net Change in Acres of Harvest Units due to OGR Modification	**0**	**+1,360**	**-95**
Net Change in Timber Volume (Gross MMBF) due to OGR Modification	**0**	**+39.2**	**-4.1**

1/ Potential mapped suitable forest land is based on the estimated area within an OGR that would be suitable forest land if the OGR was changed to a development LUD and uses GIS information to estimate suitability. It includes old and young growth.
2/ Mapped suitable and available timber is the area that qualifies as suitable and available for timber production based on GIS mapping.
3/ Based on average gross volumes per acre for high, medium, and low volstrata for old growth and 10 MBF/acre for young growth.
4/ Changes in number, area, and volume in harvest units as a result of OGR modifications for each alternative.

Table OGR-4. Effects of OGR Modifications on the Number of Units, Acres and Volume by VCU and Summary by Alternative for the Big Thorne project.

VCU	Alternatives 1, 2, and 5		Alternative 3		Alternative 4	
	Number of units	Field verified Suitable & Available Timber (acres)	Field verified Number of units	Field verified Suitable & Available Timber (acres)	Field verified Number of Units	Field verified Suitable & Available Timber (acres)
Number of Units and Mapped Suitable Acres						
5790	0	0	1	+20	-1	-13
5800	0	0	9	+208	0	0
5810	0	0	9	+276	0	0
5820	0	0	1[1]	+84	+1	+25
5830	0	0	1[1]	+61	-1	-46
5840	0	0	5	+213	0	0
5850	0	0	2[1]	+91	-2	-75
5860	0	0	8	+205	0	
5950	0	0	7	+77	-2	-21
5960	0	0	0	0	0	0
5972	0	0	7	+124	+8, -10	+260, -225
Total	**0**	**0**	**50**	**+1,360**	**-7**	**-95**
Mapped Suitable Timber Volume (Gross in MMBF)						
5790	0	0	1	+0.9	-1	-0.5
5800	0	0	9	+7.6	0	0
5810	0	0	9	+10.3	0	0
5820	0	0	1[1]	+1.0	1	+0.2
5830	0	0	1[1]	+0.8	-1	-1.8
5840	0	0	5	+3.5	0	0
5850	0	0	2[1]	+2.2	-2	-2.7
5860	0	0	8	+6.5	0	0
5950	0	0	7	+2.6	-2	-0.5
5960	0	0	0	0	0	0
5972	0	0	7	+3.7	-2	-1.2
Total	**0**	**0**	**50**	**+39.2**	**-7**	**-4.1**

[1]/ Also includes a portion of a unit
[2]/ Based on average gross volumes per acre for high, medium, and low volstrata.

VCU 5820 (Baird Peak) – Modifications to this small OGR would result in a net decrease of 72 acres in mapped suitable forest land that is available for timber production. However, after field verification and LSTA refinement, one full unit and a portion of another, totaling 84 acres of partial-cut harvest and producing about 1.0 MMBF of gross volume were added to Alternative 3 in this VCU. These units would need to be harvested by helicopter and may require long yarding distances, unless a barge in Clarence Strait can be used.

VCU 5830 (Ratz Harbor) – Modifications to this small OGR would result in a net increase of 178 acres in mapped suitable forest land that is available for timber production. After field verification and LSTA refinement, one full unit and a portion of

another, totaling 61 acres of mostly partial-cut harvest and producing about 0.8 MMBF of gross volume were added to Alternative 3 in this VCU. Almost 90 percent of this volume would require helicopter yarding and no new road construction would be required.

VCU 5840 (Sal Creek) – Modifications to this small OGR would result in a net increase of 188 acres in mapped suitable forest land that is available for timber production. After field verification and LSTA refinement, five harvest units covering 213 acres (mostly partial cut) and producing about 3.5 MMBF of gross volume were added to Alternative 3 in this VCU. Almost 90 percent of this volume would require helicopter yarding and about 0.4 mile of road construction would be required.

VCU 5850 (Sandy Beach) – Modifications to this small OGR would result in a net increase of 161 acres in mapped suitable forest land that is available for timber production. After field verification and LSTA refinement, two full harvest units and one harvest unit shared with VCU 5860 covering 91 acres and producing 2.2 MMBF of gross volume were added to Alternative 3 in this VCU. Yarding would be mostly by shovel, with some cable, and about 2.1 miles of road construction would be required.

VCU 5860 (Thorne Bay/Snug Anchorage) – Modifications to this small OGR would result in a net increase of 192 acres in mapped suitable forest land that is available for timber production. After field verification and LSTA refinement, eight harvest units (including one harvest unit shared with VCU 5860) covering 205 acres and producing about 6.5 MMBF of gross volume were added to Alternative 3 in this VCU. This volume would be harvested almost entirely by shovel and cable yarding, would require about 3 miles of new road construction, and would require use of existing state roads for access.

VCU 5950 (Steelhead) – Modifications to this small OGR would result in a net increase of 57 acres in mapped suitable forest land that is available for timber production. After field verification and LSTA refinement, seven harvest units covering 77 acres and producing 2.6 MMBF of gross volume were added to Alternative 3 in this VCU. Yarding would be about two-thirds by helicopter and, although no new roads would be required, about 1.8 miles of road reconstruction would be necessary.

VCU 5960 (Control Lake) – No modifications to the small OGR in VCU 5960 are proposed under Alternative 3.

VCU 5972 (Angel Lake) – Modifications to this small OGR would result in a net increase of 249 acres in mapped suitable forest land that is available for timber production. After field verification and LSTA refinement, seven harvest units covering 124 acres and producing 3.7 MMBF of gross volume were added to Alternative 3 in this VCU. About one-third of the volume would be yarded by helicopter, with shovel and cable yarding for the rest. About 0.8 mile of road construction would be necessary.

Cumulative Effects

No other present or reasonably foreseeable projects on the Thorne Bay and Craig Ranger Districts are expected to result in LUD modifications. Therefore, cumulative effects on the amount of suitable forest land in the project area or on the Thorne Bay and Craig Ranger Districts are expected to be the same as the direct and indirect effects. This change would result in a 0.4 percent increase in the mapped suitable forest land on the Thorne Bay and Craig Ranger Districts.

Alternative 4

Direct and Indirect Effects

Under Alternatives 4, OGR boundaries would be modified. As a result, the lands available for timber production in development LUDs of the project area would decrease by 4,288 acres and mapped suitable forest lands would decrease by approximately 1,541 acres (including both old growth and young growth). If all mapped suitable lands were verified to be suitable, an estimated 52.2 MMBF less gross timber volume (including an assumption of 10 MBF per acre for young growth) could be produced from development LUDs (Table OGR-3).

Relative to the Big Thorne project, an LSTA for the additional mapped suitable acres was developed and field investigations were conducted. As a result, many of the mapped suitable acres were determined not to be suitable due to soils concerns and other resource issues, and some acres were deferred (including the young growth). Alternative 4 includes 9 new harvest units in previous OGRs on 285 acres, producing about 8.3 MMBF of gross volume. However, 16 units covering about 380 acres and producing 12.4 MMBF of gross volume would be eliminated by new OGRs. The following paragraphs describe specific Big Thorne project effects for each VCU with OGR modifications.

VCU 5790 (Gravelly Creek/Falls Creek) – Modifications to this small OGR would result in a net decrease of 140 acres in mapped suitable forest land that is available for timber production and would result in the elimination of one 13-acre unit in the Big Thorne project, reducing the gross volume of Alternative 4 by about 0.5 MMBF. No additional harvest units would become available.

VCU 5800 (North Thorne River) – No modifications to the small OGR in VCU 5800 are proposed under Alternative 4.

VCU 5810 (Luck Lake) – No modifications to the small OGR in VCU 5810 are proposed under Alternative 4.

VCU 5820 (Baird Peak) – Modifications to this small OGR would result in a net decrease of 50 acres in mapped suitable forest land that is available for timber production. However, after field verification and LSTA refinement, one 25-acre partial-cut harvest unit, producing about 0.2 MMBF of gross volume was added to Alternative 4 and none were eliminated in this VCU. This unit would need to be harvested by helicopter and no new roads would be needed.

VCU 5830 (Ratz Harbor) – Modifications to this small OGR would result in a net decrease of 51 acres in mapped suitable forest land that is available for timber production. One harvest unit would be excluded from Alternative 4; it covers 46 acres, would include cable, shovel, and helicopter yarding, and would produce about 1.8 MMBF of gross volume. It would require 0.6 mile of road construction and 0.6 mile of reconstruction.

VCU 5840 (Sal Creek) – No modifications to the small OGR in VCU 5840 are proposed under Alternative 4.

VCU 5850 (Sandy Beach) – Modifications to this small OGR would result in a net decrease of 132 acres in mapped suitable forest land that is available for timber production. About 75 acres of two harvest units (all of one and most of the other) would

be eliminated from Alternative 4. This would result in a 2.7 MMBF reduction in the gross volume of Alternative 4. Elimination of these units would also eliminate about 1 mile of road construction.

VCU 5860 (Thorne Bay/Snug Anchorage) – No modifications to the small OGR in VCU 5860 are proposed under Alternative 4.

VCU 5950 (Steelhead) – Modifications to this small OGR would result in a net decrease of 472 acres in mapped suitable forest land that is available for timber production. About 21 acres of two harvest units (all of one and most of the other) would be eliminated from Alternative 4. This would result in a 0.5 MMBF reduction in the gross volume of Alternative 4. Elimination of these units would also eliminate about 0.4 mile of road construction

VCU 5960 (Control Lake) – Expansions of the small OGR in VCU 5960 are proposed under Alternative 4. This would result in a 437-acre net decrease in mapped suitable forest land that is available for timber production. These reductions would not directly affect Big Thorne harvest units because the expansions are essentially entirely in roadless.

VCU 5972 (Angel Lake) – Modifications to this small OGR under Alternative 4 would result in a net decrease of 260 acres in mapped suitable forest land that is available for timber production. They would have major effects on the Big Thorne project. First, they would result in the addition of 8 harvest units to Alternative 4 covering 260 acres, producing about 8.1 MMBF of gross volume, and requiring about 0.8 mile of road construction. About three-quarters of these acres would be helicopter harvest. In addition, the modifications would eliminate 10 units covering about 225 acres, producing about 6.9 MMBF of gross volume, and requiring 3.7 miles of new road construction and 0.5 mile of reconstruction. The eliminated units are over 90 percent cable and shovel. The net effect would be a 1.2 MMBF decrease in Alternative 4 volume, but the added units would have a much higher proportion of helicopter yarding than the dropped units, decreasing the economics of the harvest.

Cumulative Effects

No other present or reasonably foreseeable projects on Thorne Bay and Craig Ranger Districts are expected to result in LUD modifications. Therefore, cumulative effects on the amount of suitable forest land in the project area or on the Thorne Bay and Craig Ranger Districts are expected to be the same as direct and indirect effects. This change would result in a 0.5 percent decrease in the mapped suitable forest land on the Thorne Bay and Craig Ranger Districts.

Fish Resources

A number of stream miles that are in existing OGR would now be converted to development LUDs, while some streams that were in development LUDs would now be in OGRs. The exchange of land classifications would primarily be transferring already roaded areas of OGRs to timber harvest areas, while existing roadless areas would be transferred to OGR categories.

Alternatives 1, 2, and 5

Direct and Indirect Effects

Under Alternatives 1, 2, and 5, small OGR boundaries would not be modified so the watershed acres and stream miles within small OGRs would remain unchanged.

Cumulative Effects

No other present or reasonably foreseeable projects in the area would modify LUDs, and effects on fish resources of individual development projects are expected to be within the limits allowed by the Forest Plan and are analyzed separately and cumulatively as they are proposed.

Alternative 3

Direct and Indirect Effects

Alternative 3 would result in OGR boundary modifications, exchanging roaded portions of existing OGRs for roadless lands that are currently in Modified Landscape and Timber Production LUDs. The result would be that some existing OGR areas would be open to timber harvest under Alternative 3 while some roadless areas that were in Modified Landscape and Timber Production LUDs, would become OGR and would be closed to timber harvest.

These land allocation changes, however, are not expected to result in any adverse effects to fish resources independent of those addressed in other portions of this document. While more stream miles, including anadromous fish streams, would be placed in potential harvest areas under Alternative 3 the standards and guidelines and BMPs in place for timber harvest to protect riparian habitats and fish resources will be adequate to ensure that no additional adverse effects occur to fish resources in the project area.

OGR acres converted to development LUD acres could disproportionally open up more acres to harvest and roads in watersheds that are already heavily harvested/roaded. Under Alternative 3, this occurs with small acreages in Pin, Salamander, and Big Salt Lake subwatersheds. Based on the metrics used to measure potential cumulative watershed effects (see later in this chapter), these subwatersheds have exceedances when reasonably foreseeable actions are included (North Big Salt Lake exceeds the 20 percent of basin area harvest threshold, Salamander exceeds the 2.5 percent of basin area in roads threshold, and Pin exceeds both of these thresholds). However, essentially the entire amount of additional allowable harvest in these subwatersheds due to OGR changes is analyzed and disclosed for Alternative 3 in the Issue 4 - Cumulative Watershed Effects section of this chapter. If any additional unforeseen projects are proposed in these subwatersheds or other subwatersheds in the future, effects would be analyzed and disclosed as they are proposed in future environmental analyses.

Cumulative Effects

Cumulative effects to fish resources associated with these land allocation changes are expected to be very minor. While more stream miles, including anadromous fish streams, would be placed in potential harvest areas under Alternative 3, Forest Plan standards and guidelines and BMPs in place for timber harvest to protect riparian habitats and fish resources would be adequate to protect against adverse effects to fish resources in the

project area. As noted above, the subwatersheds with potential effects related to cumulative harvest and cumulative road development are analyzed in the Issue 4 – Cumulative Watershed Effects section of this chapter. No other present or reasonably foreseeable projects in the area would modify LUDs, and effects on fish of individual development projects are expected to be within the limits allowed by the Forest Plan and are analyzed separately and cumulatively as they are proposed.

Alternative 4

Direct and Indirect Effects

Alternative 4 would result in OGR boundary modifications, so that the small OGRs of the project area match the biologically preferred arrangement. Some existing OGR areas would be open to timber harvest, while a much larger acreage of development LUD areas would become OGR and generally be closed to timber harvest. As a result, a number of stream miles that are in existing OGRs would be converted to development LUDs, while many more streams that were in development LUDs would be in OGRs.

After the exchanges, the number of Class I, II, and III stream miles in OGRs would each increase. As noted above, OGR acres converted to development LUD acres could disproportionally open up more acres to harvest and roads in watersheds that are already heavily harvested/roaded. Under Alternative 4, none of the areas being converted to development LUDs are in subwatersheds with metrics for cumulative harvest or cumulative roads that are exceeding the subwatershed thresholds used, even when reasonably foreseeable actions are included. Subwatersheds with potential effects related to cumulative harvest and cumulative road development are analyzed in the Issue 4 – Cumulative Watershed Effects section.

Cumulative Effects

Cumulative effects to fish resources associated with these land allocation changes are expected to be very minor, but positive. While more stream miles, including anadromous fish streams, would be placed in OGRs under Alternative 4, Forest Plan standards and guidelines and BMPs in place for timber harvest to protect riparian habitats and fish resources would be adequate to protect against adverse effects to fish resources in the project area in any event. Further, no other present or reasonably foreseeable projects in the area would modify LUDs, and effects on fish of individual development projects are expected to be within the limits allowed by the Forest Plan and are analyzed separately and cumulatively as they are proposed.

Sensitive and Rare Plant Resources

This section analyzes the effects of changes in land use designations on sensitive plants over the long-term. These LUD changes, in themselves, do not result in any immediate direct effects.

Alternatives 1, 2, and 5

Direct, Indirect, and Cumulative Effects

Under Alternatives 1, 2, and 5, there would be no change in OGR boundaries. Therefore, there would be no change in the long-term protection of sensitive plants provided by

OGRs. Project area OGRs would continue to include 42 percent of the known plants and at least a portion of 30 percent of the known populations for the lesser round-leaved orchid. In addition, they would continue to include 35 percent of the known plants and at least a portion of 38 percent of the known populations for the Alaska rein orchid. These large percentages are important, in that OGRs are more likely to result in protection of sensitive plant habitats than are areas in development LUDs. Four populations of the rare plant, western meadowrue, occur within small OGRs in the project area.

Alternative 3

Direct and Indirect Effects

The number of lesser round-leaved orchid plants known within OGRs would be reduced by 49 percent (from 1,661 to 839 plants) and the number of populations partially or fully within OGRs would be reduced by 21 percent (from 33 to 26 populations). OGRs would include about 21 percent of the known plants and 24 percent of the known populations in the project area (compared with 42 percent and 30 percent under Alternatives 1, 2, and 5).

The number of Alaska rein orchid plants known within OGRs would be reduced by 31 percent (from 301 to 208 plants) and the number of populations partially or fully within OGRs would be reduced by 44 percent (from 9 to 5 populations). OGRs would include about 24 percent of the known plants and 21 percent of the known populations in the project area (compared with 35 percent and 38 percent under Alternatives 1, 2, and 5). None of these populations are located within proposed timber harvest units or new road construction for this project.

No effects to other known sensitive plant populations would occur as a result of OGR boundary modifications.

Two of the four populations of western meadowrue that occur within small OGRs would continue to occur within small OGRs after implementation of Alternative 3. However, two populations in VCU 580 are in areas that would be converted to Timber Production LUD.

Cumulative Effects

Areas with the allocations changed from OGRs to development LUDs would not all be subject to timber harvest. Even over the long term, only areas mapped as suitable POG would be targeted for harvest.

Less than half of the lesser round-leaved orchid plant locations known to occur in OGRs under existing conditions, are mapped as POG and some of these areas would be unsuitable for timber production (due to standards and guidelines, e.g., riparian buffers, legacy); therefore, less than half of the plants in areas that would change to development LUDs are expected to be subject to timber harvest over the long term.

Similarly, less than 20 percent of the Alaska rein orchid plant locations known to occur in OGRs under existing conditions are mapped as POG and some of these areas would be unsuitable for timber production (due to standards and guidelines, e.g., riparian buffers, legacy); therefore, less than 20 percent of the plants in areas that would change to development LUDs are expected to be subject to timber harvest over the long term.

Alternative 4

Direct and Indirect Effects

The number of lesser round-leaved orchid plants known within OGRs would increase by 59 percent (from 1,661 to 2,634 plants) and the number of populations partially or fully within OGRs would increase by 61 percent (from 33 to 53 populations). OGRs would include about 67 percent of the known plants and 48 percent of the known populations in the project area (compared with 42 percent and 30 percent under Alternatives 1, 2, and 5).

The number of Alaska rein orchid plants known within OGRs would increase by 24 percent (from 301 to 374 plants) and the number of populations partially or fully within OGRs would increase by 44 percent (from 9 to 13 populations). OGRs would include about 43 percent of the known plants and 54 percent of the known populations in the project area (compared with 35 percent and 38 percent under Alternatives 1, 2, and 5).

No effects to other known sensitive plant populations would occur as a result of OGR boundary modifications.

One of the four populations of western meadowrue that occurs within small OGRs would continue to occur within a small OGR after implementation of Alternative 4. However, three of these populations are in areas that would be converted to the Timber Production LUD under Alternative 4.

Cumulative Effects

Alternative 4 results in a net increase in the number of sensitive plants included in OGRs. Areas being converted from development LUDs to OGRs were not all originally subject to timber harvest. Even over the long term, only areas mapped as POG and suitable for timber production can be targeted for harvest.

Less than half of the lesser round-leaved orchid plant locations known to occur in OGRs under existing conditions, are mapped as POG and some of these areas would be unsuitable for timber production (due to standards and guidelines); therefore, less than half of the plants being incorporated into OGRs are likely to receive an increased level of protection from timber harvest. Similarly, less than 20 percent of the Alaska rein orchid plant locations known to occur in OGRs under existing conditions, are mapped as POG and some of these areas would be unsuitable for timber production (due to standards and guidelines); therefore, only a minority of the plants being incorporated into OGRs are likely to receive an increased level of protection from timber harvest.

Scenery Resources

Alternatives 1, 2, and 5

Direct, Indirect, and Cumulative Effects

Under Alternatives 1, 2, and 5, there would be no change in OGR boundaries. As a result, there would be no change in SIOs in the project area.

Cumulative Effects

No other present or reasonably foreseeable projects in the area would modify LUDs, and visual disturbances of individual development projects are expected to be within the limits

allowed by the Forest Plan and are analyzed separately and cumulatively as they are proposed.

Alternative 3

Direct and Indirect Effects

Alternative 3 would change OGR boundaries, resulting in changes in SIOs. Approximately 5,873 acres would change from high SIO to moderate, low, or very low. Similarly, 6,574 acres of moderate, low, and very low would change to high SIO.

None of the OGR modifications would result in conversion to Scenic Viewshed LUD; however, some acres of scenic viewshed would be converted to OGR in VCU 5950. Areas of potential concern where OGR conversion to Modified Landscape LUD would occur are located in VCU 5810 (north of Luck Lake), VCU 5840 (along the 3000 Road north of Sal Creek), and VCU 5850 (south of Sandy Beach). Some portions of these areas would be visible from visual priority routes and use areas. Although the SIO in these areas would generally decline as a result of conversion to Modified Landscape, the 2008 Forest Plan designated all adjacent areas with similar visual concern levels (and even those adjacent areas that are more visually sensitive) as Modified Landscape as well. A combination of partial harvest, the use of visual screens, and the placement of required legacy, in harvest units in these areas would mitigate harvest sufficiently to meet required SIOs.

Cumulative Effects

Cumulative visual effects associated with the OGR changes are expected to be low. No other present or reasonably foreseeable projects in the area would modify LUDs, and visual disturbances of individual development projects are expected to be within the limits allowed by the Forest Plan and are analyzed separately and cumulatively as they are proposed.

Alternative 4

Direct and Indirect Effects

Alternative 4 would change OGR boundaries, resulting in changes in SIOs. Approximately 3,253 acres would change from high SIO to low or very low. Similarly, 7,541 acres of high, moderate, low, and very low would change to high SIO.

None of the OGR modifications would result in conversion to Scenic Viewshed LUD; however, some acres of Scenic Viewshed would be converted to OGR in VCU 5950. No significant areas of concern would result, where OGR conversion to Modified Landscape LUD would occur. In addition, several areas of Modified Landscape LUD would be added to OGRs in VCUs 5820, 5850, and 5972.

Cumulative Effects

Cumulative visual effects associated with the OGR changes are expected to be low. No other present or reasonably foreseeable projects in the area would modify LUDs, and visual disturbances of individual development projects are expected to be within the limits allowed by the Forest Plan and are analyzed separately and cumulatively as they are proposed.

Recreation Resources

Alternatives 1, 2, and 5

Direct, Indirect, and Cumulative Effects

Under Alternatives 1, 2, and 5, there would be no change in OGR boundaries and no related changes to ROS and patterns of recreation use in the Big Thorne project area.

Cumulative Effects

No other present or reasonably foreseeable projects in the area would modify LUDs, and effects on recreation resources of individual development projects are expected to be within the limits allowed by the Forest Plan and are analyzed separately and cumulatively as they are proposed.

Alternative 3

Direct and Indirect Effects

Under Alternative 3, there would be changes to the small OGRs in the project area. Total acres in the small OGRs would have a net increase of about 590 acres under this alternative; however, many additional acres would change. Overall, there would be a net gain of 4,220 acres in Semi-Primitive ROS settings and an overall decrease in acres in Roaded ROS settings (-3,630 acres) in small OGRs. This change would be consistent with the general goal of the Old-growth Habitat LUD to provide Semi-Primitive ROS settings. The overall project-wide changes in ROS settings that would occur as a result of this alternative are shown in Table REC-5 in the Recreation section below. Viewed in terms of the project area, the resulting changes would represent a small share of the affected settings and would not be likely to affect recreation and tourism.

Harvest under this alternative in former OGR areas would occur relatively close to two of the 13 developed recreation sites in the Big Thorne project area: Thorne Lake, which is part of the Honker Divide Canoe Route and the Luck Lake Day Use Area. These areas are described below in the Recreation section. Noise and other activity associated with harvest in the former OGR area northeast of Thorne Lake would be apparent to people traveling this part of the Canoe Route and would affect the quality of their remote recreation experience. Noise and other activity associated with harvest in the former OGR area north of Luck Lake would likely to be apparent to people using the day use area and recreating on the lake. In both cases, these impacts would be temporary.

The Scenery Resources analysis (above) identified three areas of potential visual concern associated with the conversion of OGR lands to the Modified Landscape LUD, but concluded that a combination of partial harvest prescriptions, the use of visual screens, and the placement of required legacy in harvest units in these areas would mitigate harvest sufficiently to meet required SIOs; impacts to scenery would, therefore, not be expected to affect the quality of the recreation experience in these areas.

Cumulative Effects

Cumulative effects to recreation resources associated with the OGR changes are expected to be low. No other present or reasonably foreseeable projects in the area would modify LUDs,

and effects on recreation resources of individual development projects are expected to be within the limits allowed by the Forest Plan and are analyzed separately and cumulatively as they are proposed.

Alternative 4

Direct and Indirect Effects

Under Alternative 4, the boundaries of the small OGRs in the project area would be modified to correspond with the biologically preferred arrangement for the project area (as developed by an interagency team). Net acres in the small OGRs in the project area would increase by about 4,288 under this alternative, with a net gain of 400 acres in Semi-Primitive ROS settings and 3,900 acres in Roaded ROS settings within small OGRs. The overall project-wide changes in ROS settings that would occur as a result of this alternative are shown in Table REC-5 in the Recreation section below. Viewed in terms of the project area, the resulting changes would represent a small share of the affected settings and would not be likely to affect recreation and tourism.

The Scenery Resources analysis (above) indicated that significant changes to scenery with the potential to affect the quality of the recreation experience in adjacent or nearby areas would be expected to occur.

Cumulative Effects

Cumulative effects to recreation resources associated with the OGR changes are expected to be low. No other present or reasonably foreseeable projects in the area would modify LUDs, and effects on recreation resources of individual development projects are expected to be within the limits allowed by the Forest Plan and are analyzed separately and cumulatively as they are proposed.

Issue 3: Wildlife and Subsistence Use

Issue statement: *The proposed action combined with past timber harvest would affect old-growth habitat and increase road density, which may affect a range of wildlife, including deer and wolves, and subsistence use of deer.*

Public comments expressed concern about wildlife and subsistence in the Big Thorne project area. Concern was noted relative to deer, wolf, goshawk, black bear, marten, and other species. Because of its proximity to residents of Thorne Bay, Coffman Cove, Klawock, Craig, and Naukati, the Big Thorne project area is considered an important deer hunting area for these communities. The cumulative effects on old-growth habitat associated with additional harvest taken together with past harvest, old-growth connectivity, and increasing road density were also noted concerns. Additional concerns are project-related effects to deer as they relate to wolves and subsistence users.

Alternative 4 responds to these concerns by emphasizing landscape connectivity and the protection of key wildlife travel corridors; the minimization of impacts to sensitive plants (see the Botany section for additional discussion) and wildlife species, including wolves, goshawks, black bears, deer, and marten; and the retention of old-growth forest structure. Design features were incorporated into Alternative 4 to minimize effects to wildlife and subsistence (see the Wildlife and Subsistence Resources Report for a unit-by-unit description).

Units of Measure

The comparison of alternatives for this issue focuses on the following units of measure:

- Total, high-volume, and large-tree productive old growth (POG) acres by value comparison unit (VCU), WAA, project area, and biogeographic province;
- Connectivity/fragmentation (qualitative analysis of corridors; reduction of POG acres; patch size analysis);
- Road density in miles per square mile (all roads [open and closed]) by WAA below 1,200 feet and for all elevations;
- Deer habitat capability by WAA and biogeographic province in deer habitat in deer per square mile;
- Deer winter habitat acres harvested by WAA;
- Goshawk habitat (total POG and high-volume POG) acres harvested by VCU;
- Marten deep snow winter habitat acres harvested by WAA; and
- Abundance and distribution of, access to, and competition for known subsistence resources.

Regulatory Framework

Shown below is a partial list of Federal laws and executive orders pertaining to project-specific planning and environmental analysis for wildlife and subsistence use on Federal lands. While most pertain to all Federal lands, some are specific to Alaska.

- National Forest Management Act (NFMA) of 1976 (as Amended)
- Multiple Use-Sustained Yield Act
- Endangered Species Act (ESA)
- Marine Mammal Protection Act
- Bald and Golden Eagle Protection Act of 1940 (as Amended)
- Migratory Bird Treaty Act of 1918 (Amended 1936 and 1972)
- Executive Order 13443 (Hunting Heritage and Wildlife Conservation)
- Alaska National Interest Lands Conservation Act (ANILCA)

Wildlife

Section 7 of the ESA directs Federal agencies to ensure that actions authorized, funded or carried out by them are not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of their critical habitat. Impacts to Federally listed species are addressed in detail in the project Biological Assessment/Biological Evaluation (BA/BE) for wildlife and fish and summarized below.

The National Forest Management Act (section 36 CFR 219.19) requires that the Forest Service manage fish and wildlife habitat to maintain viable populations of existing native and desired non-native vertebrate species in the planning area and ensures that its actions do not contribute to trends toward Federal listing. To that end, management indicator species (MIS) were identified in the Forest Planning process. These species are used to evaluate project-related impacts to wildlife; their population changes are believed to indicate the effects of land management activities on other species with similar habitat needs. Likewise, the Forest Service manual directs the Regional Forester to identify sensitive species for each National Forest where species viability may be a concern and requires the Forest Service to manage the habitat of the species listed in the Regional Sensitive Species List (USDA 2009a) to prevent further declines in populations, which could lead to Federal listing under the Endangered Species Act (ESA). Impacts to Forest Service Sensitive species are also addressed in detail in the project BA/BE for wildlife and summarized in this section.

The Forest Plan conservation strategy, which consists of a forest-wide system of old-growth reserves (OGRs) and a series of standards and guidelines applicable to lands where timber harvest is permitted (matrix lands), was developed to ensure the maintenance of well-distributed, viable populations of old-growth-associated wildlife species across the Tongass (USDA Forest Service 2008a, 2008b). The OGRs are designed to maintain the integrity of the old-growth ecosystem and provide adequate habitat for old-growth dependent or associated species. Standards and guidelines protect other key wildlife habitats (e.g., riparian areas, the beach fringe, and wetlands); raptor nests sites and wolf dens; and components of the old-growth forest ecosystem (e.g., snags). Collectively, the reserve system and the standards and guidelines are intended to provide old-growth habitat connectivity across the landscape. A detailed overview of the Conservation Strategy is provided under Issue 2.

Subsistence

The U.S. Congress recognized the importance of subsistence resource gathering to the rural communities of Alaska with the passage of ANILCA (Public Law 96-487). ANILCA (Section 803) defines subsistence as: "The customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools or transportation; for the making and selling of handicraft articles out of non-edible by-products of fish and wildlife resources taken for personal or family consumption; and for customary trade."

ANILCA provides for the continuation of the opportunity for subsistence uses by rural residents of Alaska, including both Natives and non-Natives, on Federal public lands. The act also mandates that customary and traditional subsistence uses of renewable resources shall be the priority consumptive uses of all such resources on the public lands of Alaska. Rural residents are provided a preference for the taking of subsistence resources on public lands. Section 810 of ANILCA requires the Forest Service, in determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of NFS lands in Alaska, to evaluate the potential effects on subsistence uses and needs, followed by specific notice and determination procedures should there be a significant possibility of a significant restriction of subsistence uses. Section 811 of ANILCA requires that rural residents engaged in subsistence uses have reasonable access to subsistence resources on public lands. The road system within the Big Thorne project area would continue to provide rural residents with reasonable access for subsistence uses. The EA for the Prince of Wales ATM analyzes access for subsistence use on Prince of Wales Island. Access within the project area is also discussed below.

Methodology

Sources of information used in the preparation of this analysis include field reconnaissance, aerial photo interpretation, existing Forest Service GIS data, peer-reviewed literature (cited as appropriate below), previous NEPA analyses in the vicinity of the Big Thorne Project, and information from knowledgeable individuals.

Field Surveys

Forest Service personnel conducted goshawk surveys in the Big Thorne project area in 2010, 2011 and 2012 according to the Tongass National Forest Project-level Goshawk Inventory Protocol, a modified Broadcast Acoustical Survey method adapted for implementation on the Tongass National Forest (Stangl 2009). Limited additional surveys are planned to be conducted in 2013. Additional information on goshawk surveys is provided in the project BA/BE for wildlife. In 2010, black-tailed deer winter habitat was assessed following the protocol described in Quick-Cruise Method for Assessing Deer Winter Range in Southeast Alaska (Kirchhoff and Hanley 1992). Incidental observations of wildlife and sign were made during the field surveys, though these observations do not provide an accurate representation of all wildlife species potentially occurring in the project area due to timing, coverage, and length of surveys. Additional detail on wildlife surveys is provided in the Wildlife and Subsistence Resource Report (Woeck 2012). Supplemental information on the presence of endemic mammals in the Big Thorne project

area was obtained from small mammal trapping conducted in association with the Island Surveys to Locate Endemic Species (ISLES) program (http://www.msb.unm.edu/mammals/ISLES_ website_final_20091028/ isles_home.html).

Analysis Area

The analysis of direct and indirect effects to biodiversity consists of the following scales:

- VCUs coinciding with the project area to capture localized effects to biodiversity associated with habitat loss and fragmentation,; and
- The North Central Prince of Wales biogeographic province (province 14), which covers the northern and central portions of Prince of Wales Island and some adjacent islands, to facilitate a more comprehensive, broad analysis of biodiversity effects.

For the analysis of cumulative effects on biodiversity, ongoing and reasonably foreseeable projects were drawn from the area encompassed by the North Central Prince of Wales biogeographic province. This area is an appropriate extent because it captures projects with potential effects related to biodiversity which may overlap in space or time with the Big Thorne Project.

The Big Thorne EIS tiers to the analysis of cumulative effects at the Forest scale in the 2008 Forest Plan Final EIS (USDA Forest Service 2008b). This analysis fully considered the levels of past and likely future harvest and associated development on NFS and non-NFS lands, accounting for projects such as Big Thorne. The 2008 Forest Plan Final EIS concluded that with full implementation of the Forest Plan, extensive areas in reserves, distributed across the North Central Prince of Wales biogeographic province, would be maintained through the conservation strategy (USDA Forest Service 2008b). No gaps in the distribution of organisms within the province were anticipated (USDA Forest Service 2008b).

The analysis area for direct and indirect effects to wildlife and subsistence consists of several scales:

- For species with limited mobility, specific habitat requirements for effective movement, or smaller home ranges (e.g., Prince of Wales spruce grouse and Prince of Wales flying squirrel), impacts were assessed within VCUs coinciding with the project area.
- For mobile species (i.e., cavity nesting species, the marbled murrelet, and migratory birds), impacts were assessed at the project area scale.
- For wider-ranging species such as the black-tailed deer, wolves, marten, and black bears and for subsistence impacts were assessed at the WAA or multiple WAA scale.

For the analysis of cumulative effects, analysis areas for most wildlife and subsistence are the same as those described above for direct and indirect effects because these areas already extend beyond the project-related effects. Exceptions are the deer, wolves, and goshawks for which cumulative effects were analyzed at the biogeographic province scale. Additionally, the cumulative effects analysis accounts for past, ongoing, and

reasonably foreseeable actions on both NFS and non-NFS land ownerships and presents results in terms of the amount of original (1954) habitat remaining. Additional projects considered in this analysis are listed under the Cumulative Effects subheading below.

The Big Thorne EIS tiers to the viability assessments for goshawks, marten, wolves, other terrestrial mammals (well-distributed mammals and endemic mammals), and marbled murrelets; and the analysis of cumulative effects at the Forest scale in the 2008 Forest Plan Final EIS (USDA Forest Service 2008b). These analyses fully considered the levels of past and likely future harvest and associated development on NFS and non-NFS lands, accounting for projects such as Big Thorne. The 2008 Final EIS concluded that full implementation of the Forest Plan (in 100+ years) is expected to have a moderate to very high likelihood of maintaining habitat that supports viable and well-distributed populations of wildlife (USDA Forest Service 2008b).

Analysis Methodology

The direct, indirect, and cumulative effects of the Big Thorne Project on wildlife and subsistence were assessed assuming that the proposed project would be implemented in 2014. This is conservative because in reality, timber sales and associated effects would be spread out over the 10-year period.

Vegetation Classification and the Size-Density Model

The vegetation of Southeast Alaska and the Tongass National Forest is dominated by temperate coastal rain forests at lower elevations (less than about 2,000 feet), with interspersed muskegs, wetlands, and non-forest vegetation. At higher elevations, alpine vegetation, rock, glaciers, and snowfields dominate. In general, old-growth forest is the ecosystem most affected by timber management activities on the Tongass (USDA Forest Service 2008b). Therefore, the analysis of impacts to biodiversity focuses on the old-growth forest ecosystem.

Old-growth forests on the Tongass can be classified as unproductive and productive. POG is generally defined as old growth forest capable of producing at least 20 cubic feet of wood fiber per acre per year, or having greater than 8,000 board feet per acre. The Size-Density Model (SDM), which uses a combination of tree sizes and tree densities to classify forest structure (Caouette et al. 2006), is used by Forest Service managers and planners to map POG and assess impacts to wildlife and habitats. This classification system builds on the timber volume-based classification system (volume strata) for POG used prior to the 2008 Forest Plan (low-, medium-, and high-volume), which used only hydric soils and steep slopes as measures productivity and growth. By incorporating the characterization of forest structure, the SDM is more applicable in assessing biodiversity, estimating timber values, and describing wildlife habitat than using timber volume alone. The following seven POG types have been defined which illustrate the crosswalk between the volume strata approach and the SDM (USDA Forest Service 2008b):

- **SD4H:** Volume class 4 on hydric soils. Low productive older forests associated with wet, poorly drained land types. Canopy closure is variable. Trees are small, old, and defective. Stand volume is low.

- **SD4N:** Volume class 4 on non-hydric soils, north aspect, or flat. Low to moderately productive older upland forests. Canopy characteristics are variable and patchy, with moderate canopy closure and relatively coarse canopy texture. Stand volume is low to moderate.
- **SD4S:** Volume Class 4 on non-hydric soils, not north aspect, or flat. Highly productive younger upland forests. Stand volume is moderate, but increasing rapidly. Crown competition is high. Canopy characteristics tend to be uniform, with high canopy closure and fine canopy texture.
- **SD5H:** Volume class 5 on hydric soils. Moderately productive older forests associated with wet, poorly drained land types. Canopy closure, texture, and structure tend to be variable and patchy. Stand volume and annual growth is also variable and patchy.
- **SD5N:** Volume class 5 on non-hydric soils, north aspect, or flat. Moderately productive older upland forests. Stand volume is moderate to high. Canopy characteristics tend to be variable, with moderate canopy closure and coarse canopy texture.
- **SD5S:** Volume class 5 on non-hydric soils, not north aspect, or flat. Highly productive upland forests. Stand volume is high. Canopy characteristics tend to be uniform, with moderate to high canopy closures.
- **SD67:** Volume classes 6 and 7. Highly productive forests associated with riparian areas, alluvial fans, colluvial toe slopes, karst geology, and wind-protected uplands. Stand volume is high. Stand age can vary. Canopy closure is low to moderate and canopy texture is coarse.

POG is defined further in terms of two categories. High-volume POG is defined as the grouping of the three SD Model types that represent the highest volume stratum—SD5S, SD5N, and SD67 types. Large-tree POG is defined as the SD67 type, representing the most productive of the POG types, and typically containing the highest density of large trees. The 2008 Forest Plan Final EIS provides more information on the development and use of the Size Density Model (Forest Service 2008b).

Deer, Wolf, and Subsistence Analyses

Forest Plan standards and guidelines require the use of the most recent version of the interagency deer habitat capability model to assess impacts to deer habitat (WILD4.XIV.A.2; USDA Forest Service 2008a). The deer model takes into account snow depth (indicative of typical, moderate winter severity), elevation, aspect, and conifer forest successional stage to provide a habitat suitability index (HSI) of habitat capability. High model scores represent features that are correlated with high value deer habitat. These features include closed canopy (based on volume class rather than canopy cover), maritime influence, low elevation south facing slopes, and low average snow depth. Habitat capability values are used in this analysis to estimate changes that result from timber harvest, but do not reflect actual deer numbers.

To compare alternatives, changes in habitat capability are presented as a percent. Results from this modeling exercise are also used to evaluate impacts to wolves and subsistence

resources. The Forest Service recently issued direction on the use of the deer model including required analyses and model assumptions for wolves and subsistence (USDA Forest Service 2011). Model assumptions and shortcomings for deer, wolves, and subsistence resources are described below under the appropriate subheading.

Cumulative Effects

For the cumulative effects analysis, foreseeable timber harvest projects with known locations were incorporated into the GIS layer (see Chapter 3 introduction for additional detail). Other projects that are dependent on funding, and for which timing and location are unknown, are discussed qualitatively. Young-growth treatments and restoration projects that involve pre-commercial thinning are also discussed qualitatively because the stem exclusion stage is based on age which is unchanged by thinning treatments and because the deer model does not assign different values as a result of these stand treatments.

In addition to the cumulative effects projects identified in the project area, the wildlife and subsistence analysis also takes into consideration additional activities within the project area WAAs, located outside the project area boundary. These include additional state harvest and road construction. For the biogeographic province level cumulative effects analysis for wolves, present and reasonably foreseeable projects include additional state harvest and NFS harvest within the province (see the beginning of this chapter and Appendix D).

Affected Environment

Biodiversity

Biodiversity may be defined as “the variety of life forms and processes, including the complexity of species, communities, gene pools, and ecological functions, within the area covered by a land management plan” (USDA Forest Service 2008a). Biological diversity encompasses the variety of genetic stocks, plant and animal species and subspecies, ecosystems, and the ecological processes through which individual organisms interact with one another and their environments. Under the National Forest Management Act (NFMA), the Tongass National Forest must provide for diversity of plant and animal communities based on the suitability and capability of specific land areas.

Old-Growth Habitat

Old-growth forests support high levels of biodiversity due to their structural and ecological complexity. In Southeast Alaska, old-growth forests are typically greater than 150 years old, and are characterized by complex canopies; an interspersion of trees of multiple age classes; the presence of snags, decadent trees, and fallen trees; and variation in the amounts and distribution of live trees. These features create intricate habitat niches that support many plant and animal species (Spies 2004). In Southeast Alaska, old-growth forests have been the focus of past timber harvest.

The North Central Prince of Wales Island biogeographic province historically contained more POG than any other biogeographic province on the Tongass (Forest Plan 2008b). It has also experienced the highest amount of harvest relative to other biogeographic

provinces, with 73 percent of the total original (1954) POG on all ownerships remaining, ranging from 40 to 100 percent by VCU (Table WLD-1). There are approximately 569,000 acres of POG currently within the North Central Prince of Wales biogeographic province (Table WLD-1).

Table WLD-1. Existing Total, High-Volume, and Large-Tree POG by Biogeographic Province, VCU, and Project Area

Biogeographic Province/VCU[1/]	All POG (acres)	% Original POG Remaining	High Volume POG (acres)	% High Volume POG Remaining	Large Tree POG (acres)	% Large Tree POG Remaining
North Central Prince of Wales Island	569,098	73%	248,359	64%	127,306	60%
5720[2/]	3,869	53%	1,149	35%	824	39%
5740	14,953	80%	5,503	68%	3,155	65%
5750	11,143	96%	4,552	96%	2,237	99%
5760	6,990	93%	3,338	88%	1,630	85%
5780	3,688	75%	2,205	73%	1,640	75%
5790[2/]	2,818	40%	934	26%	334	17%
5800	7,036	72%	3,579	66%	1,385	56%
5810[2/]	6,830	50%	3,809	45%	1,741	36%
5820	2,461	100%	1,348	100%	963	100%
5830[2/]	4,866	56%	2,115	46%	884	35%
5840[2/]	5,827	59%	1,945	44%	557	28%
5850[2/]	3,088	41%	635	18%	190	10%
5860[2/]	6,336	54%	3,420	48%	1,410	39%
5950	7,053	70%	3,547	63%	2,567	64%
5960	5,596	97%	2,594	98%	1,501	97%
5971	1,516	83%	987	82%	751	87%
5972[2/]	8,620	66%	3,449	54%	1,257	44%
5980	5,459	64%[3/]	2,640	58%	1,572	57%
Project Area	98,748	67%	43,902	43%	22,128	33%

1/ Includes NFS and non-NFS lands; accounts for entire VCU, including areas extending outside of the project area boundary
2/VCUs where the Legacy standard and guideline applies.
3/The Legacy standard and guideline does not currently apply to VCU 5980 because less than 33 percent of the original POG had been harvested in 2005 when the analyses for the 2008 Forest Plan FEIS were calculated, and less than 67 percent of the total POG is projected to be harvested by the end of the Forest Plan planning horizon.

Low elevation, larger-tree stands have been disproportionately harvested on the Tongass because these highly productive and economical sites (i.e., those easiest to access) were targeted in the early years of commercial timber harvest (USDA Forest Service 2008b). Within the North Central Prince of Wales biogeographic province, approximately 64 percent of the original high-volume POG (ranging from 18 to 100 percent by VCU) and 60 percent of the original large-tree POG (ranging from 10 to 100 percent by VCU) on all ownerships remain (Table WLD-1). The North Central Prince of Wales biogeographic province currently includes over 10 and 20 percent of all the remaining high-volume and large-tree POG on the Tongass, respectively (USDA Forest Service 2008b).

An intact, undeveloped landscape is assumed to be fully functional, maintaining focal species, communities, and/or systems and their supporting ecological processes within their natural ranges of variability (Poiani et al. 2000). Thus, the intactness of a landscape is another measure of the degree to which biodiversity has been affected by human

actions. Based on the definition of an intact landscape used in the 2008 Forest Plan Final EIS, (a VCU with at least 95 percent of the original POG remaining), three project area VCUs (5750, 5820, and 5960) are intact, and thus likely to maintain a high degree of biodiversity. Although landscapes with higher amounts of past harvest likely remain fully functional, this threshold represents an index used to identify areas that are in relatively pristine conditions and thus have the highest biological importance.

The likelihood of a population persisting over time has been suggested to be related to some threshold level of habitat loss on the landscape (Fahrig 1997, 1999, 2003; Flather et al. 2002; Andren 1994). After reaching this threshold, the rate of population decline, and thus the likelihood of extinction, may increase (Haufler 2006). Reported threshold levels (percentage of habitat maintained on the landscape) range from 20 percent (Fahrig 1997) to 50 percent (Soule and Sanjayan 1998), depending in part on the dispersal capability of the species under consideration. Species with limited dispersal capabilities (i.e., flying squirrel) appear to be more sensitive to habitat loss and fragmentation than species with greater dispersal capabilities (i.e., goshawks, wolves; With 1999). Natural fragmentation of habitats can also affect the level of additional fragmentation that can be supported. The Forest Plan Legacy Forest Structure standard and guideline is intended to ensure that sufficient residual trees remain in timber harvest units within VCUs that have "experienced concentrated past harvest and are at risk for not providing the full range of matrix functions" (USDA Forest Service 2008). The Legacy standard applies to VCUs where 33 percent or more of original (1954) total POG has been harvested (67 percent total POG remaining), or where more than 67 percent of the total POG is projected to be harvested by the end of the Forest Plan planning horizon. Currently 9 project area VCUs maintain at least 67 percent of their total original POG (VCUs 5740, 5750, 5760, 5780, 5800, 5820, 5950, 5960, and 5971; Table WLD-1). The Legacy standard and guideline applies to the remaining VCUs where past harvest has reduced the amount of original total POG by more than 33 percent (Table WLD-1). The Legacy standard and guideline was applied, where required, under all alternatives.

Old-growth forest in the project area has been modified over time by both natural processes and human actions. There are approximately 50,226 acres of young-growth within the project area, of which 49,546 acres are a result of timber harvest. The remaining acres of young-growth are a result of natural processes (e.g., wind). Approximately 19,198 acres (39 percent) of young-growth in previously harvested stands are 25 years old or younger, in the stand initiation stage; the remaining 31,028 acres are older and are in the stem exclusion stage. Management of young-growth stands through pre-commercial and commercial thinning has the potential to increase biodiversity by concentrating growth in fewer, larger trees which, if allowed to grow over time, promote conditions that mimic old-growth stand characteristics at a faster rate than would occur without treatment (USDA Forest Service 2000; Carey 2003). Thinning also opens the understory and increases the amount of understory forage available for a variety of wildlife species. Approximately 12,789 acres of young growth within the project area (25 percent) have been pre-commercially thinned.

Landscape Connectivity

Landscape connectivity is defined as the degree to which the structure of a landscape helps or hinders the movement of wildlife species (Taylor et al. 1993). A landscape with a high degree of connectivity is one in which wildlife move readily between habitat patches over the long-term (USDA Forest Service 2008b). On the Tongass, connectivity between areas of similar habitats (i.e., old-growth forest) or between high and low elevation habitats is important to maintaining well-distributed, viable wildlife populations.

Landscape connectivity can be both structurally and functionally based. Structural connectivity refers to the physical connections between areas of habitat that facilitate movement of wildlife. For example, intact stream buffers function as corridors providing structural connectivity between habitat patches. Within the project area the Recreational River LUD surrounding the Thorne River contributes to functioning of the Honker large OGR complex. Likewise, the beach fringe may provide low elevation structural connectivity between watersheds and function as a transition zone between interior forest and saltwater influences (Julin 1997). Functional connectivity refers to the degree of movement or flow of organisms through broader linkage "zones" which contain an appropriate juxtaposition of habitats and land uses that facilitate movement across the landscape. On the Tongass, matrix lands provide a limited degree of functional connectivity between OGRs and other non-development LUDs.

Fragmentation resulting from actions, both natural and human-caused, reduces landscape connectivity due to the breaking apart of larger contiguous blocks of habitat into smaller patches. The value of residual habitat patches may decline if they become too small to support species with minimum area requirements or to support a subpopulation of a particular organism (i.e., the functional unit of a metapopulation, or population made up of spatially separated local populations that interact with each other). In the latter case, interaction occurs via dispersal as individuals move among patches. Populations may become isolated, and therefore at greater risk of local extirpation, if fragmentation hinders movement of individuals between subpopulations (Wilcove et al. 1986). The degree to which this occurs depends on species-specific dispersal capabilities, the distance between habitat patches, and conditions within the matrix between habitat patches.

When fragmentation occurs there is an increase in the amount of forest edge habitat and a decrease in the amount of interior forest habitat. Fragmentation is often accompanied by a decline in native biodiversity because ecological changes along the habitat edge (edge effects) favor some species over others. Edge effects may include changes in vegetation structure, species composition (both plants and animals), predation rates, and disturbance (Murcia 1995; Nilson et al. 1995; Aas 1999). Although the number of species may be higher along edges (favoring invasive species), the number of habitat specialists (i.e., those associated with interior forest conditions or structural components of old-growth forest), which tend to be more sensitive or at-risk, decreases (Aas 1999; Nilson et al. 1995; Kissling and Garton 2007).

The extent or "depth" of edge effects varies with the contrast in the structure and composition of adjacent vegetative communities, the width of the habitat fragment, and the stability of the remaining vegetation (i.e., as it relates to other environmental effects such as windthrow), and may be species-dependent (Harper et al. 2005; Euskirchen et al.

2006). Edge effects related to vegetation structure and composition typically occur within 165 feet (50 meters) of created forest edges (Harper et al. 2005), whereas edge effects related to habitat functionality for wildlife extend farther (i.e., up to 1,640 feet [500 meters] for edge-related nest predation in migratory songbirds; Wilcove 1987). However, uncertainties remain regarding the spatial and temporal nature of edge effects. Edges are a dynamic component of the landscape. On harvested landscapes, edge contrast may decrease over time with the regeneration of disturbed areas, a process called "edge softening" (Matlack 1994; Euskirchen et al. 2006). Additionally, recent studies suggest that the presence of multiple edges (i.e., three or more adjacent patch types) may affect the magnitude and extent of edge effects (Euskirchen et al. 2006; Li et al. 2007).

Table WLD-2 shows the existing number of POG patches by size class in the project area (i.e., including all POG patches which intersect the project area, resulting in an irregularly shaped area with some patches extending beyond the project area boundary). This includes the inherent level of landscape fragmentation on the Tongass due to the creation of patches through natural processes (e.g., windthrow) and naturally patchy distribution of POG forest interspersed muskeg, forested wetlands, and alpine areas. The patch size classes presented in Table WLD-2 represent fragmentation at multiple scales. Patches at the sub-stand and stand levels (i.e., the smallest size classes) represent scales of influence important to organisms such as lichens, fungi, plants, invertebrates, and small bodied mammals which may be locally endemic; occur in very specific forest structure or soil conditions; or have limited dispersal capabilities. Larger patches represent scales of influence important to wider-ranging species such as deer, marten, and forest-dwelling birds of prey.

Table WLD-2. Number of POG Patches and Acreages by Size Class Intersecting the Big Thorne Project Area under Existing Conditions

Patch Size (acres)	Number of Patches[1/]	Acreage in Size Class
0-25	305	3,009
26-100	95	4,675
101-500	35	7,254
500-1000	7	4,851
1000+	8	82,748
Total	**450**	**102,537**

1/ Includes NFS and non-NFS lands; includes all patches intersecting the project area, some of which extend beyond the project area boundary resulting in a greater total acreage than reported in Table WLD-1.

Corridors

Corridors may be structural (i.e., a physically connected patches of old-growth forest) or functional (i.e., non-contiguous patches of old-growth forest and other vegetation with structural characteristics that continue to facilitate the movement of organisms across the landscape). In the Big Thorne project area, corridors along streams and between old-growth habitats at different elevations have been reduced by past harvest. During public scoping and based on local knowledge of the project area, the following areas were identified as having experienced past harvest and where future alterations could reduce natural connectivity and limit the ability of land-based species to disperse or migrate (Figure WLD-1):

- **Honker Divide.** A key part of the old-growth conservation strategy for the northern portion of Prince of Wales Island, consisting of over 200,000 acres (USDA Forest Service 2008c); provides connectivity between old-growth habitat in the Sarkar Lakes area to the north (outside of the project area), the Thorne River drainage to saltwater (and roadless area) to the east, and the Karta Wilderness to the south. The Honker Divide area includes a number of individual corridors:
  - The Cutthroat drainage (VCU 5760) provides north-south connectivity and is located within the Honker large OGR.
  - The Control Creek drainage (VCU 5760) provides east-west connectivity between the Control Lake area and the Thorne River drainage.
  - The North Thorne drainage (VCU 5800) extends from inside the Honker large OGR, branching east and west at its north end. The east branch is within the small OGR.
  - A tributary to the Thorne River (VCU 5750; northeast of Thorne Lake) provides north-south connectivity from within the Honker large OGR to the west branch of the North Thorne Drainage.
- **Rio Beaver Drainage.** One of the primary north-south linkages between the Honker large OGR and the Karta Wilderness (VCU 597.2).
- **Rio Roberts Drainage**. One of the primary north-south linkages between the Honker large OGR and the Karta Wilderness; located within the Honker large OGR (VCU 5960).
- **Upper Steelhead Drainage.** Provides north-south connectivity between a portion of the Karta Roadless Area that abuts the Karta Wilderness to the south and another portion of the Karta Roadless Area, which abuts the Honker large OGR to the north (VCU 5950). A branch of the Steelhead also connects the Honker large OGR with Big Salt Lake outside of the project area.
- **Rush Peak Area.** Provides north-south connectivity between the Honker large OGR and saltwater at Salt Chuck (VCU 5972). Two important corridors in this area are the Rush Creek and Goose Creek drainages, located to the west and east of Rush Peak, respectively.
- **Control Lake Area.** Functions as a junction of corridors, providing connectivity between the Honker large OGR and the Upper Steelhead, Rio Roberts, and Control Creek drainages (VCUs 5940, 5950, and 5960). Corridor between Control Lake and Honker large OGR has been identified as being important to wolf movement.
- **Ratz Harbor Area.** Old growth in the vicinity of Ratz Harbor provides east-west connections north and south of Big Lake between the shoreline and interior old-growth forest (VCUs 5810, 5830, and 5840).
- **Clarence Straight Shoreline.** Old-growth forest along the shoreline, including areas beyond the beach buffer, provides connectivity (though not continuous) between Sandy Beach and Eagle Creek (VCUs 5820, 5830, 5840, and 5850).

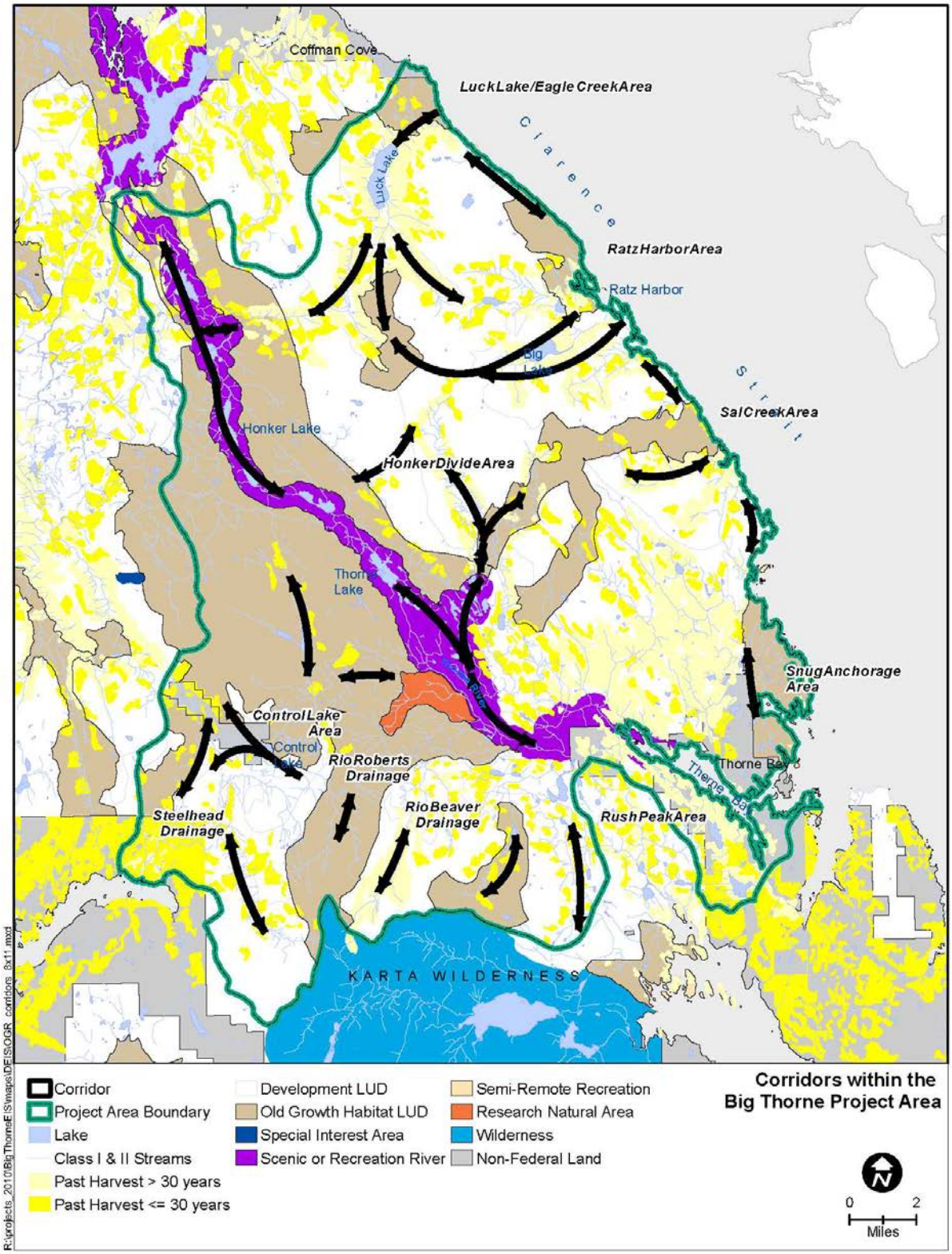

Figure WLD-1. Probable wildlife movement corridors within the Big Thorne Project Area.

- **Snug Anchorage Area.** Old-growth in the vicinity of Snug Anchorage provides a north-south connection between Sandy Beach/Slide Creek and Thorne Bay (VCUs 5850 and 5880). West of Foss Cove, the corridor is very narrow.
- **Sal Creek Area.** Old growth in the vicinity of Sal Creek provides connectivity between the saltwater and the North Thorne drainage to the west.
- **Luck Lake/Eagle Creek Area.** Low-elevation old growth along the riparian corridor of Eagle Creek provides east-west connectivity to saltwater (VCU 5810). Extending from the south end of Luck Lake, corridors also run east-west along Luck Creek to the Honker large OGR (VCUs 5740 and 5810) and north-south along tributaries to Luck Creek to the small OGR in VCU 5810 and to Little Lake.

Management Indicator Species

MIS are species whose response to land management activities can be used to predict the likely response of other species with similar habitat requirements (Forest Service Manual [FSM] 2631.3). In accordance with the 1982 Planning Regulations, 13 wildlife species were identified as MIS in the Forest Plan (USDA FS 2008a). Of these, three wildlife species (brown bear, mountain goat, and red squirrel) do not occur in the project area and will not be discussed here. The bald eagle and river otter are not addressed in detail in the EIS because they inhabit beach, estuary, and riparian habitats that are maintained under the Forest Plan conservation strategy. Moreover, the project would have negligible effects to these species due to the implementation of best management practices or other avoidance and minimizations measures (see the Wildlife and Subsistence Resource Report for a discussion of these species). Rationale for the selection of the other MIS is provided below. All of the wildlife MIS are associated with productive old-growth (POG) forests of Southeast Alaska.

Sitka Black-tailed Deer

The Sitka black-tailed deer was selected as an MIS species because it is an important game and subsistence species in Southeast Alaska. They are also an important prey species for Alexander Archipelago wolves and black bears on Prince of Wales Island. ADF&G managers believe based on field observations of deer browse levels that populations going into the winter of 2011-2012 were at or beyond carrying capacity in much of the deer winter range in the project area (B. Logan, USDA Forest Service, personal communication, 2012); however, due to high deer mortality rates resulting from the moderately severe winter of 2011-2012, ADF&G expects to see a decline in the deer population within GMU 2 (Person and Gilbert, personal comm. with B. Logan, USDA Forest Service, 2012). In light of the Pacific Decadal Oscillation, continued loss of deer winter habitat, and current observed over-browsing of deer winter range, ADF&G expects a reduction in deer carrying capacity over the next decade (Baichtal 2012).

Research conducted in Southeast Alaska indicates that low-elevation, high-volume old-growth habitats are particularly important to deer, especially during severe winters (Schoen and Kirchhoff 1990; Hanley and Rose 1987; Yeo and Peek 1992). These old-growth stands intercept snow, provide thermal cover, and support the largest biomass of herb and shrub forage for deer (Alaback 1982; Schoen et al. 1984). The interagency deer winter habitat capability model was used to assess existing habitat capability in the WAAs

coinciding with the project area. Shortcomings of the model are described in detail in the 2008 Forest Plan Final EIS (USDA Forest Service 2008b). Model assumptions, based on recent direction provided by the Forest Service, include the following:

- Historic conditions were defined as the conditions that existed prior to the onset of large-scale logging in 1954. Historic conditions were reconstructed by converting the 1986 vegetation mapping (TIM86) to the Size Density Model (SDM) types and then converting the areas mapped as harvested prior to that date into the different volstrata and SD67 POG, based on the proportion of these categories in areas harvested prior to 1992.
- All proposed harvest units are treated as even-aged harvest. This is conservative because uneven-aged harvest units would retain some of their value to deer.
- Commercial thinning was addressed in the model by leaving stands in the stem exclusion stage after thinning because the stem exclusion stage is based on age which is unchanged by thinning treatments and because the deer model does not assign different values as a result of these stand treatments.
- Stem exclusion was considered 25 years post-harvest (stands 26 to 150 years of age).
- Values output by the model were standardized to range from 0 to 1.0 by dividing all values by 1.3.
- 100 deer per square mile was used as the multiplier.
- Only NFS lands were in the project-related effects (direct and indirect effects) analysis. All land ownerships (NFS and non-NFS lands) were included in the cumulative effects analysis; however, non-NFS lands were given a zero value (conservatively assuming harvest of all non-NFS lands).
- All elevations are included in the analysis, but the model gives acres above 1,500 feet a zero value.
- Model runs assumed 2012 as the current year, 2013 for project implementation, and 2039 for stem exclusion.
- Lakes and lake islands were excluded from the analysis.
- Entire land areas for WAAs where project activities are proposed (WAAs 1315, 1318, 1319, and 1420) were included in the direct and indirect effects analysis (see the Wildlife and Subsistence resource report for the square mile values); WAAs 1316, 1421, and 1422 coincide with the project area, but because no actions are proposed within them they not included in the direct and indirect effects analysis.
- At the biogeographic province scale (cumulative effects analysis for wolves), the entire land area of WAAs intersecting the biogeographic province was included even though some WAAs extended beyond the province boundary (an exception was WAA 1003 because all the acres within the province were saltwater).
- No predation was included.

Historic (1954) and current (2012) deer habitat capability is presented in Table WLD-3. Current habitat capability in the WAAs where timber harvest is proposed ranges from 59 to 93 percent of that existing in 1954 (Table WLD-3).

Table WLD-3. Existing Deer Winter Habitat Capability on NFS Lands by WAA

WAA	1954 Deer Habitat Capability [1/]	2012 Deer Habitat Capability [1/]	% of original
1315	2,411	1,430	59%
1318	1,269	1,180	93%
1319	3,324	2,567	77%
1420	1,404	789	56%
Total	8,408	5,966	71%

1/ Deer habitat capability, in deer habitat units, calculated from the deer model for winter habitat. Habitat Suitability Indices were standardized to range from 0.0 to 1.0; 100 deer per square mile used as multiplier; all harvest was treated as even-aged; no predation was included.
Note: WAAs 1316, 1421, and 1422 are slightly within the project area boundary, but no actions are proposed within them.
Source: GIS Database, deer_model.aml, 2012

Random events such as snow and other weather conditions can influence the ecology and behavior of wintering deer by decreasing forage availability and increasing the amount of energy it takes to move through the forest (Hanley et al. 1986; Farmer et al. 2006; White et al. 2009). Thus, the habitats available to deer differ depending on winter severity, and can be defined as:

- Average snow winter habitat is defined as all POG below 1,500 feet elevation, and
- Deep snow winter habitat is defined as high-volume POG below 800 feet elevation, representing the shift toward use of lower elevations and more dense stands of POG during severe winters.

Average snow winter habitat has been reduced by 25 to 47 percent and deep snow winter habitat has been reduced by 30 to 69 percent from original (1954) amounts, depending on the WAA.

Spring, summer, and fall habitats (non-winter) are also important for deer reproduction and population recovery following severe winters, and for building up pre-winter body reserves. These habitats include all vegetation types, except young-growth in the stem exclusion phase. Since 1954, non-winter habitat has been reduced by 9 to 30 percent, depending on the WAA (Table WLD-4).

Although deer in Southeast Alaska are considered an old-growth species, they will forage in early seral stands in mild winters, spring, and summer. During the first 25 years (stand initiation), openings created by timber harvest provide abundant forage for deer as sunlight is allowed to penetrate to the forest floor enhancing growth of understory vegetation (Farmer and Kirchhoff 2007). However, as the forest regenerates, a dense canopy can form which shades out understory vegetation (stem exclusion) thereby reducing foraging habitat - a period which may last up to 150 years after harvest. Deer abundance has been shown to be lower in these forage-poor habitats (Brinkman 2009; Person et al. 2010). Thus, the effects of timber harvest are not fully realized until decades after.

Table WLD-4. Existing Average Snow Winter Habitat, Deep Snow Winter Habitat, and Non-Winter Habitat on NFS Lands by WAA

WAA	Habitat	Original (1954) Acres	2012 Acres	% Change	% of Total WAA Area with Available Habitat under Existing Conditions
1315	Deep Snow[1/]	19,848	9,296	-53%	6%
	Average Snow [2/]	46,237	26,513	-43%	17%
	Non-Winter[3/]	84,461	66,013	-22%	43%
1318	Deep Snow[1/]	10,917	7,600	-30%	5%
	Average Snow [2/]	34,080	25,339	-26%	17%
	Non-Winter[3/]	97,811	89,475	-9%	62%
1319	Deep Snow[1/]	18,279	11,827	-35%	11%
	Average Snow [2/]	54,994	41,099	-25%	39%
	Non-Winter[3/]	102,402	88,407	-14%	85%
1420	Deep Snow[1/]	10,157	3,176	-69%	5%
	Average Snow [2/]	28,969	15,233	-47%	24%
	Non-Winter[3/]	45,637	32,022	-30%	51%

1/ High-volume POG (SD 5S, 5N, 67) at or below 800 feet elevation; no GIS snow layer applied
2/ All POG (SD 4H, 4N, 4S, 5H, 5S, 5N, 67) at or below 1,500 feet elevation
3/ Spring/summer/fall habitat; all POG, non-productive old-growth and non-forested muskeg, alpine habitats

Alexander Archipelago Wolf

The Alexander Archipelago wolf was selected as an MIS because it is a species of concern and an important furbearer. The Alexander Archipelago wolf is a subspecies of gray wolf endemic to Southeast Alaska that inhabits the mainland and islands south of Frederick Sound. Wolves inhabiting Prince of Wales Island are genetically isolated from other populations in Southeast Alaska (Person 2001; Weckworth et al. 2005, 2010, 2011). Monitoring populations of wolves in the temperate rainforests of Southeast Alaska is challenging because thick forest cover makes detecting and observing wolves very difficult. Current estimates of the wolf population in this area are lacking; however, approximately 250-350 wolves were estimated to inhabit Prince of Wales Island and the surrounding islands (Person et al. 1996). However, the population on Prince of Wales Island may be lower than in previous years based on the lack of scats observed during 2009 and 2010 field effort (e.g., 30-35 scats collected versus 154 collected during a 1993-1994 effort; Person 2010, Kohira 1995). That observation was consistent with testimony from local trappers during the 2010 Alaska Board of Game meeting in Ketchikan (Logan, USDA Forest Service, personal comm. 2012). The Tongass National Forest is currently partnering with ADF&G to establish protocols for estimating and monitoring wolf population status and trends in GMU2.

In August 2011, the USFWS received a petition to list the subspecies as threatened or endangered, and to recognize Prince of Wales Island as a significant portion of its range (Center for Biological Diversity and Greenpeace 2011). The petition also requested that the USFWS consider Prince of Wales Island and adjacent islands (including Kosciusko, Tuxekan, Heceta, Suemez, Dall, and others proximate to Prince of Wales) a Distinct Population Segment based on unique genetic, physical, and ecological characteristics. At

the time of this writing, the USFWS is currently conducting a 90-day review of the Alexander Archipelago wolf which will conclude with the determination of whether or not the petition should be moved forward for additional review.

Wolves in Southeast Alaska use a wide variety of habitats but spend most of their time in productive and unproductive old-growth forests at low elevations (below 270 feet [82 meters]; young seral forests and clearcuts are typically avoided (Person 2001). Dens on Prince of Wales Island are located in root wads of large living or dead trees within old-growth forest stands less than 495 feet (150 meters) from freshwater (Person and Russell 2009). In GMU 2, wolves feed primarily on deer, though they will feed on beaver and spawning salmon when available (Darimont et al. 2002; Szepanski et al. 1999). Critical deer winter habitat was considered by Person (2001) to be a good measure of habitat quality for wolves in southern Southeast Alaska. Conserving winter habitat is important for maintaining the resilience of deer to severe winter weather, predation by wolves and black bears, and hunter harvest (Person et al. 1996, Person 2001).Forest Plan standards and guidelines require, where possible, the provision of sufficient deer habitat capability to first maintain sustainable wolf populations, and then to consider meeting estimated human deer harvest demands. This is generally considered to equate to the habitat capability to support a minimum of 18 deer per square mile (using habitat capability model outputs; USDA Forest Service 2008a). However, other factors (e.g., local knowledge of habitat conditions) are to be considered by the biologist, as well, rather than solely relying upon model outputs.

Prior to the start of large-scale commercial timber harvest in 1954, habitat capability in WAAs 1315 (29 deer per square mile), 1319 (21 deer per square mile), and 1420 (22 deer per square mile) exceeded this level where as WAA 1318 (15 deer per square mile) did not; currently, none of the project area WAAs supports 18 deer per square mile (Table WLD-5). This suggests that, based on modeled deer densities alone, the project area WAAs may not be capable of sustaining wolves without immigration from neighboring areas. However, this does not take into account the fact that wolves are highly mobile and move between WAAs and thus wolf packs may be supported by a number of adjacent WAAs (Person and Logan 2011); the potential benefits of young-growth management for deer habitat and road management for controlling hunter access; or the presence of the Honker Divide Large OGR complex (200,000+ acres) and the Karta Wilderness (about 40,000 acres) both adjacent to the project area. For example, wolves occupying the Honker Divide OGR also use areas of North and East Thorne River that are within the project area (Person 2001).

Table WLD-5. Existing Deer Winter Habitat Capability in terms of Deer Density on NFS Lands by WAA

WAA	Historic (1954) Deer Habitat Capability[1/]	2012 Deer Habitat Capability[2/]	
	Deer/mi^2	Deer/mi^2	% of Original
1315	29	17	59
1318	15	14	93
1319	21	16	76
1420	22	12	55
4 WAAs combined	21	15	71

1/ Deer habitat capability, in deer per square mile, calculated from the deer model for winter habitat. Habitat Suitability Indices were standardized to range from 0.0 to 1.0; 100 deer per square mile used as multiplier; all harvest was treated as even-aged; no predation was included.
2/ Values presented here are slightly lower than those presented in the 2008 Forest Plan EIS for the selected alternative because some stands have matured over time, and edits have been made to make the GIS layer more accurate.
Note: WAAs 1316, 1421, and 1422 are slightly within the project area boundary, but no actions are proposed within them.
3/Numbers calculated using data in Table WLD-3 and WAA land area (square miles; listed in the Wildlife and Subsistence Resource Report).
Source: GIS Database, deer_model.aml, 2012

Harvesting of wolves is regulated by the Federal Subsistence Board and the State of Alaska Board of Game (see the Wildlife and Subsistence resource report for harvest regulations). Legal harvest annually may annually remove up to 25–30 percent of the estimated wolf population and is considered to be the primary source of wolf mortality on Prince of Wales Island; however, this estimate does not include illegal take, which has been estimated to be as much as 46 percent of wolf mortality (Person and Russell 2008). From a biological perspective, in order to maintain the current population, the level of harvest-related mortality should not exceed 38 percent (Person and Russell 2008). A 30 percent cap (of the fall population) on wolf harvest in GMU 2 was designed by ADF&G to prevent serious declines in the wolf population. The ADF&G can put in effect the emergency closure on wolf harvest if the sealing data indicate that the 30 percent harvest cap has been reached or exceeded.

The mean total annual harvest in GMU 2 from1985 to 1999 was 76 wolves, ranging from 18 to 136 wolves; from 2000 to 2009 mean total annual harvest was 49 wolves, ranging from 18 to 77 wolves (Person and Logan 2012). From 2008 to 2010, average total reported harvests in GMU 2 were 24, 22, and 20 wolves, respectively (Porter, B., ADF&G, pers. comm., 2012). At the November 2010 Board of Game meeting in Ketchikan, ADF&G reported that anecdotal observations by state and Federal biologists, trappers, and hunting outfitters/guides suggested the wolf population had declined to as few as 150 wolves in GMU 2, and that a harvest cap of 45 wolves (30 percent of the population estimated by ADF&G) might be appropriate.

Person and Logan (2012) suggested that all project area WAAs may have periodically experienced unsustainable harvest (annual harvest rates ≥ 3 wolves per 300 square kilometers) with WAAs 1315, 1318, and 1420 having experiencing chronic unsustainable harvest (i.e. unsustainable harvest at least 5 times between 1985 and 2009). Moreover, WAAs 1315, 1318, and 1420 have experienced harvest at levels with the potential to result in pack turnover or pack depletion (annual harvest rates ≥7 wolves per 300 square kilometers); at times between 1985 and 2009 the risk of pack depletion in all three WAAs

may have been high (i.e., annual harvest of ≥7 wolves per 300 square kilometers for at least 2 years). However, reliable data only exist for 1992 to 1999, after which the season was temporarily closed by emergency order due to exceeding the 30 percent harvest cap. Person and Logan (2012) stated that the occurrence of unsustainable and pack depletion harvests peaked prior to 1999.

The project area WAAs may be at risk of such overharvest (both unsustainable and pack depletion) in the future even with scheduled road closures under the Prince of Wales Access and Travel Management Plan (Person and Logan 2012; see the Wildlife and Subsistence resource report for additional information). However, taking all years into account, the average annual wolf harvest between 1985-2009 for WAAs 1315, 1318, and 1319 was <3wolves per 300 square kilometer per year; average annual harvest over this period in WAA 1420 was at least 3 wolves per square kilometer and thus at a level Person and Logan determined may be unsustainable (Person and Logan 2012).

Although most wolves (i.e., 59 percent) are harvested by hunters and trappers working from boats harvest-related wolf mortality is correlated with roads and other habitat features, which influence their vulnerability to harvest (Person and Russell 2008; Person and Logan 2012). Person and Russell (2008) found that rate of harvest of both resident and non-resident wolves increased with density of roads, which provide access to hunters and trappers; however, road densities of 1.5 miles per square mile (0.9 kilometer per square kilometer) or greater had little additional effect on harvest rates. This study did not differentiate between open and closed roads though the authors stated that road status likely had an important influence on wolf mortality. Similarly, wolves are more easily observed in open habitats such as muskegs, meadows, and young clearcuts; therefore, use of these habitats, particularly in areas accessible to humans (i.e., the beach and roaded areas), increases the risk of harvest-related mortality (Person and Russell 2008). Harvest vulnerability may limit dispersal, and thus the ability of wolves to recolonize territories that have been vacated by trapping and hunting or maintain genetic interchange between separate populations.

The Forest Plan states that a road density of 0.7 to 1.0 mile per square mile or less may be necessary to reduce harvest-related mortality risk where locally unsustainable wolf mortality has been identified. Person et al. (1996) reported that wolf harvest increased twofold when total road density below 1,200 feet elevation exceeded 0.7 miles per square mile. Currently total road density below 1,200 feet elevation on POW is 0.99 mile per square mile, ranging from 0.7 to 2.5 miles per square mile for WAAs in the project area (Table WLD-6). These road densities exceed both the Forest Plan recommendation (0.7 miles per square mile) as well as the threshold of 1.5 miles per square mile suggested by Person and Russell (2008) in all cases except WAA 1318 where road density is 0.7 miles per square mile.

That wolves continue to be harvested from the project area WAAs at moderate to high rates suggests that the wolf population may be functioning despite being at risk of periodic, localized depletions (i.e., indicative of healthy source populations with some areas functioning as sinks) but could also be indicative of a decreased population overall with fewer wolves available to harvest. Moreover, the presence of large, undisturbed

blocks of habitat on Prince of Wales Island, including the Honker Divide large OGR complex and the nearly 40,000-acre Karta Wilderness to the west and south of the project, respectively, help assure the persistence of wolf packs that may serve as source populations capable of replacing wolves that periodically disappear from adjacent disturbed lands (Person et al. 1996, Person and Logan 2012).

Table WLD-6. Existing Road Density below 1,200 Feet Elevation on NFS Lands

Island/WAA	Road Density by Road Status (mile/mile^2)[1/, 2/]		
	Open	Closed	Total
1315	1.07	1.06	2.14
1318	0.49	0.23	0.71
1319	0.82	0.78	1.60
1420	1.40	1.12	2.51
Prince of Wales Island	0.53	0.46	0.99

1/ Includes only NFS lands.
2/ Closed roads are defined as all NFS roads with Operating Maintenance Level = 1 plus all decommissioned NFS roads; open roads include all other NFS roads and all state and private roads.

The ADF&G works cooperatively with the Alaska Board of Game and with Federal land managers, including the Forest Service, to identify and address conservation concerns for all wildlife in Southeast Alaska, including wolves. Through this effort revisions are proposed to regulatory entities as needs are identified. The Board of Game has made modifications to wolf hunting and trapping seasons over the years in response to information provided by agencies and the public. These regulations are intended to help ensure sustainable wolf populations and are an important part of the wolf standard and guideline.

The Forest Service is also currently participating in an interagency group referred to as the "Wolf Task Force." This group was formed to try to determine if there is unsustainable wolf mortality occurring on Prince of Wales Island or not. The group's decision would then determine if a wolf habitat management plan is needed. The group began meeting in October of 2011 although collaborative work is ongoing and no determination has been reached to date. The Forest Service and the State of Alaska are currently working to obtain more accurate wolf population estimates.

The Big Thorne project area lies within the vicinity of the Honker Divide, Steelhead, Thorne River, and Ratz Harbor wolf packs. Wolf sign was documented during goshawk surveys conducted for the Project in the Steelhead drainage, the Rio Beaver drainage, west of Rush Peak, and near Angel Lake. Biologists from ADF&G provided GIS data delineating 1,200-foot buffers centered on nine known den sites in the Big Thorne project area (Moselle, ADF&G, personal comm. 2011). These buffers overlapped four proposed harvest units. In accordance with Forest Plan standards and guidelines, the boundaries of these units were subsequently modified (or the unit was dropped) under all alternatives to eliminate portions overlapping the den site buffers.

Marten

The American marten was selected as an MIS because of its close association with old-growth forests and its importance as a furbearer. Although only one species of marten is formally recognized in Southeast Alaska two distinct lineages exist. Within the Alexander Archipelago, the coastal form *caurina* is thought to occur only on Kuiu and Admiralty

Islands, though a preliminarily identified specimen of this subspecies has been collected on Dall Island (USDA Forest Service unpublished data). The continental form occurs elsewhere in their range including Prince of Wales Island (Cook et al. 2006). Marten were transplanted to Prince of Wales Island between 1930 and 1950 (MacDonald and Cook 1999).

In GMU 2, marten are managed as a furbearer. ADF&G currently permits unlimited trapping of marten in the GMU 2 from December 1 to February 15. Marten are also a subsistence species. Trapping efforts fluctuate year-to-year depending on fur prices, fuel prices, winter weather conditions, the current economy, and marten populations. Marten harvests in GMU 2 are typically high compared to elsewhere in Southeast Alaska (see the subsistence section for marten trapping statistics).

Coastal habitats (beach fringe) and riparian areas have the highest habitat value for marten, followed by upland forested habitats below 1,500 feet in elevation (USDA Forest Service 2008a). Marten favor large- and medium-sized old-growth forests because they intercept snow, provide cover and denning sites, and provide habitat for marten prey species (Flynn and Schumacher 2001). These forests are also used by deer during winter, and winter-kill carcasses of deer represented a significant portion of marten diet in winter (Ben David et al. 1997). These forests have also experienced past timber harvest. Consequently, the quantity and quality of winter habitat is a limiting factor for marten in Southeast Alaska. Therefore, the availability of deep-snow marten habitat, defined as high-volume POG (SD 5N, 5S, and 67) below 800 feet in elevation, provides a measure of habitat quality for marten. Within the project area WAAs, the original (1954) amount of deep snow marten habitat has been reduced by between 30 and 69 percent; deep snow marten habitat within the project area as a whole has been reduced by 61 percent (Table WLD-7).

Table WLD-7. Original and Existing Deep Snow Marten Habitat

WAA	Deep Snow Marten Habitat[1/]		
	Original (1954) Acres	2012 Acres	% Change
1315	19,848	9,296	-53%
1318	10,917	7,600	-30%
1319	18,279	11,827	-35%
1420	10,157	3,176	-69%
Project Area	64,856	25,112	-61%

1/ High volume POG (SD 5S, 5N, 6/7) at or below 800 feet elevation

Due to their wide-ranging nature and close association with old-growth forest, marten were specifically considered in the design of medium-sized old-growth reserves (10,000 to 40,000 acres) under the Forest Plan Conservation Strategy (Suring et al. 1993; Flynn et al. 2004; USDA Forest Service 2008a). Large, contiguous patches of old-growth, particularly below 800 feet elevation during winter, provide the highest quality habitat for marten and marten densities are typically higher in these areas than in fragmented habitats (Hargis et al. 1999; Flynn et al. 2004). Marten also travel easily through non-commercial forests, POG, and clearcuts with established cover (Flynn et al. 2007). Thus, maintaining a matrix that facilitates movement (i.e., roadless refugia from harvest and the presence of old-growth for foraging and denning) between large, contiguous patches of old-growth is important to this species.

Assuming the minimum travel distance for marten of 8 miles (13 km) reported by Flynn (1991), and that corridors through POG are optimal, functional connectivity between OGRs in the project area for marten is as follows:

- Small OGRs in VCUs 5790, 5800, and 5840 are functionally connected to each other and to the Honker large OGR complex via VCU 5780 and 5790 (via roadless areas), and to the beach through the small OGR in VCU 5840;
- The small OGR in VCU 5950 is functionally connected (only through non-Federal land) to the Honker large OGR complex, and to the small OGR in VCU 5940;
- Small OGRs in 5960 and 5972 are functionally connected to large reserves (Honker large OGR complex and/or Karta Wilderness) and to each other (through the Karta Wilderness and roadless areas);
- Small OGRs in adjacent VCUs 5820/5830 are functionally connected to each other and (via VCU 5820 through roadless area) to the northern piece of the small OGR in VCU 5810, which is also connected to the small OGR in VCU 5720, but none are functionally connected to a larger reserve;
- The southern piece of the small OGR in VCU 5810 is functionally connected to the Honker large OGR in VCUs 5740 and 5750 (via roadless area); and
- Small OGRs in adjacent VCUs 5850/5860 are functionally connected to each other and to the small OGR in VCU 5840 through the beach buffer and a marginal connection through the VCU (due to some older [> 30 years] young-growth).

In addition to the functional connectivity across the landscape provided by the reserve system and old-growth forest in the matrix, connectivity between reserves for marten is also provided by structural elements of the Forest Plan conservation strategy including the stream, estuary, lake, and beach buffers. A discussion of travel corridors within the project area is provided in the Biodiversity subsection.

Marten populations fluctuate greatly over time in response to habitat conditions, prey densities, and trapping pressure. Timber harvest reduces habitat quality for marten through the removal of forest cover, fragmentation of old-growth habitat, and reductions in habitat for some prey species. Increased human access associated with new roads may result in increased marten harvest-related mortality. Although closed roads still facilitate access (e.g., off-highway vehicle, pedestrian), open roads receive the highest and most consistent use and therefore are likely to have the greatest effect on marten. Existing road densities (all elevations included) in the project area WAAs are listed in Table WLD-8. Roadless areas and OGRs provide refugia from trapping pressure. The Forest Plan conservation strategy provides habitat and connectivity for marten on NFS lands (USDA Forest Service 2008a).

Table WLD-8. Existing Road Density for All Elevations on NFS Lands

Island/WAA	Road Density by Road Status (mile/mile^2)[1/, 2/]		
	Open	Closed	Total
1315	0.94	0.93	1.87
1318	0.34	0.14	0.48
1319	0.61	0.58	1.19
1420	1.00	0.74	1.74

1/ Includes only NFS lands.
2/ Closed roads are defined as all NFS roads with Operating Maintenance Level = 1 plus all decommissioned NFS roads; open roads include all other NFS roads and all state and private roads.

Black Bear

Black bears were chosen as an MIS because of their importance for hunting and for recreation and tourism. In Southeast Alaska, black bears are present throughout the mainland and on the islands south of Frederick Sound. Black bears in Southeast Alaska are part of a population (Alexander Archipelago black bears) endemic to coastal British Columbia and Southeast Alaska, except Admiralty, Baranof, and Chichagof islands (Stone and Cook 2000, Peacock et al. 2007).

Prince of Wales Island is known for producing large black bears and is a popular hunting location for resident and non-resident hunters. Mean annual black bear harvest from 2007-2009 was 312 bear (ADF&G 2011). Reported black bear harvest in GMU 2 peaked in 2005 and has dropped every year thereafter (ADF&G 2011). Between September 1 and June 30, resident hunters are allowed a bag limit of 2 bears and non-residents are allowed a bag limit of 1 bear; beginning in 2012 drawing permits will be required for non-resident hunters not using registered guides. This change in hunting opportunity is driven by ADF&G concerns about sustainable harvest and is intended to bring harvest in line with harvest objectives (ADF&G 2011).

Black bears will use habitats from sea level to the alpine but appear to prefer estuarine, riparian, and forested coastal habitats (USDA Forest Service 2008b). Black bears use small openings, and areas such as wetlands, clearcuts, and subalpine meadows for foraging. On Prince of Wales Island, black bears primarily forage on vegetation in the early spring, but will prey on deer fawns for a short period in late spring (Porter 2008). During summer and fall, the accumulation of fat reserves for winter hibernation is important. Berry crops are an important food source during this period, and bears that have access to salmon streams will eat large quantities of fish.

Prince of Wales Island has some of the highest quality black bear habitat in Southeast Alaska (Porter 2008). However, more timber harvest and associated road building have occurred there than in other Southeast Alaska black bear habitats (Porter 2008). Timber harvest (the removal of POG forest), decreases habitat suitability. Past timber harvest, especially in areas adjacent to salmon streams, has also decreased bear habitat suitability. While early successional habitats may provide abundant food (berries), over the long term dense young-growth stands provide poor habitat for black bears due to the lack of understory vegetation and large hollow trees for denning. Also over the long-term reduction of den sites may result from a lack of availability of large tree root structures (Davis et al. 2012).

Timber harvest may also impact black bears through increased human access on roads. This can result in increased harvest-related mortality; however it should be noted that black bear harvest risk is not tied to a road density threshold.

Existing POG in the project area WAAs includes 27,676 acres in WAA 1315 (51 percent of the original POG existing in 1954); 32,286 acres in WAA 1318 (71 percent of the original POG existing in 1954); 47,444 acres in WAA 1319 (77 percent of the original POG existing in 1954); and 18,027 acres in WAA 1420 (56 percent of the original POG existing in 1954). The Forest Plan conservation strategy provides habitat for black bear that may provide suitable den sites

Small OGRs which provide connectivity to shoreline and riparian habitats preferred by black bears include those in VCUs 5800, 5810, 5820, 5840, and 5850. The existing small OGR in VCU 5950 does not include an area along its eastern boundary identified in 2007 by the IRT (see Issue 2 for additional discussion of interagency review of small OGRs) as being an area of high bear use.

Black bears and sign were observed in the Big Thorne project area during field surveys. Biologists from ADF&G provided GIS data delineating 300-foot buffers centered on known black bear den sites in the Big Thorne project area (Moselle, ADF&G, personal comm. 2011). The 2008 Forest Plan does not require den buffers, so the distance of 300 feet was selected because it was deemed adequate by to avoid disturbing black bear dens during timber harvest activities based on recommendations by ADF&G black bear biologists (Moselle, ADF&G, personal comm. 2011). These buffers overlapped one proposed harvest unit, which was subsequently modified to eliminate the portions of the unit that overlapped the den site buffer. Other known dens sites were not within or immediately adjacent to proposed harvest units. Any additional bear dens discovered subsequent to the finalization of the Draft EIS unit pool will be incorporated for the Final EIS.

Red-breasted Sapsucker, Hairy Woodpecker, and Brown Creeper

The hairy woodpecker, red-breasted sapsucker, and brown creeper were selected as MIS to represent old-growth-associated and snag-dependent species. Hairy woodpeckers and red-breasted sapsuckers are primary cavity excavators that require snags and dying trees for foraging and nesting. The hairy woodpecker is typically associated with high-volume POG (SDM 5S, 5N, 67) whereas the red-breasted sapsucker is typically associated with low-volume POG (SD4H category; USDA Forest Service 2008b). The brown creeper requires large diameter old-growth trees (large-tree POG; SD67 type). Existing acres of each POG category within the project area are provided in Table WLD-1.

All three species are associated with interior forest conditions (Kissling and Garton 2008). In a study of the responses of forest-dwelling birds varying forested beach buffer widths in Southeast Alaska, hairy woodpeckers and brown creepers were absent from forest buffers less than 830 feet wide (250 meters wide), indicating that these species may avoid edge habitats; 83 percent of brown creepers were detected in undisturbed control plots (Kissling 2003; Kissling and Garton 2007). Densities of red-breasted sapsuckers were positively correlated with buffer width, with the greatest densities occurring in buffers at least 1,000 feet wide (300 meters wide; Kissling 2003). Thus these species area sensitive

to fragmentation and reductions in POG patch sizes. Maintenance of habitat for these species is provided by the Forest Plan conservation strategy (USDA Forest Service 2008a).

Timber harvest activities that remove large, live trees and dead or dying trees reduce nesting and foraging habitat for these species (Hejl et al. 2002). Timber harvest may also reduce local habitat quality by creating fragmented forest patches, reducing the amount of interior forest habitat with which these species are associated. Brown creeper and hairy woodpecker would be most affected by harvest activities that reduce the number of large diameter trees and snags. Red-breasted sapsuckers were observed during 2010 wildlife surveys; no hairy woodpeckers or brown creepers were recorded but suitable habitat is present.

Vancouver Canada Goose

The Vancouver Canada goose was selected as an MIS because of its association with wetlands (both forested and non-forested) in the estuary, riparian, and upland areas of the Forest (USDA Forest Service 2008b). The Vancouver Canada goose is a primarily a non-migratory waterfowl species that occurs year-round throughout Southeast Alaska (Hupp et al. 2010). However, geese do move locally between nesting, brood rearing, molting, and wintering grounds. This species nests in forested habitats associated with beach fringe, estuary fringe, and riparian habitats. Hupp et al. (2010) documented nests in forests adjacent to muskegs. During winter, marine grasses and salt marsh plants commonly found in intertidal areas are important forage resources, and Vancouver Canada geese exhibit strong fidelity, returning repeatedly to such winter sites (Fox 2008).

Timber harvest activities may result in disturbance to geese, particularly if they occur in the vicinity of nest sites or brood rearing areas. However, timber harvest in these areas has generally been minimal because these sites are fairly unproductive. Protection from direct impact to habitat is provided by Forest Plan Standards and Guidelines for waterfowl habitat, stream, and lake buffers; overall goose habitat is provided by the Forest Plan conservation strategy (USDA Forest Service 2008a).

Potential habitats for Vancouver Canada geese in the Big Thorne project area include the shorelines of lakes, including Luck Lake, Little Lake, Big Lake, Trumpeter Lake, Power Lake, Angel Lake, Control Lake, and other small lakes in the area. Potential habitat is also located in the forested riparian and estuarine areas.

Species of Concern

The U.S. Fish and Wildlife Service and the Forest Service have identified the following species as species of concern. These species are not currently listed as threatened or endangered (see Wetlands section of the DEIS for additional discussion; Table WET-1).

Marbled Murrelet

Marbled murrelets are widely distributed across marine waters in Southeast Alaska. They spend the majority of their lives at sea, but travel inland up to 50 miles to nest in old-growth forest stands (Piatt et al. 2007). Marbled murrelets typically nest on mossy-limbed branches of large, mature coniferous trees within stands of structurally complex, coastal high-volume old-growth forest (DeGange 1996; Kuletz et al. 1995; Ralph and Miller

1995). However, on some treeless islands in Southeast Alaska marbled murrelets lay eggs on bare talus slopes in mountainous areas (Piatt et al. 2007). Nests can be very difficult to find and only six nests have been found in Southeast Alaska (Forest Service 2003).

Timber harvest, through the removal of POG forest, can directly remove nest trees, and also increases habitat fragmentation and associated edge effects, such as increased rates of nest predation (Andren 1994; Chalfoun et al. 2002). As forest patch size decreases through fragmentation, forest-edge habitat and predator access increase. Some avian predators of murrelets, especially corvids (i.e., ravens, crows, jays), are known to increase both with forest fragmentation and proximity to human activity (Burger 2002). In a study of the edge effects and nest predation risk on marbled murrelets, Malt and Lank (2007) found that disturbances by avian predators at nests were significantly more frequent at hard edges (clearcuts) relative to interiors, but less frequent at soft edges (regenerating forest); there were no edge effects at natural-edged (riparian) sites. Thus, edge-associated predation risk may subside with the progression of forest succession. Forest Plan standards and guidelines pertaining to marbled murrelets include maintaining a 600-foot radius no-cut buffer zone around identified murrelet nests (Forest Service 2008a).

Within the project area, approximately 67 percent of the original (1954) POG remains providing suitable marbled murrelet nesting habitat (Table WLD-1). No nests were documented during 2010 and 2011 field surveys though nest surveys specific to murrelets were not conducted. A dead marbled murrelet was observed.

Prince of Wales Flying Squirrel

The Prince of Wales flying squirrel is endemic to the Prince of Wales Island complex (Demboski et al. 1998; Smith 2005). The flying squirrel plays an essential role in the dynamics of coniferous forest ecosystems (Carey 2000a) because it disperses ectomycorrhizal fungi (Maser and Maser 1988), a food source that is lacking in young-growth forest (Flaherty et al. 2008). It is a species of concern on Prince of Wales Island because of this close association with old-growth forest structure and processes and because of its specific habitat requirements for efficient movement (Carey 2000a; Scheibe et al. 2006).

On September 30, 2011, the USFWS received a petition to list the Prince of Wales flying squirrel as threatened or endangered under the ESA. On August 29, 2012, the USFWS announced a 90-day finding that the petition did not present substantial information indicating that listing this subspecies may be warranted (FR 52301-52308). Therefore, at this time the petition will not move forward for additional review.

Prince of Wales flying squirrels are associated with high-volume POG and dens sites are typically located in areas with lower levels of fragmentation than elsewhere on the landscape (Pyare et al. 2010). The Prince of Wales flying squirrel is capable of crossing open areas such as meadows or riparian zones; however, this subspecies has a limited gliding range (approximately 250 feet), a distance substantially less than the average clearcut width (Flaherty et al. 2008). Recent research also indicates that the Prince of Wales flying squirrel relies on its olfactory, auditory, and visual senses for movement which are limited in clear-cuts (perceptual range of 328-492 feet) and young-growth forests (perceptual range of 82-164 feet; Flaherty et al. 2008). Flaherty et al. (2008)

speculated that Prince of Wales flying squirrels are unlikely to venture beyond their perceptual ranges, and thus may become isolated by large clearings (i.e., those that exceed 250 feet). Thus, successful dispersal of the species depends on the functional connectivity of the landscape (Smith et al. 2005).

Under the Forest Plan Conservation Strategy, the system of small OGRs was designed to provide for the distribution of flying squirrels in every major watershed and facilitate functional connectivity between larger reserves (USDA Forest Service 1997). Small OGRs were intended to support small, persistent populations of flying squirrels between larger source populations that collectively function as a metapopulation interacting through the matrix. However, based on flying squirrel movement capabilities, Pyare and Smith (2005) concluded that fewer than half of the small OGRs on northern Prince of Wales Island (including the project area) appear to be functionally connected to a source population. Moreover, Smith and Person (2007, as cited in Smith et al. 2011) hypothesized that flying squirrels populations might not persist over the long term in isolated small OGRs because the minimum patch size required to sustain a population is greater than minimum acreage requirements for small OGRs required under the Forest Plan. Small OGRs contribute to the connectivity between source populations in medium and large reserves, and therefore must either sustain sink populations long enough to ensure successful emigration to other reserves or must be close enough to larger reserves to support a back-and-forth exchange (Smith et al. 2011).

Smith et al. (2011) suggest that spacing small OGRs at a maximum distance of 0.6 mile (1 kilometer) through old-growth habitat would probably facilitate the recolonization of vacant reserves and supplementation of existing populations. Based on this suggested spacing, functional connectivity within the project area (existing small OGRs) is as follows:

- Small OGRs in VCUs 5790, 5800, and 5840 are functionally connected to each other and to the Honker large OGR and saltwater complex via VCU 5780;
- The small OGRs in VCU 5950 is functionally connected (only through its northeast corner through non-Federal land) to the Honker large OGR complex, and to the small OGR in VCU 5940;
- Small OGRs in 5960 and 5972 are functionally connected to large reserves (Honker large OGR complex and/or Karta Wilderness);
- Small OGRs in adjacent VCUs 5820/5830 and 5850/5860 are functionally connected to each other, but not to any other reserve; and
- The northern and southern pieces of the small OGR in VCU 5810 are functionally connected to each other through the stream buffer along Luck Creek but not to any larger reserves, and the northern piece of small OGR is functionally connected to the small OGR in VCU 5720 but not to a large reserve, and the southern piece would remain functionally connected to the Honker via roadless.

In addition to the functional connectivity across the landscape provided by the reserve system, legacy standards and guidelines, and old-growth forest in the matrix, connectivity between reserves for flying squirrels is also provided by structural elements of the Forest Plan conservation strategy including the stream, estuary, lake, and beach buffers. A

discussion of travel corridors within the project area is provided in the Biodiversity subsection.

Within the project area VCUs, between 40 to 100 percent of the original (1954) POG remains providing suitable habitat for flying squirrels (Table WLD-1). Past timber harvest has likely affected flying squirrel populations where clearcut size is larger than their maximum gliding range, or where scattered tall conifers in large cuts have not been retained as cover and for travel across the open spaces. These conditions may hinder dispersal and result in the creation of isolated populations.

Prince of Wales Spruce Grouse

The Prince of Wales spruce grouse is a subspecies that is endemic to Prince of Wales and nearby islands in southern Southeast Alaska. The Prince of Wales Island spruce grouse is associated with muskegs, high-volume POG, and mixed conifer (scrub) habitats but will also use young-growth forest (15-30 years following timber harvest) with a well-developed middle story; they avoid clearcuts (Russell 1999). Though they are closely associated with conifer forests, the highest densities of spruce grouse are supported by areas with a mosaic of older coniferous habitats interspersed with regenerating patches of dense trees. Existing POG within the project area VCUs is presented in table WLD-1. Denser forest stands are selected during winter because they intercept snow. Grouse also select habitats with abundant shrubs and herbaceous plants where cover and forage are available during summer. Prince of Wales spruce grouse eat Sitka spruce needles and buds, western hemlock needles, and *Vaccinium* species (e.g., blueberries; Russell 1999). Spruce grouse are poor long-distance flyers and are generally sedentary, with some limited migratory movement (typically less than a mile; Dickerman and Gustafson 1996) between summer and winter habitats (Boag and Schroeder 1992, Williamson et al. 2008).

Spruce grouse are an important prey species for goshawks and marten. Forest birds, including spruce grouse, comprised a larger proportion of goshawk diets during the breeding season on Prince of Wales Island than elsewhere in Southeast Alaska (Lewis et al. 2006). Thus, impacts to spruce grouse could also impact goshawk and marten populations. Spruce grouse are managed as a game species by ADF&G. In GMU 2, taking of spruce grouse is allowed between August 1 and May 15, with a bag limit of five per day.

Changes in forest structure, (e.g., timber harvest or windthrow) associated with fragmentation may lead to population declines if open areas are too large or forested patches are spread too far apart to enable spruce grouse to move between them (greater than 1 mile). Clearcuts may also present a dispersal barrier to this species due to the thick logging debris often present which could inhibit walking, this species preferred method of movement (Russell 1999). The existing level of fragmentation (POG patch sizes) is presented in table WLD-2.

Spruce grouse are particularly vulnerable to hunting along road systems, and thus are susceptible to overexploitation near roads and human populations (Williamson et al. 2008; Rabe 2009). Nelson (2010) found no effect between unharvested and harvested habitats on the short-term survival of radio-marked Prince of Wales spruce grouse; however, this study did not differentiate between age of past harvest or between types of unharvested

habitat. Existing total road densities on NFS lands in the project area are presented in Table WLD-8. The Forest Plan conservation strategy maintains connectivity within matrix lands that will help facilitate dispersal and interchange between isolated spruce grouse populations.

Endemic Species

The Federal ESA defines endemic as "a species native and confined to a certain region; having comparatively restricted distribution." Forest Plan standards and guidelines for endemic mammals direct the Forest to "maintain habitat to support viable populations and improve knowledge of habitat relationships of rare or endemic terrestrial mammals that may represent unique populations with restricted ranges." Likewise, the NFMA directs that management prescriptions "shall preserve and enhance the diversity of plant and animal communities, including endemic(s)."

Due to its archipelago geography and highly dynamic glacial history, Southeast Alaska has been found to be a region with an especially high degree of endemism (Demboski et al. 1998). Approximately 20 percent of the small mammal taxa (species and subspecies) known to occur in Southeast Alaska are endemic to an island or a group of islands (Dawson et al. 2007). There remain many uncertainties about the extent of endemism in Southeast Alaska because research to date has primarily focused on mammals, thus the level of endemism in other organisms such as plants, birds, amphibians, and invertebrates is unknown. The Prince of Wales Island complex appears to be an endemic hotspot based on evidence that it was refugia during the last glacial event (Cook et al. 2001; Cook et al. 2006). The following species are endemic and occur on Prince of Wales Island (ISLES 2009:

- Alexander Archipelago wolf: endemic to Southeast Alaska (Weckworth et al. 2005; discussed above);
- Prince of Wales Flying Squirrel: endemic to the Prince of Wales Island complex (Bidlack and Cook 2001, 2002; discussed above);
- Haida Gwaii ermine (*Mustela erminea haidarum*): endemic to Haida Gwaii, BC, and the Prince of Wales Island complex (Fleming and Cook 2002); closely associated with riparian and shoreline areas at low elevations (Reid et al. 2000); Note that these areas are already protected by Forest Plan standards and guidelines;
- Keen's myotis (*Myotis keenii*): endemic to the Southeast Alaska and British Columbia, recorded from Juneau south (MacDonald and Cook 2007); selects roost sites in forest patches with greater availability of large-diameter trees with decay for roosting and that were close to streams (Boland et al. 2009);
- Alexander Archipelago black bear: endemic to coastal British Columbia and Southeast Alaska, except Admiralty, Baranof, and Chichagof islands (Stone and Cook 2000; discussed above);
- Prince of Wales Spruce Grouse: endemic to Prince of Wales Island and nearby islands including Heceta, Suemez, Warren, and Zarembo; also reported on Mitkof Island (Dickerman and Gustafson 1996; discussed above).

Timber harvest has the potential to remove habitat used by endemic species, such as snags and hollow trees used by the Keen's myotis and the Prince of Wales flying squirrel; but may also create habitat for some species (e.g., regenerating forest stands for spruce grouse). Existing POG within the project area VCUs is presented in Table WLD-1. Fragmentation of habitat patches resulting could limit the ability of some species (e.g., flying squirrels) to disperse between areas of suitable habitat (the existing level of fragmentation in the project area is presented in Table WLD-2). In addition, for those species that are hunted, project roads have the potential to increase hunter access and thus may increase harvest rates along the road system and the areas that these roads access (there are no known thresholds relative to road density for these species). Due to their restricted ranges, specific habitat requirements, and sensitivity to human activity, insular endemic species (i.e., those restricted to islands or groups of islands) are highly susceptible to extirpation and eventually extinction (Soule 1983; Reid and Miller 1989; Burkey 1995). Species tied to island archipelagos are more sensitive to the effects of introduced non-natives, including pathogens and disease, and natural events, such as climate change, than other managed landscapes due to their limited mobility and isolation from other subpopulations (Cook et al. 2006).

Migratory Birds

Executive Order 13186 provides for the conservation of migratory birds and their habitats and requires the evaluation of the effects of Federal actions on migratory birds, with an emphasis on species of concern. Agencies are required to support the conservation and intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions.

Birds protected under the Migratory Bird Treaty Act (MBTA) include all common songbirds, waterfowl, shorebirds, hawks, owls, eagles, ravens, crows, native doves and pigeons, swifts, martins, swallows, and others, including their body parts (e.g., feathers, plumes), nests, and eggs. Prince of Wales Island is part of the Southeastern Biogeographic Region of Alaska, one of five Biogeographic Regions in Alaska (based on the Commission for Environmental Cooperation's hierarchical framework of nested ecological units) in which priority species, habitats, and conservation actions are identified under the Boreal Partners in Flight (BPIF) Alaska Landbird Conservation Plan (BPIF 1999). Priority migratory bird species identified in the Landbird Conservation Plan (BPIF 1999, 2011) with the potential to occur in the Big Thorne project area are listed in Table WLD-9. Of these species, 14 species use hemlock/spruce/cedar forest as primary habitat for known or probable breeding; the remaining 5 use this forest as secondary habitat.

Marbled murrelets (addressed under Species of Concern), and goshawks (addressed below) are also protected by the MBTA.

Table WLD-9. Priority Landbird Species Potentially Occurring in the Big Thorne Project Area

Common Name[1/]	Scientific Name	Potential Occurrence in Vicinity of the Big Thorne Analysis Area
western screech owl	*Otus kennicottii*	Breeding, Winter
black swift	*Cypseloides niger (borealis)*	Breeding
Vaux's swift	*Chaetura vauxi*	Migration Breeding
rufous hummingbird	*Selashorus rufus*	Migration, Breeding
red-breasted sapsucker	*Sphyrapicus ruber*	Breeding
olive-sided flycatcher	*Cantopus cooperi*	Breeding
western wood-pewee	*Contopus sordidulus*	Breeding
Hammond's flycatcher	*Empidonax hammondii*	Breeding
Pacific-slope flycatcher	*Empidonax difficilis*	Breeding
Steller's jay	*Cyanocitta stelleri*	Breeding, Winter
northwestern crow	*Corvus caurinus*	Breeding, Winter
chestnut-backed chickadee	*Poecile rufescens*	Breeding, Winter
American dipper	*Cinclu mexicanus*	Breeding
varied thrush	*Ixoreus naevius*	Migration, Breeding, Winter
Townsend's warbler	*Dendroic townsendi*	Breeding
blackpoll warbler	*Dendroica striata*	Migration
MacGillivray's warbler	*Oporornis tolmiei*	Breeding
golden-crowned sparrow	*Zonotrichia atricapilla*	Breeding, Winter
golden-crowned kinglet	*Regulus satrapa*	Breeding, Winter

1/ The blue grouse is also included on the priority list for Southeastern Alaska Region (BPIF 1999, BPIF 2011) but does not occur on Prince of Wales Island.

The main management issue for migratory birds in the Southeastern Alaska Biogeographic Region is the harvest of POG forests. Timber harvest directly removes perching, foraging, and nesting habitat and results in habitat fragmentation, which may reduce the suitability of remaining forest for species associated with interior forest conditions, such as the Townsend's warbler (Kissling 2003; Sperry 2006). The existing amount of POG in the project area is presented in table WLD-1. Fragmentation may increase the exposure of birds to edge-related predators and parasites, though there remain many unknowns about the effects of fragmentation on landbird populations in Alaska (Robinson 1992; Hoover et al. 1995; BPIF 1999). As the landscape becomes more fragmented, forest buffers become increasingly important for migratory birds to mitigate the effects of habitat loss (Kissling 2003). The existing level of fragmentation in the project area (POG patch sizes) is presented in table WLD-2. Riparian forests are also important for many species, such as the western screech owl, western wood-pewee, and Hammond's flycatcher. This habitat has been altered by road construction and other human activities; however the Forest Plan conservation strategy maintains these areas therefore mitigating some of the effects. Timber harvest and related activities may also directly impact migratory birds through disturbances of adults or young through the removal of active bird nests or by causing nest abandonment. Migratory birds are likely to be present in the project area in upland forest, riparian, and coastal habitats. Migratory bird habitat is maintained by Forest Plan conservation strategy.

Threatened, Endangered, Candidate, and Sensitive Species

Threatened, endangered, and candidate species potentially occurring in the project area were identified through consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS). Table WLD-10 provides a comprehensive list of these species and identifies those carried forward in the analysis based on known occurrences or the presence of suitable habitat in the project area. These species are addressed in detail in the draft wildlife Biological Assessment/Biological Evaluation (BA/BE) for the project which is included in the project record. For the remaining species, the project area is outside of their known range or suitable habitat is not present in the project area. Therefore, Big Thorne Project will have no effect on these species and they are not addressed further.

Forest Service Alaska Region Sensitive Species potentially occurring in the project area were obtained from the most recent Regional Forester's list (Regional Forester's Sensitive Species List 2009; Table WLD-10). The Queen Charlotte goshawk and black oystercatcher have the potential to occur in the project area. A detailed discussion of the Queen Charlotte goshawk is provided below because this species is associated with the old-growth forest ecosystem. The black oystercatcher, associated with rocky shorelines along the coast (areas protected by the 1,000-ft. beach buffer), is discussed in the BA/BE.

Queen Charlotte Goshawk

The Queen Charlotte goshawk is of special concern to the State of Alaska (Cotter 2007) and has been included by Stenhouse and Senner (2005) on Audubon's Alaska WatchList. The Queen Charlotte goshawk is recognized as a distinct subspecies of the northern goshawk (*Accipiter gentilis*) that occurs only in coastal areas of British Columbia and in Southeast Alaska. In 2007, in response to a court-ordered remand on a petition to list the species, the USFWS updated a 1997 status review for the Queen Charlotte goshawk, and concluded that Alaska supports a DPS of this species though listing of this DPS was not warranted (USFWS 2007). On August 1, 2012, the British Columbia DPS of the Queen Charlotte goshawk was listed as threatened under the ESA (FR 45870-45893).

The goshawk is a year-round resident in Southeast Alaska and may occupy different or overlapping breeding and winter territories. Goshawk breeding territories can be described hierarchically in terms of the nest site, the nest area, post-fledging area (PFA), and foraging area (see Reynolds et al. 1992 and the project BA/BE for detailed descriptions). Goshawks in Southeast Alaska typically nest in large, contiguous patches of tall, mature, and old trees with dense canopies. When mature and old-growth habitats are not available they will nest in maturing young-growth with sufficient structure (Reynolds et al. 2006, Boyce et al. 2006). Goshawk foraging areas typically consist of mature and old-growth forest stands, though they will also forage in young forest as well as along edges and in openings as long as suitable perches from which to observe and attack prey are present (Iverson et al. 1996, Bosakowski et al. 1999; McClaren 2004; Boyce et al. 2006; Reynolds et al. 2006).

Goshawks consume a wide variety of prey species and are capable of alternating between prey species, depending on prey occurrence and availability. Primary prey species for goshawks on Prince of Wales Island include spruce grouse, Steller's jays, and ptarmigan, all of which are forest dwelling birds (Lewis 2001). Prince of Wales Island is a relatively prey-

Table WLD-10. Threatened, Endangered, Candidate, and Alaska Region Sensitive Species in the Big Thorne Project Area

Common Name	Scientific Name	Habitat Association	Potential for Occurrence in the Project Area	Status[1/]
Species Under USFWS Jurisdiction				
Kittlitz's murrelet	*Brachyramphus brevirostris*	Breeds in the vicinity of glaciers and cirques in high elevation alpine areas with little or no vegetative cover; northern Gulf of Alaska and Bering Sea coast (Day et al. 1999).	No, due to lack of suitable habitat.	C; FSS[2/]
Eskimo curlew	*Numenius borealis*	Arctic tundra.	No, outside of species' range.	FE
Short-tailed albatross	*Phoebastria albatrus*	Winters in waters of the Bering Sea, Aleutian Islands, and Gulf of Alaska; breeds in Japan (USFWS 2011).	No, outside of species' range.	FE
Spectacled eider	*Somateria fischeri*	Coastal waters in northern and western Alaska (USFWS 1999).	No, outside of species' range.	FT
Steller's eider	*Polysticta stelleri*	Occurs in northern and western Alaska (USFWS 2007a).	No, outside of species' range.	FT
Yellow-billed loon	*Gavia adamsii*	Nests near freshwater lakes in the arctic tundra and winters along the Alaskan coast to the Puget Sound (USFWS 2009).	Yes, may occur during migration; no suitable habitat on the Tongass.	C
Polar bear	*Ursus maritimus*	Sea ice and coastlines of western Alaska and along the North Slope.	No, outside of the species' range.	FT
Pacific walrus	*Odobenus rosmarus divergens*	Continental shelf waters of Bering and Chukchi seas.	No, outside of the species' range.	C
Species Under NMFS Jurisdiction				
Blue whale	*Balaenoptera musculus*	Off-shore (pelagic) marine waters of the Bering Sea, Chukchi Sea, North Pacific Ocean and/or Gulf of Alaska (NMFS 2009a). Critical habitat designated for North Pacific right whales in the Bering Sea and the Gulf of Alaska (NMFS 2009a).	No, very rarely observed in Southeast Alaska.	FE
Beluga whale	*Delphinaperus leucas*			
Bowhead whale	*Blaena mysticetus*			
Fin whale	*Balaenoptera physalus*			
Northern Pacific right whale	*Eubalaena japonica*			
Sei whale	*Balaenoptera borealis*			
Sperm whale	*Physeter macrocephalus*			
Humpback Whale	*Megaptera novaeangliae*	Common in the inside waters of the Alexander Archipelago and are regularly sighted in the Inside Passage and coastal waters of the Southeast Alaska panhandle (NMFS 1991).	Yes, likely to occupy marine waters around Prince of Wales Island. May occur in shallow coastal areas near the Project.	FE

Table WLD-10. Threatened, Endangered, Candidate, and Alaska Region Sensitive Species in the Big Thorne Project Area (cont.)

Common Name	Scientific Name	Habitat Association	Potential for Occurrence in the Project Area	Status[1/]
Bearded seal	*Erignathus barbatus*	Sea-ice habitats in Bering Sea, Chukchi Sea, Beaufort seas (Federal Register 2008).	No, species do not occur in the project area.	C
Ringed Seal	*Phoca hispida*			
Spotted Seal	*Phoca largha*			
Northern sea otter, SW Alaska population	*Enhydra lutris kenyoni*	Coastal marine habitats.	No, population does not occur in the project area.	FT
Steller sea lion – Western AK DPS[3/]	*Eumetopias jubatus*	Marine and terrestrial areas from Prince William Sound westward (west of 144° west longitude).	No, DPS does not occur in project area.	FE
Steller sea lion – Eastern AK DPS[3/]	*Eumetopias jubatus*	Marine and terrestrial areas in Southeast Alaska (east of 144° west longitude).	Yes, occurs in waters surrounding the Tongass.	FT
Green sea turtle	*Chelonia mydas*	Occur in the Gulf of Alaska and some species are found as far west as the Aleutian Islands. Adults are highly migratory, but the details and locations of migrations are largely unknown (NMFS 2009b).	No, only rarely observed in Southeast Alaska.	FT
Loggerhead sea turtle	*Caretta caretta*			FT
Olive Ridley sea turtle	*Lepidochelys olivacea*			FT
Leatherback sea turtle	*Dermochelys coriacea*			FE
Chinook Salmon	*Onchorhynchus tshawytshca*	Originate in freshwater habitats Washington, Idaho, Oregon, and California; migrate through the Gulf of Alaska (USFS 2008b).	Possible, primarily occur outside waters of Southeast Alaska (USFS 2008). Occurrence in inside Southeast Alaska waters has been documented, but infrequently.	FT or FE depending on run
Snake River Sockeye Salmon	*O. nerka*			
Steelhead	*O. mykiss*			
Forest Service Alaska Region Sensitive Species				
Southeast Alaska Pacific Herring	*Clupea pallasii*	Spawns and rear in nearshore waters.	Yes, likely to occupy marine waters around Prince of Wales Island. May occur in shallow coastal areas near the project.	C, FSS[2/]
Queen Charlotte goshawk	*Accipiter Gentiles laingi*	Mature/old growth forests.	Yes, known to occur on Prince of Wales Island and suitable habitat present.	FSS

Table WLD-10. Threatened, Endangered, Candidate, and Alaska Region Sensitive Species in the Big Thorne Project Area (cont.)

Common Name	Scientific Name	Habitat Association	Potential for Occurrence in the Project Area	Status[1/]
Aleutian Tern	*Sterna aleutica*	Nests on islands, shrub-tundra, grass or sedge meadows and freshwater and coastal marshes.	No, outside of species' range.	FSS
Black oystercatcher	*Haematopus bachmani*	Rocky shorelines along the coast; forages in sheltered areas where low-sloping gravel or rock beaches with abundant prey occur.	Yes, suitable habitat present.	FSS

1/ FT = Federally threatened; FE = Federally endangered; C = candidate for Federal listing; FSS = Forest Service Alaska Region Sensitive Listed Species
2/ The "Species under USFS Jurisdiction" portion of this table lists the Forest Service Sensitive species that do not also have an ESA status; however, note that some of the ESA species are also Forest Service Sensitive species
3/DPS = Distinct Population Segment

poor area compared to the rest of Southeast Alaska because it does not support blue grouse or red squirrels, two important prey species for goshawks (Lewis et al. 2006). Goshawks on Prince of Wales Island have been documented moving great distances to forage, particularly during times of low prey abundance (McClaren 2004; Titus et al. 2005).

Timber harvest may locally limit the availability of nest sites through the removal of suitable nest trees, or through the removal of forest surrounding these trees (POG). Nest trees must be surrounded by patches of mature or old-growth forest large enough to include several alternate nests and provide post-fledging habitat. Timber harvest may also decrease foraging habitat quality through reductions in prey abundance and availability. The availability of adequate prey resources has been linked to goshawk territory occupancy and breeding success (Doyle and Smith 2001; Salafsky et al. 2005; Keane et al. 2006, Salafsky et al. 2007). Conservation measures for this species include nest habitat and legacy forest structure standards and guidelines under the Forest Plan (USFS 2008).

Within the North Central Prince of Wales Island biogeographic province, there are currently approximately 569,000 acres of POG, of which 248,360 acres are high-volume POG that provide potential goshawk habitat (Table WLD-1). High-volume POG represents optimal nesting habitat due to the presence of large trees and snags. This represents approximately 73 percent of the total POG and 64 percent of the original POG existing in 1954, the time commercial timber harvest on the Tongass National Forest commenced. The project area VCUs contain 40 to 100 percent of the original (1954) total POG, and 18 to 100 percent of the original high-volume POG (Table WLD-1).

Between 1991 and 1999, five nest areas were documented on Prince of Wales Island (Flatten et al. 2001): near Logjam Creek, Rio Roberts/Cutthroat drainage, Sarheen Creek, Sarkar Lake, and Twelvemile arm. Nesting activity has not been documented at any of these nest sites since the 1990s, and although there have been goshawk sightings no new nests in these areas have been found (ADF&G 1999, Dillman 2009). One nest was located in the Big Thorne project area within the Steelhead drainage in 2010; the harvest units containing the nest and nest buffer were subsequently removed from the unit pool. A probable nest site was documented in the Sal Creek area in 2012. The site is surrounded

by approximately 40-year-old young-growth and is within 50 feet of the beach (therefore within the beach buffer).

Subsistence

Introduction

Subsistence refers to the natural resources used by rural Alaskans. Under Section 803 of the Alaska National Interest Lands Conservation Act (ANILCA), subsistence is defined as: "the customary and traditional uses by Alaska residents of wild renewable resources for direct, personal, or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of non-edible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade."

ANILCA provides for "the continuation of the opportunity for subsistence users by rural residents of Alaska, including both Natives and non-Natives, on the public lands." It also states that "customary and traditional" subsistence uses of renewable resources "shall be the priority consumptive use of all such resources on the public lands of Alaska."

Subsistence hunting, fishing, trapping, and gathering activities are a major focus of life for many residents on Prince of Wales Island. Reasons given for the participation in subsistence activities include the ability to provide food or supplemental income; the perpetuation of cultural customs and traditions; and the importance of values associated with self-reliance (USDA Forest Service 2008b).

The effects of landscape changes caused by timber harvest on the availability of wild game are important when the harvest of wild game is a cultural practice, food source, and recreational activity. Timber harvest may influence the abundance and distribution of subsistence resources (through changes in suitable habitat), access to subsistence resources (through changes in habitat and through road development or management), and competition for subsistence resources (through changes in abundance or access). ANILCA requires that the analysis of potential effects on subsistence uses focus on these factors. These factors are discussed below in the context of the Big Thorne Project. For a full discussion see the Wildlife and Subsistence resource report.

Small OGR modifications, proposed under Alternatives 3 and 4, would affect the amount of deer winter habitat and roads used for access within the reserve system, and thus have the potential to affect the abundance and distribution of, access to, and competition for deer depending on whether or not these areas are available for harvest. The existing small OGRs in the project area include 3,325 acres of deep snow deer winter habitat (high-volume POG below 800 feet elevation) and 51 miles of road (Table OGR-2).

Abundance and Distribution of Resources

Subsistence resources in the vicinity of the Big Thorne Project include terrestrial mammals (deer, wolves, black bears, furbearers, and small game), upland birds and waterfowl, marine mammals, salmon and other fin fish, marine invertebrates, plants, firewood, berries, bark, and firewood. The terrestrial mammals (see discussions above under the appropriate species subheadings) occur throughout the project area year round. Spruce grouse (see discussion above) and ptarmigan occur throughout the project area

year round; waterfowl occur in the project area during spring and fall migration and primarily on lakes and in bays and estuaries. Marine mammals, such as seals, occur in the marine waters adjacent to the project area. Streams and lakes within the Big Thorne project area provide habitat and contribute to the production of fish that support the local subsistence, sport, guided (both freshwater and saltwater), and commercial fisheries of the area. Eagle Creek, Luck Creek, Ratz Creek, Sal Creek, Slide Creek, and the Thorne River are known subsistence systems (USDA Forest Service 2008b). Subsistence plants, which include kelp, seaweed, goose tongue, mushrooms, and berries, occur along roads, previous harvested areas (berries), and near beach and estuarine areas.

Access to Resources

Road networks connecting local communities provide access to subsistence resources in the Big Thorne project area. Road building associated with timber harvest can provide access to previously inaccessible areas, providing greater opportunities for subsistence harvest; disperse hunting and fishing pressure; and create the potential for increased competition. On Prince of Wales Island, road construction has the potential to result in increased competition from outside communities by providing greater access to non-resident hunters (USDA Forest Service 2008b). Changes in access can affect the level of effort required, time involved, and the effectiveness of the hunt, as well as potentially increase competition for subsistence resources (if associated with increased hunter success; USDA Forest Service 2009). The existing road network is described in the Transportation section of the EIS. Road closures in the project area are scheduled under the Prince of Wales Access and Travel Management Plan (see the Transportation section for details); the proposed road closures in the POW ATM would reduce access to some areas.

Competition for Resources

Competition for subsistence resources may occur when resources are abundant and access is available to local and non-local users. Competition can also occur between different subsistence user groups and between subsistence hunters and sport hunters. The existing road system in the project area has created relatively large areas that are easily accessed from local communities. The existing road system is described in Table TRAN-3. The ferry systems allow relatively easy access from off-island communities. Non-subsistence hunters make up about 15 percent of the total hunters utilizing WAA 1318, 20 percent in WAA 1319, 35 percent in WAA 1420, and 37 percent in WAA 1315 (Forest Service 2008b). Under ANILCA, in times of resource scarcity or when demand exceeds biologically sound harvest levels, subsistence harvests have priority over other consumptive use of resources.

Subsistence Communities

There are multiple communities that either currently or have historically used the project area for subsistence use. These include Coffman Cove, Craig, Hollis, Hydaburg, Kasaan, Klawock, Metlakatla, Meyers Chuck, Naukati Bay, Petersburg, Point Baker, Port Protection, Thorne Bay, Whale Pass, and Wrangell (USDA Forest Service 2008b). There are records of subsistence use of the Project area by other communities (i.e., Ketchikan, Haines, Kake, and Sitka), but levels of use are generally low; in addition, Ketchikan does

not qualify as a Federal subsistence community. Therefore, these communities have not been included in this assessment. A detailed description of each community is provided in the Wildlife and Subsistence Resources Report (Woeck 2012).

Table WLD-11. Total Deer Harvested and Annual Average Reported for Communities using the Project Area WAAs between 1996 and 2003

Community	Wildlife Analysis Areas (WAA)[1/, 2/]			
	1315	1318	1319	1420
Coffman Cove	26 (4)	-	5 (1)	607 (87)
Craig	240 (34)	806 (115)	261 (37)	175 (25)
Hollis	UNK	UNK	UNK	UNK
Hydaburg	UNK	UNK	UNK	UNK
Kasaan	26 (4)	-	-	-
Klawock	76 (11)	510 (73)	71 (10)	99 (14)
Metlakatla[3/]	-	-	-	-
Meyers Chuck	8 (1)	7 (1)	12 (2)	-
Naukati Bay	-	-	9 (1)	6 (1)
Petersburg	8 (1)	4 (1)	4 (1)	25 (4)
Point Baker	UNK	UNK	UNK	UNK
Port Protection	2 (<1)	-	-	-
Thorn Bay	802 (115)	57 (8)	863 (123)	128 (18)
Whale Pass	UNK	UNK	UNK	UNK
Wrangell	6 (1)	-	-	11 (2)

1/ Values in brackets indicated annual average between 1996 and 2003; data by WAA differentiating resident and non-resident harvest after 2003 are not available.
2/ "UNK" indicates communities that are known to subsistence hunt in the project area, but where hunting data are unknown. A dashed line indicates that a community is not known to subsistence hunt in a particular WAA.
3/ Uses adjacent WAA 1421
Data source: ADF&G (2006)

These communities harvest a variety of resources from the project area, including salmon, other finfish, marine invertebrates, bear and deer; plants, firewood, berries, and bark are also harvested. However, deer are the primary subsistence resource that would be affected by timber harvesting activities and therefore the focus of this discussion (USDA Forest Service 2008b). The Wildlife and Subsistence resource report and Fisheries resource report provide additional information on other subsistence uses by community. Table WLD-11 lists the number of deer harvested in the project area WAAs by community. Note that some communities are known to hunt in the project area, but data regarding which WAA utilized or the exact numbers of deer taken are not available (e.g., Hollis, Hydaburg, Point Baker, and Whale Pass).

Deer harvest and hunting efforts (i.e., number of deer taken) in GMU 2 generally increased from 1997 to 2000, and then declined from 2000 to 2004 (ADF&G 2005). Efforts increased again from 2004 to 2006, but remained steady between 2006 and 2007 (ADF&G 2007). Published data are not currently available for hunting efforts after 2007 for GMU 2 as a whole; however, based on unpublished data, there was a small increase in the total number of deer taken in the project area WAAs during 2008 and 2009 compared to the 2007 numbers (Bethune, ADF&G, personal comm. 2011).

Environmental Consequences

Biodiversity

Direct and Indirect Effects –All Alternatives

A functional and interconnected old-growth ecosystem is essential to maintaining various components of biodiversity, including structural complexity (within-stand and landscape level), connectivity (unfragmented, contiguous blocks of old growth), stand age and species composition, and various ecological processes (e.g., tree establishment, disturbance, and nitrogen fixation [USDA Forest Service 2008b]). Through the removal of POG, timber harvest would reduce biodiversity by shifting the age-structure of the forest (i.e., removed trees are replaced by younger generation cohorts; Franklin et al. 1997); changing the composition of understory vegetation (Deal and Tappeiner 2002); and removing key habitat features such as large decadent trees, snags, and downed logs. These changes may reduce the range of habitats that support diverse plants and animal communities and alter the ecological processes supported by the old-growth ecosystem. The amount of POG and its distribution across the landscape provide a measure of the effects of the project on biodiversity.

Indirectly, timber harvest and associated activities would fragment and reduce the quality of remaining habitats. Edge effects such as changes in vegetation structure, plant and wildlife species composition, predation rates, and disturbance may occur, with some effects extending up to 1,640 feet (500 meters) from the forest edge (see the Affected Environment discussion for additional detail). Fragmentation may remove linkages between habitat patches, making it harder for some wildlife to move across the landscape. A continuously distributed population could become a series of small, subpopulations that rely on the ability of dispersing individuals of genetic interchange and recolonization in the event of local extirpation. Remaining habitat patches would become smaller and less suitable for species associated with interior forest conditions. It can be assumed that the alternatives that harvest the most POG and result in the greatest increases in the number of POG patches on the landscape would result in the greatest edge effects and have the greatest adverse effects to biodiversity. All action alternatives would maintain 99 percent of the total, high-volume, and large-tree POG currently available in the North Central Prince of Wales biogeographic province (Tables WLD-12, WLD-13, and WLD-14). However, the historic connectivity of the landscape has been compromised by prior timber harvest activities, resulting in a reduction to 73, 64, and 60 percent of the original total, high-volume, and large-tree POG in the biogeographic province.

Table WLD-12. Harvest of Total POG by Biogeographic Province, VCU, and Project Area for Each Alternative

Biogeographic Province/VCU[1/]	1954 POG	2011 POG		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	Original Acres	Existing Acres	% Original Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining
North Central Prince of Wales Island (14)	775,821	569,098	73	0	100	4,792	99	6,696	99	4,109	99	4,848	99
5720	7,348	3,869	53	0	100	0	100	0	100	0	100	0	100
5740	18,608	14,953	80	0	100	0	100	0	100	0	100	0	100
5750	11,549	11,143	96	0	100	0	100	205	98	0	100	0	100
5760	7,542	6,990	93	0	100	12	100	12	100	0	100	12	100
5780	4,949	3,688	75	0	100	542	85	542	85	421	89	459	88
5790	7,087	2,818	40	0	100	374	87	432	85	442	84	442	84
5800	9,760	7,036	72	0	100	337	95	662	91	346	95	456	94
5810	13,590	6,830	50	0	100	471	93	745	89	455	93	445	93
5820	2,470	2,461	100	0	100	12	99	197	92	25	99	101	96
5830	8,632	4,866	56	0	100	400	92	440	91	324	93	407	92
5840	9,940	5,827	59	0	100	613	89	834	86	438	92	626	89
5850	7,544	3,088	41	0	100	256	92	347	89	137	96	130	96
5860	11,653	6,336	54	0	100	291	95	518	92	208	97	316	95
5950	10,086	7,053	70	0	100	699	90	807	89	483	93	623	91
5960	5,794	5,596	97	0	100	62	99	62	99	31	99	62	99
5971	1,820	1,516	83	0	100	26	98	26	98	17	99	26	98
5972	13,109	8,620	66	0	100	697	92	867	90	784	91	742	91
5980	8,522	5,459	64	0	100	0	100	0	100	0	100	0	100
Project Area	147,583	98,748	67	0	100	4,792	95	6,696	93	4,109	96	4,848	95

1/ Includes NFS and non-NFS land

Table WLD-13. Harvest of High-volume POG (SD 5S, 5N, 67) by Biogeographic Province, VCU, and Project Area for Each Alternative

Biogeographic Province/VCU[1/]	1954 POG	2011 POG		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	Acres	Existing Acres	% Original Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining
North Central Prince of Wales Island	385,581	248,359	64	0	100	2,503	99	3,720	99	2,419	99	2,612	99
5720	3,248	1,149	35	0	100	0	100	0	100	0	100	0	100
5740	8,060	5,503	68	0	100	0	100	0	100	0	100	0	100
5750	4,748	4,552	96	0	100	0	100	158	97	0	100	0	100
5760	3,773	3,338	88	0	100	5	100	5	100	0	100	5	100
5780	3,023	2,205	73	0	100	324	85	324	85	263	88	262	88
5790	3,657	934	26	0	100	222	76	261	72	258	72	257	73
5800	5,459	3,579	66	0	100	275	92	422	88	281	92	354	90
5810	8,477	3,809	45	0	100	371	90	555	85	354	91	348	91
5820	1,354	1,348	100	0	100	8	99	157	88	16	99	77	94
5830	4,625	2,115	46	0	100	200	91	208	90	194	91	196	91
5840	4,381	1,945	44	0	100	184	91	342	82	134	93	192	90
5850	3,540	635	18	0	100	59	91	82	87	20	97	42	93
5860	7,134	3,420	48	0	100	103	97	264	92	112	97	122	96
5950	5,595	3,547	63	0	100	442	88	547	85	303	91	409	88
5960	2,655	2,594	98	0	100	45	98	45	98	18	99	45	98
5971	1,200	987	82	0	100	7	99	7	99	6	99	7	99
5972	6,373	3,449	54	0	100	258	93	346	90	460	87	296	91
5980	4,591	2,640	58	0	100	0	100	0	100	0	100	0	100
Project Area	101,832	43,902	43	0	100	2,503	94	3,720	92	2,419	94	2,612	94

1/ Includes NFS and non-NFS lands.

Table WLD-14. Harvest of Large Tree POG (SD 67) by Biogeographic Province, VCU, and Project Area for Each Alternative

Biogeographic Province/ VCU[1/]	1954 POG	2011 POG		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	Acres	Existing Acres	%Original Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	%Existing Remaining
North Central Prince of Wales Island	213,083	127,306	60	0	100	1,318	99	1,944	98	1,210	99	1,306	99
5720	2,122	824	39	0	100	0	100	0	100	0	100	0	100
5740	4,864	3,155	65	0	100	0	100	0	100	0	100	0	100
5750	2,271	2,237	99	0	100	0	100	55	98	0	100	0	100
5760	1,915	1,630	85	0	100	5	100	5	100	0	100	5	100
5780	2,183	1,640	75	0	100	260	84	260	84	211	87	202	88
5790	1,970	334	17	0	100	133	60	138	59	144	57	142	58
5800	2,458	1,385	56	0	100	156	89	179	87	129	91	156	89
5810	4,814	1,741	36	0	100	192	89	301	83	189	89	198	89
5820	967	963	100	0	100	0	100	130	86	0	100	75	92
5830	2,503	884	35	0	100	69	92	72	92	63	93	63	93
5840	1,999	557	28	0	100	21	96	133	76	21	96	21	96
5850	1,962	190	10	0	100	14	93	22	89	0	100	14	93
5860	3,573	1,410	39	0	100	0	100	80	94	6	100	6	100
5950	3,991	2,567	64	0	100	385	85	452	82	241	91	344	87
5960	1,550	1,501	97	0	100	27	98	27	98	0	100	27	98
5971	868	751	87	0	100	0	100	0	100	0	100	0	100
5972	2,868	1,257	44	0	100	56	96	92	93	205	84	55	96
5980	2,742	1,572	57	0	100	0	100	0	100	0	100	0	100
Project Area	66,412	22,128	33	0	100	1,318	94	1,944	91	1,210	95	1,306	94

The extent of these effects would depend in part on the amount of forest structure retained in harvested stands. Thus, effects to biodiversity would be expected to be lessened under uneven-aged harvest prescriptions, which leave some portion of the trees standing in a unit. By contrast, even-aged harvest would result in marked periods in which habitat suitability and connectivity would change. For example, in the first 25 years following even-aged harvest (i.e., clear-cutting), harvested stands provide increased forage biomass, which provide a good source of forage during the summer for many wildlife species, but do not provide suitable winter habitat for species such as deer and marten. They also do not provide connectivity due to the reduction in overstory cover, required by many old-growth associated species. The even-aged young-growth stands that subsequently develop have little value to many wildlife species once the canopy closes and understory herbs and shrubs are shaded out. Unmanaged young-growth stands can remain in this condition up to 150 years before developing the characteristics of old-growth (USDA Forest Service 2008b). Alternatives that include the more uneven-aged harvest would be expected to maintain more biodiversity across the landscape than those that involve predominantly even-aged harvest.

Young-growth management could increase biodiversity in previously harvested stands. Thinning could extend the period that understory forage is available for species such as deer by delaying canopy closure, increase habitat for certain prey species, and promote conditions that mimic old-growth stand characteristics at a faster rate than would occur without treatment (USDA Forest Service 2000a; Carey 2003). This would increase habitat suitability for old-growth associated species and improve landscape connectivity over the long-term. Enhanced structural diversity of commercially thinned stands may also promote wildlife species diversity, particularly for birds (Habar et al. 1996). However, research on the effectiveness of young-growth management is ongoing and peer-reviewed results are not yet available for all of these benefits (USDA Forest Service 2011). Thus, the discussion of commercial thinning should be interpreted in the context of the remaining uncertainty associated with its benefits to biodiversity.

The system of OGRs and other non-development LUDs is intended to maintain the integrity of the old-growth ecosystem. Within the matrix, connectivity between reserves is maintained through Forest-wide standards and guidelines for stream buffers, the beach fringe, project-level legacy forest structure retention, and others that preclude or limit timber harvest in certain areas which would be implemented under all alternatives. Collectively, these measures would facilitate organism dispersal and maintain the functionality and interconnectedness of the old-growth ecosystem (USDA Forest Service 2008b). Effects of the small OGR modifications proposed under Alternatives 3 and 4 are described below and in detail in Issue 2.

Cumulative Effects-All Alternatives

The North Central Prince of Wales biogeographic province is the province on the Forest with the most extensive past and projected future harvest and development. The 2008 Forest Plan Final EIS projected the percent of original POG that would remain on all land ownerships (NFS and non-NFS) in 100+ years by biogeographic province assuming maximum future harvest (i.e., harvest of all acres in LUDs available for harvest; USDA Forest Service 2008b). Future developments on both NFS and non-NFS lands in the province were also taken into account (in the North Central Prince of Wales biogeographic province this includes the communities of Klawock, Craig, Thorne Bay, and many other small communities; USDA Forest Service 2008b). Assumptions for this analysis are included in the 2008 Forest Plan EIS (USDA Forest Service 2008b). In doing so, past, present, and reasonably foreseeable timber harvest projects, including the Big Thorne and others identified at the beginning of this chapter, were taken into account. Therefore, this analysis provides an appropriate measure of cumulative harvest, and associated biodiversity effects, with the exception of any modifications to OGRs or land exchanges (see discussion under each alternative below).

Approximately 209,472 acres have been harvested within the North Central Prince of Wales biogeographic province, including both NFS lands and non-NFS lands. Based on the 2008 Forest Plan analysis, approximately 51 percent original (1954) POG would remain in this biogeographic province after full implementation of the Forest Plan and future non-NFS harvest in 100+ years (USDA Forest Service 2008b). This does not include maturing young-growth that develops older forest characteristics during that time period (estimated to be approximately 3-6 percent of the original POG that would be

represented by mature second growth, in non-development LUDs, which would be beginning to take on older forest characteristics; USDA Forest Service 2008b). Future representation of high-volume POG and large-tree POG is expected to be approximately 41 and 43 percent of the original amount, respectively, after 100+ years (USDA Forest Service 2008b).

Currently, the amount of original total POG within the project area VCUs ranges from 40 percent to 100 percent. All action alternatives would contribute to the cumulative reduction in POG in the project area VCUs as well as in the size and/or number of corridors (structural or functional) in the Big Thorne project area (Table WLD-15). Timber harvest on NFS, including micro-sales and Free Use, as well as on state lands would result in similar effects. Collectively, the Big Thorne project in combination with ongoing and foreseeable projects would increase in the number of smaller patches on the landscape, reducing the amount of interior forest and increasing the occurrence of forest edge habitat. Edge effects such as shifts in species composition may reduce native biodiversity over time by favoring some species over others. Over time, commercial thinning proposed under Alternatives 3, 4, and 5, in combination with past and foreseeable young-growth thinning would increase biodiversity within the project area by promoting stand development.

All action alternatives, in combination with ongoing and foreseeable projects, would increase the number of project area VCUs in which the cumulative reduction in the amount of original (1954) total POG would be greater than 33 percent, the threshold at which matrix functions may be compromised (VCUs 5780 and 5950 under all action alternatives, and VCU 5800 under Alterative 3; Table WLD-1), and which triggers the implementation of the Legacy standard and guideline. In project area VCUs where total original POG has already been reduced by more than 33 percent, continued implementation of the Legacy standard and guideline would maintain the range of matrix functions. In these VCUs, increased habitat removal and fragmentation could locally hinder the movements of species with limited dispersal capabilities (e.g., Prince of Wales flying squirrel). Alternative 4 was specifically designed to minimize this effect by dropping units in areas identified as being important to connectivity and by proposing prescriptions and harvest methods that would have a lighter touch on the landscape, maintaining some value as habitat after harvest. For the remaining VCUs where cumulative POG reduction is less than 33 percent, all of the alternatives would be expected to maintain the full range of matrix functions and would not reduce the likelihood of populations persisting over time (Haufler 2006).

Although some wildlife species make more use of the larger forest types (i.e., high-volume and large-tree POG) none of the wildlife species of concern discussed in this document are restricted to these habitats, with most species making some use of both POG and non-POG habitats (e.g., unproductive old-growth and older young-growth forests). The Forest Plan conservation strategy would continue to provide for extensive areas in reserves, distributed across the province. In addition, within matrix lands implementation of the Legacy Forest Structure and Riparian standards and guidelines under all alternatives, as well as the beach and estuary fringe, would maintain the functionality and interconnectedness of the old-growth ecosystem.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effects and negligible indirect effects to biodiversity because no action would be undertaken. The existing amount of total POG, high-volume POG, and large-tree POG would be maintained in the project area VCUs under Alternative 1 (Tables WLD-12, WLD-13, and WLD-14). Previously harvested stands would not be commercially thinned. They would continue to maintain stem exclusion characteristics over the majority of the planned harvest rotation unless treated under another project. The window for thinning these stands will be limited by stand growth responses to over-stocked conditions. This results in the development of low crown ratios and high height to diameter ratios which lead to reduced stand vigor as well as increased windthrow potential. These conditions reduce the ability to commercially thin effectively, which may limit the regeneration system to even-aged management when these stands are ready for final harvest.

Under Alternative 1, the level of fragmentation would remain unchanged, except for naturally occurring events (e.g., windthrow). If in the future treatment of young-growth stands is limited to even-aged management this could increase the long-term level of fragmentation compared to the use of uneven-aged system which would maintain some habitat value within treated stands.

Cumulative Effects

Under Alternative 1 the Big Thorne Project, in combination with past, ongoing, and foreseeable harvest, would maintain at least 40, 18, and 10 percent of the original (1954) total POG, high-volume POG, and large-tree POG, respectively, within project area VCUs (Table WLD-15). Nine VCUs, including seven with project activities, would maintain less than 67 percent of the original total POG (cumulative reduction of more than 33 percent; Table WLD-15). The movement capabilities of organisms with low mobility may be limited, potentially resulting in local gaps in distribution and a reduced likelihood of local population persistence, in the VCUs that have experienced habitat loss of more than 33 percent. The remaining VCUs would continue to have a high likelihood of maintaining habitat components important to a variety of species across the landscape. Cumulative reductions in POG, due to past harvest, under Alternative 1 were accounted for in the 2008 Forest Plan FEIS analysis, which concluded that with the conservation strategy in place full implementation of the Forest Plan would be expected to maintain viable, well-distributed populations across the North Central Prince of Wales biogeographic province.

Alternative 2

Direct and Indirect Effects

Alternative 2 would harvest 4,792 acres of POG including 2,503 acres of high-volume POG and 1,318 acres of large tree POG (Tables WLD-12, WLD-13, and WLD-14). Harvest under Alternative 2 would maintain at least 85 percent of the total POG, 76 percent of the high-volume POG, and 60 percent of the large-tree POG currently available in the project area VCUs (Tables WLD-12, WLD-13, and WLD-14). Approximately 86 percent of harvest would be even-aged harvest and 14 percent would be uneven-aged

harvest, maintaining less biodiversity across the landscape than alternatives that include more uneven-aged harvest (e.g., alternatives 4 and 5; Table TSE-4).

Generally, uneven-aged harvest is proposed in individual units that are widely distributed across the landscape (i.e., one unit near Luck Lake, one near Control Lake, etc.) and not located within travel corridors between areas of past harvest; thus, they would have more limited value in terms of maintaining the functional connectivity of the old-growth ecosystem. One exception is uneven-aged harvest proposed for a series of units (units 550, 551, and 558) south of Ratz Harbor which would maintain connectivity to the beach.

Effects of Alternative 2 to biodiversity associated with the removal of POG forest would be greatest in VCUs 5950, 5972, and 5840 where the most harvest is proposed; however, 90, 92, and 89 percent of the existing POG would be maintained in these VCUs, respectively. Thus, substantial reductions in biodiversity (i.e., species richness or abundance) would not be expected. All three VCUs coinciding with the project area that are currently considered intact landscapes (VCU 5750, 5820, and 5960; Table WLD-12) would remain so under Alternative 2.

Alternative 2 would also increase the number of POG patches on the landscape by 120 percent, thereby increasing fragmentation and associated edge effects and reducing connectivity. Alternative 2 would result in the second largest increase in number of patches in the smallest (0-25 acres) size class among the alternatives; fragmentation also alters the number of patches in other size categories including the number of large patches (Table WLD-16). Alternative 2 does not include commercial thinning of young growth, and therefore would not have the potential beneficial effects to biodiversity associated with promoting stand development in previously harvested stands (related effects would be the same as described under Alternative 1).

Table WLD-15. Cumulative POG Harvest by Alternative

Biogeographic Province/VCU[2/]	1954 POG (Acres)			Percent of Original (1954) POG Remaining[1/]														
				Alt. 1			Alternative 2			Alternative 3			Alternative 4			Alternative 5		
	All POG	High Volume POG	Large Tree POG	All POG	High Volume POG	Large Tree POG	All POG	High Volume POG	Large Tree POG	All POG	High Volume POG	Large Tree POG	All POG	High Volume POG	Large Tree POG	All POG	High Volume POG	Large Tree POG
North Central Prince of Wales Island[3/]	775,821	385,581	213,083	51	41	43	51	41	43	51	41	43	51	41	43	51	41	43
5720	7,348	3,248	2,122	53	35	39	51	35	38	51	35	38	51	35	38	51	35	38
5740	18,608	8,060	4,864	80	68	65	80	68	65	80	68	65	80	68	65	80	68	65
5750	11,549	4,748	2,271	96	96	99	96	96	99	95	93	96	96	96	99	96	96	99
5760	7,542	3,773	1,915	93	88	85	93	88	85	93	88	85	93	88	85	93	88	85
5780	4,949	3,023	2,183	75	73	75	64	62	63	64	62	63	66	64	65	65	64	66
5790	7,087	3,657	1,970	40	26	17	34	19	10	34	18	10	34	18	10	34	19	10
5800	9,760	5,459	2,458	72	66	56	69	61	50	65	58	49	69	60	51	67	59	50
5810	13,590	8,477	4,814	50	45	36	47	41	32	45	38	30	47	41	32	47	41	32
5820	2,470	1,354	967	100	100	100	99	99	100	92	88	86	99	98	100	96	94	92
5830	8,632	4,625	2,503	56	46	35	52	41	33	51	41	32	53	42	33	52	41	33
5840	9,940	4,381	1,999	59	44	28	52	40	27	50	37	21	54	41	27	52	40	27
5850	7,544	3,540	1,962	41	18	10	37	16	8	36	15	8	39	17	9	39	16	8
5860	11,653	7,134	3,573	54	48	39	45	40	34	43	38	32	45	40	34	45	40	34
5950	10,086	5,595	3,991	70	63	64	62	55	55	61	53	53	65	58	58	63	56	56
5960	5,794	2,655	1,550	97	98	97	94	93	91	94	93	91	95	94	93	94	93	91
5971	1,820	1,200	868	83	82	87	82	82	87	82	82	87	82	82	87	82	82	87
5972	13,109	6,373	2,868	66	54	44	59	49	42	58	47	41	58	45	37	59	48	42
5980	8,522	4,591	2,742	64	58	57	64	58	57	64	58	57	64	58	57	64	58	57
Project Area	147,583	101,832	66,412	67	43	33	63	40	31	62	39	30	63	40	31	63	40	31

1/ Includes NFS and non-NFS lands.

2/ Includes all VCUs that coincide with the project area boundary; no project activities proposed in VCUs 5720, 5740, 5971, or 5980 under any of the alternatives.

3/Numbers based on 2008 Forest Plan Final EIS analysis for the entire biogeographic province which projected impacts of Forest Plan implementation over 100+ years (USDA Forest Service 2008b); assumes all suitable lands are harvested, incorporating the Big Thorne Project.

Table WLD-16. Number of POG Patches and POG acres within Patches by Size Class by Alternative

Patch Size (acres)[1/]	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	No. Patches	Acres	No. Patches (% change)	Acres	No. Patches (% change)	Acres	No. Patches (% change)	Acres	No. Patches (% change)	Acres
0-25	305	3,009	834 (+173%)	3,625	923 (+203%)	3,783	700 (+130%)	3,443	818 (+168%)	3,633
26-100	95	4,675	102 (+7%)	5,161	103 (+8%)	5,226	96 (+1%)	4,704	102 (+8%)	5,152
101-500	35	7,254	38 (+9%)	8,545	40 (+14%)	9,080	42 (+20%)	9,656	40 (+14%)	9,122
500-1000	7	4,851	6 (-14%)	4,481	6 (-14%)	4,465	5 (-29%)	3,896	6 (-14%)	4,577
1000+[2/]	8	82,748	10 (+25%)	76,318	10 (+25%)	73,925	9 (+13%)	77,501	9 (+13%)	75,792
Total	**450**	**102,537**	**990 (+120%)**	**98,129**	**1,082 (+140%)**	**96,479**	**852 (+89%)**	**99,200**	**975 (+117%)**	**98,275**

1/ Includes NFS and non-NFS lands; includes all patches intersecting the project area, some of which extend beyond the project area boundary.
2/ An increase in the number of 1000+ acre patches results from the fragmentation of a large patch where the resulting patches are still greater than 1,000 acres in size.

Cumulative Effects

Alternative 2, in combination with past timber harvest and ongoing and foreseeable projects, would maintain at least 34, 16, and 8 percent of the original total POG, high-volume POG, and large-tree POG, respectively, within project area VCUs (Table WLD-15). Like alternatives 4 and 5, 11 VCUs including 9 with project activities, would maintain less than 67 percent of the original total POG (cumulative reduction of more than 33 percent) under Alternative 2 (Table WLD-15). Thus Alternative 2 would result in two VCUs (in addition to those identified under Alternative 1) in which the movement capabilities of organisms with low mobility may be limited, potentially resulting in gaps in distribution and a reduced likelihood of local population persistence, due to habitat loss of more than 33 percent. The remaining VCUs would continue to have a high likelihood of maintaining habitat components important to a variety of species across the landscape. Cumulative reductions in POG under Alternative 2 were accounted for in the 2008 Forest Plan FEIS analysis, which concluded that with the conservation strategy in place, full implementation of the Forest Plan would be expected to maintain viable, well-distributed populations.

Alternative 3

Direct and Indirect Effects

Alternative 3 would harvest 6,696 acres of POG, the most under any alternative, including 3,720 acres of high-volume POG and 1,944 acres of large tree POG (Tables WLD-12, WLD-13, and WLD-14). Harvest under Alternative 3 would maintain at least 85 percent of the total POG, 72 percent of the high-volume POG, and 59 percent of the large-tree POG currently available in the project area VCUs (Tables WLD-12, WLD-13, and WLD-14). Approximately 84 percent of harvest would be even-aged harvest and 16 percent would be uneven-aged harvest, maintaining less

biodiversity across the landscape than the other alternatives more uneven-aged harvest and/or less overall harvest (Table TSE-4). The same units where uneven-aged harvest is proposed under Alternative 2 are also proposed for uneven-aged harvest under Alternative 3, and therefore would have the same effects from a connectivity standpoint as described above. However, Alternative 3 also includes uneven-aged harvest units north of Ratz Harbor and north of Sal Creek (coinciding with small OGR modifications) which would maintain functional connectivity to the beach. Effects of Alternative 3 to biodiversity would be greatest in VCUs 5972, 5840, and 5950 where the most harvest is proposed; however, 90, 86, and 89 percent of the existing POG would be maintained in these VCUs, respectively. Thus, substantial reductions in biodiversity (i.e., species richness or abundance) would not be expected. Of the three VCUs considered to be intact landscapes that coincide with the Big Thorne Project, one (VCU 5960) would remain intact under Alternative 3. The other two VCUs (5750 and 5820) may have a lower likelihood of maintaining a high degree of biodiversity but would likely remain functional because the amount of existing POG maintained is still over 90 percent.

Alternative 3 would increase the number of POG patches on the landscape by 140 percent, the most among the action alternatives, thereby increasing fragmentation and associated edge effects and reducing connectivity (Table WLD-16). Alternative 3 would result in the greatest increase in the smallest (0-25 acres) size class among the alternatives, and therefore would be expected to result in the greatest amount of edge effects among the alternatives. Alternative 3 would result in the fewest acres in the largest patch size class among the alternatives (Table WLD-16). Alternative 3 also involves the commercial thinning of 2,572 acres of young growth, and therefore would have the beneficial effects to biodiversity associated with opening the tree canopy and promoting understory development (Table TSE-4) in previously harvested stands.

Cumulative Effects

Alternative 3, in combination with past timber harvest and ongoing and foreseeable projects, would maintain at least 34, 15, and 8 percent of the original total POG, high-volume POG, and large-tree POG, respectively, within project area VCUs (Table WLD-15). Under Alternative 3, 12 VCUs including 10 with project activities, would maintain less than 67 percent of the original total POG (cumulative reduction of more than 33 percent), the most among the action alternatives (Table WLD-15). The movement capabilities of organisms with low mobility may be limited, potentially resulting in gaps in distribution and a reduced likelihood of local population persistence, in the VCUs with habitat loss of more than 33 percent. The remaining VCUs would continue to have a high likelihood of maintaining habitat components important to a variety of species across the landscape.

Cumulative reductions in POG under Alternative 3 were accounted for in the 2008 Forest Plan FEIS analysis, which concluded that, with the conservation strategy in place, full implementation of the Forest Plan was expected to maintain viable, well-distributed populations across the North Central Prince of Wales biogeographic province.

Alternative 4

Direct and Indirect Effects

Alternative 4 would harvest 4,109 acres of POG, the least under any alternative, including 2,419 acres of high-volume POG and 1,210 acres of large tree POG (Tables WLD-12, WLD-13, and WLD-14). Approximately 45 percent of harvest would be even-aged harvest and 55 percent would be uneven-aged harvest, maintaining more biodiversity across the landscape than any of the action alternatives Table TSE-4). Uneven-aged harvest under Alternative 4 includes more acres of group selection and harvest with 25 percent retention than any other alternative (Table TSE-4). These prescriptions would have a lighter touch on the landscape by maintaining more habitat value following harvest and focusing harvest on smaller areas (some as small as 0.5 acre) to maintain biodiversity and minimize wildlife impacts. Most uneven-aged harvest units under Alternative 4 are located in travel corridors between areas of past harvest (unit 194 north of Luck Lake; unit 183 northwest of Ratz Harbor; unit 177 north of Big Lake; units 158, 159, 162, 167 and 168 south of Ratz Creek/Big Lake; unit 145 south of Sal Creek; unit 121 along Gravelly Creek; unit 68 in the Gravelly Creek area; numerous units in the Phase 2 area [VCU 5780] where there is an area of concentrated past harvest near the Honker large OGR complex; and units 41, 42, 44, and 46 between the Honker Large OGR complex and the Karta Wilderness). Uneven-aged harvest of these units would maintain connectivity through these corridors.

Harvest under Alternative 4 would maintain at least 84 percent of the total POG, 72 percent of the high-volume POG, and 57 percent of the large-tree POG currently available in the project area VCUs (Tables WLD-12, WLD-13, and WLD-14). Effects of Alternative 4 to biodiversity would be greatest in VCUs 5972, 5950, and 5810 where the most harvest is proposed; however, 91, 93, and 93 percent of the existing POG would be maintained in these VCUs, respectively. Thus, substantial reductions in biodiversity (i.e., species richness or abundance) would not be expected. Of the three VCUs considered to be intact landscapes that coincide with the Big Thorne Project, all would remain intact under Alternative 4.

Alternative 4 would increase the number of POG patches on the landscape by 89 percent, thereby increasing fragmentation and associated edge effects and reducing connectivity; however, this increase is the least among the action alternatives (Table WLD-16). Alternative 4 would result in the smallest increase in the number of patches in the smallest size class and would maintain the most acreage in the largest patch size class among the action alternatives, and therefore would be expected to result in the fewest edge effects among the alternatives (Table WLD-16). Alternative 4 also involves the commercial thinning of 2,161acres of young-growth, and therefore would have the beneficial effects to biodiversity associated with opening the tree canopy and promoting understory development (Table TSE-4).

Cumulative Effects

Alternative 4, in combination with past timber harvest and ongoing and foreseeable projects, would maintain at least 34, 17, and 9 percent of the original total POG, high-volume POG, and large-tree POG, respectively, within project area VCUs

(Table WLD-15). Like alternatives 2 and 5, 11 VCUs, including 9 with project activities, would maintain less than 67 percent of the original total POG (cumulative reduction of more than 33 percent) under Alternative 4 (Table WLD-15). The movement capabilities of organisms with low mobility may be limited, potentially resulting in gaps in distribution and a reduced likelihood of local population persistence, in the VCUs with habitat loss of more than 33 percent. The remaining VCUs would continue to have a high likelihood of maintaining habitat components important to a variety of species the landscape.

Cumulative reductions in POG under Alternative 4 were accounted for in the 2008 Forest Plan FEIS analysis, which concluded that with the conservation strategy in place full implementation of the Forest Plan would be expected to maintain viable, well-distributed populations across the North Central Prince of Wales biogeographic province.

Alternative 5

Direct and Indirect Effects

Alternative 5 would harvest 4,848 acres of POG, including 2,612 acres of high-volume POG and 1,306 acres of large-tree POG (Tables WLD-12, WLD-13, and WLD-14). Harvest under Alternative 5 would maintain at least 84 percent of the total POG, 73 percent of the high-volume POG, and 58 percent of the large-tree POG currently available in the project area VCUs (Tables WLD-12, WLD-13, and WLD-14). Approximately 79 percent of harvest would be even-aged harvest and 21 percent would be uneven-aged harvest (Table TSE-4). Uneven-aged harvest units under Alternative 5 are also widely across the landscape and in most cases do not target travel corridors between areas of past harvest. Exceptions are units 158-161 and 167-169 south of Ratz Creek/Big Lake; unit 177 north of Big Lake; and unit 194 north of Luck Lake which would maintain connectivity through travel corridors.

Effects of Alternative 5 to biodiversity would be greatest in VCUs 5972, 5840, and 5950 where the most harvest is proposed; however, 91, 89, and 91 percent of the existing POG would be maintained in these VCUs, respectively. Thus, substantial reductions in biodiversity (i.e., species richness or abundance) would not be expected. Of the three VCUs considered to be intact landscapes that coincide with the Big Thorne Project, all would remain intact under Alternative 5.

Alternative 5 would increase the number of POG patches on the landscape by 117 percent, thereby increasing fragmentation and associated edge effects and reducing connectivity. The largest increases would occur in the smallest (0-25 acre) and medium (101–500 acre) size classes (Table WLD-16). Alternative 5 would have the second highest amount of acreage in the largest patch size class among the action alternatives and therefore would be expected to result in the second least amount of edge effects among the alternatives (Table WLD-16). Alternative 5 also involves the commercial thinning of 2,081 acres of young growth, and therefore would have the benefits to biodiversity associated with opening the tree canopy and promoting understory development (Table TSE-4).

Cumulative Effects

Alternative 5, in combination with past timber harvest and ongoing and foreseeable projects, would maintain at least 34, 16, and 8 percent of the original total POG, high-volume POG, and large-tree POG, respectively, within project area VCUs (Table WLD-15). Like the alternatives 2 and 4, 11 VCUs, including 9 with project activities, would maintain less than 67 percent of the original total POG (cumulative reduction of more than 33 percent) under Alternative 5 (Table WLD-15). The movement capabilities of organisms with low mobility may be limited, potentially resulting in gaps in distribution and a reduced likelihood of local population persistence, in the VCUs with habitat loss of more than 33 percent. The remaining VCUs would continue to have a high likelihood of maintaining habitat components important to a variety of species across the landscape. Cumulative reductions in POG under Alternative 5 were accounted for in the 2008 Forest Plan FEIS analysis, which concluded that with the conservation strategy in place full implementation of the Forest Plan would be expected to maintain viable, well-distributed populations across the North Central Prince of Wales biogeographic province.

Conclusion

All of the alternatives would reduce the amount of POG on the landscape and increase fragmentation. Based on the amount of POG harvest, amount of even-aged harvest, and increase in number of POG patches, effects to biodiversity would be greatest under Alternative 3, followed by Alternatives 2, 5, 4, and 1. All action alternatives increase the number of VCUs where cumulative harvest is greater than 33 percent of the original total POG (Table WLD-15). In these VCUs, additional habitat loss and fragmentation could locally hinder the mobility of species with low dispersal capabilities (e.g., Prince of Wales flying squirrel). Of the three intact VCUs, all would remain intact under Alternatives 2, 4, and 5.

Corridors

All of the action alternatives would result in timber harvest in the vicinity of the areas identified as being important as travel corridors or other areas important to connectivity. Alternative 4 was specifically designed to reduce this effect by dropping harvest units in these areas, or proposing uneven-aged harvest prescriptions and logging methods that would retain biodiversity and habitat value. None of the alternatives would affect the corridors in the Cutthroat drainage, Control Creek drainage, and the Tributary to the North Thorne River near Thorne Lake, all of which are corridors associated with the Honker Divide, or in the Rio Roberts drainage.

The following provides a description of potential project impacts to travel corridors. The comparison of alternatives below is based on approximate acres of harvest within a corridor and proportion of harvest that is uneven-age. Uneven-aged prescriptions would maintain more forest structure within harvested stands and therefore assumed to maintain the functioning of the corridor more than even-aged harvest. The corridors described here do not have a defined width or length, as they represent a general area that animals might move through; therefore, the

identification of units within a corridor per se was subjective. For this assessment, contiguous bands of old-growth forest within each corridor area were identified within which units were selected based on their proximity to the feature that appeared the most likely to function as a corridor (i.e., a drainage or other low elevation area) or in the case of the Honker Divide, along the edge of the large OGR. There are potentially additional units that may impact a corridor area as a whole, but the numbers presented here provide a relative means of comparing alternatives. Under all alternatives Forest Plan standards and guidelines for stream, beach, and estuary buffers as well as the for legacy forest structure would apply which would help to maintain connectivity outside of the reserve system.

Alternative 1

Direct, Indirect, and Cumulative Effects

- **Honker Divide:** No harvest or road building would occur adjacent to the Honker Divide large-OGR complex under Alternative 1; therefore, the functional value of habitat along its eastern edges would be maintained. No commercial thinning in these areas would occur under Alternative 1; therefore, there would be no improvement in connectivity in these corridors over the long term.
    - No activities are proposed in the Cutthroat drainage which is located within the Honker large OGR; therefore north-south connectivity in this corridor would be maintained.
    - No activities are proposed in the Control Creek drainage; therefore, east-west connectivity between the Control Lake area and the Thorne River drainage would be maintained.
    - No activities are proposed in the North Thorne drainage (east and west branch); therefore, north-south connectivity in this corridor would be maintained.
    - No activities are proposed along the tributary to the Thorne River; therefore, north-south connectivity from within the Honker large OGR to the west branch of the North Thorne Drainage would be maintained.
- **Rio Beaver Drainage:** There has been much past harvest along the Rio Beaver drainage (Figure WLD-1). There are three NEPA-cleared Control Lake timber sale units (mostly in roadless), totaling 150 acres, along the western edge of the corridor. The existing level of connectivity across the drainage would be maintained under Alternative 1 because no additional harvest or road building would occur in this drainage. No commercial thinning would occur under Alternative 1 in this drainage (included under Alternatives 3, 4, and 5); therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Rio Roberts Drainage**: No activities are proposed in this drainage under Alternative 1 because it is located within the Honker large OGR. Therefore the existing level of connectivity along this drainage would be maintained.

- **Upper Steelhead Drainage:** No additional timber harvest or road building would occur in the Upper Steelhead drainage under Alternative 1. There are two NEPA- cleared Control Lake timber sale units (in roadless), totaling 25 acres, within the upper part of the corridor. Therefore, the existing level of east-west connectivity across the drainage would be maintained. No commercial thinning would occur under Alternative 1; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Rush Peak Area:** No additional timber harvest or road building would occur in the Rush Peak area under Alternative 1. There are five NEPA-cleared Control Lake timber sale units (about half in roadless), totaling 61 acres, that occur along the edges of or in the two corridors. The existing level of north-south connectivity in this area would be maintained. The current small OGR in this VCU, which would be maintained under Alternative 1, is predominately high-elevation, high-gradient topography that provides a poor travel corridor. No commercial thinning would occur under Alternative 1; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Control Lake Area:** No additional harvest or road building would occur in the Control Lake area under Alternative 1. Three NEPA-cleared Control Lake timber sale units (in roadless), totaling 84 acres, occur along the northern edge corridor. Therefore, the existing level of connectivity between Control Lake and the Honker large OGR would be maintained under Alternative 1. No commercial thinning would occur under Alternative 1; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Ratz Harbor Area:** No additional timber harvest or road building would occur in the vicinity of Ratz Harbor under Alternative 1; therefore the existing level of east-west connectivity between the shoreline and interior forest would be maintained. However, because no commercial thinning would occur under Alternative 1, which is included under Alternatives 3, 4, and 5, there would be no improvement in functionality of this area as a travel corridor over the long-term.
- **Sal Creek Area:** There has been much past harvest along Sal Creek (VCU 5840; Figure WLD-1). The existing level of east-west connectivity would be maintained under Alternative 1 because no additional harvest or road building would occur in this drainage. However, because no commercial thinning would occur in this area under Alternative 1 (included under Alternatives 3, 4, and 5), there would be no improvement in connectivity in this corridor over the long term.
- **Clarence Strait Shoreline:** No additional harvest or road building would occur in areas adjacent to the Clarence Strait Shoreline under Alternative 1; therefore, the existing level of north-south connectivity would be maintained. No commercial thinning would occur under Alternative 1; therefore, there would be no improvement in connectivity in this corridor over the long term.

- **Snug Anchorage:** No additional harvest or road building would occur in the Snug Anchorage area under Alternative 1; therefore, the existing level of north-south connectivity between Sandy Beach and Thorne Bay would be maintained. No commercial thinning would occur under Alternative 1; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Luck Lake/Eagle Creek:** No additional harvest would occur in the Luck Lake/Eagle Creek area under Alternative 1; therefore, the existing level of connectivity between Luck Lake and the shoreline would be maintained. However, because no commercial thinning would occur in this corridor under Alternative 1 (included under Alternatives 3, 4, and 5), there would be no improvement in connectivity in this corridor over the long term.

Alternative 2

Direct, Indirect, and Cumulative Effects

- **Honker Divide:** Alternative 2 would harvest units adjacent to the Honker Divide large-OGR complex, but not within the Honker large OGR, and therefore has the potential to reduce the functional value of habitat along its eastern edge (Table WLD-17). However, because no commercial thinning would occur under Alternative 2 there would be no improvement in connectivity in these corridors over the long term.
  - No activities are proposed in the Cutthroat drainage which is located within the Honker large OGR; therefore north-south connectivity in this corridor would be maintained.
  - No activities are proposed in the Control Creek drainage; therefore, east-west connectivity between the Control Lake area and the Thorne River drainage would be maintained.

Table WLD-17. Comparison of Effects to Corridors with Project Effects by Alternative

Corridor	Alt 1		Alt 2		Alt 3		Alt 4		Alt 5		Ranking of Alternatives (Greatest to Least Effects)
	Acres	Uneven-aged Harvest	Acres	Uneven-aged Harvest	Acres	Uneven-aged Harvest	Acres	Uneven-aged Harvest	Acres	Uneven-aged Harvest	
Honker Divide Area	0	--	1,057	1%	1,606	1%	825	87%	994	11%	3, 2, 5, 4, 1
Rio Beaver Drainage	0	--	110	0%	150	0%	163	88%	163	57%	3*, 2, 5*, 4*, 1
Upper Steelhead Drainage	0	--	606	0%	715	0%	373	9%	528	0%	3, 2, 5, 4, 1
Rush Peak Area	0	--	356	0%	485	0%	418	55%	361	0%	3, 5, 2, 4, 1
Control Lake Area	0	--	156	43%	156	44%	112	61%	156	44%	2/3/5/, 4, 1
Ratz Harbor Area	0	--	460	64%	460	64%	264	100%	473	80%	2/3*, 5*, 4*, 1
Sal Creek Area	0	-	169	66%	343	83%	169	66%	169	66%	3*, 2/4*/5*, 1
Clarence Strait Shoreline	0	--	355	25%	692	53%	352	56%	410	47%	3, 2, 5, 4, 1
Snug Anchorage Area	0	--	92	0%	335	0%	17	0%	92	0%	3, 2/5, 4, 1
Luck Lake/Eagle Creek Area	0	--	248	17%	443	9%	267	51%	248	17%	3*, 2/5*, 4*, 1

'*' indicates commercial harvest would enhance connectivity over the long-term.

1/ Acres are approximate; the identification of harvest units within corridors is subjective as corridors do not have width or length dimensions.

- Harvest includes approximately 169 acres along the west branch of the North Thorne River, along the upper limits of the drainage, which would reduce this corridor. Effects to this corridor under Alternative 2 would be the second greatest among the action alternatives due to the level of proposed harvest, nearly all of which (99 percent) would be even-aged (Table WLD-17).

  No activities are proposed along the tributary to the Thorne River; therefore, north-south connectivity from within the Honker large OGR to the west branch of the North Thorne Drainage would be maintained.

- **Rio Beaver Drainage:** Alternative 2 would harvest several units at the far northern and southern ends of the drainage. Effects under Alternative 2 would be second greatest among the action alternatives because all harvest would be even-aged (Table WLD-17). There are also three NEPA-cleared Control Lake timber sale units (mostly in roadless), totaling 150 acres, along the western edge of the corridor. Though the drainage has been heavily harvested, additional harvest would reduce some of the remaining connectivity across the drainage. There would be no improvement in connectivity along the drainage over the long-term under Alternative 2 because it does not involve the commercial thinning included under Alternatives 3, 4, and 5.

- **Rio Roberts Drainage**: No activities are proposed in this drainage under Alternative 2 because it is located within the Honker large OGR. Therefore the existing level of connectivity along this drainage would be maintained.

- **Upper Steelhead Drainage:** Alternative 2 would harvest the second greatest amount of acres in the Steelhead drainage, all of which would be even-aged, and therefore would have the second greatest effects among the action alternatives (Table WLD-17). There are also two NEPA-cleared Control Lake timber sale units (in roadless), totaling 25 acres, within the upper part of the corridor. Although some connectivity and wildlife habitat would be maintained by stream buffers, timber harvest would affect many of the remaining east-west connections across the drainage. No timber harvest or road building would occur on the branch of the drainage extending to Big Salt Lake; therefore connectivity to the Honker large OGR via this corridor would be maintained. No commercial thinning would occur under Alternative 2; therefore, there would be no improvement in connectivity in this corridor over the long term.

- **Rush Peak Area:** Alternative 2 would harvest units in the Rush Peak area along both the Rush Creek (approximately 158 acres) and Goose Creek (approximately 198 acres) drainages, the least among the action alternatives (Table WLD-17). Alternative 2 has the potential to reduce north-south connectivity in this area because all harvest is uneven-aged. There are also five NEPA-cleared Control Lake timber sale units (about half in roadless), totaling 61 acres, that occur along the edges of or in the two corridors. No commercial thinning would occur under Alternative 2; therefore, there would be no improvement in connectivity in this corridor over the long term. The current small OGR in this VCU, described under Alternative 1, would also be maintained under Alternative 2.

- **Control Lake Area:** Alternative 2 would harvest one unit east of Control Lake which is an area identified as being important for wolf movement between Control Lake and the Honker large OGR; and three units south of Control Lake. Effects under Alternative 2 would be comparable to Alternatives 3 and 5, which would harvest similar acreage with approximately the same proportion of uneven-aged prescriptions, and greater than Alternative 4 (Table WLD-17). There are also three Control Lake units (mostly in roadless), totaling 150 acres, along the western edge of the corridor. No commercial thinning would occur under Alternative 2; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Ratz Harbor Area:** Alternative 2 would harvest units in the Ratz Harbor area, both north and south of Big Lake, and therefore has the potential to reduce east-west connectivity to saltwater. Effects would be comparable to Alternative 3 which would harvest similar acreage with the same proportion of uneven-aged harvest, and greater than alternatives 5 and 4 (Table WLD-17). However, some connectivity would be maintained by the existing small OGR which connects to the shoreline. Under Alternative 2 there would be no improvement in functionality of this area as a travel corridor over the long-term because no commercial thinning is proposed which is included under Alternatives 3, 4, and 5.
- **Sal Creek Area**: Alternative 2 would harvest two units south of Sal Creek which would reduce east-west connectivity to saltwater. Effects would be comparable to alternatives 4 and 5, which would harvest the same acreage with the same proportion of uneven-aged harvest, and less than Alternative 3 (Table WLD-17). Under Alternative 2 there would be no improvement in functionality of this area as a travel corridor over the long-term because no commercial thinning is proposed along Sal Creek which is included under Alternatives 3, 4, and 5.
- **Clarence Strait Shoreline**. Alternative 2 would harvest units adjacent to the shoreline, outside of the beach buffer, which would reduce north-south connectivity. However, a narrower corridor would be maintained. Effects would be less than Alternative 3, but greater than alternatives 2 and 5 due to the amount of acres harvested and proportion of uneven-aged harvest (Table WLD-17). No commercial thinning would occur under Alternative 2; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Snug Anchorage**. Alternative 2 would reduce the northern end of this corridor though two harvest units near Sandy Beach; the rest of the corridor would be maintained. There are also approximately 120 acres of the North Thorne Bay and Beach Road State timber sales that occur along the western boundary of the north-south corridor. Effects under Alternative 2 in this area would be comparable to Alternative 5, less than Alternative 3, and greater than Alternative 4 (Table WLD-17). The existing small OGR would continue to encompass a portion of this corridor. No commercial thinning would occur under Alternative 2; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Luck Lake/Eagle Creek**: Under Alternative 2 the entire length of Eagle Creek, providing connectivity from Luck Lake to the shoreline, would be maintained in

the existing small OGR. Harvest along Luck Creek (approximately 248 acres), a majority (83 percent) of which would be even-aged, would reduce this corridor extending south of Luck Lake. However, two other corridors along tributaries to Luck Creek to the small OGR in VCU 5810 and to Little Lake would be maintained. Effects under Alternative 2 would be the same as Alternative 5, less than Alternative 3 and greater than Alternative 4, which involves more uneven-aged harvest (Table WLD-17). There would be no improvement in connectivity in this area over the long-term under Alternative 2 because it does not involve the commercial thinning included under alternatives 3, 4, and 5.

Alternative 3

Direct, Indirect, and Cumulative Effects

- **Honker Divide**: Alternative 3 would harvest the same units adjacent to the Honker Divide large-OGR complex as Alternative 2, plus additional adjacent units, some of which would become available through the proposed small OGR modification. Alternative 3 has the greatest potential among the alternatives to reduce the functional value of habitat along its eastern fringe, due to the level of harvest, nearly all of which (99 percent) would be even-aged (Table WLD-17). However, because no commercial thinning would occur in these areas under Alternative 3 there would be no improvement in connectivity in these corridors over the long term.
  - No activities are proposed in the Cutthroat drainage which is located within the Honker large OGR; therefore north-south connectivity in this corridor would be maintained.
  - No activities are proposed in the Control Creek drainage; therefore, east-west connectivity between the Control Lake area and the Thorne River drainage would be maintained.
  - Harvest includes acres along the western (approximately 256 acres) and eastern (approximately 198 acres) branches of the North Thorne drainage, the latter becoming available for harvest due to the small OGR modification. Alternative 3 would result in the greatest reductions to these corridors among the action alternatives.
  - No activities are proposed along the tributary to the Thorne River; therefore, north-south connectivity from within the Honker large OGR to the west branch of the North Thorne Drainage would be maintained.
- **Rio Beaver Drainage**: Alternative 3 would harvest units at the far northern and southern ends of the drainage. Effects would be greatest among the action alternatives because all harvest would be even-aged (Table WLD-17). This drainage has been heavily harvested in the past and additional harvest would reduce some of the remaining connectivity across the drainage; however commercial thinning of previously harvested stands proposed under Alternatives 3 would improve the functionality of the drainage as a travel corridor between the Karta Wilderness and Honker large OGR complex over the long-term.

- **Rio Roberts Drainage**: No activities are proposed in this drainage under Alternative 3 because it is located within the Honker large OGR. Therefore the existing level of connectivity along this drainage would be maintained.
- **Upper Steelhead Drainage**: Alternative 3 would have the greatest effect to connectivity in the Steelhead drainage among the alternatives due to the level of harvest (Table WLD-17). There are also two NEPA-cleared Control Lake timber sale units (in roadless), totaling 25 acres, within the upper part of the corridor Reductions in the corridor along the east branch of the drainage would be the same as Alternative 2 (and greater than alternatives 4 and 5); however, Alternative 3 also includes harvest along the west branch of the drainage which connects the Honker large OGR with Big Salt and which has experienced little past harvest; although existing connectivity to Big Salt is low due to state land selection south of the highway and other non-NFS land along the northern edge of Big Salt. No commercial thinning would occur in this area under Alternative 3; therefore, there would be no improvement in connectivity in this corridor over the long term. Small OGR modifications in this area would not improve connectivity because they would not include this drainage.
- **Rush Peak Area**: Alternative 3 would harvest the most acreage in the Rush Peak area among the action alternatives, including approximately 287 acres along the Rush Creek drainage and approximately 198 acres along the Goose Creek drainage (Table WLD-17). This has the greatest potential to reduce north-south connectivity. There are five NEPA-cleared Control Lake timber sale units (about half in roadless), totaling 61 acres, that occur along the edges of or in the two corridors. No commercial thinning would occur in this area under Alternative 3; therefore, there would be no improvement in connectivity in this corridor over the long term. Small OGR modifications under Alternative 3 would decrease the amount of low-elevation POG in the vicinity of Rush Peak.
- **Control Lake Area**: Under Alternative 3, effects in the Control Lake area would be the same as under alternatives 2 and 5, and greater than Alternative 4 (see Alternative 2 for discussion).
- **Ratz Harbor Area**: Alternative 3 would harvest units in the Ratz Harbor area, both north and south of Big Lake, and therefore has the potential to reduce east-west connectivity to saltwater. Effects would be comparable to Alternative 2, and greater than alternatives 4 and 5 (Table WLD-17). However, Alternative 3 also involves commercial thinning between Ratz Harbor and Trumpeter Lake and south of Big Lake, which would improve the functionality of this area as a travel corridor over the long-term.
- **Sal Creek Area**: Alternative 3 would harvest the greatest amount around Sal Creek among the alternatives. Harvest to the south of Sal Creek would be the same as under alternatives 2, 4, and 5; Alternative 3 would also harvest units near the shoreline north of Sal Creek which would become available due to the proposed small OGR modification in VCU 5840 (Table WLD-17). This would reduce the connection between the North Thorne drainage and coastal habitats; however, a majority of this harvest (83 percent) would be uneven-aged.

Commercial thinning along Sal Creek proposed under Alternative 3 would improve connectivity in this corridor over the long-term.

- **Clarence Strait Shoreline**. Timber harvest, and thus reductions in connectivity, in this corridor would be greatest under Alternative 3 compared to the other alternatives (Table WLD-17). This would reduce north-south connectivity, though a narrower corridor would be maintained with the beach buffer. No commercial thinning would occur in this area under Alternative 3; therefore, there would be no improvement in connectivity in this corridor over the long term. Small OGR modifications in VCUs 5820 and 5830 would occur in this corridor but would have minor effects to connectivity because both the existing and proposed small OGRs include old-growth forest adjacent to the shoreline; small OGR modifications in VCU 5840 would reduce the inclusion of old-growth forest adjacent to the shoreline.
- **Snug Anchorage Area**. Alternative 3 would harvest the most acreage in the Snug Anchorage area, mainly resulting from the small OGR modification in VCU 5850 (Table WLD-17). There are also approximately 120 acres of the North Thorne Bay and Beach Road State timber sales that occur along the western boundary of the north-south corridor. Connectivity between Sandy Beach and Thorne Bay would be reduced by Alternative 3 because the narrowest part of the corridor and the portion around Sandy Beach would be harvested. No commercial thinning would occur in this area under Alternative 3; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Luck Lake/Eagle Creek**: Alternative 3 is the only alternative that would result in harvest along the Eagle Creek drainage (approximately 196 acres) which would reduce the connectivity between Luck Lake and saltwater. However, a more narrow travel route would still exist in the Class I stream buffer on Eagle Creek which drains from Luck Lake to saltwater. This area would become available for harvest due to the small OGR modification in VCU 5810. Alternative 3 would also reduce the corridor along Luck Creek, but timber harvest (approximately 248 acres) would be comparable to the Alternatives 2 and 5 (Table WLD-17). Corridors along the tributaries to Luck Creek would be maintained. Commercial thinning around Luck Lake proposed under Alternative 3 would improve connectivity in this corridor over the long term.

Alternative 4

Direct, Indirect, and Cumulative Effects

- **Honker Divide**: Alternative 4 would harvest the least acreage adjacent to the Honker Divide large-OGR complex among the action alternatives, nearly all of which (87 percent) would be uneven-aged (Table WLD-17). Therefore, Alternative 4 would have the least potential to reduce the functional value of habitat along its eastern fringe. No commercial thinning would occur in this area under Alternative 4; therefore, there would be no improvement in connectivity in these corridors over the long term. Small OGR modifications proposed under Alternative 4 include the addition of acres to the western end of the existing small OGR in VCU 5790 (Gravelly Creek/Falls Creek; approximately 240 acres),

providing a direct connection to the Honker Divide large OGR complex through VCU 5780. This would improve the biological functionality of the complex of small OGRs in VCUs 5790, 5800, and 5840.

- No activities are proposed in the Cutthroat drainage which is located within the Honker large OGR; therefore north-south connectivity in this corridor would be maintained.
- No activities are proposed in the Control Creek drainage; therefore, east-west connectivity between the Control Lake area and the Thorne River drainage would be maintained.
- Harvest includes approximately 158 acres along the west branch of the North Thorne drainage. Therefore, Alternative 4 would have the least potential to reduce connectivity along the drainage corridor. Effects to connectivity would be reduced under Alternative 4 by implementing uneven-aged harvest prescriptions with low (e.g., 25 percent) basal area removal as well as group selection harvest (as small as 0.5 acre).
- No activities are proposed along the tributary to the Thorne River; therefore, north-south connectivity from within the Honker large OGR to the west branch of the North Thorne Drainage would be maintained.

- **Rio Beaver Drainage**: Effects connectivity in the Rio Beaver drainage under Alternative 4 would be similar to Alternative 5, though more of the harvest (approximately 31 percent more) would be uneven-aged (Table WLD-1). This is a greater amount of acreage under alternatives 2 and 3, though these acres only include even-aged harvest. Commercial thinning proposed under Alternative 4 would improve the functionality of the drainage as a travel corridor between the Karta Wilderness and Honker large OGR complex over the long term.
- **Rio Roberts Drainage**: No activities are proposed in this drainage under Alternative 4 because it is located within the Honker large OGR. Therefore the existing level of connectivity along this drainage would be maintained.
- **Steelhead Drainage**: Effects to connectivity in the Steelhead drainage (east branch) would be least under Alternative 4 because units between previously harvested areas were dropped or unit shapes were modified to maintain east-west connectivity and other habitat value. Alternative 4 would harvest the least amount of acreage among the action alternatives, though most of which (91 percent) would be even-aged. There are also two NEPA-cleared Control Lake units (in roadless), totaling 25 acres, within the upper part of the corridor. The small OGR modification under Alternative 4 in VCU 5950 would add OGR acreage encompassing a portion of the corridor along the west branch of the Steelhead drainage connecting to Big Salt Lake. No commercial thinning would occur in this area under Alternative 4; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Rush Peak Area**: Alternative 4 would harvest the least acreage in the Rush Peak area among the action alternatives (Table WLD-17). This includes approximately 309 acres along the Rush Creek drainage, most of which would become available

due to the small OGR modification in VCU 5972, and approximately 109 acres along the Goose Creek drainage; approximately half of the harvest would be uneven-aged. There are also five NEPA-cleared Control Lake timber sale units (about half in roadless), totaling 61 acres, that occur along the edges of or in the two corridors. No commercial thinning would occur in this area under Alternative 4; therefore, there would be no improvement in connectivity in this corridor over the long term due to forest management. However, Alternative 4 would relocate the existing small OGR to the east, surrounding Angel Lake, protecting the only low-elevation wildlife travel corridor leading along Goose Creek from the Honker Divide large OGR (through VCUs 5972 and 5980) to saltwater at Salt Chuck. Thus, under Alternative 4 connectivity in the vicinity of Rush Peak would improve.

- **Control Lake Area**: Under Alternative 4 no harvest or road building is proposed between Control Lake and the Honker large OGR complex. Unit 27 was dropped from Alternative 4; although this unit located northwest of Control Lake would not be expected to affect wolf use of this corridor due to the presence of OGR and roadless acres that provide connectivity. There are also three NEPA-cleared Control Lake units (mostly in roadless), totaling 150 acres, along the western edge of the corridor. However, timber harvest south of Control Lake, which would be the same as the other action alternatives, would reduce connectivity slightly between the Honker large OGR and the Steelhead drainage. No commercial thinning would occur in this area under Alternative 4; therefore, there would be no improvement in connectivity in this corridor over the long term. This would be compensated for by the small OGR modifications proposed under Alternative 4, which include the addition of acres to the south of the existing small OGR (south of Control Lake), which would improve connectivity with the Honker large OGR complex, and encompass wolf habitat.
- **Ratz Harbor Area**: No timber harvest or road building would occur adjacent to Ratz Harbor under Alternative 4; however, timber harvest would affect the corridor north of Big Lake though all would be uneven-aged (Table WLD-17). Effects would be the least among the action alternatives. The small OGR modification in VCU 5830 would enhance this corridor through the addition of OGR acreage adjacent to Ratz Harbor (between Ratz Creek and the shoreline). Additionally, commercial thinning between Trumpeter Lake and the shoreline and around Big Lake proposed under Alternative 4 would improve the functionality of this area as a travel corridor over the long-term.
- **Sal Creek Area**: Effects to the corridor in the Sal Creek area under Alternative 4 would be the same as under Alternatives 2 and 5, and less than Alternative 3. Though this would reduce connectivity to the shoreline, the existing small OGR which includes old-growth forest north of Sal Creek maintains some connectivity between the North Thorne drainage and saltwater. Commercial thinning along Sal Creek proposed under Alternative 4 would improve connectivity in this corridor over the long term.

- **Clarence Strait Shoreline**. Alternative 4 would harvest the least amount of acreage near the Clarence Strait shoreline of the action alternatives, most of which (56 percent) would be uneven-aged. Though this would reduce north-south connectivity, a narrower corridor would be maintained. No commercial thinning would occur in this area under Alternative 4; therefore, there would be no improvement in connectivity in this corridor over the long term. The small OGR modification in VCU 5820 occur in this corridor but would have minor effects to connectivity because both the existing and proposed small OGRs include old-growth forest adjacent to the shoreline.
- **Snug Anchorage Area**. No timber harvest or road building would occur in the vicinity of Snug Anchorage under Alternative 4. No commercial thinning would occur in this area under Alternative 4; therefore, there would be no improvement in connectivity in this corridor over the long term due to forest management. Small OGR modifications in VCU 5850 would enhance this corridor through the addition of OGR acreage near Sandy Beach.
- **Luck Lake/Eagle Creek**: Under Alternative 4 the entire length of Eagle Creek, providing connectivity from Luck Lake to the shoreline, would be maintained in the existing small OGR. Alternative 4 would harvest slightly more acreage than the other action alternatives along Luck Creek (approximately 267 acres); though a majority (51 percent) would be uneven-aged (Table WLD-17). Although this would reduce this corridor extending south of Luck Lake; two other corridors along tributaries to Luck Creek to the small OGR in VCU 5810 and to Little Lake would be maintained. Commercial thinning around Luck Lake proposed under Alternative 4 would improve connectivity in this corridor over the long term.

Alternative 5

Direct, Indirect, and Cumulative Effects

- **Honker Divide**: Timber harvest adjacent to the Honker Divide large-OGR complex under Alternative 5 would be comparable to Alternative 2. No commercial thinning would occur in this area under Alternative 5; therefore, there would be no improvement in connectivity in these corridors over the long term.
  - No activities are proposed in the Cutthroat drainage which is located within the Honker large OGR; therefore north-south connectivity in this corridor would be maintained.
  - No activities are proposed in the Control Creek drainage; therefore, east-west connectivity between the Control Lake area and the Thorne River drainage would be maintained.
  - Harvest includes approximately 169 acres of harvest along the west branch of the North Thorne River, along the upper limits of the drainage, which would reduce this corridor. Effects to connectivity in this corridor under Alternative 5 would be the third greatest among the action alternatives due to the level of proposed harvest, nearly all of which (89 percent) would be even-aged (Table WLD-17).

  - No activities are proposed along the tributary to the Thorne River; therefore, north-south connectivity from within the Honker large OGR to the west branch of the North Thorne Drainage would be maintained.

- **Rio Beaver Drainage**: Timber harvest and associated reductions in connectivity in the Rio Beaver drainage under Alternative 5 would be similar to Alternative 4, but would include less uneven-aged harvest (31 percent less; Table WLD-17). Commercial thinning proposed under Alternative 5 would improve the functionality of the drainage as a travel corridor between the Karta Wilderness and Honker large OGR complex over the long term.
- **Rio Roberts Drainage**: No activities are proposed in this drainage under Alternative 5 because it is located within the Honker large OGR. Therefore the existing level of connectivity along this drainage would be maintained.
- **Upper Steelhead Drainage**: Alternative 5 would result in the third greatest amount of timber harvest among the action alternatives in the Upper Steelhead drainage, all of which would be even-aged. This includes approximately 31 acres along the west branch of the Steelhead drainage, which connects the Honker large OGR with Big Salt Lake and which has experienced little past harvest, although existing connectivity to Big Salt is low due to state land selection south of the highway and other non-NFS land along the northern edge of Big Salt. There are also two NEPA-cleared Control Lake timber sale units (in roadless), totaling 25 acres, within the upper part of the corridor. Thus east-west and north-south connectivity through the drainage would be reduced. No commercial thinning would occur in this area under Alternative 5; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Rush Peak Area**: Effects of Alternative 5 in the Rush Peak area would be comparable to Alternative 2. No commercial thinning would occur in this area under Alternative 5; therefore, there would be no improvement in connectivity in this corridor over the long term. The current small OGR in this VCU, described under Alternative 1, would also be maintained under Alternative 5.
- **Control Lake Area**: Effects of Alternative 5 in the Control Lake area would be the same as under Alternative 2 (Table WLD-17; see Alternative 2 for discussion). No commercial thinning would occur in this area under Alternative 5; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Ratz Harbor Area**: Alternative 5 would result in a similar level of harvest in the Ratz Harbor area, and therefore also has the potential to reduce east-west connectivity to saltwater (Table WLD-17). Some connectivity would be maintained by the existing small OGR in VCU 5830 which connects to the shoreline. Commercial thinning between Trumpeter Lake and the shoreline and around Big Lake under Alternative 5 would improve the functionality of this area as a travel corridor over the long-term.
- **Sal Creek Area**: Timber harvest in the Sal Creek area under Alternative 5 would be the same under Alternative 2 (Table WLD-17). However, commercial thinning

along Sal Creek proposed under Alternative 5 would improve connectivity in this corridor over the long term.

- **Clarence Strait Shoreline**. Timber harvest near the Clarence Strait shoreline under Alternative 5 would be similar to Alternative 2; however, Alternative 5 involves more uneven-aged harvest (22 percent more; Table WLD-17). No commercial thinning would occur in this area under Alternative 5; therefore, there would be no improvement in connectivity in this corridor over the long term. Therefore, effect to connectivity along the shoreline would be slightly less than under Alternative 2.
- **Snug Anchorage Area**. Timber harvest in the Snug Anchorage area under Alternative 5 would be the same as under Alternative 2 (Table WLD-17). Thus, although the northern end of this corridor would be reduced by two harvest units near Sandy Beach, the rest of the corridor would be maintained. No commercial thinning would occur in this area under Alternative 5; therefore, there would be no improvement in connectivity in this corridor over the long term. The existing small OGR would continue to encompass a portion of this corridor.
- **Luck Lake/Eagle Creek**: Timber harvest in the vicinity of Luck Lake/Eagle Creek under Alternative 5 would be the same as under Alternative 2. However, commercial thinning around Luck Lake proposed under Alternative 5 would improve connectivity in this corridor over the long term. Connectivity from Luck Lake to the shoreline would continue to be protected by the existing small OGR.

Conclusion

Alternative 3 has the greatest potential to adversely affect travel corridors or other areas that provide old-growth habitat connectivity, followed by Alternatives 2, 5, 4, and 1. Among the alternatives, Alternative 3 would result in the greatest amount of timber harvest within the corridors described above, and the small OGR modifications proposed under Alternative 3 would reduce connectivity (e.g., Rush Peak, Ratz Harbor, Sal Creek, and Luck Lake/Eagle Creek). Generally, less timber harvest would occur under Alternatives 2 and 5, and connectivity would be maintained by the existing small OGRs. The least amount of timber harvest within the corridors would occur under Alternative 4, and small OGR modifications proposed under Alternative 4 would improve connectivity (e.g., Honker Divide, Rush Peak, Control Lake, and Ratz Harbor).

Management Indicator Species

Sitka Black-tailed Deer

Direct and Indirect Effects – All Alternatives

All of the alternatives would reduce deer habitat capability (Table WLD-18). Effects would be realized immediately after project completion (2013), but more so in 25 years (2039), as forest succession progresses and harvested stands reach the stem exclusion stage. Under all alternatives this would occur to some extent due to natural succession of previously harvested stands. Over the long-term, reductions in habitat capability could reduce carrying capacity, or the numbers of deer an area is capable of supporting given the available resources. This could lead to a decline in the deer population, particularly

following severe winters, if the demand for resources (e.g., food or habitat) exceeds that which is available. Uneven-aged harvest prescriptions would lessen reductions in habitat capabilities as both some cover and forage would be maintained in harvested stands. Declines in the deer population resulting from reduced habitat capability may decrease the availability of deer to wolves and hunters (Person 2001, Farmer et al. 2006, Brinkman et al. 2009). Likewise, reductions in deer habitat capability over the long-term may reduce the access to and availability of deer to subsistence hunters. Effects to wolves and subsistence resources are discussed below in the respective sections.

Timber harvest under all of the alternatives would decrease the amount of available average snow and deep snow winter habitat (Table WLD-19). This could alter the distribution of these habitats on the landscape (Schoen et al. 1984), although they are already patchily distributed in the project area. Timber harvest would increase foraging habitat over the short-term, but could also reduce overall the amount of non-winter habitat (through POG reduction). Loss of non-winter habitat could reduce the ability of deer to withstand harsh winter conditions if not enough forage is available for deer to build fat reserves.

Table WLD-18. Relative Changes in Deer Habitat Capability (DHC) by WAA by Alternative for NFS Lands Only

WAA[1/]	1954 DHC	2012 DHC (%)	Deer Habitat Capability Reduction as Percent of 2012 Values[2/, 3/]									
			Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
			at Project Completion	at Stem Exclusion	at Project Completion	at Stem Exclusion	at Project Completion	at Stem Exclusion	at Project Completion	at Stem Exclusion	at Project Completion	at Stem Exclusion
1315	2,411	59%	0%	-7%	-4%	-10%	-7%	-13%	-3%	-10%	-4%	-10%
1318	1,269	93%	0%	-4%	-4%	-8%	-5%	-8%	-3%	-7%	-4%	-7%
1319	3,324	77%	0%	-4%	-1%	-8%	-6%	-10%	-4%	-8%	-4%	-8%
1420	1,404	56%	0%	-11%	-5%	-15%	-9%	-19%	-5%	-15%	-5%	-16%

1/ WAAs 1316, 1421, and 1422 are slightly within the project area boundary, but no actions are proposed.
2/ DHC calculated from the deer model for winter habitat. Habitat Suitability Indices (HSIs) were standardized to range from 0.0 to 1.0; 100 deer per square mile used as multiplier; all harvest was calculated as even-aged; no predation was included. Source: GIS Database, deer_model.aml, 2012.
3/ Assumes harvest of all proposed units (project completion) occurs in 2013; assumes stem exclusion reached in 2039.

Table WLD-19. Changes to Average Snow Winter Range, Deep Snow Winter Range, and Non-Winter Habitat for Deer by WAA by Alternative (NFS and Non-NFS Lands)

WAA	Habitat	1954 acres	2012 acres	Acres Impacted (% reduction from existing)				
				Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	Deep Snow 1/	19,848	9,296	0	277 (3%)	580 (6%)	216 (2%)	288 (3%)
	Average Snow 2/	46,237	26,513	0	1,159 (4%)	1,683 (6%)	783 (3%)	1,073 (4%)
	Non-Winter 3/	84,461	66,013	0	1,196 (2%)	1,761 (3%)	821 (1%)	1,124 (2%)
1318	Deep Snow 1/	10,917	7,600	0	343 (5%)	402 (5%)	212 (3%)	302 (4%)
	Average Snow 2/	34,080	25,339	0	699 (3%)	807 (3%)	483 (2%)	623 (3%)
	Non-Winter 3/	97,811	89,475	0	711 (1%)	820 (1%)	489 (1%)	634 (1%)
1319	Deep Snow 1/	18,279	11,827	0	749 (6%)	900 (8%)	699 (6%)	745 (6%)
	Average Snow 2/	54,994	41,099	0	1,990 (5%)	2,718 (7%)	1,964 (5%)	2,101 (5%)
	Non-Winter 3/	102,402	88,407	0	2,124 (2%)	2,906 (3%)	2,093 (2%)	2,284 (3%)
1420	Deep Snow 1/	10,157	3,176	0	116 (4%)	424 (13%)	81 (3%)	184 (6%)
	Average Snow 2/	28,969	15,233	0	793 (5%)	1,292 (9%)	712 (5%)	871 (6%)
	Non-Winter 3/	45,637	32,022	0	909 (3%)	1,436 (5%)	833 (3%)	983 (3%)
Total	**Deep Snow 1/**	---	---	**0**	**1,485**	**2,306**	**1,208**	**1,519**
	Average Snow 2/	---	---	**0**	**4,641**	**6,500**	**3,942**	**4,668**
	Non-Winter 3/	---	---	**0**	**4,941**	**6,923**	**4,237**	**5,025**

1/ High volume POG (SD 5S, 5N, 6/7) at or below 800-foot elevation; GIS snow layer not applied.
2/ All POG (SD 4H, 4N, 4S, 5H, 5S, 5N, 6/7) at or below 1,500-foot elevation
3/ Spring/summer/fall habitat; all POG, non-productive old-growth, non-forested, muskeg, alpine habitats

Cumulative Effects – All Alternatives

Cumulative past harvest activities have reduced deer habitat capability to between 56 and 93 percent of the estimated capability in these WAAs in 1954 (Table WLD-20). Habitat capability would continue to be reduced as natural and harvest-associated windthrow occur and previously harvested reach the stem-exclusion stage. Additional harvest on NFS lands would further reduce deer habitat capability; microsales and free use have a negligible effect on deer habitat capability because they do not result in substantial stand modification.

Average snow, deep snow, and non-winter habitat have also been reduced by past harvest and would be further reduced from historic condition by all action alternatives. Cumulative reductions in deep snow and average snow winter habitat would be greatest in WAA 1315 and 1319 under all action alternatives (Table WLD-21). No other projects proposed small OGR modifications; therefore, there would be no additional change in the amount of deer winter habitat or low-elevation POG, representative of travel corridors for deer, included in the reserve system.

Table WLD-20. Relative Changes Deer Habitat Capability (DHC) by WAA by Alternative for All Lands (NFS and Non-NFS Lands) Including Reasonably Foreseeable Projects

WAA[1/]	1954 DHC	2012 DHC (% 1954)	Deer Habitat Capability as Percent of 1954 Values (Additional Reduction)[2/, 3/, 4]									
			Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
			At Project Completion	At Stem Exclusion	At Project Completion	At Stem Exclusion	At Project Completion	At Stem Exclusion	At Project Completion	At Stem Exclusion	At Project Completion	At Stem Exclusion
1315[4/]	2,411	59%	59% (0%)	55% (-4%)	57% (-2%)	53% (-6%)	55% (-4%)	52% (-7%)	58% (-1%)	54% (-5%)	57% (-2%)	53% (-6%)
1318	1,269	93%	93% (-<1%)	89% (-4%)	89% (-4%)	86% (-7%)	89% (-4%)	85% (-8%)	90% (-3%)	87% (-6%)	88% (-5%)	86% (-7%)
1319	3,324	77%	77% (-<1%)	74% (-3%)	74% (-3%)	71% (-6%)	73% (-4%)	70% (-7%)	74% (-3%)	71% (-6%)	74% (-3%)	71% (-6%)
1420	1,404	56%	56% (-<1%)	50% (-6%)	54% (-2%)	48% (-8%)	51% (-5%)	45% (-11%)	54% (-2%)	48% (-8%)	53% (-3%)	47% (-9%)

1/ WAAs 1316, 1421, and 1422 are within the project area boundary, but no actions are proposed.
2/ DHC calculated from the deer model for winter habitat at all elevations. Habitat Suitability Indices (HSIs) were standardized to range from 0.0 to 1.0; 100 deer per square mile used as multiplier; all harvest was calculated as even-aged; no predation was included. Source: GIS Database, deer_model.aml, 2012.
3/ Assumes harvest of all proposed units (project completion) occurs in 2013; assumes stem exclusion reached in 2039.
4/ Assumes all non-NFS lands are harvested.

Table WLD-21. Cumulative Effects to Average Snow Winter Habitat, Deep Snow Winter Habitat, and Non-Winter Habitat for Deer by WAA and by Alternative on all Lands (NFS and Non-NFS Lands) Including Reasonably Foreseeable Projects

WAA	Habitat	Original (1954) acres	2012 (Percent Original Remaining)	Percent Original Habitat Remaining (Additional Reduction)[4/, 5/]				
				Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	Deep Snow [1/]	19,848	47	44 (-3%)	43 (-4%)	41 (-6%)	43 (-4%)	43 (-4%)
	Average Snow [2/]	46,237	57	55 (-2%)	53 (-5%)	52 (-6%)	53 (-4%)	53 (-5%)
	Non-Winter [3/]	84,461	78	77 (-1%)	75 (-3%)	75 (-3%)	76 (-2%)	76 (-3%)
1318	Deep Snow [1/]	10,917	70	70 (<1%)	66 (-3%)	66 (-4%)	68 (-2%)	67 (-3%)
	Average Snow [2/]	34,080	74	74 (<1%)	72 (-2%)	72 (-3%)	73 (-2%)	72 (-2%)
	Non-Winter [3/]	97,811	91	91 (<1%)	91 (-1%)	91 (-1%)	91 (-1%)	91 (-1%)
1319	Deep Snow [1/]	18,279	65	65 (<1%)	61 (-4%)	60 (-5%)	61 (-4%)	61 (-4%)
	Average Snow [2/]	54,994	75	74 (<1%)	71 (-4%)	69 (-5%)	71 (-4%)	71 (-4%)
	Non-Winter [3/]	102,402	86	86 (<1%)	84 (-2%)	83 (-3%)	84 (-2%)	84 (-3%)
1420	Deep Snow [1/]	10,157	31	31 (<1%)	30 (-1%)	27 (-4%)	30 (-1%)	29 (-2%)
	Average Snow [2/]	28,969	53	52 (<1%)	49 (-3%)	48 (-5%)	50 (-3%)	49 (-3%)
	Non-Winter [3/]	45,637	70	70 (<1%)	68 (-2%)	67 (-3%)	68 (-2%)	68 (-2%)

1/ High volume POG (SD 5S, 5N, 6/7) at or below 800 ft elevation; GIS snow layer not applied.
2/ All POG (SD 4H, 4N, 4S, 5H, 5S, 5N, 6/7) at or below 1,500 ft elevation
3/ Spring/summer/fall habitat; all POG, non-productive old-growth, non-forested, muskeg, alpine habitats
4/ WAA 1315 incorporates reasonably foreseeable harvest on state lands and misc. National Forest harvest; WAA 1318 incorporates reasonably foreseeable National Forest harvest (Control Lake project and misc. projects); WAA 1319 incorporates reasonably foreseeable National Forest harvest (Control Lake project and misc. projects); and WAA 1420 incorporates reasonably foreseeable harvest on state lands and miscellaneous National Forest harvest.
5/ Percent change and percent reduction may not match exactly due to rounding

There is an inherent level of climate variability in the Pacific Northwest associated with Pacific Decadal Oscillation (PDO), or the shift between two different circulation patterns that occurs every 20 to 30 years in the North Pacific Ocean. Shifts in the location of cold and warm water in the Pacific alter the path of the jet stream, and thus result in long-term changes in weather patterns typified by “warm” and “cold” phases. It has been suggested that Southeast Alaska is in the early to middle cycle of a cold phase, marked by greater precipitation and cooler temperatures (D’Aleo and Easterbrook 2011). Thus, much past harvest (1980s and 1990s) occurred during a warm phase and therefore effects to the deer population may not be fully realized. Additionally, based on the past PDO cycles, it could mean another fifteen years or more with generally colder winters (D’Aleo and

Easterbrook 2011). Having more extreme cold winters over a prolonged period of several years could lead to higher winter mortality rates for deer (Baichtal 2012). Therefore, long-term climate patterns may also contribute to cumulative effects to deer. However, there are many uncertainties related to how PDO works and how it might best be monitored, modeled, and predicted. Ultimately, the Forest Plan Conservation Strategy is intended to maintain the persistence the old-growth ecosystem (and the predator-prey dynamic of wolves and deer which it supports) under the unpredictable effects of climate (USDA Forest Service 2008b).

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effects to deer habitat capability or to average snow, deep snow, or non-winter habitat because no action would be undertaken. Alternative 1 would result in an immediate reduction in deer habitat capability by WAA, as some stands move into the stem exclusion stage between now and project implementation, less than 1 percent from current conditions under each alternative (Table WLD-18). At stem exclusion, deer habitat capability would be reduced by a total of 4 to 11 percent from current conditions, depending on the WAA (Table WLD-18).

No commercial thinning of young-growth stands would occur under Alternative 1; therefore, development of young-growth into a stand with old-growth forest characteristics would occur slowly over time.

No small OGR modifications are proposed under Alternative 1. Therefore there would be no associated effects to deer. The current small OGRs collectively contain 3,325 acres of deep snow deer winter range and 7,405 acres of low elevation POG, which is indicative of higher value habitat (See Table OGR-2 under Issue 2).

Cumulative Effects

Alternative 1 in combination with past, ongoing, and foreseeable projects would maintain 56 to 93 percent of the original (1954) deer habitat capability at project completion, and 50 to 89 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-20). Alternative 1 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 31 to 70 percent of original amounts; average snow winter habitat to 52 to 74 percent of original amounts; and non-winter habitat to 70 to 91 percent of original amounts depending on the WAA (Table WLD-21).

Alternative 1 would not contribute to the beneficial effects of commercial thinning; however, pre-commercial thinning would occur in the project area under the Tongass Pre-commercial thinning program which would improve deer habitat. However, reductions in deer habitat capability due to natural succession under Alternative 1 may result in local declines in the deer population over time.

Alternative 2

Direct and Indirect Effects

Alternative 2 would result in an immediate reduction in deer habitat capability by WAA ranging from 1 to 5 percent from current conditions, the second highest among the alternatives (comparable to Alternative 5; Table WLD-18). At stem exclusion, deer

habitat capability would be reduced by a 8 to 15 percent from current conditions, depending on the WAA (Table WLD-18).

Alternative 2 would result in the harvest of approximately 1,484 total acres of deep snow winter habitat (3 to 6 percent reduction from current conditions by WAA), 4,641 total acres of average snow winter habitat (3 to 5 percent reduction from current conditions by WAA), and 4,941 total acres of non-winter habitat (1 to 3 percent reduction from current conditions by WAA; Table WLD-19). A majority of the timber harvest in all WAAs would be even-aged under Alternative 2 (Table WLD-22). Reductions in habitat capability and the amount of habitat available under Alternative 2 would result in local reductions in the numbers of deer an area is capable of supporting given the available resources. No commercial thinning of young-growth stands would occur under Alternative 2; therefore, development of young-growth stands into a stand with old-growth characteristics would occur slowly over time.

No small OGR modifications are proposed under Alternative 2. Therefore there would be no associated effects to deer. The current small OGRs contain 3,325 acres of deep snow deer winter range and 7,405 acres of low-elevation POG, which is indicative of higher value habitat (See Table OGR-2 under Issue 2).

Table WLD-22. Harvest by Prescription by WAA

WAA	Acres of Total Harvest														
	Alt 1			Alt 2			Alt 3			Alt 4			Alt 5		
	Even-aged Harvest	Uneven-aged Harvest	Commercial Thinning	Even-aged Harvest	Uneven-aged Harvest	Commercial Thinning	Even-aged Harvest	Uneven-aged Harvest	Commercial Thinning	Even-aged Harvest	Uneven-aged Harvest	Commercial Thinning	Even-aged Harvest	Uneven-aged Harvest	Commercial Thinning
1315	--	--	--	808 (67%)	389 (33%)	0	1198 (68%)	563 (32%)	843	487 (59%)	334 (41%)	674	775 (69%)	349 (31%)	639
1318	--	--	--	644 (91%)	68 (9%)	0	753 (92%)	68 (8%)	0	388 (79%)	101 (21%)	0	566 (89%)	68 (11%)	0
1319	--	--	--	2110 (99%)	15 (1%)	0	2881 (99%)	15 (1%)	626	730 (35%)	1354 (65%)	494	2074 (91%)	201 (9%)	479
1420	--	--	--	670 (74%)	240 (26%)	0	955 (67%)	477 (33%)	1103	293 (35%)	535 (65%)	992	526 (54%)	453 (46%)	963

Cumulative Effects

Under Alternative 2, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would maintain 54 to 89 percent of the original (1954) deer habitat capability at project completion, and 48 to 86 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-21). Alternative 2 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 30 to 66 percent of original amounts; average snow winter habitat to 49 to 72 percent of original amounts; and non-winter habitat to 68 to 91 percent of original amounts, depending on the WAA (Table WLD-22). Alternative 2 would not contribute to the beneficial effects of commercial thinning. However, deer habitat would be improved in the future through pre-commercial thinning

projects implemented under the Tongass Pre-commercial Thinning program. Ultimately, reductions in deer habitat capability due to timber harvest and natural succession under Alternative 2 may result in local declines in the deer population.

Alternative 3

Direct and Indirect Effects

Alternative 3 would result in an immediate reduction in deer habitat capability by WAA ranging from 6 to 9 percent from current conditions, the most among the alternatives (Table WLD-18). At stem exclusion, deer habitat capability would be reduced by a total of 8 to 19 percent from current conditions, depending on the WAA (Table WLD-18).

Alternative 3 would result in the harvest of approximately 2,306 total acres of deep snow winter habitat (5 to 13 percent reduction from current conditions by WAA), 6,500 total acres of average snow winter habitat (3 to 9 percent reduction from current conditions by WAA), and 6,923 total acres of non-winter habitat (1 to 5 percent reduction from current conditions by WAA; Table WLD-19). A majority of harvest in all WAAs (67 to 99 percent) would be even-aged under Alternative 3 (Table WLD-22). Reductions in habitat capability and the amount of habitat available under Alternative 3 would result in local reductions in the numbers of deer an area is capable of supporting given the available resources. However, Alternative 3 would also result in the commercial thinning of 2,572 acres of young-growth which would enhance deer habitat.

With the exception of VCU 5820 (Baird Peak), small OGR modifications under Alternative 3 would reduce the amount of deep snow deer winter range (reduction of 1,401 acres) and low-elevation POG (reduction of 2,909 acres) contained in the reserve system (see Table OGR-2 under Issue 2). This would potentially make these areas available to timber harvest which would reduce habitat capability for deer.

Cumulative Effects

Under Alternative 3, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would maintain 51 to 89 percent of the original (1954) deer habitat capability at project completion, and 45 to 85 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-20). The level of deer habitat capability maintained under Alternative 3 would be the least among the alternatives. Alternative 3 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 27 to 66 percent of original amounts; average snow winter habitat to 48 to 72 percent of original amounts; and non-winter habitat to 67 to 91 percent of original amounts, depending on the WAA (Table WLD-21).

Cumulative effects would be greatest under Alternative 3 relative to the other alternatives, though these effects would be mitigated to some extent by commercial thinning. Commercial thinning would contribute to similar benefits provided by pre-commercial thinning (up to 12,300 acres pre-commercial thinning are anticipated to occur in the project area WAAs over the next 10 years) in enhancing deer habitat (forage availability). However, ultimately reductions in winter habitat capability, due to the removal of deer winter habitat, as a result of past, ongoing, and foreseeable harvest activities, would locally reduce deer carrying capacity. Over the long-term, these cumulative effects would likely result in a population decline, especially following severe winters. This could

reduce the number of deer available to wolves and hunters (see discussion under Wolf and Subsistence subsections below).

Alternative 4

Direct and Indirect Effects

Alternative 4 was designed in part to minimize impacts to deer such as by harvesting less winter habitat, and maintaining more travel corridors. Some units originally proposed were removed from the unit pool, or were modified by dropping portions or adjusting the unit boundary, to avoid deer winter habitat and travel routes between areas of past harvest. The inclusion of small patch and strip cuts (e.g., 0.5 to 1.0 acre) in the Phase 2 area (VCUs 5780 and 5971) and in some units on the edge of the Honker large OGR complex would create edge habitats that deer prefer in proximity to areas of cover through which deer can move.

Alternative 4 would result in an immediate reduction in deer habitat capability by WAA ranging from 3 to 5 percent from current conditions, the least among the action alternatives (Table WLD-18). At stem exclusion state, deer habitat capability would be reduced by a total of 7 to 15 percent from current conditions, depending on the WAA (Table WLD-18).

Alternative 4 would result in the harvest of approximately 1,208 total acres of deep snow winter habitat (2 to 6 percent reduction from current conditions by WAA), 3,942 total acres of average snow winter habitat (2 to 5 percent reduction from current conditions by WAA), and 4,237 total acres of non-winter habitat (1 to 3 percent reduction from current condition by WAA; Table WLD-19). A majority of harvest would be even-aged in WAAs 1315 (59 percent) and 1318 (79 percent), but a majority would be uneven-aged in WAAs 1319 and 1420 (both 65 percent) where the most harvest of winter habitat would occur (Table WLD-22). Reductions in habitat capability and the amount of habitat available under Alternative 4 would result in local reductions in the numbers of deer an area is capable of supporting given the available resources. However, Alternative 4 would also result in the commercial thinning of approximately 2,161 acres of previously harvested young-growth stands which would enhance deer habitat.

Small OGR modifications proposed under Alternative 4 would increase inclusion of deep snow winter habitat (912 acres) and/or low-elevation POG (2,591 acres) in all VCUs where modifications are proposed with the exception of VCUs 5820 and 5830 (See Table OGR-2 under Issue 2). Collectively these modifications would reduce the amount of deer habitat available for harvest. Many of the modification would also include low-elevation travel corridors which could be used by deer.

Cumulative Effects

Under Alternative 4, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would maintain 54 to 90 percent of the original (1954) deer habitat capability at project completion, and 48 to 87 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-20). Alternative 4 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 30 to 68 percent of original amounts;

average snow winter habitat to 50 to 73 percent of original amounts; and non-winter habitat to 68 to 91 percent of original amounts, depending on the WAA (Table WLD-21).

Cumulative effects would be least under Alternative 4 relative to the other alternatives, and would be mitigated to some extent by commercial thinning which would contribute to similar benefits provided by pre-commercial thinning conducted on NFS lands in enhancing deer habitat (i.e., increased forage availability; Hanley 2005). However, ultimately reductions in deer habitat capability due to timber harvest and natural succession under Alternative 4 may result in local declines in the deer population.

Alternative 5

Direct and Indirect Effects

Alternative 5 would result in an immediate reduction in deer habitat capability by WAA ranging from 4 to 5 percent from current conditions (Table WLD-18). At stem exclusion state, deer habitat capability would be reduced by a total of 7.6 to 13.9 percent from current conditions, depending on the WAA (Table WLD-18). Effects would be less than under Alternative 3 but comparable to alternatives 2 and 4.

Alternative 5 would result in the harvest of approximately 1,519 total acres of deep snow winter habitat (3 to 6 percent reduction from current conditions by WAA), 4,668 total acres of average snow winter habitat (3 to 6 percent reduction from current conditions by WAA), and 5,025 total acres of non-winter habitat (1 to 3 percent reduction from current conditions by WAA; Table WLD-19). A majority of harvest in all WAAs (54 to 91 percent) would be even-aged under Alternative 5 (Table WLD-22). Reductions in habitat capability and the amount of habitat available under Alternative 5 would result in local reductions in the numbers of deer an area is capable of supporting given the available resources. However, Alternative 5 would also result in the commercial thinning of 2,081 acres of previously harvested stands which would enhance deer habitat.

No small OGR modifications are proposed under Alternative 5. Therefore there would be no associated effects to deer. The current small OGRs contain 3,325 acres of deep snow deer winter range and 7,405 acres of low-elevation POG, which is indicative of higher value habitat (see Table OGR-2 under Issue 2).

Cumulative Effects

Under Alternative 5, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would maintain 53 to 88 percent of the original (1954) deer habitat capability at project completion, and 47 to 86 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-20). Alternative 5 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 29 to 67 percent of original amounts; average snow winter habitat to 49 to 72 percent of original amounts; and non-winter habitat to 68 to 91 percent of original amounts, depending on the WAA (Table WLD-21).

Cumulative effects under Alternative 5 would be comparable to Alternatives 2, less than Alternative 3, and greater than Alternative 4. However, they would be mitigated to some extent through commercial thinning which would contribute to the similar benefits provided by pre-commercial thinning in enhancing deer habitat (i.e., increased forage

availability). Ultimately, reductions in deer habitat capability due to timber harvest and natural succession under Alternative 5 may result in local declines in the deer population.

Conclusion

Deer winter habitat capability would be reduced under all alternatives. The greatest impacts would occur under Alternative 3, followed by Alternatives 2, 5, 4, and 1. Deep snow winter, average snow winter, and non-winter habitat would also be reduced under all action alternatives, with effects being greatest under Alternative 3, followed by 5, 2, and 4. Alternative 4 would have the fewest effects to deer because it harvests the fewest acres of deer winter habitat, and because greater habitat functionality would be maintained in harvested stands due to the predominance of uneven-aged harvest. A majority of harvest in WAAs 1319 and 1420 would be uneven-aged under Alternative 4 where the most harvest is proposed, which would maintain some of the functionality of this habitat. Alternatives 3, 4 and 5 all propose acres of commercial thinning which would mitigate to some extent the effects of timber harvest by enhancing deer habitat.

Small OGR modifications proposed under Alternative 3 would reduce inclusion of deer winter habitat and low-elevation POG (indicative of higher value habitat) in the reserve system, whereas, all proposed small OGR modifications under Alternative 4 would benefit deer by increasing the amount of winter habitat and low-elevation POG and travel corridors in the reserve system.

Reductions in habitat capability in combination with periodic severe winters may result in a local decline in the deer population, particularly given recent declines observed on Prince of Wales Island, which could limit the number of deer available to wolves and hunters. The 2008 Forest Plan Final EIS (USDA Forest Service 2008b) predicts that with full implementation of the Forest Plan, WAAs 1315, 1318, 1319, and 1420 will retain 47, 75, 64, and 40 percent of the historic (1954) habitat capability in 100+ years, respectively, on NFS lands. Predictions including non-NFS lands would likely be lower (USDA Forest Service 2008b). However, this analysis does not account for roadless acres in development LUDS, which, under the current roadless rule, are not likely be harvested. Regardless of the alternative chosen for the Big Thorne Project, management activities would retain habitat capability (taking only NFS lands into account) above these predicted levels in all WAAs at project completion and at stem exclusion (Table WLD-18).

Alexander Archipelago Wolf

Direct and Indirect Effects – All Alternatives

The Big Thorne Project has the potential to directly adversely affect wolves through activities that create noise or disturbance, which could result in the displacement of wolves. Although there are several known wolf dens within the project area there are no known wolf dens within any of the proposed harvest units. For known den sites close to harvest units, the 1,200-foot Forest Plan den site buffer was applied and unit boundaries adjusted as necessary; therefore none of the alternatives would directly or indirectly impact active wolf dens. A new den site was discovered in the summer of 2012; however its location (and associated buffer) does not affect any proposed Big Thorne units.

Indirect effects of the Big Thorne Project include the reduction of the wolf prey base (deer) and increased human access along project roads. It is assumed that a decline in the

deer population would likely result in a decline in the wolf population (USDA Forest Service 2008b). Resonating effects could include reductions in opportunities to hunt or trap wolves. Therefore, impacts to wolves are assessed in terms of the reduction in deer habitat capability (based on habitat capability model outputs in terms of deer density). Note that this density does not represent actual population numbers but represents the functioning of the predator-prey system dynamic. Model assumptions, based on recent direction provided by the Forest Service include:

- For the project-related direct and indirect effects analysis, deer habitat capability by WAA (including only NFS lands) was divided by the total square miles of NFS lands (all elevations included, but with acres above 1,500 feet elevation receiving a zero value) in the WAA.
- For the cumulative effects analysis, deer habitat capability from all land ownerships (NFS and non-NFS lands) was divided by the total square miles of all lands (all elevations included, but habitats on non-NFS land and land above 1,500 feet elevation receiving a zero value) in the WAA.

Timber harvest would decrease carrying capacity for deer over the long-term due to reductions in the amount of available winter range (Table WLD-23; see also discussion of effects to deer). Current deer habitat capabilities in the project area WAAs are below the Forest Plan guideline of 18 deer per square mile, and suggest the project would result in higher risk that there will be insufficient number of deer to sustain wolves and hunting (see existing modeled deer densities in Table WLD-23). That concern exists despite the limited availability of alternative prey due in part to the fact that alternative prey may delay a decline in wolf numbers relative to deer potentially causing wolf predation to have greater impact on declining deer numbers. Deer model calculations show that there would be an estimated decline of approximately 1 deer per square mile in the project area WAAs from current levels due to natural forest succession (i.e., between current levels and the stem exclusions stage).

Table WLD-23. Effects of Timber Harvest on Deer Density by WAA (NFS Lands Only)

WAA	Year	Density or %	Existing Conditions	Deer Habitat Capability and % of 2012 DHC by Alternative 1/				
				Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	1954	deer/mi2	29	--	--	--	--	--
	2012	deer/mi2	17	--	--	--	--	--
		% of 1954	59%	--	--	--	--	--
	2013 after Implementation	deer/mi2	--	17	16	16	16	16
		% of 2012	--	100%	94%	94%	94%	94%
	2039 at Stem Exclusion	deer/mi2	--	16	15	15	15	15
		% of 2012	--	94%	88%	88%	88%	88%
1318	1954	deer/mi2	15	--	--	--	--	--
	2012	deer/mi2	14	--	--	--	--	--
		% of 1954	93%	--	--	--	--	--
	2013 after Implementation	deer/mi2	--	14	13	13	13	13
		% of 2012	--	100%	93%	93%	93%	93%
	2039 at Stem Exclusion	deer/mi2	--	13	13	13	13	13
		% of 2012	--	93%	93%	93%	93%	93%
1319	1954	deer/mi2	21	--	--	--	--	--
	2012	deer/mi2	16	--	--	--	--	--
		% of 1954	76%	--	--	--	--	--
	2013 after Implementation	deer/mi2	--	16	15	15	15	15
		% of 2012	--	100%	94%	94%	94%	94%
	2039 at Stem Exclusion	deer/mi2	--	15	15	15	15	15
		% of 2012	--	94%	94%	94%	94%	94%
1420	1954	deer/mi2	22	--	--	--	--	--
	2012	deer/mi2	12	--	--	--	--	--
		% of 1954	55%	--	--	--	--	--
	2013 after Implementation	deer/mi2	--	12	12	11	12	11
		% of 2012	--	100%	100%	92%	100%	2%
	2039 at Stem Exclusion	deer/mi2	--	11	10	10	10	10
		% of 2012	--	92%	83%	83%	83%	83%

1/ Deer habitat capability calculated from the deer model for winter habitat (all elevations). Habitat Suitability Indices (HSIs) were standardized to range from 0.0 to 1.0; 100 deer per square mile used as multiplier; all harvest was calculated as even-aged; no predation was included.
Source: Forest Service GIS Database, deer_model.aml, 2012

All action alternatives involve the construction of roads. The roads associated with timber harvest may also increase the risk of hunting and trapping related wolf mortality by increasing human access; however this should be examined in the context of the existing road system. New roads constructed in drainages with an extensive system of existing roads would be expected to have less of an effect on harvest-related mortality risk than new roads entering undisturbed areas which may provide new points of access for hunters and trappers. All proposed roads under the Big Thorne Project consist mainly of short segments with no new road connections. Such effects would also be counteracted to some extent through additional road closures (Prince of Wales Island ATM); open roads would

be expected to have a greater effect than roads that are closed (either through storage or decommissioning) following their use (Person and Russell 2008). However, Person and Logan (2012) modeled the effects of such closures and found them to have little influence on mortality risk. Under all action alternatives, system roads constructed for the project would be closed and stored in 1 to 5 years following timber sale activities; prior to that, the roads will remain open to High Clearance Vehicles to allow for firewood removal from May 1 to November 30 (see Chapter 2 and the Transportation section for additional discussion of road classes).

Existing road densities in WAAs 1315, 1319, and 1420 exceed the 1.5 mile per square mile (0.9 km per square km) threshold suggested by Person and Russell beyond which they found road density to have little additional effect on harvest rates. Harvest rates would potentially increase in WAA 1318 because current total road densities are below this threshold; however, increases under all alternatives would be 0.2 mile per square mile or less (Table WLD-24). The effects of roads on wolf mortality risk may be exacerbated in WAAs that have beach access (WAAs 1420 and 1315) used by hunters and trappers. (Note that for direct and indirect effects, road densities are calculated for NFS lands only below 1,200 feet, while for cumulative effects, road densities are calculated for NFS and non-NFS lands below 1,200 feet.)

Table WLD-24. Road Density below 1,200 feet Elevation on NFS Lands Only after Implementation of the Alternatives

Island/WAA	Road Status[2/, 3/]	Road Density by Alternative (mile/mile^2)[1/]				
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	Open	1.07	1.10	1.16	1.08	1.07
	Closed	1.06	1.15	1.19	1.11	1.08
	Total	**2.14**	**2.25**	**2.34**	**2.19**	**2.15**
1318	Open	0.49	0.51	0.51	0.49	0.49
	Closed	0.23	0.27	0.28	0.25	0.25
	Total	**0.71**	**0.78**	**0.79**	**0.75**	**0.74**
1319	Open	0.82	0.87	0.87	0.83	0.83
	Closed	0.78	0.85	0.73	0.80	0.82
	Total	**1.60**	**1.72**	**1.60**	**1.63**	**1.65**
1420	Open	1.40	1.41	1.42	1.40	1.40
	Closed	1.12	1.14	1.15	1.19	1.13
	Total	**2.51**	**2.55**	**2.58**	**2.59**	**2.52**
Prince of Wales Island[4/]	Open	0.53	0.54	0.54	0.54	0.53
	Closed	0.46	0.47	0.47	0.46	0.46
	Total	**0.99**	**1.01**	**1.01**	**1.00**	**1.00**

1/ Includes only NFS lands.
2/ Closed roads are defined as all NFS roads with Operating Maintenance Level = 1 plus all decommissioned NFS roads; open roads include all other NFS roads and all state and private roads.
3/ Note - all proposed System roads are treated as open roads; however, they will be closed within 1-5 years after harvest (for 1 to 5 years following timber harvest activities the roads will remain open to High Clearance Vehicles to allow for firewood removal from May 1 to November 30)
4/ Includes 18 Prince of Wales Island WAAs; does not include the adjacent island WAAs (e.g., Kosciusko, Heceta, Tuxekan, Dall, etc.). This is the spatial area within which Person and Logan (2012) documented a correlation between wolf harvest-mortality risk and road density.

Cumulative Effects – All Alternatives

Timber harvest that has occurred since 1954 has reduced habitat capability for deer in GMU 2 through the removal of POG. All action alternatives result in an additional reduction of deer habitat capability, contributing to similar effects associated with ongoing and future timber harvest on NFS and lands in other ownership. Collectively this has the potential to result in localized declines in the deer population, and thus the prey base for wolves. At project completion (all alternatives), none of the project area WAAs (all land ownerships included) would support 18 deer per square mile, though none of them do currently (Table WLD-25). However, wolves are highly mobile within their territories and adjacent WAAs with higher deer densities would continue to support wolves in the vicinity of the project. Some WAAs adjacent to the project area (e.g., 1323 and 1332), taking into account ongoing and foreseeable projects, would meet or exceed this level of habitat capability (see the Wildlife and Subsistence resource report for additional detail). . Moreover, the intent of this guideline was to apply to a larger spatial scale (i.e., multiple WAAs or biogeographic province).

At the biogeographic province scale, deer habitat capability is currently 15 deer per square mile, remaining at this level under all action alternatives at project completion (less than 1 percent reduction in deer per square mile) and 14 deer per square mile at stem exclusion (1 percent reduction; Table WLD-25). Under all alternatives 33 percent of WAAs (7 of 21 WAAs) in the biogeographic province would support at least 18 deer per square mile at project completion; 29 percent of WAAs in the biogeographic province (6 of 21 WAAs) would support this level of habitat capability at stem exclusion. In considering only the core WAAs in the northwest and central portion of the biogeographic province to more accurately represent conditions immediately surrounding the project area, weighted average deer habitat capability is currently 19 deer per square mile. It would remain at 19 deer per square mile under all alternatives at project completion (less than 1 percent reduction); at stem exclusion, all action alternatives would support a weighted average deer habitat capability of 18 deer per square mile within this area. Thus, regardless of the alternative chosen, all would result in sufficient deer habitat within the biogeographic province and in the WAAs surrounding the project area to maintain a sustainable wolf population.

Table WLD-25. Cumulative Impacts to Deer Habitat Capability by WAA (NFS and Non-NFS Lands)

WAA	Year	Density or % of 1954	Existing	Deer Habitat Capability and % of 1954 DHC by Alternative [1/, 2/]				
				Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	1954	deer/mi^2	16	--	--	--	--	--
	2012	deer/mi^2	9	--	--	--	--	--
		% of 1954	56%	--	--	--	--	--
	2013 after Implementation	deer/mi^2	--	9	9	9	9	9
		% of 1954	--	56%	56%	56%	56%	56%
	2039 at Stem Exclusion	deer/mi^2	--	9	8	8	9	9
		% of 1954	--	56%	50%	50%	56%	56%
1318	1954	deer/mi^2	7	--	--	--	--	--
	2012	deer/mi^2	6	--	--	--	--	--
		% of 1954	86%	--	--	--	--	--
	2013 after Implementation	deer/mi^2	--	6	6	6	6	6
		% of 1954	--	86%	86%	86%	86%	86%
	2039 at Stem Exclusion	deer/mi^2	--	6	6	6	6	6
		% of 1954	--	86%	86%	86%	86%	86%
1319	1954	deer/mi^2	21	--	--	--	--	--
	2012	deer/mi^2	16	--	--	--	--	--
		% of 1954	76%	--	--	--	--	--
	2013 after Implementation	deer/mi^2	--	16	15	15	15	15
		% of 1954	--	76%	71%	71%	71%	71%
	2039 at Stem Exclusion	deer/mi^2	--	15	15	14	15	15
		% of 1954	--	71%	71%	66%	71%	71%
1420	1954	deer/mi^2	19	--	--	--	--	--
	2012	deer/mi^2	11	--	--	--	--	--
		% of 1954	58%	--	--	--	--	--
	2013 after Implementation	deer/mi^2	--	11	10	10	10	10
		% of 1954	--	58%	53%	53%	53%	53%
	2039 at Stem Exclusion	deer/mi^2	--	10	9	9	9	9
		% of 1954	--	53%	47%	47%	47%	47%
North Central Prince of Wales Biogeographic Province (all WAAs)	1954	deer/mi^2	20	--	--	--	--	--
	2012	deer/mi^2	15	--	--	--	--	--
		% of 1954	75%	--	--	--	--	--
	2013 after Implementation	deer/mi^2	--	15	15	15	15	15
		% of 1954	--	75%	75%	75%	75%	75%
	2039 at Stem Exclusion	deer/mi^2	--	14	14	14	14	14
		% of 1954	--	70%	70%	70%	70%	70%

Table WLD-25. Cumulative Impacts to Deer Habitat Capability by WAA (NFS and Non-NFS Lands) (cont.)

WAA	Year	Density or % of 1954	Existing	Deer Habitat Capability and % of 1954 DHC by Alternative [1/, 2/]				
				Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
North Central Prince of Wales Biogeographic Province (10 Core WAAs in NW and Central Portion of Province)[3/]	1954	deer/mi^2	27	--	--	--	--	--
	2012	deer/mi^2	19	--	--	--	--	--
		% of 1954	70%	--	--	--	--	--
	2013 after Implementation	deer/mi^2	--	19	19	19	19	19
		% of 1954	--	70%	70%	70%	70%	70%
	2039 at Stem Exclusion	deer/mi^2	--	18	18	18	18	18
		% of 1954	--	67%	67%	67%	67%	67%

1/ Deer habitat capability calculated from the deer model for winter habitat (all elevations). Habitat Suitability Indices (HSIs) were standardized to range from 0.0 to 1.0; 100 deer per square mile used as multiplier; all harvest units were treated as even-aged; no predation was included.
2/ All non-NFS lands were assumed to be harvested.
Source: GIS Database, deer_model.aml, 2012
3/ Includes WAAs 1316, 1319, 1323, 1421, 1422, 1525, 1526, 1527, 1529, and 1531

GMU 2, particularly in the north central and central portions of Prince of Wales Island, has an extensive road system, which provides access to hunters and trappers. All action alternatives would result in the construction of new roads, though most stem from existing road systems and all would eventually be closed and stored within 1 to 5 years of timber harvest activities (for 1 to 5 years after timber sale activities the roads would remain open to High Clearance Vehicles to allow for firewood removal from May 1 to November 30; see the Transportation section). Ongoing and foreseeable timber harvest projects may also increase open road density. These projects include the completion of NEPA-approved projects like Control Lake in WAAs 1318 and 1319, micro timber sales in all WAAs; and state timber projects in WAAs 1315 and 1420. Implementation of the Prince of Wales ATM, which involves road closures, would reduce access on NFS lands.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effect to wolves because no timber would be harvested and no roads would be constructed. Modeled deer densities would remain at currently estimated levels immediately after project initiation (in 2013; Table WLD-23). However, indirectly, over time there would be a reduction in modeled deer densities as previously harvested stands move into the stem exclusion stage (Table WLD-23). Reductions from existing (2012) amounts at stem exclusion would be greatest in WAA 1420 (8 percent), followed by WAAs 1318 (7 percent), and 1318/1319 (6 percent), respectively (Table WLD-23). In all WAAs this equates to a reduction in modeled deer densities of one deer per square mile from the existing level (Table WLD-23).

No commercial thinning of previously harvested stands would occur under Alternative 1. Thus, habitat improvements in young-growth potentially benefiting deer, and thus wolves, over the long-term would occur more slowly (i.e. at the rate of natural succession) than under the other alternatives.

Existing total road densities below 1,200 feet elevation would remain, ranging from 0.7 to 2.5 miles per square mile (Table WLD-24). Total road density at elevations below 1,200 feet for Prince of Wales Island would be 1.0 mile per square mile under Alternative 1 (Table WLD-24).

No small OGR modifications are proposed under Alternative 1. Therefore there would be no associated effects to wolves.

Cumulative Effects

Alternative 1 would not directly contribute to cumulative effect to wolves because no action would be undertaken under the Big Thorne Project; taking into account all landownerships and reasonably foreseeable timber projects, deer densities would be not change from current conditions, ranging from 6 to 16 deer per square mile depending on WAA (56 to 86 percent of original [1954] amounts; Table WLD-25). Over time, unthinned, previously harvested stands would reach the stem exclusion stage and deer habitat capability would be reduced from original (1954) amounts by 9 deer per square mile in WAA 1420 and 6 deer per square mile in WAA 1319; there would be no additional reduction in WAAs 1315 and 1318 (deer habitat capability in both would remain below original (1954) levels by 7 deer per square mile (Table WLD-25). Taking all land ownerships into account, modeled deer densities at stem exclusion would range from 6 to 15 deer per square mile depending on the WAA (53, 56, 71, and 86 of original amounts in WAAs 1420, 1315, 1319, and 1318, respectively; Table WLD-25). Reductions in deer habitat capability have the potential to reduce deer densities; however, foreseeable pre-commercial thinning projects would improve conditions for deer and would be expected to improve habitat capability. These improvements are not taken into account within the deer model. Thus, Alternative 1 has a low likelihood of resulting in local declines in deer habitat capability which could affect wolves, and thus hunters and trappers.

Wolves are highly mobile within their territories and some adjacent WAAs with higher deer densities would continue to support wolves in the vicinity of the project. Taking into account ongoing and foreseeable projects, deer habitat capability of the 10 core WAAs in the northwest and central portion of the North Central Prince of Wales biogeographic province (WAAs 1316, 1319, 1323, 1421, 1422, 1525, 1526, 1527, 1529, and 1531; see Wildlife Resource report for additional details) would collectively continue to support at least 18 deer per square (weighted average habitat capability of 19 deer per square mile at project completion [same as current amount] and 18 deer per square mile at stem exclusion; Table WLD-25). Individually, WAAs 1323, 1525, 1526, 1527, 1529, and 1531 would support at least 18 deer per square mile at stem exclusion. Deer habitat capability in the biogeographic province as a whole would remain at 15 deer per square mile at project completion, and would be reduced to 14 deer per square mile at stem exclusion. The presence of large, undisturbed blocks of habitat on Prince of Wales Island adjacent to the project area, including the Honker Divide large OGR complex (200,000+ acres) and the nearly 40,000-acre Karta Wilderness to the west and south, respectively, help assure

the persistence of wolf packs because these area support source populations capable of replacing wolves that periodically disappear from adjacent disturbed lands (Person et al. 1996, Person and Logan 2012).

Cumulative total road densities below 1,200 feet on Prince of Wales Island under Alternative 1 would be approximately 1.3 miles per square mile. Total road density below 1,200 feet would range from 1.6 to 2.7 miles per square mile within individual WAAs (Table WLD-26). Cumulative total road densities on Prince of Wales Island, taking all elevations into account, would be 1.1 miles per square mile under Alternative 1, ranging from 1.2 to 2.5 miles per square mile within the four project area WAAs. Cumulative road densities in all WAAs, except 1318, remain at a level beyond which increases in road density would not be expected to result in an increased risk of harvest (1.5 miles per square mile; Person and Russell 2008).

Table WLD-26. Cumulative Road Density on All Ownerships Below 1,200 Feet Elevation by Alternative

Island/WAA	Road Status[3/, 4/]	Road Density by Alternative (mile/mile^2)[1/, 2/]				
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	Open	2.10	2.12	2.15	2.11	2.10
	Closed	0.62	0.67	0.69	0.64	0.63
	Total	**2.72**	**2.79**	**2.84**	**2.75**	**2.73**
1318	Open	2.30	2.30	2.30	2.30	2.30
	Closed	0.14	0.16	0.16	0.15	0.15
	Total	**2.44**	**2.46**	**2.46**	**2.45**	**2.45**
1319	Open	0.86	0.91	0.91	0.87	0.87
	Closed	0.76	0.83	0.86	0.79	0.81
	Total	**1.63**	**1.74**	**1.77**	**1.66**	**1.68**
1420	Open	1.48	1.50	1.51	1.49	1.48
	Closed	0.96	0.97	0.99	0.96	0.96
	Total	**2.44**	**2.47**	**2.50**	**2.45**	**2.45**
Prince of Wales Island[5/]	Open	0.92	0.92	0.93	0.92	0.92
	Closed	0.38	0.39	0.40	0.39	0.39
	Total	**1.30**	**1.32**	**1.32**	**1.31**	**1.31**

1/ Includes all land ownerships (NFS lands and non-NFS).
2/ WAA 1315 incorporates reasonably foreseeable roads on state lands; WAA 1318 incorporates reasonably foreseeable National Forest roads related to the Control Lake project; WAA 1319 incorporates reasonably foreseeable National Forest roads related to the Control Lake project; and WAA 1420 incorporates reasonably foreseeable roads on state lands.
3/ Closed roads are defined as all NFS roads with Operating Maintenance Level = 1 plus all decommissioned NFS roads; open roads include all other NFS roads and all state and private roads.
4/ Note: all proposed System roads are treated as open roads; however, they will be closed within 1-5 years after harvest activities (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal from May 1 to November 30).
5/ Includes 18 Prince of Wales Island WAAs; does not include the adjacent island WAAs (e.g., Kosciusko, Heceta, Tuxekan, Dall, etc.).

Alternative 2

Direct and Indirect Effects

Timber harvest under Alternative 2 would result in an immediate reduction in modeled deer densities to 12 to 16 deer per square mile, depending on the WAA, ranging from 0 to 6 percent from existing amounts (Table WLD-23). This equates to a reduction of one deer per square mile from existing (2012) levels in WAAs 1315, 1318, and 1319; there would be a less than 1 deer per square mile reduction in WAA 1420. At stem exclusion, deer densities would further be reduced to 10 to 15 deer per square mile, depending on the WAA, though in part this would be due to the succession of previously harvested stands into the stem exclusion stage (Table WLD-23). Long-term reductions in deer habitat capability from existing (2012) amounts at the stem exclusion stage under Alternative 2 would be the greatest in WAA 1420 (17 percent), followed by WAAs 1315 (12 percent); no additional reduction in habitat capability would occur in WAAs 1318 and 1319 which would remain at 7 percent and 6 percent below current levels (Table WLD-23). This equates to a total reduction of two deer per square mile from existing (2012) levels in WAAs 1315 and 1420 and a less than 1 deer per square mile reduction in WAAs 1318 and 1319 under Alternative 2 (Table WLD-23). Thus, Alternative 2 has the potential to result in a local reduction in the wolf prey base and thus in the wolf density.

No commercial thinning of previously harvested stands is proposed under Alternative 2. Thus, habitat improvements in young growth potentially benefiting deer, and thus wolves, over the long-term would occur more slowly than under the other action alternatives.

Total road densities on NFS lands below 1,200 feet would range from 0.8 to 2.6 miles per square mile, depending on the WAA, under Alternative 2 (Table WLD-24). Increases would be greatest in WAA 1319, followed by WAAs 1315, 1318, and 1420. Total road density under 1,200 feet elevation for Prince of Wales Island would be 1.0 miles per square mile under Alternative 2, the same as current road density. Therefore, Alternative 2 would only locally increase human access in the project area.

No small OGR modifications are proposed under Alternative 2. Therefore there would be no associated effects to wolves.

Cumulative Effects

With implementation over the next decade, Alternative 2 in combination with past, ongoing and foreseeable projects would reduce modeled deer densities to 6 to 15 deer per square mile at project completion, depending on the WAA (53, 56, 71, and 86 percent of the original [1954] habitat capability in WAAs 1420, 1315, 1319, and 1318, respectively; Table WLD-25). Approximately 25 years after harvest, when harvested stands reach the stem exclusion stage, cumulative deer densities would range from 6 to 15 deer per square mile, depending on the WAA (47, 50, 71, and 86 percent of the original [1954] habitat capability in WAAs 1420, 1315, 1319, and 1318, respectively; Table WLD-25). Note that there would be no additional reduction in habitat capability following project completion in WAAs 1318 and 1319. This equates to a total cumulative reduction of 10 deer per square mile in WAA 1420, 8 deer per square mile in WAAs 1315, 6 deer per square mile in WAA 1319, and 1 deer per square mile in WAA 1318 (Table WLD-25). Thus, Alternative 2 may result in local declines in the deer population due to reduced habitat capability which could affect wolves, and thus hunters and trappers.

As described under Alternative 1, wolves are highly mobile within their territories and adjacent WAAs (see list of core WAAs in the northwest and central portion of the North Central Prince of Wales biogeographic province under Alternative 1) would collectively continue to support wolves in the vicinity of the project area under Alternative 2 by supporting a deer habitat capability of at least 18 deer per square mile. The weighted average habitat capability of these 10 WAAs would be 19 deer per square mile at project completion [same as current amount] and 18 deer per square mile at stem exclusion under Alternative 2 (Table WLD-25). Individually, WAAs 1323, 1525, 1526, 1527, 1529, and 1531 would support at least 18 deer per square mile at stem exclusion. Deer habitat capability in the biogeographic province as a whole would remain at 15 deer per square mile at project completion, and would be reduced to 14 deer per square mile at stem exclusion. The presence of large, undisturbed blocks of habitat on Prince of Wales Island adjacent to the project area (e.g., the Honker Divide large OGR and Karta Wilderness), help assure the persistence of wolf packs that may serve as source populations (see Alternative 1 discussion; Person et al. 1996, Person and Logan 2012).

Cumulative total road densities below 1,200 feet under Alternative 2 on Prince of Wales Island would be approximately 1.3 miles per square mile, ranging from 1.7 to 2.8 miles per square mile within individual project area WAAs (Table WLD-26). Cumulative total road densities on Prince of Wales Island, taking all elevations into account, would be approximately 1.1 miles per square mile under Alternative 2, ranging from 1.3 to 2.5 miles per square mile within individual project area WAAs (see Table WLD-22 in the Marten section). Alternative 2 would not be expected to affect wolf harvest rates (i.e., through increased access) in any project area WAAs because existing total cumulative road densities in WAAs 1315, 1319, and 1420 are already at a level beyond which additional increases would increase harvest risk (i.e., above 1.5 miles per square mile; Person and Russell 2008) and because the increase in WAA 1318 is minor (less than 0.1 mile per square mile; Table WLD-22).

Alternative 3

Direct and Indirect Effects

Timber harvest under Alternative 3 would result in an immediate reduction in modeled deer densities to 11 to 16 deer per square mile, depending on the WAA (Table WLD-23). This equates to a reduction of one deer per square mile from existing (2012) levels in all project area WAAs. At stem exclusion, deer densities would range from 10 to 15 deer per square mile, depending on the WAA, (Table WLD-23). Long-term reductions in deer habitat capability (at the stem exclusion stage) from existing (2012) amounts under Alternative 3 would be the greatest in WAA 1420 (17 percent), followed by WAA 1315 (12 percent) though in part this would be due to the succession of previously harvested stands into the stem exclusion stage; there would be no additional reduction in habitat capability in WAAs 1318 and 1319 which would remain 7 percent and 6 percent below existing levels, respectively. This equates to a total reduction of two deer per square mile from existing (2012) levels in WAAs 1315 and 1420 and one 1 deer per square mile reduction in WAAs 1318 and 1319 under Alternative 3 (Table WLD-23). Reductions in all WAAs under Alternative 3 would be the same as under Alternatives 2, 4, and 5; the same as Alternative 1 in WAAs 1318 and 1319; and slightly greater than Alternative 1 in

WAAs 1420 and 1315. Thus, Alternative 3 has the potential to result in a local reduction in the wolf prey base and thus potentially in the wolf density. These effects would be reduced to some extent because Alternative 3 would also result in the commercial thinning of 2,983 acres of young growth which would improve deer habitat quality by increasing forage availability (Hanley 2005).

Total road densities on NFS lands under 1,200 feet elevation would range from 0.8 to 2.6 miles per square mile, depending on the WAA, under Alternative 3 (Table WLD-24). Increases would be greatest in WAA 1315, followed by WAAs 1420, 1318, and 1319. Total road density under 1,200 feet elevation for Prince of Wales Island would remain at 1.0 miles per square mile under Alternative 3. Therefore, Alternative 3 would only locally increase human access in the project area, but more so than the other alternatives.

OGR modifications proposed under Alternative 3 would maintain or reduce inclusion of habitat suitable for wolf dens sites and other areas identified by the interagency review team (IRT) as being important to wolves (see Table OGR-2 and discussion in the Biodiversity discussion). With the exception of the small OGR in VCUS 5820 (Baird Peak) small OGR modifications under Alternative 3 would reduce inclusion of deep snow deer winter range (reduction of 1,401 acres) and low-elevation POG, which is indicative of higher value habitat (reduction of 2,909 acres). Harvest of these areas would reduce habitat capability for deer and thus the prey base for wolves. Additionally, with the exception of small OGRs in VCUs 5960 (Steelhead) and 5850 (Sandy Beach), inclusion of areas identified as being important for landscape connectivity would be reduced (see Table OGR-2 and discussion in the Biodiversity subsection). Future timber harvest and road building in these areas would have the potential to reduce the ability of wolves to move and disperse or increase the risk of harvest. However, areas relocated from existing small OGRs typically included areas of previous harvested and roads, traded for areas with fewer impacts (road miles and young growth acres). Thus in some cases this resulted in a tradeoff between inclusion of low-elevation POG/deer winter habitat and higher elevation areas with fewer acres of POG/deer winter habitat and young-growth and fewer roads.

Cumulative Effects

With implementation over the next decade, Alternative 3 in combination with past, ongoing, and foreseeable projects reduce modeled deer densities to 6 to 15 deer per square mile at project completion, depending on the WAA (53, 56, 71, and 86 percent of the original [1954] habitat capability in WAAs 1420, 1315,1319, and 1318, respectively; Table WLD-25). Approximately 25 years after harvest, when stands reach the stem exclusion stage, cumulative deer densities would range from 6 to 14 deer per square mile, depending on the WAA (47, 50, 66, and 86 percent of original [1954] habitat capability in WAAs 1420, 1315, 1319, and 1318, respectively; Table WLD-25). Note that there would be no additional reduction in habitat capability following project completion in WAA 1318. This equates to a cumulative reduction of 10 deer per square mile in WAA 1420, 8 deer per square mile in WAA 1315, 7 deer per square mile in WAA 1319, and 1 deer per square mile in WAA 1318 from original (1954) habitat capability (Table WLD-25). Thinning proposed under Alternative 3, in combination with ongoing and foreseeable thinning conducted various watershed restoration plan in the project area WAAs would mitigate these effects to some extent. However, Alternative 3 may result in local declines

in the deer population due to reduced habitat capability which could affect wolves, and thus hunters and trappers.

As described under Alternative 1, wolves are highly mobile within their territories and adjacent WAAs (see list of core WAAs in the northwest and central portion of the North Central Prince of Wales biogeographic province under Alternative 1) with higher deer densities would continue to collectively support wolves in the vicinity of the project under Alternative 3 by supporting a deer habitat capability of at least 18 deer per square mile (Table WLD-25). The weighted average habitat capability of these 10 WAAs would be 19 deer per square mile at project completion [same as current amount] and 18 deer per square mile at stem exclusion under Alternative 3 (Table WLD-25). Individually, WAAs 1323, 1525, 1526, 1527, 1529, and 1531 would support at least 18 deer per square mile at stem exclusion. Deer habitat capability in the biogeographic province as a whole would remain at 15 deer per square mile at project completion, and would be reduced to 14 deer per square mile at stem exclusion. The presence of large, undisturbed blocks of habitat on Prince of Wales Island adjacent to the project area (e.g., the Honker Divide large OGR and Karta Wilderness), help assure the persistence of wolf packs that may serve as source populations (see Alternative 1 discussion; Person et al. 1996, Person and Logan 2012).

Cumulative total road densities below 1,200 feet on Prince of Wales Island under Alternative 3 would be approximately 1.3 miles per square mile, ranging from 1.8 to 2.8 miles per square mile within individual project area WAAs (Table WLD-26). Cumulative total road densities on Prince of Wales Island, taking all elevations into account, would be 1.1 miles per square mile under Alternative 3, ranging from 1.3 to 2.6 miles per square mile within individual project area WAAs (see Table WLD-22 in the Marten discussion). Alternative 3 would not be expected to affect wolf harvest rates (i.e., through increased access) in any project area WAAs because existing total cumulative road densities in WAAs 1315, 1319, and 1420 are already at a level beyond which additional increases would increase harvest risk (i.e., above 1.5 miles per square mile; Person and Russell 2008) and because the increase in WAA 1318 is minor (approximately 0.1 mile per square mile; Table WLD-22).

Alternative 4

Direct and Indirect Effects

Effects to modeled deer densities, and thus the wolf prey base, under Alternative 4 would be the same as under Alternative 2 (Table WLD-23; see Alternative 2 discussion). Thus, Alternative 4 has the potential to result in a local reduction in the wolf prey base and thus potentially in wolf density; however, these effects would be reduced to some extent because Alternative 4 would also result in the commercial thinning of 2,585 acres of young-growth which would improve deer habitat quality.

Total road densities on NFS lands below 1,200 feet elevation would range from 0.8 to 2.6 miles per square mile, depending on the WAA, under Alternative 4 (Table WLD-24). Increases would be greatest in WAA 1315, followed by WAAs 1318/1420, and 1319. Total road density under 1,200 feet elevation for Prince of Wales Island would be 1.0 mile

per square mile under Alternative 4, the same as existing. Therefore, Alternative 4 would only locally increase human access in the project area.

Effects to wolves would be mitigated through the implementation of harvest prescriptions and modifications to OGRs proposed under Alternative 4 that increase inclusion of deer winter habitat or connectivity as compared to the other alternatives. The utilization of uneven-aged management (group selections) in the Phase 2 area (VCUs 5780 and 5971) and in some units on the fringes of the Honker large OGR complex would benefit wolves by creating edge habitats that deer prefer in proximity to areas of cover. Wolves would also directly benefit from small OGR modifications proposed under Alternative 4 in VCUs 5830 (Ratz Harbor), 5950 (Steelhead Drainage), 5960 (Control Lake), and 5972 (Angel Lake) which protect known wolf dens (although known wolf dens are already afforded protection by the 1,200-foot buffer under the Forest Plan Wolf standards and guidelines) or other wolf habitat as identified by the 2008/2011 IRT (see Biodiversity discussion above and Table OGR-2); OGR modifications proposed in other VCUs would increase inclusion of deer winter range (net increase of 912 acres) and areas identified as being important for landscape connectivity in the reserve system (net increase in 2,591 acres of low-elevation POG), and thus indirectly benefit wolves (see discussion under Deer and under Issue 2 above).

Cumulative Effects

Cumulative reductions in deer habitat capability under Alternative 4 would be the same as under Alternative 2 (see discussion under Alternative 2). Thus, Alternative 4 may result in local declines in the deer population due to reduced habitat capability which could affect wolves, and thus hunters and trappers. However, thinning proposed under Alternative 4, in combination with ongoing and foreseeable thinning conducted various watershed restoration plans would mitigate these effects to some extent. Adjacent WAAs (see Alternative 1 for a list of the core WAAs in the northwest and central portion of the North Central Prince of Wales biogeographic province) would continue to collectively support wolves in the vicinity of the project by supporting a deer habitat capability of at least 18 deer per square mile (Table WLD-25). The weighted average habitat capability of these 10 WAAs would be 19 deer per square mile at project completion [same as current amount] and 18 deer per square mile at stem exclusion under Alternative 4 (Table WLD-25). Individually, WAAs 1323, 1525, 1526, 1527, 1529, and 1531 would support at least 18 deer per square mile at stem exclusion. Deer habitat capability in the biogeographic province as a whole would remain at 15 deer per square mile at project completion, and would be reduced to 14 deer per square mile at stem exclusion. Additionally, the persistence of source wolf packs in the vicinity of the project area would continue to be maintained by large reserve areas (e.g., the Honker Divide large OGR and Karta Wilderness).

Cumulative total road densities below 1,200 feet on Prince of Wales Island under Alternative 4 would be approximately 1.3 miles per square mile, ranging from 1.7 to 2.7 miles per square mile within individual project area WAAs (Table WLD-26). Cumulative total road densities on Prince of Wales Island, taking all elevations into account, would be approximately 1.1 miles per square mile under Alternative 4, ranging from 1.2 to 2.5 miles per square mile within individual project area WAAs (see Table WLD-22 in the Marten discussion). Alternative 4 would not be expected to affect wolf harvest rates (i.e.,

through increased access) in any project area WAAs because existing total cumulative road densities in WAAs 1315, 1319, and 1420 are already at a level beyond which additional increases would increase harvest risk (i.e., above 1.5 miles per square mile; Person and Russell 2008) and because the increase in WAA 1318 is minor (less than 0.1 mile per square mile; Table WLD-22).

Alternative 5

Direct and Indirect Effects

Effects to modeled deer densities, and thus the wolf prey base, under Alternative 5 would be the same as under Alternative 3 (Table WLD-23; see Alternative 3 discussion). Thus, Alternative 5 has the potential to result in a local reduction in the wolf prey base and thus potentially in wolf density. However, these effects would be reduced to some extent because Alternative 5 would also result in the commercial thinning of 2,525 acres of young-growth which would improve deer habitat quality.

Total road densities on NFS lands under 1,200 feet elevation would range from 0.7 to 2.5 miles per square mile, depending on the WAA, under Alternative 5 (Table WLD-24). Increases would be greatest in WAA 1319, followed by WAAs 1318, and 1315/1420. Total road density under 1,200 feet elevation for Prince of Wales Island would be 1.0 miles per square mile under Alternative 5, the same as existing. Therefore, Alternative 5 would only locally increase human access in the project area.

No small OGR modifications are proposed under Alternative 5. Therefore there would be no associated effects to wolves.

Cumulative Effects

Cumulative reductions in deer habitat capability under Alternative 5 would be the same as under Alternative 4 (see discussion under Alternative 4). Thus, Alternative 5 may result in local declines in the deer population due to reduced habitat capability which could affect wolves, and thus hunters and trappers. However, thinning proposed under Alternative 5, in combination with ongoing and foreseeable thinning conducted various watershed restoration plans would mitigate these effects to some extent. Adjacent WAAs (see Alternative 1 for a list of core WAAs in the northwest and central portion of the North Central Prince of Wales biogeographic province) would continue to collectively support wolves in the vicinity of the project by supporting a deer habitat capability of at least 18 deer per square mile (Table WLD-25). The weighted average habitat capability of these 10 WAAs would be 19 deer per square mile at project completion [same as current amount] and 18 deer per square mile at stem exclusion under Alternative 5 (Table WLD-25). Individually, WAAs 1323, 1525, 1526, 1527, 1529, and 1531 would support at least 18 deer per square mile at stem exclusion. Deer habitat capability in the biogeographic province as a whole would remain at 15 deer per square mile at project completion, and would be reduced to 14 deer per square mile at stem exclusion. Additionally, the persistence of source wolf packs in the vicinity of the project area would continue to be maintained by large reserve areas (e.g., the Honker Divide large OGR and Karta Wilderness).

Cumulative total road densities below 1,200 feet on Prince of Wales Island under Alternative 5 would be approximately 1.3 miles per square mile, ranging from 1.7 to 2.7 miles per square mile within individual project area WAAs (Table WLD-26). Cumulative total road densities on Prince of Wales Island, taking all elevations into account, would be approximately 1.1 miles per square mile under Alternative 5, ranging from 1.3 to 2.5 miles per square mile within individual project area WAAs (see Table WLD-22 in the Marten discussion). Alternative 5 would not be expected to affect wolf harvest rates (i.e., through increased access) in any project area WAAs because existing total cumulative road densities in WAAs 1315, 1319, and 1420 are already at a level beyond which additional increases would increase harvest risk (i.e., above 1.5 miles per square mile; Person and Russell 2008) and because the increase in WAA 1318 is minor (less than 0.1 mile per square mile; Table WLD-22).

Conclusion

Effects to wolves from reductions in deer habitat capability would occur under all alternatives; however, none of the action alternatives would reduce deer habitat capability by more than 1 deer per square mile in any WAA. Taking only NFS lands into account, long-term (stem exclusion) deer habitat capability would be the same under all action alternatives. When taking both NFS and non-NFS lands into account deer habitat capability would be comparable under any of the alternatives, with differences between alternatives being no more than 1 deer per square mile (or a 5 percent difference in deer habitat capability) and in most cases less. None of the project area WAAs alone provide a habitat capability of 18 deer per square mile, generally considered under the Forest Plan to be sufficient to maintain sustainable wolf populations, taking into account hunting. Additional, project-related effects to deer habitat capability under the action alternatives, and reductions due to forest succession in previously harvested stands, have the potential to reduce the prey base for wolves. Accordingly, there would be some reduction in the ability of project area WAAs to maintain a sustainable wolf population, based on deer habitat capability alone. However, the Forest Plan standard and guideline was intended to apply at a broader scale. At the scale of the biogeographic province, the cumulative effect of all alternatives would be the maintenance of approximately 14 deer per square mile 25 years after harvest (at stem exclusion); within the 10 core WAAs in the north central portion of the biogeographic province habitat capability would be approximately 18 deer per square mile over this same time period. This indicates that regardless of the alternative selected, the ability of the larger area surrounding the project to maintain a sustainable wolf population would not change.

Benefits to wolves in the project area would be provided indirectly (by improving habitat for deer) through young-growth management. Alternatives 3, 4 and 5 would also result in the commercial thinning of young-growth acres which would improve deer habitat quality.

Cumulative road densities would increase under all action alternatives. Impacts to wolves related to increased human access along the road system would generally be greatest under Alternative 3, followed by Alternatives 2, 4, 5, and 1. Road densities in all project area WAAs (lands below 1,200 feet elevation) currently exceed the Forest Plan recommended level of 0.7 to 1.0 mile per square mile for managing harvest-related morality risk both when considering only NFS lands and all landownerships, except WAA 1318 for NFS

lands only. Further increases in road density have the potential to increase wolf harvest mortality risk; however, Person and Russell (2008) concluded that road densities above 1.5 miles per square mile (0.9 km/km^2) had little additional effect on harvest rates. Therefore, minor increases in road density under any of the alternatives would not be expected to substantially increase harvest risk because existing road densities in project area WAAs are either above this number, or increases in road density are minor. If wolf harvest levels appear unsustainable, ADF&G has the ability to implement a harvest cap in GMU 2.

American Marten

Direct and Indirect Effects – All Alternatives

Timber harvest has the potential to directly affect marten through disturbance which may displace individuals or adversely affect young. Through the removal of forest cover and old-growth ecosystem features such as decadent live trees and snags (POG), timber harvest would reduce the vertical and horizontal structural complexity important to marten in relation to prey access, denning and resting sites, escape from predation, and thermoregulation (Buskirk and Zielinski 1997; Hargis et al. 1999; Flynn and Schumacher 2001). Forest fragmentation resulting from timber harvest may also alter patterns of occupancy by marten (Thompson and Harestad 1994, Bissonette et al. 1997, Chapin et al 1998; see Table WLD-2 for a patch size analysis by alternative). Uneven-aged harvest would maintain a higher habitat value in harvested stands, compared to even-aged harvest, by maintaining some structural complexity (see Table WLD-22 for a comparison of alternatives by harvest prescription). Alternatives that result in the greatest reduction in deep snow marten habitat would be expected to have the greatest effects to marten. The greatest effects to marten under all alternatives would occur in WAA 1319 (Table WLD-27).

Table WLD-27. Impacts to Deep Snow Marten Habitat by WAA and by Alternative

WAA	Original (1954) acres	2012 acres		Acres Impacted and Percent Reduction from Existing[1/]									
		Acres	% Original	Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
1315	19,848	9,296	47%	0	NA	277	-3%	580	-6%	216	-2%	288	-3%
1318	10,917	7,600	70%	0	NA	343	-5%	402	-5%	212	-3%	302	-4%
1319	18,279	11,827	65%	0	NA	749	-6%	900	-8%	699	-6%	745	-6%
1420	10,157	3,176	31%	0	NA	116	-4%	424	-13%	81	-2%	184	-6%
Total						**1,485**		**2,306**		**1,208**		**1,519**	

1/ High volume POG (SD 5S, 5N, 6/7) at or below 800 ft elevation.

Increased human access associated with new roads may result in increased marten vulnerability to harvest, particularly along open roads (Flynn et al. 2004). All alternatives would increase road densities (Table WLD-28). However, it should be noted that roads proposed for this project are typically temporary, short spurs that lead to the harvest units; therefore they are not likely to be areas where trappers would target marten.

Table WLD-28. Road Density at All Elevations on NFS Lands Only after Implementation of the Alternatives

Island/WAA		Road Status[2/, 3/]	Road Density by Alternative (mile/mile^2)[1/]				
			Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	All Elevations	Open	0.94	0.96	1.01	0.95	0.94
		Closed	0.93	1.00	1.03	0.96	0.94
		Total	**1.87**	**1.96**	**2.04**	**1.91**	**1.87**
1318	All Elevations	Open	0.34	0.35	0.35	0.34	0.34
		Closed	0.14	0.17	0.17	0.16	0.15
		Total	**0.48**	**0.51**	**0.52**	**0.50**	**0.49**
1319	All Elevations	Open	0.61	0.64	0.65	0.61	0.62
		Closed	0.58	0.63	0.65	0.60	0.61
		Total	**1.19**	**1.28**	**1.30**	**1.21**	**1.23**
1420	All Elevations	Open	1.00	1.02	1.02	1.01	1.00
		Closed	0.74	0.77	0.78	0.76	0.77
		Total	**1.74**	**1.79**	**1.81**	**1.77**	**1.78**

1/ Includes only NFS lands.
2/ Closed roads are defined as all NFS roads with Operating Maintenance Level = 1 plus all decommissioned NFS roads; open roads include all other NFS roads and all state and private roads. All proposed System roads are treated as open roads; however, they will be closed within 1-5 years after harvest (for 1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal from May 1 to November 30).

Marten were chosen as one of the design species in 1997 Forest Plan because they exhibit a consistent close association with mature forests throughout their distributional range (Sturtevant et al. 1996). Under the current Forest Plan, the marten population are supported by the conservation strategy which works to maintain mature forest cover and coarse woody debris to provide structure important to marten for resting, denning, escape from predators, trapping refugia, and facilitate marten dispersal (see the discussion of OGR modifications under Alternatives 3 and 4 below).

Cumulative Effects – All Alternatives

Between 31 and 70 percent of the original (1954) deep snow marten habitat remains within the project area WAAs (Table WLD-29). The Big Thorne Project would result in additional reductions in deep snow marten habitat, contributing to similar effects resulting from on-going and foreseeable timber harvest projects on NFS, state, and private lands.

The greatest cumulative reductions under all alternatives would occur in WAA 1420, followed by WAAs 1315, 1319, and 1318 (Table WLD-29). Given the sensitivity of marten to changes in habitat, there has likely already been some change in marten distribution in these WAAs due to the lack of connectivity. Young-growth stands also lack large hollow trees and root masses important for denning, though these features would be protected in harvested stands to some extent on NFS lands through implementation of the Legacy standard and guideline, which is intended to provide for the habitat needs of marten (developed for the 2008 Forest Plan to replace the original marten habitat standard and guideline) across the Tongass. Further reductions in habitat could locally reduce the capacity of the area to support marten over the long-term (Flynn and Schumacher 1997). The Forest Plan conservation strategy as a whole will continue to be critical in maintaining a sustainable marten population in the project area WAAs.

Table WLD-29. Cumulative Effects to Deep Snow Marten Habitat by WAA and by Alternative

WAA	1954 acres	2012 acres	% Original	Percent Original (1954) Deep Snow Habitat Remaining[1/, 2/]				
				Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	19,848	9,296	47	44	43	41	43	43
1318	10,917	7,600	70	70	66	66	68	67
1319	18,279	11,827	65	65	61	60	61	61
1420	10,157	3,176	31	31	30	27	30	29

1/ High volume POG (SD 5S, 5N, 6/7) at or below 800 ft elevation.
2/ WAA 1315 incorporates reasonably foreseeable harvest on state lands and misc. National Forest harvest; WAA 1318 incorporates reasonably foreseeable National Forest harvest (Control Lake project and misc. projects); WAA 1319 incorporates reasonably foreseeable National Forest harvest (Control Lake project and misc. projects); and WAA 1420 incorporates reasonably foreseeable harvest on state lands and misc. National Forest harvest.

The project area has an extensive road system and new roads associated with the Big Thorne Project as well as other forest management projects (see Chapter 2) would contribute to potential issues associated with human access and overexploitation of marten along the road system (Table WLD-30). However, implementation of the Prince of Wales Island ATM as well as the temporary nature of some project roads and closure and storage of all project system roads within 1 to 5 years after completion of timber harvest activities will mitigate these effects to some extent (note that for 1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal from May 1 to November 30). Projected total road densities under the Prince of Wales ATM are 1.9 miles per square mile in WAA 1315, 1.8 miles per square mile in WAAs 1318 and 1420, and 1.0 mile per square mile in WAA 1319 Though it should be noted that there are some differences in how road densities listed in the POW ATM were calculated compared to this analysis. There is no road density threshold for marten under the Forest Plan. Moreover, it is not road density per se that is important to marten but rather the availability of roadless refugia (Flynn et al. 2007). The existing roadless refugia (i.e., roadless areas, unroaded portions of OGRs, wilderness) in the project area WAAs would be maintained or enhanced under all alternatives (see discussion of small OGR modifications under Alternatives 3 and 4 below).

Table WLD-30. Cumulative Road Density on All Ownerships at All Elevations by Alternative

Island/WAA	Elevation	Road Status[3/, 4/]	Road Density by Alternative (mile/mile^2)[1/, 2/]				
			Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	All elevations	Open	1.86	1.92	1.94	1.91	1.90
		Closed	0.59	0.59	0.61	0.57	0.56
		Total	**2.46**	**2.51**	**2.55**	**2.48**	**2.46**
1318	All elevations	Open	1.79	1.79	1.79	1.79	1.79
		Closed	0.11	0.12	0.12	0.11	0.11
		Total	**1.89**	**1.91**	**1.91**	**1.90**	**1.90**
1319	All elevations	Open	0.64	0.68	0.68	0.64	0.65
		Closed	0.57	0.63	0.65	0.59	0.61
		Total	**1.21**	**1.30**	**1.32**	**1.24**	**1.25**
1420	All elevations	Open	1.10	1.12	1.12	1.10	1.10
		Closed	0.67	0.70	0.71	0.69	0.67
		Total	**1.77**	**1.81**	**1.83**	**1.80**	**1.78**

1/ Includes all land ownerships (NFS lands and non-NFS).
2/ WAA 1315 incorporates reasonably foreseeable roads on state lands; WAA 1318 incorporates reasonably foreseeable National Forest roads related to the Control Lake project; WAA 1319 incorporates reasonably foreseeable National Forest roads related to the Control Lake project; and WAA 1420 incorporates reasonably foreseeable roads on state lands.
3/ Closed roads are defined as all NFS roads with Operating Maintenance Level = 1 plus all decommissioned NFS roads; open roads include all other NFS roads and all state and private roads.
4/ Note: all proposed System roads are treated as open roads; however, they will be closed within 1-5 years after harvest (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal from May 1 to November 30).

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effects to marten because no timber harvest or road building would occur. However, indirectly because no commercial thinning would occur under Alternative 1, managed stands would continue to grow slowly and would provide little forage or structural diversity for marten during the stem exclusion stage, which may last for decades.

No small OGR modifications are proposed under Alternative 1. Therefore, there would be no associated connectivity or other effects to marten.

Cumulative Effects

Alternative 1 does not propose timber harvest or road building and therefore would not contribute to cumulative effects to marten. Taking into account past, ongoing, and foreseeable projects, deep snow marten habitat would be maintained at between 31 and 70 percent of the original (1954) levels under Alternative 1, depending on the WAA (Table WLD-29). The POW ATM would be implemented under Alternative 1 which would decrease the number of open roads on the landscape, thereby reducing hunter access and associated trapping pressure. However, presence of large, undisturbed blocks of habitat on Prince of Wales Island adjacent to the project area (e.g., the Honker Divide large OGR and Karta Wilderness) would contribute to the maintenance of a sustainable marten population.

Alternative 2

Direct and Indirect Effects

Alternative 2 would harvest 1,485 total acres of deep snow marten habitat, resulting in a decrease ranging from 3 to 6 percent from the existing amount depending on the WAA (Table WLD-27). Effects would be greatest in WAA 1420, followed by WAAs 1315, 1319, and 1318. However, because no commercial thinning would occur under Alternative 2, there would be no long-term benefits associated with the promotion of stand development toward a stage providing suitable marten habitat. Reductions in deep snow marten habitat under Alternative 2 may result in localized reductions the capability of the remaining habitat to support marten.

Alternative 2 would increase total road density on NFS lands to between 0.5 mile per square mile (WAA 1318) and 2.0 miles per square mile (WAA 1315) and thus would indirectly increase hunter access and associated trapping pressure (Table WLD-28). However, the actual increases due to the project would be small (approximately 0.1 mile per square mile or less) and 60 percent of the roads constructed under Alternative 2 would be temporary, which would limit this effect because they will be decommissioned after harvest activities.

No small OGR modifications are proposed under Alternative 2. Therefore, there would be no connectivity or other associated effects to marten.

Cumulative Effects

Under Alternative 2 the Big Thorne Project in combination with past, ongoing, and foreseeable projects would reduce deep snow marten habitat to between 30 and 66 percent of the original (1954) levels, depending on the WAA (Table WLD-29). Cumulative reductions in habitat would be greatest in WAA 1420, followed by WAAs 1315, 1319, and 1318, respectively. Cumulative reduction in marten deer snow winter habitat may result in localized declines in marten densities or gaps in distributions. However, presence of large, undisturbed blocks of habitat on Prince of Wales Island adjacent to the project area (e.g., the Honker Divide large OGR and Karta Wilderness), help assure the persistence of a sustainable marten population in the project area WAAs.

Cumulative total road densities (all land ownerships) under Alternative 2 would range from 1.3 (WAA 1319) to 2.5 (WAAs 1315) miles per square mile (Table WLD-30). The POW ATM would be implemented under Alternative 2 which would decrease the number of open roads on the landscape, thereby reducing hunter access and associated trapping pressure.

Alternative 3

Direct and Indirect Effects

Alternative 3 would harvest 2,306 total acres of deep snow marten habitat, the most of any alternative, resulting in a decrease ranging from 5 to 13 percent from the existing amount depending on the WAA (Table WLD-27). Effects would be greatest in WAA 1420, followed by WAAs 1319, 1315, and 1318, respectively. Reductions in deep snow marten habitat under Alternative 3 may result in localized reductions the capability of the

remaining habitat to support marten. This would be mitigated to some extent through the commercial thinning of approximately 2,572 acres under Alternative 3, which would have long-term benefits associated with the promotion of stand development toward a stage providing suitable marten habitat.

Alternative 3 would increase total road density on NFS lands to between 0.5 mile per square mile (WAA 1318) and 2.0 miles per square mile (WAA 1315; Table WLD-28), the most among the alternatives, and thus would indirectly increase hunter access and associated trapping pressure. Increases under Alternative 3 would range from less than 0.1 to 0.2 miles per square mile. However, 69 percent of roads constructed under Alternative 3 would be temporary, which would limit this effect because they will be decommissioned after harvest activities (Table 2-1).

Small OGR modifications under Alternative 3 would directly affect marten by reducing inclusion of deep snow marten habitat in all VCUs except VCU 5820 (a total reduction of 1,401 acres; Table OGR-2). Modifications would also reduce inclusion of Class I streams in the reserve system (representative of riparian habitat for marten prey) in all VCUs except VCU 5820 and 5950; though in some cases this was a tradeoff for including OGR acres that contained less young-growth forest or fewer roads (Table OGR-2). Indirectly, small OGR modifications would affect functional connectivity between reserves. Assuming the mean minimum travel distance for marten of 8 miles (13 km) reported by Flynn (1991 as cited in Flynn and Schumacher 2001; note that the mean maximum travel distance reported in this study was 12 miles [20 km] and that travel distances of up to 39 miles [65 km] have been documented), and that corridors through POG are optimal, functional connectivity between OGRs in the project area for marten under Alternative 3 would be as follows:

- Small OGRs in VCUs 5790, 5800, and 5840 would remain functionally connected to each other and to the Honker large OGR complex via VCU 5790 though now only through a narrow connection; the connection through VCU 5780 and the connection between VCU 5840 and the beach now would be available for timber which would reduce the suitability of these areas for marten travel corridors;
- The small OGR in VCU 5950 would remain functionally connected (only through non-Federal land) to the Honker large OGR complex (though proposed harvest units in the area made available due to the OGR modifications would reduce this connection), and to the small OGR in VCU 5940 (through roadless);
- Small OGRs in 5960 and 5972 would remain functionally connected to large reserves (Honker large OGR complex and/or Karta Wilderness) and to each other (through the Karta Wilderness). Small OGR modifications in VCU 5972 would make some acres available for timber harvest;
- Small OGRs in adjacent VCUs 5820/5830 would remain functionally connected to each other and (via VCU 5820) to the northern piece of the small OGR in VCU 5810 and then to the small OGR in VCU 5720; connectivity would be improved with the addition of small OGR acreage between reserves in VCUs 5810 and 5820. The OGR modifications in these VCUs have made acres available for timber harvest;

- The southern piece of the small OGR in VCU 5810 would remain functionally connected (through roadless) to the Honker large OGR in VCUs 5740 and 5750; Small OGR modifications in VCU 5810 would make some acres available for timber harvest; and
- Small OGRs in adjacent VCUs 5850/5860 would remain functionally connected to each other but would no longer be connected to the small OGR in VCU 5840 due to the presence of harvest units south of Sal Creek and near Sandy Beach. The OGR modifications in these VCUs would make acres available for timber harvest.

Cumulative Effects

Under Alternative 3, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would reduce deep snow marten habitat to between 27 and 66 percent of the original (1954) levels depending on the WAA, the least among the alternatives (Table WLD-29). Cumulative effects would be greatest in WAA 1420, followed by WAAs 1315, 1319, and 1318, respectively. Cumulative reduction in marten deer snow winter habitat may result in localized declines in marten densities, and thus local gaps in marten distribution, particularly in WAA 1420 where less than a third of the original habitat remains. However, the presence of large, undisturbed blocks of habitat on Prince of Wales Island adjacent to the project area (e.g., the Honker Divide large OGR and Karta Wilderness), help assure the persistence of a sustainable marten population in the project area WAAs.

Cumulative road densities (all land ownerships) under Alternative 3 would range from 1.3 (WAA 1319) to 2.6 (WAAs 1315) miles per square mile (Table WLD-30). The POW ATM would be implemented under Alternative 3 which would decrease the number of open roads on the landscape, thereby reducing hunter access and associated trapping pressure.

Alternative 4

Direct and Indirect Effects

Alternative 4 would harvest 1,208 total acres of deep snow marten habitat, the least of any action alternative, resulting in a decrease ranging from 2 to 6 percent from the existing amount depending on the WAA (Table WLD-27). Effects would be greatest in WAA 1319, followed by WAAs 1318, 1420/1315. Reductions in deep snow marten habitat under Alternative 4 may result in localized reductions the capability of the remaining habitat to support marten. This would be mitigated to some extent through the commercial thinning of approximately 2,161 acres under Alternative 4, which would have long-term benefits associated with the promotion of stand development toward a stage providing suitable marten habitat.

Alternative 4 would increase total road density on NFS lands to between 0.5 mile per square mile (WAA 1318) and 1.9 miles per square mile (WAA 1315; Table WLD-28), the second least among the action alternatives, and thus would indirectly increase hunter access and associated trapping pressure. However, 87 percent of roads constructed under Alternative 4 would be temporary, which would limit this effect because they will be decommissioned after harvest activities.

Small OGR modifications under Alternative 4 would directly affect marten by increasing inclusion of deep snow marten habitat (total increase of 912 acres) and Class I streams (representative of riparian habitats) in all VCUs except 5820 and 5830 (Table OGR-2). They would also increase the inclusion of the largest contiguous blocks of habitat and old-growth travel corridors, which are important to marten. Collectively these modifications would reduce the amount of marten habitat available for harvest. Indirectly, small OGR modifications would affect functional connectivity between reserves. Assuming the minimum travel distance for marten of 8 miles (13 km) reported by Flynn (1991 as cited in Flynn and Schumacher 2001; note that the mean maximum travel distance reported in this study was 12 miles [20 km] and that travel distances of up to 39 miles [65 km] have been documented), and that corridors through POG are optimal, functional connectivity between OGRs in the project area for marten under Alternative 4 would be as follows:

- Small OGRs in VCUs 5790, 5800, and 5840 would remain functionally connected to each other and to the Honker large OGR complex via VCUs 5780 and 5790 and connectivity to the large OGR would be enhanced through a direct connection provided by the addition of OGR acreage in VCU 5780;
- The small OGR in VCU 5950 would remain functionally connected (only through non-Federal land) to the Honker large OGR and to the small OGR in VCU 5940; OGR modifications in VCU 5950 would enhance connectivity through greater inclusion of the POG travel corridor;
- Small OGRs in 5960 and 5972 would remain functionally connected to large reserves (Honker large OGR complex and/or Karta Wilderness) and to each other (through the Karta Wilderness) though through a different route;
- Small OGRs in adjacent VCUs 5820/5830 would remain functionally connected to each other and (via VCU 5820) to the northern piece of the small OGR in VCU 5810 and then the small OGR in VCU 5720; connectivity would be enhanced through the addition of small OGR acreage between reserves in VCUs 5810 and 5820;
- The southern piece of the small OGR in VCU 5810 would remain functionally connected (through the roadless) to the Honker large OGR in VCUs 5740 and 5750; and
- Small OGRs in adjacent VCUs 5850/5860 would remain functionally connected but connectivity to the small OGR in VCU 5840 would be reduced due to the presence of harvest units south of Sal Creek.

Cumulative Effects

Under Alternative 4, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would reduce deep snow marten habitat to between 31 and 67 percent of the original levels (Table WLD-29). Cumulative reductions in marten habitat would be greatest in WAA 1420, followed by WAAs 1315, 1319, and 1318, respectively. Cumulative reduction in marten deer snow winter habitat may result in localized declines in marten densities, and thus local gaps in marten distribution, particularly in WAA 1420 where only a third of the original habitat would. However, presence of large, undisturbed blocks of habitat on Prince of Wales Island adjacent to the project area (e.g., the Honker

Divide large OGR and Karta Wilderness), help assure the persistence of a sustainable marten population in the project area WAAs.

Cumulative road densities (all land ownerships and at all elevations) under Alternative 4 would range from 1.24 (WAA 1319) to 2.48 (WAAs 1315) miles per square mile (Table WLD-30). The POW ATM would be implemented under Alternative 4 which would decrease the number of open roads on the landscape, thereby reducing hunter access and associated trapping pressure.

Alternative 5

Direct and Indirect Effects

Alternative 5 would harvest 1,519 total acres of deep snow marten habitat, resulting in a decrease ranging from 2 percent to 6 percent from the existing amount depending on the WAA (Table WLD-27). The magnitude of effects under Alternative 5 would fall between Alternatives 2 and 4. Effects under Alternative 5 would be greatest in WAA 1420/1319, followed by WAAs 1318 and 1315, respectively. Reductions in deep snow marten habitat under Alternative 5 may result in localized reductions the capability of the remaining habitat to support marten. This would be mitigated to some extent through the commercial thinning of approximately 2,081 acres under Alternative 5, which would have long-term benefits associated with the promotion of stand development toward a stage providing suitable marten habitat.

Alternative 5 would increase total road density on NFS lands to between 0.5 mile per square mile (WAA 1315) and 1.9 miles per square mile (WAA 1315; Table WLD-28), the least among the action alternatives, and thus would indirectly increase hunter access and associated trapping pressure. However, 91 percent of roads constructed under Alternative 5 would be temporary, which would limit this effect because they will be decommissioned after harvest activities.

No small OGR modifications are proposed under Alternative 5. Therefore there would be no connectivity or other associated effects to marten.

Cumulative Effects

Under Alternative 5, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would reduce deep snow marten habitat to between 29 and 67 percent of the original levels (Table WLD-29). Cumulative effects would be greatest in WAA 1420, followed by WAAs 1315, 1319, and 1318, respectively. Cumulative reduction in marten deer snow winter habitat may result in localized declines in marten densities, and thus local gaps in marten distribution, particularly in WAA 1420 where only a third of the original habitat would. However, presence of large, undisturbed blocks of habitat on Prince of Wales Island adjacent to the project area (e.g., the Honker Divide large OGR and Karta Wilderness), help assure the persistence of a sustainable marten population in the project area WAAs.

Cumulative road densities (all land ownerships) under Alternative 5 would range from 1.3 (WAA 1319) to 2.5 (WAA 1315) miles per square mile (Table WLD-30). The POW ATM would be implemented under Alternative 5 which would decrease the number of

open roads on the landscape, thereby reducing hunter access and associated trapping pressure.

Conclusion

Loss of marten deep snow winter habitat could locally reduce the capacity of the area to support marten over the long-term (Flynn and Schumacher 1997). This is most likely in VCU 1420, where currently only 31 percent of the original deep snow marten habitat remains, with minor reductions (1 to 4 percent) occurring under each of the action alternatives. All of the alternatives would increase road densities which would indirectly affect marten by providing greater access for trapping and thus result in more demand on the marten population. However, all new and reconstructed roads under all alternatives would be closed within 1 to 5 years of timber harvest activities completion (i.e., 1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal from May 1 to November 30). Functional connectivity for marten between OGRs would be maintained under Alternatives 1, 2, and 5. Small OGR modifications under Alternative 3 would reduce functional connectivity between the Honker large OGR and small OGRs in VCUs 5790, 5800, and 5840 and between small OGRs in VCUs 5850 and 5840; modifications in other VCUs would maintain the existing level of connectivity. Small OGR modifications under Alternative 3 would also reduce the amount of deep snow marten habitat included in the reserve system. Small OGR modifications under Alternative 4 would maintain or enhance functional connectivity in all VCUs, except in VCU 5850; they would also increase the amount of deep snow marten habitat included in the reserve system. Effects to marten would be greatest under Alternative 3, followed by Alternatives 2, 5, 4, and 1.

Black Bear

Direct and Indirect Effects – All Alternatives

Preferred habitats for black bears, which include coastal, estuarine, and riparian areas, are protected by the Forest Plan conservation strategy. Therefore, none of the alternatives are expected to substantially affect black bear habitat (see discussions under Alternatives 3 and 4 pertaining to small OGR modifications). However, timber harvest has the potential to adversely affect black bears through activities that create noise or disturbance. There are no known black bear dens within any of the proposed harvest units. For known den sites within the project area close to harvest units, a 300-foot buffer was applied to minimize disturbance and to maintain known denning sites.

Timber harvest would increase forage availability for black bears over the short-term in the resulting early-successional plant communities. However, this food source typically lasts about 25 years post-logging in association with canopy closure. Over the long-term, timber harvest would decrease habitat suitability for black bears, due to the reduced understory forage in young-growth stands and loss of denning habitat in upland areas (e.g., large woody structures such as hollow logs and hollow living trees; Davies et al. 2012). Under all alternatives, direct impacts would be greatest in WAA 1319 where the most timber harvest is proposed (Table WLD-31).

Timber harvest projects may also indirectly increase the susceptibility of black bears to over-harvest if road access is increased or improved. Although there is no road density threshold for black bears, it can be assumed that an increase in open roads, particularly in open habitats such as clearcuts, muskegs, and alpine areas, where bears forage and are easier to see, increases the potential for human-bear interactions. The amount of road access, quantified in terms of the amount of road construction and reconstruction proposed under each alternative, is representative of the potential for over-hunting (USDA Forest Service 2008b). Under all alternatives, the potential for increased hunter access would be greatest in WAA 1319 where the most roads are proposed.

Table WLD-31. Productive Old-growth Harvest by WAA under each Alternative

WAA	Original (1954) Acres	2011		Acres Impacted and Percent Reduction from Existing				
		Acres	% Original	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
1315	53,586	27,676	52	0	1,159 (-4%)	1,699 (-6%)	783 (-3%)	1,073 (-4%)
1318	45,408	32,286	71	0	699 (-2%)	807 (-2%)	483 (-1%)	623 (-2%)
1319	61,677	47,444	77	0	2,050 (-4%)	2,808 (-6%)	2,039 (-4%)	2,199 (-5%)
1420	32,071	18,027	56	0	883 (-5%)	1,382 (-8%)	804 (-4%)	953 (-5%)
			Total	**0**	**4,792**	**6,696**	**4,109**	**4,848**

Cumulative Effects – All Alternatives

Cumulative POG harvest under the action alternatives would reduce the percent of original (1954) POG remaining within the project area WAAs (Table WLD-32). Under all alternatives, cumulative reductions in habitat would be greatest in WAA 1315, followed by WAAs 1420, 1318, and 1319, respectively. This would contribute to similar effects resulting from ongoing and foreseeable harvest on NFS, state, and private lands. After timber harvest there would be a short-term (about 25 years) increase in the forage availability for bears, which may result in short-term population growth (Porter 2008). However, over the long-term (25-150 years), as the forest canopy fills, forage species would be reduced. This reduction in forage production may reduce carrying capacity for bears (Porter 2008). A main area of concern on Prince of Wales Island continues to be whether long-term bear carrying capacity can be maintained in the face of additional timber harvest and the transition of harvested stands to the stem exclusion stage which can last up to 150 years or more (Porter 2008). Young-growth stands generally lack large hollow trees and root masses important for denning, though these features would be protected in harvested stands to some extent on NFS lands under the Forest Plan. Commercial thinning under Alternatives 3, 4, and 5, in combination with thinning of young-growth stands on NFS lands (under the Luck Lake/Eagle Creek and North Thorne River watershed restoration plans) would improve habitat conditions for black bears over the short-term by increasing the period during which forage is available and over the long-term promote the development of larger trees which could provide suitable den sites.

Table WLD-32. Cumulative POG Harvest by WAA

WAA	1954 Acres	2012 Acres	% Original	Cumulative Percent Original (1954) POG Remaining[1/]				
				Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	53,586	27,676	52	50	48	47	48	48
1318	45,408	32,286	71	71	69	69	70	70
1319	61,677	47,444	77	76	73	72	73	73
1420	32,071	18,027	56	56	53	52	53	53

1/ WAA 1315 incorporates reasonably foreseeable harvest on state lands and misc. National Forest harvest; WAA 1318 incorporates reasonably foreseeable National Forest harvest (Control Lake project and misc. projects); WAA 1319 incorporates reasonably foreseeable National Forest harvest (Control Lake project and misc. projects); and WAA 1420 incorporates reasonably foreseeable harvest on state lands and misc.

Road building associated with past timber harvest in the project area WAAs has resulted in some of the highest road densities in Southeast Alaska. Cumulative total road densities on all land ownerships would increase under all alternatives, and would be greatest in WAA 1315, followed by WAAs 1420, 1319, and 1318, respectively (Table WLD-30). Increased harvest of bears due to human access along roads would be mitigated to some extent through the closure of system roads within 1 to 5 years of completion of timber sale activities (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal from May 1 to November 30 (see Transportation section for additional detail). Other timber harvest projects on NFS and state lands that involve road construction also have the potential to result in road-related effects to black bears. However, in the foreseeable future, additional road storage and decommissioning would occur with implementation of the Prince of Wales ATM, as funding allows. Projected total road densities (all lands) under the Prince of Wales ATM are 1.9 miles per square mile in WAA 1315, 1.8 miles per square mile in WAAs 1318 and 1420, and 1.0 mile per square mile in WAA 1319.

Alternative 1

Direct and Indirect Effects

Under Alternative 1, no timber would be harvested and new roads would be constructed or reconstructed; therefore, this alternative would have no direct effects to black bears. However, overtime the existing early-successional stands would mature, reducing forage availability for black bears. Alternative 1 would also not have the beneficial effect of commercial thinning which would improve forage availability in young-growth stands for black bears.

Hunter access would not change as a result of the project, with total NFS road miles (open and closed) ranging from 43 miles in VCU 1315 to 192 miles in VCU 1420. Road densities in the project area WAAs would remain at 0.5 to 1.9 miles per square mile (Table WLD-28). Therefore no increase in human access would occur.

No small OGR modifications are proposed under Alternative 1. Values provided to black bears provided by the current OGRs are described in the affected environment section. Therefore there would be no associated effects to black bears.

Cumulative Effects

Alternative 1 would not harvest POG or result in additional roads, and therefore would not contribute to cumulative effects to black bears. Taking into account past, ongoing, and foreseeable projects Alternative 1 would maintain 50 to 76 percent of the original (1954)

POG within the project area WAAs (Table WLD-32). Although Alternative 1 would not contribute to the benefits of commercial thinning, pre-commercial thinning associated with the Tongass PCT program and other forest restoration projects would benefit black bears through increased forage availability in young-growth stands.

Cumulative total road densities (all landownerships) in the project area WAAs would range from 1.2 to 2.5 miles per square mile (Table WLD-30). Alternative 1 would not contribute to an increase in harvest of bears.

Alternative 2

Direct and Indirect Effects

Under Alternative 2, approximately 4,792 total acres of POG would be harvested, resulting in a reduction of 2 to 5 percent from existing conditions depending on the WAA (Table WLD-31). This would decrease forage availability for bears over the long-term. Effects would be greatest in WAA 1420 followed by WAAs 1315/1319 and 1318, respectively. Although Alternative 2 would not contribute to the benefits of commercial thinning, pre-commercial thinning associated under the Tongass PCT program and other forest restoration projects would benefit black bears through increased forage availability.

Under Alternative 2, 43 miles of roads would be constructed and 20 miles would be reconstructed (Table 2-1). Road densities in the project area WAAs would range from 0.5 to 2.0 miles per square mile (Table WLD-28). Thus, Alternative 3 would only locally increase human access in the project area WAAs.

No small OGR modifications are proposed under Alternative 2. Therefore, there would be no associated effects to black bears.

Cumulative Effects

Under Alternative 2, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively maintain between 48 and 73 percent of the original (1954) POG within the project area WAAs (Table WLD-32). Thus, Alternative 2 may result in local declines in black bear carrying capacity, and thus in the black bear population, due to reduced forage availability. Although Alternative 2 would not contribute to the benefits of commercial thinning, pre-commercial thinning associated with the Tongass PCT program and other forest restoration projects would benefit black bears through increased forage availability.

Cumulative total road density (all land ownerships) in the project area WAAs would range from 1.3 to 2.5 miles per square mile (Table WLD-30). Because all project area roads would be closed within 1 to 5 years of timber harvest (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal from May 1 to November 30), Alternative 2 would not be expected to substantially affect the harvest of black bears. Thus, Alternative 2 may result in local declines in the black bear population over the long-term.

Alternative 3

Direct and Indirect Effects

Under Alternative 3, approximately 6,696 total acres of POG would be harvested, the most among the action alternatives, resulting in a reduction of 2 to 8 percent from existing conditions by WAA (Table WLD-31). This would decrease forage availability for bears over the long-term. However, thinning of approximately 2,572 acres under Alternative 3 would extend the time during which forage is available in young-growth stands for black bears.

Under Alternative 3, 66 miles of roads would be constructed and 48 miles would be reconstructed, the most among the action alternatives (Table 2-1). Road densities in the project area WAAs would range from 0.5 to 2.0 miles per square mile (Table WLD-28). Thus, Alternative 3 would only locally increase human access in the project area WAAs.

Small OGR modifications proposed under Alternative 3 would not affect black bears. Values provided to black bears by the current OGRs are described in the affected environment section. Connectivity to beach, estuary, and shoreline habitats would continue to be provided by the Forest Plan conservation strategy.

Cumulative Effects

Under Alternative 3, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively maintain between 47 and 72 percent of the original (1954) POG within the project area WAAs (Table WLD-32). Thus, Alternative 3 may result in local declines in black bear carrying capacity, and thus in the black bear population, due to reduced forage availability. Commercial thinning under Alternative 3 would contribute to the beneficial effects to black bear habitat associated with ongoing and foreseeable young-growth management (PCT) and riparian thinning on NFS lands.

Cumulative total road density (all land ownerships) in the project area WAAs would range from 1.3 to 2.6 miles per square mile (WLD-30). Because all project area roads would be closed within 1 to 5 years of timber harvest (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal from May 1 to November 30), Alternative 3 would not be expected to substantially affect the harvest of black bears.

Small OGR modifications proposed under Alternative 3 would generally reduce connectivity to shoreline and riparian habitats preferred by black bears; though these habitats are protected by the Forest Plan conservation strategy. However, riparian thinning conducted under the Cobble Watershed (Ratz and Cobble creeks), Luck Creek/Eagle Creek, and North Thorne watershed restoration plans would improve black bear habitat in the VCUs where the small OGR modifications are proposed.

Alternative 4

Direct and Indirect Effects

Under Alternative 4, approximately 4,109 total acres of POG would be harvested, the least among the alternatives, resulting in a reduction of 1 to 4 percent from existing conditions by WAA (Table WLD-31). This would decrease forage availability for bears over the

long-term. However, thinning of approximately 2,161 acres under Alternative 4 would extend the time during which forage is available in young-growth stands for black bears.

Under Alternative 4, 26 miles of roads would be constructed and 25 miles would be reconstructed, the least among the action alternatives (Table 2-1). Road densities in the project area WAAs would range from 0.5 to 1.9 miles per square mile (Table WLD-28). With this minor increase, Alternative 4 would only locally increase human access in the project area WAAs.

Small OGR modifications proposed under Alternative 4 would not affect black bears. Values provided to black bears by the current OGRs are described in the affected environment section. Connectivity to beach, estuary, and shoreline habitats would continue to be provided by the Forest Plan conservation strategy.

Cumulative Effects

Under Alternative 4, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively maintain between 48 and 73 percent of the original (1954) POG within the project area WAAs (Table WLD-32). Thus, Alternative 4 may result in local declines in black bear carrying capacity, and thus in the black bear population, due to reduced forage availability. Commercial thinning under Alternative 4 would contribute to the beneficial effects to black bear habitat associated with ongoing and foreseeable young-growth management (PCT and riparian thinning) on NFS lands.

Cumulative total road density in the project area WAAs would range from 1.2 to 2.5 miles per square mile (WLD-30). Because all project area roads would be closed within 1 to 5 years of timber harvest (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal from May 1 to November 30), Alternative 4 would not be expected to substantially increase harvest of black bears.

Small OGR modifications under Alternative 4 would enhance connectivity to shoreline and riparian habitats preferred by black bears. This would contribute to the beneficial effects to black bears (increased forage availability) associated with riparian thinning conducted under the Cobble Watershed (Ratz and Cobble creeks), Luck Creek/Eagle Creek, and North Thorne watershed restoration plans in the VCUs where OGR modifications are proposed.

Alternative 5

Direct and Indirect Effects

Under Alternative 5, approximately 4,848 total acres of POG would be harvested, resulting in a reduction of 2 to 5 percent from existing conditions by WAA (Table WLD-21). Effects would range between Alternatives 2 and 4. This would decrease forage availability for bears over the long-term. However, thinning of approximately 2,081 acres under Alternative 5 would extend the time during which forage is available in young-growth stands for black bears.

Under Alternative 5, 20 miles of roads would be constructed and 18 miles would be reconstructed (Table 2-1). Road densities in the project area WAAs would range from 0.5 to 1.9 miles per square mile (Table WLD-28). With this minor increase, Alternative 5 would only locally increase human access in the project area WAAs.

No small OGR modifications are proposed under Alternative 5. Therefore there would be no associated effects to black bears.

Cumulative Effects

Under Alternative 5, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively maintain between 48 and 73 percent of the original (1954) POG within the project area WAAs (Table WLD-32). Thus, Alternative 5 may result in local declines in black bear carrying capacity, and thus in the black bear population, due to reduced forage availability. Commercial thinning under Alternative 5 would contribute to the beneficial effects to black bear habitat associated with ongoing and foreseeable young-growth management (PCT and riparian thinning) on NFS lands.

Cumulative total road density in the project area WAAs would range from 1.3 to 2.5 miles per square mile (WLD-30). Because all project area roads would be closed within 1 to 5 years of timber harvest (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal from May 1 to November 30), Alternative 5 would not be expected to substantially increase harvest of black bears.

Conclusion

All of the action alternatives would reduce the amount remaining POG and increase road densities, with the greatest being under Alternative 3, followed by Alternatives 2, 5, 4, and 1 (Tables WLD-31 and WLD-32). The black bear habitat in GMU 2 is thought to be some of the highest quality in Southeast Alaska, particularly in the northern portion of Prince of Wales Island, including the project area WAAs (Wood 1990). However, over the long term there is the potential for a decline in bear numbers as previously harvested stands (approximately 19,198 acres in the project area) move into the stem exclusion stage and forage availability is reduced (Porter 2008). Preferred habitats for black bears would continue to be protected on NFS lands by beach, estuary, and stream buffers; old-growth reserves; and other non-development LUDs.

Red-breasted Sapsucker, Hairy Woodpecker, and Brown Creeper

Direct and Indirect Effects – All Alternatives

Timber harvest and associated activities under all action alternatives have the potential to disturb nesting adults and young, destroy nests, reduce habitat availability or cause nest abandonment. Because these species are year-round residents, timber harvest activities could also disturb and displace birds during the non-breeding season.

Direct effects to the red-breasted sapsucker, hairy woodpecker, and brown creeper would also result from the removal of nesting and foraging habitat (POG forest; Tables WLD-12 and WLD-14). These species rely on structural components (e.g., large diameter trees, snags) of the old-growth forest ecosystem for nesting and foraging. Red-breasted sapsuckers are most closely associated with low-volume old-growth; whereas hairy woodpeckers and brown creepers are associated with high-volume and large-tree, respectively. All harvest prescriptions and methods would reduce the number of large trees; however, uneven-aged harvest would retain some structural components suitable for

these species. It is assumed that alternatives that harvest more POG would have greater effects to these species.

Indirect effects to these species would be associated with fragmentation and the reduction in POG patch sizes (Table WLD-16). Fragmentation resulting from timber harvest increases edge habitat and reduces the amount of interior forest habitat, reducing habitat suitability for these species (Kissling and Garton 2008). Alternatives that result in the greatest increase in the number of patches in the smallest size classes would be expected to have greater effects to the red-breasted sapsucker, hairy woodpecker, and brown creeper. Indirectly, timber harvest and road building increase fragmentation, reducing the effectiveness of interior forest habitat and creating habitat edges along which there may be increased rates of nest predation by avian predators.

Cumulative Effects – All Alternatives

Past timber harvest has reduced the amount of foraging and nesting habitat available in the project area for the red-breasted sapsucker, hairy woodpecker, and brown creeper. Fragmentation resulting from past timber harvest has also reduced patch sizes, decreasing the suitability of remaining habitat through the loss of interior forest conditions. All of the action alternatives would contribute to these effects (Table WLD-15). Ongoing and foreseeable timber harvest on NFS lands, including microsales and free use (albeit minor), and state lands would result in additional habitat loss and associated fragmentation. Young-growth treatments on NFS lands may provide additional foraging opportunities for cavity nesters through the increase in downed wood and decaying slash. Restoration activities that involve thinning would have similar effects. Under all alternatives, the Forest Plan conservation strategy would maintain habitats for these species.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct or indirect effects to red-breasted sapsucker, hairy woodpecker, and brown creeper because there would be no harvest of POG (Tables WLD-12 and WLD-14). The project area would continue to be influenced by natural disturbance processes (i.e., wind events, and landslides) which could create snag habitat for these species. Under Alternative 1 no commercial thinning would occur, and therefore there would be no potential benefits associated additional foraging opportunities (decaying slash), and the development of larger trees.

No small OGR modifications are proposed under Alternative 1. Therefore there would be no associated effects to cavity nesters.

Cumulative Effects

Alternative 1 would make no contribution to cumulative impacts to these species because no action would be undertaken. Under Alternative 1 past, ongoing, and foreseeable projects would collectively maintain 67 and 33 percent of the original (1954) total and large-tree POG present in the project area, respectively (Table WLD-15). Thus, populations of these species have likely declined to some extent in the project area, with resulting gaps in species distributions. Pre-commercial thinning on NFS lands would benefit these species by accelerating the development of large conifers that over time could provide suitable foraging and nesting habitat.

Alternative 2

Direct and Indirect Effects

Alternative 2 would harvest 4,972 acres of POG, including 1,318 acres of large-tree POG, retaining 95 and 94 percent of the amounts of these habitats currently available in the project area, respectively (Tables WLD-12 and WLD-14). Alternative 2 would result in a 120 percent increase in the number of POG patches (all size categories) in the project area (Table WLD-25). Therefore, Alternative 2 would locally reduce the amount of suitable nesting and foraging habitat available for these species. Under Alternative 2, no commercial thinning would occur, and therefore there would be no potential benefits associated with additional foraging opportunities (decaying slash).

No small OGR modifications are proposed under Alternative 2. Therefore, there would be no associated effects to cavity nesters.

Cumulative Effects

Under Alternative 2, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively maintain 63 and 31 percent of the original (1954) total and large-tree POG present in the project area, respectively (Table WLD-15). Cumulative reductions in nesting and foraging habitat under Alternative 2 could result in local declines in cavity nester populations due to reduced habitat availability, and thus in gaps in the distribution of these species. Pre-commercial thinning on NFS lands would benefit these species by accelerating the development of large conifers that over time could provide suitable foraging and nesting habitat.

Alternative 3

Direct and Indirect Effects

Alternative 3 would have the greatest effects to the red-breasted sapsucker, hairy woodpecker, and brown creeper among the alternatives. Alternative 3 would harvest 6,696 acres of POG, including 1,944 acres of large-tree POG, retaining 93 and 91 percent of the amounts of these habitats currently available in the project area, respectively (Tables WLD-12 and WLD-14). Alternative 3 would result in a 140 percent increase in the number of POG patches (all size categories) in the project area (Table WLD-16). Therefore, Alternative 3 would reduce the amount of suitable nesting and foraging habitat available for these species. Under Alternative 3, commercial thinning in young-growth stands may reduce conditions that promote snag development in younger stands.

Small OGR modification proposed under Alternative 3 would increase the amount of suitable cavity nester habitat (POG) included within small OGRs in VCUs 5790, 5800, 5820, 5830, and 5950; modifications in VCUs 5810, 5840, 5850, 5860, and 5972 would decrease the amount of POG within the reserve system (Table OGR-2).

Cumulative Effects

Under Alternative 3, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively maintain 62 and 30 percent of the original (1954) total and large-tree POG present in the project area, respectively, the least among the alternatives (Table WLD-15). The cumulative reduction in nesting and foraging habitat

could result in local declines in cavity nester populations due to reduced habitat availability, and thus in gaps in the distribution of these species. Commercial thinning under Alternative 3 may contribute to the beneficial effects resulting from other young-growth treatments and restoration activities on NFS lands that involved thinning would accelerate the development of large conifers that provide suitable foraging and nesting habitat for cavity nesters. Small OGR modifications under Alternative 3 would result in a net reduction of 1,142 acres of POG inclusion in small OGRs. These areas would become available for timber harvest and thus could result in additional habitat loss for cavity nesters, contributing to the effects of ongoing and foreseeable timber harvest projects.

Alternative 4

Direct and Indirect Effects

Alternative 4 would have the least effects to the red-breasted sapsucker, hairy woodpecker, and brown creeper among the alternatives. Alternative 4 would harvest 4,109 acres of POG, including 1,210 acres of large-tree POG, retaining 96 and 95 percent of these habitats currently available in the project area, respectively (Tables WLD-12 and WLD-14). Alternative 4 would result in an 89 percent increase in the number of POG patches (all size categories) in the project area (Table WLD-16). Therefore, Alternative 4 would reduce the amount of suitable habitat available for these species. Under Alternative 4, commercial thinning in young-growth stands may reduce conditions that promote snag development in younger stands.

Small OGR modifications under Alternative 4 in all VCUs except VCU 5972 would increase the amount of POG included; however, the OGR location in VCU 5972 is in the biologically preferred location in Alternative 4 (Table OGR-2). This would increase the amount of suitable cavity nester habitat maintained within the reserve system.

Cumulative Effects

Under Alternative 4, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively maintain 63 and 31 percent of the original (1954) total and large-tree POG present in the project area, respectively, the most among the action alternatives (Table WLD-15). This reduction could result in local declines in cavity nester populations due to reduced habitat availability, and thus in additional gaps in the distribution of these species. Commercial thinning under Alternative 4 may contribute to the beneficial effects resulting from other young-growth treatments and restoration activities on NFS lands that involve pre-commercial or riparian thinning, which would accelerate the development of large conifers that provide suitable foraging and nesting habitat for cavity nesters. Small OGR modifications under Alternative 4 would result in a net increase of 1,925 acres of POG maintained in small OGRs, which collectively would increase the amount of cavity nester habitat in the project area maintained in the reserve system.

Alternative 5

Direct and Indirect Effects

Alternative 5 would harvest 4,848 acres POG, including 1,306 acres of large-tree POG, retaining 95 and 94 percent of these habitats currently available in the project area (Tables WLD-12 and WLD-14). Effects of Alternative 5 rank between Alternatives 2 and 4. Alternative 5 would result in a 117 percent increase in the number of POG patches (all size categories) in the project area (Table WLD-16). Therefore, Alternative 2 would reduce the amount of suitable habitat available for these species. Under Alternative 5, commercial thinning in young-growth stands may reduce conditions that promote snag development in younger stands.

No small OGR modifications are proposed under Alternative 5. Therefore, there would be no associated effects to cavity nesters.

Cumulative Effects

Under Alternative 5, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively maintain 63 and 31 percent of the original (1954) total and large-tree POG present in the project area, respectively (Table WLD-15). This reduction could result in local declines in cavity nester populations due to reduced habitat availability, and thus in additional gaps in the distribution of these species. Commercial thinning under Alternative 5 may contribute to the beneficial effects resulting from other young-growth treatments and restoration activities on NFS lands that involve pre-commercial or riparian thinning, which would accelerate the development of large conifers that provide suitable foraging and nesting habitat for cavity nesters.

Conclusion

All action alternatives would reduce suitable cavity nesting habitat through the removal of POG forest and fragmentation. Impacts would be greatest under Alternative 3, followed by Alternatives 2, 5, 4, and 1. Habitat for the red-breasted sapsucker, hairy woodpecker, and brown creeper would be maintained in the project area under the Forest Plan conservation strategy; however, small OGR modifications under Alternative 3 would reduce the amount of cavity-nester habitat (POG forest including snags and large trees) maintained within the reserve system that would become available for harvest.

Vancouver Canada Goose

Direct and Indirect Effects – All Alternatives

The Vancouver Canada goose nests and rears its broods in coastal forested habitats near water sources and winters along marine waters. This species uses both forested and un-forested wetlands. Forest Plan standards and guidelines that maintain habitats are beach and estuary buffers and riparian and lake buffers. Protection of wetlands and areas of concentrated waterfowl use is also provided for under the Waterfowl and Shorebird Habitat standards and guidelines; though there are no such areas identified in the project area.

Timber harvest and associated activities would have the potential to affect Vancouver Canada geese through noise and disturbance if activities occur in the vicinity of nest sites.

Timber harvest would also affect this species through the removal of forested wetlands. Conversion of these stands to young growth would be expected to lower the ability of this habitat to support Vancouver Canada geese. It is assumed that alternatives that harvest the most forested wetlands would have the greatest effects to Vancouver Canada geese (Table WET-2).

Conversion of stands to young-growth as well as the conversion of the young growth to stem exclusion would be expected to lower the ability of this habitat to support Vancouver Canada geese. Commercial thinning proposed to occur in Alternatives 3, 4 and 5 would help to mitigate the effects of timber harvest by reducing the time that the stands would be in stem exclusion stage.

Cumulative Effects – All Alternatives

Timber harvest in Vancouver Canada goose habitat has generally been minimal because these sites are fairly unproductive for timber harvest. Approximately 19 percent of the forested wetlands in the project area have been previously harvested or filled for road building (see Wetlands section of the DEIS for additional discussion; Table WET-2). The action alternatives would make minor contribution to these effects.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct or indirect effects to the Vancouver Canada goose because no action would be undertaken (Table WET-2).

Cumulative Effects

The conversion of previously harvested stands to stem exclusion would be expected to lower the ability of this habitat to support Vancouver Canada geese. Alternative 1 would make minimal contribution to cumulative effects to the Vancouver Canada goose because no action would be undertaken. No commercial thinning would occur under Alternative 1. Under Alternative 1, the Forest Plan conservation strategy would continue to maintain habitat for the Vancouver Canada.

Alternatives 2, 3, 4, and 5

Direct and Indirect Effects

Alternative 3 would affect the greatest amount of forested wetlands and thus the greatest effects to the Vancouver Canada goose among the alternatives (2,850 acres), followed by Alternative 5 (2,092 acres), Alternative 2 (1,793 acres), and Alternative 4 (1,673 acres). This represents 5.0, 3.6, 3.1, and 2.9 percent of the existing forested wetlands in the project area, respectively (Table WET-2; see the Wetlands section of the DEIS for additional discussion of wetland impacts). Thus, all alternatives would reduce the amount of habitat available for Vancouver Canada geese.

Commercial thinning in forested wetlands, proposed under Alternatives 3 (475 acres), 4 (442 acres), and 5 (435 acres) would have the potential to result in an additional, localized sources of noise and disturbance during implementation. However, commercial thinning would help to mitigate the effects of timber harvest by reducing the time that the stands would be in stem exclusion stage.

Cumulative Effects

Taking into account past, ongoing, and foreseeable projects, Alternative 3 would have the greatest cumulative effects to forested wetlands (24 percent of original forested wetlands impacted, including impacts due to harvest and roads), followed by Alternatives 2 and 5 (22 percent of original forested wetlands, including impacts due to harvest and roads), and Alternative 4 (23 percent of original forested wetlands; see the Wetlands section of the DEIS for additional discussion). Timber harvest, as well as commercial thinning conducted under Alternatives 3, 4, and 5, would contribute to noise and disturbance resulting from other ongoing and foreseeable projects within and near forested wetlands which could affect nesting geese. However commercial thinning would contribute to the beneficial effects of other thinning projects in the project area would reduce the time that the stands would be in stem exclusion stage. All activities on NFS lands would implement Forest Plan standard and guidelines which maintain habitat for this species.

Conclusion

All action alternatives would result in an additional reduction (3 to 5 percent) in Vancouver Canada goose habitat. Effects would be greatest under Alternative 3, followed by Alternatives 5, 2, 4, and 1. However, habitat for this species would be maintained by the Forest Plan conservation strategy.

Other Species of Concern

Marbled Murrelet

Direct and Indirect Effects – All Alternatives

Marbled murrelets nest in structurally complex old-growth forest stands (Piatt et al. 2006). As a result, timber harvesting and road construction within POG forest stands (especially high-volume POG) can remove nest trees or disturb nesting birds. Indirectly, timber harvest and road building increase fragmentation, reducing the effectiveness of interior forest habitat and creating habitat edges along which there may be increased rates of nest predation by avian predators. Alternatives that harvest the most POG and result in the greatest increase in the number of small POG patches on the landscape would be expected to have the greatest direct and indirect effects to marbled murrelets (Tables WLD-12 and WLD-14). Under all alternatives, marbled murrelet nesting habitat would be protected by the Forest Plan conservation strategy. If marbled murrelet nests are discovered during project implementation, appropriate Forest Plan standards and guidelines would apply, including establishment of a nest buffer.

Cumulative Effects – All Alternatives

Past timber harvest and associated activities have reduced the amount of suitable marbled murrelet nesting habitat (POG) to 67 percent of the original (1954) amount within the project area (Table WLD-15). The action alternatives would contribute to these effects. Ongoing and foreseeable timber harvest on NFS and state lands would also remove nesting habitat and increase the level of fragmentation on the landscape. Commercial thinning under Alternatives 3, 4, and 5, in combination with young-growth treatments and thinning projects (e.g., those conducted under the Cobble, Luck Creek/Eagle Creek, and North Thorne watershed restoration plans) on NFS lands would improve marbled murrelet habitat over the long term by promoting stand development including large trees. Effects

to nesting murrelets associated with activities on NFS lands would be minimized through the implementation of Forest Plan Marbled Murrelet standards and guidelines.

Alternative 1

Direct,Indirect, and Cumulative Effects

Alternative 1 would have no direct, indirect, or cumulative effects to the marbled murrelet because no action would be undertaken. Effects to POG and patch size would be the same as described in the Red-breasted sapsucker, Hairy Woodpecker, and Brown Creeper subsection above.

Alternatives 2, 3, 4, and 5

Direct and Indirect Effects

All of the action alternatives would reduce the amount of suitable marbled murrelet nesting habitat in the project area and increase fragmentation. An analysis of POG harvest, POG patch creation (fragmentation), and other effects to POG forests resulting from the alternative are described above in the Red-breasted Sapsucker, Hairy Woodpecker, and Brown Creeper subsection. Effects would be greatest under Alternative 3, followed by Alternatives 2, 5, 4 (Table WLD-12 and WLD-16). Small OGR modifications under Alternative 3 would generally reduce inclusion of marbled murrelet habitat in the reserve system (reduction of 669 acres); whereas inclusion would increase with modifications proposed under Alternative 4 (425 acres; Table OGR-2). The existing system of small OGRs would be maintained under Alternatives 2 and 5.

Cumulative Effects

Cumulative effects to POG and patch size in the project area by alternative are described above in the Red-breasted Sapsucker, Hairy Woodpecker, and Brown Creeper subsection. The Big Thorne Project in combination with past, ongoing, and foreseeable projects would result in an additional reduction of 5 percent or less of the original (1954) POG in the project area under any of the action alternatives, resulting in a cumulative reduction to 62 to 63 percent of 1954 levels (Table WLD-15). Thus, Alternative 2, 3, 4, and 5 may result in local declines in the marbled murrelet population due to the reduced availability of nesting habitat. However, under Alternatives 2, 4 (see Issue 2 discussion), and 5 the Forest Plan conservation strategy would continue to provide habitat for this species in the project area.

Conclusion

All the action alternatives have the potential to disturb nesting birds and would remove marbled murrelet nesting habitat. Effects would be greatest under Alternative 3, followed by Alternatives 2, 5, 4, and 1. Forest Plan standards and guidelines for nest buffers would be implemented under all alternatives which would minimize impacts to this species if a nest is discovered during project implementation.

Prince of Wales Flying Squirrel

Direct and Indirect Effects – All Alternatives

Prince of Wales flying squirrels are limited by their habitat requirements and dispersal capabilities. Densities of flying squirrels are linked to structural features common in POG

forests such as large-diameter downed woody debris, snags, and tall trees (Smith et al. 2004) and abundance has been shown to be reduced by forestry practices that influenced the structure or age of residual stands (Smith et al. 2011). Additionally, due to their gliding locomotion, forest openings resulting from timber harvest can act as dispersal barriers if flying squirrels are not able to traverse openings (Flaherty et al. 2008, 2010; Smith et al. 2011). Fragmentation resulting from timber harvest has the potential to reduce the value of residual patches of old growth in the matrix if they become isolated from adjacent patches either by distance or habitat type (young growth). The duration of reduced habitat suitability following timber harvest depends in part on the time required for harvested stands to regenerate. Habitat suitability for flying squirrels would be expected to return more quickly under uneven-aged management (in 10-20 years), where some forest cover and structure are retained in the stand, than under even-aged management (in 60+ years; Smith and Holloway 2011).

Functional connectivity between OGRs, and its relationship to dispersal probability, is critical to the sustainability of Prince of Wales flying squirrel populations. At the landscape level, populations are sustained by the network of medium and large OGRs which support local source populations, interconnected by small OGRs which function as stepping stones between them (Smith et al. 2011).

All action alternatives would reduce the quality and quantity of flying squirrel nesting, foraging, and denning habitat in the project area but effects would be expected to be greatest under alternatives that propose the most POG harvest (Table WLD-12). Fragmentation would also increase under all action alternatives. Alternatives resulting in the greatest increase in the number of small POG patches would be expected to have the greatest effects to flying squirrels (Table WLD-16).

Commercial thinning proposed under Alternatives 3, 4, and 5 would benefit flying squirrels over the short-term by increasing canopy height and creating more open space in the midstory - conditions which facilitate efficient gliding (Scheib et al. 2006). Over the long-term, commercial thinning would promote stand development toward conditions capable of supporting breeding flying squirrels and improve the functional connectivity between old-growth reserves (Smith et al. 2011).

Cumulative Effects – All Alternatives

Past timber harvest has reduced the amount of flying squirrel denning, nesting, and foraging habitat available in the project area VCUs. Fragmentation resulting from past timber harvest has also reduced patch sizes, decreasing the suitability of remaining habitat through the loss of interior forest conditions. All of the action alternatives would contribute to these effects. Ongoing and foreseeable timber harvest on NFS lands and state lands would result in additional habitat loss and associated fragmentation. The cumulative reduction in POG and connectivity within the matrix has the potential to isolate subpopulations of flying squirrels (Table WLD-15). Impacts would be greatest in VCUs where there has already been substantial past harvest, and large young-growth stands or large clearcuts (>0.6 mi or 1 km across) are already present which may act as barriers to flying squirrel movements. Young-growth treatments on NFS lands and restoration projects (i.e., those conducted under the Cobble, Luck Creek/Eagle Creek, and North Thorne watershed restoration plans) that involve thinning, in combination with the commercial thinning proposed under Alternatives 3, 4, and 5, would improve habitat

quality for flying squirrels creating structural conditions in young-growth stands that are conducive to flying squirrel dispersal (i.e., through which flying squirrels can glide). Activities on NFS lands would implement the Forest Plan conservation strategy which would maintain habitat for flying squirrels.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effects to the Prince of Wales flying squirrel because no POG would be harvested. However, because no commercial thinning would occur under Alternative 1, managed stands would continue to grow slowly and would provide little suitable habitat for flying squirrels during the stem exclusion stage, which may last for 25-150 years. Under Alternative 1, the project area would continue to be subject to natural disturbances (i.e., windthrow), which would create gaps of various sizes over time. No small OGR modifications are proposed under Alternative 1. Based on the minimum reserve spacing suggested by Smith et al. (2011) of 0.6 mile (1 km) the existing functional connectivity within the project area would remain under Alternative 1 as follows:

- Small OGRs in VCUs 5790, 5800, and 5840 would be functionally connected to each other and to the Honker large OGR complex via VCU 5780;
- Small OGRs in VCUs 5950 would be functionally connected (only through its northeast corner through non-Federal land) to the Honker large OGR complex, and to the small OGR in VCU 5940;
- Small OGRs in 5960 and 5972 would remain functionally connected to large reserves (Honker large OGR complex or Karta Wilderness);
- Small OGRs in adjacent VCUs 5820/5830 and 5850/5860 would remain functionally connected to each other, but not to any larger reserve; and
- The two pieces of the small OGR in VCU 5810 would remain functionally connected to each other through the stream buffer along Luck Creek and to a larger reserve through roadless acres, and the northern piece of the small OGR would remain functionally connected to the small OGR in VCU 5720.

Cumulative Effects

Under Alternative 1 past, ongoing, and foreseeable projects would collectively maintain between 40 and 100 percent of the original (1954) POG within individual VCUs (Table WLD-15). A summary of cumulative effects by VCU is provided in Table WLD-15. Although Alternative 1 would not involve commercial thinning, pre-commercial thinning conducted in the project area under the Tongass PCT program and thinning implemented under various watershed restoration plans (e.g., Cobble, Luck Creek/Eagle Creek, and North Thorne) would promote the development of suitable denning, nesting, and foraging habitat and facilitate flying squirrel movement through young-growth stands.

Alternatives 2

Direct and Indirect Effects

Alternative 2 would maintain at least 85 percent of the POG currently available in the project area VCUs (Table WLD-12). Impacts by VCU are summarized in Table WLD-12.

Effects would be greatest in VCUs 5950, 5972, and 5840 where the most harvest is proposed, which would maintain 90, 92, and 89 percent of the existing POG in these VCUs, respectively. Alternative 2 would result in a 120 percent increase in the number of POG patches (all size categories) in the project area which would increase fragmentation and reduce connectivity (Table WLD-16). This would reduce the amount of habitat available for flying squires and may locally limit dispersal. Corridors between areas of past harvest would be affected by proposed harvest units in some cases (see the Wildlife and Subsistence Resource Report for a unit-by-unit discussion). No small OGR modifications are proposed under Alternative 2; therefore, the existing level of functional connectivity between reserves as described under Alternative 1 would be maintained.

Cumulative Effects

Under Alternative 2 the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively maintain between 34 and 96 percent of the original (1954) POG within individual VCUs (Table WLD-15). A summary of cumulative effects by VCU is provided in Table WLD-15. Cumulative reductions in POG and connectivity within the matrix would further reduce the amount of suitable flying squirrel habitat, which may result in local declines in the flying squirrel population. Although Alternative 2 would not involve commercial thinning, pre-commercial thinning under the Tongass PCT program and thinning implemented under various watershed restoration plans (e.g., Cobble, Luck Creek/Eagle Creek, and North Thorne) would promote the development of suitable denning, nesting, and foraging habitat and facilitate flying squirrel movement through young-growth stands.

Alternative 3

Direct and Indirect Effects

Alternative 3 would maintain at least 85 percent of the POG currently available in the project area VCUs, having the greatest effects among the alternatives (Table WLD-12). Impacts by VCU are summarized in Table WLD-12. Effects would be greatest in VCUs 5972, 5840, and 5950 where the most harvest is proposed, which would maintain 90, 86, and 89 percent of the existing POG in these VCUs, respectively. Alternative 3 would result in a 140 percent increase in the number of POG patches in the project area (all size categories), the most among the alternatives, which would increase fragmentation and reduce connectivity (Table WLD-16). Corridors between areas of past harvest would be affected by proposed harvest units in some cases, more so than the other alternatives due to the greater number of harvest units and more clearcut prescriptions (see the Wildlife and Subsistence Resource Report for a unit-by-unit discussion).This would reduce the amount of habitat available for flying squires and may locally limit dispersal. However, commercial thinning under Alternative 3 would promote forest conditions that facilitate flying squirrel movement through young-growth stands.

Small OGR modifications proposed under Alternative 3 would reduce functional connectivity for flying squirrels in the project area by increase the spacing between small OGRs in some VCUs. Based on the maximum reserve spacing suggested by Smith et al. (2011) of 0.6 miles (1 km), functional connectivity for flying squirrels would be as follows under Alternative 3:

- Small OGRs in 5960 and 5972 would remain functionally connected to large reserves (Honker large OGR complex and/or Karta Wilderness)
- Small OGRs in adjacent VCUs 5820/5830 and 5850/5860 would remain functionally connected to each other, but not to any larger reserve;
- Proposed modifications in the small OGR in VCU 5800, would disconnect the small OGRs in VCUs 5790, 5800, and 5840 from the Honker large OGR complex, though they would remain connected to each other;
- The northern small OGR in VCU 5810 would be disconnected from the small OGR in VCU 5720, but would now be functionally connected to the proposed northern, isolated portion of the small OGR in VCU 5820 (along the shoreline); The two pieces of the small OGR in VCU 5810 would remain functionally connected to each other through the stream buffer along Luck Creek and to a larger reserve through roadless acres;
- The small OGR in VCU 5950 would be disconnected from the Honker large OGR complex due to the removal of OGR acreage (and addition of harvest units) along its northeast edge; however this OGR is already disconnected from the Honker due to State land.

Cumulative Effects

Under Alternative 3, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively maintain between 34 and 95 percent of the original (1954) POG within individual WAAs (Table WLD-15). Alternative 3 would have the greatest cumulative effects among the alternatives. Cumulative reductions in POG and connectivity within the matrix would further reduce the amount of suitable flying squirrel habitat which may result in local declines in the flying squirrel population. However, commercial thinning under Alternative 3 would contribute to the beneficial effects associated with pre-commercial thinning under the Tongass PCT program and thinning implemented under various watershed restoration plans (e.g., Cobble, Luck Creek/Eagle Creek, and North Thorne), which would promote the development of suitable denning and nesting habitat and facilitate flying squirrel movement through young-growth stands.

Alternative 4

Direct and Indirect Effects

Alternative 4 would maintain at least 84 percent of the POG currently available in the project area VCUs, having the least effects among the action alternatives (Table WLD-12). Impacts by VCU are summarized in Table WLD-12. Effects would be greatest in VCUs 5972, 5950, and 5810 where the most harvest is proposed, which would maintain 91, 93, and 93 percent of the existing POG in these VCUs, respectively. Alternative 4 would result in an 89 percent increase the number of POG patches (all size categories) in the project area which would increase fragmentation and reduce connectivity (Table WLD-16). Corridors between areas of past harvest would be affected by proposed harvest units in some cases, less so than the other action alternatives due to the fewer harvest units and more uneven-aged prescriptions, and because some units were dropped or modified under Alternative 4 to

avoid effects to travel corridors (see the Wildlife and Subsistence Resource Report for a unit-by-unit discussion). This would reduce the amount of habitat available for flying squires and may locally limit dispersal. However, commercial thinning under Alternative 4 would promote forest conditions that facilitate flying squirrel movement through young-growth stands.

Small OGR modifications proposed under Alternative 4 would improve functional connectivity for flying squirrels in the project area by widening areas of functional connectivity and reducing the distances between small OGRs in some VCUs. Based on the maximum reserve spacing suggested by Smith et al. (2011), functional connectivity for flying squirrels would be as follows under Alternative 4:

- Small OGRs in adjacent VCUs 5820/5830 and 5850/5860 would remain functionally connected to each other, but not to any larger reserve;
- A connection to the Honker large OGR complex in VCU 5780 would be added to the network of small OGRs in VCUs 5790, 5800, and 5840 ;
- The northern small OGR in VCU 5810 would remain functionally connected to VCU 5720, but would also be functionally connected to the small OGR in VCU 5820 (along the shoreline to the proposed isolated northern piece of the small OGR in this VCU); The two pieces of the small OGR in VCU 5810 would remain functionally connected to each other through the stream buffer along Luck Creek and to a larger reserve through roadless acres;
- Small OGRs in VCUs 5950 and 5960 would remain functionally connected to the Honker large OGR complex and the Karta Wilderness, respectively, but the areas of connectivity would be widened;
- The small OGR in VCU 5972 now be functionally connected to the small OGR in VCU 5960 (and through this VCU and roadless acres to the Karla Wilderness) and the Honker large OGR.

Cumulative Effects

Under Alternative 4, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively maintain between 34 and 99 percent of the original (1954) POG within individual VCUs (Table WLD-15). A summary of cumulative effects by VCU is provided in Table WLD-15. Alternative 4 would result in the least cumulative effects among the action alternatives. Cumulative reductions in POG and connectivity within the matrix would further reduce the amount of suitable flying squirrel habitat which may result in local declines in the flying squirrel population. However, commercial thinning under Alternative 4 would contribute to the beneficial effects associated with pre-commercial thinning under the Tongass PCT program and thinning implemented under various watershed restoration plans (e.g., Cobble, Luck Creek/Eagle Creek, and North Thorne), which would promote the development of suitable denning and nesting habitat and facilitate flying squirrel movement through young-growth stands.

Alternative 5

Direct and Indirect Effects

Alternative 5 would maintain at least 84 percent of the POG currently available in the project area VCUs (Table WLD-12). Impacts by VCU are summarized in Table WLD-12. Effects would be greatest in VCUs 5972, 5840, and 5950 where the most harvest is proposed, which would maintain 91, 89, and 91 percent of the existing POG in these VCUs, respectively. Alternative 5 would result in a 117 percent increase in the number of POG patches (all size categories) in the project area which would increase fragmentation and reduce connectivity (Table WLD-16). Corridors between areas of past harvest would be affected by proposed harvest units in some cases, similar to Alternative 2 (see the Wildlife and Subsistence Resource Report for a unit-by-unit discussion). This would reduce the amount of habitat available for flying squires and may locally limit dispersal. However, commercial thinning under Alternative 5 would promote forest conditions that facilitate flying squirrel movement through young-growth stands.

No small OGR modifications are proposed under Alternative 5; therefore, the existing level of functional connectivity between reserves as described under Alternative 1 would be maintained.

Cumulative Effects

Under Alternative 5, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively maintain between 34 and 96 percent of the original (1954) POG within individual VCUs (Table WLD-15). A summary of cumulative effects by VCU is provided in Table WLD-15. Cumulative reductions in POG and connectivity within the matrix would further reduce the amount of suitable flying squirrel habitat which may result in local declines in the flying squirrel population. However, commercial thinning under Alternative 5 would contribute to the beneficial effects associated with pre-commercial thinning under the Tongass PCT program and thinning implemented under various watershed restoration plans (e.g., Cobble, Luck Creek/Eagle Creek, and North Thorne), which would promote the development of suitable denning and nesting habitat and facilitate flying squirrel movement through young-growth stands.

Conclusion

All action alternatives would reduce suitable flying squirrel denning, nesting, and foraging habitat through the removal of POG forest and fragmentation. Effects to flying squirrels would be greatest under Alternative 3, followed by Alternatives 2, 5, 4, and 1. To some extent these effects would be mitigated through commercial thinning under Alternatives 3, 4 and 5 which would improve habitat suitability for flying squirrels in dense young-growth stands. The existing level of functional connectivity between reserves would be maintained under Alternatives 1, 2, and 5. However, small OGR modifications proposed under Alternative 3 may reduce functional connectivity among reserves in some VCUs; modifications proposed under Alternative 4 would maintain or improve functional connectivity for flying squirrels. Thus Alternatives 1, 2, 4, and 5 are more likely to continue facilitating back-and-forth exchange between source populations in larger

reserves and small OGRs, whereas Alternative 3 has the potential to result in the isolation of local populations where functional connectivity is reduced.

Prince of Wales Spruce Grouse

Direct and Indirect Effects – All Alternatives

Prince of Wales spruce grouse are associated with microhabitats within POG forests and therefore timber harvest would alter habitat availability for this species, though effects would change over time. Prince of Wales spruce grouse avoid young (less than 5 years) clearcuts presumably due to the presence of large amounts of debris that inhibit movement, increased exposure to predators, and lack of food; however, as the understory vegetation peaks after 15 to 25 years, grouse likely benefit from increased berry production and cover for chicks (Russell 1999). After this, forest conditions become unfavorable to spruce grouse, characterized by canopy closure, high stem densities, and little understory vegetation due to reduced light which reduces the overall structural and horizontal diversity of the stand. These conditions can persist up to 150 years after even-aged timber harvest. Thus, timber harvest under all action alternatives would have a short-term benefit to grouse due to increased forage availability, followed by an extended period in which habitat conditions in harvested units would not be suitable. Timber harvest could result in local reductions in spruce grouse density, though this effect would likely change over time with forest succession (Turcotte et al. 2000; USFWS 2010). It is assumed that alternatives that harvest the most POG would result in the greatest effects to spruce grouse (Table WLD-12). Commercial thinning under Alternatives 3, 4, and 5 would encourage structural and horizontal diversity beneficial to grouse in previously harvested stands. Under all alternatives, spruce grouse habitat would be maintained by the Forest Plan conservation strategy.

Due to their generally sedentary nature and preference for walking rather than flying, fragmentation due to timber harvest can result in the isolation of local spruce grouse populations. If patches of suitable habitat are spread too far apart (i.e., more than 1 mile; Russell 1999, Nelson 2010) for spruce grouse to move between, or if conditions in matrix lands between OGRs and other habitat reserves are not connected by suitable habitat they may become barriers to spruce grouse. This may reduce exchange between neighboring populations, making it difficult for isolated populations to recruit new breeders. It is assumed that alternatives that result in the greatest increase in number of patches on the landscape would have the greatest effects to spruce grouse (Table WLD-16).

Increased road densities associated with timber harvest could also adversely affect this species by increasing hunter access (USFWS 2010). Rabe (2009) concluded that Prince of Wales spruce grouse found in roaded areas are the most vulnerable to harvest, whereas birds in unroaded areas have little chance of being harvested. Road strike accounted for 17 to 22 percent of the mortalities of radio-marked birds in a study of grouse mortality on Prince of Wales Island, comparable to the level of hunter harvest (Nelson 2010). This is influenced in part by the fact that spruce grouse appear to use roads for dispersal (USFWS 2010). However, there is no known road density threshold for spruce grouse. Alternatives resulting in the greatest increase in road density would be expected to have the greatest potential to increase spruce grouse vulnerability to harvest (Table WLD-28). However, many of the remaining intact old-growth forests within the project area that

provide suitable habitat for spruce grouse are maintained within OGRs as well as other reserves.

Cumulative Effects – All Alternatives

Timber harvest within Southeast Alaska has occurred disproportionately in the range of the Prince of Wales spruce grouse (USFWS 2010), reducing the availability of large, unfragmented patches of POG and resulting in an extensive road system. All of the action alternatives would cause additional habitat loss and fragmentation, contributing to these effects. Habitat loss and fragmentation would also occur in association with ongoing and foreseeable timber harvest on both NFS lands and lands in other ownerships. Cumulative effects to POG are presented in Table WLD-15.

Commercial thinning proposed under Alternatives 3, 4, and 5 would improve habitat suitability for spruce grouse within the matrix, as would foreseeable young-growth treatments on NFS lands and other watershed restoration plans that involve thinning (e.g., those implemented under the Cobble, Luck Creek/Eagle Creek, and North Thorne watershed restoration plans).

All action alternatives would expand the road system in the project area; however, roads would be closed within 1 to 5 years of timber harvest (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal from May 1 to November 30), thus limiting the period in which spruce grouse harvest vulnerability would be expected to increase. Scheduled road closures under the Prince of Wales Island ATM would further reduce harvest and road kill vulnerability over the long term. Cumulative road densities at all elevations are presented in Table WLD-30.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effect to spruce grouse because no action would be undertaken. However, because commercial thinning would not occur under Alternative 1, there would be no associated benefits to grouse and structural diversity within previously harvested stands would develop slowly over time. The project area would also continue to be influenced by natural disturbance processes (i.e. periodic wind events, landslides) which have the potential to create gaps in the spruce grouse distribution.

Cumulative Effects

Alternative 1 would not contribute to cumulative effects to spruce grouse because no action would be undertaken. Under Alternative 1, commercial thinning would not occur and therefore there would be no associated benefits to grouse. Pre-commercial thinning under the Tongass PCT program and riparian thinning under the Cobble, Luck Creek/Eagle Creek, and North Thorne watershed restoration plans would enhance the suitability of young-growth stands for spruce grouse.

Alternatives 2, 3, 4, and 5

Direct and Indirect Effects

Harvest of POG within VCUs and POG patch numbers by alternative are described in the Prince of Wales Flying Squirrel subsection above (Tables WLD-12 and WLD-16). Based on acres of POG harvested and the resulting number of POG patches, Alternative 3 would

have the greatest effect to spruce grouse related to habitat loss and fragmentation, followed by Alternatives 2, 5, and 4.

Commercial thinning under Alternatives 3, 4, and 5 would encourage structural and horizontal diversity beneficial to grouse in previously harvested stands. Total road densities (NFS lands only at all elevations) by alternative are discussed in the Marten subsection above (Table WLD-28). Based on the increase in total road densities, Alternative 3 would have the greatest effect related to increased vulnerability to harvest along roads, followed by Alternatives 2, 4, and 5.

Small OGR modifications under Alternative 3 in VCUs 5790, 5840, 5850, 5860, and 5972 would reduce inclusion of the largest blocks of POG, thereby increasing the likelihood that they will become fragmented by timber harvest (Table OGR-2). Small OGR modifications under Alternative 4 would maintain or increase inclusion of the largest POG patches in all VCUs, except VCU 5972, which would maintain spruce grouse habitat (Table OGR-2).

Cumulative Effects

Cumulative effects to POG in the project area VCUs by alternative, taking into account past, ongoing, and foreseeable projects, are described above in the Prince of Wales Flying Squirrel subsection. Cumulative road densities are described in the Marten subsection. Thus, all alternatives would reduce the amount of habitat available to spruce grouse and may increase harvest risk along roads, which could lead to a local decline in the spruce grouse population. Based on cumulative reductions in POG and increases in road densities, cumulative effects to spruce grouse would be greatest under Alternative 3, followed by Alternatives 2, 5, and 4 (Table WLD-15 and WLD-28).

Conclusion

All action alternatives would reduce suitable Prince of Wales spruce grouse habitat through the removal of POG forest and increased fragmentation. Based on acres of POG harvested, POG patches created, and road construction, effects to spruce grouse would be greatest under Alternative 3, followed by Alternatives 2, 5, 4 and 1. To some extent, these effects would be mitigation through commercial thinning under Alternatives 3, 4, and 5, which would encourage structural diversity in young-growth stands, increasing their suitability as spruce grouse habitat (Russell 1999).

Conservation measures including the system of OGRs and other non-development LUDs in addition to the standards and guidelines that maintain connectivity within matrix lands (e.g., various buffer requirements) that would be implemented under all alternatives would facilitating dispersal and interchange between spruce grouse populations. Small OGR modifications under Alternative 3 would decrease inclusion of the largest blocks of POG; inclusion of large blocks of POG would increase under Alternative 4.

All action alternatives would expand the road system in the project area; however, roads would be closed within 1 to 5 years of timber harvest (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal from May 1 to November 30), thus limiting the period in which spruce grouse harvest vulnerability would be expected to increase. Scheduled road closures under the

Prince of Wales Island ATM would further reduce harvest and road kill vulnerability over the long term.

Endemic Species

Direct and Indirect Effects – All Alternatives

Prince of Wales Island has been identified as a hotspot for endemism, and is also an area where there has been intensive past timber harvest (Cook et al. 2006). By definition, endemic species occur in isolated populations and many have limited mobility or specific habitat requirements. Thus they are vulnerable to the effects of habitat loss and fragmentation; introduced non-natives; pathogens and disease; natural events (i.e., climate change); and overharvesting (Dawson et al. 2007). Therefore, the ability to disperse and recolonize is an important factor in how endemic species are able to respond to environmental changes.

Timber harvest would directly affect endemic species by through habitat loss (POG) and fragmentation (reduced patch size), and by altering the distribution of habitats across the landscape. This may inhibit the ability of individuals to move between patches of suitable habitat, and therefore may further limit the distribution of a population or reduce genetic interchange between subpopulations. Effects to POG and fragmentation (POG patch size) are presented in Tables WLD-12 and WLD-16.

Road construction associated with timber harvest can fragment populations and increase human access to remote areas, thereby increasing the probability of overexploitation for some species (e.g., wolves and spruce grouse; Pearson et al. 1996, Russell 1999). With the exception of wolves, there are no known road density thresholds for any endemic species.

Effects to the Alexander Archipelago wolf, Alexander Archipelago black bear, Prince of Wales flying squirrel, and Prince of Wales spruce grouse are discussed in detail above. No direct or indirect effects to the Haida Gwaii ermine are anticipated under any of the alternatives because this species is associated with low elevation riparian and shoreline areas which would be protected by the Forest Plan conservation strategy. The alternatives analysis here focuses on the Keen's myotis, which is associated with large trees and snags present in POG (Boland et al. 2009).

Alternatives that harvest the most POG and result in the greatest increase in the number of smaller POG patches on the landscape would be expected to have the greatest effect to the Keen's myotis (Table WLD-12 and WLD-16). This may reduce the number of suitable roost trees for bats; however, it should be noted that roost trees for Keen's myotis do not appear to be limited on Prince of Wales Island, and bats may choose a large-diameter tree for roosting regardless of whether or not it is located in an area with past timber harvest (Boland et al. 2009). Commercial thinning proposed under Alternatives 3, 4, and 5 would benefit this species by promoting more rapid development of larger trees in young-growth stands. Habitat and landscape connectivity would be provided for this species by the Forest Plan conservation strategy.

Cumulative Effects – All Alternatives

Past timber harvest has reduced the amount of POG habitat available for the Keen's myotis. Timber harvest proposed under the action alternatives would further reduce and

fragment POG habitat, and could reduce the number of forested flyways used for bats commuting between foraging and roosting areas. Additional habitat loss and fragmentation would occur in association with ongoing and foreseeable timber harvest on NSF lands and lands in other ownerships (Table WLD-15). Commercial thinning proposed under Alternatives 3, 4, and 5, in combination with young-growth treatments on NSF lands and restoration projects that involve thinning (e.g., those implemented under the Cobble, Luck Creek/Eagle Creek, and North Thorne watershed restoration plans) would promote stand development and increase habitat availability for this species over the long term.

The Forest Plan conservation strategy was designed to address effects to endemic species through the network of OGRs and other non-development LUDs and Forest-wide standards and guidelines which were intended to maintain habitat components important to a variety of species and maintain connectivity across the landscape.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effects to the Keen's myotis because no action would be undertaken. Indirectly, without commercial thinning, managed stands would continue to grow slowly and would provide little structural diversity suitable for roosting during the stem exclusion stage, which may last for decades. Over time, natural events (i.e., windthrow) would continue to alter the forest and create roosting habitat.

No small OGR modifications would occur under Alternative 1. Therefore, there would be no related effects to the Keen's myotis.

Cumulative Effects

Alternative 1 would not contribute to cumulative effects to the Keen's myotis because no action would be undertaken. Under Alternative 1 past, ongoing, and foreseeable projects would collectively maintain between 40 and 100 percent of the original (1954) POG in the project area VCUs (Table WLD-15). Young-growth management activities on NFS lands would promote stand development.

Alternatives 2, 3, 4, and 5

Direct and Indirect Effects

Productive old-growth harvest by VCU and changes in POG patch numbers by alternative are described in the Prince of Wales Flying Squirrel subsection above (Tables WLD-12 and WLD-16). Timber harvest would remove POG, thereby reducing the number of potential day-roosts available to bats, a critical resource for this forest-dwelling species (Boland et al. 2009). Indirectly, timber harvest may also reduce the suitability remaining roosting habitat through increased fragmentation (and decreased patch sizes) as day-roosts are more likely to be selected if they are located in stands with a higher number of trees in early to late decay stages (Boland et al. 2009). However, Boland et al. (2000) concluded that roost sites do not appear to be limited on Prince of Wales Island.

Alternative 3 would have the greatest effect to the Keen's myotis related to habitat loss and fragmentation, followed by Alternatives 2, 5, and 4. However, under all alternatives effects would be minor given that roost sites are not a limiting factor on Prince of Wales

Island. Commercial thinning under Alternatives 3, 4, and 5 would accelerate the development of trees capable of providing roosting habitat and improve landscape connectivity.

Small OGR modification proposed under Alternative 3 would increase the amount of suitable Keen's myotis roosting habitat (POG) included in small OGRs in VCUs 5790, 5800, 5820, 5830, and 5950; modifications in VCUs 5810, 5840, 5850, 5860, and 5972 would decrease the amount of POG included (Table OGR-2). Small OGR modifications under Alternative 4 in all VCUs except VCU 5972 would increase the amount suitable Keen's myotis roosting habitat maintained within the reserve system (Table OGR-2). No small OGR modifications would occur under Alternative 2 and 5. Therefore, there would be no related effects to the Keen's myotis.

Cumulative Effects

Cumulative POG harvest by VCU is discussed in the Prince of Wales Flying Squirrel subsection above (Table WLD-15). Under Alternative 3, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would maintain the least amount of original (1954) POG and therefore the least habitat for the Keen's myotis, followed by Alternatives 2, 5, and 4. Moreover, small OGR modifications under Alternative 3 would result in a net reduction of 1,142 acres of POG maintained in small OGRs. These areas would become available for timber harvest and thus could result in additional loss of roosting habitat, as well as forested travel corridors, for the Keen's myotis, contributing to the effects of ongoing and foreseeable timber harvest projects. Alternatively, small OGR modifications under Alternative 4 would result in a net increase of 1,925 acres of POG maintained in small OGRs, which would provide greater protection of roosting habitat.

Conclusion

Based on POG harvest and increase in number of patches on the landscape, effects to the Keen's myotis would be greatest under Alternative 3, followed by Alternatives 2, 5, 4, and 1. All action alternatives would increase the risk of reducing forested corridors (see discussion in POW flying squirrel) that would facilitate movement of bats across the landscape.

Migratory Birds

Direct and Indirect Effects – All Alternatives

Direct effects to migratory birds would result from disturbances that disrupt breeding birds, remove active bird nests, or cause nest abandonment. For species that are year-round residents, timber harvest (POG removal) and associated activities (road building) have the potential to disturb and displace birds during the non-breeding season. Indirect effects would result from the reduction of perching, foraging, and potential nesting habitat and the increase in fragmentation. After timber harvest there would be a short-term increase in the habitat for species associated with early successional habitats and forest edges, which may result in short-term population growth for these species. However, extended local reductions in available habitat would be expected as forest succession progresses.

Habitat fragmentation can strongly influence bird community composition and bird distribution and has been identified as a major cause of population declines of breeding

migratory songbirds (DellaSala et al. 1996; Manuwal and Manuwal 2002). Habitat removal would reduce the effectiveness of interior forest habitat, and increase the potential for nest predation and nest parasitism for some species, which can ultimately reduce reproductive success (Robinson et al. 1995). Migratory birds would be most susceptible to impacts from harvest activities occurring in suitable nesting habitat during the nesting/fledging period, which generally begins in mid-April and ends about mid-July, when young birds have fledged.

The migratory bird species most likely to be adversely affected by the project are those that primarily nest in POG forests, including the Western screech-owl, rufous hummingbird, red-breasted sapsucker, Pacific-slope flycatcher, Steller's jay, northwestern crow, chestnut-backed chickadee, golden-crowned kinglet, varied thrush, Townsend's warbler, blackpoll warbler, northern goshawk and marbled murrelet. Therefore, the discussion here focuses on old-growth associated species. Alternatives that harvest more POG and result in greater increases in the number of POG patches on the landscape would be expected to have greater effects to these migratory bird species (Tables WLD-12 and WLD-16). However, species associated with early successional or scrub habitats such as the MacGillivray's warbler, golden-crowned sparrow, and golden-crowned kinglet would benefit through increases in suitable habitat over the short- to mid-term from timber harvest.

Effects to migratory birds can be minimized by altering the season of activity, retaining snags, maintaining the integrity of breeding sites, considering key winter and migration areas, and minimizing pollution or detrimental alteration of habitats (USDA Forest Service 2008c). Under all alternatives, migratory bird habitat would be maintained by the Forest Plan conservation strategy.

Cumulative Effects – All Alternatives

Past timber harvest in the project area has removed migratory bird habitat or reduced its suitability through fragmentation (and associated edge effects such as predation). The action alternatives would contribute to the loss and fragmentation of migratory bird habitat. However, the action alternatives would contribute to the fragmentation and reduction in POG habitats (Table WLD-15); however, migratory bird habitat would be maintained by the Forest Plan conservation strategy. Commercial thinning under Alternatives 3, 4, and 5, in combination with other young-growth treatment on NFS lands and watershed restoration activities that involve thinning, would collectively improve habitat conditions for old-growth associated migratory birds; though over the long-term, these stands would become available for harvest again.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no adverse direct and indirect effects to migratory birds because no timber or associated activities would occur. Therefore there would be no reduction in habitat or fragmentation. Alternative 1 would not have the beneficial effects of young-growth management which would increase the suitability of these stands for old-growth associated migratory birds. Overtime, previously harvested stands would continue to grow slowly and would provide little forage or structural diversity for migratory birds during the stem exclusion stage, which may last for decades. No small OGR

modifications would occur under Alternative 1; therefore, there would be no associated effects to migratory birds.

Cumulative Effects

Alternative 1 would not contribute to cumulative effects to migratory birds because no timber would be harvested. Under Alternative 1, past, ongoing, and foreseeable projects would maintain between 40 and 100 percent of the original (1954) POG within the project area VCUs (Table WLD-15). Although Alternative 1 would not contribute to the potential benefits of commercial thinning associated with improving habitat suitability for migratory birds, these effects would occur in association with PCT under the Tongass PCT program, as well as thinning conducted under the Cobble, Luck Creek/Eagle Creek, and North Thorne watershed restoration plans.

Alternatives 2, 3, 4, and 5

Direct and Indirect Effects

Productive old-growth harvest in the project area and associated changes in the number of POG patches (fragmentation) by alternative are discussed in the Red-breasted Sapsucker, Hairy Woodpecker, and Brown Creeper subsection above (Tables WLD-12 and WLD 16). Effects to most migratory birds related to habitat loss and fragmentation would be greatest under Alternative 3, followed by Alternatives 2, 5, and 4. However, these effects would be mitigated to some extent by commercial thinning under Alternatives 3, 4, and 5 which has the potential to improve long-term habitat suitability for migratory birds by accelerates stand development, and associated potential foraging, roosting, and potentially nesting habitat. These beneficial effects would not occur under Alternative 2 which does not involve thinning.

Direct and indirect effects of small OGR modifications proposed under Alternatives 3 and 4 to migratory birds (inclusion of POG) would be comparable to those described under Endemics. No modifications are proposed under Alternatives 2 and 5.

Cumulative Effects

Cumulative POG harvest within the project area is discussed in the Red-breasted Sapsucker, Hairy Woodpecker, and Brown Creeper subsection above (Table WLD-15). Under Alternative 3, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would maintain the least amount of original (1954) POG followed by Alternatives, 2, 5, and 4. This would locally reduce habitat for migratory bird species associated with POG habitats. Migratory bird species associated with early seral and scrub habitats would benefit over the short-term from ongoing and foreseeable timber harvest projects. Alternatives 3, 4, and 5 would contribute to the potential beneficial effects to old-growth associated migratory birds of commercial thinning associated with stand development resulting from PCT under the Tongass PCT program, as well as thinning conducted under the Cobble, Luck Creek/Eagle Creek, and North Thorne watershed restoration plans. Cumulative effects of small OGR modifications under Alternatives 3 and 4 to migratory birds (inclusion of POG) would be comparable to those described under Endemics.

Conclusion

All action alternatives would reduce foraging and nesting habitat for old-growth associated migratory birds and increase fragmentation; however, effects would be localized and would not preclude migratory birds from using the project area. Species associated with early successional and scrub habitats would experience short-term benefits from timber harvest. Birds may be displaced if project activities occur during the nesting season. Impacts would be greatest under Alternative 3, followed by Alternatives 2, 5, 4, and 1.

Threatened, Endangered, Candidate, and Sensitive Species

A preliminary determination was made to assess the effects of the project on threatened, endangered, candidate, and sensitive species. A detailed analysis of effects to each species is provided in the project BA/BE and summarized in Table WLD-33. None of the alternatives would adversely affect listed species or their habitats, nor would they be likely to result in a trend toward Federal listing or a loss of viability for any sensitive species. A detailed analysis of effects to the Queen Charlotte goshawk is provided below.

Queen Charlotte Goshawk

Direct and Indirect Effects – All Alternatives

The Big Thorne Project has the potential to directly adversely affect goshawks through activities that create noise or disturb adults or young, resulting in the temporary displacement of individual birds, removal of active nests, or nest abandonment. There are no known goshawk nests within any of the proposed harvest units; therefore none of the alternatives would directly impact actively nesting birds. Goshawks are year-round residents in the project area; therefore, timber harvest and associated activities could disturb or temporarily displace birds during the non-breeding season. Indirect effects of the Big Thorne Project include the reduction of perching, foraging, and potential nesting habitat (POG).

Impacts to goshawks are assessed in terms of the reduction in total and high-volume POG, which provides potential high quality nesting and foraging habitat. High-volume POG represents optimal nesting habitat due to the presence of large-trees and snags. Reductions in forest cover, and the subsequent progression of forest succession in second-growth stands, also have the potential to affect the abundance and availability of prey. This may cause goshawks foraging in the North Central Prince of Wales Island biogeographic province to increase their breeding home range size in order to gather sufficient prey to raise young (McClaren 2004; Bloxton 2002). Alternatives that harvest the most POG would be expected to have the greatest effect on goshawks. All action alternatives would maintain 99 percent of the existing total POG and high-volume POG in the North Central Prince of Wales biogeographic province (Tables WLD-12 and WLD-13). It should be noted that there is a low abundance of goshawks on POW due to the lack of prey.

Table WLD-33. Summary of Effects Determinations for Threatened, Endangered, Candidate, and Sensitive Species

Common Name / *Scientific Name*	Status	Effects Determination[2/]	Effects Summary/Rationale for Determination
Species Under USFWS Jurisdiction			
Yellow-billed loon *Gavia adamsii*	ESA Candidate	No determination made	• Potential for exposure to oil / fuel spills associated with use of MAFs and the transport of logs. • Species occurs at very low densities near the project area; very few individuals would be at risk. • Vessels would operate at infrequent intervals.
Species Under NMFS Jurisdiction			
Humpback Whale *Megaptera novaeangliae*	Endangered	Not likely to adversely affect	• Potential for exposure to vessel traffic and oil/fuel spills associated with the use of marine access facilities (MAFs) and the transport of logs; • Potential for vessel collisions. • Species are transient, and vessels would operate at low, constant speeds and infrequent intervals. • Measures would be taken to reduce impacts from disturbances and risk of collisions (i.e., preventing vessels from approaching marine mammals, and adhering to Forest Plan Standards and Guidelines, MMPA, and ESA). • All project activities would be conducted in accordance with Alaska Water Quality Standards for log transfer facilities (LTFs), limiting effects to water quality.
Steller sea lion – Eastern DPS / Western DPS *Eumetopias jubatus*	Threatened / Endangered	Not likely to adversely affect	
Chinook salmon *Onchorhynchus tshawytscha*	Threatened or Endangered depending on run	Not likely to adversely affect	• Potential for exposure to oil / fuel spills associated with use of MAFs and the transport of logs. • Potential for reductions in water quality and indirect impacts to benthic prey due to bark accumulations near LTFs. • Species may be present but are transient; not likely to occur near any project related activity. • All project activities will be conducted in accordance with Alaska Water Quality Standards for LTFs, limiting effects to water quality.
Sockeye salmon *Onchorhynchus nerka*		Not likely to adversely affect	
Steelhead *Onchorhynchus mykiss*		Not likely to adversely affect	
Alaska Sensitive Species			
Pacific herring *Clupea pallasii*	Forest Service Sensitive; ESA Candidate	May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing	NA

Table WLD-33. Summary of Effects Determinations for Threatened, Endangered, Candidate, and Sensitive Species (continued)

Common Name / *Scientific Name*	Status	Effects Determination[2/]	Effects Summary/Rationale for Determination
Queen Charlotte goshawk *Accipiter gentilis laingi*	Forest Service Sensitive	May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing	• Potential for noise and disturbances. • Removal of POG would decrease available nesting and foraging habitat; local expansion of individual goshawk home ranges possible, potentially leading to a local reduction in breeding density. • Species is highly mobile and breeding density is already low due to existing levels of timber harvest. • Forest Plan standards and guidelines for protection of known active nests applied.
Black oystercatcher *Haematopus bachmani*	Forest Service Sensitive	May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing	• Potential for exposure to oil / fuel spills associated with use of MAFs and the transport of logs. • Species occurs at very low densities near the project area; very few individuals would be at risk. • Vessels would operate at infrequent intervals.

1/ "Yes" if the species is known or is likely to occur, or its habitat occurs, in the project area or in marine waters adjacent to the project area. "No" if the species has not been documented or is not likely to occur in the Analysis Area.
2/ Determinations are only required for listed and sensitive species. Determinations for threatened and endangered species include "no effect (NE)," "not likely to adversely affect (NLAA)," or "likely to adversely affect (LAA);" no determinations are made for candidate species (Bosch 2004). Determinations for sensitive species include "no impacts", "beneficial impacts", "may impact individuals but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing," or "likely to result in a loss of viability in the Planning Area, or in a trend toward federal listing" (Bosch 2004).

Uneven-age prescriptions and legacy retention, which leave a proportion of the trees standing in the harvest unit, would maintain some habitat value for goshawks following harvest, provided that the trees with branches adequate to support goshawk perching are retained (Detrich and Woodbridge 1994; Table WLD-22).

Commercial thinning, proposed under Alternatives 3, 4, and 5 would enhance goshawk habitat and habitat for goshawk prey by promoting stand development. Stands selected for treatment are at least 50 years old, and currently provide marginal goshawk habitat because they consist of high densities of small diameter trees, factors which limit availability of goshawk prey species and goshawk maneuverability (Salafsy et al. 2007).

Under all alternatives, goshawk habitat is maintained by the Forest Plan conservation strategy. If a new nest were located during the course of the project, Forest Plan standards and guidelines for goshawk nest protection would apply.

Cumulative Effects – All Alternatives

Timber harvest since 1954 has increased fragmentation of productive forest habitat and reduced the amount of high-quality habitat within the North Central Prince of Wales biogeographic province, which has experienced more harvest than other portions of the Tongass National Forest. Taking all land ownerships into account, the approximately 51

percent of the original total POG and 41 percent of the original high-volume POG present in 1954 remains in the North Central Prince of Wales biogeographic province (Table WLD-15). Within individual VCUs, the amount of original total POG ranges from 40 to 100 percent; the amount of original high-volume POG ranges from 18 to 100 percent (Table WLD-15). Refer to the biodiversity analysis above for a detailed discussion of effects to POG. Ongoing and future timber harvest on NFS and state and private lands (e.g., Logjam, Roadside EA, and Alaska State DNR timber sales) would result in additional loss of old-growth forest. However, commercial thinning under Alternatives 3, 4, and 5 in combination with future young-growth treatment and other thinning projects on NFS lands will, over the long-term, enhance goshawk habitat.

Foraging goshawks could be temporarily disturbed or displaced by timber harvest activities associated with the Big Thorne Project; similar disturbance also has the potential to occur in association with the other timber harvest, restoration, and ongoing road maintenance activities listed in Chapter 2. Minor short-term cumulative effects to goshawks may occur if the noise or disturbance associated with these activities and the Big Thorne Project coincide.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have negligible effects to goshawks because no action would be undertaken. No small OGR modifications would occur under Alternative 1; therefore, there would be no related effects to the goshawk.

Cumulative Effects

Alternative 1 would not contribute to cumulative effects to goshawks as no action would be undertaken. Refer to the Biodiversity section for an analysis of cumulative effects to POG within the North Central Prince of Wales biogeographic province and by VCU under Alternative 1 (Table WLD-15).

Alternative 2

Direct and Indirect Effects

Alternative 2 would harvest 4,792 acres of POG and 2,503 acres of high-volume POG, the third highest amount among the alternatives, which would reduce potential goshawk habitat (Tables WLD-12 and WLD-13). Approximately 14 percent of harvest would be uneven-aged under Alternative 2, thus most units would retain little value to goshawks following harvest (Table WLD-22). Refer to the biodiversity analysis for a discussion of effects to POG within the biogeographic province and by VCU.

No small OGR modifications would occur under Alternative 2; therefore, there would be no related effects to the goshawk.

Cumulative Effects

Within the project area VCUs, Alternative 2 would maintain 34 to 99 percent of the original total POG and 16 to 99 percent of the original high-volume POG (Table WLD-15). Refer to the Biodiversity discussion for an analysis of cumulative effects to POG within the North Central Prince of Wales biogeographic province and by VCU under Alternative 2. Thus, Alternative 2 has the potential to result in a local reduction goshawk

nesting and foraging habitat, and in the goshawk prey base. This could result in a reduction in the density of goshawks in the project area VCUs.

Alternative 3

Direct and Indirect Effects

Alternative 3 would harvest the most total POG (6,699 acres) and high-volume POG (3,720 acres) among the alternatives, and thus would result in the greatest reduction in potential goshawk habitat (Tables WLD-12 and WLD-13). Approximately 16 percent of harvest would be uneven-aged, thus most units would retain little value to goshawks following harvest (Table WLD-22). Refer to the Biodiversity analysis for a discussion of effects to POG within the biogeographic province and by VCU.

Small OGR modification proposed under Alternative 3 would increase the amount of goshawk habitat (POG) included in small OGRs in VCUs 5790, 5800, 5820, 5830, and 5950; modifications in VCUs 5810, 5840, 5850, 5860, and 5972 would decrease the amount of POG included (Table OGR-2).

Cumulative Effects

Alternative 3 would maintain 34 to 95 percent of the original total POG and 15 to 93 percent of the original high-volume POG within the project area VCUs (Table WLD-15). Refer to the Biodiversity section for an analysis of cumulative effects to POG within the North Central Prince of Wales biogeographic province and by VCU under Alternative 3.

Small OGR modifications under Alternative 3 would result in a net loss of 669 acres of high-volume POG included in the Old-growth LUD (Table OGR-2). This would reduce inclusion of goshawk nesting and foraging habitat in the reserve system, making it available for timber harvest which would contribute to the effects of ongoing and foreseeable timber harvest projects on goshawk habitat.

Thus, Alternative 3 has the potential to result in a local reduction goshawk nesting and foraging habitat, and in the goshawk prey base. This could result in a reduction in the density of goshawks in the project area VCUs.

Alternative 4

Direct and Indirect Effects

Alternative 4 would harvest 4,109 acres of total POG and 2,419 acres of high-volume POG, the least among the action alternatives (Tables WLD-12 and WLD-13). Thus it would result in the least reduction in goshawk habitat. Refer to the Biodiversity analysis above for a discussion of effects to POG within the biogeographic province and by VCU. Approximately 55 percent of the harvest under Alternative 4 would be uneven-aged management, the most among the alternatives (Table WLD-22). This would retain some structural components in harvested stands suitable for goshawks.

Small OGR modifications under Alternative 4 in all VCUs except VCU 5972 would increase the amount goshawk habitat (POG) maintained within the reserve system (Table OGR-2).

Cumulative Effects

Alternative 4 would maintain 34 to 99 percent of the original total POG, and 17 to 98 percent of the original high-volume POG within the project area VCUs (Table WLD-15).

Refer to the Biodiversity section for an analysis of cumulative effects to POG within the North Central Prince of Wales biogeographic province and by VCU under Alternative 4.

Small OGR modifications under Alternative 4 would result in a net gain of 454 acres of high-volume POG in the Old-growth Habitat LUD (Table OGR-2). This element of Alternative 4 would benefit goshawks because the biologically preferred alternatives are intended to include the largest remaining blocks of POG within each VCU and areas identified as potential goshawk nesting habitat.

Thus, Alternative 4 has the potential to result in a local reduction goshawk nesting and foraging habitat, and in the goshawk prey base. This could result in a reduction in the density of goshawks in the project area VCUs.

Alternative 5

Direct and Indirect Effects

Alternative 5 would harvest 4,848 acres of total POG and 2,612 acres of high-volume POG, the second highest amount among the alternatives, which would reduce potential goshawk habitat (Tables WLD-12 and WLD-13). Approximately 21 percent of harvest would be uneven-aged under Alternative 5, thus most units would retain little value to goshawks following harvest (Table WLD-22). Refer to the Biodiversity analysis for a discussion of effects to POG within the biogeographic province and by VCU.

No small OGR modifications would occur under Alternative 5; therefore, there would be no related effects to the goshawk.

Cumulative Effects

Alternative 5 would maintain 34 to 96 percent of the original total POG, and 16 to 96 percent of the original high-volume POG within the project area VCUs (Table WLD-15). Refer to the Biodiversity section for an analysis of cumulative effects to POG within the North Central Prince of Wales biogeographic province and by VCU under Alternative 5. Thus, Alternative 5 has the potential to result in a local reduction goshawk nesting and foraging habitat, and in the goshawk prey base. This could result in a reduction in the density of goshawks in the project area VCUs.

Conclusion

At the scale of the biogeographic province the action alternatives would result in a minor reduction in suitable nesting and foraging habitat for goshawks through the removal for forest cover. Under all alternatives there would be no direct impacts to any known nest area. Effects to goshawks would be greatest under Alternative 3, followed by Alternatives 2, 5, 4, and 1. Reductions in nesting and foraging habitat in the North Central Prince of Wales Island biogeographic province could result in the local expansion of individual goshawk home ranges, potentially leading to a reduction in breeding density. However, given that goshawks are highly mobile and that breeding density is currently low within the North Central Prince of Wales Island biogeographic province, and habitat is protected under the Forest Plan conservation strategy the effects of the Big Thorne Project in combination with past, present, and foreseeable activities may adversely impact individuals, but are not likely to result in a loss of viability in the Planning Area, nor cause a trend toward Federal listing.

Subsistence

Direct and Indirect Effects – All Alternatives

ANILCA requires that any analysis of project-related effects on Federal lands within Alaska take into account, 1) subsistence resource distribution and abundance, 2) access to these resources by subsistence users, and 3) competition for the use of these subsistence resources. This is because changes in access to subsistence resources due to project-related activities can affect the level of effort required, time involved, and the effectiveness of harvesting these resources. Altered distributions and abundance of subsistence resources can effect competition between subsistence and non-subsistence user, as well as competition between individual subsistence users.

Road building associated with timber harvesting is an important agent of change in Southeast Alaska. These road networks provide greater access to areas previously not accessible and can affect subsistence both positively and negatively by providing access, dispersing hunting and fishing pressure, and creating the potential for increased competition for favored hunting areas among communities connected by the existing road system (Forest Plan 2008b).

None of the Big Thorne Project alternatives would present "a significant possibility of a significant restriction" of subsistence uses for most subsistence resources (fish and marine invertebrates, food plants, personal use timber, upland game birds and waterfowl, furbearers, and marine mammals). These resources are briefly discussed below.

The direct and indirect effects of the Big Thorne Project alternatives may have a significant possibility of a significant restriction for subsistence uses of deer in the project area WAAs (USDA Forest Service 2008c). As noted above, deer are considered the "indicator" for potential subsistence resource consequences concerning the abundance and distribution of the resources, given their association with old-growth forest habitat and that they are the largest terrestrial component of subsistence food resources (USDA Forest Service 2008b); therefore, they are the only species addressed in detail in this analysis.

Sitka Black-tailed Deer

Abundance and Distribution

The abundance and distribution of deer is generally based on assessing the number and location of deer available for hunter harvest. After timber harvest, deer may shift their patterns of activity in response to forest succession, and the density of deer may decline as even-aged young-growth stands progress beyond shrub and sapling stages to stem-exclusion forests (Wallmo and Schoen 1980). As described in the Deer Effects section, implementation of the action alternatives would locally reduce deer winter habitat capability; which, over the long-term, could result in a reduction in deer numbers. Alternatives that result in the greatest reduction in deer habitat capability would be expected to have the greatest effect to deer abundance and distribution.

Access

Road building associated with timber harvesting is an important agent of change in Southeast Alaska. These road networks provide greater access to areas previously not accessible and can affect subsistence both positively and negatively by providing access,

dispersing hunting pressure, and creating the potential for increased competition for favored hunting areas among communities connected by the existing road system (Forest Plan 2008b). New proposed roads would be closed and stored 1 to 5 years after timber harvest activities are completed, under all alternatives; during the 1 to 5 year period, they would be open seasonally (from May 1 to November 30) to High Clearance Vehicles to allow for firewood removal and would improve access, especially on foot (see the Transportation section for more information on road management objectives).

Alternatives that would result in the greatest increase in the road system would be expected to result in the greatest increase in access to both subsistence and non-subsistence hunters. The greatest increase in road access would occur during project implementation when temporary and new roads are in use. Road access would decrease as road closures are applied, making them no longer available for use by motorized vehicles. Historical access would remain available under all the alternatives. Under all action alternatives there would be temporary restrictions in road access to subsistence during active logging operations as a safety precaution. As this project would occur over 10-years, all proposed timber operations, and temporary road closures would not occur simultaneously.

Timber harvest would also increase access to deer over the short term, due to the clearing of dense vegetation which makes them more visible to hunters. In a study of the influence of industrial logging on deer harvest on Prince of Wales Island, Brinkman et al. (2009) determined that hunters preferred habitats with open terrain, low vegetative cover, and high visibility (i.e., clearcuts). However, shrub and trees establishment in harvested areas associated with the transition of the forest to the stem exclusion stage creates undesirable hunting conditions (i.e., low visibility). Young-growth stands were least popular for hunting because they impeded the hunters' ability to see deer and were thought to contain fewer deer (Brinkman et al. 2009). Young-growth management, proposed under Alternatives 3, 4, and 5, may locally improve hunter access to deer over the long term.

Competition

Competition for subsistence resources is a result the distribution and fluctuation in population levels of game species, harvest regulations, mobility, and access provided to rural communities in the form of roads, ferries, and commercial air carriers. The Big Thorne project area is commonly used by subsistence hunters from a number of local communities for harvesting deer and other subsistence resources. The road network on Prince of Wales Island connects most of the communities on the island to the project area, and has allowed communities access to the area for hunting and other subsistence activities. Non-subsistence users (e.g., those from Ketchikan and Juneau, as well as out-of-state hunters) also hunt in the project area.

Timber harvest can influence competition for resources through new road construction, particularly near communities potentially generating competition from outside communities with lower abundance of the same resources. Habitat alternations that reduce carrying capacity, which could in turn reduce deer densities, will also increase competition for deer if allowable levels of harvest remain the same but available subsistence resources are diminished. Indirectly, displacement of subsistence hunters from areas with active timber harvest operations could temporarily increase competition in other subsistence use areas. Alternatives resulting in the greatest reduction in deer

carrying capacity and increase in the road system would be expected to result in the greatest likelihood of increasing competition for resources.

Other Subsistence Resources

Fish and Marine Invertebrates

The Big Thorne Project would not affect the abundance and distribution of, access to, or competition for anadromous or marine fish and marine invertebrates. The risk of project-related impacts to fish populations due to timber harvest would be minimal because of Tongass Timber Reform Act (TTRA) stream buffers, and Forest Plan beach and estuary, riparian, and fish standards and guidelines which maintain water quality and fish habitat (See Issue 4 for detailed assessment). Although the project may adversely affect Freshwater Essential Fish Habitat (EFH) and Marine EFH, effects would be temporary and localized. Fishing and marine invertebrate harvesting occurs primarily from boats, on beaches, and along estuaries. No activity associated with the Big Thorne Project is expected to occur in the marine environment that would preclude access to, or increase competition, for these resources. Freshwater fisheries are accessed by the road system, with motorized vehicles and OHVs. New roads under Alternatives 2, 3, 4, and 5, some of which would remain open for a period of years, may temporarily increase access to streams used for subsistence fishing. Some existing roads would be closed to public use for safety reasons during active timber harvesting, but any reduction in access would be temporary and localized.

Food Plants and Personal Use Timber

None of the alternatives are expected to negatively affect the abundance or distribution of subsistence plants gathered for food, because these resources are abundant along roads and in previously harvested areas. They are also are expected to increase in harvested stands during the early successional stage, declining thereafter. The Big Thorne Project would also not preclude Alaska residents from obtaining timber and firewood for personal use. New roads under Alternatives 2, 3, 4, and 5, some of which would remain open for a period of years, may temporarily increase access to areas where food plants and firewood can be gathered. Some existing roads would be closed to public use for safety reasons during active timber harvesting, but any reduction in access would be temporary and localized. Given that any beneficial changes in the abundance and distribution of food plants, and temporary effects to access, would be distributed throughout the project area over time (i.e., over the 10-year project period and beyond), no changes in competition for food plants or personal use timber would be expected.

Upland Game Birds and Waterfowl

All action alternatives would reduce upland game bird habitat (e.g., POG) and have the potential to increase vulnerability to harvest associated with increased access (see discussion of spruce grouse above). The presence of old growth reserves in the Big Thorne project area and implementation of standards and guidelines that maintain connectivity within matrix lands (e.g., various buffer requirements) would help sustain local populations. No measurable effects to waterfowl would occur, given that most species occur in the project area only during migration on lakes and in bays and estuaries (an exception is the Vancouver Canada goose which uses forested wetlands), and thus would be minimally exposed to project-related activities in the vicinity of these areas. Thus no changes in the

abundance or distribution of upland game birds and waterfowl are anticipated under any of the alternatives. The number of hunters may temporarily increase in the project area due to increased access along project roads, but competition would likely remain the same because upland birds and waterfowl do not contribute a large percentage of the foods for the subsistence communities in the project area.

Furbearers

Estuary, riparian, and forested coastal habitats that receive the greatest use by furbearers such as river otters and ermine are protected under Forest Plan conservation strategy. Therefore, the Big Thorne Project would not affect the abundance or distribution of this species.

Timber harvest (through the removal of POG and associated fragmentation)and road building (increased access) could affect the local distribution of marten. Marten may become more vulnerable to harvest with due to increased hunter access along project roads. This could increase competition among local communities, particularly if increased access in currently accessible areas were to lead to overharvest. However, these effects would be somewhat mitigated through project road closure and closures scheduled under the Prince of Wales Island ATM.

Marine Mammals

Marine mammals have the potential to be exposed to disturbance and noise associated with marine access facilities (MAFs) activity, potential collisions with vessels, and fuel or oil spills associated with vessel traffic. Alternatives 2, 3, 4, and 5 have the potential to result in a minor increase in vessel activity at the existing MAFs and in association with the export of logs. However, vessel activity would be infrequent, and would be spread over 10 years. Vessels used to transport logs are not likely to affect the abundance or distribution of marine mammals in Clarence Strait, given the transient nature of these species and the fact that such vessels typically operate at low, constants speeds, giving the marine mammal species time for avoidance, and would operate at infrequent intervals. Additionally, it is assumed that all vessels operating on behalf of the Big Thorne Project would adhere to Marine Mammal Protection Act, Endangered Species Act (ESA), and National Marine Fisheries Service (NMFS) guidelines for approaching marine mammals, as required under the Forest Plan. Therefore, no change in access to, or competition for, marine mammals would occur as a result of the project.

Cumulative Effects – All Alternatives

The Big Thorne project would have no effect to the abundance or distribution of, access to, or competition for marine fish and invertebrates, waterfowl, furbearers using estuary, riparian, or coastal habitats, or marine mammals. Therefore, the project would make no contribution to cumulative effects to these species. Exceptions are the Vancouver Canada goose (waterfowl), and marten (furbearer) which would be affected by reductions in POG habitat and/or increased road densities and related effects associated with increased human access under all the action alternatives (see the species-specific discussions above). Ongoing and foreseeable timber harvest projects would contribute to these effects. The Big Thorne project would result in temporary increases in the abundance and distribution of food plants, and temporary increases in access to food plants/personal use timber and

freshwater fish. Ongoing and foreseeable timber harvest (through increases in early seral forest and roads) would contribute to these effects.

Past timber harvest has altered the distribution of deer used by the communities in the vicinity of the Big Thorne Project, through changes in the distribution of habitat types and road development. Ongoing and foreseeable timber harvests and associated road construction, as well as other development, would contribute to these effects. The Big Thorne Project, in conjunction with past and foreseeable actions, may further alter the abundance or distribution of deer through reductions in carrying capacity.

It is assumed that a deer population at carrying capacity should be able to support a sustainable hunter harvest (demand) equal to approximately 10 percent of the habitat capability while also providing a reasonably high level of hunter success in the WAA (USDA Forest Service 2008b). Hunter success can be expected to decline (through reduced hunter efficiency and moderate difficulty in obtaining deer) in areas where demand equates to between 10 and 20 percent of habitat capability. If demand exceeds 20 percent of habitat capability, harvest of deer by hunters may be directly (through restriction in seasons and bag limits) or indirectly (through reduced hunter efficiency and increased difficulty in obtaining deer relative to historical rates) affected (USDA Forest Service 2008b). A comparison of projected numbers of deer available, based on modeled deer habitat capability (taking all landownerships into account), and hunter demand by WAA is provided in Table WLD-34. Because actual hunter demand is unknown, hunter harvest data (number of deer taken) from 2005 to 2010 were used to represent hunter demand. It should be noted that this likely underestimates actual hunter demand, as it does not include hunters who were not successful in taking any deer or took fewer deer than they desired.

Habitat capability in WAAs 1318 and 1319 currently appears adequate to sustain current levels of deer harvest (i.e., hunter demand is less than 10 percent of habitat capability; Table WLD-34). Current levels of deer harvest would be expected to decline in WAA 1315 (i.e., hunter demand is just over 10 percent of habitat capability; Table WLD-34). Due to past timber harvest, existing deer habitat capability in WAA 1420 may not be adequate to sustain the current levels of deer harvest (i.e., hunter demand is close to 20 percent of habitat capability; Table WLD-34). Over time, hunter success in WAA 1420 would be expected to decline due to reduced hunter efficiency and moderate difficulty in obtaining deer (USDA Forest Service 2008b).

Commercial thinning proposed under Alternatives 3, 4, and 5 would improve deer habitat by extending the period during which forage is available. Over time, these actions would increase deer habitat capability, and therefore potentially the abundance and distribution of deer available to hunters. Improvements in deer habitat capability may also reduce necessity for hunting restrictions.

Table WLD-34. Hunter Demand by WAA of Current (2012) and Projected Deer Habitat Capability by Alternative (NFS and non-NFS[1/] lands) Incorporating Past and Foreseeable Projects

		Wildlife Analysis Area (WAA)			
		1315	1318	1319	1420
WAA Area (square miles)		152.6	199.2	163.3	73.5
Hunter Demand (no. deer)[2/]		280	138	203	182
Existing Deer Habitat Capability (deer/sq mi)[3/]		17	14	16	12
Total Deer Habitat Capability (per WAA)					
Current Conditions		2,594	2,789	2,613	882
Alternative 1	Project Completion	2,594	2,789	2,613	882
	Stem Exclusion	2,442	2,590	2,450	809
Alternative 2	Project Completion	2,442	2,590	2,450	882
	Stem Exclusion	2,289	2,590	2,450	735
Alternative 3	Project Completion	2,442	2,590	2,450	809
	Stem Exclusion	2,289	2,590	2,450	735
Alternative 4	Project Completion	2,442	2,590	2,450	882
	Stem Exclusion	2,289	2,590	2,450	735
Alternative 5	Project Completion	2,442	2,590	2,450	809
	Stem Exclusion	2,289	2,590	2,450	735
Hunter Demand as % of Habitat Capability [4/]					
Current Conditions		10.8%	4.9%	7.8%	20.6%
Alternative 1	Project Completion	10.8%	4.9%	7.8%	20.6%
	Stem Exclusion	11.5%	5.3%	8.3%	22.5%
Alternative 2	Project Completion	11.5%	5.3%	8.3%	20.6%
	Stem Exclusion	12.2%	5.3%	8.3%	24.8%
Alternative 3	Project Completion	11.5%	5.3%	8.3%	22.5%
	Stem Exclusion	12.2%	5.3%	8.3%	24.8%
Alternative 4	Project Completion	11.5%	5.3%	8.3%	20.6%
	Stem Exclusion	12.2%	5.3%	8.3%	24.8%
Alternative 5	Project Completion	11.5%	5.3%	8.3%	22.5%
	Stem Exclusion	12.2%	5.3%	8.3%	24.8%

1/ Assumes deer habitat capability is zero on all non-NFS acres.
2/ Hunter harvest data (including resident and nonresident hunters) from 2005 to 2010 was used to estimate the average hunter harvest, representing hunter demand.
3/ Deer habitat capability calculated from the deer model for winter habitat at all elevations. Habitat Suitability Indices (HSIs) were standardized to range from 0.0 to 1.0; 100 deer per square mile used as multiplier; all harvest units were assumed to be even-aged; no predation was included.
4/ Assumes average annual deer harvest between 2005 and 2009 (resident and non-resident) represents demand; ≤10 = reasonably high hunter success expected, 10-20 = Hunter success can be expected to decline, >20 = harvest may be directly (through restriction in seasons and bag limits) or indirectly (through reduced hunter efficiency and increased difficulty in obtaining deer relative to historical rates) affected (USDA Forest Service 2008b).
Source: GIS Database, deer_model.aml, 2012

Collectively, new proposed roads associated with the Big Thorne Project in addition to those resulting from other projects would temporarily improve access and reduce competition. All alternatives would implement the Prince of Wales Island ATM, under which additional road closures would occur as funding allows, reducing access to subsistence resources over the long-term (USDA Forest Service 2009).

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effects on subsistence resources as no project-related activities would occur. Abundance of, access to, and competition for subsistence resources under Alternative 1 would be similar to existing conditions. However, there would be indirect effects to deer habitat over time in the absence of young-growth management as existing previously harvested stands move into the stem exclusion stage thereby reducing the abundance of the resource (deer; Table WLD-18). Conditions in unmanaged young-growth stands reduce access to deer and increased undesirable habitat for deer hunting (Brinkman et al. 2009). Thus, over time, reductions in habitat capability for deer may reduce the deer abundance. Under Alternative 1, deer habitat capability would be reduced by less than 1 percent at project completion, and by 6 to 8 percent at stem exclusion, depending on the WAA (Table WLD-18).

Under Alternative 1, no new roads would be constructed. Therefore, road access would remain the same.

Reductions in deer habitat capability at stem exclusion primarily result from the progression of recently harvested stands on non-NFS lands to the stem exclusion phase. As hunter efficiency and success decrease in these areas, there is the potential for increased competition for deer on NFS lands where habitat capability, and potentially deer abundance, is higher.

Under Alternative 1 there would be no change in OGR boundaries. As a result, access for subsistence resources would be unchanged. Further, the current amount of deer winter habitat incorporated in project area small OGRs would be maintained under these alternatives. Thus, there would be no change in the availability of deer to subsistence hunters.

Cumulative Effects

Alternative 1 would have negligible impacts to subsistence because it would not result in a measureable reduction in deer habitat capability or result in road building (Tables WLD-34 and WLD-35). However, Alternative 1 would benefit from the improvement in deer habitat quality resulting from young-growth treatments and watershed restoration projects that involve thinning on NSF lands. Therefore under Alternative 1, the distribution of, competition for subsistence resources would remain as they are; however the abundance of deer may change as stands move into the stem exclusion stage

Alternative 1 in combination with past, ongoing, and foreseeable projects would maintain 56 to 86 percent of the original (1954) deer habitat capability at project completion, and 53 to 86 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-20). Alternative 1 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 31 to 70 percent of original amounts; average snow winter habitat to 52 to 74 percent of original amounts; and non-winter habitat to 70 to 91 percent) of original amounts depending on the WAA (Table WLD-21).

Under Alternative 1, scheduled road closures under the Prince of Wales Island ATM would be implemented. This would reduce access to subsistence resources.

Alternative 2

Direct and Indirect Effects

Alternative 2 would result in an increase in approximately 54 miles of open roads, of which approximately 31 would be new or reconstructed NFS roads that would be open seasonally from 1 to 5 years following harvest to allow for firewood removal and 23 miles would be temporary roads (see Table TRAN-3 in Transportation section) . Most would be in WAA 1319 (26 miles), followed by WAAs 1315 (16 miles), 1420 (8 miles), and 1318 (5 miles each). Approximately 4 miles of road would be converted to motorized trails when the roads are stored; with ATM implementation there would be a total of 48 miles of motorized trails under Alternative 2 (see Table TRAN-6 in Transportation section). Of the four action alternatives, this alternative proposes the second highest amount of new road construction, and would have the second greatest temporary improvement in access.

Effects to deer habitat capability by WAA under Alternative 2 are described under the Sitka Black-tailed Deer subsection (Table WLD-18). Alternative 2 would result in an immediate reduction in deer habitat capability by WAA ranging from 0 to 7 percent from current conditions, the second highest among the alternatives (Table WLD-18). At stem exclusion, deer habitat capability would be reduced by a total of 6 to 17 percent from current conditions, depending on the WAA (Table WLD-18). Alternative 2 would result in the harvest of approximately 1,484 acres of deep snow winter habitat (3 to 6 percent reduction from current conditions by WAA), 4,641 acres of average snow winter habitat (3 to 5 percent reduction from current conditions by WAA), and 4,941 acres of non-winter habitat (1 to 3 percent reduction from current conditions by WAA; Table WLD-19).

No OGR modifications are proposed under Alternative 2; therefore the OGRs would provide deer as a subsistence resource with abundance (deer habitat capability in the OGRs), access (miles of road in the OGRs), distribution (winter habitat in the OGRs), and competition the same as under Alternative 1.

Under Alternative 2, hunter success would be expected to remain high in WAAs 1318 and 1319, decline in WAA 1315, and be directly or indirectly reduced through harvest restrictions or difficulty obtaining deer in WAA 1420 at project completion (Table WLD-34). At stem exclusion, hunter success would be expected to remain high in WAAs 1318 and 1319, decline in WAA 1315, and continue to be directly or indirectly affected through harvest restrictions or difficulty obtaining deer in WAA 1420 (Tables WLD-34 and WLD-35).

Cumulative Effects

Under Alternative 2, the Big Thorne Project in combination with past, ongoing, and reasonably foreseeable projects would maintain 53 to 86 percent of the original (1954) deer habitat capability at project completion, and 47 to 86 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-19). Alternative 2 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 30 to 66 percent of original amounts; average snow winter habitat to 49 to 72 percent of original amounts; and non-winter habitat to 68 to 91 percent of original amounts, depending on the WAA (Table WLD-20).

Commercial thinning would not occur under Alternative 2, and therefore it would not contribute to the improvement of deer habitat resulting from young-growth treatments and other projects that involve thinning on NFS lands.

Cumulative open road miles by WAA under Alternative 2, accounting for all landownerships and all elevations, would be highest in WAA 1318 (360 miles), followed by WAAs 1315 (294 miles), 1319 (118 miles), and 1420 (84 miles), the second highest among the alternatives. This includes road construction from other timber harvest projects, which would also increase access. Scheduled road closures under the Prince of Wales Island ATM implemented under Alternative 2 would ultimately reduce access to, and may increase competition for, deer in the project area due to the reduction in motorized road access (USDA Forest Service 2009).

Alternative 3

Direct and Indirect Effects

Alternative 3 would result in an increase in approximately 95 miles of open roads, of which approximately 56 would be new or reconstructed NFS roads that would be open seasonally from 1 to 5 years following harvest to allow for firewood removal and 39 miles would be temporary roads (see Table TRAN-3 in Transportation Section). Most would be in WAA 1319 (43 miles), followed by WAAs 1315 (29 miles), 1420 (16 miles), and 1318 (7 miles). Approximately 5 miles of road would be converted to motorized trails when the roads are stored; with ATM implementation there would be a total of 49 miles of motorized trails under Alternative 3 (see Table TRAN-6 in Transportation section). Of the four action alternatives, this alternative proposes the highest amount of new road construction, and thus would result in the greatest temporary improvement in access.

Effects to deer habitat capability by WAA under Alternative 3 are described under the Sitka Black-tailed Deer subsection (Table WLD-18). Alternative 3 would result in an immediate reduction in deer habitat capability by WAA ranging from 6 to 8 percent from current conditions, the most among the alternatives (Table WLD-18). At stem exclusion, deer habitat capability would be reduced by a total of 6 to 17 percent from current conditions, depending on the WAA (Table WLD-20).

Alternative 3 would result in the harvest of approximately 2,306 acres of deep snow winter habitat (5 to 13 percent reduction from current conditions by WAA), 6,500 acres of average snow winter habitat (3 to 9 percent reduction from current conditions by WAA), and 6,923 acres of non-winter habitat (1 to 5 percent reduction from current conditions by WAA (Table WLD-19).

With the exception of VCU 5820 (Baird Peak), small OGR modifications under Alternative 3 would reduce inclusion of deep snow deer winter range in the reserve system. Harvest of these areas would reduce the amount of suitable habitat for deer (Table OGR-2), which could reduce the abundance and distribution of deer in the project area.

Under Alternative 3, hunter success would be expected to remain high in WAAs 1318 and 1319, decline in WAA 1315, and be directly or indirectly reduced through harvest restrictions or difficulty obtaining deer in WAA 1420 at project completion (Tables WLD-34 and WLD-35). At stem exclusion hunter success would be expected to remain high in

WAAs 1318 and 1319, decline in WAA 1315, and continue to be directly or indirectly affected through harvest restrictions or difficulty obtaining deer in WAA 1420 (Tables WLD-34 and WLD-35). Reductions in hunter success would be greater under Alternative 3 than under the other alternatives.

Cumulative Effects

Under Alternative 3, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would maintain 53 to 86 percent of the original (1954) deer habitat capability at project completion, and 47 to 86 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-20). The level of deer habitat capability maintained under Alternative 3 would be the least among the alternatives. Alternative 3 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 27 to 66 percent of original amounts; average snow winter habitat to 48 to 72 percent of original amounts; and non-winter habitat to 67 to 91 percent of original amounts, depending on the WAA (Table WLD-21).

Commercial thinning under Alternative 3, would contribute to the improvement of deer habitat resulting from young-growth treatments and other projects that involve thinning on NFS lands. Over time, these actions would increase deer habitat capability, and therefore potentially the abundance and distribution of deer available to hunters. Improvements in deer habitat capability would also reduce necessity for hunting restrictions.

Cumulative open miles by WAA under Alternative 3, accounting for all landownerships and all elevations, would be highest in WAA 1318 (360 miles), followed by WAAs 1315 (300 miles), 1319 (118 miles), and 1420 (85 miles), the highest among the alternatives. This includes road construction from other timber harvest projects, which would also increase access. Scheduled road closures under the Prince of Wales Island ATM implemented under Alternative 3 would ultimately reduce access to, and may increase competition for, deer in the project area due to the reduction in motorized road access (USDA Forest Service 2009).

Alternative 4

Direct and Indirect Effects

Alternative 4 would result in an increase in approximately 41 miles of open roads, of which approximately 25 would be new or reconstructed NFS roads that would be open seasonally from 1 to 5 years following harvest to allow for firewood removal and 16 miles would be temporary roads (see Table TRAN-3 in Transportation Section). Most would be in WAAs 1315/1319 (15 miles each), followed by WAAs 1420 (10 miles), and 1318 (2 miles). Approximately 2 miles of road would be converted to motorized trails when the roads are stored; with ATM implementation there would be a total of 46 miles of motorized trails under Alternative 4 (see Table TRAN-6 inTransportation section).Of the four action alternatives, this alternative proposes the second least amount of new road construction, and thus would have the least effects related to temporarily improving access.

Effects to deer habitat capability by WAA under Alternative 4 are described under the Sitka Black-tailed Deer subsection (Table WLD-18). Alternative 4 would result in an immediate reduction in deer habitat capability by WAA ranging from 0 to 7 percent from

current conditions, the least among the action alternatives (Table WLD-18). At stem exclusion state, deer habitat capability would be reduced by a total of 6 to 17 percent from current conditions, depending on the WAA (Table WLD-18).

Alternative 4 would result in the harvest of approximately 1,208 acres of deep snow winter habitat (2 to 6 percent reduction from current conditions by WAA), 3,942 acres of average snow winter habitat (2 to 5 percent reduction from current conditions by WAA), and 4,237 acres of non-winter habitat (1 to 3 percent reduction from current condition by WAA (Table WLD-19).

In most VCUs (all except VCU 5972) small OGR modifications proposed under Alternative 4 would increase inclusion of deep snow winter habitat and/or low-elevation POG (Table OGR-2). This could increase the abundance and distribution of deer in the project area.

Under Alternative 4, hunter success would be expected to remain high in WAAs 1318 and 1319, decline in WAA 1315, and be directly or indirectly reduced through harvest restrictions or difficulty obtaining deer in WAA 1420 at project completion (Tables WLD-34 and WLD-35). At stem exclusion hunter success would be expected to remain high in WAAs 1318 and 1319, decline in WAA 1315, and continue to be directly or indirectly affected through harvest restrictions or difficulty obtaining deer in WAA 1420 (Tables WLD-34 and WLD-35). Changes in hunter success under Alternative 4 would be comparable to those under Alternative 2.

Cumulative Effects

Under Alternative 4, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would maintain 53 to 86 percent of the original (1954) deer habitat capability at project completion, and 47 to 86 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-20). Alternative 4 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 30 to 68 percent of original amounts; average snow winter habitat to 50 to 73 percent of original amounts; and non-winter habitat to 68 to 91 percent of original amounts, depending on the WAA (Table WLD-21).

Commercial thinning under Alternative 4 would contribute to the improvement of deer habitat resulting from young-growth treatments and other projects that involve thinning on NFS lands.

Cumulative open miles by WAA under Alternative 4, accounting for all landownerships and all elevations, would be highest in WAA 1318 (358 miles), followed by WAAs 1315 (289 miles), 1319 (107 miles), and 1420 (83 miles), the second least among the alternatives. This includes road construction from other timber harvest projects, which would also increase access. Scheduled road closures under the Prince of Wales Island ATM implemented under Alternative 4 would ultimately reduce access to, and may increase competition for, deer in the project area due to the reduction in motorized road access (USDA Forest Service 2009).

Alternative 5

Direct and Indirect Effects

Alternative 5 would result in an increase in approximately 31 miles of open roads, of which approximately 17 would be new or reconstructed NFS roads that would be open seasonally from 1 to 5 years following harvest to allow for firewood removal and 14 miles would be temporary roads (see Table TRAN-3 in Transportation Section). Most would be in WAAs 1319 (17 miles each), followed by WAAs 1420 (8 miles), 1315 (4 miles), and 1318 (2 miles). Approximately 1 mile of road would be converted to motorized trails when the roads are stored; with ATM implementation there would be a total of 45 miles of motorized trails under Alternative 5 (see Table TRAN-6 in Transportation section). Of the four action alternatives, this alternative proposes the least amount of new road construction, and thus would have the fewest effects related to temporarily improving access.

Effects to deer habitat capability by WAA under Alternative 5 are described under the Sitka Black-tailed Deer subsection (Table WLD-18). Alternative 5 would result in an immediate reduction in deer habitat capability by WAA ranging from 6 to 8 percent from current conditions (Table WLD-18). At stem exclusion state, deer habitat capability would be reduced by a total of 7 to 17 percent from current conditions, depending on the WAA (Table WLD-18). Effects would be less than under Alternative 2 and 3 but greater than under Alternative 4.

Alternative 5 would result in the harvest of approximately 1,518 acres of deep snow winter habitat (3 to 6 percent reduction from current conditions by WAA), 4,668 acres of average snow winter habitat (3 to 6 percent reduction from current conditions by WAA), and 5,025 acres of non-winter habitat (1 to 3 percent reduction from current conditions by WAA (Table WLD-19).

No OGR modifications are proposed under Alternative 5; therefore the OGRs would provide deer as a subsistence resource with abundance (deer habitat capability in the OGRs), access (miles of road in the OGRs), distribution (winter habitat in the OGRs), and competition the same as under Alternative 1.

Under Alternative 5, hunter success would be expected to remain high in WAAs 1318 and 1319, decline in WAA 1315, and be directly or indirectly reduced through harvest restrictions or difficulty obtaining deer in WAA 1420 at project completion (Tables WLD-34 and WLD-35). At stem exclusion, hunter success would be expected to remain high in WAAs 1318 and 1319, decline in WAA 1315, and continue to be directly or indirectly affected through harvest restrictions or difficulty obtaining deer in WAA 1420 (Tables WLD-34 and WLD-35). Changes in hunter success under Alternative 5 would be comparable to those under Alternatives 2 and 4.

Cumulative Effects

Under Alternative 5, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would maintain 53 to 86 percent of the original (1954) deer habitat capability at project completion, and 47 to 86 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-20). Alternative 5 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deer habitat to 29 to 67 percent of original amounts;

average snow winter habitat to 49 to 72 percent of original amounts; and non-winter habitat to 68 to 91 percent of original amounts, depending on the WAA (Table WLD-21).

Commercial thinning under Alternative 5 would contribute to the improvement of deer habitat resulting from young-growth treatments and other projects that involve thinning on NFS lands.

Cumulative open road miles by WAA under Alternative 5, accounting for all landownerships and all elevations, would be highest in WAA 1318 (358 miles), followed by WAAs 1315 (286 miles), 1319 (110 miles), and 1420 (81 miles), the least among the alternatives. This includes road construction from other timber harvest projects, which would also increase access. Scheduled road closures under the Prince of Wales Island ATM implemented under Alternative 5 would ultimately reduce access to, and may increase competition for, deer in the project area due to the reduction in motorized road access (USDA Forest Service 2009).

Conclusion

The Record of Decision (ROD) for the 2008 Forest Plan Final EIS (USDA Forest Service 2008d) concluded that the "deer habitat capabilities in areas of the Tongass with heavier timber harvest may not be adequate to sustain current and future deer harvest levels, and that increased competition for deer harvest may cause a significant possibility of a significant restriction in the future." The cumulative effects analysis in the 2008 Forest Plan Final EIS concluded that full implementation of the Forest Plan may result in a significant restriction to subsistence use of deer due to the potential effects of projects on the abundance and distribution of this resource, and on competition for this resource (USDA Forest Service 2008b). A discussion of the Section 810 determination for the Forest Plan is provided in the 2008 ROD.

The ROD for the Big Thorne Project will include a final finding about any significant restrictions on subsistence uses that may result from implementation of the Selected Alternative. The following summarizes the anticipated finding:

- The direct and indirect effects from all alternatives associated with the Big Thorne Project do not present a significant possibility of a significant restriction of subsistence uses of fish and marine invertebrates, food plants, personal use timber, upland game birds and waterfowl, furbearers, marine mammals or deer.
- The potential cumulative effects associated with implementing the Forest Plan through the entire rotation period, which include the Big Thorne Project no action and action alternatives, do not present a significant possibility of a significant restriction to subsistence uses fish and marine invertebrates, food plants, personal use timber, upland game birds and waterfowl; however, a possibility of a restriction may exist for deer.

Subsistence Findings

The 1997 Forest Plan Final EIS (USDA Forest Service 1997) included a cumulative effects analysis of resource development on subsistence resources. Based on that analysis, the Forest Plan ROD (USDA Forest Service 2008) concluded that full implementation of the Forest Plan "may result in a significant restriction to subsistence use of deer due to the potential effects of projects on the abundance and distribution of these resources, and on

competition for these resources". It is not possible to substantially reduce timber harvest in one area and concentrate it in other areas without affecting subsistence resources and uses important to one or more rural communities (USDA Forest Service 1997).

For this reason, timber sale activities cannot completely avoid cumulative landscape effects to subsistence uses. Based on this evaluation and ANILCA definitions of significance, it was determined that, in combination with other past, present and reasonably foreseeable future actions, all of the alternatives (if implemented through project-level decisions and actions) may result in a significant restriction of subsistence uses of deer, due to potential effects on abundance and distribution, and on competition. This determination is based on an anticipated increase in human population, an associated increase in subsistence activities, and the capability of the habitat to produce deer. As a result of this finding, the Forest Service will notify the appropriate state agencies, local communities, the Southeast Alaska Federal Subsistence Regional Advisory Council, and State Fish and Game Advisory Committees.

Section 810 (a)(3) of ANILCA requires that when a use, occupancy, or disposition of public lands may result in a significant possibility of a significant restriction, a determination must be made whether (1) such a restriction is necessary, consistent with sound management principles for the utilization of public lands, (2) the proposed activity involves the minimum amount of public lands necessary to accomplish the purposes of the use, and (3) reasonable steps will be taken to minimize adverse impacts on subsistence uses and resources resulting from the actions.

Using the information described earlier in this section, the alternatives were evaluated for potential effects on subsistence uses and needs, as described above.

Necessary and Consistent with Sound Management of Public Lands: The alternatives proposed in this EIS have been examined to determine whether they are necessary and consistent with sound management of public lands. In this regard, the National Forest Management Act, the Alaska National Interest Lands Conservation Act, the Tongass Timber Reform Act, the Wilderness Act, the 2008 Forest Plan Amendment Final EIS, the Alaska State Forest Resources and Practices Act, and the Alaska Coastal Zone Management Program have been considered.

National Forest land management plans are required by the National Forest Management Act and must provide for the multiple-use and sustained yield of renewable forest resources in accordance with the Multiple-Use Sustained Yield Act of 1960. Multiple-use is defined as "the management of all the various renewable surface resources of the National Forest System so that they are utilized in the combination that will best meets the needs of the American people" (36 CFR 219.3). The alternatives presented herein represent different ways of managing Tongass National Forest resources in combinations that are intended to meet the needs of the American people. The potential restrictions associated with each alternative are necessary and consistent with the sound management of public lands.

Amount of Public Land Necessary to Accomplish the Proposed Action: The amount of land necessary to implement each alternative is, considering sound multiple-use management of public lands, the minimum necessary to accomplish the purpose of that alternative. The entire forested portion of the Tongass is used by at least one rural

community for subsistence purposes for, at a minimum, deer hunting. It is not possible to avoid all of these areas in implementing resource use activities, such as timber harvesting and road construction, under any alternative, and attempting to reduce effects in some areas can mean increasing the use of others. The current Forest-wide Standards and Guidelines and LUD prescriptions provide for management or limit activities in many of the area's most important for subsistence uses, such as beaches and estuaries, and areas with high fish and wildlife habitat values.

Reasonable Steps to Minimize Adverse Impacts to Subsistence Uses and Resources: Subsistence use is addressed specifically in a 2008 Forest-wide Standards and Guidelines, and subsistence resources are covered by the Forest-wide Standards and Guidelines for wildlife, fish, riparian areas, and biological diversity, among others. Fish and wildlife habitat productivity would be maintained at the highest level possible under all alternatives, consistent with the overall multiple-use goals of the current Forest Plan, with improved protection under the Forest Plan.

Issue 4: Cumulative Watershed Effects

Issue statement: *The proposed action combined with past timber harvest would increase the percentage of each watershed area covered by timber harvest and would increase road densities in each watershed, potentially resulting in higher rates of sedimentation and/or other effects on aquatic habitats.*

Introduction

The identified issues and concerns relevant to watershed resources within the Big Thorne project area were developed based on external scoping comments from the public and internal review. The primary issues/concerns surrounding these resources are related to the intensity of past harvest and road construction in the project area and the potential cumulative effects on watersheds and fish associated with additional harvest. The project area includes a number of streams with high fisheries value that are located in watersheds with histories of intensive harvest and road construction. The interdisciplinary team identified Issue 4 and developed Alternative 5 in response to cumulative watershed effects concerns.

Direct, indirect, and cumulative effects for all affected watersheds are estimated using quantifiable measures for actual effects (e.g., stream crossings are a measure for increased sediment) as supported by the literature cited. Table WTR-1 lists the units of measure used to evaluate the effects of the proposal and compare alternatives.

Table WTR-1. Watershed Issues/Concerns Addressed and Environmental Components Analyzed for the Big Thorne Project Area

Issue/Concern	Environmental Component	Measure or Indicator
Cumulative Effects of Harvest and Road Construction on Watersheds	• Changes in streamflow	• Watersheds with more than 20 percent basin area harvested from 1981 through project implementation (young growth 30 years of age or younger)
	• Increased sediment	• Existing and new miles and acres of road construction by watershed • Existing and new numbers of Class I, II, and III stream crossings by watershed
	• Changes in stream habitat	• Existing and new numbers of Class I and II stream crossings by watershed

Methodology

The project area boundary does not coincide with watershed boundaries; therefore, the analysis area for direct, indirect, and cumulative effects includes all watersheds with any proposed ground disturbance in any alternative. This allows for watershed-level analysis of effects resulting from project actions.

To effectively analyze the direct, indirect, and cumulative effects of harvest and road construction on watersheds in the project area, and to utilize available assessments at finer subwatershed scales, project effects and alternative comparisons were conducted at both

watershed and subwatershed scales. Watershed and subwatershed polygons at both scales were clipped to the land area, eliminating marine area from the analysis.

Although analyses were conducted at both the watershed and subwatershed scales, to succinctly describe the effects resulting from project actions at a finer scale, project effects and alternative comparisons are reported at the subwatershed scale. When effects resulting from project actions were found at the watershed scale, those results are provided. The complete detailed analyses of project effects and alternative comparisons at both the watershed and subwatershed scale are provided in the Watershed Resource Report (James 2012).

Information sources used in the analyses include field reconnaissance surveys conducted in the project area between 2009 and 2011, available literature, and geographic information system (GIS) data. USDA Forest Service watershed and fisheries staff conducted field reconnaissance of the proposed roads and units between 2009 and 2011, resulting in updates to the streams layer and detailed records of erosion features, windthrow, and other relevant observations. Proper Functioning Condition (PFC) assessments (USDI Bureau of Land Management 1998) and roads surveys were conducted by USDA Forest Service watershed and fisheries staff in the Eagle Creek (Fryxell 2009), North Thorne River (USDA Forest Service 2006a; Beard 2011), and North Big Salt Lake (also known as “Steelhead”) (USDA Forest Service unpublished document 2010a) watersheds, and the Gravelly Creek (USDA Forest Service 2006a; Beard 2011), Falls Creek (USDA Forest Service 2006a and Beard 2011), and Sal Creek (Prussian 2008) subwatersheds. Tier II stream surveys were conducted by USDA Forest Service watershed and fisheries staff in the Eagle Creek, Sal Creek, Big Ratz and North Thorne River watersheds. Tier II surveys are intended to provide consistent, quantitative estimates of habitat parameters that are required in order to evaluate the condition of a stream relative to the forest habitat management objectives (RHMO). The tier II surveys include measurements of channel morphology, pools, ponded areas, large wood, disturbance, stream buffers, floodplain characteristics, fish presence and migration barriers (USDA Forest Service 2001).

GIS queries were used to evaluate effects and compare alternatives, and provide surrogate measures of effects, supported by literature cited. Harvest and road indicator thresholds are used for analysis purposes only and are not prescribed by the Forest Plan. More information on methodology is contained in the Watershed Resource Report (James 2012).

Road miles and harvest unit acres were estimated from continued Forest Service micro-sales and the State’s 5-Year Schedule of Timber Sales (ADNR 2011) and included in calculations of cumulative harvest and roads in affected watersheds.

Affected Environment

The Big Thorne project area encompasses roughly 232,000 acres of north Prince of Wales Island in Southeast Alaska near Thorne Bay and Coffman Cove. Elevation ranges from sea level to over 3,800 feet in the southwest portion of the North Big Salt Lake (also known as “Steelhead”) watershed. Annual precipitation may exceed 100 inches, with the

highest rainfall occurring during October and lowest in June. Individual storms vary dramatically over short distances and can produce intense rainfall and high winds.

The Big Thorne project area contains two distinct ecological subsections: Central Prince of Wales Till Lowlands and Central Prince of Wales Volcanics. The majority of the project area is characterized as Central Prince of Wales Volcanics, especially along the coast and headwaters of Thorne River. This terrain originated as rugged volcanic mountains. Subsequent glaciation carved steeply sloped U-shaped valleys (Nowacki et al. 2001). The lowlands around Thorne River are characterized as Central Prince of Wales Till Lowlands. This subsection developed gently undulating terrain under continental ice lobes. Slow moving palustrine and floodplain channel types are common on this landscape (Nowacki et al. 2001). Shallow lakes and ponds pockmark an intermixture of forested and non-forested bogs and fens.

There are 21 watersheds with at least part of their drainage within the project boundary (Figure WTR-1). Of these, eight watersheds have no proposed ground disturbance in any alternative. Because there would be no proposed ground disturbance in any alternative within these eight watersheds, and they would not be affected by project activities outside of their watershed boundaries, analysis of effects is limited to the 13 remaining watersheds with proposed ground disturbance.

There are 48 subwatersheds with at least part of their drainage within the project boundary (Figure WTR-2). Of these, 11 subwatersheds have no proposed ground disturbance in any alternative and would not be affected by the project. Because there would be no proposed ground disturbance in any alternative within these 11 subwatersheds, and they would not be affected by project activities outside of their subwatershed boundaries, analysis of effects is limited to the 37 subwatersheds with proposed ground disturbance. Table WTR-2 lists by name each of the subwatersheds with proposed ground disturbance in any alternative.

Figure WTR-1. Watersheds within the Big Thorne Project Area

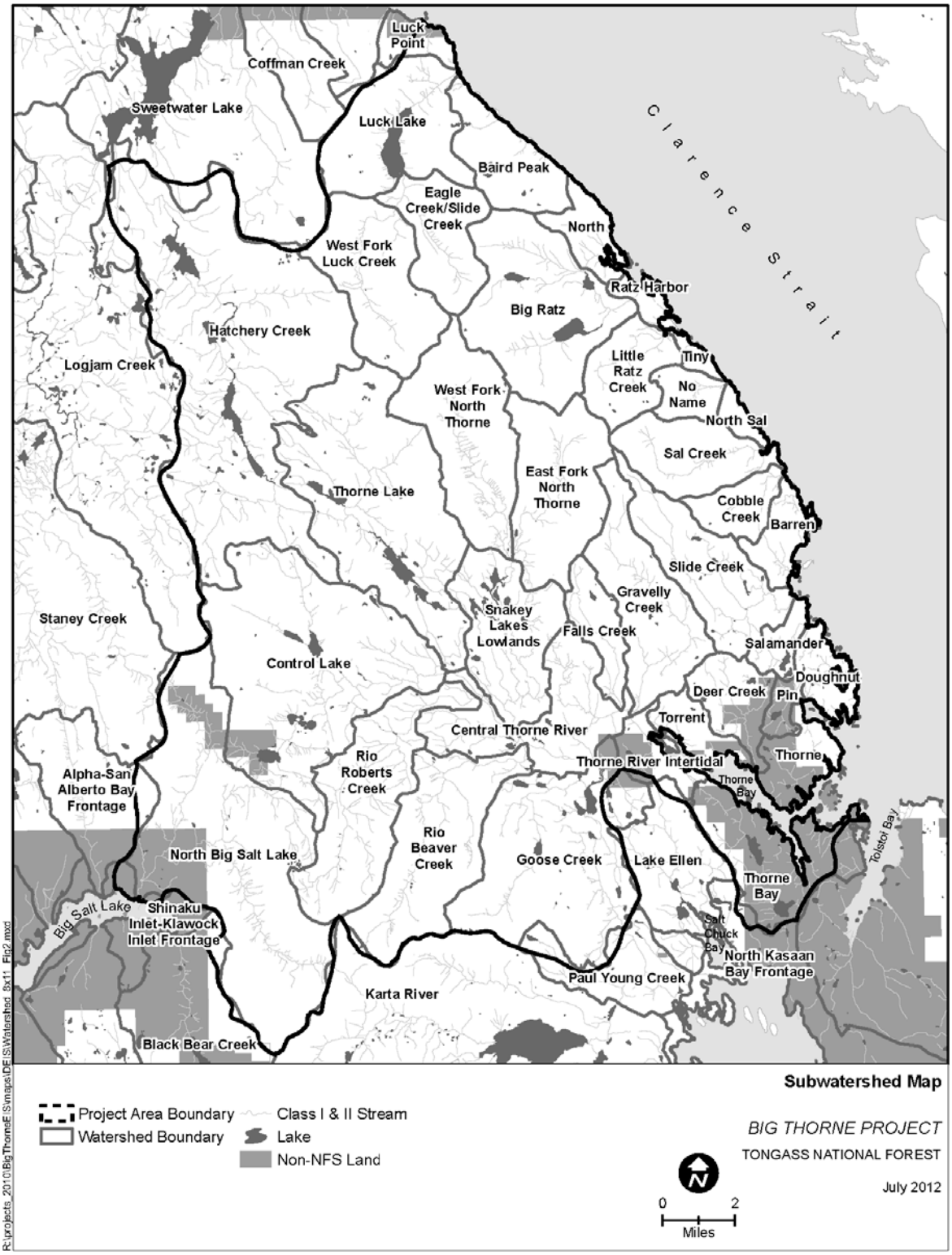

Figure WTR-2. Subwatersheds within the Big Thorne Project Area

Table WTR-2. Subwatersheds Affected by Big Thorne Project Alternatives

Subwatershed Name	Total Subwatershed Acres[1/]	Percent Non-NFS Lands in Subwatershed	Total Acres in Project Boundary	Percent Non-NFS Lands in Project Area	Percent of Entire Subwatershed in Project Boundary[2/]
Baird Peak	4,230	0	4,230	0	100
Barren	2,000	0	1,997	0	100
Big Ratz	10,299	0	10,299	0	100
Central Thorne River	6,986	1	6,986	1	100
Cobble Creek	2,137	0	2,137	0	100
Control Lake	18,624	4	18,611	4	100
Deer Creek	2,902	34	2,902	34	100
Doughnut	1,863	0	1,857	0	100
Eagle Creek/Slide Creek	4,556	0	4,556	0	100
East Fork North Thorne	7,548	0	7,548	0	100
Falls Creek	2,408	0	2,408	0	100
Goose Creek	13,502	4	12,422	2	92
Gravelly Creek	6,864	0	6,864	0	100
Lake Ellen	5,331	0	332	0	6
Little Ratz Creek	3,530	0	3,530	0	100
Luck Lake	7,499	0	7,183	0	96
Luck Point	1,410	36	674	12	48
No Name	1,556	0	1,556	0	100
North	2,031	0	2,024	0	100
North Big Salt Lake	20,299	16	19,928	16	98
North Kasaan Bay Frontage	14,707	71	212	1	1
North Sal	688	0	688	0	100
Pin	857	84	857	84	100
Ratz Harbor	828	0	827	0	100
Rio Beaver Creek	9,050	0	9,013	0	100
Sal Creek	4,644	0	4,643	0	100
Salamander	1,289	1	1,289	1	100
Slide Creek	6,485	0	6,485	0	100
Snakey Lakes Lowlands	6,645	0	6,645	0	100
Thorne	2,509	61	2,508	61	100
Thorne Bay	6,358	88	5,480	75	86
Thorne Lake	16,110	0	16,110	0	100
Thorne River Intertidal	1,810	41	1,628	36	90
Tiny	529	0	527	0	100
Torrent	1,807	21	1,806	21	100
West Fork Luck Creek	7,317	0	7,278	0	99
West Fork North Thorne	8,382	0	8,382	0	100

1/ Subwatershed areas were clipped to land area and do not contain marine acres.
2/ The "Percent of Entire Subwatershed in Project Boundary" is less than 100 percent but greater than 99.5 percent for those subwatersheds where the "Total subwatershed Acres" and "Total Acres in Project Boundary" are different, but the "Percent of Entire Subwatershed in Project Boundary" rounds to 100.

The majority of the 37 subwatersheds primarily flow directly into Clarence Strait between Coffman Cove and Thorne Bay, or into the Thorne River, which drains into Thorne Bay. A few of the subwatersheds draining directly into Clarence Strait are not true subwatersheds with single outlet streams; Baird Peak, Barren, North, North Sal, Ratz

Harbor, and Tiny are frontal subwatersheds containing discrete first order streams that empty directly into saltwater. In addition, the Big Ratz, Little Ratz, No Name, Sal Creek, Cobble Creek, Salamander, Doughnut, Luck Point, Pin, and Slide Creek subwatersheds all directly flow into Clarence Strait. In the north end of the project area are the Eagle Creek subwatersheds, including Eagle Creek/Slide Creek, Luck Lake, and West Fork Luck Creek subwatersheds. Eagle Creek is the outflow of Luck Lake, which flows into Clarence Strait. In the southern end of the project area the Thorne Bay, Thorne, and Deer Creek subwatersheds drain directly into Thorne Bay. The Control Lake, East Fork North Thorne River, West Fork North Thorne River, Snakey Lakes Lowlands, Central Thorne River, Falls Creek, Gravelly Creek, Torrent, Goose Creek, Thorne Lake, and Rio Beaver Creek subwatersheds all drain into the Thorne River, which flows into the Thorne River Intertidal subwatershed as the outlet to Thorne Bay. The Lake Ellen and North Kasaan Bay Frontage subwatersheds drain directly into North Kasaan Bay. The North Big Salt Lake subwatershed drains into Big Salt Lake, which opens into San Alberto Bay.

Fourteen of the 37 subwatersheds with ground disturbance in any alternative are part of the larger Slide Creek – Frontal Clarence Strait watershed (Baird Peak, Barren, Cobble Creek, western portion of Doughnut, Little Ratz Creek, Luck Point, No Name, eastern portion of North, North Sal, Ratz Harbor, Sal Creek, Salamander Creek, Slide Creek, and Tiny). This watershed is a USDA Forest Service priority watershed and was rated as "functioning-at risk" using the Watershed Condition Framework (USDA Forest Service 2011b). The "functioning-at risk" ranking is a national ranking based on assessments of watersheds within the National Forest Service system that were completed as part of an effort to prioritize watersheds for restoration actions. Major contributors to this ranking include previous harvest of riparian vegetation, density and proximity of roads to streams, as well as presence of contaminated soils. The Watershed Resource Report (James 2012) contains more detailed watershed and subwatershed descriptions. The following section will describe the existing conditions for streamflow, water quality, sediment and turbidity, temperature, stream habitat, and lake habitat.

Streamflow

U.S. Geological Survey (USGS) stations provide the only available long term streamflow records near the project (USGS 2011). The hydrographs (Figure WTR-3) display mean monthly streamflow in cubic feet per second (CFS) normalized for drainage area in square miles for the station near the mouth of Staney Creek (USGS Staney Creek near Klawock 15081497, 50.6 square miles) and in the headwaters of the North Fork of Staney Creek (USGS North Fork Staney Creek near Klawock 15081495, 3.07 square miles). The hydrographs represent the typical annual streamflow regimes observed in all the affected watersheds and subwatersheds. A small snowmelt peak in spring is followed by low flows during drier summer weather when groundwater storage is depleted. Large rainstorms in fall produce the highest peak flows. Peak flows also occur in winter during rain-on-snow events.

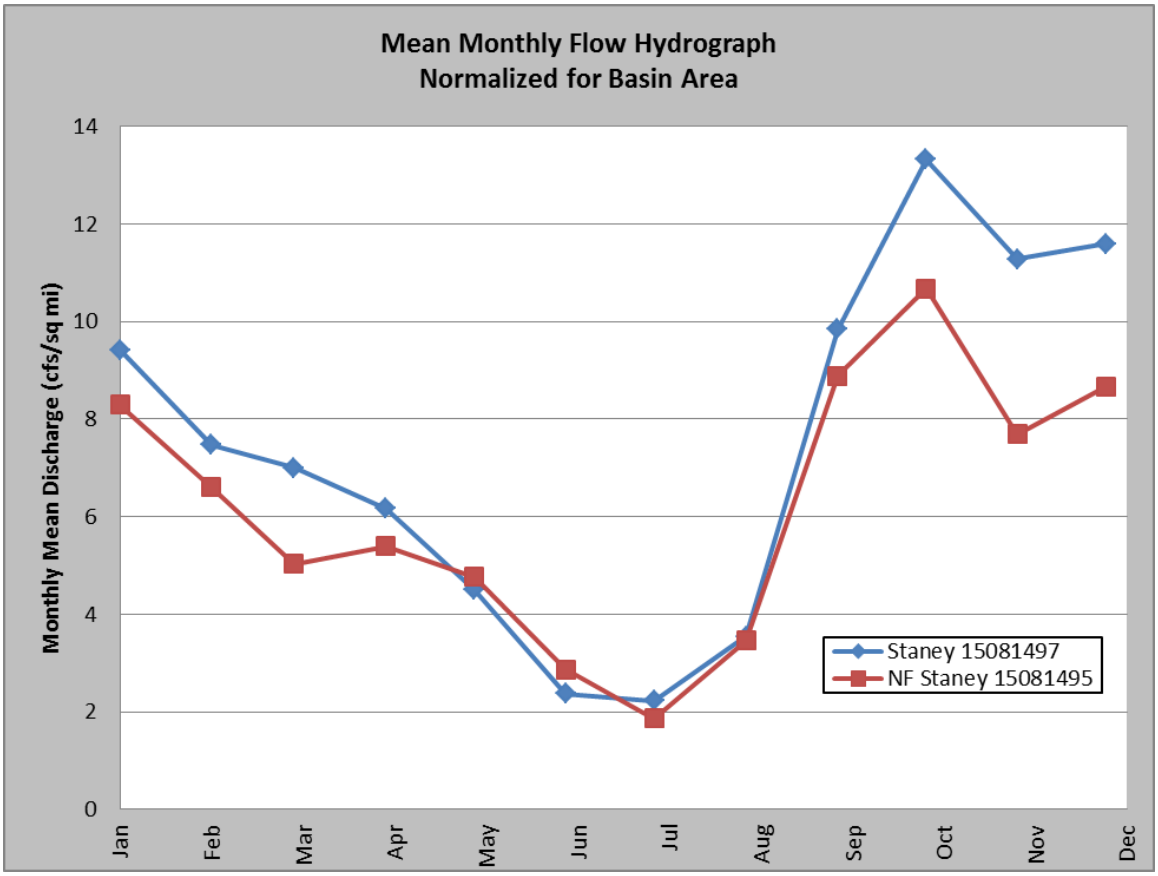

Figure WTR-3. Typical Streamflow Regime in Watersheds and Subwatersheds Affected by Big Thorne Project Alternatives

Timber harvest changes streamflow by altering processes that control the amount and timing of water delivered to streams. The direct removal of forest canopy affects rain interception (Prussian 2010), evapotranspiration, snow storage, snow melt, and soil moisture (Jones and Grant 1996; Hubbart et. al. 2007). After harvest is completed, soil moisture and transpiration changes continue in response to uptake and use of water by remaining and regenerating vegetation.

Commercial and PCT methods are used within the Tongass National Forest in an effort to accelerate old growth characteristics in otherwise overly dense timber stands. Commercial thinning would remove trees of commercial harvest size while also releasing remaining trees from overcrowded conditions in an effort to accelerate growth and improve conditions for future commercial harvest and resource values. Pre-commercial thinning involves cutting young trees within an area and leaving them in place. No removal occurs with PCT. Impacts of commercial thinning on streamflow are dependent upon local conditions, as well as the methodology and intensity of the thinning operations. The results of studies on timber harvest and flow relationships are highly variable (Scherer and Pike 2003). Some research has shown significant differences in peak flow responses between partial-cut and clear-cut watersheds. Keppeler et al. (2003) found that a 65 percent partial-cut watershed had minimal peak flow increases, while a 50 percent clear-cut watershed had increases up to 300 percent. Grant et al. (2008) found that detections of

increases in peak flow did not occur until 29 percent of a basin is harvested for rain-dominated systems. Using their model results, they further propose that 40 percent thinning harvest evenly distributed over 100 percent of the basin area would likely result in a non-detectable peak flow increase in rain-dominated systems.

Changes in streamflow following timber harvest and road building are commensurate with the proportion of watershed harvested (Harr 1986; Jones and Grant 1996; Jones 2000; Moore and Wondzell 2005). Bosch and Hewlett (1982) suggested a threshold effect at 20 percent of basin area harvested. Because no baseline (pre-harvest) streamflow data are available for the affected watersheds, this conservative threshold of cumulative harvest suggested by Bosch and Hewlett (1982) was used to assess the potential changes in streamflow resulting from past management. Specifically, watersheds with at least 20 percent area in young growth less than 30 years of age (as shown in the right hand column of Table WTR-3) may have experienced streamflow changes. Another more recent "state of the science report" on peak flow response to timber harvest (Grant et al. 2008) establishes a minimum, cumulative harvest/stream flow response threshold of 20 to 40 percent over a 5-year time span. Climate cycles also influence streamflow and probably confound most of these studies, which have not occurred over long enough timeframes to account for climate shifts (USGS 2000; Neal et al. 2002). The Watershed Resource Report (James 2012) discusses other studies considered.

Peak flow increases in the affected watersheds are probably more likely than low flow increases, based on most of the studies in the Pacific Northwest. Although studies have suggested forest canopy recovery occurs in 10-30 years (Jones and Grant 1996; Jones 2000, Prussian 2010), for this analysis it is assumed that forest canopy recovery occurs in 30 years (since 1981) (Hicks et al. 1991; Jones 2000) and would be instrumental in recovery of pre-harvest rainfall interception (Prussian 2010). The Watershed Resource Report (James 2012) contains more information on these studies.

The North Big Salt Lake (also referred to as "Steelhead") and Thorne Bay subwatersheds (shaded in Table WTR-3) meet or exceed the 20 percent area harvested since 1981 threshold. Streams in these drainages may currently have increases in peak flows, especially when considering the combined effects of stream network extension by roads (see sediment and turbidity section below) in these subwatersheds. If no further harvest occurs in these subwatersheds, all subwatersheds except the Thorne Bay subwatershed would reach a state of hydrologic recovery, based on forest canopy, by 2019.

Table WTR-3. Past Harvest in Subwatersheds Affected by Big Thorne Project Alternatives

Subwatershed Name	Total Harvested (Acres)	Total Harvested (Percent Basin Area)	Total Harvested since 1981 (Acres)	Total Harvested since 1981 (Percent Basin Area)
Baird Peak	276	7	19	0
Barren	272	14	124	6
Big Ratz	3,050	30	1,017	10
Central Thorne River	1,207	17	721	10
Cobble Creek	777	36	199	9
Control Lake	645	3	645	3
Deer Creek	1,949	67	190	7
Doughnut	54	3	0	0
Eagle Creek/Slide Creek	1,810	40	335	7
East Fork North Thorne River	1,197	16	456	6
Falls Creek	771	32	218	9
Goose Creek	2,014	15	1,885	14
Gravelly Creek	2,962	43	649	9
Lake Ellen	1,805	34	953	18
Little Ratz Creek	1,173	33	238	7
Luck Lake	2,653	35	1,037	14
Luck Point	174	12	103	7
No Name	204	13	204	13
North	515	25	118	6
North Big Salt Lake	4,503	22	4,185	21
North Kasaan Bay Frontage	3,376	23	2,631	18
North Sal	103	15	53	8
Pin	103	12	63	7
Ratz Harbor	171	21	34	4
Rio Beaver Creek	2,509	28	594	7
Sal Creek	1,546	33	392	8
Salamander	548	42	70	5
Slide Creek	3,713	57	628	10
Snakey Lakes Lowlands	1,097	17	885	13
Thorne	205	8	96	4
Thorne Bay	2,744	43	1,250	20
Thorne Lake	387	2	387	2
Thorne River Intertidal	964	53	107	6
Tiny	161	30	27	5
Torrent	998	55	149	8
West Fork Luck Creek	2,021	28	4,635	9
West Fork North Thorne	1,551	19	4,644	6

At the watershed scale, the Slide Creek – Frontal Clarence Strait watershed does not exceed the 20 percent area harvested since 1981 threshold (8 percent basin area harvested since 1981). However, the North Big Salt Lake and Tolstoi Bay – Frontal Clarence Strait watersheds exceed the 20 percent area harvested since 1981 threshold (21 and 25 percent basin area harvested since 1981, respectively). Streams in the North Big Salt Lake and Tolstoi Bay – Frontal Clarence Strait watersheds may currently have increases in peak flows, especially when considering the combined effects of stream network extension by roads (see sediment and turbidity section below) in these watersheds. If no further harvest

occurs in these watersheds, they would reach a state of hydrologic recovery, based on forest canopy, by the mid-2020s. The Watershed Resource Report (James 2012) discusses all watersheds in more detail.

In summary, past harvest (including harvest prior to 1981) may have caused increased streamflow at the subwatershed scale in 22 of the affected subwatersheds. Two of these, the North Big Salt Lake and Thorne Bay subwatersheds, may currently experience increased flows. A 10 percent increase in peakflow at the subwatershed scale (Grant et al. 2008) is plausible; however, the body of supporting science on this issue has contributed to variable conclusions and it is unlikely that an increase could be measured due to the lack of baseline data in the affected subwatersheds.

Water Quality

Beneficial Uses of Waters on the Project Area

Water bodies in Alaska are protected for all uses; the most stringent numeric criteria apply in accordance with Alaska Water Quality Standards (ADEC 2011a). For stream temperature, the most stringent criterion is aquatic life and for turbidity it is drinking water. Existing uses of water from the subwatersheds in the project area include potable water supplies, aquatic life, and limited contact recreation.

There are two potable water supplies (PWS) in the affected subwatersheds: Water Lake and Linkum Creek. Water Lake is located within the Thorne subwatershed, approximately 0.1 mile north of the municipality of Thorne Bay, and supplies potable water to the area residents. Water Lake is a state-classified PWS source area and is entirely on non-Federal lands (State of Alaska and City of Thorne Bay lands). Linkum Creek is located within the North Kasaan Bay Frontage subwatershed near the organized village of Kasaan and supplies water to area residents. Linkum Creek is a state-classified PWS source area and is entirely on tribal land.

Two MAFs are likely to be used for log transport as part of project activities; Thorne Bay and Coffman Cove. The Thorne Bay MAF is a former LTF and is considered an impaired waterbody due to bark deposits. Coffman Cove is not considered an impaired waterbody.

Impaired Waterbodies

The Watershed Resource Report (James 2012) contains definitions for categories of Impaired Waterbodies. There are two marine areas adjacent to the project area that meet ADEC Division of Water criteria (2010) for impaired waterbodies: Thorne Bay and Salt Chuck Bay.

Within Thorne Bay, there are 7.5 acres listed as Category 4a due to bark and wood debris residues from historic log rafting at log transfer facilities in this marine area. Although there have been improvements in water quality and the amount of debris residue in this area, due to its impaired status, the area is a barge only site. There are three subwatersheds with proposed harvest activities that are adjacent to Thorne Bay (the Torrent, Thorne River Intertidal, and Thorne Bay subwatersheds). In addition, there is potential for this site to be utilized during the Big Thorne Project, as this is a permitted MAF. All permits are currently up-to-date for log transfer and barging operations that would be associated with its use for the project.

Within Salt Chuck Bay, 19.2 acres are listed as Category 5 due to toxic and other deleterious organic and inorganic substances and pollutant parameters for copper from historic mining activity and tailings that were left on site. This marine area is adjacent to the Lake Ellen subwatershed. Provided in the Contaminated Sites section below is additional information on contaminants and remediation efforts at Salt Chuck Mine.

Contaminated Sites

Contaminated sites are defined as locations polluted with hazardous materials that have been disposed of or stored improperly (ADEC 2011b) and have the potential to threaten human health. The ADEC Division of Spill Prevention and Response Contaminated Sites Program provide a database of contaminated sites. For the watersheds and subwatersheds within the project area, the database includes 11 contaminated sites: five completed site cleanups, two completed site cleanups with institutional controls, and four sites remain open. The USDA Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, USDA Forest Service Salt Chuck Mine, and USDA Forest Service Thorne Bay Landfill are the four sites that remain open.

The USDA Forest Service Thorne Bay Warehouse Historic Spills and Thorne Bay DuRette Shop sites are located within the town of Thorne Bay. The USDA Forest Service Thorne Bay Warehouse Historic Spills site contains petroleum and metal contaminated materials. The Thorne Bay DuRette Shop site is a historical waste oil sump with petroleum contaminated soils.

The Salt Chuck Mine is a historic gold, silver, copper, and palladium mine located in the Lake Ellen subwatershed and is 4.5 miles south of the town of Thorne Bay. Contaminants include the remnants of 25 structures, two diesel tanks and four banks of diesel engines on site, and a tailings deposit covering approximately 23 acres from the intertidal zone to the uplands. An additional 45 acres of uplands have been contaminated by mining related activities. The main contaminants of concern are copper, arsenic, and vanadium. In 2010 the Salt Chuck Mine was added by the Environmental Protection Agency (EPA) to its National Priorities List, resulting in the site being under CERCLA (Comprehensive Environmental Response, Compensation and Liability Act, otherwise known as Superfund) authority (ADEC 2011c). During 2011, the USDA Forest Service began cleanup and remediation activities on Federal lands within the upland area. Remediation activities included the construction of a temporary road to the site, the removal of approximately 5,400 cubic yards of petroleum and metal contaminated soils and tailings to an out of state landfill, and the removal of building debris and tanks. These remediation activities will likely contribute to improved water quality in Salt Chuck Bay over time, by lowering the levels of copper, arsenic, and vanadium. Additional removal activities on Federal lands are anticipated to be addressed under the EPA Superfund action. Testing was done in the winter of 2011 followed by continued remediation in the summer of 2012.

The USDA Forest Service Thorne Bay landfill is located in the Torrent subwatershed and is 1.5 miles west of the City of Thorne Bay. The landfill is comprised predominately of solid waste, but hazardous wastes such as paint, waste oil, old gas, diesel fuel, batteries, paint thinner, waste solvent, PCB transformers, and arsenic-based pesticides have also been dumped in the area. Metals are reported to be leaching from the site into nearby waterways. Three streams drain the landfill site, two of which - Ditch Creek and South

Creek - are fish bearing. Ditch Creek runs through the northern edge of the landfill, and South Creek through the middle. In 2002, iron and manganese were found in Ditch Creek and South Creek. Due to the presence of the hazardous waste, under CERCLA authority, the USDA Forest Service conducted an engineering Removal Action and NFRAP ("No Further Remedial Action Planned") with long-term monitoring required. Annual monitoring of surface water for iron and manganese, as well as fish surveys for 10 years was required with a 5-year review.

In 2009 the 5-year review was conducted and results demonstrated that the sampling locations in Ditch Creek, closest to the Thorne Bay Estuary, met water quality standards for iron and manganese for 5 years, and no additional sampling was needed at those locations (ADEC 2011d). Within South Creek, Alaska Water Quality Standards exceedences for iron and manganese were observed and monitoring remained necessary. Due to the lack of established trends, fish monitoring was eliminated at all sampling locations.

Acid Rock Drainage

Acid rock drainage (ARD) is created when iron pyrite, oxygen, and water combine and produce acidified water that dissolves metal compounds resulting in elevated metal concentrations in the water. The ARD acronym is used for rock containing sulfides such as iron pyrite that break down and produce acidified water.

The Coffman Cove Road project, a Federal Highways project north of the Big Thorne Project boundary, utilized a rock source from the Descon Formation for a portion of the construction. The Descon Formation is an Ordovician to Silurian aged black, thin-bedded shale and/or chert. The use of this pyritic material in the road's subgrade resulted in the generation of ARD which negatively impacted water quality and aquatic environments downstream of the construction. Subsequent testing of the waters above the Coffman Cove Road cleanup effort showed some metal values exceeding Alaska State Water Quality Standards. This suggests that mineralization exists in other zones within the watersheds (Baichtal personal comm. 2011, as cited in Barnhart 2012).

Approximately 15.2 percent (35,074 acres) of the Big Thorne project area is underlain by the Descon Formation. Most of the Descon Formation (Sod) area contains disseminated pyrite. Some shear and fault zones within this formation are more heavily mineralized than others. The use of this pyritic material in the road's subgrade can result in the generation of "acid rock drainage" (ARD) which can negatively impact water quality and aquatic environments downstream of the construction. Existing forest roads and quarries in this area are constructed from the Descon Formation. It is estimated that 253.8 miles of existing road likely constructed from the Descon Shale exist within the Big Thorne project area. It is not known if the material sources used in this construction contained mineralization. However, no past problems have been observed (Baichtal personal comm. 2011, as cited in Barnhart and Hitner 2012).

Sediment and Turbidity

Limited sediment and turbidity information has been collected in some of the affected subwatersheds and is summarized in this section.

Sediment is introduced into streams by channel erosion, roads, landslides and debris flows, and rain splash on bare soils. The amount of sediment delivered to streams is influenced by road construction, road drainage, road-use frequency, number of road-stream crossings, subwatershed road density, and management actions in forested drainages (Reid and Dunne 1984; Swanson et al. 1987; Chamberlin et al. 1991; Furniss et al. 1991; Croke et al. 2005; Gomi et al. 2005). Although riparian buffer zones in watersheds are considered to be sediment sinks, under some circumstances, buffer zones may be sediment sources (Dillaha and Inamdar 1997). Gomi et al. (2005) reviewed studies related to the effects of timber harvest on sediment production and discusses that increased peak flow response due to vegetation loss may increase sediment recruitment from within-channel sources and transport capacity of streams. Because increased peak flows may increase sediment recruitment from stream channel erosion and bed scour (Tonina et al. 2008), stream channel erosion could be increased within subwatersheds containing 20 percent or greater area harvested since 1981 (30 years) (Table WTR-3).

The effects of commercial thinning on sediment production are dependent upon multiple factors, including area of basin harvested, hydrologic regime, topography, soil conditions, and harvest methods. Landslides resulting from disturbance can contribute significant amounts of sediment and may occur due to disturbances related to harvest operations that are unrelated to basin area harvested (Kreutzweiser and Capell 2001). Karwan et al. (2007) found that sedimentation effects from a partial-cut of 50 percent of a watershed were insignificant when compared to the control, while effects from 50 percent clear-cut harvest were significant.

On the Tongass National Forest, monitoring data indicate that harvested areas are consistently within the established standard of less than 15 percent detrimental soil disturbance (USDA Forest Service 2005). Additionally, BMP implementation and effectiveness monitoring occurred at recent timber harvest sites on Prince of Wales Island and in most cases, BMPs were found to be implemented appropriately (USDA Forest Service 2010a). Examination of five harvest units and related roads by an interdisciplinary team found effective implementation of the BMPs with no visual sign of erosion or sedimentation into site area streams (USDA Forest Service 2011). This further suggests that increased stream sediment from present harvest practices would be minimal.

Roads have been found to contribute more sediment to streams than any other land management activity (Reid and Dunn 1984; Gucinski et al. 2001; Gomi et al. 2005) and pose the greatest potential risk to watershed resources and fish habitat (Furniss et al. 1991; Luce and Wemple 2001). Timber harvest and road construction on unstable slopes may trigger landslides and debris flows. The delivery of sediment to streams from these events depends on their connection to streams (Gomi et al. 2005).

Landslide inventories were completed in the project area. Natural and management-induced landslides and other sediment sources are described in the Soils (Cox et al. 2012), Karst (Kovarik 2012), and Fisheries (Knutzen 2012) Resource Reports. Naturally caused landslides affect approximately 1.8 percent of the project area and a total of 2.7 percent of the project area has naturally disturbed soils (Cox et al. 2012). Approximately 0.1 percent of the project area is affected by landslides resulting from previous harvest activities. Past harvest on steep slopes greater than 72 percent may also contribute to mass wasting events; however, most past harvest did not occur on slopes greater than 72 percent. Total

soil disturbance due to management affects 2.2 percent of the project area. Roads are associated with 61 (56 acres) management related landslides (Cox et al. 2012). Further details on landslides are discussed in the Watershed Resource Report (James 2012).

Road construction in Southeast Alaska requires substantial ground disturbance, producing short term increases in sediment transport (Paustian 1987). Road reconstruction, maintenance, and storage activities also mobilize sediment. These periodic short term increases would have occurred in each of the affected watersheds and subwatersheds starting around the 1950s and continuing through current road construction and maintenance activities.

Studies in Southeast Alaska have correlated higher rates of road erosion with heavy traffic and poor quality rock surfacing (Kahklen and Hartsog 1999). In Washington's Olympic Peninsula, Cederholm et al. (1980) found that accumulation of fine sediment in streambeds was highest in basins where the road area exceeded 2.5 percent of the basin area. A statistical relationship between fine streambed sediment and watershed disturbance has not been reported in Southeast Alaska studies (Bryant et al. 2004; Woodsmith et al. 2005). Nonetheless, the suggested threshold by Cederholm et al. (1980) provides a measure to evaluate the potential impacts of roaded areas in the affected watersheds and subwatersheds in comparison to findings elsewhere in the Pacific Northwest.

The Deer Creek, Ratz Harbor, Salamander, Slide Creek, Thorne River Intertidal, and Torrent subwatersheds exceed the 2.5 percent threshold within the Big Thorne project area (as shown in the right hand column of Table WTR-4). In an assessment of 17 subwatersheds located within the Big Thorne project area, the Big Ratz, Sal Creek, and Slide Creek subwatersheds were determined to have the highest sediment movement potential and detrimental effects from past management activities based on stream density and miles of transport streams (USDA Forest Service 2004a). In an additional assessment of these 17 subwatersheds, Prussian and Bair (2006) ranked the Big Ratz, No Name, Deer Creek, Slide Creek, Ratz Harbor, and Torrent subwatersheds highest for potential sediment impacts to aquatic resources. Through an assessment and field reconnaissance, Fryxell (2010) ranked the Luck Lake, West Fork Luck Creek, and Eagle Creek-Slide Creek subwatersheds as high for sediment risk and landslide influences on fish habitat. In addition, the Sal Creek and Slide Creek subwatersheds have sediment sources due to landslides and drainage issues related to roads (Thompson and Brigham personal comm. 2012). Furthermore, increased peak flows associated with past harvest (Table WTR-3) could be resulting in stream channel erosion contributing to accumulations of fine sediment in streambeds. These inherent and management-induced sediment contributions could be degrading subwatershed conditions; however, the available data suggests sediment and turbidity ranges in the affected subwatersheds are within ranges observed in unmanaged subwatersheds and within the criteria established by the state.

Based on minimum clearing widths and road surface specifications, a width of 40 feet was used to estimate area of road surface and cut slope contribution to erosion and sediment within each watershed and subwatershed. Table WTR-4 summarizes existing roads in subwatersheds affected by the Big Thorne Project alternatives.

At the watershed scale, the Slide Creek – Frontal Clarence Strait watershed does not exceed the 2.5 percent threshold (1.6 percent of basin as roads). However, the Thorne Bay – Frontal Tolstoi Bay is the only watershed exceeding the 2.5 percent threshold (3.1 percent of basin as roads). Although this is the only watershed exceeding the 2.5 percent threshold, the Eagle Creek, Ratz Creek, and North Thorne River watersheds have sediment sources due to landslides and drainage issues related to roads (Thompson and Brigham personal comm. 2012). These inherent and management-induced sediment contributions could be degrading watershed conditions; however, the available data suggests sediment and turbidity ranges in the affected watersheds are within ranges observed in unmanaged watersheds and within the criteria established by the state. The Watershed Resource Report (James 2012) discusses all watersheds in more detail.

Road condition surveys in the project area were primarily completed from 1998 to 2002. In 2002 the Forest Service implemented Watershed Improvement Tracking to address restoration needs in the Central Thorne and Gravelly Creek subwatersheds. Forest Roads 3015105, 3015635, 3015639, 3016000, 3016300, 3016350, and 3017000 were found to have road disturbance, plugged culverts and gully erosion issues with a low priority for treatment. Forest Roads 30152600, 3015630, 3015635, and 3016100 were found to have road disturbance and gully erosion issues with a medium priority for treatment. Forest Roads 3015105_0.95L had road disturbance issues with a high priority for treatment. Recommended treatments in these subwatersheds include road decommissioning, scarifying and seeding, unplugging and removing culverts, and improving drainage (USDA Forest Service unpublished document 2002a).

In the Deer Creek, Tiny, Sal Creek, and North subwatersheds, surveys identified sediment sources along roads. These include Forest Roads 2030000, 2030700, 3000000, 3015600, and 3025000. Repairs began in 2010 and will continue until recommended maintenance is complete (USDA Forest Service unpublished document 2010a and 2011).

From 2005 to 2007 various restoration efforts were implemented in the Sal Creek subwatershed. Roads were stormproofed and improved for drainage and six culverts were removed to improve fish passage (Prussian 2008). In 2011, repairs began in Sal Creek on Forest Road 3020000. Maintenance includes replacing culverts and clearing the ditch and road surface (USDA Forest Service unpublished document 2010b and 2011).

Table WTR-4. Existing Roads in Subwatersheds Affected by Big Thorne Project Alternatives

Subwatershed Name	Total Basin Size (Acres)	Total Existing Roads[1/] (Miles)	Total Existing Roads[1/] (Acres)	Percent of Basin as Roads[2/]
Baird Peak	4,230	2.0	9.8	0.2
Barren	2,000	6.3	30.8	1.5
Big Ratz	10,299	29.0	140.4	1.4
Central Thorne River	6,986	19.9	96.7	1.4
Cobble Creek	2,137	7.7	37.1	1.7
Control Lake	18,624	22.7	110.2	0.6
Deer Creek	2,902	19.0	92.1	3.2
Doughnut	1,863	0.0	0.0	0.0
Eagle Creek/Slide Creek	4,556	12.5	60.8	1.3
East Fork North Thorne River	7,548	14.3	69.2	0.9
Falls Creek	2,408	9.0	43.5	1.8
Goose Creek	13,502	35.0	169.7	1.3
Gravelly Creek	6,864	28.5	138.1	2.0
Lake Ellen	5,331	23.6	114.4	2.1
Little Ratz Creek	3,530	9.7	47.2	1.3
Luck Lake	7,499	25.7	124.5	1.7
Luck Point	1,410	3.4	16.4	1.2
No Name	1,556	5.7	27.4	1.8
North	2,031	6.5	31.7	1.6
North Big Salt Lake	20,299	59.0	286.2	1.4
North Kasaan Bay Frontage	14,707	56.3	272.8	1.9
North Sal	688	2.0	9.7	1.4
Pin	857	3.8	18.2	2.1
Ratz Harbor	828	4.5	21.8	2.6
Rio Beaver Creek	9,050	30.9	150.0	1.7
Sal Creek	4,644	14.0	67.8	1.5
Salamander	1,289	7.6	37.0	2.9
Slide Creek	6,485	37.1	179.9	2.8
Snakey Lakes Lowlands	6,645	14.3	69.5	1.0
Thorne	2,509	1.8	8.7	0.3
Thorne Bay	6,358	31	150.2	2.4
Thorne Lake	16,110	7.7	37.1	0.2
Thorne River Intertidal	1,810	9.4	45.8	2.5
Tiny	529	2.2	10.7	2.0
Torrent	1,807	16.8	81.5	4.5
West Fork Luck Creek	7,317	18.2	88.1	1.2
West Fork North Thorne	8,382	11.7	56.5	0.7

1/ Includes all roads (open/stored/decommissioned) in and out of harvest units. Paved highway and non-Forest Service roads are also included in this analysis.
2/ Rows for subwatersheds with 2.5 percent or more covered by roads are shaded in table.

In monitoring installations of new stream structures within the Tongass National Forest, downstream turbidity following installation did not exceed state water quality standards (USDA Forest Service 2009a). Results from BMP implementation and effectiveness monitoring of a sample of 10 to 15 percent of roads constructed, stored, and decommissioned over the 4 years prior to 2010, as well as units harvested in 2010, found the Tongass National Forest is successfully implementing the Standards and Guidelines for protection of Soil and Water Resources in most cases (USDA Forest Service 2010).

Although successful implementation of BMPs occurred, there were a few departures related to erosion control associated with seeding along road construction and decommissioned segments, stabilization of excavated banks, and removal of temporary culverts to provide fish passage at varied stream flows. The team conducting the monitoring noted that action plans include clarifications on implementation of the BMPs in road storage and road decommissioning road contracts (USDA Forest Service 2010).

Tucker and Thompson (2010) conducted a comparison study related to management practices that included Shaheen Creek on Prince of Wales Island and concluded that the Forest Plan Standards and Guidelines are effective in maintaining water quality in Shaheen Creek. Furthermore, Tucker and Thompson (2010) results suggest that increases in turbidity (and sediment) within Shaheen Creek may not be measurable when compared to natural conditions, and if downstream increases were detected in the study, recovery to baseline level occurred without degrading water quality.

Alaska Water Quality Standards state that "Turbidity may not exceed 5 nephelometric turbidity units (NTU) above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than a 10 percent increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 25 NTU" (ADEC 2011a). Continuous turbidity monitoring at locations on Prince of Wales Island suggests that background turbidity, even in a heavily harvested watershed, is consistently near 0 NTUs, but can peak near 200 NTUs in both unharvested and harvested watersheds during storm events (Thompson and Tucker 2007). The available data suggest that turbidity ranges in the affected subwatersheds are within ranges observed in unmanaged watersheds and subwatersheds and within the criteria established by the state.

In summary, the combined effect of percent basin in roads, sediment sources from landslides, drainage issues related to roads, and increased peak flows associated with past harvest could be increasing fine sediment deposition and contributing towards degraded subwatershed conditions in the Big Ratz, No Name, Deer Creek, Ratz Harbor, Salamander, Slide Creek, Sal Creek, Thorne River Intertidal, Torrent, Luck Lake, West Fork Luck Creek, and Eagle Creek/Slide Creek subwatersheds. Although these combined effects could be increasing sediment sources in the affected subwatersheds, the best available information suggests that sediment transport and turbidity within these subwatersheds are not degrading subwatershed condition.

Temperature

Removal of riparian vegetation can increase stream temperature. Riparian vegetation intercepts and reduces the intensity of solar radiation to streams and reduces back-radiation during cold months (Platts 1991). In coastal British Columbia, daily maximum temperature in summer increased in streams with no buffer, while water temperature in streams with 10 and 30 meter buffers did not (Gomi et al. 2006). Riparian harvest occurred in all of the affected subwatersheds (Table WTR-5) prior to 1991 (the year the Tongass Timber Reform Act of 1990 was implemented), even along fish streams. Past riparian harvest could have resulted in stream temperature increases during warm weather, but recovery of at least deciduous (alder) shade has likely occurred in these harvested riparian areas. The Watershed Resource Report (James 2012) discusses water temperature in watersheds and subwatersheds in more detail.

Evaluation of stream temperature data from both harvested and un-harvested watersheds on Prince of Wales Island showed no predictive relationship between harvest and high stream temperatures (USDA Forest Service 2004b; Walters and Prefontaine 2005). Additionally, Walters and Prefontaine (2005) found that the streams on Prince of Wales Island naturally exceed water quality temperatures. Tucker and Thompson (2010) conducted a comparison study that included Scary Creek (within the Rio Beaver Creek watershed) and a reference watershed (Chanterelle Creek, within the Rio Roberts watershed) with no timber harvest or roads. Based on this study, all drainages exceeded the most stringent numeric criteria of the Alaska Water Quality Standards for maximum stream temperature. Tucker and Thompson (2010) note that while Scary Creek contains upland and riparian harvest and roads, it usually experienced shorter duration exceedences and fewer days exceeding maximum temperature criteria than the reference stream. Hetrick et al. (1998) found that the main determinant of high stream temperatures was low flow. Due to Southeast Alaska's weather, when there is an increase in solar radiation, there is little precipitation, and therefore, lower discharge rates for streams. Likewise, when precipitation returns, stream discharge increases, resulting in lower radiation and stream temperatures.

The lack of a predictive relationship between harvest and elevated stream temperatures on Prince of Wales Island (USDA Forest Service 2004b; Walters and Prefontaine 2005), and implementation of riparian no-harvest buffers along Class I, II, and III streams for any future harvests, suggests that stream temperature is not likely to be measurably affected by harvest activities.

Table WTR-5. Past Riparian Harvest in Subwatersheds Affected by Big Thorne Project Alternatives

Subwatershed Name	Total Riparian (acres)[1/]	Total Riparian Harvested (acres)[1/]	Percent Riparian Harvested
Baird Peak	335	16	5
Barren	190	45	24
Big Ratz	1,431	435	30
Central Thorne River	1,756	87	5
Cobble Cree	207	86	41
Control Lake	3,003	44	1
Deer Creek	429	281	66
Doughnut	226	0	0
Eagle Creek/Slide Creek	683	425	62
East Fork North Fork Thorne River	1,341	424	32
Falls Creek	353	121	34
Goose Creek	1,856	129	7
Gravelly Creek	976	439	45
Lake Ellen	15	3	17
Little Ratz Creek	422	210	50
Luck Lake	1,380	371	27
Luck Point	47	0	0
No Name	163	18	11
North	223	85	38
North Big Salt Lake	3,338	787	24
North Kasaan Bay Frontage	5	2	36
North Sal	32	0	0
Pin	216	21	10
Ratz Harbor	66	15	23
Rio Beaver Creek	1,311	378	29
Sal Creek	556	289	52
Salamander	251	103	41
Slide Creek	954	516	54
Snakey Lakes Lowlands	1673	83	5
Thorne	284	26	9
Thorne Bay	1,015	298	29
Thorne Lake	2,837	24	1
Thorne River Intertidal	307	194	63
Tiny	33	15	46
Torrent	176	103	59
West Fork Luck Creek	1,074	484	45
West Fork North Thorne	1,202	264	22

1/ Total riparian and riparian harvest acres were calculated using USDA Forest Service GIS information and includes all streams in watersheds on both Federal and non-Federal lands.

Stream Habitat

The Fisheries Resource Report describes the distribution and characteristics of streams throughout the affected subwatersheds (Knutzen 2012). The process groups used to classify and map streams in the project area reflect state of the art knowledge about inherent stream channel functions and processes affecting fish habitat (Paustian et al. 1992). The process groups also aid our understanding of the effects of past practices. In 2010, revisions were made to the channel types to facilitate in the logical determinations

of channels types within the established process groups (Paustian 2010). The revised channel types were used during field surveys for the Big Thorne Project.

In the project area, all watersheds (Control Lake, Rio Roberts Creek, Rio Beaver Creek, Goose Creek, Thorne Lake, North Thorne River, and Outlet Thorne River) draining into the Thorne River, as well as the Eagle Creek and Ratz Creek watersheds, and the Sal Creek and Slide Creek subwatersheds contain the most sensitive anadromous fish streams (Knutzen 2012). In these channels, stream habitat complexity is dependent on a continuous supply of large wood from old growth conifer riparian forests. Wood provides essential cover and primary productivity. It is a key agent in scouring and maintaining stable pools in low gradient gravel bed streams (Maser and Sedell 1994).

Wood is also influential in fishless high gradient headwater streams, storing sediment and releasing it to downstream reaches over time (May and Greswell 2003; Gomi et al. 2001). These headwater streams are also important sources of organic material which supplies food to downstream fish populations (Wipfli and Gregovich 2002).

Widespread historic riparian harvest in the affected subwatersheds removed large old growth conifer trees, resulting in red alder dominated forest along stream channels. Although alder provides shade and leaf litter important to primary productivity, it does not provide long lasting large wood (Johnson and Edwards 2002). Current riparian conditions along stream channels are dominated by red alder with young conifers beginning to establish. Recovery of riparian vegetation to pre-harvest conditions of large coniferous trees could take decades.

PFC surveys are qualitative assessments of the hydrology, vegetation, and erosion/deposition characteristics of streams, and riparian areas. Information collected includes channel stability, large woody debris and other pool-forming features, riparian conditions, and geomorphological functions. PFC assessments were conducted for the North Big Salt Lake (commonly referred to as “Steelhead”) (USDA Forest Service unpublished document 2010a), Sal Creek (Prussian 2008), Gravelly Creek (USDA Forest Service unpublished document 2001, 2002b), and Falls Creek (USDA Forest Service unpublished document 2001) subwatersheds. In addition, PFC surveys were conducted for the Eagle Creek (Fryxell 2010) and North Thorne River watersheds (USDA Forest Service unpublished document 2002b). The Watershed Resource Report (James 2012) contains information on PFC assessments at the watershed scale.

In the North Big Salt Lake (also referred to as “Steelhead”) subwatershed, PFC assessments were done on three reaches of Steelhead Creek (USDA Forest Service unpublished document 2010a). One stream reach was determined to be “functioning-at risk,” due to past riparian harvest and a lack of large woody debris (LWD). A second section of the stream was also determined to be “functioning-at risk” due to bank erosion, past riparian harvest, and a lack of LWD. The third reach was determined in to be in “properly functioning condition.”

The Sal Creek subwatershed was determined to be in “properly functioning condition” based on PFC surveys conducted in 2002. Restoration and monitoring efforts have been ongoing in the Sal Creek subwatershed since the 1980s. The most recent restoration project occurred between 2006 and 2007 and entailed placing approximately 400 trees along 1.2 miles of mainstem channel, stormproofing and improving drainage on over 1.5

miles of logging road within the floodplain, removing six culverts that were impeding fish passage to over 1 mile of tributary streams, and thinning alder and conifers from over 75 acres of floodplain (Prussian, 2008). Between 2004 and 2008, Tier II and III level surveys were used to monitor the LWD restoration actions in Sal Creek (Prussian 2008). The Tier III survey provides additional detail over the Tier II survey. Habitat parameters are subdivided into more detailed levels for collection of additional data on riparian habitat. Channel morphology measurements are replicated and fish populations assessed. The additional outputs may be used to develop or refine RHMOs. These surveys may be appropriate for evaluation of fish enhancement proposals, determination of restoration needs, or studies of habitat utilization by fish (USDA Forest Service 2001). Although no significant findings were determined from monitoring, general trends indicated an increase in pool frequency and area.

PFC and Tier II surveys were conducted in four reaches of the Gravelly Creek subwatershed in 2001 and 2002 (USDA Forest Service unpublished document 2001 and 2002b). One reach was determined to be "functioning-at risk" with a downward trend due to extensive past riparian harvest, unstable banks, aggradation, and road encroachment. This reach received past restoration efforts including LWD addition in 1989 (USDA Forest Service unpublished document 2001). A second reach was determined to be in "properly functioning condition" with an intact riparian buffer to the slope break (USDA Forest Service unpublished document 2001). A third reach was also in "properly functioning condition" and contained LWD, pool-riffle sequences, and adequate riparian vegetation (USDA Forest Service unpublished document 2002b). A fourth reach was determined to be "functioning-at risk" due to a lack of LWD, pool formations, and spawning gravel (USDA Forest Service unpublished document 2002b). Tier II surveys, conducted in 2002, found low LWD and pool density, large substrate size (small to large boulder), and a previously harvested riparian area (USDA Forest Service unpublished document 2002b).

PFC and Tier II surveys were conducted on one reach in the Falls Creek subwatershed in 2001 (USDA Forest Service unpublished document 2001). The surveyed reach was determined to be "not functioning" due to past riparian harvest, constriction created by an existing bridge, lack of riparian vegetation, lack of LWD and pools, and bank instability and erosion.

Lake Habitat

Lakes play an important role in the affected subwatersheds. They moderate streamflow by storing water during dry periods, they provide important fish habitat, and they act as sinks for sediment. The Eagle Creek watershed includes Luck Lake, which is comprised of 531 acres. The Luck Lake vicinity has been impacted from sediment deposition associated with headwater landslides and roads to access timber for harvest. The Big Ratz watershed contains the 208 acre Big Lake, plus the smaller Trumpeter and Little Lakes. The North Kasaan Bay Frontage subwatershed includes the 29 acre Power Lake, which drains into Salt Chuck Bay. The North Thorne River watershed contains numerous lakes that have been impacted by road conditions (USDA Forest Service 2006a). The Tolstoi Bay-Frontal Clarence Strait watershed contains Water Lake, which supplies potable water to the City of Thorne Bay. The Control Lake and Thorne Lake watersheds contain the highest surface area of lakes and ponds (roughly 409 and 518 acres total lakes and ponds

surface area, respectively). See Fisheries section in this chapter for more details on lakes in the project area.

Environmental Consequences

Direct, indirect, and cumulative effects for all affected watersheds are estimated using quantifiable surrogates for actual effects, as supported by the literature cited (for example, stream crossings are a surrogate for increased sediment). The level (magnitude and intensity) of effects is also characterized by descriptors which account for how measurable the effect would be, how widespread the effect is likely to be, and how long it is likely to last. Descriptors of effects are the following:

- Negligible: Effects would be undetectable or if detected, would be considered slight, detectable only at the site, and last less than a day.
- Minor: Effects would be measurable, although the changes would be small, localized to the site or affected stream reach, and last less than a week.
- Moderate: Effects would be measurable at the stream reach or subwatershed scale, and last more than a week.
- Major: Effects would be readily measurable at the watershed scale and would last for years.

Exceptions to these descriptors are noted as applicable, since they are not a perfect fit for all effects. Our ability to actually detect significant changes in streamflow, sediment, habitat features, or other aquatic parameters in response to the Big Thorne Project is extremely limited due to the lack of baseline data and the natural range of variability of these parameters in response to climate and other factors. Nonetheless, we have sufficient information for these watersheds and subwatersheds to proceed with a credible comparison of the magnitude and extent of likely effects across alternatives.

Streamflow

As described in the Affected Environment section, changes in streamflow following timber harvest and road building are commensurate with the proportion of watershed harvested (Harr 1986; Jones and Grant 1996; Jones 2000; Moore and Wondzell 2005). Studies from coastal British Columbia suggest that even selective harvesting may result in statistically significant increases in peak flows (Hudson 2001). Bosch and Hewlett (1982) suggested a threshold effect at 20 percent of basin area harvested. As the forest canopy begins to close, forest canopy recovery is assumed to occur in 30 years (Hicks et al. 1991; Jones 2000) and likely recovery of pre-harvest streamflow conditions. Increases in low flow are also described in a few studies, but are less probable in the affected subwatersheds.

To determine the amount of timber harvested proposed under each alternative, the area harvested was calculated by taking into account actual harvest from the various harvest prescriptions. Even-aged management stands were calculated as 100 percent of the harvest area, and uneven stand management (also referred to as partial harvest) was calculated as 50, 33, and 25 percent of the harvest area depending on the specific prescription for the harvest unit. In addition, the actual harvest acreages for thinning

treatments were taken into account with harvest amount calculations depending on the individual unit prescription. This approach provides an estimate of actual ground clearing and harvest removal acreages necessary for comparing against the streamflow effects threshold of 20 percent of basin area harvested. For analysis purposes, commercial thinning treatments were treated the same as partial harvest.

No shoreline or riparian harvest is proposed under this project. Riparian buffers are designed to mitigate sediment and flow impacts due to harvest. While commercial thinning is proposed for stand improvement in some alternatives, this would take place outside the designated riparian management areas. Non-project PCT would continue where determined needed by Forest Service staff and would be covered under subsequent assessments.

Table WTR-6 displays subwatersheds that will have 20 percent or more area harvested (includes harvest and road area) in the past 30 years, by alternative. These subwatersheds may experience increased peak flow. Road effects on streamflow are accounted for by including road area cleared for each alternative. Further discussion on road effects is included in the sediment and turbidity section below.

Effects on streamflow in the Luck Lake (Alternative 3), North Big Salt Lake (all alternatives), and Thorne Bay (all alternatives) subwatersheds could be moderate; but it is unlikely that streamflow increases would be measurable. The Big Thorne Project alternatives are unlikely to increase peak flows in any of the other subwatersheds.

As described in the Analyzing Effects section above, additional harvest of NEPA-cleared units and state lands is planned in watersheds and subwatersheds that would be affected by the Big Thorne Project. These harvest activities could result in additional cumulative streamflow increases (based on percent basin area harvested) in the affected watersheds and subwatersheds. The cumulative effects analysis of the additional harvest combined with harvest proposed under each alternative for each subwatershed is provided in Table WTR-9 and Appendix A of the Watershed Resource Report.

Additional harvest of NEPA-cleared units and state lands in the affected subwatersheds, excluding any project related harvest, would likely result in additional cumulative streamflow increases (based on percent basin area harvested) in the North Big Salt Lake, Pin, and Thorne Bay subwatersheds. Cumulatively, the percent basin area harvested in the past 30 years, plus future harvest of NEPA-cleared units and proposed harvest on state lands in the affected subwatersheds, added to the percent basin area harvested due to the Big Thorne Project alternatives, may result in moderate streamflow increases in the Goose Creek (Alternative 3), Luck Lake (Alternative 3), North Big Salt Lake (all alternatives), Pin (Alternative 3), and Thorne Bay (all alternatives) subwatersheds. The cumulative harvest in the past 30 years in these basins could increase to as much as 20.0, 20.5, 25.4, 36.5, and 23.1 percent of the basin area, respectively, under Alternative 3 (Table WTR-9 and Appendix A of the Watershed Resource Report, James 2012).

Table WTR-6. Proposed Harvest (including road clearing) by Big Thorne Project Alternatives in Affected Subwatersheds

Subwatershed Name	Total Basin Size (Acres)	Harvest and Roads Since 1981 (Percent Basin Area)[1/]				
		Existing Condition (Alternative 1)	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Baird Peak	4,230	0.5	0.8	2.7	0.5	1.9
Barren	2,000	7.1	19.1	19.1	16.3	14.5
Big Ratz	10,299	10.2	12.9	15.0	13.7	13.8
Central Thorne River	6,986	10.8	17.0	17.0	13.8	16.4
Cobble Creek	2,137	9.4	12.0	12.7	11.1	12.7
Control Lake	18,624	3.8	4.2	4.2	4.0	4.2
Deer Creek	2,902	7.1	14.3	16.8	13.8	16.4
Doughnut	1,863	0.0	0.0	0.9	0.0	0.0
Eagle Creek/Slide Creek	4,556	7.4	8.2	8.6	8.1	7.8
East Fork North Thorne River	7,548	6.3	7.2	11.1	8.3	8.8
Falls Creek	2,408	9.4	13.3	13.5	13.4	13.5
Goose Creek	13,502	14.5	18.5	19.4	17.2	18.3
Gravelly Creek	6,864	9.7	10.9	13.2	12.6	12.9
Lake Ellen	5,331	18.2	18.2	18.2	18.2	18.2
Little Ratz Creek	3,530	7.0	9.1	11.2	8.5	9.8
Luck Lake	7,499	14.3	16.8	20.5	17.2	18.0
Luck Point	1,410	7.9	7.9	9.7	7.9	7.9
No Name	1,556	14.3	17.3	19.1	14.3	17.3
North	2,031	6.3	6.7	8.6	7.6	7.2
North Big Salt Lake	20,299	21.2	24.5	25.1	23.3	24.1
North Kasaan Bay Frontage	14,707	18.9	19	19.0	19	19.0
North Sal	688	8.4	8.4	18.5	8.4	8.4
Pin	857	9.3	9.3	13.3	9.3	9.3
Ratz Harbor	828	5.6	10.1	10.9	6.8	10.9
Rio Beaver Creek	9,050	7.1	9.5	11.4	9.6	10.6
Sal Creek	4,644	8.7	10.7	12.6	12.1	12.5
Salamander	1,289	6.2	6.2	11.0.	6.2	6.2
Slide Creek	6,485	10.1	11.4	11.6	10.3	11.2
Snakey Lakes Lowlands	6,645	13.6	18.7	19.0	15.0	18
Thorne	2,509	4.1	4.1	11.6	4.1	4.1
Thorne Bay	6,358	20.3	20.3	20.6	20.6	20.6
Thorne Lake	16,110	2.5	2.5	3.8	2.5	2.5
Thorne River Intertidal	1,810	6.1	6.1	8.6	8.5	8.5
Tiny	529	5.8	14.3	16.1	11.8	15.9
Torrent	1,807	9.9	14.4	14.4	12.5	14.4
West Fork Luck Creek	7,317	8.9	11.6	12.7	11.3	11.6
West Fork North Thorne River	8,382	5.6	9.0	9.4	6.9	9.0

1/ Harvest and roads since 1981 includes the existing conditions and conditions after completion of alternative actions. Refer to Watershed Resource Report (James 2012) for calculations

Although cumulative harvest may result in moderate streamflow increases, this assumes harvest of NEPA-cleared units, proposed state lands, and Big Thorne Project alternatives would occur in the same year. This assumption is not correct because this harvest is likely to occur over many years (the Big Thorne Project may occur over 10 years). Because of this timeframe, subwatershed canopy cover in mid-aged harvest areas (those near 30 years since last harvest) would approach normal canopy cover, reducing effects on streamflow. Total cumulative harvest (without Big Thorne harvest) would be less than 20 percent of the basin area by 2014 in all subwatersheds, except the North Big Salt Lake, Pin, and Thorne Bay subwatersheds, which would not be less than 20 percent of the basin area until 2015, 2043, and 2019, respectively. Therefore, it is unlikely that streamflow increases associated with cumulative harvest would be measurable in any subwatersheds except possibly the North Big Salt Lake, Pin, and Thorne Bay subwatersheds.

Delaying harvest in subwatersheds expected to have 20 percent or more area harvested over the most recent 30 year-period, may limit increased peak flows. Because the Goose Creek, Luck Lake, North Big Salt Lake, Pin, and Thorne Bay subwatersheds would all have 20 percent or more area harvested in one or more alternatives if the project and additional planned sales (non-project Forest Service and State sales) occurred, delaying harvest in each subwatershed was evaluated to determine when total harvest would be exceed or drop below the 20 percent level.

The Goose Creek subwatershed would increase to as much as 20.0 percent harvested during the past 30 years, if all project and additional planned sales occurred in 2013. While this is at the 20 percent harvest level, the percent harvested would never exceed 20.0 percent, so no harvest would need to be delayed in the Goose Creek subwatershed.

The Luck Lake subwatershed may exceed the 20.0 percent harvested level under Alternative 3 by 0.5 percent, depending on when harvest occurs. Because, at most, only 37 acres of harvest would need to be delayed to maintain the percent harvested at less than 20 percent, delaying harvest in the Luck Lake subwatershed would not result in a measurable difference in peak flows.

The North Big Salt Lake subwatershed would increase to 21.5 percent of forest less than 30 years old under Alternative 1 (no action) if all additional planned sales occurred in 2013. With the action alternatives, this percentage would range from 23.7 under Alternative 4 to 25.4 under Alternative 5. Delaying harvest in the North Big Salt Lake subwatershed would reduce the percent harvested to less than 20 percent and minimize the potential for increased peak flows. Specifically, if only 151 acres were harvested in 2015 or later, 226 acres in 2016 or later, 114 acres in 2017 or later, 171 acres in 2018 or later, and all remaining acres in 2019 or later, the North Big Salt Lake subwatershed would remain below the 20 percent level. Delaying and staggering harvest between 2015 and 2019 would provide enough forest regeneration to minimize any potential for increased peak flows within the subwatershed.

The Pin subwatershed would increase to 32.5 percent of forest less than 30 years old under Alternative 1 (no action), because of planned future state sales. Because of these additional planned sales, delaying harvest could not reduce the percent area harvested to anywhere close to the 20 percent level during the expected timeline for the Big Thorne

Project. Only Alternative 3 includes harvest under the Big Thorne Project in the Pin subwatershed.

The Thorne Bay subwatershed would increase to as much as 22.7 percent of forest less than 30 years old because of planned future state timber sales under Alternative 1. Big Thorne harvest would result in no more than a 0.4 percent increase in this percentage under any alternative, and, delaying harvest would not substantially reduce the percent area harvested less than 30 years old nor reduce it below the 20 percent level during the expected timeline for the project.

At the watershed scale, the Slide Creek – Frontal Clarence Strait watershed does not exceed the 20 percent area harvested since 1981 threshold, even when combined with additional harvest of NEPA-cleared units and state lands. However, effects on streamflow in the North Big Salt Lake (all alternatives), Thorne Bay – Frontal Tolstoi Bay (Alternatives 2, 3, and 5), and Tolsoi Bay – Frontal Clarence Strait (Alternative 3) watersheds could be moderate; but it is unlikely that streamflow increases would be measurable. The Big Thorne Project alternatives are unlikely to increase peak flows in any of the other watersheds. The Watershed Resource Report (James 2012) discusses all watersheds in more detail.

Water Quality

Beneficial Uses of Waters in the Project Area

As described in the Affected Environment section, there are two potable water supplies (PWS) in the affected watersheds and subwatersheds: Water Lake and Linkum Creek. The Affected Environment section described the current conditions (Alternative 1) related to the PWS.

Water Lake is located within the Thorne subwatershed, approximately 0.1 mile north of the municipality of Thorne Bay, and supplies potable water to the area residents. Only Alternative 3 proposes harvesting in the Thorne subwatershed. The proposed units and access roads are located outside of the drainage area of Water Lake. Due to the distance of the PWS from project activity, there would be no impact to Water Lake.

Linkum Creek is located within the North Kasaan Bay Frontage subwatershed near the organized village of Kasaan and supplies water to area residents. Alternatives 2 through 5 propose harvesting in one unit within the North Kasaan Bay Frontage subwatershed. The proposed unit is well outside of the drainage area of Linkum Creek, approximately 8.5 miles away. Due to the distance of the PWS from the proposed unit there will be no impact to Linkum Creek.

Impaired Waterbodies

The Affected Environment section described the current impaired waterbodies in the Big Thorne project area. The impaired waterbodies, Thorne Bay and Salt Chuck Bay, are adjacent to and receive flow from watersheds and subwatersheds within the project area (see Figures WRT-1 and WRT-2).

For the Big Thorne Project, the Thorne Bay MAF is likely to be used for log transport. Within Thorne Bay, approximately 7 acres are designated as impaired due to excessive bark accumulation from log storage and hauling. Water quality has improved and bark

accumulation has now decreased in Thorne Bay. If the Thorne Bay MAF is used for the project, it will be a barge-only site. Using this facility as a barge-only site and following site-specific BMPs should result in minimal bark addition to this waterbody, resulting in limited impacts to the impaired waterbody. All permits for this MAF are currently up-to-date for log transfer and barging operations that would be associated with its use for the project.

As part of Alternative 3, harvest activities would include a single unit located approximately 1 mile away from the Salt Chuck mine remediation site and in an adjacent drainage that could potentially be hydrologically connected through roads with surface flow draining into Power Lake, which outflows into Salt Chuck Bay. However, due to the combination of the distance of the harvest unit from the remediation site, the presence of Power Lake intercepting flows and sediment before they reach the site, and the implementation of site-specific BMPs, the likelihood of any increased flows or sediment affecting areas adjacent to the impaired waterbody would result in minimal, if any, impacts. Therefore, it is highly unlikely that the project would result in further degradation of the listed waterbody or hamper further remediation efforts.

Contaminated Sites

The Affected Environment section described the four contaminated sites in subwatersheds within the project area that are open: the Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, Forest Service Salt Chuck Mine, and Forest Service Thorne Bay Landfill. The Forest Service Thorne Bay Warehouse Historic Spills and Thorne Bay DuRette Shop sites are located within the town of Thorne Bay. As no ground disturbance activities for any alternative occurs within the town of Thorne Bay, these locations would not be affected by project activities.

As stated above, there is potential for hydrologic connection between proposed harvest (under Alternative 3) in an adjacent watershed and the Forest Service Salt Chuck Mine site. Within the upland areas of the Salt Chuck Mine site, remediation activities for the Forest Service land are complete. The remaining remediation activities are the responsibility of the State and EPA and could include marine remediation and additional stream work. Any increases in sediment and/or flows from project activities are unlikely to reach the Salt Chuck Mine site due to the same factors stated above (in Impaired Waterbodies). Therefore, it is unlikely that the project would result in further impacts to the contaminated site or hamper further remediation efforts.

The Forest Service Thorne Bay Landfill is within the Torrent subwatershed. As part of Alternatives 2, 3, and 5, project activities would include harvest in two units (approximately 6 acres each) that would be hydrologically connected to the Forest Service Thorne Bay Landfill. The two harvest units are located outside of the Forest Service Landfill, approximately 0.1 and 0.5 mile, in the headwaters of South Creek and Ditch Creek, respectively. Neither stream is fish-bearing within the harvest units; however both are fish-bearing streams through the landfill. The harvest unit located approximately 0.1 mile from the landfill proposes harvest on both sides of South Creek. This headwater portion of South Creek is Class III and has the potential to transport sediment to the fish-bearing portion of the creek running through the middle of the landfill. Harvest actions could contribute to increased streamflow and sedimentation within South Creek; however,

implementation of the riparian no-harvest Class III stream buffer and BMPs (as described on the unit cards) would minimize increased streamflow and sedimentation in the creek and not likely have an effect on iron or manganese concentrations in the landfill. The harvest unit located approximately 0.5 mile from the landfill proposes harvest adjacent to Ditch Creek. This headwater portion of Ditch Creek is Class IV. Because this portion of Ditch Creek is Class IV, and due to implementation of BMPs, project actions are not likely to have an effect on iron or manganese concentrations in the landfill.

Acid Rock Drainage

As discussed in the Affected Environment section, ARD has occurred north of the Big Thorne project area along the Forest Road 3030 (Coffman Cove Road). During road construction, the use of pyritic material from the Descon Formation resulted in the generation of ARD. This formation has been identified within the Big Thorne project area. Existing forest roads and quarries in the Big Thorne project area are constructed from the Descon Formation. It is estimated that 253.8 miles of existing road, likely constructed from the Descon Shale, exists within the Big Thorne project area. It is not known if the material sources used in this construction contained mineralization. However, no past problems have been observed (Baichtal personal comm. 2011, as cited in Barnhart 2012). Present or reasonably foreseeable actions or new construction on these road or use of quarries from this rock formation should be tested for sources with high potential and be avoided. If ARD potential rock is disturbed, mitigation should include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Road construction and quarry development for the Big Thorne Project activities would utilize and excavate into the underlying Descon Shale. Any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas shall be assessed for its ARD potential (Baichtal personal comm. 2011, as cited in Barnhart 2012). In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the USDA Forest Service geologist will provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials will be tested and sources with high potential will be avoided. If ARD potential rock is disturbed, mitigation will include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Sediment and Turbidity

Road ditches integrate with and extend the stream network, thereby increasing sediment transport efficiency to streams (Montgomery 1994; Wemple et al. 1996). Road effects on streamflow, sediment, and turbidity may not recover until flow paths are reclaimed during road decommissioning. Roads can modify drainage density by extending the stream channel network by linking roads to stream channels through hydrologic flow paths. This frequently happens when roadside ditches collect hill-slope non-stream surface and subsurface flows and drain them directly into a stream, or reroute headwater streams into a roadside ditch for a distance before draining them into a different stream system.

In the Big Thorne project area, the existing extent of roads in some affected watersheds, combined with the knowledge that some roads, such as those found in the Eagle and North

Thorne River watersheds, have failed drainage structures and ditch or road surface erosion, suggests that additional road construction activities would compound the effects of extended stream networks until progress is made on road storage and decommissioning. Where poor maintenance is responsible for added drainage network effects, proper maintenance may help reduce sedimentation from the road network. The Watershed Resource Report (James 2012) describes specific areas and roads of concern for some watersheds and specific issues with roads used for the project are presented in the Road Cards.

Road reconstruction of Management Level (ML) 1 stored roads should have less of an effect on streamflow and sediment production than new construction, as disturbance to the existing landscape should be less. Reconstruction activities would include brushing, clearing of alders and replacing drainage structures. Reconstruction would keep the roads in a safe and useful condition for which they are managed, while meeting Forest plan standards and guidelines and following the applicable BMPs (see RMO road cards for road site specific items). No changes are being proposed to the Objective Maintenance Level (OBML) and Road Management Objectives (RMO) designated in the Prince of Wales ATM (Barnhart 2012).

Alternatives 2 through 5 would include standard maintenance of existing roads and would repair road drainage problems as needed (Barnhart 2012). Impacts should be moderated by the requirement that all new, reconstructed ML1 stored, and new road construction over decommissioned road grades would either be stored or decommissioned after timber harvest. Specifically, all temporary roads would be decommissioned after timber harvest. All new system roads (new roads and new road construction over decommissioned road grades) and reconstructed ML1 stored roads would remain seasonally open for firewood gathering for 1 to 5 years after timber harvest, with seasonal closures between November 30 and May 1. Seasonal closure reduces use, thereby reducing sediment impacts associated with use. In addition, closing roads during the wetter months reduces the potential for rutting and road degradation occurring due to travel on saturated road surfaces. At the end of 1 to 5 years, all new system roads and reconstructed ML1 stored roads would be designated as not for public motor vehicle use and would be placed in a self-maintaining hydrologic status. These roads would be reviewed annually and would be intermittent service roads (ML1) after the completion of timber sale and additional activities and physically blocked or natural vegetation allowed to grow and eliminate motorized access. Drainage structures would be reviewed on a case-by-case basis and may be removed or left in place with additional cross drains. A review will be conducted at the time of closure for any additional resource concerns needing addressed (Barnhart 2012).

Lack of road maintenance presents a chronic sediment problem in the Big Thorne project area (USDA Forest Service unpublished document 2002a, Fryxell 2010, Beard 2011). The Affected Environment section discusses some known areas of road sediment issues within the project area. The effects of road-related sediment sources at the watershed scale probably cannot be measured; however historic road building and maintenance practices represent a chronic source of sediment and do not meet road management objectives (USDA Forest Service unpublished document 2002a, Fryxell 2010, Beard 2011).

All road construction for the Big Thorne Project would follow the applicable BMPs and all temporary roads would be decommissioned within 1 to 5 years after harvest. New and reconstructed system roads would be closed and placed in storage as described in the road cards (Appendix C; also see Barnhart and Hitner 2012 and James 2012 for different levels of storage and impacts). Decommissioning of temporary roads and storage of any new and reconstructed system roads would reduce sedimentation effects of road construction. While all new road construction would follow BMPs and Forest Plan Standards and Guidelines, there may be increased risk of sedimentation due to the presence of the road prism within subwatersheds.

Under existing conditions (Alternative 1) the Deer Creek, Ratz Harbor, Salamander, Slide Creek, Thorne River Intertidal, and Torrent subwatersheds exceed the analytical threshold (Cederholm et al. 1980) of 2.5 percent basin area in roads (Table WTR-7). As a result of proposed new road miles, the Deer Creek (Alternatives 2 through 5), Pin (Alternative 3), Ratz Harbor (Alternatives 2 through 4), Salamander (Alternative 3), Slide Creek (Alternatives 2 through 4), Thorne River Intertidal (Alternatives 3 through 5), and Torrent (Alternatives 2 through 5) subwatersheds would further exceed the analytical threshold for the indicated alternatives. Although none of these subwatersheds are above the 20 percent harvest and roads since 1981 (Table WTR-6) under any of the alternatives, because the analytical threshold of 2.5 percent basin in roads is exceeded, fine sediment accumulation would be probable in streams and have moderate effects on water quality due to road construction and reconstruction in these subwatersheds. These effects are not expected to degrade water quality or fish habitat.

Table WTR-7. Proposed Road Construction by Big Thorne Project Alternatives

Subwatershed Name	Total Basin Size (Acres)	Existing Roads (Alternative 1)		Alternative 2 Roads		Alternative 3 Roads		Alternative 4 Roads		Alternative 5 Roads	
		Total Existing Roads (miles)[1/]	Percent of Basin as Roads[1/2/]	Total Project Road miles[3/]	Percent of Basin as Roads	Total Project Road miles[3/]	Percent of Basin as Roads	Total Project Road miles[3/]	Percent of Basin as Roads	Total Project Road miles[3/]	Percent of Basin as Roads
Baird Peak	4,230	1.5	0.2	1.7	0.3	2.2	0.3	0.0	0.2	1.7	0.2
Barren	2,000	4.7	1.5	3.2	2.2	3.2	2.2	1.8	1.9	0.0	1.5
Big Ratz	10,299	22.1	1.4	2.4	1.4	5.4	1.4	4.5	1.4	1.6	1.4
Central Thorne River	6,986	14.3	1.4	5.1	1.6	5.1	1.6	1.6	1.5	2.5	1.5
Cobble Creek	2,137	5.9	1.7	0.6	1.8	1.0	1.9	0.2	1.7	0.2	1.7
Control Lake	18,624	18.9	0.6	1.1	0.6	1.1	0.6	0.3	0.6	1.1	0.6
Deer Creek	2,902	15.1	3.2	5.2	3.5	8.0	3.5	5.1	3.3	2.0	3.2
Doughnut	1,863	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eagle Creek/Slide Creek	4,556	10.3	1.3	0.0	1.3	1.0	1.3	1.0	1.3	1.0	1.3
East Fork North Thorne	7,548	12.2	0.9	0.8	0.9	2.8	1.0	0.7	0.9	0.8	0.9
Falls Creek	2,408	7.1	1.8	0.6	1.9	1.0	1.9	0.9	1.9	0.6	1.9
Goose Creek	13,502	28.4	1.3	5.6	1.4	6.4	1.4	1.0	1.3	1.2	1.3
Gravelly Creek	6,864	23.1	2.0	0.6	2.0	7.3	2.1	3.3	2.0	2.6	2.0
Lake Ellen	5,331	18.4	2.1	0.0	2.1	0.1	2.2	0.0	2.1	0.0	2.1
Little Ratz Creek	3,530	7.8	1.3	0.0	1.3	2.6	1.3	2.4	1.3	0.0	1.3
Luck Lake	7,499	20.1	1.7	2.3	1.7	4.9	1.8	3.3	1.7	3.1	1.7
Luck Point	1,410	3.0	1.2	0.0	1.2	0.6	1.3	0.0	1.2	0.0	1.2
No Name	1,556	4.9	1.8	0.3	1.9	0.6	1.9	0.0	1.8	0.0	1.8
North	2,031	4.9	1.6	0.3	1.6	0.6	1.6	0.4	1.6	0.4	1.6
North Big Salt Lake	20,299	51.5	1.4	4.8	1.5	7.0	1.5	2.0	1.5	2.2	1.4
North Kasaan Bay Frontage	14,707	54.9	1.9	0.0	1.9	0.0	1.9	0.0	1.9	0.0	1.9
North Sal	688	1.9	1.4	0.0	1.4	0.1	1.4	0.0	1.4	0.0	1.4
Pin	857	3.8	2.1	0.0	2.1	1.2	2.8	0.0	2.1	0.0	2.1
Ratz Harbor	828	3.9	2.6	0.9	3.0	1.1	3.0	0.2	2.6	0.0	2.6
Rio Beaver Creek	9,050	25.8	1.7	3.9	1.7	8.2	1.7	4.3	1.7	4.7	1.7
Sal Creek	4,644	8.9	1.5	0.8	1.5	1.1	1.5	0.7	1.5	0.8	1.5
Salamander	1,289	5.2	2.9	0.0	2.9	0.8	3.2	0.0	2.9	0.0	2.9
Slide Creek	6,485	29	2.8	3.6	2.9	4.1	2.9	2.3	2.8	0.0	2.8
Snakey Lakes Lowlands	6,645	8.9	1.0	5.6	1.3	5.8	1.3	2.4	1.1	1.3	1.1
Thorne	2,509	1.8	0.3	0.0	0.3	3.1	1.0	0.0	0.3	0.0	0.3
Thorne Bay	6,358	29	2.4	0.1	2.4	0.3	2.4	0.3	2.4	0.3	2.4
Thorne Lake	16,110	4.1	0.2	0.0	0.2	2.6	0.3	0.0	0.2	0.0	0.2
Thorne River Intertidal	1,810	7.0	2.5	0.0	2.5	1.0	2.7	0.4	2.5	0.4	2.5
Tiny	529	2.1	2.0	0.0	2.0	0.0	2	0.0	2.0	0.0	2
Torrent	1,807	13.1	4.5	1.3	4.8	1.3	4.8	1.0	4.7	0.1	4.5
West Fork Luck Creek	7,317	14.4	1.2	0.2	1.2	0.2	1.2	0.2	1.2	0.2	1.2
West Fork North Thorne	8,382	10.3	0.7	3.0	0.7	3.0	0.7	0.5	0.7	2.3	0.7
Total		**497.9**		**54.3**		**95**		**41**		**31.1**	

1/ Percent basin in road was calculated by converting miles of road to acres of road using an estimated 40 feet road width and then calculating the percent of basin acres in road acreage.
2/ Table includes all roads in available GIS coverage's [system (including roads in storage), temporary (including any decommissioned roads still available in the GIS layers), unauthorized, and non-National Forest roads].
3/ Total Project Road Miles (system and temporary roads) include proposed new roads, new construction over decommissioned road grades, and reconstructed ML1 roads. Only proposed new roads affect the percent basin in roads as the other two categories are accounted for in the existing conditions. Differences in amount of total miles per alternative compared to the Transportation report are due to rounding.

Due to cumulative road miles associated with existing conditions, NEPA-approved unharvested units, and harvest on state lands (Appendix B of the Watershed Resource Report [James 2012])), the Deer Creek, Pin, Ratz Harbor, Salamander, Slide Creek, Thorne Bay, Thorne River Intertidal, and Torrent subwatersheds exceed the analytical threshold of 2.5 percent basin area in roads. When proposed new road miles are combined with road miles associated with existing conditions, NEPA-approved unharvested units, and harvest on state lands, the Deer Creek (Alternatives 2 through 5), Pin (Alternative 3), Ratz Harbor (Alternatives 2 through 4), Salamander (Alternative 3), Slide Creek (Alternatives 2 through 4), Thorne River Intertidal (Alternatives 3 through 5), and Torrent (Alternatives 2 through 5) subwatersheds would further exceed the analytical threshold for the indicated alternatives. Furthermore, the Sal Creek and Slide Creek subwatersheds have areas of known sediment sources related to roads (Thompson and Brigham personal comm. 2012), and the Deer Creek, Big Ratz, No Name, and Slide Creek subwatersheds have the highest risk for sediment impacts out of 17 subwatersheds evaluated (Prussian and Bair 2006). In addition, within the Big Ratz, Deer Creek, and Slide Creek subwatersheds, factors such as unstable soils and landslides contribute sediment, and further land-disturbing activities may increase sediment delivery potential. The effects of fine sediment accumulation in streams within these subwatersheds could be moderate; but it is unlikely that sediment accumulation would be measurable. Decommissioning all Big Thorne Project temporary roads and applying BMPs, described in the unit cards, would minimize impacts to water quality. Storage of new and reconstructed system roads would also occur. However, there would be potential for sedimentation inherent to road presence in the subwatersheds. Alternatives with higher road construction would have higher sedimentation potential due to the presence of the road prism within subwatersheds.

Restoration efforts to remediate some of the existing chronic sediment issues include actions related to the Luck Lake Area Watershed Restoration Plan (Fryxell 2010). These include planned road maintenance, riparian management and large woody debris (LWD) placement. Floodplain streams in this watershed are dependent upon wood for sediment retention and bank stabilization (Fryxell 2009). Past management actions have resulted in low functional wood within these streams. Wood placement can aid in maintaining channel morphology, sediment deposition, and preventing rapid loss of alluvial sediments and eroding banks (Fryxell 2009, 2010). Planned restoration efforts include LWD placement and road decommissioning and improvement to 2.5 miles of stream in the lower East Fork and Middle Forks of Luck Creek, and in the West Fork and main stem of Luck Creek. The LWD material will be obtained from old logging roads in the project area that are slated for closure. Upon completion of the restoration actions, natural drainage patterns and fish access will be restored along the road segments in accordance with the Prince of Wales ATM (SOPA, USFS 2011). At the watershed scale, the Slide Creek – Frontal Clarence Strait watershed does not exceed the 2.5 percent threshold, even when combined with cumulative road miles associated with existing conditions, harvest on state lands, and Big Thorne Project activities. However, the Thorne Bay – Frontal Tolstoi Bay watershed exceeds the 2.5 percent basin area in roads threshold under all alternatives, including existing conditions. The effects of fine sediment accumulation in streams within this watershed could be moderate; but it is unlikely that sediment accumulation would be measurable. Decommissioning all Big Thorne project area temporary roads and following BMPs, described in unit cards, would maintain state water

quality standards. Storing new and reconstructed system roads may provide additional watershed benefits. However, while all new road construction will follow BMPs and Forest Plan Standards and Guidelines, there may be increased risk of sedimentation due to the presence of the road prism within subwatersheds. The Watershed Resource Report (James 2012) discusses all watersheds in more detail.

Road construction, including bridge and culvert installation, is expected to temporarily increase sediment delivery to streams (Paustian 1987); however, results of grab sample turbidity monitoring during drainage structure installation suggests that under typical construction conditions, BMPs are effective in achieving water quality criteria within a couple of days following completion of instream work (Thompson 2002). In monitoring installation of four new stream structures and one bridge installation within the Tongass National Forest, downstream turbidity following installation did not exceed state water quality standards (USDA Forest Service 2009). Tucker and Thompson (2010) conducted a comparison study related to management practices that included Shaheen Creek on Prince of Wales Island and concluded that the Forest Plan standards and guidelines are effective in maintaining water quality in Shaheen Creek. Furthermore, Tucker and Thompson (2010) results suggest that increases in turbidity (and sediment) within Shaheen Creek may not be measurable when compared to natural conditions, and if downstream increases were detected in the study, recovery to baseline level occurred without degrading water quality.

Riparian no-harvest buffers along Class I, II, and III streams, as described in the unit cards, and BMPs, as described in the road cards, would minimize erosion and sediment transport to streams (Rashin et al. 2006) and maintain cool stream temperatures (Gomi et al. 2006). Where Class IV streams are within harvest units, disturbance would be minimized through BMPs described in the unit cards. Tongass National Forest monitoring data indicate that harvested areas are consistently within the established standard of less than 15 percent detrimental soil disturbance (USDA Forest Service 2005). Recent BMP implementation and effectiveness monitoring of five harvest units and related roads by an interdisciplinary team on Prince of Wales Island found effective implementation of the BMPs and no sign of erosion or sedimentation into site area streams (USDA Forest Service 2010). These findings suggest that ground disturbance during timber harvest alone is probably not a direct source of sediment. Timber harvest would have negligible direct effects on water quality at both the watershed and subwatershed scale.

In addition to evaluating sediment effects within each subwatershed based on the analytical threshold from Cederholm et al. (1980), the number of proposed road-stream crossings (by stream Classes I, II, and III) was determined for each of the alternatives (Table WTR-8). Because existing road crossings on decommissioned and stored roads are already counted in the existing conditions under Alternative 1 (Table WTR-8), only proposed new crossings would increase the total road-stream crossing count. Table WTR-8 also shows the number of total crossings that could potentially be impacted by project alternatives. These numbers are displayed in parentheses next to the total number (they include crossings along roads to be reconstructed and roads built over decommissioned road grades). For example, in the Deer Creek subwatershed, under Alternative 2, there would be a total of 41 stream crossings, which is only 1 more crossing than under existing

conditions. However, when reconstructed road crossings and road crossings on roads built over decommissioned grades are included, in the count of crossings potentially impacted by the project, there are a total of 10 crossings that could have project activities in the Deer Creek subwatershed under Alternative 2.

Alternative 3 proposes the most new road-stream crossings (34 Class I, II, and III streams) as well as the most road-stream crossings for new construction over decommissioned road grades (13 Class I, II, and III streams). High stream crossing numbers indicate typically higher potential for short term (last less than a week) sedimentation due to construction in the stream and long-term (potentially last for years) effects due to drainage disruption by the road prisms. Properly placed and maintained crossings affect only the local channel segment, and are individually minor effects.

The subwatershed with the most road-stream crossings, under all alternatives, is North Big Salt Lake. The subwatersheds with most stream crossings for reconstructed roads would be the Rio Beaver (under all action alternatives) and West Fork North Thorne River (Alternatives 2, 3, and 5) (see Watershed Resource Report [James 2012] for detailed crossing analysis).

At the watershed scale, the Slide Creek – Frontal Clarence Strait watershed has the most existing road-stream crossings. The watersheds with the most proposed stream crossings include North Big Salt Lake under Alternatives 2 and 3, Goose Creek under Alternative 3, and Thorne Lake under Alternative 3. The North Thorne River watershed would have the most reconstructed stream crossings under all alternatives (see Watershed Resource Report [James 2012] for calculations).

Reconstructed road crossings are likely to have less of an impact than new road crossings; however, sediment impacts are still likely and proper road storage and decommissioning are necessary to minimize sediment impacts. Sedimentation effects resulting from replacement of the stream crossing structures on reconstructed roads should be shorter term and more localized than installation of stream crossings for new road construction, because the road prism, and in some cases bridge abutments, already exist for reconstructed roads. Proper Decommissioning and maintenance procedures, and adherence to BMPs as proposed under the Big Thorne Project should minimize effects from road construction and stream crossings. Road closure and storage actions for system roads may result in limited road prism and crossing removal. Because of limited road prism and crossing removal, there may be continue to be increased risk of sedimentation due to the presence of the road prism within subwatersheds.

Table WTR-8. Proposed Road-Stream Crossings by Big Thorne Project Alternatives in Affected Watersheds

Subwatershed Name	Existing Road Crossings (Alternative 1)				Crossings by Subwatershed for Action Alternatives[1/]															
					Alternative 2				Alternative 3				Alternative 4				Alternative 5			
	I	II	III	Total	I	II	III	Total[2/]	I	II	III	Total[2/]	I	II	III	Total[2/]	I	II	III	Total[2/]
Baird Peak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barren	6	3	0	9	6	3	0	9	6	3	0	9	6	3	0	9	6	3	0	9
Big Ratz	13	13	35	61	13	13	36	62 (2)	13	13	36	62 (8)	13	13	36	62 (5)	13	13	35	61 (1)
Central Thorne River	13	9	4	26	14	9	4	27 (3)	14	9	4	27 (3)	13	9	4	26	13	9	4	26
Cobble Creek	2	3	11	16	3	4	11	18 (2)	3	4	11	18 (2)	2	3	11	16	2	3	11	16
Control Lake	24	14	11	49	24	14	11	49	24	14	11	49	24	14	11	49	24	14	11	49
Deer Creek	1	21	18	40	1	21	19	41 (10)	1	21	19	41 (17)	1	21	19	41 (11)	1	21	18	40 (4)
Doughnut	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eagle Creek/Slide Creek	14	1	14	29	14	1	14	29	14	1	14	29	14	1	14	29	14	1	14	29
East Fork North Thorne	20	8	34	62	20	8	34	62 (6)	21	8	34	63 (14)	20	8	34	62 (6)	20	8	34	62 (6)
Falls Creek	4	0	9	13	4	0	9	13	4	0	9	13 (2)	4	0	9	13 (2)	4	0	9	13
Goose Creek	26	6	42	74	27	6	44	77 (3)	28	7	45	80 (6)	27	6	42	75 (1)	26	6	42	74
Gravelly Creek	11	12	43	66	11	12	44	67 (1)	11	12	46	69 (19)	11	12	44	67 (6)	11	12	43	66 (5)
Lake Ellen	13	5	23	41	13	5	23	41	13	5	23	41	13	5	23	41	13	5	23	41
Little Ratz Creek	9	12	17	38	9	12	17	38	9	12	17	38 (8)	9	12	17	38 (7)	9	12	17	38
Luck Lake	9	14	33	56	9	14	34	57 (3)	9	14	34	57 (4)	9	14	34	57 (5)	9	14	33	56 (2)
Luck Point	0	1	2	3	0	1	2	3	0	1	2	3 (3)	0	1	2	3	0	1	2	3 (4)
No Name	0	12	15	27	0	12	15	27	0	12	15	27	0	12	15	27	0	12	15	27
North	5	4	4	13	5	4	4	13	5	4	4	13	5	4	4	13	5	4	4	13
North Big Salt Lake	21	40	83	144	21	41	91	153 (11)	21	41	91	153 (27)	21	41	85	147 (3)	21	40	85	146 (2)
North Kasaan Bay Frontage	7	10	15	32	7	10	15	32	7	10	15	32	7	10	15	32	7	10	15	32
North Sal	0	0	4	4	0	0	4	4	0	0	4	4	0	0	4	4	0	0	4	4
Pin	2	4	2	8	2	4	2	8	3	6	2	11 (3)	2	4	2	8	2	4	2	8
Ratz Harbor	5	3	0	8	5	3	0	8	5	3	0	8	5	3	0	8	5	3	0	8
Rio Beaver Creek	22	11	47	80	22	11	47	80 (11)	22	11	47	80 (24)	22	11	47	80 (14)	22	11	47	80 (13)
Sal Creek	13	5	15	33	13	5	15	33 (3)	13	5	15	33 (3)	13	5	15	33 (3)	13	5	15	33 (3)
Salamander	3	7	3	13	3	7	3	13	3	7	3	13	3	7	3	13	3	7	3	13
Slide Creek	9	23	18	50	9	23	18	50 (3)	9	23	18	50 (5)	9	23	18	50 (3)	9	23	18	50
Snakey Lakes Lowlands	14	3	1	18	14	3	1	18 (3)	14	3	1	18 (3)	14	3	1	18 (2)	14	3	1	18
Thorne	1	0	1	2	1	0	1	2	2	0	1	3 (1)	1	0	1	2	1	0	1	2
Thorne Bay	20	13	22	55	20	13	22	55	20	13	22	55	20	13	22	55	20	13	22	55
Thorne Lake	3	0	12	15	3	0	14	17	3	0	19	22 (5)	3	0	14	17	3	0	14	17
Thorne River Intertidal	6	2	11	19	6	2	11	19	6	2	11	19	6	2	11	19	6	2	11	19
Tiny	0	1	9	10	0	1	9	10	0	1	9	10	0	1	9	10	0	1	9	10
Torrent	4	10	6	20	4	11	6	21	4	11	6	21	4	11	6	21	4	11	6	21
West Fork Luck Creek	17	9	19	45	17	9	19	45	17	9	19	45	17	9	19	45	17	9	19	45
West Fork North Thorne	2	26	25	53	2	26	25	53 (22)	2	26	25	53 (22)	2	26	25	53 (3)	2	26	25	53 (18)
Total – All	**319**	**306**	**610**	**1235**	**322**	**308**	**624**	**1254 (83)**	**326**	**311**	**632**	**1269 (179)**	**320**	**307**	**616**	**1243 (71)**	**319**	**306**	**612**	**1237 (58)**
Total Proposed New					3	2	14	19	7	5	22	34	1	1	6	8	0	0	2	2
Total Reconstructed ML1 Road					21	21	18	60	31	46	55	132	23	10	24	57	16	15	20	51
Total Construction Over Decommissioned Road Grade					2	2	0	4	2	5	6	13	0	2	4	6	0	1	4	5

1/ Road-stream crossings are by stream class and are the total number of stream crossings (existing and proposed) that would exist under that alternative.

2/ The total includes existing and proposed new crossings. Reconstructed ML1 road crossings and crossings for new construction over decommissioned road grades are already accounted for in the existing crossing numbers. Parentheses values are total number of crossings with possible project activity (crossings for proposed new roads, reconstructed ML1 roads, and new construction over decommissioned road grades). See Watershed Resource Report (James 2012) for additional information regarding crossing types by subwatershed and watershed.

Temperature

Riparian no-harvest buffers along Class I, II, and III streams would maintain cool stream temperatures (Gomi et al 2006). No effects to stream temperature are anticipated as a result of implementation of any of the action alternatives.

Stream Habitat

Riparian no-harvest buffers along Class I, II, and III streams, as described in the unit cards, will avoid direct impacts to stream habitat in watersheds and subwatersheds. Effects will be negligible and limited to road-stream crossing corridors. Table WTR-8 provides alternative comparison for numbers of stream crossings at the subwatershed level, including fish streams, for new roads and reconstructed ML1 stored roads. Alternative 3 proposes 12 new road crossings on fish-bearing streams, far more than any other alternative. Additionally, this alternative proposes on ML1 stored roads to reconstruct up to 77 crossings on fish-bearing streams, and 7 crossings on fish-bearing streams for roads proposed over decommissioned roadbeds.

Units with high wind risk have been identified and will receive consideration for reasonable assurance of windfirm buffer design during unit layout (Barnhart and Iozzi 2012). Recent forest plan monitoring results have shown that "post-harvest windthrow is present in 140 (52 percent) of the 266 buffers monitored adjacent to units harvested from 2000 through 2007. The average amount of windthrow in the buffers is 6.5 percent. The amount of windthrow is expressed as the cumulative number of trees windthrown divided by the original number of standing trees in a buffer. The cumulative windthrow mortality in the buffers is highly variable and ranges from 0 to 85 percent. To date, 74 percent of the buffers have less than 5 percent windthrow mortality, 83 percent have less than 10 percent windthrow, and 96 percent of the buffers have less than 50 percent windthrow (USDA Forest Service 2010b).

Lake Habitat

Lake riparian buffers and other BMPs would avoid effects on lake habitat. Effects on lake habitat would be negligible.

Effects by Alternative

Analysis of direct, indirect, and cumulative effects for the Big Thorne Project is provided in the previous sections (see Environmental Consequences section above on Streamflow, Water Quality, Stream Habitat, and Lake Habitat). The following sections provide summaries of direct, indirect, and cumulative effects for each alternative and comparisons among alternatives.

Tables WTR-9 and WTR-10 present summaries of cumulative harvest and cumulative road construction and acres by subwatershed for each alternative. These tables incorporate reasonably foreseeable future projects. Table WTR-11 summarizes the results from analyzing direct, indirect, and cumulative effects by subwatershed.

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Table WTR-9. Cumulative Harvest by Big Thorne Project Alternative

Subwatershed Names	Total Basin Size (Acres)	Existing and Foreseeable (Alternative 1)			Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Total Harvested and Roads since 1981 (Acres)[1/]	Reasonably Foreseeable Harvest (Acres)[2/]	Harvest and Roads Since 1981 (% Basin Area)[3/]	Proposed Harvest and Roads (Acres)[4/]	Cumulative harvest and Roads Since 1981 (% Basin Area)[5/]	Proposed Harvest and Roads (Acres)[4/]	Cumulative harvest and Roads Since 1981 (% Basin Area)[5/]	Proposed Harvest and Roads (Acres)[4/]	Cumulative harvest and Roads Since 1981 (% Basin Area)[5/]	Proposed Harvest and Roads (Acres)[4/]	Cumulative harvest and Roads Since 1981 (% Basin Area)[5/]
Baird Peak	4,230	19	1	0.5	13	0.8	97	2.8	0	0.5	61	1.9
Barren	2,000	141	<1	7.1	241	19.1	241	19.1	185	16.3	150	14.6
Big Ratz	10,299	1051	3	10.2	280	13.0	490	15.0	362	13.7	373	13.9
Central Thorne River	6,986	757	2	10.9	438	17.1	438	17.1	213	13.9	388	16.4
Cobble Creek	2,137	202	1	9.5	54	12.0	70	12.8	35	11.1	70	12.8
Control Lake	18,624	717	93	4.3	74	4.7	74	4.7	30	4.5	74	4.7
Deer Creek	2,902	202	42	8.4	211	15.7	283	18.2	194	15.1	270	17.7
Doughnut	1,863	0	1	0.0	0	0.0	17	0.9	0	0.0	0	0.0
Eagle Creek/Slide Creek	4,556	339	1	7.5	34	8.2	52	8.6	30	8.1	16	7.8
East Fork North Thorne River	7,548	474	2	6.3	71	7.3	365	11.2	151	8.3	190	8.8
Falls Creek	2,408	226	1	9.4	95	13.4	99	13.5	98	13.5	99	13.5
Goose Creek	13,502	1961	68	15.0	537	19.0	667	20.0	365	17.7	508	18.8
Gravelly Creek	6,864	669	2	9.8	80	10.9	238	13.2	195	12.6	214	12.9
Lake Ellen	5,331	972	<1	18.2	0	18.2	0	18.2	0	18.2	0	18.2
Little Ratz Creek	3,530	247	1	7.0	73	9.1	147	11.2	53	8.5	99	9.8
Luck Lake	7,499	1070	2	14.3	186	16.8	465	20.5	220	17.2	283	18.1
Luck Point	1,410	112	<1	7.9	0	7.9	27	9.8	0	7.9	0	7.9
No Name	1,556	221	<1	14.2	48	17.3	76	19.1	0	14.2	48	17.3
North	2,031	128	1	6.3	9	6.7	49	8.7	27	7.6	20	7.3
North Big Salt Lake	20,299	4300	69	21.5	685	24.9	793	25.4	434	23.7	604	24.5
North Kasaan Bay Frontage	14,707	2778	<1	18.9	10	19.0	10	19.0	10	19.0	10	19.0
North Sal	688	58	<1	8.5	0	8.5	70	18.6	0	8.5	0	8.5
Pin	857	80	198	32.5	0	32.5	35	36.5	0	32.5	0	32.5
Ratz Harbor	828	46	<1	5.6	38	10.2	45	11.0	10	6.8	44	10.9
Rio Beaver Creek	9,050	644	155	8.8	212	11.2	384	13.1	227	11.3	317	12.3
Sal Creek	4,644	404	1	8.7	92	10.7	182	12.7	158	12.1	175	12.5
Salamander	1,289	80	30	8.6	0	8.6	62	13.4	0	8.6	0	8.6
Slide Creek	6,485	655	2	10.1	88	11.5	95	11.6	12	10.3	74	11.3
Snakey Lakes Lowlands	6,645	907	2	13.7	340	18.8	361	19.1	90	15.0	292	18.1
Thorne	2,509	117	168	11.3	0	11.4	185	18.7	0	11.4	0	11.4
Thorne Bay	6,358	1255	186	22.7	3	22.7	29	23.1	23	23.0	23	23.0
Thorne Lake	16,110	406	5	2.6	0	2.6	206	3.8	0	2.6	0	2.6
Thorne River Intertidal	1,810	110	3	6.2	0	6.2	46	8.7	43	8.6	43	8.6
Tiny	529	30	<1	5.8	45	14.3	55	16.2	32	11.8	54	16.0
Torrent	1,807	149	3	8.4	83	13.0	83	13.0	47	11.0	81	12.9
West Fork Luck Creek	7,317	648	2	8.9	205	11.7	285	12.8	181	11.4	205	11.7
West Fork North Thorne River	8,382	471	3	5.6	284	9.0	319	9.5	104	6.9	284	9.0

1/ Existing harvest and roads area since 1981, including: harvested area and area in roads outside of harvest.
2/ Reasonably foreseeable harvest and roads area, including: foreseeable non-Project harvest related to the Roadside EA micro-sales and individual use free timber, the Control Lake EA, and future harvest on State lands. Area is rounded to the nearest acre. See Watershed Resource Report (James 2012) for detailed calculations.
3/ Includes existing harvest and roads and reasonably foreseeable harvest as percent basin area.
4/ Alternative-specific proposed harvest and roads area including: acres of proposed harvest and acres of proposed roads outside of harvest areas.
5/ Cumulative harvest and roads since 1981 includes including: harvest and roads since 1981, reasonably foreseeably harvest, and area of proposed harvest and roads.

Table WTR-10. Cumulative Percent Road Area by Big Thorne Project Alternatives

Subwatershed Names	Total Basin Size (Acres)	Existing and Foreseeable (Alternative 1)		Alternative 2	Alternative 3	Alternative 4	Alternative 5
		Total Road (Acres)[1/]	Percent of Basin as Roads[2/,3/]	Percent of Basin as Roads[2/,3/]	Percent of Basin as Roads[2/,3/]	Percent of Basin as Roads[2/,3/]	Percent of Basin as Roads[2/,3/]
Baird Peak	4,230	9.8	0.2	0.3	0.3	0.2	0.2
Barren	2,000	30.8	1.5	2.2	2.2	1.9	1.5
Big Ratz	10,299	140.4	1.4	1.4	1.4	1.4	1.4
Central Thorne River	6,986	96.7	1.4	1.6	1.6	1.5	1.5
Cobble Creek	2,137	37.1	1.7	1.8	1.9	1.7	1.7
Control Lake	18,624	110.2	0.6	0.6	0.6	0.6	0.6
Deer Creek	2,902	91.8	3.2	3.5	3.5	3.3	3.2
Doughnut	1,863	0	0	0	0	0	0
Eagle Creek/Slide Creek	4,556	60.8	1.3	1.3	1.3	1.3	1.3
East Fork North Thorne	7,548	69.2	0.9	0.9	1	0.9	0.9
Falls Creek	2,408	43.5	1.8	1.9	1.9	1.9	1.9
Goose Creek	13,502	171.6	1.3	1.4	1.5	1.3	1.3
Gravelly Creek	6,864	138.1	2	2	2.1	2	2
Lake Ellen	5,331	114.4	2.1	2.1	2.2	2.1	2.1
Little Ratz Creek	3,530	47.2	1.3	1.3	1.3	1.3	1.3
Luck Lake	7,499	124.5	1.7	1.7	1.8	1.7	1.7
Luck Point	1,410	16.4	1.2	1.2	1.3	1.2	1.2
No Name	1,556	27.4	1.8	1.9	1.9	1.8	1.8
North	2,031	31.6	1.6	1.6	1.6	1.6	1.6
North Big Salt Lake	20,299	286.2	1.4	1.5	1.5	1.5	1.4
North Kasaan Bay Frontage	14,707	272.8	1.9	1.9	1.9	1.9	1.9
North Sal	688	9.7	1.4	1.4	1.4	1.4	1.4
Pin	857	26.5	3.1	3.1	3.8	3.1	3.1
Ratz Harbor	828	21.8	2.6	3	3	2.6	2.6
Rio Beaver Creek	9,050	153.9	1.7	1.8	1.8	1.7	1.7
Sal Creek	4,644	67.8	1.5	1.5	1.5	1.5	1.5
Salamander	1,289	37	2.9	2.9	3.2	2.9	2.9
Slide Creek	6,485	179.2	2.8	2.9	2.9	2.8	2.8
Snakey Lakes Lowlands	6,645	69.5	1	1.3	1.3	1.1	1.1
Thorne	2,509	17.4	0.7	0.7	1.3	0.7	0.7
Thorne Bay	6,358	164.5	2.6	2.6	2.6	2.6	2.6
Thorne Lake	16,110	37.1	0.2	0.2	0.3	0.2	0.2
Thorne River Intertidal	1,810	45.8	2.5	2.5	2.7	2.5	2.5
Tiny	529	10.7	2	2	2	2	2
Torrent	1,807	80.8	4.5	4.8	4.8	4.7	4.5
West Fork Luck Creek	7,317	88.1	1.2	1.2	1.2	1.2	1.2
West Fork North Thorne	8,382	56.5	0.7	0.7	0.7	0.7	0.7

1/ Includes existing roads and foreseeable future roads associated with the Control Lake EIS (NEPA-approved unharvested units) and timber harvest on State lands.
2/ Percent of basin in roads was calculated by converting miles of road to acres of road using an estimated 40 feet wide road width and then calculating the percent of basin area in road acreage.
3/ Table includes all roads in available GIS coverage's [system (including roads in storage), temporary (including any decommissioned roads still available in the GIS layers), unauthorized, and non-National Forest roads].

Table WTR-11. Direct, Indirect, and Cumulative Effects by Big Thorne Project Alternatives in Affected Subwatersheds

Subwatershed Name	Alternative 2					Alternative 3					Alternative 4					Alternative 5				
	Streamflow		Sedimentation		Increases in Number of Crossings[1/]	Streamflow		Sedimentation		Increase in Number of Crossings[1/]	Streamflow		Sedimentation		Increase in Number of Crossings[1/]	Streamflow		Sedimentation		Increase in Number of Crossings[1/]
	Direct and Indirect	Cumulative	Direct and Indirect	Cumulative		Direct and Indirect	Cumulative	Direct and Indirect	Cumulative		Direct and Indirect	Cumulative	Direct and Indirect	Cumulative		Direct and Indirect	Cumulative	Direct and Indirect	Cumulative	
Baird Peak	minor	minor	minor	minor	no	minor	minor	minor	minor	no	none	none	none	none	no	minor	minor	minor	minor	no
Barren	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	none	none	no
Big Ratz	minor	minor	minor	minor	yes	minor	minor	minor	minor	yes	minor	minor	minor	minor	yes	minor	minor	minor	minor	no
Central Thorne River	minor	minor	minor	minor	yes	minor	minor	minor	minor	yes	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Cobble Creek	minor	minor	minor	minor	yes	minor	minor	minor	minor	yes	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Control Lake	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Deer Creek	minor	minor	moderate	moderate	yes	minor	minor	moderate	moderate	yes	minor	minor	moderate	moderate	yes	minor	minor	moderate	moderate	no
Doughnut	none	none	none	none	no	minor	minor	none	none	no	none	none	none	none	no	none	none	none	none	no
Eagle Creek/Slide Creek	minor	minor	none	none	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no
East Fork North Thorne	minor	minor	minor	minor	no	minor	minor	minor	minor	yes	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Falls Creek	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Goose Creek	minor	minor	minor	minor	yes	minor	moderate	minor	minor	yes	minor	minor	minor	minor	yes	minor	minor	minor	minor	no
Gravelly Creek	minor	minor	minor	minor	yes	minor	minor	minor	minor	yes	minor	minor	minor	minor	yes	minor	minor	minor	minor	no
Lake Ellen	none	none	none	none	no	minor	minor	minor	minor	no	none	none	none	none	no	none	none	none	none	no
Little Ratz Creek	minor	minor	none	none	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	none	none	no
Luck Lake	minor	minor	minor	minor	yes	moderate	moderate	minor	minor	yes	minor	minor	minor	minor	yes	minor	minor	minor	minor	no
Luck Point	none	none	none	none	no	minor	minor	minor	minor	no	none	none	none	none	no	none	none	none	none	no
No Name	minor	minor	minor	minor	no	minor	minor	minor	minor	no	none	none	none	none	no	minor	minor	none	none	no
North	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no
North Big Salt Lake	moderate	moderate	minor	minor	yes	moderate	moderate	minor	minor	yes	moderate	moderate	minor	minor	yes	moderate	moderate	minor	minor	yes
North Kasaan Bay Frontage	minor	minor	none	none	no	minor	minor	none	none	no	minor	minor	none	none	no	minor	minor	none	none	no
North Sal	none	none	none	none	no	minor	minor	minor	minor	no	none	none	none	none	no	none	none	none	none	no
Pin	none	none	none	none	no	minor	moderate	moderate	moderate	yes	none	none	none	none	no	none	none	none	none	no
Ratz Harbor	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no	minor	minor	none	none	no
Rio Beaver Creek	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Sal Creek	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Salamander	none	none	none	none	no	minor	minor	moderate	moderate	no	none	none	none	none	no	none	none	none	none	no
Slide Creek	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no	minor	minor	none	none	no
Snakey Lakes Lowlands	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Thorne	none	minor	none	none	no	minor	minor	minor	minor	yes	none	minor	none	none	no	none	minor	none	none	no
Thorne Bay	moderate	moderate	minor	moderate	no	moderate	moderate	minor	moderate	no	moderate	moderate	minor	moderate	no	moderate	moderate	minor	moderate	no
Thorne Lake	none	none	none	none	no	minor	minor	minor	minor	yes	none	none	none	none	no	none	none	none	none	no
Thorne River Intertidal	none	none	none	none	no	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no
Tiny	minor	minor	none	none	no	minor	minor	none	none	no	minor	minor	none	none	no	minor	minor	none	none	no
Torrent	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no
West Fork Luck Creek	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no
West Fork North Thorne	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no

1/ Indicates increase in number of Class I, II, III stream-crossings compared to the total number of Class I, II, III stream-crossings for existing roads.

Alternative 1 – No Action

Direct and Indirect Effects

Since no activities are proposed in this alternative, no direct or indirect effects would occur. Vegetation recovery would occur by 2014 in all watersheds, except the Tolstoi Bay – Frontal Clarence Strait watershed, and by 2019 in all subwatersheds, as forested areas increase in maturity. No associated road maintenance would occur, therefore sediment sources and other road maintenance issues would not be improved. Natural soil disturbances would continue to occur; however, vegetation in previously harvested areas would grow, adding stability to the soil, and reduce the likelihood of landslides in watersheds and subwatersheds. Although the watersheds and subwatersheds within the Big Thorne project area are not undisturbed, streamflow and water quality would be maintained.

The Forest Service nationally rated Slide Creek – Frontal Clarence Strait watershed will likely remain "functioning-at risk" due to high percentages of riparian areas in young growth and the current density of roads and proximity to waterbodies. The presence of fish barrier stream-crossings and contaminated soils will also continue to result in a degraded watershed condition. Sediment sources and other road maintenance would be limited to those actions occurring due to standard road maintenance and restoration activities that are not associated with the Big Thorne Project. Riparian conditions would continue to improve with time as stands age, and riparian thinning would continue to occur in an effort to accelerate maturation of stand condition to more old-growth characteristics.

Cumulative Effects

Because there are no direct or indirect effects associated with the Big Thorne Project, there are no cumulative effects associated with Alternative 1. Effects of past activities are described in the Affected Environment. Effects of present and reasonably foreseeable activities would be as described in the previous sections.

Per Appendix A of the Watershed Resources Report (James 2012) and Table WTR-9, past harvest plus reasonably foreseeable harvest may result in streamflow increases (based on percent basin area harvested) in the North Big Salt Lake and Tolstoi Bay – Frontal Clarence Strait watersheds and North Big Salt Lake, Pin, and Thorne Bay subwatersheds. Increased streamflow within these watersheds and subwatersheds may be moderate, but the changes are not expected to result in measurable effects on sedimentation or aquatic habitat.

The State of Alaska and EPA reclamation and cleanup efforts to address the Category 5 Salt Chuck Bay impaired waterbody and Salt Chuck Mine site would continue. These efforts will likely cause a reduction in potential hazardous material runoff to streams, lakes, and the Salt Chuck Bay near the mine site. The Forest Service monitoring of the Category 4a Thorne Bay Landfill would continue within South Creek. Continued monitoring will likely help determine if hazardous material from the landfill persists in South Creek.

It is estimated that 253.8 miles of existing road, likely constructed from the Descon Shale, exists within the Big Thorne project area. It is not known if the material sources used in

this construction contained mineralization. However, no past problems have been observed (Baichtal personal comm. 2011, as cited in Barnhart 2012). Present or reasonably foreseeable actions or new construction on these roads or use of quarries from this rock formation should be tested for sources with high potential and be avoided. If ARD potential rock is disturbed, mitigation should include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Per Appendix B of the Watershed Resource Report (James 2012), when past, present, and reasonably foreseeable road construction is combined, the Thorne Bay – Frontal Tolstoi Bay watershed and Deer Creek, Pin, Ratz Harbor, Salamander, Slide Creek, Thorne Bay, Thorne River Intertidal, and Torrent subwatersheds exceed the 2.5 percent basin area in roads threshold and may result in moderate (though difficult to measure) impacts.

Conclusion

Alternative 1 (No Action) has no direct, indirect, or cumulative effects on watersheds or subwatersheds as a result of the Big Thorne Project. Harvest and road construction in the Big Thorne project area would be less than in the action alternatives.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Alternative 2 would result in minor effects on sedimentation and aquatic habitat, with moderate effects in some watersheds and subwatersheds. Alternative 2 would increase the percent basin area harvested since 1981 in the North Big Salt Lake watershed and North Big Salt Lake and Thorne Bay subwatersheds above the 20 percent threshold (Table WTR-6). Streamflow may increase in these watersheds and subwatersheds, but the changes are not expected to result in measurable effects on sedimentation or aquatic habitat. Alternative 2 would not increase any other watershed or subwatershed percent basin harvested over the 20 percent in 30 years threshold.

Alternative 2 is not expected to result in any direct or indirect effects to the two PWS, Category 4a Thorne Bay impaired waterbody, Category 5 Salt Chuck Bay impaired waterbody, or the USDA Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, USDA Forest Service Salt Chuck Mine, and USDA Forest Service Thorne Bay Landfill contaminated sites. Riparian no-harvest buffers along Class I, II, and III streams, as described in the unit cards, and BMPs, as described in the road cards, would limit impacts from the planned activities on these water supplies, waterbodies, and contaminated sites.

Road construction and quarry development for the Big Thorne Project activities would utilize and excavate into the underlying Descon Shale. Any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas under Alternative 2 would be assessed for its ARD potential. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the USDA Forest Service geologist will provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials will be tested and sources with high potential will be avoided. If ARD

potential rock is disturbed, mitigation will include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Alternative 2 would construct 35 miles of road (proposed new roads and new construction over decommissioned road grades) that have 9 Class I and II (14 Class III) road-stream crossings and reconstruct 19.3 miles of road that have 42 Class I and II (18 Class III) road-stream crossings. This would result in minor to moderate effects on sedimentation and aquatic habitat in all watersheds and subwatersheds. Moderate (though difficult to measure) effects on sedimentation and aquatic habitat may occur in the Thorne Bay – Frontal Tolstoi Bay watershed and Deer Creek, Ratz Harbor, Slide Creek, and Torrent subwatersheds, as they exceed the 2.5 percent basin area in roads threshold (Table WTR-7). Compared to other action alternatives, Alternative 2 would have the second-highest level of effects on sedimentation and aquatic habitat.

Alternative 2 would have minor effects on the USDA Forest Service nationally rated "functioning-at risk" Slide Creek – Frontal Clarence Strait watershed. The watershed will likely remain "functioning-at risk" due to high percentages of riparian areas being in young growth and the current density of roads and proximity to waterbodies. Harvest and road construction under Alternative 2 would not result in greater than 20 percent of the basin area harvested since 1981 or increase road density above the 2.5 percent basin area in roads threshold for this watershed. Implementation of riparian no-harvest buffers along Class I, II, and III streams, as described in the unit cards, BMPs, as described in the road cards, and decommissioning all temporary project roads would minimize direct and indirect effects on the Slide Creek – Frontal Clarence Strait watershed. However, while all new road construction will follow BMPs and Forest Plan Standards and Guidelines, there may be increased risk of sedimentation due to the presence of the road prism within the watershed.

Cumulative Effects

Watershed and subwatershed effects from past practices are described in the Affected Environment. Because present and reasonably foreseeable activities are consistently evaluated across all alternatives, Alternative 2 ranks second in cumulative effects on sedimentation and aquatic habitat in all watersheds and subwatersheds.

Per Appendix A of the Watershed Resources Report (James 2012) and Table WTR-9, additional harvest of NEPA-cleared units and state lands may result in streamflow increases (based on percent basin area harvested) in the North Big Salt watershed and North Big Salt Lake and Thorne Bay subwatersheds. Increased streamflow within these watersheds and subwatersheds may be moderate, but the changes are not expected to result in measurable impacts on sedimentation or aquatic habitat.

Because there are no direct or indirect effects to the two PWS, Category 4a Thorne Bay impaired waterbody, Category 5 Salt Chuck Bay impaired waterbody, or the USDA Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, USDA Forest Service Salt Chuck Mine, and USDA Forest Service Thorne Bay Landfill contaminated sites, there are no cumulative effects.

During road construction, any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas under Alternative 2 would be assessed for its ARD potential. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the USDA Forest Service geologist will provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials will be tested and sources with high potential will be avoided. If ARD potential rock is disturbed, mitigation will include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Per Appendix B of the Watershed Resources Report (James 2012) and Table WTR-10, when past and reasonably foreseeable road construction is combined with road construction under Alternative 2, the Thorne Bay – Frontal Tolstoi Bay watershed and Deer Creek, Pin, Ratz Harbor, Salamander, Slide Creek, Thorne Bay, Thorne River Intertidal and Torrent subwatersheds exceed the 2.5 percent basin area in roads threshold and may result in moderate (though difficult to measure) impacts.

Conclusion

Alternative 2 would result in no effect, minor effects, or moderate effects relative to sedimentation and aquatic habitat, depending on the subwatershed. In general, effects would be localized, at the site or stream-reach level. Compared to the other action alternatives, Alternative 2 is similar to Alternative 4, with less effect on sedimentation and aquatic habitat than Alternative 3, but more effect than Alternative 5. Compared to Alternative 4, Alternative 2 would have more road-stream crossings (Class I, II, and III), resulting in greater effects relative to sedimentation and aquatic habitat than Alternative 4.

Alternative 3

Direct and Indirect Effects

Alternative 3 would result in minor effects on sedimentation and aquatic habitat, with moderate effects in some watersheds and subwatersheds. Alternative 3 would increase the percent basin area harvested since 1981 in the North Big Salt Lake and Tolstoi Bay – Frontal Clarence Strait watersheds and Luck Lake, North Big Salt Lake, and Thorne Bay subwatersheds above the 20 percent threshold (Table WTR-6). Streamflow may increase in these watersheds and subwatersheds, but the changes are not expected to result in measurable effects on sedimentation or aquatic habitat. Alternative 3 would not increase any other watershed or subwatershed percent basin harvested over the 20 percent in 30 years threshold.

Alternative 3 is not expected to result in any direct or indirect effects to the two PWS, Category 4a Thorne Bay impaired waterbody, Category 5 Salt Chuck Bay impaired waterbody, or the Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, Forest Service Salt Chuck Mine, and Forest Service Thorne Bay Landfill contaminated sites. Riparian no-harvest buffers along Class I, II, and III streams, as

described in the unit cards, and BMPs, as described in the road cards, would limit impacts from the planned activities on these water supplies, waterbodies, and contaminated sites.

Road construction and quarry development for the Big Thorne Project activities would utilize and excavate into the underlying Descon Shale. Any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas under Alternative 3 would be assessed for its ARD potential. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the USDA Forest Service geologist will provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials will be tested and sources with high potential will be avoided. If ARD potential rock is disturbed, mitigation will include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Alternative 3 would construct 56 miles of road (proposed new roads and new construction over decommissioned road grades) that have 12 Class I and II (91 Class III) road-stream crossings and reconstruct 39 miles of road that have 77 Class I and II (55 Class III) road-stream crossings. This would result in minor to moderate effects on sedimentation and aquatic habitat in all watersheds and subwatersheds. Moderate (though difficult to measure) effects on sedimentation and aquatic habitat may occur in the Thorne Bay – Frontal Tolstoi Bay watershed and Deer Creek, Pin, Ratz Harbor, Salamander, Slide Creek, Thorne River Intertidal, and Torrent subwatersheds, as they exceed the 2.5 percent basin area in roads threshold (Table WTR-7). Compared to other action alternatives, Alternative 3 would have the most effects on sedimentation and aquatic habitat.

Alternative 3 would have minor effects on the Forest Service nationally rated "functioning-at risk" Slide Creek – Frontal Clarence Strait watershed. The watershed will likely remain "functioning-at risk" due to high percentages of riparian areas being in young growth and the current density of roads and proximity to waterbodies. Harvest and road construction under Alternative 3 would not result in greater than 20 percent of the basin area harvested since 1981 or increase road density above the 2.5 percent basin area in roads threshold for this watershed. Implementation of riparian no-harvest buffers along Class I, II, and III streams, as described in the unit cards, BMPs, as described in the road cards, and decommissioning all temporary project roads would minimize direct and indirect effects on the Slide Creek – Frontal Clarence Strait watershed. However, while all new road construction will follow BMPs and Forest Plan Standards and Guidelines, there may be increased risk of sedimentation due to the presence of the road prism within the watershed.

Cumulative Effects

Watershed and subwatershed effects from past practices are described in the Affected Environment. Because present and reasonably foreseeable activities are consistently evaluated across all alternatives, Alternative 3 would result in the highest level of cumulative effects on sedimentation and aquatic habitat in all watersheds and subwatersheds.

Per Appendix A of the Watershed Resources Report (James 2012) and Table WTR-9, additional harvest of NEPA-cleared units and state lands will likely result in streamflow increases (based on percent basin area harvested) in the Goose Creek, North Big Salt Lake, Thorne Bay – Frontal Tolstoi Bay, and Tolstoi Bay – Frontal Clarence Strait watersheds and Goose Creek, Luck Lake, North Big Salt Lake, Pin, and Thorne Bay subwatersheds. Increased streamflow within these watersheds and subwatersheds may be moderate, but the changes are not expected to result in measurable impacts on sedimentation or aquatic habitat.

Because there are no direct or indirect effects to the two PWS, Category 4a Thorne Bay impaired waterbody, Category 5 Salt Chuck Bay impaired waterbody, or the Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, Forest Service Salt Chuck Mine, and Forest Service Thorne Bay Landfill contaminated sites, there are no cumulative effects.

During road construction, any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas under Alternative 3 would be assessed for its ARD potential. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the USDA Forest Service geologist will provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials will be tested and sources with high potential will be avoided. If ARD potential rock is disturbed, mitigation will include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Per Appendix B of the Watershed Resources Report (James 2012) and Table WTR-10, when past and reasonably foreseeable road construction is combined with road construction under Alternative 3, the Thorne Bay – Frontal Tolstoi Bay watershed and Deer Creek, Pin, Ratz Harbor, Salamander, Slide Creek, Thorne Bay, Thorne River Intertidal, and Torrent subwatersheds exceed the 2.5 percent basin area in roads threshold and may result in moderate (though difficult to measure) impacts.

Conclusion

Alternative 3 would result in no effect, minor effects, or moderate effects relative to sedimentation and aquatic habitat, depending on the subwatershed. In general, effects would be localized, at the site or stream-reach level. Compared to other alternatives, Alternative 3 has the largest effects relative to sedimentation and aquatic habitat.

Alternative 4

Direct and Indirect Effects

Alternative 4 would result in minor effects on sedimentation and aquatic habitat, with moderate effects in some watersheds and subwatersheds. Alternative 4 would increase the percent basin area harvested since 1981 in the North Big Salt Lake watershed and North Big Salt Lake and Thorne Bay subwatersheds above the 20 percent threshold (Table WTR-6). Streamflow may increase in these watershed and subwatersheds, but the

changes are not expected to result in measurable effects on sedimentation or aquatic habitat. Alternative 4 would not increase any other watershed or subwatershed percent basin harvested over the 20 percent in 30 years threshold.

Alternative 4 is not expected to result in any direct or indirect effects to the two PWS, Category 4a Thorne Bay impaired waterbody, Category 5 Salt Chuck Bay impaired waterbody, or the Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, Forest Service Salt Chuck Mine, and Forest Service Thorne Bay Landfill contaminated sites. Riparian no-harvest buffers along Class I, II, and III streams, as described in the unit cards, and BMPs, as described in the road cards, would limit impacts from the planned activities on these water supplies, waterbodies, and contaminated sites.

Road construction and quarry development for the Big Thorne Project activities would utilize and excavate into the underlying Descon Shale. Any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas under Alternative 4 would be assessed for its ARD potential. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the USDA Forest Service geologist will provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials will be tested and sources with high potential will be avoided. If ARD potential rock is disturbed, mitigation will include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Alternative 4 would construct 19.5 miles of road (proposed new roads and new construction over decommissioned road grades) that have 4 Class I and II (10 Class III) road-stream crossings and reconstruct 21.5 miles of road that have 33 Class I and II (24 Class III) road-stream crossings. This would result in minor to moderate effects on sedimentation and aquatic habitat in all watersheds and subwatersheds. Moderate (though difficult to measure) effects on sedimentation and aquatic habitat may occur in the Thorne Bay – Frontal Tolstoi Bay watershed and Deer Creek, Ratz Harbor, Slide Creek, Thorne River Intertidal, and Torrent subwatersheds, as they exceed the 2.5 percent basin area in roads threshold (Table WTR-7). Compared to other action alternatives, Alternative 4 would have effects similar to Alternative 2 on sedimentation and aquatic habitat.

Alternative 4 would have minor effects on the USDA Forest Service nationally rated “functioning-at risk” Slide Creek – Frontal Clarence Strait watershed. The watershed will likely remain “functioning-at risk” due to high percentages of riparian areas being in young growth and the current density of roads and proximity to waterbodies. Harvest and road construction under Alternative 4 would not result in greater than 20 percent of the basin area harvested since 1981 or increase road density above the 2.5 percent basin area in roads threshold for this watershed. Implementation of riparian no-harvest buffers along Class I, II, and III streams, as described in the unit cards, BMPs, as described in the road cards, and decommissioning all temporary project roads would minimize direct and indirect effects on the Slide Creek – Frontal Clarence Strait watershed. However, while all new road construction will follow BMPs and Forest Plan Standards and Guidelines,

there may be increased risk of sedimentation due to the presence of the road prism within the watershed.

Cumulative Effects

Watershed and subwatershed effects from past practices are described in the Affected Environment. Because present and reasonably foreseeable activities are consistently evaluated across all alternatives, Alternative 4 ranks third in cumulative effects on sedimentation and aquatic habitat in all watersheds and subwatersheds.

Per Appendix A of the Watershed Resources Report (James 2012) and Table WTR-9, additional harvest of NEPA-cleared units and state lands will likely result in streamflow increases (based on percent basin area harvested) in the North Big Salt Lake and Tolstoi Bay – Frontal Clarence Strait watersheds and the North Big Salt Lake, Pin, and Thorne Bay subwatersheds. Increased streamflow within these watersheds and subwatersheds may be moderate, but the changes are not expected to result in measurable impacts on sedimentation or aquatic habitat.

Because there are no direct or indirect effects to the two PWS, Category 4a Thorne Bay impaired waterbody, Category 5 Salt Chuck Bay impaired waterbody, or the Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, Forest Service Salt Chuck Mine, and Forest Service Thorne Bay Landfill contaminated sites, there are no cumulative effects.

During road construction, any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas under Alternative 4 would be assessed for its ARD potential. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the USDA Forest Service geologist will provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials will be tested and sources with high potential will be avoided. If ARD potential rock is disturbed, mitigation will include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Per Appendix B of the Watershed Resources Report (James 2012) and Table WTR-10, when past and reasonably foreseeable road construction is combined with road construction under Alternative 4, the Thorne Bay – Frontal Tolstoi Bay watershed and Deer Creek, Pin, Ratz Harbor, Salamander, Slide Creek, Thorne Bay, Thorne River Intertidal, and Torrent subwatersheds exceed the 2.5 percent basin area in roads threshold and may result in moderate (though difficult to measure) impacts.

Conclusion

Alternative 4 would result in no effect, minor effects, or moderate effects on sedimentation and aquatic habitat, depending on the subwatershed. In general, effects would be localized, at the site or stream-reach level. Compared to other action alternatives, Alternative 4 is similar to Alternative 2, with less effect relative to

sedimentation and aquatic habitat than Alternative 3, but more effect than Alternative 5. Compared to Alternative 2, Alternative 4 would have fewer road-stream crossings (Class I, II, and III), resulting in less effects relative to sedimentation and aquatic habitat than Alternative 2.

Alternative 5

Alternative 5 was developed to specifically respond to Issue 4, by reducing the effects on sedimentation and aquatic habitat beyond what is required under the Forest Plan while maintaining an economically viable timber sale that would meet the purpose and need of the project. This alternative would construct the least amount of roads, substantially less road miles than Alternatives 2 or 3, and have the fewest road-stream crossings (Class I, II, and III) of all the alternatives. In addition, specific units were removed, while other units were changed to helicopter in areas where there were concerns from past harvest and/or high percentage of the basin in roads.

Direct and Indirect Effects

Alternative 5 would result in minor effects on sedimentation and aquatic habitat, with moderate effects in some watersheds and subwatersheds. Alternative 5 would increase the percent basin area harvested since 1981 in the North Big Salt Lake watershed and North Big Salt Lake and Thorne Bay subwatersheds above the 20 percent threshold (Table WTR-6). Streamflow may increase in these watershed and subwatersheds, but the changes are not expected to result in measurable effects on sedimentation or aquatic habitat. Alternative 5 would not increase any other watershed or subwatershed percent basin harvested over the 20 percent in 30 years threshold.

Alternative 5 is not expected to result in any direct or indirect effects to the two PWS, Category 4a Thorne Bay impaired waterbody, Category 5 Salt Chuck Bay impaired waterbody, or the Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, Forest Service Salt Chuck Mine, and Forest Service Thorne Bay Landfill contaminated sites. Riparian no-harvest buffers along Class I, II, and III streams, as described in the unit cards, and BMPs, as described in the road cards, would limit impacts from the planned activities on these water supplies, waterbodies, and contaminated sites.

Road construction and quarry development for the Big Thorne Project activities would utilize and excavate into the underlying Descon Shale. Any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas under Alternative 5 would be assessed for its ARD potential. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the Forest Service geologist will provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials will be tested and sources with high potential will be avoided. If ARD potential rock is disturbed, mitigation will include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Alternative 5 would construct 15.5 miles of road (proposed new roads and new construction over decommissioned road grades) that have only 1 Class II (6 Class III) road-stream crossings and reconstruct 15.6 miles of road that have 31 Class I and II (20

Class III) road-stream crossings. This would result in minor to moderate effects on sedimentation and aquatic habitat in all watersheds and subwatersheds. Moderate (though difficult to measure) effects on sedimentation and aquatic habitat may occur in the Thorne Bay – Frontal Tolstoi Bay watershed and Deer Creek, Thorne River Intertidal, and Torrent subwatersheds, as they exceed the 2.5 percent basin area in roads threshold (Table WTR-7). Compared to other action alternatives, Alternative 5 would have the least effects on sedimentation and aquatic habitat.

Alternative 5 would have minor effects on the Forest Service nationally rated "functioning-at risk" Slide Creek – Frontal Clarence Strait watershed. The watershed will likely remain "functioning-at risk" due to high percentages of riparian areas being in young growth and the current density of roads and proximity to waterbodies. Harvest and road construction under Alternative 5 would not result in greater than 20 percent of the basin area harvested since 1981 or increase road density above the 2.5 percent basin area in roads threshold for this watershed. Implementation of riparian no-harvest buffers along Class I, II, and III streams, as described in the unit cards, BMPs, as described in the road cards, and decommissioning all temporary project roads would minimize direct and indirect effects on the Slide Creek – Frontal Clarence Strait watershed. However, while all new road construction will follow BMPs and Forest Plan Standards and Guidelines, there may be increased risk of sedimentation due to the presence of the road prism within the watershed.

Cumulative Effects

Watershed and subwatershed effects from past practices are described in the Affected Environment. Because present and reasonably foreseeable activities are consistently evaluated across all alternatives, Alternative 5 would result in the least cumulative effects on sedimentation and aquatic habitat in all watersheds and subwatersheds.

Per Appendix A of the Watershed Resources Report (James 2012) and Table WTR-9, additional harvest of NEPA-cleared units and state lands will likely result in streamflow increases (based on percent basin area harvested) in the North Big Salt Lake and Tolstoi Bay – Frontal Clarence Strait watersheds and the North Big Salt Lake, Pin, and Thorne Bay subwatersheds. Increased streamflow within these watersheds and subwatersheds may be moderate, but the changes are not expected to result in measurable impacts on sedimentation or aquatic habitat.

Because there are no direct or indirect effects to the two PWS, Category 4a Thorne Bay impaired waterbody, Category 5 Salt Chuck Bay impaired waterbody, or the Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, Forest Service Salt Chuck Mine, and Forest Service Thorne Bay Landfill contaminated sites, there are no cumulative effects.

During road construction, any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas under Alternative 5 would be assessed for its ARD potential. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be

mineralized, the Forest Service geologist will provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials will be tested and sources with high potential will be avoided. If ARD potential rock is disturbed, mitigation will include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Per Appendix B of the Watershed Resources Report (James 2012) and Table WTR-10, when past and reasonably foreseeable road construction is combined with road construction under Alternative 5, the Thorne Bay – Frontal Tolstoi Bay watershed and the Deer Creek, Pin, Ratz harbor, Salamander, Slide Creek, Thorne Bay, Thorne River Intertidal, and Torrent subwatersheds would exceed the 2.5 percent basin area in roads threshold and may result in moderate (though difficult to measure) impacts.

Conclusion

Alternative 5 would result in no effect, minor effects, or moderate effects relative to sedimentation and aquatic habitat, depending on the subwatershed. In general, effects would be localized, at the site or stream-reach level. Compared to all other action alternatives, Alternative 5 has the least road construction and road-stream crossings (Class I, II, and III), resulting in the least effects relative to sedimentation and aquatic habitat of all alternatives.

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Other Resource Considerations

PHYSICAL ENVIRONMENT

Karst

Introduction

Karst is a comprehensive term that applies to the unique topography, surface and subsurface drainage systems, and landforms that develop by the action of water on soluble rock (primarily limestone and marble (carbonates)) in Southeast Alaska. The dissolution of the rock results in the development of internal drainage, producing sinking streams (streams that sink into the stream bed or karst features), closed depressions, sinkholes, collapsed channels, micro-relief karst features, and caves.

The geology and climate of Southeast Alaska are particularly favorable for karst development. Extensive areas of very pure carbonate (>95 percent $CaCO_3$) (Maas et al. 1992), approximately 537,588 acres (840 square miles), are found within the boundaries of the Tongass National Forest. This includes carbonate bedrock on private, State, and Federal lands. Because of fractures in the carbonates, high annual precipitation, and peatlands adjacent to the carbonate bedrock, karst has developed, to varying extent, within all carbonate blocks. The Tongass National Forest contains the largest known concentration of limestone dissolution caves in Alaska.

Affected Environment

In Southeast Alaska the karst landscape can be characterized as an ecological unit found on top of carbonate bedrock in which karst features and drainage systems have developed as a result of differential solution by surface and groundwater. These acidic waters are a direct product of abundant precipitation and passage of these waters through the organic-rich forest soil and the adjacent peat lands. Recharge areas may be on carbonate or adjacent non-carbonate substrate. A few characteristics of this ecological unit include: mature, well-developed spruce and hemlock forests along valley floors and lower slopes, increased productivity for plant and animal communities, extremely productive aquatic communities, well-developed subsurface drainage, and the underlying unique cave resources (Baichtal and Swanston 1996; Wissmar et al. 1997; Bryant et al. 1998). Approximately 1 percent of the Big Thorne project area is underlain by limestone or marble containing karst development. These outcrops comprise the limestone associated with the Luck Creek Breccia, the Heceta Limestone, or the Wadleigh Limestone. Some of these limestones are re-crystallized to marble. Karst landforms and drainage systems have developed within the recrystallized limestone outcrops to varying extent. Karst areas exist mainly in the vicinity of Baird Peak and Control Lake.

The overall amount of karst development located within the project area is very small. The Big Thorne project area is predominantly underlain by Ordovician to Silurian aged andesitic breccias, andesitic and basaltic lavas and graywacke turbidites, conglomerate, sandstone, chert, and shale that have been intruded in the east by Permian diorite (Figure KST-1). These rocks generally outcrop as dark-gray, greenish-gray, to black blocky, weather-resistant topographic highs and cliffs. Minor recrystallized limestone reefs are scattered throughout the volcanic breccias and flows. Younger, Tertiary sandstones and volcanic rocks are found as small exposures along Lava Creek and the Thorne River in the southeastern portion of the project area. Permian diorite has intruded these rocks to the eastern portion of the project area.

The andesitic breccias, andesitic and basaltic lavas and graywacke turbidites, conglomerate, sandstone, chert, and shale outcrops resisted the scouring efforts of the past glaciation and form the highlands in the eastern two-thirds of the project area. Of these, the conglomerates, sandstones, and shale locally weather to form soil. The carbonaceous shale and thin-bedded cherts weather to form fine, silty soil and are prone to erosion and mass wasting. The volcanic rocks are weather resistant and contribute little soil development. The breccias and conglomerates are well indurated and weather much like the volcanic flow rock. Beneath cliffs of these materials are colluvial deposits. Here these rock types weather to form course-grained complexes with fine-grained interstitial soils. Locally metamorphosed volcanic and sedimentary rocks adjacent to the intrusion weather rapidly and are prone to erosion and mass wasting. In places, the diorite weathers to a granular soil and clays prone to erosion and mass wasting.

Karst Vulnerability

Karst lands present land management challenges not encountered in non-karst areas because this three-dimensional landform functions differently than other landforms. Karst resources must be evaluated according to their vulnerability to land uses affecting karst systems. Vulnerability mapping recognizes that some parts of the karst landscape are more sensitive than others to surface activities and groundwater contamination. These differences in vulnerability may be a function of the extent of karst development, the openness of the karst systems, and the sensitivity of other resources that benefit from karst groundwater systems (USDA Forest Service 2008).

Low Vulnerability Karst Lands

Low vulnerability karst lands are those areas where resource damage threats associated with land management activities in the areas are not likely to be appreciably greater than those posed by similar activities on non-carbonate substrate.

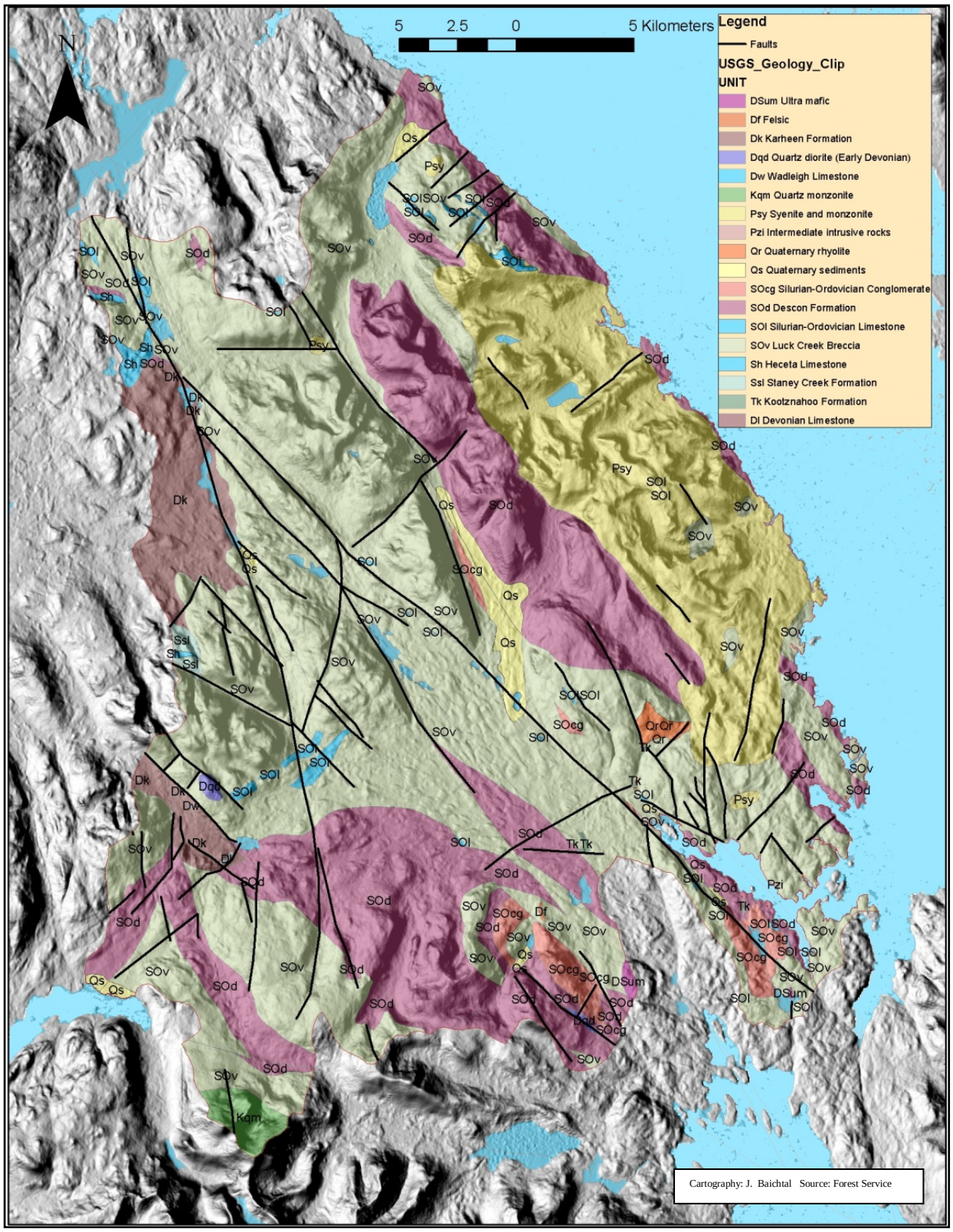

Figure KST-1. Geologic Map of the Big Thorne Project Area

A generalized characterization of these lands would be that they are underlain by carbonate bedrock that is moderately well to well drained, most commonly internally drained, but surface streams may be present. Generally, these areas have been greatly modified by glaciation, and a deep (greater than 40 inches deep) covering of glacial till or mineral soil, and little or no epikarst (the upper/outer layer of karst rock in the unsaturated zone, immediately below the soil layer) showing at the surface. The epikarst may be buried and/or ground off, depending on the intensity of glaciation. These lands pose little or no threat to organic, sediment, debris, or pollutant introduction into the karst hydrologic systems beneath through diffuse recharge. Often these are areas of little or no slope (less than 20 percent).

Moderate Vulnerability Karst Lands

The moderate vulnerability karst lands are those areas where resource damage threats associated with land management activities in the areas are appreciably greater than those posed by similar activities on low vulnerability karst lands.

A generalized characterization of these areas would be areas underlain by carbonate bedrock that are well drained internally. Surface streams are rare. The soils of moderate vulnerability areas are a mosaic of shallow organic (20 to 40 percent, McGilvery soils) and mineral (80 to 60 percent, Sarkar [less than 20-inch depth] and Ulloa [greater than 20-inch depth] soils) with minor amounts of glacial till. The epikarst is moderate- to well-developed and is visible at the surface. These areas tend to be at higher elevations (i.e., greater than 500 feet, and on knobs, ridges, and on the dip-slope of carbonate bedding planes when near the surface). The surface of these areas tends to be irregular and undulating, following the epikarst development, which is the result of solution of the bedrock surface rather than solution and/or collapse features such as sinkholes.

High Vulnerability Karst Lands

The high vulnerability karst lands are those areas where resource damage threats associated with land management activities are appreciably greater than those posed by similar activities on low or moderate vulnerability karst lands. These are the areas contributing to or overlying significant caves and areas containing a high density of karst features.

These are areas underlain by carbonate bedrock that are well drained internally. Surface streams are rare. Karst systems and epikarst are extremely well-developed and collapse karst features may be numerous. These include all collapse karst features, caves, sinking or losing streams, insurgences, open resurgences, and open grikelands (i.e., those without soil or moss infilling and with open connections to the subsurface). The highest vulnerability features are those that could produce and transport the greatest amount of sediment, debris, and/or organics if disturbed. These include till-lined sinkholes and cave entrances accepting a sinking stream, whether intermittent or not. Also considered high vulnerability are karst lands in which the epikarst is well- or extremely well-developed and the soils are predominantly (greater than 50 percent) very shallow organic (less than 10 inches deep, McGilvery) and (less than 50 percent) mineral (less than 20 inches deep, Sarkar). The subsurface drainage network is highly vulnerable to sediment, organic matter, logging debris, and other pollutants generated as the result of surface activities.

On areas labeled as high or moderate vulnerability there are features that require buffering under Forest Plan standards and guidelines. These buffers are drawn as the 100-foot radius buffer. However, these buffers may need to be designed and laid out with a karst specialist during unit layout to account for factors such as aspect, slope, windthrow potential, soils, etc., so that buffers may be modified to respond to these conditions.

Existing Condition

Approximately 8 percent or 245 acres of carbonate bedrock in the Big Thorne project area has been harvested historically. Where karst systems have developed adjacent and beneath harvested areas, it is possible that sedimentation and slash from prior harvest washed into karst features, altering the ecology of the karst system through affecting the water chemistry and flow paths (Aley et al. 1993). It is also possible that in areas that have already been harvested, thickly regenerated forests are causing increased interception rates resulting in less water moving through the karst systems. Without the natural flow rates through the system, slash and debris will remain instead of being washed out. In addition, decreased water flow downstream from these karst areas results in a reduction of fish habitat where karst streams contribute to fish streams (Bryant et al. 1998). High and moderate vulnerability karst are most susceptible to these effects, as outlined in the prior section.

Environmental Consequences

Alternative 1 – No Action

The No-action Alternative is just as stated. If this alternative is chosen, no harvest would occur within the project area under the Big Thorne project. No other projects are currently planned to occur on karstlands.

Direct and Indirect Effects

There would be no direct or indirect effects on the karst resource by not harvesting in the Big Thorne project area.

Cumulative Effects

Effects from past harvest and natural processes in the Big Thorne project area such as sedimentation and erosion would experience no beneficial or adverse change, but would continue at the present rate.

Table KST-1. Changes to Total Harvest on Karst for the Big Thorne Project Area

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Acres of Previous Harvest on Karst	245	245	245	245	245
Percent Karst Acres Harvested Historically[a]	8%	8%	8%	8%	8%
Acres of Proposed Harvest on Low Vulnerability Karst	0	0	11.2	11.2	11.2
Acres of Proposed Harvest on Moderate and High Vulnerability Karst	0	0	0	0	0
Acres Thinning in Previous Harvest on Karst	0	8.7	8.7	8.7	8.7
Total Acres Proposed Harvest and Thinning on Karst	0	8.7	19.9	19.9	19.9
Total Acres Harvest on Karst	245	245	256	256	256
Percent Change	0%	0%	0.5%	0.5%	0.5%

Table based on data from the Tongass geology layer and the Big Thorne unit layer - data current September 20, 2011.

Alternatives 2, 3, 4, and 5

Harvest on Karst

Total harvest on karst acreages per alternative are shown in Table KST-1. Under no alternative is there greater than a 0.5 percent change in the percent harvest on karst relative to the existing condition of the karst resource of the project area. High vulnerability karst areas have been removed from proposed harvest units, as described in the unit cards (Appendix B). Specific harvest requirements for units containing moderate and low vulnerability karst are outlined in the unit cards. Harvest prescriptions are discussed alternative by alternative under the specific unit addressed in the mitigation and monitoring section.

Roads on Karst

There are no proposed roads on karst areas in the Big Thorne project. Road building on high vulnerability karst would be avoided under all alternatives. Specific requirements concerning road building on moderate vulnerability and high vulnerability karst are located in the Forest Plan (Appendix H, section III.A.4.b.ii).

Direct and Indirect Effects for all Action Alternatives

The lowest acreage of karst proposed for harvest is Alternative 2 with no harvest or thinning on karst. Alternatives 3, 4, and 5 would conduct 11.2 acres of new harvest on low vulnerability karst (Table KST-1) and 8.7 acres of thinning on karstlands that were previously harvested. The effects are expected to be minor with all alternatives because of removing high vulnerability karst areas from proposed harvest units and protecting soil and water quality in low vulnerability areas by specifying suspension requirements in the unit cards. Effects could include initial increase in flow through karst systems after initial harvest in low and moderate vulnerability karst areas and subsequent (approximately 5 years post-harvest) decrease to flow through these karst systems due to dense forest regeneration (Aley et al. 1993). Increase to turbidity and changes in water chemistry through the karst system could also occur due to these changes in flow (Aley et al. 1993). Also see Baichtal and Swanston (1996) and Baichtal (1997) for more detailed descriptions of effects.

The standards and guidelines of the amended Forest Plan are based on these studied and documented direct, indirect, and cumulative effects. The Karst Standards and Guidelines

are applied in this project to mitigate the direct, indirect, and cumulative effects to the karst resource of the Big Thorne project area. Detailed site by site mitigation is prescribed, where necessary, in the unit and road cards (Appendices B and C).

Cumulative Effects

Alaska Forest Highway 33 (the Coffman Cove Road) was paved during the summer of 2011 in the project area. This road construction did not significantly affect karst in the project area, or in affected watersheds in the project area.

Cumulative effects from harvesting additional karst areas in the project area would not be significant since the karst standards and guidelines will be applied as described in the unit cards (Appendix B), roads cards (Appendix C), and in the "Mitigation" section.

Mitigation for Alternatives 2, 3, 4, and 5

Portions of a number of the original units were identified as high vulnerability karst. As a result, these areas were deleted from the units or the units were dropped. No special prescription is required for areas on low vulnerability karst.

3 Environment and Effects

Soils

Introduction

This section provides a summary of the soil resources in the Big Thorne project area. Forest-wide standards and guidelines for this resource are on pages 4-64 through 4-67 of the Forest Plan. The analysis and results presented in the environmental consequences section are based upon proposed harvest unit boundaries and the overall project area boundary. The analysis for the soils resource uses both temporary and NFS road information. Detailed discussion of the soil and wetlands of the Big Thorne project area can be found in the Soil and Wetland Resources Report (Cox et al. 2012) in the Big Thorne project record.

Timber harvest can adversely affect the soils resource by:

- Disturbing, displacing, or burying the nutrient-rich forest floor and exposing mineral soils to erosion, and
- Increasing the frequency of landslides which also displace nutrient rich soils and increase erosion potential.

Resource Analysis Area

The boundary selected for the following analysis of soils is the same as the Big Thorne project area. The project area is about 231,848 acres, including 217,679 acres of NFS lands and 14,169 acres of state and private lands. Soil types and physical properties are described for the project area.

The analysis area for direct, indirect and cumulative effects to soils includes the “activity area” (FSM 2554). For this project, the “activity area” includes individual proposed timber harvest units and associated land impacted by temporary road construction. The Forest Service Manual limits the amount of detrimental (long-term) soil disturbance to “activity areas. FSM 2554 requires that a minimum of 85 percent of an area remain in a condition of acceptable productivity potential for trees and other managed vegetation.

The direct and indirect effects of the Big Thorne Project to the soil resource include landslides and other long-term (detrimental) soil disturbance that are a result of temporary road construction and harvest activities. The unit of measure for the soil analysis is acres of detrimental soil disturbance due to temporary road construction, yarding activities, and management related landslides. The temporal extent of effects to soil is decades or longer due to the length of time it takes for soils to recover and regenerate vegetative cover after clearing.

Detailed discussion of the soil resource and analysis methods can be found in the Soil and Wetland Resources Report (Cox et al. 2012) in the Big Thorne project record.

Affected Environment

The project area is located within the Central Prince of Wales Volcanics and the Till Lowlands ecological subsections (USDA Forest Service 2001a). Within the volcanic mountain ecological subsection, most rock outcrops are volcanic rocks; glacial tills soils

are common at low elevations (USDA Forest Service 2001a). Within the Central Prince of Wales Till Lowlands, organic soils overlay glacial till (USDA Forest Service 2001a).

Project area soils range from very poorly drained to well drained soils. Very poorly drained soils (36 percent) are mostly organic and typically have low productivity and support muskeg vegetation. Other soils in the project area include poorly drained (10 percent), moderately well drained (20 percent), and well drained (32 percent); the remaining 2 percent of the project area is mapped as fresh or salt water or small islands. Moderately well and well drained soils typically support productive forests. Most soils in the project area have a thick organic or duff layer that prevents erosion of the underlying mineral soil from raindrop impact and supplies many nutrients for plant growth. Keeping the organic mat in place during management activities is a key to maintaining soil productivity. Windthrow is the dominant disturbance factor on slopes exposed to southern aspects. Landslides are the dominant disturbance factor on steep wind-protected slopes. Gently sloping lowlands are present along the valley bottoms and support wetland vegetation.

The soils on the Big Thorne project area are mostly in natural condition. Past management activities on NFS and non-NFS lands include about 49,546 acres of timber harvest, resulting in about 1,486 acres of detrimental soil disturbance. In addition, 618 miles of road construction (includes past temporary, NFS, state, decommissioned, and private and local) and associated rock quarry development have occurred within the project area. Existing soil disturbances (natural and management related) on the Big Thorne project area are summarized in Table SOIL-1.

Management activities have caused past soil disturbances. Existing management-related detrimental soil disturbance is estimated to be about 3,081 acres or 1.3 percent of the project area. These past disturbances are considered to be minor and currently have minimal erosion concerns. In the Big Thorne project area, natural and management-related soil disturbances are within parameters found in Region 10 Soil Quality Standards at the project area scale. The following sections describe the natural and management-induced soil disturbances in detail.

Natural Disturbances

Natural soil disturbances on the project area include areas such as erosion from overland flow, stream bank erosion, windthrow, and colluvial activity. These natural soil disturbances, excluding natural landslides which are discussed below, are estimated to occur over about 2,402 acres in the project area.

Table SOIL-1. Existing Soil Disturbance in Big Thorne Project Area

Soil Disturbance	Acres Affected	Project Area (%)
Management Related Soil Disturbances		
Past log yarding activities[1/]	1,486	0.6%
Existing acres of temporary road (1 mile)	5	0.002%
Existing acres of NFS and state road (454 miles)	2,201	0.9%
Existing acres of FS decommissioned (system and temp) (119 miles)	577	0.2%
Existing acres of other roads[2/] (44 miles)	213	0.1%
Existing rock quarries[3/]	564	0.2%
Landslides from past harvest[4/] (241)	393	0.2%
Landslides from road construction (61)	56	0.02%
Total Soil Disturbances from Management	5,495	2.4%
Total Detrimental Soil Disturbances from Management[5/]	3,081	1.3%
Natural Soil Disturbances		
Naturally Occurring Disturbances		
Naturally occurring landslides (676)	3,150	1.4%
Natural soil disturbances [6/]	2,402	1.0%
Total Natural Soil Disturbances	5,552	2.4%
Total Existing Soil Disturbance	11,047	4.8%

Notes:
1/ 3% of harvest areas (Landwehr and Nowacki 1999)
2/ Other roads include “Private”, “Unknown”, and “Local”.
3/ Assumes 1 acre of disturbance from quarry development for every mile of road
4/ These were defined as any landslide where the initiation point of the landslide (or the highest elevation point) fell within a harvest unit (Landwehr 1998 and 2011, Saari 2009)
5/ Does not include NFS, state, or other roads
6/ Defined as 2% of moderately and well drained soils within the project area (Saari 2011, Landwehr and Nowaki 1999). Calculation included primary and secondary drainage classes for each SMU.

The project area is exposed to high wind events that lead to windthrow. Numerous areas have experienced windthrow and are at risk for future events. Windthrow may also lead to landslide activity on shallow soils present on steep forested slopes (Swanston 1967). However, windthrow may play an important role in the soil disturbance and nutrient cycling regime of some soils on the project area. Nutrients tend to accumulate and become immobilized in organic and upper layers of the soil which can lead to nutrient deficiency in areas where minimal windthrow disturbance or other soil disturbance mechanisms are present (Bormann et al. 1995). Windthrow can provide mixing and aeration of the organic and mineral soil horizons, freeing nutrients to be used by plants, thus increasing soil productivity. Conversely, Stephens et al. (1968) found that stands regenerated from windthrow had a site index that was about 20 feet less than in stands originating following clearcutting or fires.

Natural and Management-related Landslides

Landslides (mass wasting) are the dominant erosion process in steep forested terrain with high soil water levels in Southeast Alaska (Swanston 1969). Topographic, geologic, and soil conditions in combination with high amounts of rainfall are the major contributing factors. The soil mass movement index is a tool used to assess slope stability at the project scale. Mass movement index (MMI) hazard classes are used to group soil map units that

have similar properties relative to the stability of natural slopes. Four categories of MMI soil hazard classes exist: MMI 1 (most stable) through MMI 4 (least stable). Soils with a very high mass movement index (MMI 4) have the greatest probability for slope failure.

A landslide inventory was completed for the project area using aerial photography and field observations. Each landslide was associated with the MMI class where it was initiated as shown in Table SOIL-2. Table SOIL-2 indicates that 978 landslides have disturbed about 3,597 acres across the project area. Most of these slides initiated in MMI 3 and 4 (50 percent and 31 percent, respectively).

Table SOIL-2. Total Mapped Landslides within the Big Thorne Project Area

Mass Movement Index Class	Acres of MMI Class	Number of Landslides	Approx. Acres of Landslides
Initiated in MMI 1	101,245	147	1,260
Initiated in MMI 2	20,022	32	37
Initiated in MMI 3	85,913	491	745
Initiated in MMI 4	20,223	308	1,555
Other[1]	4,446	--	--
Total	**231,848[2]**	**978**	**3,597**

1/ Project area also includes 4,446 acres of water and other minor areas with no MMI mapping.
2/ Sum of MMI class acres results in 231,849 due to rounding, but project area is 231,848 acres.

Landslides occurring within the Big Thorne project area over the last 40[1] years were assessed to compare landslides occurring in unharvested areas and landslides due to management practices as shown in Table SOIL-3. During this 40-year period, 209 natural landslides occurred in productive old growth (POG), disturbing about 194 acres of soil, and averaging less than 1 acre in size. In this same 40-year time period, 200 landslides occurred within previously harvested areas disturbing about 276 acres of soils, an**d** averaging about 1.4 acres in size. The majority of all landslides initiated in MMI 3 and MMI 4 soils and these classes had a much higher rate of landslide initiation per unit area. Also, note that most landslides indicated by GIS as having initiated in MMI 1, actually initiated just outside of MMI 1 polygons in higher risk areas, or represent minor GIS mapping errors in the mass movement index layer.

Table SOIL-3. Landslides in Harvested Areas and Non-Harvested POG during the Past 40 Years (1971-2010)

Category	Total Acres	Number of Landslides	Approx. Acres of Landslides
Natural Landslides			
Landslides in Unharvested POG	98,787	209	194
Management-related Landslides			
Harvest Areas	45,346	200	276
Roads (564 miles of NFS, temp., and private)		55	48
Forty-Year Totals		**464**	**518**

Note: Does not include landslides outside of productive old growth.

[1]Based on dates in GIS landslide inventory, not including pre-1971.

When the Big Thorne project area landslide inventory data are compared on a landslide per acre basis, the data indicate that landslides in harvested areas (200 landslides in 45,346 acres of harvest areas) are approximately 2.1 times more likely to occur than landslides in POG areas (209 landslides per 98,787 acres of POG). The increased occurrence of landslides in harvested areas may be attributed to management practices. Decreased rainfall interception may result in increased soil water content and pore pressure; removal of the protective organic mat exposes soil to erosion; and soil stability decreases as roots decay in the years following harvest. In comparison, other studies have shown that clearcut timber harvests resulted in 3 to 10 times more landslides than uncut areas (Swanston and Marion 1991; Bishop and Stevens 1964; Landwehr 1994,1998).

A total of 55 road-related landslides have been recorded during this same 40-year period and have affected about 48 acres, averaging about 0.9 acre per landslide (Table SOIL-3). Road-related landslides are generally the result of ditches concentrating water and delivering it to a naturally unstable area of the slope or by excessive road fill weight on a naturally unstable slope (Landwehr 1999).

Management-related Disturbances

Past Harvest Activities

Soil disturbances associated with past harvest activities have typically been the result of road construction and log yarding. Total past harvest in the project area is approximately 48,903 acres. Harvest entries prior to 1980 accounted for about 28,408 acres. Harvest entries in the 1960s accounted for about 18,538 acres, or 38 percent of all harvest. Since the late 1970s yarding methods used suspension techniques that provided partial suspension of logs and full suspension in some cases. These yarding techniques greatly minimized potential for soil disturbances when compared to non-suspension techniques. Soil disturbances from past yarding activities in the project area are estimated to total about 1,467 acres. The estimated acres of disturbed soil associated with past harvest assumes a 3 percent disturbance of all harvest areas based on soil disturbance monitoring data summarized by Landwehr and Nowacki (1999).

Road Construction

Soil disturbances associated with road construction (includes NFS and state, temporary, and private roads) cover about 2,734 acres from about 564 miles of road in the project area (based on a 40-foot-wide disturbed soil corridor); however, disturbance associated with NFS, State, and other (i.e., private and local roads) do not count towards detrimental soil disturbance. Soil disturbances from road construction involve removing the nutrient-rich organic layer to shape cutslopes and burying some areas of productive soil under shot rock. Overlay road construction has been commonly used on nearly level or gently sloping poorly drained soils in wetland areas. Overlay road construction does not impact as large an area of soil as cut-and-fill road construction.

Additionally, numerous rock quarries were developed to build these roads. In rock quarries, soils are removed to expose the bedrock and are stacked adjacent to the quarry burying other productive soils. Assuming 1 acre of disturbance from quarry development for every mile of road, past development of rock quarries has resulted in about 564 acres of detrimental soil disturbance.

As noted above, 55 road-related landslides have been recorded during a 40-year period and have affected about 48 acres, averaging about 0.9 acre per landslide.

Harvests on Slopes Greater Than 72 Percent

Past harvest activities have avoided most slopes greater than 72 percent gradient. The digital elevation model for the project area when overlain with the managed stands layer indicates approximately 965 acres (2 percent of harvested areas in the project area) of slopes greater than 72 percent gradient have been harvested. The percent acres harvested on slopes greater than 72 percent was greater than 3 percent in 3 out of 21 subwatersheds: Karta River, Ratz Creek, and Rio Beaver Creek. Of these, management-related landslides have occurred in the Ratz Creek and Rio Beaver Creek subwatersheds. There were approximately 643 acres of landslides (management and natural) in the Ratz Creek subwatershed, of which 212 acres were on slopes greater than 72 percent. There were 199 acres of landslides in the Rio Beaver Creek subwatershed, of which 56 acres were on slopes greater than 72 percent. Most landslide activity resulting from harvesting and roads occurred before current Forest Plan standards and guidelines were implemented. Therefore, past effects are likely to be greater than those that have occurred following more recent timber harvests using modern BMPs and those that would occur under future harvests.

Environmental Consequences

Direct and Indirect Effects

Data used for soil analysis come from existing resources such as the Soil Resource Inventory, the landslide inventory, the digital elevation model, and field data collected through on-site surveys conducted in support of this project. Road acres are based on an average road width of 40 feet (from top of cutslope to toe of fillslope). Effects are compared between the alternatives based on the following measurements and estimates:

- Acres of detrimental soil conditions in harvest units due to temporary road construction and yarding activities,
- Acres of proposed timber harvest on slopes 72 percent or greater,
- Acres of road (existing and proposed NFS and temporary) on slopes 67 percent or greater,
- Acres of future landslides acres as a result of management activities based on the project area landslide inventory, and
- Cumulative acres of soil removed from productivity by roads, detrimental soil conditions within harvest units, and landslides.

Soil Productivity

Region 10 Soil Quality Standards state that a minimum of 85 percent of an area should be left in a condition of acceptable productivity potential for trees and other managed vegetation following land-management activities. Detrimental soil conditions are defined in FSM 2554. Detrimental soil areas are areas of soil that have been altered to the point where soil productivity has been affected. Detrimental soil conditions are typically

associated with road construction, log felling, and log yarding. Soil disturbances associated with NFS road construction are not counted toward detrimental soil condition because system roads are removed from the productive land base. Temporary roads are considered part of the land base and are included in the calculation of detrimental soil conditions.

Detrimental soil conditions are calculated for two areas – the activity area, which includes the harvest units and associated temporary roads, and the overall project area. Detrimental soil conditions incurred by proposed harvest activities such as tree felling and yarding include soil displacements, a loss of ground cover, compaction, and soil puddling. This analysis of detrimental soil conditions in harvest units is based on soil quality monitoring data collected on the Tongass as reported by Landwehr and Nowacki (1999). This analysis assumes 3 percent detrimental soil condition for areas where partial suspension or shovel yarding is proposed and 2 percent detrimental soil condition where full suspension is proposed. Table SOIL-4 displays the estimated acres of detrimental soil conditions resulting from the implementation of the alternatives.

Table SOIL-4. Estimated Acres of Detrimental Soil Conditions from Implementation of the Alternatives

Category	Alt. 1 No Action	Alt. 2 Proposed Action	Alt. 3	Alt. 4	Alt. 5
New proposed temporary road construction (acres)[1/]	0	93	126	44	37
Rock quarry development for new road construction (acres)[2/]	0	35	56	19	16
Yarding disturbances in Harvest Units (acres)[3/]	0	129	254	166	180
New management-related landslides (next 30 years)[4/]	0	26	51	34	38
Total acres of new detrimental soil condition[5/]	**0**	**283**	**487**	**255**	**271**

Notes:
1/ New road construction is based upon 40-foot road base.
2/ A 2-acre rock quarry has been estimated for every 2 miles of road construction
3/ Yarding disturbances based on an estimate of 3% of the harvest area where partial suspension or shovel yarding is proposed and 2% where full suspension is proposed; excludes temporary roads
4/ Landslide acre estimate based on past landslide inventory projected for 30 years into the future
5/ Detrimental soils conditions based on proposed timber harvest acres and do not include deferral acres

Table SOIL-4 data indicate that Alternative 3 would result in the greatest impact to soil productivity. Of the action alternatives, implementation of Alternative 4 would result in the least amount of detrimental soil conditions; however, the results are similar for Alternatives 2 and 5. A detailed analysis of estimated soil disturbance for each proposed harvest unit has been conducted and is included in the Big Thorne project record. The evaluation of detrimental soils disturbance from proposed roads, rock quarries, and harvest indicate that every alternative will meet Region 10 Soil Quality Standards for soil productivity on a project area scale. When the evaluation includes existing detrimental soil disturbance, including previous management-related landslides, harvest, and decommissioned roads, available data indicate that all but three units meet the Region 10 Soil Quality Standards. In Alternative 3, Units 508, 555, and 575 include enough acres of

detrimental soil disturbance due to existing temporary or decommissioned roads or management related landslides in previously harvested areas to exceed the 85 percent standard. Alternatives 4 and 5 also include Units 508 and 575 as exceeding the standard due to management-related landslides in previously harvested areas. Alternative 2 meets the standard in all units, as this alternative does not include young-growth thinning units.

Further analysis of units that may not meet the Region 10 Soil Quality Standard is being conducted to better define the existing conditions. Following further evaluation, these units would be modified or removed from the sale if necessary, to ensure the Region 10 Soil Quality Standard would be met.

Harvest on Slopes Greater than 72 Percent

All proposed old-growth harvest units with slopes exceeding 50 percent were field reviewed for slope stability. Field verification of young-growth stands will occur prior to project implementation. Some areas will likely be dropped from young-growth units following field verification. Boundaries are modified on areas with concerns about slope stability and impacts to soil productivity following harvest. Landslide-prone slopes are removed from harvest consideration to protect soil resources and prevent potential degradation of downslope resources. Slopes greater than 72 percent are identified within units in the project area, and excluded from harvest if unstable. In total, across the project area, approximately 1,996 acres were deemed unstable and excluded from the harvest units. Likely, a majority of these areas were on slopes greater than 72 percent. In addition, harvest prescriptions and suspension requirements are determined for other steep slope areas. Complete details are included in the soil unit resource reports and in the individual unit cards (in the Big Thorne project record).

Approximately 206 acres of slopes greater than 72 percent gradient remain in the unit pool because they rate well below MMI 4 landslide potential. Most areas are less than 5 acres in size and consist of short steep slopes associated with rock outcrops. Units 37, 158, 201, 546, 550, and 551 include greater than 5 acres total of harvests on slopes greater than 72 percent. Harvest areas on slopes greater than 72 percent are included in the proposed harvest units because they appear stable and will facilitate yarding of surrounding lesser slopes. Appropriate mitigation measures are prescribed in the unit cards. Complete details are included in the soil stability investigation reports (in the Big Thorne project record) and/or Unit Cards.

Table SOIL-5 displays the proposed acres of slopes greater than 72 percent gradient that remain in the unit pool, and the proposed harvest systems on those slopes, for each alternative. The areas in Table SOIL-5 meet the criteria for timber harvest on slopes greater than 72 percent gradient as defined by the Forest Plan. The majority of these units are proposed for helicopter yarding with 25, 33, or 50 percent retention. Partial cutting in these helicopter units would help ensure an adequate amount of live root mass remains intact to preserve slope stability. Less soil disturbance in a harvest unit results in less disruption of the root mat and subsequently more root strength than if the soil is disturbed (Swanston 1974).

Alternative 2 has the least acreage of harvest on slopes greater than 72 percent and Alternative 3 has the most acreage for both old-growth harvest and young-growth

thinning. Most areas with slopes greater than 72 percent that are included in proposed harvests are associated with rock outcrops that average less than 1 acre in size and can be operated around.

The Mitkof Highway assessment (Swanston 2006) was considered during this analysis. The slope stability factors considered in the Mitkof slope stability assessment are the same factors considered in the slope stability assessment for the Big Thorne harvest units. Those factors are also described in the 2008 Forest Plan. The downslope resources at risk in the Mitkof assessment are very different than the downslope resources at risk on the Big Thorne project area. The soils and site factors are somewhat different between the two project areas. The mitigation described for the Big Thorne harvest units is appropriate when considering the soil and site factors and the downslope resources at risk.

The digital elevation model for the project area, when overlain with proposed roads, indicates that Alternatives 3, 4, and 5 each have less than 0.1 mile of proposed temporary road on slopes greater than 67 percent. It is likely that the location of roads will be adjusted prior to implementation. The Forest Plan directs to avoid locating roads on a slope greater than 67 percent, on an unstable slope, or in a slide-prone area, where feasible.

Alternative 1

Under Alternative 1, no timber harvest or road building would take place and no soil disturbances would be caused by new management activities associated with the Big Thorne Project. No rehabilitation efforts involving road construction, storage, and decommission would be completed on existing roads under this project. Roads on the project area will continue to receive incidental use from hunters and other visitors. Landslides would continue to occur in unharvested areas and existing harvested areas. Vegetation in harvested areas would continue to grow and add stability to soils on those sites. Detrimental soil conditions would remain within Region 10 Soil Quality Standards.

Table SOIL-5. Proposed Harvest Unit Acreage with Slopes Greater than 72% that Meet the Slope Stability Analysis Criteria for Timber Harvest (old-growth harvest and young growth thinning[1,2,3/])

Proposed Harvest System	Alt. 2 Slopes		Alt. 3 Slopes		Alt 4. Slopes		Alt. 5 Slopes	
	OG Harvest	YG Thinning	OG Harvest	YG Thinning	OG Harvest	YG Thinning	OG Harvest	YG Thinning
Ground	1	0	1	0	0	0	1	0
Cable	11	0	19	118	10	106	2	101
Helicopter	39	0	55	0	55	0	59	0
Total	**51**	**0**	**75**	**118**	**65**	**106**	**62**	**101**

Notes:
1/ Field verification of young-growth stands was not completed as of this writing. Acres of harvest on slopes over 72% based on field collected data for old-growth and 20 meter DEMS for young-growth. After it is completed prior to implementation, it is likely that additional area will be dropped from young-growth units.
2/ Total numbers may not match sum exactly due to rounding
3/ Areas with steep slopes that will utilize ground based equipment are short rock outcrops that average less than 1 acre in size and can be operated around.
OG = old growth; YG = young growth

Alternative 2

Alternative 2 proposes approximately 4,944 acres of old-growth timber harvest. Approximately 1,628 acres would be helicopter yarded, 1,383 acres cable yarded, and 1,934 acres shovel yarded under minimum partial suspension requirements. This alternative includes about 23 miles of temporary road construction or reconstruction, and 11.9 miles of proposed NFS roads. Construction of 19.2 miles of new temporary road (excluding reconstruction) would result in approximately 93 acres of soil disturbance. Additionally, rock quarry development would result in about 30 acres of disturbance based on 30 miles of new temporary and NFS roads (excluding reconstruction). About 129 acres of soil disturbance would result from harvest and approximately 26 acres of management-related landslides are projected to occur over the following 30 years as a result of this alternative. Total area of soil with reduced productivity would be approximately 278 acres (see Table SOIL-4). All harvest units in Alternative 2 would meet Region 10 Soil Quality Standards.

Approximately 51 acres of slopes greater than 72 percent gradient would be harvested in Alternative 2. Alternative 2 includes the lowest amount of timber harvest proposed on slopes greater than 72 percent of any action alternative. All proposed old-growth harvest units with slopes exceeding 50 percent were field reviewed for slope stability and will meet the requirements set forth in the Forest Plan.

Alternative 3

Alternative 3 proposes approximately 9,481 acres of timber harvest, of which 6,909 acres is old growth and 2,572 acres is young-growth thinning. Of the old-growth harvest, approximately 2,583 acres would be helicopter yarded, 1,871 acres cable yarded, and 2,456 acres shovel yarded under minimum partial suspension requirements. This alternative includes about 39 miles of temporary road construction or reconstruction and about 18 miles of proposed NFS roads. Construction of 26 miles of new temporary road (excluding reconstruction) would result in approximately 126 acres of soil disturbance. Additionally, rock quarry development would result in about 41 acres of disturbance based on about 41 miles of new temporary and NFS roads (excluding reconstruction). About 254 acres of soil disturbance would result from harvest and approximately 51 acres of management-related landslides are projected to occur over the following 30 years. Total area of soil with reduced soil productivity would be approximately 472 acres (see Table SOIL-4).

All but three harvest units would meet Region 10 Soil Quality Standards at the unit scale. Further analysis, of these units is being conducted to better define the existing conditions. These units would be modified or removed from the sale, to ensure the Region 10 Soil Quality Standard would be met.

Approximately 193 acres of slopes greater than 72 percent gradient would be harvested in Alternative 3. Alternative 3 includes the greatest amount of timber harvest proposed on slopes greater than 72 percent of any alternative. All proposed old-growth harvest units with slopes exceeding 50 percent were field reviewed for slope stability. Field verification of young growth stands will occur prior to project implementation. Harvest proposed on

slopes greater than 72 percent gradient will meet the requirements set forth in the Forest Plan.

Alternative 4

Alternative 4 proposes approximately 6,383 acres of timber harvest, of which 4,223 is old growth and 2,160 is young-growth thinning. Of the old-growth harvest, approximately 2,359 acres would be helicopter yarded, 845 acres cable yarded, and 1,020 acres shovel yarded under minimum partial suspension requirements. This alternative includes about 16 miles of temporary road construction or reconstruction and 3 miles of proposed NFS roads. Construction of about 9.1 miles of new temporary road (excluding reconstruction) would result in approximately 44 acres of soil disturbance. Additionally, rock quarry development would result in about 12 acres of disturbance based on about 12 miles of new temporary and NFS roads (excluding reconstruction). About 166 acres of soil disturbance would result from harvest and approximately 34 acres of management-related landslides are projected to occur over the next 30 years. Total area of soil with reduced productivity would be approximately 248 acres (see Table SOIL-4).

All but two harvest units would meet Region 10 Soil Quality Standards at the unit scale. Further analysis of these units is being conducted to better define the existing conditions. These units would be modified or removed from the sale, if necessary to ensure the Region 10 Soil Quality Standard would be met.

Approximately 171 acres of slopes greater than 72 percent gradient would be harvested in Alternative 4. All proposed old-growth harvest units with slopes exceeding 50 percent were field reviewed for slope stability. Field verification of young-growth stands will occur prior to project implementation. Harvest proposed on slopes greater than 72 percent gradient will meet the requirements set forth in the Forest Plan.

Alternative 5

Alternative 5 proposes approximately 7,093 acres of timber harvest, of which 5,012 acres are old growth and 2,081 acres are young growth. Of the old-growth harvest, approximately 3,218 acres would be helicopter yarded, 730 acres cable yarded, and 1,064 acres shovel yarded under minimum partial suspension requirements. This alternative includes about 14 miles of temporary road construction or reconstruction and about 2 miles of proposed NFS roads. Construction of about 7.7 miles of new temporary road (excluding reconstruction) would result in approximately 37 acres of soil disturbance. Additionally, rock quarry development could result in about 9 acres of disturbance based on about 9 miles of new temporary and NFS roads (excluding reconstruction). About 180 acres of soil disturbance would result from harvest and approximately 38 acres of management-related landslides are projected to occur over the following 30 years. Total area of soil with reduced productivity would be approximately 264 acres (Table SOIL-4).

All but two harvest units would meet Region 10 Soil Quality Standards at the unit scale. Further analysis, of these units is being conducted to better define the existing conditions. These units would be modified or removed from the sale, if necessary to ensure the Region 10 Soil Quality Standard would be met.

Approximately 163 acres of slopes greater than 72 percent gradient would be harvested in Alternative 5. All proposed old-growth harvest units with slopes exceeding 50 percent

were field reviewed for slope stability. Field verification of young growth stands will occur prior to project implementation. Harvest proposed on slopes greater than 72 percent gradient will meet the requirements set forth in the Forest Plan.

Cumulative Effects

The cumulative effects analysis area for soils is the project area. Cumulative effects of the proposed harvest and road construction/reconstruction on long-term soil productivity are directly related to the amount of soil disturbance that occurs through time because of natural events, temporary road construction, and resource management.

Reasonably foreseeable projects considered include the Roadside micro-sales, remaining Control Lake sales, additional harvests on state lands within the project area identified in the State's 5-year timber plan, road activities on NFS lands, young-growth treatments on NFS lands, restoration activities in the project area, and Recreation projects. The State-managed harvests include the Beach Road, North Thorne #3, and North Thorne #4 sales northeast of Thorne Bay and the South Thorne Bay #4 and South Thorne Bay #4 sales on the Kasaan Peninsula.

Because the effects of the present and reasonably foreseeable actions are consistent across all alternatives, the cumulative effects are comparable by alternative. Region 10 Soil Quality Standards require a minimum of 85 percent of the area left for productivity (FSM 2500, R-10 Supplement 2500-2006-1). Table SOIL-6 includes the estimated cumulative detrimental soil disturbance from past, present, and reasonably foreseeable projects within the project area.

Detrimental soil disturbance from the Big Thorne Project and foreseeable actions combined with existing conditions would total to approximately 1.3 to 1.5 percent detrimental soil conditions within the project area under each alternative, meeting the Region 10 Soil Quality Standards at the project area level.

Alternative 1 would not contribute to the cumulative effects of other present and reasonably foreseeable actions on soils. Alternatives 2 through 5 would add the effects as described in the direct and indirect effects section and summarized in Table SOIL-6 above. Alternative 3 would have the largest cumulative effect on soil resources, the Big Thorne Project adding 472 acres of detrimental soil conditions and other reasonably foreseeable actions adding 60 acres of detrimental soil conditions. Alternative 2 would have similar cumulative effects to Alternatives 4 and 5 in terms of acres of cumulative detrimental soil conditions.

Table SOIL-6. Estimated Acres of Cumulative Detrimental Soil Disturbance by Alternative

Detrimental Soil Disturbance	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Total Existing Detrimental Soil Disturbance from Management (acres)	3,061	3,061	3,061	3,061	3,061
Detrimental Soil Disturbance from Big Thorne Project (acres)[1/]	0	283	487	255	271
Reasonably Foreseeable Actions					
Roadside EA (micro-sales)[2/]	1.5	1.5	1.5	1.5	1.5
Remaining Control Lake Sales (includes roads)	16	16	16	16	16
Harvests on state lands (includes roads)[3/]	38	38	38	38	38
Estimated Predicted Landslides from Harvest on State Lands (over next 30 years)[1/]	3	3	3	3	3
Free Use Timber Sales	0.3	0.3	0.3	0.3	0.3
Total Detrimental soil disturbance from Reasonably Foreseeable Actions (acres)	60	60	60	60	60
Cumulative Soil Disturbance (acres) [4/]	3,121	3,404	3,608	3,376	3,392
Cumulative Soil Disturbance (percent of project area)	1.3%	1.5%	1.6%	1.5%	1.5%

1/ Includes 30 years' worth of management-related landslides at the predicted rate (SOIL-4).
2/ Assumes 3 percent detrimental soil disturbance of 182.5 acres calculated in Watershed Resource report.
3/ Assumes 4 miles of roads and 3 percent soil disturbance as a result of 635 acres of harvest and on state lands.
4/ Sums may not add correctly due to rounding

Effects Common to All Alternatives

See Table SOIL-1 for a summary of existing soil disturbances on the project area. Past timber harvest and road construction is associated with 241 landslides totaling about 393 acres. Natural soil disturbances and naturally occurring landslides would continue to occur under each alternative. Reasonably foreseeable projects with quantifiable effects are included in Table SOIL-6 above. The Roadside EA would contribute approximately 1.5 acres of detrimental soil disturbance. The remaining Control Lake sales would contribute approximately 16 acres of detrimental soil disturbance. Harvests on state lands would contribute approximately 38 acres of detrimental soil disturbance, which includes roads. As a result of harvest on State lands, landslides predicted from harvest on State lands would contribute approximately 3 acres over the next 30 years. Free Use Timber Sales would contribute approximately 0.3 acres of detrimental soil disturbance.

In addition, several reasonably foreseeable projects have effects common to all alternatives, but are not quantifiable at this stage, and are therefore not included in Table SOIL-6 above. Road activities on NFS lands include ongoing road maintenance on NFS roads will result in some soil disturbance; however, these do not count toward detrimental soil disturbance. Normally this type of work is determined to fit the category of routine repair and maintenance of roads that do not individually or cumulatively have a significant effect on the quality of the human environment and may be categorically excluded (FSH 1909.15, 321.12). Restoration activities could result in temporary, localized soil effects, but it is expected that the overall effect from activities, such as landslide and stream stabilization, would be beneficial to the soil resource. Recreation and facility projects in

the project area would result in some additional soil disturbances; however, these effects would be limited by BMP implementation and do not count towards detrimental soil disturbance.

The following describes the cumulative effects by alternative.

Alternative 1

In addition to the effects described for all alternatives above, the Big Thorne Project would not contribute to the cumulative detrimental soil disturbance. The reasonably foreseeable projects identified in Table SOIL-6 would result in about 60 acres of detrimental soil conditions. Total detrimental soil disturbance within the project area would be about 3,121 acres, or about 1.3 percent of the project area. Natural soil disturbances including landslides will continue to occur. Natural surface erosion due to ice, wind, water, or gravity that usually occurs in small patches will continue across the project area. Vegetation in harvested areas will continue to grow and add root mass and add stability to soil, thus landslide frequency will likely decline over time in the previously harvested areas (Landwehr 1994).

Alternative 2

In addition to the effects described for all alternatives above, the implementation of Alternative 2 would contribute about 283 acres of detrimental soil disturbance. When combined with the reasonably foreseeable projects, detrimental soil disturbance on the project area would increase to approximately 3,404 acres, or about 1.5 percent of the project area (Table SOIL-6). This level of disturbance is well within Region 10 Soil Quality Standards at the project scale. Natural soil disturbances including landslides will continue to occur. Natural surface erosion due to ice, wind, water, or gravity that usually occurs in small patches will continue across the project area. Vegetation in previously harvested areas will continue to grow and add root mass and stability to the soil, thus landslide frequency will likely decline over time in the harvested areas (Landwehr 1994). Over the next 30 years, about 29 acres of landslides are estimated to be associated with management activities cumulatively.

Alternative 2 meets the Region 10 soil productivity standard in all units, as this alternative does not include young growth thinning units.

Alternative 3

In addition to the effects described for all alternatives above, the implementation of Alternative 3 would result in about 487 acres of detrimental soil conditions. When combined with the existing condition and reasonably foreseeable activities, detrimental soil disturbance on the project area would increase to approximately 3,608 acres, or about 1.6 percent of the project area (Table SOIL-6). This level of disturbance is well within Region 10 Soil Quality Standards at the project scale. Natural soil disturbances including landslides will continue to occur. Natural surface erosion due to ice, wind, water, or gravity that usually occurs in small patches will continue across the project area. Vegetation in previously harvested areas will continue to grow and add root mass and stability to the soil, thus landslide frequency will likely decline over time in the harvested areas (Landwehr 1994). Over the next 30 years, about 54 acres of landslides are estimated to be associated with management activities cumulatively.

All but three harvest units would meet Region 10 Soil Quality Standards at the unit scale. Without modification, Units 508, 555, and 575 may not meet standards due to existing temporary or decommissioned roads or management related landslides on previously harvested areas. Further analysis, such as aerial photo review and/or ground truthing, of these units is necessary to better define the existing conditions. Following further review, these units could be modified, or potentially removed from the sale, to ensure the Region 10 Soil Quality Standard would be met. Proposed harvest for these units will be resolved in the FEIS ROD and in the unit cards, as further analysis is ongoing.

Alternative 4

In addition to the effects described for all alternatives above, the implementation of Alternative 4 would include about 255 acres of detrimental soil conditions. When combined with the existing condition and reasonably foreseeable activities, detrimental soil disturbance on the project area would increase to approximately 3,376 acres, or about 1.5 percent of the project area (Table SOIL-6). This level of disturbance is well within Region 10 Soil Quality Standards at the project scale. Natural soil disturbances including landslides will continue to occur. Natural surface erosion due to ice, wind, water, or gravity that usually occurs in small patches will continue across the project area. Vegetation in previously harvested areas will continue to grow and add root mass and stability to the soil, thus landslide frequency will likely decline over time in the harvested areas (Landwehr 1994). Over the next 30 years, about 37 acres of landslides are estimated to be associated with management activities cumulatively.

All but two harvest units would meet Region 10 Soil Quality Standards at the unit scale. Without modification, Units 508 and 575 may not meet standards due to existing temporary or decommissioned roads or management related landslides on previously harvested areas. Further analysis, such as aerial photo review and/or ground truthing, of these units is necessary to better define the existing conditions. Following further review, these units could be modified, or potentially removed from the sale, to ensure the Region 10 Soil Quality Standard would be met. Proposed harvest for these units will be resolved in the FEIS ROD and in the unit cards, as further analysis is ongoing.

Alternative 5

In addition to the effects described for all alternatives above, the implementation of Alternative 5 would include about 271 acres of detrimental soil conditions. When combined with the existing condition and reasonably foreseeable activities, detrimental soil disturbance on the project area would increase to approximately 3,392 acres, or about 1.5 percent of the project area (Table SOIL-6). This level of disturbance is well within Region 10 Soil Quality Standards at the project scale. Natural soil disturbances including landslides would continue to occur. Natural surface erosion due to ice, wind, water, or gravity that usually occurs in small patches will continue across the project area. Vegetation in previously harvested areas would continue to grow and add root mass and stability to the soil, thus landslide frequency would likely decline over time in the harvested areas (Landwehr 1994). Over the next 30 years, about 41 acres of landslides are estimated to be associated with management activities cumulatively.

All but two harvest units would meet Region 10 Soil Quality Standards at the unit scale. Without modification, Units 508 and 575 may not meet standards due to existing temporary or decommissioned roads or management related landslides on previously harvested areas. Further analysis, such as aerial photo review and/or ground truthing, of these units is necessary to better define the existing conditions. Following further review, these units could be modified, or potentially removed from the sale, to ensure the Region 10 Soil Quality Standard would be met. Proposed harvest for these units will be resolved in the FEIS ROD and in the unit cards, as further analysis is ongoing.

3 Environment and Effects

Climate Change

Introduction

Forest Plan Analysis

The EIS prepared for the 2008 Tongass Forest Plan Amendment discusses several issues related to climate change. These include the considerable uncertainty concerning specific predictions of how the climate may change, and the uncertainty regarding the effects of climate change on the resources of the Tongass. To deal with this uncertainty, the Tongass National Forest will continue to monitor potential effects of climate change through the existing Forest Plan monitoring programs, and other studies that are happening regionally and nationally.

The 2008 Forest Plan EIS contains an extensive discussion of climate change related to management activities (pgs. 3-11 to 3-20, 3-50 to 3-51, 3-77, 3-92 to 3-93, 3-116 to 3-117, 3-125 to 3-126, 3-203, 3-250, 3-296, 3-340, 3-351, 3-401). Models available for estimating climate change are designed to predict changes on a regional scale and are not detailed enough to predict changes to the Tongass National Forest specifically. Existing models do not entirely agree on how global warming will affect Southeast Alaska. The variation and possibilities are discussed extensively in the 2008 Forest Plan Amendment EIS.

The 2008 ROD for the Tongass Plan Amendment concludes that because of the uncertainty related to the specific effects of climate change on the resources of the Tongass, the uncertainty about how activities on the Forest affect climate change and the predicted small magnitude of these effects, the best course of action is continued management of the Tongass for resiliency in ecosystem functions. This will be accomplished primarily by management of the Tongass as a mostly intact ecosystem with a robust monitoring plan that will allow for adaptive management intervention if and when effects of climate change are more certain. Important components of the 2008 Tongass Forest Plan include:

- A conservation strategy that includes an extensive reserve system in non-development land use designations and standards and guidelines where active management is minimized that protect over 90 percent of the existing productive old-growth habitat.
- Standards and guidelines that include specific protection measures for soils on slopes that are >67 percent and >72 percent. These measures help retain carbon stored as organic material in soils where timber harvest and road building occur.

In addition to the Forest Plan's monitoring and evaluation provisions that address the effects of climate change, there are Regional forest health program monitoring changes related to insects, disease, pathogens, windthrow, and the long-term forest inventory system. If these efforts detect changes due to climate they will be addressed through existing planning procedures to determine whether changes in management are warranted.

Even at the Forest Plan level, differences between alternatives in terms of the effects of climate change on the Tongass - and in the effects of land management activities on

climate change - are uncertain, unquantifiable, and likely to be small (especially when compared to other routine human activities). For these reasons, information on climate change was deemed not essential to a reasoned choice among the alternatives considered in the 2008 Forest Plan EIS, and therefore for these same reasons, would not be essential to a reasoned choice among alternatives for the Big Thorne EIS (Kimbell 2009).

The Tongass National Forest is currently adjusting management in relation to climate change. Based on ongoing research and scientific recommendations (Hennon et al. 2007), and in response to the public's concern about cedar decline, the regeneration of yellow cedar is being more closely monitored and efforts made to influence species composition to include more Alaska yellow cedar in regenerating stands. This will allow managers the ability to maintain or increase yellow cedar on sites judged to be suitable for the species long-term survival (i.e., not prone to future yellow cedar decline due to climate change) using future intermediate treatments such as PCT.

The Tongass is also in the process of organizing a scenario planning effort with key stakeholders, to include relevant scientists and other agency personnel, business and community leaders, and internal personnel to identify key resources at risk and assessment needs. This effort will provide information on the risks and range of change for key resources and prioritize climate-change related issues and needs across Southeast Alaska.

Further discussion on climate change issues and vegetation can be found in the Climate Change, Timber, and Botany Resource Reports (Crookston 2012; Barnhart and Iozzi 2012; Opolka 2012).

3 Environment and Effects

BIOLOGICAL ENVIRONMENT

Fisheries

Introduction

Streams and lakes of the Big Thorne project area provide important habitat for the production of resident and anadromous fish resources. These resources support the Prince of Wales subsistence, sport, guided (both freshwater and saltwater), and commercial fisheries of the area as well as traditional and cultural values. Fish are a major component of the biodiversity of Southeast Alaska. The annual migrations of anadromous fish for spawning are necessary for the functioning of many plant and animal communities. Willson and Halupka (1995), in their discussion of anadromous fish as keystone species, list 36 birds and mammals that consume salmon or salmon eggs in Southeast Alaska. Animals such as the black bear and bald eagle depend on salmon as a primary food source. Abundant rainfall and watersheds with high stream densities provide an unusual number and diversity of freshwater habitats. These abundant freshwater systems on the Tongass National Forest provide spawning and rearing habitat for most of the fish produced in Southeast Alaska.

Watershed and subwatershed boundaries and names for the Big Thorne project area are based on USDA Forest Service 5th, 6th, 7th level watershed dataset. Often all three levels have been characterized as "watersheds" for analysis of varied project effects on Prince of Wales Island. However, for the Big Thorne project, watersheds and subwatersheds have been analyzed separately for Issue 4 – Cumulative Watershed Effects (earlier in this chapter) and in the Watershed Resource Report (James 2012). The subsections below use the same definitions described for watersheds and subwatersheds in Issue 4. However, most of the discussions on effects to fisheries resources are limited to the breakdown at the subwatershed level, which provides a finer scale division for descriptions of baseline conditions and potential project effects.

Stream Type Definitions

Stream classification and channel type characteristics are the primary factors used in determining potential production of fish within the Tongass as well as types of protection needed relative to forest management actions. The Tongass National Forest uses two specific categorization systems to describe streams. The first is broadly defined as a stream value classification and defines relative fish use or presence in streams; it is called Stream Class, or Aquatic Habitat Management Unit (AHMU) class. The second is a classification of streams into Process Groups and Channel Types. These are based on stream geomorphic characteristics and location within the watershed, which is important for assessing fish habitat capability and sensitivity to management actions.

The Alaska Region stream value classification (stream class) is based on subsistence, recreational, and economic fish harvest considerations. The value classes do not imply either ecological importance or prioritization of fish harvest over maintenance of watershed function. Stream classes are as follows:

1. Class I. Streams and lakes with anadromous (migrating from the ocean) or adfluvial (migrating from lakes) fish or fish habitat; or, high quality resident fish waters, or habitat above fish migration barriers known to provide reasonable enhancement opportunities for anadromous fish.
2. Class II. Streams and lakes with resident fish or fish habitat and generally steep (6 to 25 percent or higher) gradients where no anadromous fish occur, and otherwise not meeting class I criteria.
3. Class III. Streams are perennial and intermittent streams that have no fish populations or fish habitat, but have sufficient flow or sediment and debris transport to directly influence downstream water quality or fish habitat capability.
4. Class IV. Other intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capabilities to directly influence downstream water quality or fish habitat capability. These streams have bankfull width of at least 1 foot over the majority of the stream segment. Class IV streams are too small to be mapped on aerial photographs, thus only the ones field verified are listed.

Process groups describe the geomorphic properties of stream channels and their general location in the landscape, while channel types further differentiate channels within process groups. AHMU class, channel types and process groups are used to assign appropriate buffers. Methods of determining channel type and process group are in FSH 2090.21 (USDA 2001). The process group code is explained below in Table FISH-1.

Methodology

Methodology used for fish habitat assessment included both GIS analysis and field surveys. GIS analysis included initial determination of stream characteristics (class, type, length location), existing and proposed road locations and distance, and road-stream crossing information within the proposed project area. Many of these parameters were field verified. The interdisciplinary team, used channel type and stream class data, anadromous and resident fish stream road condition surveys (RCS) data, ADF&G stream catalog, and field survey results in the vicinity of proposed activities, as a basis for effects analysis.

The effects of the alternatives were compared using quantitative variables such as number of existing stream crossings and proposed stream crossings, miles and area of existing and proposed road constructed, acres of past riparian management area harvested, miles of existing roads in riparian management areas (RMA), acres of past and proposed harvest and percent canopy removed. These same parameters were considered in a cumulative manner for other reasonably foreseeable project area actions.

See the Fisheries Resource Report (Knutzen 2012) for more information on methods used.

Table FISH-1. Brief Description of Process Groups

Process Group	Process Group Name	Channel Morphometry	Channel Sediment Function	Fish Habitat
HC	High Gradient Contained	Steep mountain slope tributaries	Source and transport channel system	Small resident fish populations and limited anadromous fish-rearing habitat
AF	Alluvial Fan	Multi-branched channels on depositional footslopes	Episodic deposition processes	Low productivity due to dynamic channels and interrupted surface flow
MM	Moderate Gradient Mixed Control	Valley bottom streams with variable confinement	Transitional transport/deposition channels influence by bedrock control and riparian vegetation.	Moderate to Highly Productive anadromous and resident spawning and fish-rearing habitat
MC	Moderate Gradient Contained	Completely contained by adjacent landforms frequently by bedrock	Efficient sediment transport and delivery channels	Low to moderate productive anadromous and resident fish-rearing and spawning habitat
LC	Low Gradient Contained	Moderately incised and well contained low gradient streams in lowlands and large valleys	Mixed sediment storage and transport channels	Moderately productive resident and anadromous fish-rearing and spawning habitats
FP	Flood Plain	Unconfined valley flood plain streams	Complex depositional channel networks	Diverse and Highly productive anadromous fish-spawning and -rearing habitat
PA	Palustrine	Low gradient streams associated with low relief landforms and wetland drainage networks	Peatland-bog runoff dominates	Highly productive juvenile anadromous and resident fish-rearing potential
ES	Estuarine	Intertidal streams influenced by tidal inundation	Primarily depositional environments including saltwater marches, mudflats and gravel deltas	Low to high productivity anadromous and resident fish-rearing and -spawning habitat, varying by specific channel type

Source: Paustian et al. 1992; Paustian and Kelliher 2010

Affected Environment

This section describes the affected environment and existing condition in the subwatersheds where activities are proposed. Table WTR-2 under Issue 4 lists subwatershed acres.

Alaska Department of Fish and Game (ADF&G) developed a rating system to rank VCUs on the Tongass National Forest which classified VCUs as Primary Fish Producers if they were in the top 10 percent of all VCUs in Southeast Alaska for pink salmon escapement, potential coho salmon smolt production, or angler effort or if it had a close connection (e.g. same river system) to another VCU that was ranked as a Primary Fish Producer (Flanders et al. 1998). Within the project area, eight VCUs (5750, 5760, 5780, 5860, 5950, 5960, 5971, and 5972), which included parts of several subwatersheds in the project

area including Thorne Lake, Control Lake (two VCUs), Snakey Lakes Lowlands, around Thorne Bay (parts of seven subwatersheds), North Big Salt, Central Thorne River, and Goose Creek/Rio Beaver subwatersheds were rated as Primary Fish Produces (Figure FISH-1). ADF&G recommends that those VCUs that have the highest resource value should be managed to reduce risks to fish and wildlife and their habitats.

Stream and Lake Habitat

The Big Thorne project area has about 1,500 miles of streams and over 3,100 acres of lakes and ponds. Streams are differentiated by process group, channel type and by AHMU class (Tables FISH-2 through FISH-4).

Each process group varies in the amount and quality of fish habitat. Some process groups provide more rearing habitat for juveniles and some have more spawning habitat for adult fish. The amount of habitat that is available is directly based on the miles of each process group in a given subwatershed. Table FISH-2 shows the miles of stream for each process group for each subwatershed. About 63 percent of the stream miles are in the HC process group and about 24 percent of the stream miles are in the more productive and sensitive process groups (ES, FP, PA, and MM).

Stream classes provide a means to categorize stream channels based on their fish production values. Stream Classes I and II receive more protection because they have fish populations. Table FISH-3 shows the total length of stream (in miles) for each stream class in each subwatershed. The length of Class I and II streams (fish-bearing stream classes) for each subwatershed will give an indication of which subwatersheds have more fish habitat and greater risk of impacts from management activities. Over the project area subwatersheds, nearly half (44 percent) of the known stream miles are fish-bearing streams (Class I and II), although it is acknowledged that Class IV streams are greatly underrepresented in the overall GIS data base. Lakes play an important role in water storage, as sediment and organic matter sinks, and as moderator of highs and lows in downstream water quality conditions especially for larger lakes. They are also important sources of fish habitat, especially for juvenile sockeye salmon and resident Dolly Varden and cutthroat trout. Lakes provide needed over-wintering habitat for coho and sockeye salmon, steelhead trout, resident Dolly Varden, and cutthroat trout, with over 92 percent of all project area lakes Class I or II (Table FISH-4). Five subwatersheds account for over 65 percent of the lake area in the project area; these include Big Ratz, Control Lake, Eagle Creek, Goose Creek, and Thorne Lake (Table FISH-4). The largest lake in the project area is Luck Lake in the Eagle Creek watershed. These subwatersheds all exceed 300 acres of lake habitat, while the remaining have less than 300 acres each. No data on lake depths, volumes, or water quality are available.

Table FISH-2. Stream Miles by Process Group by Subwatershed

watershed	Miles of Stream by Process Group[1/]										
	HC	MM	FP	PA	MC	AF	LC	ES	UC [2/]	UI [3/]	Total [2/]
Baird Peak	17.9	0.8	0	0.5	0.3	0.4	0	0.1	1.6	0.4	21.9
Barren	4.6	5.4	0	0.4	0.1	0	0	0.0	1.1	0.2	11.9
Big Ratz	46.1	5.8	1.7	1.6	3.5	1.2	0.1	0	3.6	0	63.6
Central Thorne River	5.1	5.8	9.2	13.8	4.0	0.2	0.0	0.0	1.7	0	39.8
Cobble Creek	9.8	2.4	0.5	0.1	1.1	0	0	0	1.2	0.2	15.2
Control Lake	76.1	14.9	6.0	8.9	13.7	2.1	5.1	0	1.0		127.9
Deer Creek	12.4	4.8	0	3.1	0.3	0	0	0	1.4	0.2	22.1
Doughnut	6.9	1.5	0	0.2	1.4	0	0	0	0.1	0.7	10.9
Eagle Creek/Slide Creek	19.5	4.4	2.2	0	0	3.0	0.1	0	0.6	0	29.8
East Fork North Thorne	46.5	4.0	4.5	3.1	0.2	4.6	0	0	2.5	0	65.5
Falls Creek	15.4	0.8		0.3	0.3	0.5	0.2	0	0.3	0	17.7
Goose Creek	55.5	12.6	5.3	7.2	7.4	1.4	3.2	0	1.4	0	94.0
Gravelly Creek	38.9	2.7	5.1	0.6	2.5	0.9	0.4	0	1.2	0	52.4
Lake Ellen	15.5	6.4	0.6	2.9	3.4	2.0	0	0.5	0	1.1	32.5
Little Ratz Creek	17.7	4.4	1.5	0	0.4	0.9	0	0.3	1.8	0	27.0
Luck Lake	31.9	5.1	0.7	1.6	0.8	3.3	0	0.2	4.1	0	47.8
Luck Point	5.3	1.0	0	0	0	0	0	0	0.5	0.5	7.2
No Name	12.6	0.8	0	0.2	0.2	0.1	0	0	1.5	0.0	15.4
North	7.9	0	0.8	0	0.9	0	0.3	0.1	0.2	1.7	11.9
North Big Salt Lake	144.8	12.2	13.1	4.2	17.2	1.5	0.8	0.2	2.3	0	196.2
North Kasaan Bay Frontage	21.1	4.8	0.4	1.2	1.7	1.1	0	0.3	0	3.5	34.1
North Sal	4.6	0.5	0	0	0	0.1	0	0.0	0.9	0.4	6.4
Pin	5.4	0.2	0.4	0.1	0.8	0	0	0	0.2	0.1	7.3
Ratz Harbor	1.3	0.9	0	0.8	0	0	0	0.1	0.3	0.3	3.7
Rio Beaver Creek	55.2	4.5	9.1	2.3	2.2	0	1.9	0	0.2	0	75.3
Sal Creek	28.8	2.8	2.1	0	1.6	1.4	0	0.3	1.1	0	38.1
Salamander	4.5	1.9	0	0.1	0	0.3	0	0	0.1	0.1	7.0
Slide Creek	20.5	8.2	2.7	1.9	2.1	0.4	0.4	0.1	0.4	0.2	36.9
Snakey Lakes Lowlands	5.3	5.7	4.1	14.9	2.2	0	3.2	0	1.0	0	36.4
Thorne	10.7	1.6	0.4	0.7	0.3	0	0	0.1	0.6	0.6	15.0
Thorne Bay	25.1	8.0	0.2	2.9	2.0	0.2	0	0.4	0	2.1	40.9
Thorne Lake	51.6	8.3	9.0	12.9	7.7	1.7	2.8	0	0	0	94.1
Thorne River Intertidal	5.5	0.8	0	0.7	1.0	0	0	3.0	0	1.8	12.9
Tiny	3.4	0.2	0	0	0.4	0	0	0	0	0.4	4.4
Torrent	5.4	1.5	0.2	0.2	1.1	0	0	0.9	0.3	0.5	10.1
West Fork Luck Creek	32.8	2.9	5.3	1.7	0	1.5	0.4	0	2.5	0	47.2
West Fork North Thorne	53.8	5.3	7.3	3.0	0	4.2	0	0	7.8	0	81.3
Total	**925.6**	**154.0**	**92.3**	**92.3**	**80.5**	**33.0**	**18.8**	**6.6**	**43.7**	**15.2**	**1,462.1**

1/ Process group code definitions can be found in Table Fish-1 and the unit cards (Appendix B).
2/ UC= Unclassified streams
3/ UI= Unidentified intertidal channels

Table FISH-3. Known Stream Miles by AHMU Class and Basin Area by Subwatershed

Watershed	Basin Area (Sq. Mi.)	Miles of Stream by Class[1/]				
		I	II	III	IV	Total
Baird Peak	6.6	0.9	4.0	12.3	4.8	21.9
Barren	3.1	4.7	2.6	2.1	2.6	11.9
Big Ratz	16.1	8.0	15.1	31.9	8.6	63.6
Central Thorne River	10.9	30.9	3.6	1.8	3.5	39.8
Cobble Creek	3.3	3.8	1.4	7.7	2.3	15.2
Control Lake	29.1	45.2	18.0	63.0	1.7	127.9
Deer Creek	4.5	0.8	11.3	6.4	3.7	22.1
Doughnut	2.9	3.4	5.1	2.4	0.1	10.9
Eagle Creek/Slide Creek	7.1	10.0	1.6	13.8	4.4	29.8
East Fork North Thorne	11.8	14.7	2.0	41.5	7.3	65.5
Falls Creek	3.8	2.6	5.7	8.0	1.4	17.7
Goose Creek	21.1	35.3	7.9	31.6	19.1	94.0
Gravelly Creek	10.7	13.8	5.0	30.2	3.3	52.4
Lake Ellen	8.3	17.0	3.4	12.2	0.0	32.5
Little Ratz Creek	5.5	3.6	5.0	15.4	3.0	27.0
Luck Lake	11.7	8.5	6.3	21.4	11.6	47.8
Luck Point	2.2	1.9	2.1	1.0	2.2	7.2
No Name	2.4	0.0	3.4	9.5	2.4	15.4
North	3.2	3.8	3.5	4.2	0.3	11.9
North Big Salt Lake	31.7	24.4	45.2	105.3	21.3	196.2
North Kasaan Bay Frontage	23.0	10.9	6.2	17.0	0.0	34.1
North Sal	1.1	0.6	0.2	2.6	3.1	6.4
Pin	1.3	2.4	3.4	1.3	0.3	7.3
Ratz Harbor	1.3	1.2	1.5	0.3	0.7	3.7
Rio Beaver Creek	14.1	19.6	9.0	33.3	13.5	75.3
Sal Creek	7.3	5.8	4.0	26.1	2.2	38.1
Salamander	2.0	2.2	2.6	2.0	0.2	7.0
Slide Creek	10.1	8.5	12.9	14.5	0.8	36.9
Snakey Lakes Lowlands	10.4	29.2	1.9	3.8	1.6	36.4
Thorne	3.9	4.4	3.6	5.1	1.8	15.0
Thorne Bay	9.9	17.0	9.0	14.9	0.0	40.9
Thorne Lake	25.2	37.8	8.8	47.5	0.0	94.1
Thorne River Intertidal	2.8	8.0	0.9	4.0	0.0	12.9
Tiny	0.8	0.3	0.4	2.9	0.8	4.4
Torrent	2.8	2.5	2.6	3.8	1.2	10.1
West Fork Luck Creek	11.4	12.1	1.9	28.4	4.9	47.2
West Fork North Thorne	13.1	16.1	9.7	33.1	22.4	81.3
Total	336.9	**411.9**	**230.8**	**662.2**	**157.2**	**1462.1**

1/ Class IV streams greatly under represented as streams can only be determined by site surveys.

Table FISH-4. Lake Area by AHMU Class in the Project Area Subwatersheds

Subwatershed	Total Subwatershed Lake Acres	Percent of Lake Acres in Project Area[1/]	Project Area Lake Acre by Lake Class				Total Lake Acres in Project Area
			Landlocked[2/]	Class I	Class II	Class III	
Baird Peek	70.3	100	2.2	0.0	0.0	68.1	70.3
Barren	0.0	NA	0.0	0.0	0.0	0.0	0.0
Big Ratz	324.0	100	1.7	259.2	63.1	0.0	324.0
Central Thorne River	52.6	100	0.9	51.6	0.0	0.0	52.6
Cobble Creek	1.5	100	0.0	0.0	0.0	1.5	1.5
Control Lake	407.5	100	11.4	385.3	0.9	9.9	407.5
Deer Creek	34.2	100	0.3	0.0	26.3	7.6	34.2
Doughnut	12.1	100	0.2	2.0	9.9	0.0	12.1
Eagle Creek/Slide Creek	1.2	100	0.0	1.2	0.0	0.0	1.2
East Fork North Thorne	9.1	100	1.9	7.2	0.0	0.0	9.1
Falls Creek	18.0	100	2.4	15.7	0.0	0.0	18.0
Goose Creek	359.6	87	10.2	284.6	17.2	2.4	314.3
Gravelly Creek	11.6	100	1.6	0.0	0.0	10.0	11.6
Lake Ellen	115.4	4	0.0	0.0	0.0	4.8	4.8
Little Ratz Creek	5.8	100	0.3	0.0	0.0	5.5	5.8
Luck Lake	529.4	100	3.2	516.5	0.0	9.1	528.9
Luck Point	4.3	0	0.0	0.0	0.0	0.0	0.0
No Name	2.4	100	0.0	0.0	0.0	2.4	2.4
North	0.0	NA	0.0	0.0	0.0	0.0	0.0
North Big Salt Lake	21.7	100	12.1	1.1	8.5	0.0	21.7
North Kasaan Bay Frontage	72.8	6	0.0	2.2	0.0	2.2	4.4
North Sal	0.0	NA	0.0	0.0	0.0	0.0	0.0
Pin	38.5	100	2.4	36.2	0.0	0.0	38.5
Ratz Harbor	0.0	NA	0.0	0.0	0.0	0.0	0.0
Rio Beaver Creek	8.3	100	3.8	4.5	0.0	0.0	8.3
Sal Creek	2.6	100	0.0	0.0	0.0	2.6	2.6
Salamander	66.2	100	0.0	66.2	0.0	0.0	66.2
Slide Creek	74.8	100	2.6	46.6	23.3	2.3	74.8
Snakey Lakes Lowlands	263.4	100	4.2	259.2	0.0	0.0	263.4
Thorne	42.2	100	0.6	41.6	0.0	0.0	42.2
Thorne Bay	261.3	100	5.6	252.1	0.0	3.0	260.7
Thorne Lake	517.8	97	11.0	485.4	0.5	6.6	503.5
Thorne River Intertidal	22.8	98	0.8	21.5	0.0	0.0	22.3
Tiny	0.0	NA	0.0	0.0	0.0	0.0	0.0
Torrent	4.2	100	4.2	0.0	0.0	0.0	4.2
West Fork Luck Creek	7.6	88	3.6	0.0	0.0	3.1	6.7
West Fork North Thorne	3.5	100	2.8	0.7	0.0	0.0	3.5
Total	**3,351.9**	**93**	**90.0**	**2,740.7**	**149.7**	**141.0**	**3,121.4**

1/ Percent values rounded
2/ Landlocked are lakes with no associated downslope exit drainage streams

Fish Species in the Project Area

A total of seven anadromous and/or resident salmonid fish species are present in project area streams. The species include four of the five Pacific Coast salmon, one char, a trout species, and steelhead:

- Pink salmon (*Oncorhynchus gorbuscha*)
- Chum salmon (*O. keta*)
- Coho salmon (*O. kisutch*)
- Sockeye salmon (*O. nerka*)
- Steelhead (*O. mykiss*)
- Cutthroat trout (*O. clarki*)
- Dolly Varden char (*Salvelinus malma*)

The known presence of salmonid fish in project area subwatersheds is included in Table FISH-5. Detailed descriptions of habitat requirements at various life stages and important fish-bearing streams are described in the Fisheries Resource Report (Knutzen 2012).

Management Indicator Species

NFMA regulations direct the use of MIS in forest planning to help display the effects of forest management. MIS are species whose population changes are believed to indicate the effects of land management activities. The Tongass Forest Plan selected pink and coho salmon, Dolly Varden char, and cutthroat trout as MIS as representative of varied fish life history habitat uses of the Tongass stream systems. Details of species-specific habitat use are presented in the Fisheries Resource Report (Knutzen 2012).

Threatened, Endangered, and Proposed Listed Fish or Sensitive Fish Species

Under Section 7 of the ESA, federal agencies are required to ensure that actions are not likely to jeopardize the continued existence of a listed species. The effects analysis for threatened and endangered (T&E) species is required to address the direct and indirect effects of the action(s) on T&E species and their critical habitat (50 CFR 402.02). The effects analysis is to comply with Section 7 of the ESA which requires all federal agencies, in consultation with the USFWS and NMFS, to ensure that their actions are not likely to jeopardize the continued existence of T&E species or adversely modify their habitat.

There are no fish species in the streams and lakes of the Tongass National Forest that are federally ESA listed or under the State of Alaska ESA. In addition, as of 2009 (USDA Forest Service 2009c), there are no Region 10 Sensitive fish species in the Tongass National Forest. However, the listing of Pacific herring in Southeast Alaska as a candidate species for federal listing results in this species being included as a sensitive species in Tongass National Forest. The Southeast Alaska Distinct Population Segment (DPS) of Pacific herring was listed as a federal candidate species in 2008 (73 Federal Register 19824).

Table FISH-5. Known Anadromous and Resident Fish Species Presence by Subwatershed in the Project Affected Area

Subwatershed	Anadromous Salmon, Char, and Trout [1/]						
	Pink	Chum	Coho	Sockeye	Dolly Varden	Cutthroat	Steelhead
Baird Peak			Y		Y(r)		
Barren	Y		Y		Y		
Big Ratz	Y	Y	Y	Y	Y(a,r)	Y(r)	Y
Central Thorne River	Y	Y	Y	Y	Y(a,r)	Y(a,r)	Y
Cobble Creek	Y	Y	Y		Y(a,r)	Y(a,r)	
Control Lake	Y		Y	Y	Y(r)	Y(r)	Y
Deer Creek	Y				Y(r)	Y(a,r)	Y(r)
Doughnut	Y		Y			Y	
Eagle Creek/Slide Creek	Y	Y	Y	Y	Y(a,r)	Y(a,r)	Y
East Fork North Thorne	Y		Y	Y	Y(a,r)	Y(a,r)	Y
Falls Creek	Y	Y	Y		Y	Y	
Goose Creek			Y	Y	Y(a,r)	Y(a,r)	Y
Gravelly Creek	Y	Y	Y		Y(a,r)	Y(r)	Y(a)
Lake Ellen	Y	Y	Y		Y(a,r)	Y(a,r)	Y
Little Ratz Creek	Y	Y	Y		Y(r)	Y(r)	Y
Luck Lake	Y	Y	Y	Y	Y(a,r)	Y(a,r)	Y
Luck Point					Y	Y	
No Name[2/]							
North	Y	Y	Y		Y(r)	Y(r)	Y(r)
North Big Salt Lake	Y	Y	Y		Y(a,r)	Y(a,r)	Y
North Kasaan Bay Frontage					Y(r)	Y(r)	
North Sal					Y(r)		
Pin	Y		Y		Y		
Ratz Harbor	Y	Y	Y		Y(r)	Y(r)	
Rio Beaver Creek	Y	Y	Y		Y(a,r)	Y(a,r)	Y
Sal Creek	Y	Y	Y		Y(a,r)	Y(a,r)	Y
Salamander	Y		Y		Y(a,r)	Y(a,r)	
Slide Creek	Y	Y	Y	Y	Y(r)	Y(a,r)	
Snakey Lakes Lowlands	Y		Y	Y	Y(a,r)	Y(a,r)	Y
Thorne Bay	Y		Y		Y(a,r)	Y(a,r)	
Thorne	Y		Y			Y	
Thorne Lake	Y	Y	Y	Y	Y(r)	Y	Y
Thorne River Intertidal	Y	Y	Y	Y	Y	Y	Y
Tiny[2/]							
Torrent	Y				Y(r)		
West Fork Luck Creek	Y	Y	Y	Y	Y(a,r)	Y(a,r)	Y
West Fork North Thorne	Y		Y	Y	Y(a,r)	Y(a,r)	Y

Source: ADF&G Anadromous Waters Catalog (http://www.ADF&G.alaska.gov/sf/SARR/AWC); Forest Service Field Sampling data, RCS data

1/ All fish are assumed to be anadromous unless indicated by "a" for anadromous or "r" for resident as determined by Forest Service field data collection and RCS database

2/ ADF&G Anadromous Fish Catalog have no data for these subwatersheds and no Forest Service field or RCS data are available for the subwatershed.

This species is ubiquitous in Southeast Alaska (Carls et al. 2008). Juvenile herring typically spend their first 3 years of life in nearshore regions commonly utilizing bay areas. As they grow they reside in deeper offshore waters. They are primarily a pelagic species. Sampling has been limited in the shoreline areas near the project area so exact distribution in this region is also limited. Spawning has been documented near Craig/Klawock and Thorne Bay (Pritchett 2006 as cited in Carls et al 2008). Thus this species may occur in shoreline areas in the vicinity of the project.

During February and March, herring concentrate near the bottom (at 200 to 300 feet) off traditional spawning beaches. They remain there until late April, when sea-surface temperatures increase and then move into tidal shallows to commence spawning, which typically takes place over a 2- to 3-week period between late April and early May. After spawning, the adult herring return to deep-water areas. Herring spawning typically takes place in nearshore habitat. Additionally juvenile herring spend early years rearing in nearshore waters feeding on pelagic plankton commonly in bays of Southeast Alaska.

Subsistence Fish

ANILCA requires that federal agencies with jurisdiction over public lands in Alaska analyze subsistence resources and their uses and evaluate potential effects of management activities on these resources and uses (ANILCA Sec. 810). This analysis typically focuses on food-related resources that are most likely to be affected by habitat loss or alteration associated with land management activities. Fish subsistence uses are described in Issue 3 of this chapter and in the Fisheries Resource Report (Knutzen 2012).

Acid Rock Drainage (ARD)

ARD has been an issue for fish resources from past road construction actions in one known region of the Prince of Wales Island. ARD is created when iron pyrite, oxygen, and water combine to produce acidified water that dissolves metal compounds resulting in elevated dissolved metal concentrations in water. About 15 percent of the project area contains rock type (Descon Formation) that has some potential to contribute to ARD. Based on recent past road construction ARD could occur under certain conditions. The details of potential for ARD in the project area are presented under Issue 4**.** During the construction of a road to Coffman Cove (FS Highway 3030) some issues with ARD were found and ultimately remedied. Surveys that were conducted on the ten streams crossed by the ARD affected 3.5-mile road segment, recorded the presence of an orange precipitate in the channelsdownstream of the road. These stream reaches had elevated metals levels and fish avoided those areas, while fish were present in streams outside of those crossed by 3.5-mile road segment (AMEC 2008). Remediation occurred along the 3.5-mileroad segment and subsequent sampling of the streams crossed by this segment found that pH and other constituents in the streams returned to normal levels. The orange precipitate was dissipated and invertebrate populations were similar to unaffected areas as well as fish returned to the stream regions crossed by the affected road segment (AMEC 2008).

Existing Forest roads and quarries in the project area are constructed from the Descon Formation. It is estimated that 253.8 miles of existing road likely constructed from the Descon Shale exist within the project area. It is not known if the material sources used in

this construction contained mineralization. However, no past problems other than those noted above have been observed (Baichtal personal comm. 2011, as cited in Barnhart and Hitner 2012).

Stream Crossings

In the Big Thorne project area, surface road erosion and road prism failures are probably the dominant process by which management disturbance results in occasional sedimentation events. These processes are discussed and effects estimated in the Issue 4 section above.

The Aquatic Habitat Management Handbook (USDA Forest Service 2001) specifies guidelines for fish passage through culverts. These guidelines will be followed in all proposed road reconstruction and new road construction in the Big Thorne project area.

The guiding criteria for culvert design is to allow for natural migration by adult and juvenile fish through the culvert during various flows. The Tongass National Forest developed a juvenile fish passage evaluation criteria matrix with an interagency group of professionals. The evaluation matrix stratifies culverts by type, and establishes thresholds for culvert gradient, stream channel constriction, debris blockages, and vertical barrier (or perch) at culvert outlet. Culvert categories are:

- **Green:** conditions that have a high certainty of meeting adult and juvenile fish passage requirements at all desired stream flows;
- **Gray:** conditions are such that additional analysis is required to determine juvenile fish passage ability; and
- **Red:** conditions that have a high certainty of not providing juvenile fish passage at all desired stream flows.

Most fish stream crossing structures on roads in the Big Thorne project have been surveyed and categorized as green, gray, or red. Some culverts designated as red may not impede larger fish and may pass fish of all sizes during certain stream flow levels. There are 155 red crossings in the project areas and all have known fish populations upstream (Table FISH-6). There are approximately 12 miles of Class I and 22 miles of Class II fish habitat upstream of these red crossings, which represents about 5 percent of the known fish habitat in the project's subwatersheds. Four of these culverts are still in place on temporary roads that have already been decommissioned while the rest are on open roads. See the Fish Passage section below for details on future plans for red culvert treatment.

Table FISH-6. Fish Passage in the Project Area by Subwatershed

Subwatershed	Number of Fish Crossing by Category				Fish Habitat Upstream of Red Culverts (miles)[1/]		
	Total	Green	Gray	Red	Class I	Class II	Total
Baird Peak	0	0	0	0	0.00	0.00	0.00
Barren	7	5	0	2	0.00	0.63	0.63
Big Ratz	28	18	1	9	0.17	1.04	1.21
Central Thorne River	20	7	0	13	2.65	3.13	5.79
Cobble Creek	9	5	2	2	0.00	0.43	0.43
Control Lake	13	4	2	7	0.00	1.49	1.49
Deer Creek	19	9	2	8	0.00	3.55	3.55
Doughnut	0	0	0	0	0.00	0.00	0.00
Eagle Creek/Slide Creek	15	10	0	5	0.19	0.55	0.74
East Fork North Thorne	23	11	0	12	1.14	0.37	1.51
Falls Creek	1	1	0	0	0.00	0.00	0.00
Goose Creek	14	6	0	8	2.78	0.78	3.56
Gravelly Creek	21	9	0	12	0.00	0.96	0.96
Lake Ellen	0	0	0	0	0.00	0.00	0.00
Little Ratz Creek	14	8	1	5	0.04	0.67	0.72
Luck Lake	14	6	0	8	0.00	1.20	1.20
Luck Point	0	0	0	0	0.00	0.00	0.00
No Name	0	0	0	0	0.00	0.00	0.00
North	5	0	0	5	0.11	0.85	0.96
North Big Salt Lake	14	6	0	8	1.61	1.04	2.65
North Kasaan Bay Frontage	0	0	0	0	0.00	0.00	0.00
North Sal	1	0	1	0	0.00	0.00	0.00
Pin	0	0	0	0	0.00	0.00	0.00
Ratz Harbor	8	2	1	5	1.19	0.51	1.70
Rio Beaver Creek	17	11	0	6	0.32	0.35	0.67
Sal Creek	12	8	2	2	0.00	0.16	0.16
Salamander	7	0	0	7	0.00	2.14	2.14
Slide Creek	26	21	0	5	0.00	0.78	0.78
Snakey Lakes Lowlands	22	11	0	11	0.44	0.75	1.19
Thorne	0	0	0	0	0.00	0.00	0.00
Thorne Bay	3	1	0	2	0.00	0.55	0.55
Thorne Lake	3	2	0	1	0.00	0.02	0.02
Thorne River Intertidal	0	0	0	0	0.00	0.00	0.00
Tiny	0	0	0	0	0.00	0.00	0.00
Torrent	1	1	0	0	0.00	0.00	0.00
West Fork Luck Creek	23	11	1	11	0.65	0.30	0.94
West Fork North Thorne	8	7	0	1	0.40	0.00	0.40
TOTAL	348	180	13	155	11.69	22.27	33.96

1/ Upstream habitat distance for some crossings estimated by GIS analysis for this project assessment

Environmental Consequences

See the Issue 4 section for the effects analysis of stream habitat, water quality, and water yield.

Effects Common to all Action Alternatives

Young-Growth Harvest

Some of the proposed harvest in Alternatives 3, 4, and 5 would include commercial thinning of young growth. Commercial thinning would remove trees of commercial harvest size while providing the remaining trees enhanced conditions to accelerate growth. RMAs would be treated the same as standard practices for timber harvest including buffering. Commercial thinning would be equivalent to harvest practices that remove about 35 percent of the forest canopy and general effects to fisheries resources would be similar to those when using comparable harvest methods. Overall effects would be similar to those that occur to comparable partial harvest of old growth with proper implementation of standards and guidelines and BMPs.

Large Woody Debris

In all alternatives, the standards and guidelines for the RMAs will be followed. The design of RMA buffers is described in the unit cards in this Draft EIS. These site-specific designs are expected to effectively protect water quality and fish habitat. LWD recruitment and spacing would remain therefore having no direct or indirect effects and thus no cumulative effects on fish habitat.

Windthrow

The IDT considered windthrow risk and precautionary measures to protect RMAs; this is discussed in detail in the Silviculture section of this chapter. The specific application of the RMA is described for each unit in the unit cards descriptions.

Fish Passage

The Forest Service is required to provide passage for aquatic species under the Clean Water Act (CWA) in the following manner: CWA Section 404 permitting requirements exempt the Forest Service from 404 permitting only if Forest roads are used for silvicultural purposes and are constructed and maintained in accordance with BMPs specified in 33 CFR 323.4(a) providing aquatic passage is one of those BMPs. If the Agency does not provide passage, then a 404 permit must be obtained. All fish stream crossings installed on new roads in all action alternatives will be designed to meet fish passage standards. In addition, all structures will be removed from new temporary roads and these roads will be decommissioned when their use period is over. The action alternatives are expected to result in no measureable direct or indirect effects to fish passage in the project area, as all new fish streams crossings will be crossed with log culverts or bridges. The number of fish streams crossed by alternative is provided in Table WTR-8 under Issue 4.

Additionally, all red crossings that are on roads designated to remain open independent of the project are prioritized on a Forest level to determine the appropriate management plan. Limited funds are allocated by Congress for this purpose, and will be appropriated according to priorities across the Forest. Those red crossings not replaced or removed

will continue to impede fish migration at certain flows and life stages until they are replaced or removed.

As noted in the Affected Environment section, a total of 155 red culverts in the project area inhibit access to fish habitat (Table FISH-6). These culverts inhibit access to about 34 miles of fish habitat, about 12 and 22 miles of Class I and II habitat, respectively (Table FISH-7). Currently, the Central Thorne River and Goose Creek subwatersheds have the most habitat of all subwatersheds with impeded or blocked passage at 5.8 and 3.6 miles, respectively. The Fisheries Resource Report (Knutzen 2012) supplies information on subwatershed and road locations for each of these red culverts. The status of some red culverts will change from those currently scheduled under the No-action Alternative by each action alternative. Any red culvert on a road that had been designated for storage but that is used by the project will be considered for removal at the end of the project (Table FISH-7).

In the No-action Alternative, roads would be stored or decommissioned or culverts replaced under the Prince of Wales ATM, and culvert status considered on a case-by-case basis, when funding becomes available. There are 42 red crossings on roads that are proposed for storage under the Prince of Wales ATM in the Big Thorne project area (Table FISH-7). The storing of these roads would reconnect some of the drainage patterns in the subwatersheds and improve access up to approximately 7 miles of upstream habitat ifif all red culverts are removed, based on the completed upstream habitat assessments and GIS queries as shown in Table FISH-7. There are 108 red culverts blocking nearly three-fourths of all passage-impeded fish habitat (24.6 miles) in the project area that will be prioritized for replacement independent of project actions (Table FISH-7). There are five red culverts scheduled for replacement in 2012 on existing system roads that will remain open, independent of alternative actions, adding 2.32 miles of habitat (Table FISH-7) (see Fisheries Resource Report for details [Knutzen 2012]).

Table FISH-7. Changes in Red Culvert Status by Alternative in the Big Thorne Project Area

Planned Culvert Status[1/]	Upstream Class	Number of Red Culverts and Miles of Upstream Fish Habitat [2/]									
		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Number	Miles	Number	Miles	Number	Miles	Number	Miles	Number	Miles
Potential Project Removal	I	0	0.00	1	0.05	2	0.13	2	0.13	1	0.05
	II	0	0.00	15	3.08	25	4.60	17	3.19	17	3.43
	I&II	0	0.00	16	3.13	27	4.73	19	3.32	18	3.48
Planned Removal	I	4	0.47	3	0.42	2	0.34	2	0.34	3	0.42
	II	38	6.60	23	3.52	13	2.00	21	3.41	21	3.17
	I&II	42	7.07	26	3.94	15	2.35	23	3.75	24	3.59
Replacement 2012	I	2	1.06	2	1.06	2	1.06	2	1.06	2	1.06
	II	3	1.26	3	1.26	3	1.26	3	1.26	3	1.26
	I&II	5	2.32	5	2.32	5	2.32	5	2.32	5	2.32
Prioritized Replacement	I	26	10.16	26	10.16	26	10.16	26	10.16	26	10.16
	II	82	14.41	82	14.41	82	14.41	82	14.41	82	14.41
	I&II	108	24.57	108	24.57	108	24.57	108	24.57	108	24.57
Total	I	32	11.69	32	11.69	32	11.69	32	11.69	32	11.69
	II	123	22.27	123	22.27	123	22.27	123	22.27	123	22.27
	I&II	155	33.96	155	33.96	155	33.96	155	33.96	155	33.96

1/ Status Definitions:
Potential Project Removal = those on existing system roads that had been planned for storage but will be used by the project will be considered for removal at project end. Recommendations for priority removal of some of those that are on reconstructed roads are included in road cards.
Planned Removal = those on roads planned for storage, but dependent on future funding.
Replacement 2012 = those under contract for replacement in 2012 with fish passable structure on roads that will remain open.
Prioritized Replacement = those on roads that will remain open. They will be prioritized forest wide for replacement and dependent on future funds.
2/ Upstream habitat distance estimated by GIS analysis for some culverts for this project assessment (see Fisheries Resource Report [Knutzen 2012])
Source: Forest Service developed RCS data file: CMP_2012_Replacement.shp

No alternatives would affect scheduling of the five red culverts designated for replacement in 2012 or the 108 culverts on existing roads that will be prioritized in the future for replacement. However, among the action alternatives, a portion of the remaining 42 culverts which have been designated for planned removal would have removal considered at project completion. Initial prioritization of removal of red culverts on roads to be reconstructed as part of the respective alternatives has been developed and included in road cards. Within 1 to 5 years after harvest, project roads would be stored, temporary roads decommissioned after their use period is over, resulting in removal of some of the red culverts, reconnecting drainage patterns in the subwatersheds and improving access to a portion of these streams. Alternative 3 influences access to the greatest amount habitat (4.73 miles) above 27 red culverts and has the potential to increase access to the greatest portion of habitat if all red culverts were removed Alternatives 2, 4, and 5 may likely have similar improvements on habitat access, including about 3 miles of primarily Class II fish habitat (Table FISH-7). None of the action alternatives could affect access to a substantial amount of Class I habitat (0.13 mile or less for all action alternatives) if all of these Class I culverts were replaced. Central Thorne River and North Big Salt Lake subwatersheds have the most fish habitat (1.2 and 1.0 miles, respectively) that could potentially be reconnected to downstream fish populations for Alternatives 2, 3, 4, and 5. As noted, prioritization, based on potential amount of upstream habitat that could be reconnected from red culvert removal, has been developed and is included in the road cards. Final decisions on removal of red culverts will be made in the ROD or during implementation on a case-by-case basis.

Overall, there is little difference between the action alternatives as none of the project alternatives would have a marked effect on potentially restoring access to fish habitat upstream of red culverts in the project area. Under the action alternatives, about 3 to 5 miles of habitat at most would potentially have fish passage access improved possibly within 5 to 15 years. Similar passage access may occur under the No-action Alternative but it depends on future non-project funding. Limited Class I habitat will also be gained under any alternative (Knutzen 2012).

The effects of the Old Growth Reserve change on fish habitat and fish resources is discussed in Environmental Consequences section in Issue 2 above, and will not be repeated here. Similarly, direct, indirect, and cumulative effects to aquatic habitat can be found in Environmental Consequences section under Issue 4 above and no further discussion is provided in this section.

Essential Fish Habitat Assessment

Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act states that all federal agencies must consult NMFS for actions and proposed actions that may adversely affect essential fish habitat (EFH) for federally managed marine and anadromous fish species. This Draft EIS and incorporated sections constitute the formal EFH assessment. The Forest Service determined that the Big Thorne project may adversely affect freshwater and marine EFH. NMFS will be consulted on Forest Service determination and they will provide conservation recommendations if needed. The Forest Service will respond to NMFS conservation recommendations in a letter format providing

the Forest Service's formal response. This will satisfy the EFH consultation requirement based on the 2007 Agreement with NMFS. NMFS comments and recommendations and the Forest Service response will provided in an appendix to the Final EIS.

There are four main steps in the consultation process:

1. The Forest Service determines if the proposed action will have "no adverse effect" or if it "may adversely affect" EFH. Only the "may adversely affect" determination triggers consultation.
2. An EFH assessment is prepared by the Forest Service as a component of the NEPA document and forwarded to the NMFS to initiate formal consultation.
3. The NMFS will respond in writing as to whether it concurs with the conclusion in the EFH assessment. In addition, they may provide extra conservation recommendations to minimize effects of the action on EFH.
4. The Forest Service must provide a written response to NMFS within 30 days explaining their evaluation of the conservation recommendations. The response may include reasons for not following the recommendations.

EFH is the water and substrate necessary for fish spawning, breeding, feeding, or growth to maturity. For EFH, "fish" refers to federally managed fish or shellfish species and their prey. Freshwater EFH includes streams, rivers, lakes, ponds, wetlands, and other bodies of water currently and historically accessible to salmon. Marine EFH in Alaska includes estuarine and marine areas from tidally submerged habitat to the 200-mile exclusive economic zone.

EFH for Pacific salmon recognizes six critical life history stages: (1) spawning and incubation of eggs, (2) juvenile rearing, (3) winter and summer rearing during freshwater residency, (4) juvenile migration between freshwater and estuarine rearing habitats, (5) marine residency of immature and maturing adults, and (6) adult spawning migration. Habitat requirements within these periods can differ significantly and any modification of the habitat within these periods can adversely affect EFH.

Description of the Proposed Action

The proposed action (Alternative 2) for the Big Thorne project would harvest 4,944 acres of old-growth National Forest System land and construct 30 miles of new road and reconstruct 19 miles of existing roads and 5 miles of road construction on a decommissioned roadbed on Prince of Wales Island. The other three action alternatives propose harvest ranging from 6,383 to 9,481 acres of combined old growth and young growth, and new road construction ranging from 9 to 41 miles, reconstructed road ranging from 16 to 39 miles, and 6 to 15 miles of road construction on a decommissioned roadbed. The road construction includes both temporary and system roads, which all would be decommissioned or placed into storage after harvest. After timber harvest is complete, temporary roads would be decommissioned when their use period is over, and system roads stored within 1 to 5 years. The number of new road crossings on Class I streams range from zero to seven among the alternatives (exclusive of reconstructed crossings or those over reused decommissioned roadbeds). All fish streams on new roads and those constructed roads on decommissioned road prisms would be crossed with a bridge or log

culvert structure. These structures would be prioritized for removal during system road storage, 1 to 5 years after timber harvest is complete, and for temporary roads to be decommissioned, after their use period is over. Various yarding systems including cable, shovel, and helicopter are proposed. Logs would either be trucked to mills on the island or barged from one of the MAFs discussed below.

Potential Adverse Effects on Freshwater EFH

The Big Thorne project area has over 1,500 known miles of stream in 37 subwatersheds that have some proposed activities among all considered alternatives. Of this total, 412 miles are Class I streams (see Table FISH-3). Eagle Creek, Thorne River, Ratz Creek, and tributaries are important fish-bearing streams in the Big Thorne project area. Eagle Creek, Thorne River, and Ratz Creek have pink, chum, sockeye, and coho salmon, Dolly Varden char, cutthroat trout, and steelhead (ADF&G 2011b). Table FISH-8 shows the salmon species and their life stage that could be affected by the Big Thorne project.

Table FISH-8. Salmon Species and their Freshwater Life Stages that could be Affected by the Big Thorne Project

Salmon Species	Freshwater Eggs	Freshwater Larvae and Juveniles	Estuarine Juveniles	Freshwater Adults
Pink	X	X	X	X
Chum	X	X	X	X
Sockeye	X	X	X	X
Coho	X	X	X	X

As discussed in the existing conditions section, ARD has been an issue for fish resources from past road construction actions in one known region north of the project area on the Prince of Wales Island. In this area, over 3.5 miles of stream habitat and fish resource were adversely affected by ARD (AMEC 2008). Remediation actions were found to remedy the problem area. The pyritic material in the naturally occurring Descon formation can produce acid drainage to streams under the right water and air conditions (see Issue 4 in this section for analysis of the effects of this relative to project actions). This material however has commonly been used for road construction in the Big Thorne project area (estimated to be over 250 miles of roads) without apparently causing ARD to streams or adversely affecting fish resources.

Road construction and quarry development as a result of the project would utilize and excavate into the underlying Descon Shale. It is estimated that 6.3 miles of new road construction with Alternative 2 would be across Descon Shale bedrock. Any existing material source or newly developed source within the Descon Formation and used to construct access to the proposed harvest areas shall be assessed as to its ARD potential.

As discussed under Issue 4, actions will be in place, including monitoring of rock sources and potential installation of limestone rock to neutralize acid runoff, to insure that potential ARD issues for fisheries and aquatic resources will be controlled and eliminated for any potential project-related action.

In this EFH assessment, the Forest Service determined that the Big Thorne project may adversely affect EFH because fish streams are directly or indirectly affected by harvest and stream crossings. All action alternatives would result in minor effects on water

quality and aquatic habitat. These potential impacts include increased peak flows, increased sediment delivery, altered riparian vegetation (Class IV streams and new road stream crossing), and disturbed channel integrity (see Issue 4). While all of these effects are minor, they will have some short-term adverse effects to migratory, spawning, and rearing habitat for anadromous salmonids. However, by following the standards and guidelines and BMPs in the Forest Plan, the effects on EFH would be minimized for the following reasons:

- All newly constructed and reconstructed NFS system roads that are used for the Big Thorne project would be left open seasonally for wood gathering and stored within 1 to 5 years after timber haul and associated activities are complete Temporary roads would be decommissioned after their use period is over and priority fish passage structures on newly constructed temporary roads would be removed in all alternatives. Any impassable existing culverts (ie red pipes) on rebuilt roads that are stored or decommissioned would be prioritized for removal on a case-by-case basis.
- All Class I and II streams in the Big Thorne project area would be protected by a minimum no-cut buffer of 100 feet with additional area protected depending on process groups, sensitive riparian soils, elevated windthrow concern, and other relevant resource concerns according to the Forest Plan and Tongass Timber Reform Act.
- Class III streams would be protected at least by a no-harvest buffer to the top of the side slope (v-notch) according to the Forest Plan (USDA 2008b).
- Additional precautionary measures would be prescribed to minimize windthrow in RMA buffers where the risk of windthrow is high. These measures include retaining additional trees adjacent to the RMA.
- Maintenance will be built into road construction contracts that will correct existing erosion features.
- Bridges or log culverts would be placed over fish streams on new road crossings and constructed roads over existing road prisms to avoid risks of channel disturbance and culvert blockage. Priority crossings would be removed when roads are stored (system roads) or decommissioned (temporary roads).
- BMPs would be implemented to protect water quality and aquatic habitat protection for all freshwater streams within the project area. See unit cards (Appendix B) for specific applications of BMPs.
- Any rock sources from Descon shale area formation used for road surfacing and road construction in all alternatives would be assessed as to its ARD potential to minimize effects on pH and dissolved metals concentrations in streams on the project area.

Potential Adverse Effects on Marine EFH

The two MAFs that the Big Thorne project may use are the Coffman Cove and Thorne Bay MAFs. On October 31, 2008, the State of Alaska Department of Environmental Conservation (ADEC) assumed authority over the Authorization to Discharge under the

Alaska Pollutant Discharge Elimination System (APDES) for Section 402 modification of Section 404 permits for log transfer facilities which received a Section 404 permit prior to October 22, 1985, and log transfer facilities in Alaska. The Tongass National Forest requested and received for most sites an adoption and/or renewal of the pre-existing NPDES General Permits for both pre-1985 (AK-G70-000 and post-1985 (AK-G70-1000) log transfer facilities in Alaska. The Coffman Cove site was renewed on April 15, 2009; however, the Thorne Bay APDES site permit was not renewed (see Thorne Bay MAF section below). Because the waters in this part of the bay are 303 (d) listed for bark residue, no additional bark discharge is allowed in these waters until the water quality issues are resolved. Thus, no permit reissuance for an APDES is allowed under State or Federal regulations. Additionally, the Coffman Cove site has been transferred to the authority of the City of Coffman Cove, and is no longer a Forest Service–managed facility.

Coffman Cove MAF

The MAF in Coffman Cove is a viable option for a timber purchaser to move logs off Prince of Wales Island. The Coffman Cove MAF is a sloped shot-rock fill with a mid-tide riprap-buttressed barge loading ramp. This is a barge loading–only facility. It was recently (2011) used for barging of logs destined to Klawock. The last dive survey was in 2001 with a zone of bark deposit of 0.18 acre. If log transport in water were to occur at this site other than by barge, additional dive surveys would be needed. The Forest Service conducted an overlapping dive survey in 2003 from the MAF to the new site of the Inter-island Ferry Authority ferry dock to identified eelgrass beds. Only one eelgrass bed was found close to the MAF site, which covered approximately one square meter. The majority of the intertidal plant growth was *Fucus* sp. (rockweed), *Desmarestia viridis*, and *Halosaccion glandiforme* (sea sac).

The Alaska Department of Natural Resources tideland lease number is ADL 27882 expiring in 2021 and was transferred to the City of Coffman Cove. The National Pollutant Discharge Elimination Permit (NPDES), AK-G70-0039, was issued on February 7, 2003. The Coffman Cove site was renewed as a state administered APDES permit in April 15, 2009. As noted above, use of this facility is now managed by the City of Coffman Cove.

Thorne Bay MAF

The MAF in Thorne Bay is viable option for a timber purchaser to move logs off Prince of Wales Island. The sort yard has a trap to reduce sedimentation entering the waters of Thorne Bay. The Thorne Bay MAF is listed as a Tier I, Category 5, Section 303(d) water quality limited waterbody (ADEC 2006b, p. 89). The Thorne Bay MAF (Alaska ID #1010362) was placed on the 1996 Section 303(d) list for debris (bark and woody material from the MAF and log raft area), and hydrogen sulfide (ADEC 1996, p. 39). Excess debris from the MAF has accumulated on the bottom of Thorne Bay. Review of the data in 1998 showed that the levels of hydrogen sulfide complied with water quality standards outside the mixing zone authorized for dredging. Hence, hydrogen sulfide was removed from the listing by ADEC in 1998 (ADEC 1999, p. 5). In 2006, ADEC removed the marine log storage area in Thorne Bay from the 303(d) listing but not the remaining 35-acre log transfer area.

While the MAF is in operation, dive surveys must be conducted annually to monitor bark accumulation (ADEC requirement). Bark debris has been shown to smother natural substances and potentially reduce prey organisms. The last dive to monitor the bark deposit took place during April 2004. The MAF had an area with continuous bark cover of 6.45 acres and an area with discontinuous bark cover of 2.26 acres. Thorne Bay has a zero maximum daily loading for the bark contaminant; therefore this is a barge loading only facility. Therefore, no permit reissuance for an APDES permit is allowed under state or federal regulations. Since no in-water log storage or direct in-water log rafting is planned, no more-recent dive surveys have been made in this region.

For both facilities, elimination of transportation of logs by in-water rafting would nearly eliminate any bark accumulation in the respective bay area, thus greatly reducing potential adverse effects to marine systems associated with bark accumulation.

Table FISH-9 and Table FISH-10 show the fish species that may be located in the marine environments and their life stage that could be affected by the use of the log transfer facilities for the Big Thorne project.

Table FISH-9. Marine Species and Their Life Stages that could be Affected by the Big Thorne Project

Species	Eggs	Larvae	Early Juvenile	Late Juvenile	Adults
Arrowtooth Flounder *(Atheresthes stomias)*		X		X	X
Atka Mackerel *(Pleurogrammus monopterygius)*		X			X
Dover *Sole (Microstomus pacificus)*	X	X		X	X
Flathead Sole *(Hippoglossoides elassodon)*	X	X		X	X
Pacific cod *(Gadus macrocephalus)*	X	X		X	X
Pacific Ocean Perch *(Sebastes alutus)*		X		X	X
Rex *Sole (Glyptocephalus zachirus)*	X	X		X	X
Rock Sole		X		X	X
Sablefish *(Anoplopoma fimbria)*	X	X		X	X
Sculpin *(Cottidae* family)				X	X
Shortraker/Rougheye Rockfish *(Sebastes borealis)*		X			X
Skates *(Rajidae* family)					X
Squid				X	X
Walleye Pollock *(Theragra chalcogramma)*	X	X		X	X
Weathervane Scallops				X	X
Yelloweye Rockfish *(Sebastes ruberrimus)*		X		X	X
Yellowfin sole *(Limanda aspera)*	X	X		X	X

Table FISH-10. Salmon Species and Their Marine Life Stages that could be Affected by the Big Thorne Project

Salmon Species	Estuarine Juveniles	Marine Juveniles	Marine Immature and Maturing Adults
Pink	X	X	X
Chum	X	X	X
Coho	X	X	X
Sockeye	X	X	X

Primary prey items for the following species are based on the Gulf of Alaska Fishery Management Plan (NPFMC 1998):

- Sablefish feed throughout the water column. Larval sablefish feed on a variety of zooplankton. Juveniles feed primarily on macrozooplankton and euphausiids. Adults are opportunistic feeders. Their main diet is other fish, including salmon fry and Pollock. Other food includes benthic invertebrates, squid, jellyfish, and fishery discards.
- Sculpins mainly feed near the bottom. Prey items include crabs, barnacles, and mussels. Larger sculpins eat fish.
- Adult chum, sockeye, coho, and pink salmon are primarily fish eaters, although pelagic crustaceans and squid are also consumed, particularly by pink salmon. Juvenile salmon consume plankton and small crustaceans.
- Arrowtooth flounder feed in gravel-mud substrates near the seafloor. Adults feed on other groundfish. Juveniles feed on euphausiids, crustaceans, amphipods, and young pollock. Larvae feed on phytoplankton and zooplankton.
- Pacific cod are omnivorous. Adult cod feed mostly on other fish such as walleye pollock, yellowfin sole, and fisheries discard. Young cod feed mostly on invertebrates such as amphipods, crangonid shrimp, polychaete worms, and bivalves.
- Skates feed on bottom invertebrates (crustaceans, mollusks, polychaetes) and fish.
- Walleye pollock feed throughout the water column on copepods, euphausiids, young pollock, and other fish.
- Yelloweye rockfish eat primarily fish including other small rockfish, herring, sandlance, as well as caridean shrimp, small crabs, and lingcod eggs.
- Shortraker and rougheye rockfish feed primarily on shrimp, squids, and myctophids. Juveniles feed on shrimp and amphipods.
- Pacific Ocean perch are overwhelmingly planktivorous, and may eat small shrimp and squids. Juveniles eat mostly calanoid copepods and euphausiids.

Primary prey items for the following species are based on information from the National Oceanic and Atmospheric Administration Alaska Fisheries Science Center website:[2]

[2] http://www.afsc.noaa.gov/

- Atka mackerel are a schooling semi-demersal fish. Juveniles and adults eat mainly copepods and euphausiids, but have been known to eat shrimp, gastropods, annelids, and fish eggs and larvae.
- Rock sole eggs are adhesive and are laid on the bottom of the ocean. The larvae that hatch consume small zooplankton until they metamorphosis into juveniles. Juveniles are abundant in shallow, near-shore waters and feed on polychaetes and small crustaceans. Adult continue to eat small invertebrates throughout their lives.
- Yellowfin sole adults exhibit a benthic lifestyle and occupy separate winter spawning and summertime feeding distributions feeding mainly on benthic infauna and epifauna, euphausiids, and fish.
- Flathead sole adults exhibit a benthic lifestyle and occupy separate winter spawning and summertime feeding distributions with their diet composed primarily of organisms living on the bottom (epibenthic) and pelagic organisms in close association with the bottom (nektobenthic). Flathead sole less than 30 centimeters (cm) total length consumed mainly mysids, gammarid amphipods, and decapod shrimps, whereas flathead sole larger than 30 cm total length consumed mainly ophiuroids, walleye pollock, and decapod shrimps.
- Rex sole feed almost exclusively on benthic invertebrates. Small (<15 cm standard length [SL]) rex sole feed mainly on amphipods and other crustaceans. Large (15-45 cm SL) rex sole prey chiefly on polychaetes. Rex sole <20 cm SL prey primarily on euphausiids, decapod crab larvae, copepods, *Oikopleura*, and ostracods. Mollusks form only a minor part of rex sole diet. Euphausiids are principal prey only during summer and cumaceans and *Oikopleura* are more common during the winter.
- Dover sole feed almost exclusively on benthic infaunal and epifaunal invertebrates, mainly polychaetes, ophiuroids, and mollusks. Amphipods are important crustacean prey and Pelecypods make up the most molluskan biomass consumed. Annelids are usually dominated in the diet of juvenile Dover sole.

The Forest Service determined that the Big Thorne project may adversely affect marine EFH in the project area. Adverse effects include diminished habitat for managed species and their prey and reduced rearing capability for juvenile salmon due to potentially reduced water quality. Water quality effects include fuel spills from equipment used for loading barges which are likely to be limited in both quantity and distribution as most activity and spills would be on shore having only localized effects to nearshore fish and fish food resources from runoff to the marine environment. Impacts to these waters are expected to be minimal for the following reasons:

- Standards and guidelines of the Forest Plan and implementation of BMPs would be used at the Thorne Bay facility
- Coffman Cove and Thorne Bay MAFs are barge loading–only facilities greatly reducing potential for adverse bark accumulations and they would be the most viable options for a timber purchaser to move logs off Prince of Wales Island.

EFH Conclusion

Based on the known effects from timber harvest and road building, the Forest Service believes that the Big Thorne project may adversely affect freshwater EFH and marine EFH. The Forest Service determines that by implementing Forest Plan standards and guidelines, BMPs, and project-specific mitigation, effects to essential fish habitat would be minimized under all action alternatives. Additional impacts to EFH are likely to occur only from unforeseen events such as landslides, debris blockages of culverts, fuel spills, and road failures. A copy of this Draft EIS will be sent to the NMFS, and the Forest Service will continue participating in the EFH consultation process.

Threatened, Endangered, and Proposed Listed Fish or Sensitive Fish Species

Herring rearing, feeding and spawning habitat can be adversely affected by actions that add sediment such as dredging, reduce water quality such as oil spill, nearshore habitat modification including log storage, and other related construction actions like boat traffic and noise (Carls et al.1999, Misund et al. 1996, Valbo et al. 2002, Barnhart 1988, NOAA 2012). , To the degree that these activities occur in association with this project, the potential exists for impact. However, currently implemented standard BMPs during all project phases would greatly reduce the potential for these types of impacts. Log transport activities at the potential MAFs of Prince of Wales Island may have some effect on nearshore habitat use by juvenile herring as well, although the effect would be very minor and infrequent.

In summary, Alternative 1 would not affect Southeast Alaska DPS Pacific herring, a Tongass National Forest Sensitive species, because no action would be undertaken. Under Alternatives 2, 3, 4, and 5, Pacific herring is unlikely to have substantial adverse effects as direct spawning disruption is unlikely to occur from specific actions at any of the MAF and effects to rearing habitat quality and quantity would be slight and infrequent from all potential project actions.

Also, the presence of Threatened or Endangered salmon and steelhead from the Pacific Northwest has commonly been documented for Southeast Alaska inside channels. Occurrence near project affected areas and facilities is unknown, but may be uncommon (Tucker et al. 2011; Oris and Jaenicke 1996; Trudel et al. 2009; McNeil and Himsworth 1980). No critical habitat has been designated for these species in Alaskan waters. Based on the 2008 Forest Plan (USDA Forest Service 2008c) any proposed actions indirectly resulting from the Forest Plan will be evaluated on case-specific bases as to their effect on listed species and may include formal or informal consultation with NMFS at the time of project evaluation. This will include the development in a report called a Biological Assessment (BA). A completed BA/BE (Biological Evaluation) for the Big Thorne project, which includes federal ESA listed and candidate fish species and Forest Service sensitive species that may be near the proposed project, is included in a separate document in the project record. The conclusion of the BA, which considered the actions of all alternatives, is that the project would not cause any adverse effects to federally listed fish species, resulting in a “no effects” determination. The conclusion in the BE for the Forest Service sensitive Pacific herring is “*may impact individuals but is not likely to cause a trend to federal listing or loss of viability*.”

Wetlands

Introduction

This section summarizes wetland resources in the project area. Wetlands are defined by the Tongass Forest Plan, U.S. Army Corps of Engineers, and the U.S. Environmental Protection Agency (EPA) as "those areas that are inundated or saturated by surface water or groundwater with a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions" (33 CFR 328.3; 40 CFR 230.3). The three widely accepted functions that wetlands may provide are water quality improvement, hydrologic functions, and wildlife habitat. Wetlands may reduce flooding, improve water quality through sequestration of physical (sediment) and chemical contaminants in the water, and provide habitat for a variety of plants and animals.

Management activities on NFS lands are required to comply with the Forest Plan and federal and state laws. Relevant standards and guidelines and regulations intended to protect wetlands include the Tongass Forest Plan; Executive Order 11990 (Protection of Wetlands), and the Clean Water Act (CWA). Wetlands are extensive in the project area, covering more than half of the land area. Due to the extent of wetlands in the project area and because forested wetlands are managed for their timber resources, complete avoidance of wetlands during road planning and construction is not feasible. However, higher value and rare wetlands such as estuaries and tall sedge fens have been avoided. . Where a wetland cannot be avoided, the impacts are to be minimized. Best management practices (BMP) 12.5 provides guidance for wetland information, evaluation, and protection.

Wetland type and extent were estimated based on the Tongass Wetland Mapping layer and field verified in about 85 percent of the old-growth units. The young-growth units have not been field verified; however, additional field review for these units would be conducted upon implementation. Wetlands were classified according to the Tongass Wetland Classification System (DeMeo and Loggy 1989). Additional detailed information regarding the regulatory framework, methodology, and analysis of wetlands in the project area can be found in the Soil and Wetland Resource Report (Cox et al. 2012).

Affected Environment

Approximately 55 percent of the project area (127,386 acres) is covered by wetland. Wetland types are interspersed throughout the project area, although some wetland types tend to be more common in some portions of the project area. Forested wetlands comprise about 25 percent of the project area and are particularly common in the southern third of the project area. Forested wetland/emergent short sedge complex wetlands comprise about 13 percent of the project area and are common along the eastern and western edges of the project area. Non-forested wetland types comprise 18 percent of the project area and are interspersed throughout the project area, although alpine wetland is particularly common in the north-central portion of the project area. Wetland types are described in detail in the following sections.

Wetland Types

Forested Wetland

Forested wetlands are wetlands dominated by vegetation greater than 20 feet in height. In the project area, species composition of the overstory is varied and may contain the following species: western hemlock (*Tsuga heterophylla*), western red-cedar (*Thuja plicata*), shore pine (*Pinus contorta)* and yellow cedar (*Callitropsis nootkatensis*). The understory is often dominated by skunk cabbage (*Lysichitum americanum*) and deer cabbage (*Nephrophyllidium crista-galli*). Forested wetlands occur on poorly or very poorly drained hydric mineral and organic soils. Forested wetlands are most common on broad glacial valley bottoms, gently sloping hill slopes or benches, but are also commonly found on steep terrain in areas overlaying volcanic geology. Forested wetlands provide important functions including wildlife habitat, water quality improvement, peak flow reduction and erosion control, organic matter production and export, and nutrient and carbon cycling (Cooke 2005). Forested wetlands may support the transfer of water to downslope resources, function as recharge areas for groundwater and streams, and provide depositional areas for sediment and nutrients. The project area contains 57,450 acres of forested wetland, comprising approximately 25 percent of the land area in the project area.

Forested Wetland/Emergent Short Sedge Complex

The forested wetland/ emergent short sedge complex is less than 50 percent forested. The forested wetland and emergent short sedge wetlands are so intermixed that they cannot be mapped at a small scale. Forested wetland/ emergent short sedge complexes share characteristics of both forested wetland and emergent short sedge types. Sphagnum mosses, sedges, and skunk cabbage dominate these wetlands with low volume class hemlock, cedar, and pine. Soils are very poorly drained hydric organic soils, with occasional hydric mineral soils in small pockets of forested wetland. These complexes are commonly found in riparian areas and occur in gently sloping hill slopes and benches, glacial valley bottoms, lower foot slopes, and on broad ridge tops. Both complexes contribute to the transfer of water downslope, groundwater and stream recharge, and carbon and nutrient cycling. These complexes provide terrestrial and aquatic habitat for wildlife species, such as black bear, deer, and mink. The forested wetland/emergent short-sedge complex is the second most abundant type of wetland in the project area and covers approximately 29,361 acres and 13 percent of the project area.

Emergent Short Sedge Wetland

Emergent short sedge wetlands contain organic soils that are very poorly drained, moderately deep and are dominated by short sedges and mosses, although there are often patchy areas of shrubs and shore pine. They may include poor fens and rich bogs and there is typically some water flow through. Emergent short sedge wetland is often found on lower foot slopes, in valleys, and on broad ridge tops. These wetlands provide habitat for distinctive plants and animals and contribute water to downslope resources, provide carbon and nutrient cycling benefits for watershed function, provide water storage for flood and erosion control (EPA 2011). These wetlands cover approximately 10,085 acres (4 percent of the project area).

Emergent Tall Sedge Fens

Emergent tall sedge fens are characterized by a diverse community of sedges, dominated by tall sedges such as Sitka sedge, with a variety of forbs and occasional stunted trees, usually spruce or hemlock. Soils are typically deep organic muck, often with some thin layers of alluvial mineral soil material. They occur in landscape positions where they receive some run-off from adjacent slopes resulting in somewhat richer nutrient status than bogs. These wetlands function as areas of recharge of groundwater and streams, deposition and storage of sediment and nutrients, and for waterfowl and terrestrial wildlife habitat, including black bear, mink, river otter, and beaver. Tall sedge fens are located in areas with water flow through and many contain beaver ponds; the open water component provides habitat for a variety of wildlife including waterfowl, beaver, otter, and fish. Tall sedge fens account for about 2,549 acres (1 percent) of the project area.

Alpine Muskeg

Alpine muskegs are similar to emergent sedge and muskeg complexes; however, they occur at higher elevations in the landscape, such as ridge tops and mountain summits and are typically closed hydrologic systems. Alpine muskegs are dominated by sphagnum moss with a wide variety of other plants adapted to very wet, acidic, organic soils. Vegetation is a combination of muskeg and sedge meadows of peat deposits, and low-growing blueberry and heath on higher rises. Similar to muskeg, stunted trees less than 15 feet high are common. Alpine muskegs are important for snow storage and can be a source for snowmelt water throughout the spring and early summer months. These wetlands also provide summer habitat for wildlife. Alpine muskeg wetlands cover approximately 20,653 acres (9 percent) of the project area.

Moss Muskeg

Moss muskegs are characterized by nutrient-limiting acid peat bogs, dominated by sphagnum moss and peat deposits. Muskeg wetlands support a distinctive flora which are adapted to life in these acidic, wet, low-nutrient environments (EPA 2011). Common plants include ericaceous shrubs such as cranberry (*Vaccinium oxycoccos*) and blueberry (*Vaccinium spp.*), cottongrass (*Eriophyllum spp.*), Labrador tea (*Ledum grandifolium*), and sundews (*Drosera spp.*) and occasional stunted trees, particularly shore pine (*Pinus contorta*), may also be present. Soils are typically organic peat deposits and accumulate over unconsolidated glacial till or impermeable glacial silts, typically on gentle or nearly level slopes. Moss muskegs often have no significant inflow or outflow of water other than precipitation, thus ponded areas, a result of a high water table, occur within the wetland. These wetlands function as areas of surplus water and peat accumulation creating a stable microclimate and habitat for waterfowl and wildlife, including cranes, black bear, amphibians, mink, and deer. Moss muskegs account for approximately 7,240 total acres (3 percent) of the project area.

Estuaries

Estuaries are intertidal zones where brackish saltwater mixes with fresh water from rivers or streams. They are the least represented type of wetland on the project area supporting complex and productive ecosystems for vegetation, fish and wildlife. There are two types of estuarine wetlands: emergent wetlands in the upper tidal zone, and intertidal, regularly flooded zones. The emergent wetlands are characterized by grasses and sedges, especially

tufted hairgrass (*Deschampsia caespitosa*), Lyngby's sedge (*Carex lyngbei*) and dune wild rye (*Leymus mollis*) in the upper tidal zone. The intertidal, regularly flooded zone largely comprises aquatic algal beds and rocky or unconsolidated shore. The Forest Service manages the estuarine wetlands above mean high tide (USDA Forest Service 2008). The Forest Plan standards and guidelines give estuaries a 1,000-foot buffer. Estuaries cover approximately 47 acres in the project area.

Past Activities that affected Wetlands

The majority of wetlands in the project area are undisturbed and intact. However, because 55 percent of the project area is covered by wetlands, total avoidance has not been practicable. Past impacts include forested wetlands that were previously logged as well as road construction through wetlands. Previously logged forested wetlands are in the process of regenerating, and support young forests. Past road construction in both uplands and wetlands, primarily associated with timber harvesting, has occurred in the project area.

Road Construction

Roads across sloping wetlands may affect hydrologic connectivity across the wetland due to road ditches or road fills. A total of 1,113 acres of wetland have been replaced by roads in the project area. Road building on wetlands has occurred primarily on forested wetland (about 691 acres) and forested wetland/ emergent short sedge wetland (301 acres), covering about 1 percent of each wetland type in the project area. Forested wetlands and forested wetland/ emergent short sedge wetlands are common, covering nearly 25 and 13 percent of the project area, respectively.

Implementation of adequate road drainage minimizes the impacts to hydrologic connectivity of wetlands. About 120 acres of a combination of tall sedge fen, emergent sedge fen, moss, and alpine muskeg wetlands have been converted to road, less than 1 percent of the total acreage of these wetland types. Based on research regarding the effect of road construction impacts on adjacent wetlands in Southeast Alaska (Glaser 1999; Kahklen and Moll 1999; McGee 2000), effects to wetland hydrology and vegetation adjacent to these roads are expected to be limited to a few meters of the road. Table WET-1 displays the existing acreage and miles of wetlands impacted by roads.

Past Harvest

Timber harvest on wetlands has temporary effects on wetland hydrology. Rainfall interception studies (Patric 1966; Beaudry and Sagar 1995; Banner et al. 2005) indicate that the amount of rainfall hitting the soil surface will increase following clearcutting. Soils within harvested sites tend to gain higher moisture levels resulting in slower growth in the seedling and sapling stage. Soil moisture conditions remain elevated until evapotranspiration surfaces in the canopy of a young stand become equivalent to pre-harvest conditions. Depending on the soil moisture status of the wetland, this effect can range from negligible to lasting more than 20 years. In partially harvested stands, retention of a portion of the canopy cover would help minimize the effect of timber harvest on soil moisture. Many of the forested wetlands on the Big Thorne project area support commercial stands of timber. Some of these stands have been harvested in the

past and some are proposed for harvest in this EIS. Table WET-1 displays the existing acres of wetlands harvested by wetland habitat type.

Table WET-1. Existing Road Construction and Timber Harvest on Wetlands

Habitat Type	Total Acres in Project Area	Road Construction			Timber Harvesting	
		Acres Filled for Road Construction	Percent of Type Filled in Project Area	Miles of Road	Acres Harvested	Percent of Type Harvested in Project Area
Moss Muskeg[1]	7,240	61	0.8%	12.8	546	8%
Alpine Muskeg[1]	20,653	6	<0.1%	1.2	54	0.3%
Emergent Tall Sedge Fen[1]	2,549	6	0.2%	1.2	145	6%
Emergent Short Sedge Fen[1]	10,085	47	0.5%	9.8	294	3%
Forested Wetland/ Emergent Short Sedge Complex	29,361	301	1.0%	62.6	2,833	10%
Forested Wetland	57,450	691	1.2%	143.2	10,458	18%
Estuarine	47	0	0	0.1	14[2]	28%
Totals	**127,385**	**1,112**	**0.9%**	**230.9**	**14,344**	**11%**

[1] Harvested acres of non-forested wetland included due to inclusions of small areas within past harvest units.
[2] Harvested prior to forest plan requirements that prohibit harvesting in estuaries.

Wetland Avoidance

The extent of wetlands in the project area has resulted in past wetland impacts. Approximately 41 percent of existing roads in the project area are in wetlands and 55 percent of the project area is wetland. Thus, it can be concluded that past road construction activity has avoided wetlands where practicable, because the proportion of roads in wetlands is lower than the proportion of roads in the project area.. However, wetland impacts have occurred as a result of the extensive, interspersed wetland coverage in the project area and the location of harvestable timber. Access to timber through road construction on wetlands is often the most economically viable and lowest overall impact option. Wetland impacts from road construction have occurred to access timber, which may be located on forested wetland or on upland areas separated by wetland. Wetland impacts have also occurred when steep slopes are avoided for road construction; often construction of a road in a wetland is the environmentally preferred alternative to construction on a steep slope. Within the context of past project objectives, including economics and minimizing environmental harm, past road construction has avoided wetlands to the extent practicable in the project area.

Environmental Consequences

The analysis area selected for direct, indirect, and cumulative effects of the project includes the entire project area. This boundary was selected because project effects on wetlands are primarily limited to the watershed of the effected wetlands and the project area generally follows watershed boundaries. An interdisciplinary project team has identified key indicators for measuring project effects on wetlands. These indicators are:

- Acres of wetland filled for road construction,
- Acres of harvest on forested wetlands, and

- Cumulative acres of wetland habitat harvested and removed from productivity by roads.

The effects of the Big Thorne project on wetlands would be limited through the site-specific application of Forest Plan standards and guidelines as well as BMPs for all action alternatives. In particular, the LUD-specific measures identified in Chapter 3, the Forest-wide measures identified in the Wetlands section of Chapter 4 of the 2008 Forest Plan, and the baseline provisions included in the CWA, would be implemented.

All action alternatives propose some level of timber harvest on forested wetlands. The effects of timber harvest (primarily increased soil moisture levels) on forested wetlands are expected to be temporary. All harvested sites are expected to regenerate naturally.

Due to the preponderance of wetlands and the interspersed nature of wetlands with uplands on the project area, complete avoidance of wetlands from proposed road construction activities is not practicable. Most proposed roads would be constructed on forested wetlands and uplands. All estuaries are avoided by proposed roads in the action alternatives. All proposed roads will be constructed according to state approved BMPs as required by 33 CFR 323. State-approved BMPs consist of those BMPs documented in FSH 2509.22 and documented on the road cards in the Big Thorne project record. All roads through wetlands will also follow the 15 baseline provisions provided in 33 CFR 323 also documented on the road cards. Table WET-2 provides a summary of proposed timber harvest and road construction wetlands.

The four action alternatives avoid wetlands to the extent practicable. Site-specific wetland avoidance is documented on the road cards for NFS road segments and the unit cards for temporary road segments (unit cards and road cards are in Appendices B and C of this EIS). At the project scale, 42 percent of all proposed roads, both NFS and temporary, are on wetlands in Alternative 2. In Alternatives 3, 4, and 5, a total of 35, 37, and 37 percent of the proposed NFS and temporary roads are on wetlands, respectively. Within all action alternatives, from 26 to 36 percent of the proposed harvest is on sites classified as forested wetlands. Access within and to these stands often requires crossing wetlands.

Table WET-2. Road and Timber Harvesting Impacts on Wetland Types by Action Alternative

Impact Type	Wetland Type	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Road Construction[1/2/] (acres)	Moss Muskeg[4]	0.7	2	0.2	0.1
	Alpine Muskeg[4]	1	1	0.1	0
	Emergent Tall Sedge Fen[4/]	0	0	0	0
	Emergent Short Sedge Fen[4/]	0.3	0.3	0.3	0
	Forested /Emergent Short Sedge Complex	11	13	4	0.4
	Forested Wetland	61	74	20	19
	Total Acres of Wetland Road Impact	**74**	**90**	**25**	**19**
Timber Harvesting[3/4/] (acres)	Moss Muskeg[4/]	24	34	16	27
	Alpine Muskeg[4/]	6	11	11	11
	Emergent Tall Sedge Fen[4/]	0	0	0	0
	Emergent Short Sedge Fen[4/]	10	18	17	17
	Forested /Emergent Short Sedge Complex	77	192	165	176
	Forested Wetland	1,732	2,776	1,653	2,074
	Total Acres of Harvested Wetland	1,850	3,031	1,863	2,304

1/ Road acreage calculated based on a 40-foot wide road disturbance area.
2/ Reconstruction of temporary roads through wetlands is not included in the proposed road construction numbers, as these areas are included in number of acres of existing roads.
3/ Includes all harvest prescriptions, including partial harvest and young growth thinning.
4/ Acres of harvest on non-forested wetland are due to small inclusions of forest land within a wetland map unit that is typically non-forested, or small inclusions of non-forested wetland on the edges of or inside harvest units.

Alternative 1 – No Action

Description of Alternative 1

Alternative 1 is the No-action Alternative. In addition to being an alternative to the proposed action it provides a baseline for evaluation of the impacts associated with the action alternatives. It would result in no timber harvest or road construction activities in wetlands as a result of the project.

Direct and Indirect Effects of Alternative 1

No wetlands would be impacted under Alternative 1 due to harvest or road construction as a result of the Big Thorne project. Vegetation on forested wetlands harvested in the past would continue to grow toward hydrologic maturity (many stands have already reached this stage). Wetlands impacted by roads in the past would continue to be impacted. Vegetation would occupy ditch lines and, in the case of closed roads the roadbed, may be occupied by red alder. The road prism would remain in an upland condition. Road ditches, where present, support a variety of upland and wetland vegetation depending on local conditions and seed sources. Hydrologic and vegetation effects would typically

remain limited beyond the road prism (Glaser 1999; Kahklen and Moll 1999; McGee 2000).

Effects Common to All Action Alternatives

Road construction and timber harvest are proposed in wetlands in all action alternatives. Effects common to all alternatives are summarized below and effects are discussed by alternative in the following subsections.

Road impacts, required to access timber, would result in a permanent loss of wetland acreage in all action alternatives. Acres of impacts from roads for each alternative are described in the following sections and summarized in Table WET-2. Acres of wetland loss due to road impacts generally correspond to the total miles of proposed road construction for each alternative.

Effects from Road Building

The effects of road building on wetlands may vary based on the substrate (soil type) and the landscape position of the wetland. Regardless of the type and location, road construction on wetlands results in an overall loss of wetland acreage.

Road construction on peatlands of the Tongass National Forest was studied and found to have little effect on wetland vegetation, hydrology, or water quality adjacent to the road (Glaser 1999). These wetland types are often located on ridge tops and relatively flat areas and the soils in these landscape positions are typically peat soils over bedrock. Changes to the plant community and hydrology were found to be limited to within a few meters of the road. This is theorized to be due to the high water-holding capacity of the soil and abundant local precipitation.

Roads crossing slope wetlands have a higher chance of disrupting the down-gradient flow of water, as water is intercepted by roadside ditches and potentially blocked by the road bed. The implementation of BMPs for road construction on wetlands in these landscape positions is necessary to prevent adverse hydrological impacts to wetlands located down-gradient of the road. While application of BMPs provides some assurance that surface water streams will not be diverted by roads, ground and surface water may be captured and diverted to the nearest stream or drainage-relief culvert. However, the high precipitation rates and soil moisture in Southeast Alaska appears to minimize the impacts of water that is intercepted by roadside ditches. A study in Southeast Alaska indicated that water level disruptions from road building quickly recover beyond the immediate road vicinity (McGee 2000). An additional study on the effects of roads on hydrology indicated that the effects range from between 5 and 10 meters on each side of the road prism (Kahklen and Moll 1999).

Effects from Timber Harvesting

Forested wetlands cover 25 percent of the project area and are managed for their timber resources. As a result, the action alternatives would conduct harvest on 1,653 to 2,776 acres of forested wetlands, depending on the alternative.

The three widely accepted functions that wetlands provide are water quality maintenance, hydrologic functions, and wildlife habitat. Research regarding the effects of timber

harvesting on forested wetlands and their functions is limited (CSS 2005). Project effects on two of these functions are not exclusive to wetlands; wildlife habitat effects are analyzed in the Wildlife and Subsistence Resource Report (Woeck 2012) and effects on water quality can be found in the Watershed Resource Report (James 2012). Research regarding potential project effects on wetland hydrology and tree growth rates are described below.

Research has demonstrated that the water balance of coastal forests can be affected through timber harvest (Patric 1966; Beaudry and Sagar 1995; Banner et al. 2005; Julin and D'Amore 2003), leading to an increase in soil moisture and slower growth in seedlings and saplings. This effect is the result of removal of the forest canopy resulting in an increase in the amount of precipitation reaching the ground surface and lower evapotranspiration rates. Timber harvest is proposed in wetlands in all action alternatives. Harvest activities are expected to have a minimal and short-term effect on wetland soil moisture. Removal of timber would lead to a short-term increase in soil saturation until young-growth establishes evapotranspiration surfaces similar to pre-harvest conditions. Effects on soil moisture will likely be less in areas where partial cutting is utilized. The proposed harvest in all action alternatives would not pose a long-term negative impact to wetlands in the project area.

Alternative 2 – Direct and Indirect Effects

Alternative 2 proposes to harvest timber from approximately 1,732 acres of forested wetland. An additional 117 acres mapped as wetland also occur within harvest units; these primarily represent forested wetland/emergent short sedge (77 acres), which can be up to 50 percent forested and mapped inclusions of non-forested wetlands (40 acres). Following harvest, trees growing on these wetlands would likely grow slower than trees on upland sites. Soil moisture would temporarily increase as described in Effects Common to All Action Alternatives. Approximately 80 percent of the harvested wetlands would be clearcut with the remaining having partial harvest prescriptions. These partial harvest areas would be expected to have soil moisture increases that are lower, due to the lower proportion of trees harvested. Although this alternative would have the lowest overall amounts of harvest on wetlands, this is due to the absence of young-growth thinning in this alternative. Alternative 2 would have the second-highest effect from harvesting on wetlands due to the amount of acreage clearcut.

Road construction under this alternative would result in conversion of wetland to road on approximately 61 acres of forested wetlands, 11 acres of forested wetland/ emergent short sedge, less than 1 acre of moss muskeg, less than ½ acre of emergent short sedge, and 1 acre of alpine muskeg. The specific effects are described above. This alternative would have the second-highest amount of wetland affected by road construction.

Overall, this alternative would have the second-highest impact to wetlands, with 74 acres of wetland fill due to road construction and the second-highest amount of clearcut forested wetland. This alternative would have fewer impacts than Alternative 3, and more impacts than Alternatives 4 and 5. Although the overall acreage of harvest on wetlands would be higher for all other alternatives, these impacts are temporary, and as noted above, have a much lower effect for the substantial acreage that has partial harvest and thinning

prescriptions. The effects due to road fill are more significant due to the resulting long term loss of wetland acreage. In comparison to the other alternatives, Alternative 2 would fill 16 fewer acres than Alternative 3 and would fill an additional 49 and 55 acres over Alternatives 4 and 5, respectively.

Alternative 3 – Direct and Indirect Effects

Alternative 3 proposes to harvest timber from approximately 2,776 acres of forested wetland, 192 acres of forested wetland/ emergent short sedge, 34 acres of moss muskeg, 18 acres of emergent short sedge, and 11 acres of alpine muskeg. Following harvest, trees growing on these wetlands would likely grow slower than trees on upland sites. Soil moisture would temporarily increase as described in Effects Common to All Action Alternatives. Approximately 65 percent of the harvested forested wetlands would be clearcut, 18 percent would have partial harvest prescriptions and 17 would be young growth thinning. These partial harvest and thinned areas would be expected to have soil moisture increases that are lower, due to the lower proportion of trees harvested. This alternative would have the highest overall amounts of harvest on wetlands and the highest amount of clear cuts on wetlands. Alternative 3 would have the highest effect from harvesting on wetlands due to the amount of acreage clearcut.

Road construction under this alternative would result in conversion of wetland habitat to road on approximately 74 acres of forested wetlands, 13 acres of forested wetland/ emergent short sedge, 2 acres of moss muskeg, 0.3 acre of emergent short sedge, and 1 acre of alpine muskeg. The specific effects are described above. This alternative would have the highest amount of wetland affected by road construction.

Overall, this alternative would have the highest impact to wetlands, with 90 acres of wetland fill due to road construction and the highest amount of clearcut forested wetland. In comparison to the other alternatives, Alternative 3 would fill 16, 65, and 71 more acres of wetland than Alternatives 2, 4, and 5, respectively.

Alternative 4 – Direct and Indirect Effects

Alternative 4 proposes to harvest timber from approximately 1,653 acres of forested wetland, 165 acres of forested wetland/ emergent short sedge, 16 acres of moss muskeg, 17 acres of emergent short sedge, and 11 acres of alpine muskeg. Following harvest, trees growing on these wetlands would likely grow slower than trees on upland sites. Soil moisture would temporarily increase as described in Effects Common to All Action Alternatives. Approximately 31 percent of the harvested wetlands would be clearcut, 43 percent would have partial harvest prescriptions and 26 percent would be young growth thinning. These partial harvest and thinned areas would be expected to have soil moisture increases that are lower, due to the lower proportion of trees harvested. This alternative would have the second lowest overall amount of harvest on wetlands but the overall lowest effect from harvesting on wetlands due to the smallest amount of clear cutting and the large proportion of the harvest that is a partial harvest prescription or young growth thinning.

Road construction under this alternative would result in conversion of wetland habitat to road on approximately 20 acres of forested wetlands, 4 acres of forested wetland/

emergent short sedge, 0.2 acre of moss muskeg, 0.3 acre of emergent short sedge, and 0.1 acre of alpine muskeg. The specific effects are described above. This alternative would have the second lowest amount of wetland affected by road construction.

Overall, this alternative would have the second lowest impact to wetlands, with 26 acres of wetland fill due to road construction and the lowest amount of clearcut forested wetland. Although this alternative has the lowest amount of clearcut harvest of forested wetlands, it would have the second lowest effect because it has more acres of wetland fill than Alternative 5. The effects due to road fill would have a greater overall effect due to the resulting long term loss of wetland acreage compared to the temporary effects resulting from harvesting on wetlands. In comparison to the other alternatives, Alternative 4 would fill 6 more acres of wetland than Alternative 5, and would have 49 and 65 fewer acres of wetland fill than Alternatives 2 and 3, respectively.

Alternative 5 – Direct and Indirect Effects

Alternative 5 proposes to harvest timber from approximately 2,074 acres of forested wetland, 176 acres of forested wetland/ emergent short sedge, 27 acres of moss muskeg, 17 acres of emergent short sedge, and 11 acres of alpine muskeg. Following harvest, trees growing on these wetlands would likely grow slower than trees on upland sites. Soil moisture would temporarily increase as described in Effects Common to All Action Alternatives. Approximately 59 percent of the harvested wetlands would be clearcut, 21 percent would have partial harvest prescriptions and 20 percent would be young growth thinning. These partial harvest and thinned areas would be expected to have soil moisture increases that are lower, due to the lower proportion of trees harvested. This alternative would have the second-lowest level of clearcutting on wetlands following Alternative 4.

Road construction under this alternative would result in conversion of wetland habitat to road on approximately 19 acres of forested wetlands, and 0.4 acres of forested wetland/ emergent short sedge, 0.1 acre of moss muskeg.

This alternative would have the lowest amount of wetland affected by road construction.

Overall, this alternative would have the lowest impact to wetlands, with 19 acres of wetland fill due to road construction and the second lowest amount of clearcut forested wetland. Although this alternative has the second lowest amount of clearcut harvest of forested wetlands, it would have the lowest overall effect because it has the least number of acres of wetland fill. The effects due to road fill would have a greater overall effect due to the resulting long-term loss of wetland acreage compared to the temporary effects resulting from harvesting on wetlands. In comparison to the other alternatives, Alternative 5 would have 55, 71, and 6 fewer acres of wetland fill than Alternatives 2, 3, and 4, respectively.

Cumulative Effects

Because the effects of the past, present, and reasonably foreseeable actions are consistent across all alternatives, the cumulative effects are comparable by alternative. Table WET-3 indicates the estimated cumulative acres of tree harvesting and road effects on wetlands from past, present and foreseeable projects within the project area. Present and reasonably foreseeable projects are described in more detail at the beginning of Chapter 3.

Alternative 1

Approximately 14,344 acres of timber have been harvested from wetlands on the project area, including 10,458 acres of forested wetland, 2,833 acres of forested wetland/emergent sedge complex and 1,053 acres of non-forested wetland. This equates to about 11 percent of the wetlands on the project area. On wetlands where timber has been harvested, vegetation would continue to grow toward hydrologic maturity, and overall soil moisture levels would return to pre-harvest conditions. Vegetation on the oldest harvest areas would be more than 30 years old, are generally vigorous young-growth stands, and soil moisture conditions should be returning to near pre-harvest conditions.

Table WET-3. Estimated Acres of Cumulative (Existing, Project, and Foreseeable) Wetland Impacts from Harvesting by Alternative

Project Category		Total Wetland Impacts Due to Harvesting		Total Wetland Impacts Due to Roads	
		Acres	% of Total Wetlands in Project Area	Acres	% of Total Wetlands in Project Area
Past Projects		**14,344**	**11%**	**1,112**	**2.5%**
Big Thorne Project	Alt. 1	0	0%	0	0.0%
	Alt. 2	1,849	1.5%	62	0.1%
	Alt. 3	3,031	2.4%	74	0.1%
	Alt. 4	1,863	1.5%	25	0.1%
	Alt. 5	2,304	1.8%	18	<0.1%
Reasonably Foreseeable Projects[1/]		**37**	**0.03%**	**.03**	**<.01%**
Cumulative Projects[2/]	Alt. 1	14,381	11%	1,112	2.5%
	Alt. 2	16,230	13%	1,174	2.6%
	Alt. 3	17,412	14%	1,186	2.6%
	Alt. 4	16,244	13%	1,137	2.6%
	Alt. 5	16,685	13%	1,130	2.5%

1/ Impacts calculated assuming projects have a similar level of impact as the proposed action for the Big Thorne Project. Acres calculated based on projects described at beginning of Chapter 3 (Control Lake 351 acres, State Lands 635 acres, Free Use and Micro-sales 100 acres)
2/ Includes past projects, Big Thorne project, and present/reasonably foreseeable projects.

About 691 acres of forested wetland, 301 acres of forested/emergent complex, and 1,112 acres non-forested wetlands have been converted to road surfaces; ditches and fill slopes in the project area (see Table WET-1). Open roads on the project area would continue to receive incidental use by recreation visitors. Vegetation would grow in ditch lines on all roads, and on closed roads vegetation will likely colonize the road surfaces.

Contributions for current and reasonably foreseeable projects would have additional impacts, contributing approximately an additional 37 acres of harvesting on wetlands and less than a tenth of an acre of road impacts. Cumulatively, these reasonably foreseeable impacts would have little cumulative effect, resulting in less than a 1 percent of additional wetland effects by harvesting and roads, see Table WET-3. About 86 percent of wetlands in the project area would be in a natural condition and would not have been affected by past activities. Of the wetland acreage affected, less than 3 percent would be due to road impacts.

Alternative 2

Implementation of Alternative 2 would result in cumulative effects (existing, current and reasonably foreseeable, and Big Thorne) of approximately 16,230 acres of timber harvested from wetlands on the project area, including 12,223 acres of forested wetland, 2,913 acres of forested wetland/emergent sedge complex and 1,094 acres of non-forested wetland. This equates to about 13 percent of the wetlands on the project area. This alternative would result in an increase of about 2 percent over the No-action Alternative and similar cumulative acres harvested on wetlands as Alternatives 4 and 5. This alternative would have less cumulative effects on harvesting compared to Alternative 3. However, because Alternatives 4 and 5 include substantial acreages of thinning and partial harvest and this alternative includes more clearcutting, this alternative would have second-highest effects on wetlands due to timber harvesting. On wetlands where timber has been harvested, vegetation would continue to grow toward hydrologic maturity, and overall soil moisture levels would return to pre-harvest conditions. Vegetation on the oldest harvest areas would be more than 30 years old, are generally vigorous young-growth stands, and soil moisture conditions should be returning to near pre-harvest conditions.

Implementation of Alternative 2 would result in cumulative impacts of about 1,174 acres of wetland converted to road surfaces, ditches and fill slopes in the project area, consisting of 742 acres of forested wetland, 310 acres of forested/emergent complex, and 122 acres of non- forested wetlands (see Table WET-1). Open roads on the project area would continue to receive incidental use by recreation visitors. Vegetation would grow in ditch lines on all roads, and on closed roads vegetation will likely colonize the road surfaces. This alternative would result in the second-highest cumulative acres of wetland impacts due to roads of the. Overall, the total cumulative increase due to roads would be about a tenth of a percent higher than Alternatives 1 and 5 and similar to Alternatives 3 and 4 (Table WET-3).

Under Alternative 2, about 84 percent of wetlands in the project area are would remain in a natural condition and would not have been affected by past activities. This is one percent lower than Alternative 1, similar to Alternatives 4 and 5, one percent lower than Alternative 3. Of the wetland acreage affected, less than 3 percent would be due to road impacts.

Alternative 3

Implementation of Alternative 3 would result in cumulative effects (existing, current and reasonably foreseeable, and Big Thorne) of approximately 17,412 acres of timber harvested from wetlands on the project area, including 13,266 acres of forested wetland, 3,028 acres of forested wetland/emergent sedge complex and 1,117 acres of non-forested wetland. This equates to about 14 percent of the wetlands on the project area. This alternative would result in an increase of about 3 percent over the No-action Alternative and 1 percent over the remaining action alternatives. This alternative would have the highest cumulative effects from harvesting. On wetlands where timber has been harvested, vegetation would continue to grow toward hydrologic maturity, and overall soil moisture levels would return to pre-harvest conditions. Vegetation on the oldest harvest areas would be more than 30 years old, are generally vigorous young growth stands, and soil moisture conditions should be returning to near pre-harvest conditions.

Implementation of Alternative 3 would result in cumulative effects of about 1,186 acres of wetland converted to road surfaces, ditches and fill slopes in the project area, consisting of 752 acres of forested wetland, 311 acres of forested/emergent complex, and 123 acres non-forested wetlands (see Table WET-1). Open roads on the project area would continue to receive incidental use by recreation visitors. Vegetation would grow in ditch lines on all roads, and on closed roads vegetation will likely colonize the road surfaces. This alternative would result in the highest cumulative acres of wetland effects due to roads. Overall, the total cumulative increase due to roads is about a tenth of a percent higher than Alternatives 1 and 5 and similar to Alternatives 3 and 4 (Table WET-3).

Under Alternative 3, about 83 percent of wetlands in the project area are would remain in a natural condition and would not have been affected by past activities. This is 3 percent lower than Alternative 1, 1 percent lower than the remaining action alternatives. Of the wetland acreage affected, less than 3 percent would be due to road impacts.

Alternative 4

Implementation of Alternative 4 would result in cumulative effects (existing, current and reasonably foreseeable, and Big Thorne) of approximately 16,244 acres of timber harvested from wetlands on the project area, including 12,143 acres of forested wetland, 3,001 acres of forested wetland/emergent sedge complex and 1,099 acres of non-forested wetland. This equates to about 13 percent of the wetlands on the project area. This alternative would result in an increase of about 2 percent over the No-action Alternative, 1 percent lower than Alternative 3, and similar to Alternatives 2 and 5. This alternative would have the lowest cumulative effects from harvesting due to the amount of harvest that would be partial cutting or thinning of young growth, as described in the Environmental Consequences section. On wetlands where timber has been harvested, vegetation would continue to grow toward hydrologic maturity, and overall soil moisture levels would return to pre-harvest conditions. Vegetation on the oldest harvest areas would be more than 30 years old, are generally vigorous young growth stands, and soil moisture conditions should be returning to near pre-harvest conditions.

Implementation of Alternative 4 would result in cumulative effects of about 1,137 acres of wetland converted to road surfaces, ditches and fill slopes in the project area, consisting of 712 acres of forested wetland, 305 acres of forested/emergent complex, and 123 acres non forested wetlands (see Table WET-1). Open roads on the project area would continue to receive incidental use by recreation visitors. Vegetation would grow in ditch lines on all roads, and on closed roads vegetation will likely colonize the road surfaces. This alternative would result in the second lowest cumulative acres of wetland effects due to roads. Overall, the total cumulative increase due to roads is about a tenth of a percent higher than Alternatives 1 and 5 and similar to Alternatives 2 and 3 (Table WET-3).

Under Alternative 4, about 84 percent of wetlands in the project area are would remain in a natural condition and would not have been affected by past activities. This is 2 percent lower than Alternative 1, 1 percent lower Alternative 3 and similar to Alternatives 2 and 5. Of the wetland acreage affected, less than 3 percent would be due to road impacts.

Alternative 5

Implementation of Alternative 5 would result in cumulative effects (existing, current, and reasonably foreseeable, and Big Thorne) of approximately 16,685 of timber harvested from wetlands on the project area, including 12,564 acres of forested wetland, 3,012 acres of forested wetland/emergent sedge complex and 1,109 acres of non-forested wetland. This equates to about 13 percent of the wetlands on the project area. This alternative would result in an increase of about 2 percent over the No-action Alternative and 1 percent lower than Alternative 3 and similar to Alternatives 2 and 4. This alternative would have the second lowest cumulative effects from harvesting. On wetlands where timber has been harvested, vegetation would continue to grow toward hydrologic maturity, and overall soil moisture levels would return to pre-harvest conditions. Vegetation on the oldest harvest areas would be more than 30 years old, are generally vigorous young growth stands, and soil moisture conditions should be returning to near pre-harvest conditions.

Implementation of Alternative 5 would result in cumulative effects of about 1,130 acres of wetland converted to road surfaces, ditches, and fill slopes in the project area, consisting of 708 acres of forested wetland, 302 acres of forested/emergent complex, and 120 acres non forested wetlands (see Table WET-1). Open roads on the project area would continue to receive incidental use by recreation visitors. Vegetation would grow in ditch lines on all roads, and on closed roads vegetation will likely colonize the road surfaces. This alternative would result in the lowest cumulative acres of wetland effects due to roads. Overall, the total cumulative increase due to roads is similar to the Alternative 1 and about a tenth of a percent lower than the remaining action alternatives (Table WET-3).

Under Alternative 5, about 84 percent of wetlands in the project area are would remain in a natural condition and would not have been affected by past activities. This is 2 percent lower than Alternative 1, 1 percent lower Alternative 3, and similar to the remaining action alternatives.

Botany

Introduction

This section provides a summary of existing conditions and the direct, indirect, and cumulative effects on sensitive and rare plants in the Big Thorne project area. Only one species in Alaska, *Polystichum aleuticum* (C. Christen.) is listed as endangered. Its known range is restricted to Adak Island in the Aleutian Islands. No proposed or federally listed species are known on the Tongass National Forest. Full discussion of the botany resource is available in the Biological Evaluation for Plants (Opolka 2012a) and the Botany Resource Report (Opolka 2012b) located in the project record.

Analysis Area

The analysis area for direct and indirect effects to sensitive and rare plants is the project area. The analysis area for cumulative effects to sensitive and rare plants considers Biogeographic Provinces 14 and 18, which includes all of Prince of Wales Island, plus some of the neighboring islands (see Land Division section at the beginning of Chapter 3). This area represents the most biologically and physiographically similar area and is geographically isolated. These provinces were used for cumulative effects analysis because many of the Sensitive and Rare plants have a range that extends beyond the project area and species viability must take other populations into consideration.

Methods

Field Surveys

Prior to field surveys, a prefield review of the project area was conducted. This included review of aerial photographs, discussions with resource specialists, a review of previously documented species, and a review of GIS habitat data to determine habitat types present in the project area.

Focused intuitive surveys for Sensitive and Rare plants were conducted for the project. This survey type involves identifying suitable habitat for targeted species and then focusing the survey effort within those identified habitats. The field surveys were conducted in 2009, 2010, and 2011 at an appropriate time of year to identify targeted species. Field surveys included portions of 153 harvest units and covered approximately 15 percent of the unit pool area, 3 percent of the project area, and 10 miles of proposed road. Surveys were also conducted outside of harvest units and in non-development LUDs, which aided in the cumulative effects analysis for alternative comparison. Multiple populations of sensitive and rare plant species were identified as a result of field surveys for this project. Based on field surveys, the spatial extent of each population was mapped and digitized and a plant count or estimate was made for each. Additional field surveys have been completed and results will be considered and incorporated into the Final EIS. Additional details of the prefield review and field survey can be found in the Biological Evaluation for Plants (Opolka 20012a) in the project record.

Habitat Suitability Models

General habitat suitability models have been developed for several sensitive plant species on the Tongass National Forest, including two of the species found in a number of

locations in the project area: Alaska rein orchid (*Piperia unalascensis*) and lesser round-leaved orchid (*Platanthera orbiculata*; USDA Forest Service 2011). Use of the model for analysis for analysis of effects was based on guidance outlined in the habitat suitability model report (USDA Forest Service 2011). The primary use of the models was to estimate the percentage of potentially suitable habitat affected by alternative relative to the total suitable habitat within the project area and the cumulative effects analysis area. These models are considered only a tool for identifying *potential* suitable habitat; they do not provide accurate information on the actual distribution of sensitive plants, but can be used in a relative sense for comparisons. Therefore, the models need to be used in combination with other information, including professional expertise and field survey data, to make determinations of risk regarding project effects on these species.

GIS Analyses

GIS layers were created for known sensitive and rare plant populations (with plant count information) and survey areas. Using this information, effects on populations and individuals were estimated. A direct effect to a population was recorded if part of a sensitive plant population polygon overlapped with a road, landing, or harvest area. An indirect effect to a sensitive or rare plant population was recorded if any of the activities causing a direct effect were located within 50 meters of a sensitive plant polygon. The number of individuals directly or indirectly affected was estimated by adjusting the plant count for each polygon based on the proportion of the polygon area affected.

Affected Environment

Sensitive Plants

There are 17 plant species and one lichen that have been designated as Sensitive on the Alaska Regional Forester's list; 16 of these are known or suspected to occur on the Tongass National Forest. Five of these species have been documented on the Thorne Bay Ranger District; three of these have been documented in the project area. The Thorne Bay Ranger District is within the potential range of an additional five species, which are suspected to occur on the District. Table BOT-1 summarizes the general habitat requirements of the 10 plant species that are either known to occur or suspected to occur on the Thorne Bay Ranger District.

Table BOT-1. Known or Suspected Plants in the Thorne Bay Ranger District

Scientific Name	Common Name	Presence[1/]	Habitat
Botrychium spathulatum	Spatulate moonwort	Suspected	Lightly vegetated coastal dunes and meadows and alpine slopes
Botrychium tunux	Moosewort fern	Suspected	Lightly vegetated coastal beaches and alpine scree
Cypripedium parviflorum var. *pubescens*	Large yellow lady's slipper orchid	Known	Peatlands, occasionally on limestone substrates, open forested habitats
Ligusticum calderi	Calder's loveage	Suspected	Subalpine meadows, occasionally of calcareous origin, perhaps in glacial refugia; forest edges; muskegs and fens
Lobaria amplissima	none	Known	Coastal areas on the forest fringe, often on the water-side of tree boles and large limbs
Piperia unalascensis	Alaska rein orchid	Known	Forested areas, roadsides and frequently on edges between forest and muskeg
Platanthera orbiculata	Lesser round-leaved orchid	Known	A variety of habitats, most commonly in forested habitats and along the forested muskeg edge. Found in both old and young growth.
Romanzoffia unalaschcensis	Unalaska mist-maid	Known	Coarse substrates including stream side gravelly areas, rock outcrops and crevices, and coastal areas
Sidalcea hendersonii	Henderson's checkermallow	Suspected	Coastal areas in the zone between estuary and forest
Tanacetum bipinnatum	Dune tansy	Suspected	Sandy soils in coastal areas

1/ Known=known to occur in the Thorne Bay Ranger District.
Suspected=suspected to occur in the Thorne Bay Ranger District

Two sensitive species were found with some regularity during project field surveys; these are the Alaska rein orchid and the lesser round-leaved orchid. Twenty-four populations of the former and 110 populations of the latter were located in the project area.

Alaska Rein Orchid: The 24 populations of the Alaska rein orchid documented in the project area have an estimated plant count of 867 individuals, which represents about 90 percent of the known individuals located on the Tongass National Forest. The majority of populations in the project area are concentrated along the Thorne Bay to Control Lake highway, in the North Thorne River drainage, west of Sandy Beach, and north of Luck Lake. These plants typically are found at the edge of muskeg and old growth forest, although they are also been found in forest interiors and along road edges. In the project area, it frequently has been found along edges between the forest and muskeg and some of the largest populations have been found along roads and in ditches. Approximately 75 percent of the known individuals are in non-productive old growth, in areas unlikely to be harvested.

Lesser Round-leaved Orchid: The lesser round-leaved orchid was observed at numerous locations during field surveys for the Big Thorne project. A total of 110 populations of this species were mapped, containing an estimated 3,923 individuals, which represents about 73 percent of the known individuals on the Tongass National Forest. The majority of populations in the project area are concentrated in the same general areas as the Alaska rein orchid—along the Thorne Bay to Control Lake highway, in the lower North Thorne River drainage, west of Sandy Beach, and north of Luck Lake.

This plant is typically found in old growth, often in productive old growth, but commonly in non-productive old growth. Approximately two-thirds of the known populations in the project area are located in non-productive old growth, effectively preserving the majority of the known population for this plant.

Although it is mostly found in old growth, the plant is occasionally found in older young-growth stands and disturbed habitats. Approximately 10 percent of known populations of this plant were found in young growth (forest-wide). It is unknown if these plants survived the initial harvest, became established subsequent to harvest, or if they were more or less abundant prior to the original harvest. Due to the unknowns regarding the tolerance of this plant to past harvest and its distribution in young growth, the effects of harvest on this plant are not clearly understood. Some plants may be damaged or killed during harvesting; however, plants growing in young growth have either survived or repopulated the area after clearcutting.

Rare Plants

Rare plant species having known or suspected occurrence on the Tongass National Forest are evaluated based on a list derived from the Alaska Natural Heritage Program (USDA Forest Service 2009). Included are species with a State Ranking[3] of S1, S2, or occasionally S3, excluding species that are already listed as Sensitive on the Tongass National Forest. Additional plants have been evaluated for this project because they are known to be rare, but do not yet have a State ranking by the ANHP. The list may change with plants added or dropped as additional information on plant distribution and taxonomy is learned.

Two rare plants were found during surveys within the Big Thorne project area, including western meadowrue (*Thalictrum occidentale*) and lance leaf grapefern (*Botrychium lanceolatum*). Western meadowrue was found at 13 locations, almost entirely on stream banks and lake shores, while the lance leaf grapefern was found at one location, in forest habitat near Luck Lake.

[3] Rank S1 indicates a plant is critically imperiled and extremely rare in the State of Alaska.
Rank S2 indicates that within the State of Alaska the status of this species is imperiled due to rarity (between 6 and 20 occurrences) or some other concern.
Rank S3 indicates the plant is rare or uncommon (21-100 occurrences) in the State of Alaska.

Environmental Consequences

Direct and Indirect Effects

The project has the potential to have direct, indirect, and cumulative effects on sensitive plant species. Direct effects are those that would occur immediately or soon after the implementation of the action. Indirect effects are those effects that are may occur at a later point in time after the project has been implemented. Cumulative effects are those that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of the source of the action.

Direct effects of the project may include the following:

- *Physical Damage*—Plants may be destroyed or damaged through crushing by logging equipment and activities associated with tree felling and yarding. Road building would completely bury or remove plants or entire populations if they were located in the road bed and could also damage plants or populations of plants that are located along the perimeter of the road embankment.

Indirect effects of the project may include the following:

- *Hydrology*—Road building can alter the hydrology, as surface and ground water may be redirected and channelized by roadside ditches, altering the hydrologic regime. Increased water levels may result in the death or decline in vigor of plants not adapted to a high water table. Conversely, plants adapted to wetland conditions may become desiccated by a decrease in water availability. Removal of the tree canopy results in changes in light, temperature and soil moisture (Heithecker and Halpern 2007), potentially beyond the tolerance levels of some species. BMPs will be implemented that will limit alterations to hydrology (see Watersheds Resource Report [James 2012]).
- *Light Levels*—Partial or complete removal of the tree canopy results in an increase in the light levels in the understory, potentially resulting in light levels beyond the tolerance for shade dependent species. Once the stand regenerates, light levels will decrease with increasing canopy cover due to high density of small conifers. This too may alter normal light requirements for many species, including Sensitive and Rare plants.
- *Invasive Species*—Increased light levels associated with tree harvesting, expansion of the road network, and ground disturbing activities can result in the introduction and/or spread of invasive species. Invasive species can out-compete native species and colonize preferred habitat.

The indirect effects distance used for analysis was based on past research on the edge effect changes to microclimate, changes in understory vascular plants in mature or old growth forest in response to adjacent clearcutting, the temporal edge effects, and the tolerance to edge habitat of the species of concern. Changes to microclimate can be observed up to 200 meters or more into adjacent unharvested stands (Concannon 1995; Chen 1993, 1995), although the long-term effects on understory vegetation are less clear. At least in the short term (less than 5 years post-harvest), the research indicates that changes are either not apparent or limited to within 10 meters of the edge (Concannon

1995; Heithecker and Halpern 2007). Known locations for sensitive and rare plants in the project area were also evaluated, based on their known occurrences and apparent tolerance for edge habitat. Based on all available information, a distance of 50 meters was used as the outer limits for indirect effects, with consideration given to the gaps in research, potential unknowns with regards to habitat requirements, and changes that may occur over the course of decades. Additional details of these studies and the distribution of existing plant populations with respect to edge environments are included in the Biological Evaluation for Plants and Botany Resource Report (Opolka 2012a, 2012b), which are in the project record.

Avoidance and Minimization Measures

Through project design, efforts to avoid and minimize impacts on sensitive plants have been taken to prevent or reduce effects to known populations of sensitive and rare plants. These measures were conducted to ensure viability of sensitive and rare plants in the project area. Following is a summary of these measures.

- The only species with direct effects is widely distributed in the project area. Those with fewer populations or only one population were avoided under all alternatives.
- Where sensitive plants were widely distributed, proposed effects were not always avoidable. To minimize effects to individuals and the species the geographic extent of the population was considered. For example, for lesser round-leaved orchid, all alternatives directly affect individuals. However, these effects, for all alternatives, preserved the geographic extent of plant distribution in the project area. Populations near the geographic extent of the species distribution, and isolated populations were avoided under all alternatives.
- Population size and vigor was considered for populations that may be affected. Where populations were affected, they were generally small, with few individuals present or had poor habitat quality, such as at the edge of blowdown where additional blowdown was likely to occur.
- Where larger populations were affected, this was generally only done when there were large, extensive populations located nearby.
- Easily avoided populations, such as those on the edge of a stream buffer or along a unit edge were avoided.
- Legacy forest structure placement considered sensitive plants; when possible these legacy areas were designed to include sensitive plant populations.
- Appendix D in the Botany resource report (Opolka 2012b) and the unit cards (Appendix B of this EIS) summarize every unit that had, or has sensitive or rare plants in or near the unit. Proposed effects are explained with a summary that may include relevant considerations such as the geographic species distribution, population size and vigor, and occurrence frequency in the project area.

Cumulative Effects

Cumulative effects are the sum of the direct and indirect effects from the Big Thorne project plus other projects that have occurred in the past, are presently occurring, or are expected to occur in the foreseeable future. Individually these effects may be minor, but together can result in cumulative effects over time. The analysis area for cumulative effects is explained previously under the Analysis Area section.

The direct, indirect, and cumulative effects of the project are used to determine the risk of the project on sensitive species that may potentially be affected by the project. This is conducted through a risk assessment, included in the Biological Evaluation for Plants (Opolka 2012a).

Alternative 1 – No Action Alternative

For all the assessed species, Alternative 1, the No-action Alternative would not result in direct or indirect effects on Sensitive or Rare plant populations or their habitats as a result of the Big Thorne project. As a result, there would be no incremental cumulative effects associated with the Big Thorne project. Past timber harvest, road construction, and other activities have resulted in some impacts to the habitats of these assessed species. However, the standards and guidelines (particularly those associated with beach and estuary fringe and riparian management areas) and the low level of reasonably foreseeable projects in alpine and subalpine habitats, peatlands, and rock outcrops, and the Forest Plan conservation strategy indicate that cumulative effects on these plants would be low.

Alternatives 2, 3, 4, and 5

Spatulate Moonwort (Sensitive Species)

In southeastern Alaska, spatulate moonwort is known to grow on maritime sand dunes (USFS 2009b). There are only two known populations in Alaska, on Chichagof Island and Kruzof Island (USFS 2009b). Spatulate moonwort is suspected to occur in the Thorne Bay Ranger District although there are no known occurances.

Direct and Indirect Effects

The project would not affect known populations or habitat of spatulate moonwort. The habitat in which this plant is predominantly known to grow would not be affected by the project. No timber harvest is proposed within 1,000 feet of the beach/estuary with this project. Direct and indirect effects to this plant are not anticipated by any of the project alternatives.

Cumulative Effects

None of the action alternatives would result in direct or indirect effects to known populations of this plant or its habitat. In addition, although limited timber harvest is permitted, the Forest Plan provides protections for the ecological integrity of beach and estuary fringe within 1,000 feet of saltwater shorelines. Consequently, the project would not result in cumulative effects to this plant.

Moosewort Fern (Sensitive Species)

In Alaska, moosewort fern is known to grow on sandy beaches in the upper meadow zone and in alpine areas (USFS 2009b). Moosewort fern is suspected to occur in the Thorne Bay Ranger District although there are no known occurances.

Direct and Indirect Effects

The project would not affect known populations or habitat of moosewort fern. The habitat in which this plant is predominantly known to grow, such as lightly vegetated coastal beaches and alpine scree, would not be affected by the project. No timber harvest is proposed within 1,000 feet of the beach/estuary with this project. Direct and indirect effects to this plant are not anticipated by any of the project alternatives.

Cumulative Effects

None of the action alternatives would result in direct or indirect effects to known populations of this plant or its habitat. In addition, although limited timber harvest is permitted, the Forest Plan provides protections for the ecological integrity of beach and estuary fringe within 1,000 feet of saltwater shorelines. Consequently, the project would not result in cumulative effects to this plant.

Dune Tansy (Sensitive Species)

Dune tansy grows in well drained, sandy soils in coastal areas (USDA Forest Service 2009b). Dune tansy is suspected to occur in the Thorne Bay Ranger District, although there are no known populations.

Direct and Indirect Effects

The project would not affect known populations or habitat of dune tansy. No timber harvest is proposed within 1,000 feet of the beach/estuary with this project. Direct and indirect effects to this plant are not anticipated by any of the project alternatives.

Cumulative Effects

None of the action alternatives would result in direct or indirect effects to known populations of this plant or its habitatIn addition, although limited timber harvest is permitted, the Forest Plan provides protections for the ecological integrity of beach and estuary fringe within 1,000 feet of saltwater shorelines. Consequently, the project would not result in cumulative effects to this plant.

Henderson's Checkermallow (Sensitive Species)

Henderson's checkermallow grows in coastal areas in the zone between the estuary and forest. It is suspected to occur in the Thorne Bay Ranger District, although there are no known occurences.

Direct and Indirect Effects

The project would not affect known populations or habitat of Henderson's checkermallow. No timber harvest is proposed within 1,000 feet of the beach/estuary with this project. Direct and indirect effects to this plant are not anticipated by any of the project alternatives.

Cumulative Effects

None of the action alternatives would result in direct or indirect effects to known populations of this plant or its habitat. In addition, although limited timber harvest is permitted, the Forest Plan provides protections for the ecological integrity of beach and estuary fringe within 1,000 feet of saltwater shorelines. Consequently, the project would not result in cumulative effects to this plant.

Calder's Loveage (Sensitive Species)

Calder's loveage inhabits forest edges, wetlands, and subalpine meadows, occasionally of calcareous origin in areas that may have been spared from glaciation during the last ice age (USFS 2009). It is documented on Prince of Wales Island and is suspected to occur in the Thorne Bay Ranger District (USFS 2009b), although there are no known occurences.

Direct and Indirect Effects

The project would have no effects to known populations of Calder's loveage. This plant is not known to occur in the project area, although potential habitat is present. The project could potentially affect undetected individuals and habitat through road building activities, which could occur in wetland habitat. Individuals growing along forested edges could also be affected. Direct effects could occur through damage by machinery and placement of fill material during road building or harvesting. Indirect effects are also possible, potentially occurring as a result of soil moisture changes as a result of road building activities and windthrow or changes in cover due to harvesting. However, the overall risk to Calder's loveage as a result of this project is low.

Cumulative Effects

None of the action alternatives would result in direct or indirect effects to known populations of this plant, although there could be cumulative effects to undetected individuals due to past, present, and future construction of roads in this plant's habitat. All action alternatives would result in road construction through wetlands (see Wetlands section), with the greatest potential effects caused by Alternative 3, followed by Alternatives 2, 4, and 5. However, the amount of cumulative road mileage on wetlands represents only a very small percentage of the overall wetland habitat in the project area, less than 3 percent for all action alternatives. Another potential cumulative risk factor for this species in Biogeographic Provinces 14 and 18 is potential mining activity at the south end of Prince of Wales Island, especially near Bokan Mountain, which has a number of known locations for this species. However, no direct effects from mineral exploration activities have occurred to date and mine developments are not yet reasonably foreseeable. The overall risk to Calder's loveage as a result of this project is low due to a lack of effects to known populations and because it commonly occurs in habitats where management activities are unlikely to occur or limited.

Lobaria Amplissima (Sensitive Species)

Lobaria amplissima grows on the trunks and large branches of living trees and has been found on several different tree species where it grows at the beach fringe (USDA Forest Service 2009b). *L. amplissima* has been documented on the Thorne Bay Ranger District (USDA Forest Service 2009) and three populations, containing almost 20 individuals, were identified in the project area.

Direct and Indirect Effects

The project would have no direct effects to known populations or habitat of *Lobaria amplissima*. No timber harvest is proposed within 1,000 feet of the beach/estuary with this project. This lichen usually grows on trees facing the ocean, and the majority of dust would be "filtered" by existing trees and vegetation. Further, due to the amount of precipitation in Southeast Alaska, the number of days that dust would be present is limited.

Project-related dust may indirectly effect one known population located close to a main haul road. To minimize effects on a population located near existing NFS road 300000 (the Sandy Beach Road) at milepost 24.8, consider using the provision of the contract clause for the application of water to the road surface within 300 feet of this population to reduce dust if the amount of dust is expected to increase with the use of the road for a particular contract. Frequency of water application would be dependent on the road use intensity and weather conditions.

Cumulative Effects

Cumulative effects due to past, present and reasonably foreseeable projects are possible. Past timber harvest and road construction that occurred prior to Forest Plan beach buffer standards and guidelines may have impacted this lichen, due to the harvesting of trees that it grows on. Cumulative effects due to present or future timber harvesting projects are expected to be minimal due to the beach buffer requirements. Cumulative effects due to past, present, recreational use of the beach and firewood cutting may affect this lichen, although the Big Thorne project would not contribute to these effects. Two of the known locations in the project area are located on trees in areas that are being used recreationally, which may impact survival of the lichens at these locations. Overall risk to this species as a result of the project is low.

Unalaska Mist-Maid (Sensitive Species)

There are three known occurrences of this plant in Southeast Alaska, with one of these occurrences located on the Tongass National Forest, on nearby Heceta Island. Unalaska mist-maid grows in gravelly substrates in a variety of locations, from streams to rock outcrops (USDA Forest Service 2009b), and on Heceta Island it is found on high elevation limestone. This plant is not known to occur in the project area.

Direct and Indirect Effects

The project would have no effects on known populations of Unalaska mist-maid. The project could potentially directly affect undetected individuals and habitat through road building activities. Direct effects could occur through damage by machinery and placement of fill material during road building. Indirect effects are also possible, potentially occurring as a result of soil moisture changes due to road building or timber harvest. The risk of adverse effects to this plant is low, as minimal impacts to its habitat are likely to result from the project, and would primarily result from stream crossings. Potential effects to undetected individuals would be greatest among Alternative 3, which has the most road building and stream crossings, followed by Alternatives 2, 4, and 5, in that order.

Cumulative Effects

Cumulative effects to Unalaska mist-maid due to past, present, and reasonably foreseeable projects are possible. Past projects, primarily those involving road building, may have impacted undetected individuals or habitat in the project area. Similarly, current or future projects (described in Chapter 3) that involve road building, including the Big Thorne Project, could affect undetected individuals or habitat. The potential for cumulative effects as a result of the project would be the highest from Alternative 3, which has the most road building and stream crossings, followed by Alternatives 2, 4, and 5, in that order. Overall risk to this plant as a result of the project is low, due to a lack of effects to known populations and the limited activities expected to occur in its habitat.

Large Yellow Lady's Slipper (Sensitive Species)

The large yellow lady's slipper is typically found in peatlands and is known to occur in the Thorne Bay Ranger District, although the known locations are not in the project area.

Direct and Indirect Effects

The project would have no effects to known populations of large yellow lady's slipper. The project could potentially directly affect undetected individuals and habitat through road building activities in this plant's known habitat (primarily peatlands) and timber harvest in open forest habitats. Direct effects could occur through damage by machinery and placement of fill material during road building. Indirect effects are also possible, potentially occurring as a result of soil moisture changes as a result of road building activities. The risk of adverse effects to this plant is low, as minimal impacts to its habitat are likely to result from the project. Potential effects to undetected individuals and habitat would be greatest among Alternative 3, which has the most road building, followed by Alternatives 2, 4, and 5.

Cumulative Effects

Cumulative effects to this plant due to past, present, and reasonably foreseeable projects are possible. Past projects, primarily those involving road building, may have impacted undetected individuals or habitat in the project area. Similarly, current or future projects (described in Chapter 3) that involve road building, including the Big Thorne project, could affect undetected individuals or habitat and timber harvest in open forest habitats. Road maintenance could affect existing plants located near roads. Cumulative effects as a result of the project would be from Alternative 3, which has the most road building, followed by Alternatives 2, 4, and 5, in that order. The overall risk to this plant as a result of this project is low due to a lack of effects to known populations and because it commonly occurs in habitats where management activities are unlikely to occur or limited.

Lance Leaf Grapefern (Rare Species)

One population of three individuals is present in the project area in forested habitat.

Direct and Indirect Effects

None of the action alternatives would result in any direct or indirect effects to known populations of lance leaf grapefern, a rare plant. Potential effects to undetected individuals and habitat would be greatest among Alternative 3, which has the most harvesting, followed by Alternatives 2, 5, and 4.

Cumulative Effects

Cumulative effects on this plant could occur to undetected individuals in forested habitat, primarily through timber harvesting. Past projects, including those that involve road building or timber harvesting, may have impacted undetected individuals or habitat in the project area. Similarly, current or future projects (described in Chapter 3) that involve these activities, including the Big Thorne project, could affect undetected individuals or habitat. The potential for cumulative effects as a result of the project would be highest from Alternative 3, which has the most harvesting, followed by Alternatives 2, 5, and 4, in that order. The overall risk to this plant in the cumulative effects analysis area as a result of this project is moderate or less due to a lack of effects on known populations and potentially suitable habitat

Western Meadowrue (Rare species)

Western meadowrue is typically found along lakeshores and stream banks; in the project area, it was typically found along larger, fish-bearing streams. Thirteen populations of over 1,900 plants are known in the project area.

Direct and Indirect Effects

None of the action alternatives would result in any direct effects to known populations of western meadowrue, a rare plant. In addition, Alternatives 2, 4, and 5 would not have any indirect effects on known populations of this species. Two helicopter units in Alternative 3 (Units 420 and 439) could indirectly affect two known populations of this plant representing 17 percent of the known populations in the project area and about 50 percent of the individual plants known to exist in the project area. The project could potentially directly affect undetected individuals and habitat through road building activities. Direct effects could occur through damage by machinery and placement of fill material during road building. Indirect effects are also possible, potentially occurring as a result of soil moisture changes due to road building or timber harvest. The risk of adverse effects to this plant is low, as minimal impacts to its habitat are likely to result from the project, and would primarily result from stream crossings. Potential effects to undetected individuals would be greatest among Alternative 3, which has the most road building and stream crossings, followed by Alternatives 2, 4, and 5, in that order.

Cumulative Effects

This plant is commonly found along streams and lakes, which are generally protected by buffers under the current forest plan; the state also requires buffers for streams and lakes. Prior to these buffers being required, past projects likely did affect this plant and its habitat. However, due to the present requirement of stream and lake buffers, little habitat is likely to be directly affected by present or future projects. Past, projects primarily those involving road building, may have impacted undetected individuals or habitat in the project area. Similarly, current or future projects (described in Chapter 3) that involve road building, including the Big Thorne project, could affect undetected individuals or habitat. The potential for cumulative effects as a result of the project would be the highest from Alternative 3, which has the most road building and stream crossings (and potential indirect effects), followed by Alternatives 2, 4, and 5, in that order. The overall risk to this plant on the cumulative effects analysis area as a result of this project is low due to the absence of

direct effects to known populations and because it commonly occurs in habitats (stream and lake buffers) where management activities are unlikely to occur or limited.

Alaska Rein Orchid (Sensitive Species)

Alaska rein orchid has been documented in the project area and 24 populations of this species have been mapped. The total estimated plant count for these 24 populations is 867 individuals, which represents about 90 percent of the known individuals located on the Tongass National Forest.

These plants typically are found at the edge of muskeg and old-growth forest, although they also occur in forest interiors and along road edges. In the project area, some of the largest populations were found along roads and in ditches. Approximately 81 percent of the known individuals in the project area were found in areas mapped (using cover type mapping) as nonforest or non-productive old growth (i.e., areas unlikely to be harvested).

Conservative habitat suitability models were used to evaluate the amount of potential suitable habitat present in the project area. Survey efforts covered approximately a quarter of the potential suitable habitat for this species within the unit pool.

Direct and Indirect Effects

Effects to Alaska rein orchid as a result of the Big Thorne project are summarized by alternative and in Table BOT-2. All alternatives avoid direct effects to known Alaska rein orchid plants. Avoidance and minimization measures were previously summarized and were applied to proposed harvest in the vicinity of this species. Appendix D of the Plant Biological Evaluation (Opolka 2012a) and the Botany Resource Report (Opolka 2012b) summarizes the avoidance measures unit by unit for this plant.

Table BOT-2. Percentage of Known Populations and Estimated Percentage of Individuals of Alaska Rein Orchid Directly or Indirectly Affected in the Project Area by the Big Thorne Project

Type Affected	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	Direct Effects	Indirect Effects	Direct Effects	Indirect Effects	Direct Effects	Indirect Effects	Direct Effects	Indirect Effects	Direct Effects	Indirect Effects
Populations Affected	0	0	0	5	0	7	0	2	0	5
Estimated Percentage of Known Populations Potentially Affected[1/]	0%	0%	0%	21%	0%	29%	0%	8%	0%	21%
Individuals Affected2/	0%	0%	0	45	0	54	0	5	0	45
Estimated Percentage of Known Individuals Potentially Affected[3/]	0%	0%	0%	5%	0%	6%	0%	0.6%	0%	5%

1/There are 24 known populations in the project area.
2/ Number of individuals affected was estimated by multiplying the number of individuals identified in a population by the proportion of that population area within the direct or indirect effect zone (see Methods Section). There are approximately 867 known individuals in the project area.
3/ There are approximately 867 known individuals in the project area.

Alternative 1

Alternative 1 would not result in any direct or indirect effects on known populations of Alaska rein orchids, as a result of the Big Thorne project.

Alternative 2

Alternative 2 would have no direct effects on known populations of the Alaska rein orchid, as all new roads and harvest units avoid known populations. However, this alternative could indirectly affect 5 populations totaling 45 individuals of this plant. This alternative would have similar effects to populations and individuals as Alternative 5, less than Alternative 3, and more than Alternative 4.

Alternative 3

Alternative 3 would have no direct effects on known populations of Alaska rein orchid. This alternative could indirectly affect 7 populations totaling 54 individuals of this plant. This alternative would have the largest effect on individuals and populations of all the alternatives.

Alternative 4

Alternative 4 would have no direct effects on known populations of Alaska rein orchid. This alternative could indirectly affect 2 populations totaling five individuals of this plant and would have the lowest effect on individuals and populations.

Alternative 5

Alternative 5 would have no direct effects on known populations of Alaska rein orchid. This alternative could indirectly affect 5 populations totaling 45 individuals of this plant. This alternative would have a similar level of effect on individuals and populations as Alternative 2, less than Alternative 3, and more than Alternative 4.

Cumulative Effects

The following cumulative effects analysis summarizes known affects with respect to the project area and biogeographic provinces 14 and 18,. Present and reasonably foreseeable projects could affect undetected individuals through timber harvesting and road building activities. Because of its prevalence along roadsides, road maintenance activities could also affect individuals; however, these would likely affect only an insignificant portion of the populations in the project area and biogeographic provinces 14 and 18. Cumulative effects on potential suitable habitat include past projects and the Big Thorne project. While reasonably foreseeable projects would contribute to effects on suitable habitat, specific project boundaries are not known for all projects and it is not possible to consistently analyze effects to potential suitable habitat for these projects. This section summarizes cumulative effects by alternative; after that, summaries of cumulative effects for the project area and for biogeographic provinces 14 and 18 are provided.

Alternative 1

Alternative 1 would not result in any direct or indirect effects on any known populations, as a result of the Big Thorne project. Past projects have directly affected approximately 17 percent of the potentially suitable habitat in the project area and approximately 11 percent of the potentially suitable habitat in biogeographic provinces 14 and 18 (Prince of Wales Island and adjacent islands). With reasonably foreseeable projects, these percentages would be approximately 17 percent for the project area and 12 percent for biogeographic provinces 14 and 18.

Alternative 2

In the project area, this alternative would not directly affect any known populations, but would potentially indirectly affect an estimated 21 percent of the known populations and 5 percent of the known individuals. In biogeographic provinces 14 and 18, this alternative would potentially indirectly affect about 17 percent of the known populations and 5 percent of the known individuals. This alternative would have the second-highest level of indirect effects on populations and individuals, similar to that of Alternative 5. It would have less effect than Alternative 3 and more than Alternative 4.

Past projects have directly affected approximately 17 percent of the potentially suitable habitat in the project area (based on habitat modeling).). Alternative 2 would affect an additional 3 percent, resulting in 20 percent of potentially suitable habitat being affected

in the project area. In biogeographic provinces 14 and 18, approximately 11 percent of potentially suitable habitat has been directly affected and contributions by Alternative 2, plus reasonably foreseeable projects, would increase the overall effect to about 12 percent. This alternative would have less effect on suitable habitat than Alternative 3. It would have similar effects to suitable habitat as Alternatives 4 and 5.

Alternative 3

In the project area, this alternative would not directly affect any known populations, but would potentially indirectly affect an estimated 29 percent of the known populations and 6 percent of known individuals. In biogeographic provinces 14 and 18, this alternative would potentially indirectly affect about 23 percent of the known populations and 6 percent of the known individuals.

Past projects have directly affected approximately 17 percent of potentially suitable habitat in the project area. Alternative 3 would affect an additional 4 percent, resulting in 21 percent of potential suitable habitat affected in the project area. In biogeographic provinces 14 and 18, approximately 11 percent of potential suitable habitat has been directly affected and contributions by this alternative, plus reasonably foreseeable projects, would increase the overall effect to about 12 percent. This alternative would have the highest level of indirect effects and effects to suitable habitat.

Alternative 4

In the project area, this alternative would not directly affect any known populations, but would potentially indirectly affect an estimated 8 percent of the known populations and 0.6 percent of known individuals. In biogeographic provinces 14 and 18, this alternative would potentially indirectly affect about 7 percent of the known populations and 1 percent of the known individuals. This alternative would have the lowest effect on this plant.

Past projects have directly affected approximately 17 percent of potentially suitable habitat in the project area (based on habitat modeling). Alternative 4 would affect an additional 2 percent, resulting in almost 20 percent of potential suitable habitat affected in the project area. In biogeographic provinces 14 and 18, approximately 11 percent of potentially suitable habitat has been affected and contributions by this alternative, plus reasonably foreseeable projects, would increase the overall affect to about 12 percent. This alternative would have slightly less cumulative potential suitable habitat effect than Alternative 3 and similar effects as the other action alternatives.

Alternative 5

In the project area, this alternative would not directly affect any known populations, but would potentially indirectly affect an estimated 21 percent of the known populations and 5 percent of known individuals. In biogeographic provinces 14 and 18, this alternative would potentially indirectly affect about 17 percent of the known populations and 5 percent of the known individuals. This alternative would have similar effects on this plant as Alternatives 2 and 3 and larger effects than Alternative 4.

Past projects have directly affected approximately 17 percent of potentially suitable habitat in the project area (based on habitat modeling). As a result of the Big Thorne project, an additional 3 percent would be affected by this alternative, resulting in about 20

percent of potential suitable habitat affected in the project area. In biogeographic provinces 14 and 18, approximately 11 percent of potential suitable habitat has been affected and contributions by this alternative, plus reasonably foreseeable projects, would increase the overall affect to about 12 percent. This alternative would have less effect on suitable habitat than Alternative 3, and similar effects as Alternatives 2 and 4.

Summary of Cumulative Effects for the Project Area

The estimated percentage of individuals potentially indirectly affected in the project area would range from as low as 0.6 percent (Alternative 4) to as high as 6 percent (Alternative 3). These indirect effects would likely be of much lower intensity than those resulting from known direct effects, which are completely avoided by the project for this species. Present and reasonably foreseeable projects could directly or indirectly affect additional individuals, although there are no known effects at this time. However, limited effects could occur as a result of road maintenance activities, micro timber sales, or precommercial thinning (e.g., precommercial thinning is planned for a unit that is adjacent to a population growing along the road north of Luck Lake).

Cumulative effects may result from this project in combination with other past, present, and reasonably foreseeable projects. In order to approximate the cumulative effects that have already occurred to the Alaska rein orchid, a general habitat model was used to evaluate potential suitable habitat; these results summarized above by alternative. Based on this analysis, past projects have affected approximately 17 percent of potentially suitable habitat in the project area. As a result of the Big Thorne project, cumulative effects could range from 20 percent (Alternatives 2, 4, and 5) to 21 percent (Alternative 3). Present and reasonably foreseeable projects would slightly increase the amount of potential suitable habitat affected, but the cumulative effects would still range from 20 to 21 percent.

In summary, because none of the alternatives would result in direct effects on known populations, because the majority of known individuals are in non-productive old growth habitats in areas unlikely to be harvested, and because the project would not result in a loss of sufficient potential suitable habitat likely to adversely affect the population viability, it is concluded that the project may adversely affect individuals, but is not likely to result in a loss of viability in the project area, nor would it cause a trend toward federal listing for any of the action alternatives. Refer to the Biological Evaluation for Plants in the project record for a more detailed evaluation, including descriptions by unit of indirect effects.

Summary of Cumulative Effects for Biogeographic Provinces 14 and 18

The known cumulative effects to individuals in biogeographic provinces 14 and 18 as a result of the Big Thorne project are the same as those listed above for the project area, as there are no additional known effects to individual plants or populations. The estimated percentage of individuals potentially indirectly affected as a result of the Big Thorne project in biogeographic provinces 14 and 18 would range from as low as 0.6 percent (Alternative 4) to as high as 6 percent (Alternative 3). Present and reasonably foreseeable projects include current timber harvesting on state and NFS lands, and pre-commercial thinning of young growth.

Other projects that could impact this plant in biogeographic provinces 14 and 18 include remaining harvest in the Logjam, Control Lake, Soda/Nick, and Chasina, and other timber sale projects, as well as additional harvest on non-NFS lands. Although no additional known affects to this species have been identified, it should be noted that it was not on the sensitive species list prior to 2009, and thus would not have been a targeted species in surveys. Identification of this plant can be difficult unless the plant is flowering, which requires that the surveys be conducted at the right time for identification. Although undetected populations could be present, it is likely that the degree of effect on this species as a result of past timber sale projects was relatively low, since this plant commonly grows near muskeg edges in unproductive timber areas that are not commercially viable for harvest. Additional harvest on state and private lands is expected to have similar effects to those on National Forest lands.

Past harvest has affected about 11 percent of the modeled potential suitable habitat in biogeographic provinces 14 and 18. Cumulatively, if the Big Thorne harvest is added, the total cumulative effect is expected to be no more than 12 percent with any of the alternatives.

A total of 36 known populations of Alaska rein orchid totaling 959 individuals are known on the Tongass National Forest. The majority of these, including 30 populations and 953 individuals occur in biogeographic provinces 14 and 18. An additional population is in biogeographic province 4; three known populations are in biogeographic province 6, and two known populations are in biogeographic province 15.

In summary, because none of the alternatives would result in direct effects on known populations, because the majority of known individuals are in non-productive old growth habitats in areas unlikely to be harvested, and because the project would not result in a loss of sufficient potential suitable habitat likely to adversely affect the population viability, it is concluded that the project may adversely affect individuals, but is not likely to result in a loss of viability in biogeographic provinces 14 and 18 or on the Tongass, nor would it cause a trend toward federal listing for any of the action alternatives. Refer to the Biological Evaluation for Plants in the project record for a more detailed evaluation, including descriptions by unit of indirect effects.

Lesser Round-Leaved Orchid (Sensitive Species)

The lesser round-leaved orchid was observed in numerous locations during field surveys for the Big Thorne project. A total of 110 populations of this species were found in the project area. The total estimated plant count for these populations was 3,923 individuals, which represents about 73 percent of the known individuals in the Tongass National Forest.

Survey efforts covered approximately 18 percent of the potential suitable habitat for this species within the unit pool and approximately 4 percent of the potential suitable habitat in the project area (based on generalized habitat modeling).

Direct and Indirect Effects

Direct and indirect effects to lesser round-leaved orchid are summarized by alternative and in Table BOT-3. All of the action alternatives have effects to lesser round-leaved orchid. Avoidance and minimization measures were previously summarized and were

applied to proposed harvest in the vicinity of this species. Appendix D in the Botany resource report (Opolka 2012b) and the unit cards (Appendix B of this EIS) summarize the avoidance measures unit by unit for this plant.

Alternative 1

Alternative 1 would not result in any direct or indirect effects on any known populations of lesser round-leaved orchids, as a result of the Big Thorne project.

Alternative 2

This alternative would directly affect 22 of the 110 known populations and an estimated 157 individuals of this plant in the project area. This reflects a direct effect on 20 percent of the known populations in the project area, although only 4 percent of the total individuals known to inhabit the project area would be directly affected.

Table BOT-3. Percentage of Known Populations and Estimated percentage of Individuals of Lesser Round-Leaved Orchid Directly or Indirectly[1/] Affected in the Project Area by the Big Thorne Project

Type Affected	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	Direct Effects	Indirect Effects	Direct Effects	Indirect Effects	Direct Effects	Indirect Effects	Direct Effects	Indirect Effects	Direct Effects	Indirect Effects
Populations Affected	0	0	22	22	28	26	4	25	20	19
Estimated Percentage of Known Populations Potentially Affected in Project Area[2/]	0%	0%	20%	20%	25%	24%	4%	22%	18%	17%
Individuals Affected[3/]	0	0	157	407	306	903	7	411	171	401
Estimated Percentage of Known Individuals Potentially Affected in Project Area[4/]	0%	0%	4%	10%	8%	23%	0.2%	10%	4%	10%

1/ Indirect populations potentially affected in the table include only those in addition to the ones directly affected to avoid double counting.
2/ There are 110 known populations in the project area.
3/ Number of individuals estimated by multiplying the number of individuals identified in a population by the proportion of that population area within the direct or indirect effect zone (see Methods Section).
4/ There are approximately 3,923 known individuals in the project area.

This alternative could indirectly affect 22 additional known populations and an estimated 407 individuals of this plant. This reflects a potential combined direct or indirect effect on 40 percent of the known populations in the project area, although just 14 percent of the total known individuals in the project area could be directly or indirectly affected. Alternative 2 would be intermediate in terms of direct and potential indirect effects on the lesser round-leaved orchid.

Alternative 3

Alternative 3 would directly affect 28 known populations and an estimated 306 individuals of this plant. This reflects a direct effect on 25 percent of the known populations in the project area and 8 percent of the total individuals in the project area.

This alternative could indirectly affect 26 additional known populations and an estimated 903 individuals of this plant. This reflects a potential combined direct or indirect effect on 54 percent of the known populations in the project area and 31 percent of the total known individuals in the project area. Alternative 3 would have the highest direct and potential indirect effects on the lesser round-leaved orchid.

Alternative 4

Under this alternative, sensitive plant populations would often be deferred from harvest, by either excluding the plant population from the unit or through including the population in unharvested areas of units with partial harvest prescriptions. This alternative would directly affect 4 known populations and an estimated 7 individuals of this plant. This reflects a direct effect on 4 percent of the known populations in the project area and 0.2 percent of the total known individuals known to inhabit the project area.

This alternative could indirectly affect 25 additional known populations and an estimated 411 individuals of this plant. This reflects a potential combined direct or indirect effect on 26 percent of the known populations in the project area and 10 percent of the total known individuals in the project area. Alternative 4 would have the lowest level of direct and potential indirect effects, much lower than with the other action alternatives.

Alternative 5

This alternative would directly affect 20 known populations and an estimated 171 individuals of this plant. This reflects a direct effect on 18 percent of the known populations in the project area and 4 percent of the total known individuals in the project area.

This alternative could indirectly affect 19 additional known populations and an estimated 401 individuals of this plant. This reflects a combined direct or indirect effect on 35 percent of the known populations in the project area and 14 percent of the total known individuals in the project area. Alternative 5 would be intermediate in terms of direct and potential indirect effects on the lesser round-leaved orchid.

Cumulative Effects

The following cumulative effects analysis summarizes known effects with respect to the project area and biogeographic provinces 14 and 18. Present and reasonably foreseeable projects could affect undetected individuals through timber harvesting and road building activities. Cumulative potential suitable habitat includes past projects and the Big Thorne project. While current or reasonably foreseeable projects would likely contribute to effects on suitable habitat, specific project boundaries are not known for all projects and it is not possible to consistently analyze effects to potential suitable habitat for these projects. This section summarizes cumulative effects by alternative; after that, summaries of cumulative effects for the project area and for biogeographic provinces 14 and 18 are provided.

Alternative 1

Alternative 1 would not result in any direct or indirect effects on any known populations, as a result of the Big Thorne project. Past projects have directly affected approximately

28 percent of the potentially suitable habitat in the project area and approximately 16 percent of the potentially suitable habitat in biogeographic provinces 14 and 18 (Prince of Wales Island and adjacent islands).). With reasonably foreseeable projects, these percentages would be approximately 29 percent for the project area and 17 percent for biogeographic provinces 14 and 18.

Alternative 2

In the project area, this alternative would directly affect an estimated 4 percent and potentially indirectly affect 10 percent of the known individuals (14 percent cumulatively). For biogeographic provinces 14 and 18, this alternative would directly affect 4 percent and indirectly affect 9 percent of the known individuals (13 percent cumulatively). Alternative 2 would be intermediate in effects for these provinces.

Past projects have directly affected approximately 28 percent of potential suitable habitat in the project area (based on habitat modeling). As a result of Alternative 2 and other reasonably foreseeable harvest (including non-NFS harvest), an additional 4 percent would be affected by this alternative, resulting in about 32 percent of potential suitable habitat affected in the project area. Within Biogeographic provinces 14 and 18, approximately 16 percent of potential suitable habitat has been directly affected and contributions by this alternative plus reasonably foreseeable harvest, would increase the overall effect by about 1 percent, to about 17 percent cumulatively. This alternative would affect less suitable habitat than Alternative 3 and a similar amount as Alternatives 4 and 5.

Alternative 3

In the project area, this alternative would directly affect an estimated 8 percent and potentially indirectly affect 23 percent of the individuals (31 percent cumulatively). For biogeographic provinces 14 and 18, this alternative would directly affect about 7 percent and indirectly affect about 21 percent of the known individuals (28 percent cumulatively). This alternative would have the highest effects on this plant.

Past projects have directly affected approximately 28 percent of potential suitable habitat in the project area (based on habitat modeling). As a result of Alternative 3 and other reasonably foreseeable harvest (including non-NFS harvest), an additional 5 percent would be directly affected, resulting in 33 percent of potential suitable habitat directly affected in the project area. For biogeographic provinces 14 and 18, approximately 16 percent of potential suitable habitat has been affected and contributions by this alternative would increase the overall effect by about 2 percent, to about 18 percent cumulatively. This alternative would have the highest effects to potential suitable habitat.

Alternative 4

In the project area, this alternative would directly affect an estimated 0.2 percent and potentially indirectly affect 10 percent of the individuals (10 percent cumulatively). For biogeographic provinces 14 and 18, this alternative would directly affect about 0.1 percent and indirectly affect 8 percent of the known individuals (8 percent cumulatively). This alternative would have the lowest effect on this plant.

Past projects have directly affected approximately 28 percent of potentially suitable habitat in the project area (based on habitat modeling). As a result of Alternative 4 and other reasonably foreseeable harvest (including non-NFS harvest), an additional 3 percent would be affected, resulting in 31 percent of potential suitable habitat directly affected in the project area. For biogeographic provinces 14 and 18approximately 16 percent of potential suitable habitat has been directly affected and contributions by this alternative would increase the overall effect by about 1 percent, to about 17 percent cumulatively. This alternative would have lower effects on potential suitable habitat compared with Alternative 3, and have similar effects as Alternatives 2 and 5.

Alternative 5

In the project area, this alternative would directly affect an estimated 4 percent and indirectly affect 10 percent of the individuals (14 percent cumulatively). For biogeographic provinces 14 and 18, this alternative would directly affect about 3 percent and indirectly affect 7 percent of the known individuals (10 percent cumulatively). This alternative would have intermediate effects relative to the other alternatives.

Past projects have directly affected approximately 28 percent of potentially suitable habitat in the project area (based on habitat modeling). As a result of Alternative 5 and other reasonably foreseeable harvest (including non-NFS harvest), an additional 4 percent would be affected, resulting in 31 percent of potential suitable habitat directly affected in the project area. For biogeographic provinces 14 and 18, approximately 16 percent of potential suitable habitat has been directly affected and contributions by this alternative would increase the overall effect by about 1 percent, to almost 17 percent cumulatively. This alternative would have intermediate effects on potential suitable habitat relative to the other alternatives.

Summary of Cumulative Effects for the Project Area

The estimated percentage of individuals directly affected in the project area as a result of the Big Thorne project would be as low as 0.2 percent (Alternative 4) to 8 percent (Alternative 3). The estimated percentage of individuals potentially indirectly affected in the project area as a result of the Big Thorne project would be as low as 10 percent (Alternatives 2, 4, and 5) to as high as 23 percent (Alternative 3). Alternatives 2 and 5 have similar indirect effects as Alternative 4. Alternative 4 was designed to avoid effects to sensitive and rare plants, so these numbers may initially seem to contradict the intent of this alternative. However, the indirect effects are slightly higher due to avoidance of direct affects in Alternative 4, which typically have much more of an adverse effect on plants.

Populations of this plant are concentrated in the project area, particularly in the south-central portion of the project area. During project planning, populations located near the outer edge of population concentrations, or larger outlying populations, were protected from roads and harvest to preserve the geographic distribution of this plant. Similarly, populations within units were often protected by designating legacy retention in these areas (for units in VCUs requiring legacy). These measures were done primarily in Alternative 4, but they were implemented to a degree in all alternatives. These efforts to

minimize effects to populations are documented on the unit cards and in the Botany Resource Report (Opolka 2012b).

In order to approximate the cumulative effects that have already occurred to the lesser round-leaved orchid, the general habitat model was used to evaluate potential suitable habitat in the project area. About 28 percent of potentially suitable habitat has been previously affected in the project area, primarily through timber harvesting and road building. When the effects of the Big Thorne project are included, an additional 2 to 3 percent would be affected, resulting in cumulative effects ranging from 30 percent (Alternatives 2, 4, and 5) to 31 to 33 percent (Alternative 3). Present and reasonably foreseeable projects would slightly increase the amount of potential suitable habitat affected, by less than 1 percent.

For these reasons, it is expected that the project may adversely affect individuals, but is not likely to result in a loss of viability in the project area or cause a trend toward federal listing for any of the action alternatives. Refer to the Botany Resource Report (Opolka 2012a) in the project record for a unit by unit explanation detailing direct and indirect effects and mitigation for rare and sensitive plants.

Summary of Cumulative Effects for Biogeographic Provinces 14 and 18

The known cumulative effects to individuals in biogeographic provinces 14 and 18, as a result of the Big Thorne project, are the same as those listed above for the project area, with the exception of one additional individual directly impacted as a result of the Logjam project. Present and reasonably foreseeable projects for biogeographic provinces 14 and 18 include current timber harvesting timber harvesting on state and NFS lands, PCT of young growth, and the potential for commercial thinning of young growth on the National Forest. Projects outside the project area include remaining harvest in the Logjam, Control Lake, Soda/Nick, Chasina, and other timber sale projects, as well as additional harvest on non-NFS lands.

The estimated percentage of individuals directly affected in biogeographic provinces 14 and 18 as a result of the Big Thorne project would range from 0.2 percent (Alternative 4) to 7 percent (Alternative 3). The estimated percentage of individuals potentially indirectly affected in these provinces as a result of the Big Thorne project would be as low as 9 percent (Alternatives 2, 4, and 5) to 21 percent (Alternative 3).

Approximately 16 percent of potential suitable habitat has been directly affected in biogeographic provinces 14 and 18. When the Big Thorne project effects, plus the effects of other reasonably foreseeable harvest (including non-NFS harvest) are included, the increase would be between 1 and 2 percent depending on the alternative, with the maximum affected at about 18 percent for Alternative 3.

Reasonably foreseeable projects that may affect known populations include the Logjam project, where one plant may be directly affected. Although additional plants were not found during Logjam project surveys, this species was not on the Sensitive Species List at that time and was not targeted for surveys. Other timber sale projects in biogeographic provinces 14 and 18 may affect suitable habitat, but none are expected to affect known populations.

In order to evaluate the impact on the extent of the distribution of lesser round-leaved orchid with respect to the Tongass National Forest, the distribution of populations across the forest were mapped. A total of 282 known populations of lesser round-leaved orchid and 5,360 individuals are known on the Tongass National Forest. The majority of individuals (4,362), but less than half of the populations (127) occur in biogeographic provinces 14 and 18. Additional populations of this plant are found in two other biogeographic provinces. Thirty-two populations of about 500 plants are in biogeographic province 13, to the northeast of the project area and 123 populations; totaling about 510 plants are in biogeographic province 15 located east and southeast of the project area.

In summary, the Big Thorne project would directly affect between 0.2 percent (Alternative 4) and 8 percent (Alternative 3) of the known individual plants identified in the Big Thorne project area, which is between 0.1 percent (Alternative 4) and 6 percent (Alternative 3) of the known individual plants on the Tongass. About 44 percent of all the known individuals in the project area are in non-productive old growth habitats (i.e., unlikely to be harvested). The Big Thorne project has avoided direct effects on at least 92 percent of known individuals in the project area, even under Alternative 3. Although potential indirect effects range from 10 to 23 percent, the potential adverse effects are much less likely than those expected from direct effects. In addition, about 9 percent of all known populations of this plant have been found in areas mapped as young-growth, mostly from 40 to 50 years old. Although there are many unknowns surrounding these plants, they are apparently not restricted to productive old-growth stands. For these reasons, it is expected that the project may adversely affect individuals, but is not likely to result in a loss of viability in the biogeographic provinces or cause a trend toward federal listing for any of the action alternatives. Refer to the Botany Resource Report (Opolka 2012a) in the project record for a unit by unit explanation detailing direct and indirect effects and mitigation for rare and sensitive plants.

3 Environment and Effects

Invasive Plants

Introduction

This analysis is based on known invasive plants and their expected response to habitat alteration and vectors as a result of project activities. Species are considered invasive if they are not native to an ecosystem and are likely to cause harm to human health, the economy, or the environment (Executive Order [EO] 13112).

In October 2007, the Tongass National Forest adopted guidelines for invasive plant management with a supplement to FSM 2080 (Supplement No. R10 TNF-2000-2007-1). The objective of this supplement is to provide an integrated pest management approach for managing invasive plants on the Tongass National Forest. This supplement requires the development of a risk assessment as part of an environmental analysis for ground-disturbing activities. The risk assessment for this project is in the project record (Opolka 2012c). The 2008 Forest Plan includes direction on invasive species, which include the overall context of desired conditions (see Biodiversity goals and objectives) as well as standards and guidelines for invasive species. These were based on a number of laws, but most directly on EO 13112. Specifically, EO 13112 directs all federal agencies to address the impacts that their actions may have on invasive species.

The Alaska Natural Heritage Program's (ANHP) Weed Ranking Project (see http://akweeds.uaa.alaska.edu/akweeds_ranking_page.htm) was used to develop a list of target invasive plants about which the Forest has concerns. This ranking process takes into account the following characteristics for each plant species: potential ecological impact, biological characteristics, dispersal ability, current distribution, and the feasibility of control. Plants are then ranked on a scale of 0-100, with 100 having the highest invasiveness rank. The Tongass National Forest High-Priority Invasive Plant Species List is a list of target plants of which the Forest is most concerned (USDA Forest Service 2007). This list uses the ANHP Weed Ranking Project results to rank the invasiveness of each species. Those species known to occur on the Forest, as well as several not yet here, with a ranking higher than 60 are highlighted for management concerns. In addition to the target list of high priority species, the Tongass is also concerned about other species not on this list, depending on their abundance, location, and threats to ecosystem functions and/or biodiversity.

Methodology

Invasive plant surveys were conducted on Prince of Wales Island in 2005 for all Maintenance Level 3 and 4 road systems. This project included surveys every ¼ mile along the road system as well as at each intersection and rock quarry encountered. Overall, 2,635 non-native plant sites were documented in areas such as rock quarries, road intersections, and road pullouts. The survey covered approximately 584 miles of road. Surveys were done at the appropriate time of year to identify the broadest range possible of non-native plant species.

In addition to the contract invasive plant surveys in 2005, surveys in the Big Thorne project area were conducted in 2009, 2010, and 2011 along existing system roads,

temporary roads, landings, LTFs and in natural settings. If any non-native plants were observed, the boundary of the infestation was recorded with GPS and delineated in GIS.

Affected Environment

A total of 61 non-native plant species are documented to occur within the project area. Of these, 11 are classified as high-priority invasive plant species by the Tongass National Forest. Table INV-1 summarizes these plants, their invasive ranking, and the populations and locations in the project area.

Table INV-1. High Priority Invasive Plant Species found in the Project Area

Scientific Name	Common Name	Invasive Rank[1/]	Populations and Location[2/]
Cirsium arvensis	Canada thistle	76	6 populations; SE and SW portion of project area
Cirsium vulgare	bull thistle	61	27 populations; SE and SW portion of project area
Hieracium aurantiacum,	orange hawkweed,	79	115 populations; scattered primarily in southern portion of project area
Hieracium caespitosum	meadow hawkweed	79	3 populations; 1 population in NE portion of project area, 2 populations near southern edge of project area
Senecio jacobaea	tansy ragwort	63	5 populations; located near project boundary in southern and SE portion of project area
Sonchus arvensis	perennial sowthistle,	61	1 population in southern portion of project area
Crepis tectorum	narrow-leaf hawk's beard	54	17 populations in southern portion of project area
Leucanthemum vulgare	oxeye daisy	61	164 populations, ubiquitous
Melilotus alba	white sweetclover	80	1 population in southeastern corner of project area
Phalaris arundicacea	reed canarygrass	83	607 populations, common along existing roads and has been found in riparian areas
Tanacetum vulgare	common tansy	57	6 scattered populations

1/ Numerical Rankings assigned according to the Alaska Natural Heritage Program's (ANHP) Weed Ranking Project. Ranked on a scale of 0-100, with 100 having the highest invasiveness risk.
2/ Populations primarily located adjacent to roads; maps of invasive plant populations available in the project record.

Invasive Plant Risk Assessment

The invasive plant risk assessment was conducted according to FSM 2080 (Supplement No. R10 TNF-2000-2007-1), which requires an invasive plant risk assessment for ground-disturbing activities. The risk assessment evaluates the locations of known invasive plants, existing habitat vulnerability, and the potential response of invasive plants as a result of project actions that result in habitat alteration and increased vectors. Additional details regarding the basis of risk assessment are included in the Environmental Consequences section. The invasive plant risk assessment (Opolka 2012c) and Invasive Species Resource Report (Opolka 2012c) are also in the project record.

In an attempt to limit the spread of invasive plants during project implementation, the following mitigation and monitoring measures are required for the project:

- Mitigation Measures
  - In order to avoid the introduction of new invasive plants into the project area, ground-based equipment (road building equipment, yarders, shovels, skidders, forwarders, harvesters, processors or feller bunchers, etc.) will be cleaned prior to implementation and mobilization, if the equipment is imported to Prince of Wales Island from another location.
  - Only Forest Service approved rock sources will be used;
  - Any new introductions of high-priority invasive plants found in the Project Area will be treated according to Forest Service Manual supplement (TNF 2000-2007-1), and the Region 10 and Tongass Invasive Plant Management Plan as part of the District's program of work for invasive species management.
  - The specific invasive plant populations in Table INV-2 have been identified for manual treatment (hand-pulling) or monitoring based on their limited distribution in the project area, potential for spread, and feasibility for treatment.
- Monitoring Measures
  - Newly constructed roads, existing roads that were improved, and any active rock quarries in the Project Area will be monitored for at least 3 years after project completion for new non-native plant introductions.
  - Monitor treated plant populations as noted in Table INV-2 and according to the Tongass Invasive Plant Management Plan and the District's program of work.

Ongoing Treatments

Independent of the mitigation and monitoring measures recommended for the project, the Forest Service also has an ongoing invasive plant program of work. This work varies from year to year, and will continue as funding allows. In the past several years, this program has monitored and treated a number of infestations in the vicinity of the project area. A summary of past treatment information is available in the project record.

Table INV-2. Specific Invasive Plant Populations for which Treatment is Recommended

Species	Location	Comments
Cirsium arvensis Canada thistle	Two populations, one each by Units 26 and 116	Both have been treated in the past, recommend monitoring and follow-up treatments
Cirsium vulgaris bull thistle	Several populations located by Units 1, 2, 4, 22, 501, 502,	All have been treated in the past, recommend monitoring and follow-up treatments
Crepis tectorum narrow-leaf hawk's beard	One population by Unit 6	Treatment recommended
Senecio jacobaea tansy ragwort	One population by Units 58 and 59, one population along haul route by Sandy Beach	All locations have been treated. The population by Units 58 and 59 is not known to persist; this location should be monitored and treated if plants are observed. The population by Sandy Beach is known to persist and should be treated.
Sonchus arvensis perennial sowthistle	One population adjacent to the existing road that goes through Unit 504	Treatment recommended
Tanacetum vulgare common tansy	Two populations by Unit 363, three additional populations by Units 68, 135, and 572	Populations by Units 68 and 135 have been treated; monitoring has not observed continued infestations. These locations should continue to be monitored and treated if plants are observed. Populations by Units 363 and 572 should be treated.
Melilotus alba white sweet clover	1 population in southeastern corner of project area west of Unit 123.	Population has been treated; monitor and treat if plants are observed.

Environmental Consequences

All of the alternatives would result in some risk to the spread of invasive plants in the project area; even the No-action Alternative would have a moderate risk of spread due to existing invasive plants and traffic along the road system. Overall risk of invasive plant spread under the action alternatives is moderate to high along roadsides. However, risk of introduction of new invasive plants and spread of existing invasives into natural habitats and along temporary roads is considered moderate and short term (Opolka 2012c).

Mitigation measures have been designed to minimize the risk of invasive plant spread. The risk of invasive plant spread can be measured through the vectors in the analysis area, habitat vulnerability, and the proximity of existing invasive plant infestations. These are described in more detail in the Invasive Plant Risk Assessment (Opolka 2012c), available in the project record.

The relative potential for invasive plant spread can be measured through the acres harvested, miles of road built, number of stream crossings, and acres of rock quarries developed as a result of the project and can be compared by alternative. The effects of project actions are described below with respect to risk of invasive plant spread. Potential project effects that may result in invasive plant spread or establishment are indirect effects. As a result of habitat alteration and/or vectors, invasive plant spread could result

from project activities. These are discussed in a comparative format in the following subsections.

Effects from Timber Harvest

Habitat alteration as a result of the project will occur as timber is harvested in the project area, resulting in an increase in the acreage of habitat altered through clear cutting and partial harvest of old growth and the thinning of young growth. These actions could create habitat conditions vulnerable to invasive plant establishment with increased light levels, and proximity to existing populations of invasive plants. Timber harvesting would also remove wind-breaks, thereby creating new wind-paths that could spread seeds.

The project would use a combination of conventional (cable and shovel) and helicopter harvesting methods. The logging system used also affects risk because of variability in habitat alteration due to ground disturbance and an increase in vectors. Slightly higher risk is associated with conventional (shovel or cable) logging systems compared with helicopter. Tongass soil monitoring shows a small difference in detrimental soil disturbance between partial suspension (cable and shovel) (3 percent) and full suspension (helicopter) (2 percent) (Landwehr and Nowacki 1999). Additional soil disturbance not categorized as detrimental may also be possible in harvest units. These areas may result from smaller disturbances to the organic surface layer of the soil. Persistence of invasives is not likely to occur in these areas.

Another factor in the risk of invasive plant spread relative to harvesting method (conventional versus helicopter) is the proximity to existing roads, which often harbor invasive plants. Helicopter units are frequently located in remoter areas without road access, and thus in areas that are less likely to be infested with invasive plants. Alternatively, conventional harvesting requires road access and equipment usage in the unit (for shovel harvesting) and thus an increased exposure to invasive plants. The risk associated with invasive plant spread into harvest units is temporary. As these areas revegetate, invasive plants are expected to be out-competed by native vegetation.

Harvest prescriptions would include clearcuts and partial harvests of old growth and thinning of young growth. Risk associated with harvest prescription is related to the amount of light reaching the ground surface. Clearcuts result in removal of the tree canopy, high light levels, and have a higher risk of invasive plant spread. Partial harvests and thinning result in partial canopy removal and moderate lower risk of invasive plant spread due to increased light levels. While the overall acres harvested is a factor and will be considered in this analysis, the highest overall risk of invasive spread due to harvesting, when also considering habitat alteration and vectors, includes roads and conventionally harvested (shovel and cable) clearcuts, while the lowest overall risk would be partial harvesting by helicopter.

Table INV-3. Summary of Acres Harvested by Logging System, Prescription, and Alternative

Logging System	Alternative	Old Growth		Young Growth	Total Acres Harvested	Estimated Acres of Soil Disturbance[1/]
		Clearcut	Partial Harvest	Thinning		
Conventional (Shovel, Cable)	1	0	0	0	0	0
	2	3,301	15	0	3,316	99
	3	4,312	15	2,572	6,899	168
	4	1,389	474	2,160	4,023	81
	5	1,794	0	2,081	3,875	85
Helicopter	1	0	0	0	0	0
	2	931	696	0	1,627	26
	3	1,474	1,108	0	2,582	41
	4	510	1,849	0	2,359	29
	5	2,148	1,070	0	3,218	54
Total	1	0	0	0	0	0
	2	4,232	711	0	4,943	125
	3	5,786	1,123	2,572	9,481	209
	4	1,899	2,323	2,160	6,382	110
	5	3,942	1,070	2,081	7,093	139

[1/] Assumes 3% disturbance for conventional clearcut, 2% disturbance for helicopter clearcut, 1.5% disturbance (half of clearcut disturbance) for conventional partial harvest and thinning, and 1% disturbance (half of clearcut disturbance) for helicopter partial harvest and thinning.

Effects of Roads

Roads may result in altered habitat susceptible to invasive plant spread and their use and creation may result in additional vectors that could spread invasive plants. Use of roads by people and animals provides a source of invasive plant dispersal. Animals may spread invasive plant species through ingesting their seeds or transporting seeds on their fur or feathers. People may spread invasive plants along roads and trails by transporting seeds on their shoes, clothing, and vehicles. New road construction would also alter habitat and create areas of continuous soil disturbance and open habitats where invasive plants may continue to spread. Vehicles and equipment (both off and on-road) use could also transport these invasive plants along the road network and into the forest. Road maintenance including vegetation mowing also may disperse invasive plants along the road system. Many of the existing invasive plants present along the road network may also spread through wind and water dispersal. All of these vectors contribute to invasive plant dispersal and it is difficult to determine which vector has the greatest impact. The combination of these vectors results in a high risk of spread of invasive plants along the roadway, substantiated by the presence of invasive plants along the existing road system.

Although the risk of invasive plant spread along existing roadways is high, risk of spread into forested habitats is generally low due to existing dense vegetation cover. While the majority of invasive plants are located along the road system, invasive plants can spread into other natural habitats. For example, the seeds of reed canarygrass may enter roadside

drainages and be transported into streams and wetlands. Similarly, the windblown seeds of invasive plants may be transported into vulnerable habitats. The project will involve the construction or reconstruction of new roads; the type of road constructed (i.e., long term or short term) impacts the risk of invasive spread. Roads open permanently would create long-term opportunities for invasive plant spread and establishment. Temporary roads or roads that would be decommissioned after use are expected to become vegetated with native species eventually, but would present a risk in the shorter term for invasive plant introduction and spread. New system roads created for the project will remain open for 1 to 5 years after harvest, with temporary roads typically open for a shorter period. Between 1 and 5 miles of road (depending on alternative) will be converted to motorized trail use, resulting in long-term habitat alteration and vectors along these trails. Existing roads that will require maintenance for the project are a concern due to the potential for invasive plants to be transported to new areas during maintenance activities and new ground disturbance that could be vulnerable to new invasive plant infestations. While each type of road may have effects on invasive plant spread, the overall total road miles for each alternative has the greatest effect for invasive spread, since populations of invasive plants are concentrated along the road network and are likely to spread along this network due to the vectors and habitat vulnerability described above. The number of stream crossings required generally increases along with road mileage. Each road-stream crossing alters riparian habitat, resulting in vulnerability due to vegetation removal, increased light, and soil disturbance. Similar to roadways, rock quarry development also creates a habitat vulnerable to invasive plant infestations, due to the frequency of substrate disturbance and open habitat.

Implementation of any of the action alternatives may result in establishment of invasive plants, as all action alternatives will result in habitat alteration from tree harvesting, road construction, stream crossings, and rock quarry development. However, the logging methods and prescriptions, miles of road constructed, and rock quarries developed vary substantially among alternatives as does the potential risk of invasive plant introduction and spread. These are discussed by alternative in the following section and summarized Table INV-4.

Table INV-4. Summary of Acres Harvested, Road Construction, Number of Stream Crossings, and Acres of Rock Quarry as a result of the Big Thorne Project

	Total Acres Harvested (including young-growth thinning)	Total Miles of Road Construction and Reconstruction[1/]	Number of Stream Crossings[2/]	Acres of Rock Quarries[3/]
Alternative 1	0	0	0	0
Alternative 2	4,944	54	85	35
Alternative 3	9,481	95	112	56
Alternative 4	6,383	41	39	19
Alternative 5	7,093	31	16	16

1/ Includes all types of road construction and reconstruction.
2/ Includes all new road crossings of streams classes 1-4 proposed for use by the project in the project area.
3/ Assumes 1-acre of rock quarry development needed for every mile of road construction.

Alternative 1 (No Action)

Habitat alteration associated with the Big Thorne project under this alternative would be the same as existing conditions; there would not be tree harvesting, new stream crossings, rock quarries, or road building as a result of the Big Thorne project. The risk of invasive plant spread

Alternative 2 (Proposed Action) – Direct and Indirect Effects

Alternative 2 includes mostly clearcutting and a small amount of partial-cutting prescriptions, using conventional (cable and shovel) logging systems, as well as helicopter yarding to harvest old-growth timber on about 4,944 total acres. Approximately two-thirds of the harvesting would be done using conventional methods, with the remaining utilizing helicopters. Approximately 86 percent of the harvested acreage would be clearcut. This alternative would result in 3,301 acres of conventionally harvested clearcut, which has the highest risk for invasive plant spread, considering harvest prescription and harvest method(described in the Effects from Timber Harvest subsection above).

This alternative proposes approximately 54 total miles of road construction and reconstruction consisting of 19 miles of reconstruction of stored system roads, 12 miles of new system road, 23 miles of temporary road, and 4 new miles of motorized trail use. This alternative also proposes 85 stream crossings, and the construction of approximately 35 acres of rock quarries. Effects of these actions are discussed in detail under the preceding road construction effects section.

This alternative would have the second-highest amount of conventionally harvested clearcuts, total road construction, stream crossings and rock quarry development; correspondingly, it would have the second-highest level of risk for invasive plant spread among the alternatives, based on these actions.

Alternative 3 – Direct and Indirect Effects

This alternative includes mostly clearcutting and a small amount of partial-cutting prescriptions, using conventional (cable and shovel) logging systems, as well as helicopter yarding to harvest old-growth timber on about 6,910 total acres. In addition, Alternative 3 includes commercial thinning of young growth on 2,572 acres using conventional harvesting systems. This alternative would result in 4,312 acres of conventionally harvested clearcut, which has the highest risk for invasive plant spread, considering harvest prescription and harvest method (described in the Effects from Timber Harvest subsection above). This alternative proposes approximately 95 total miles of road construction and reconstruction consisting of 39 miles of reconstruction of stored system roads, 18 miles of new system road, 39 miles of temporary road, and 5 new miles of motorized trail use. This alternative also proposes 112 stream crossings, and the construction of approximately 56 acres of rock quarries. Effects of these actions are discussed in detail under the preceding road construction effects section.

This alternative would have the most acres of conventionally harvested clearcuts, road construction, stream crossings, and rock quarry development and would have the highest level of risk for invasive plant spread among the alternatives, based on these actions.

Alternative 4 – Direct and Indirect Effects

This alternative includes mostly clearcutting and a small amount of partial-cutting prescriptions, using conventional (cable and shovel) logging systems, as well as helicopter yarding to harvest old-growth timber on about 4,223 total acres. In addition, Alternative 4 includes commercial thinning of young growth on 2,160 acres using conventional harvesting systems. This alternative would result in 1,389 acres of conventionally harvested clearcut, which has the highest risk for invasive plant spread, considering harvest prescription and harvest method (described in the Effects from Timber Harvest subsection above). This alternative proposes approximately 41 total miles of road construction and reconstruction consisting of 22 miles of reconstruction of stored system roads, 3 miles of new system road, 16 miles of temporary road, and 2 new miles of motorized trail use. This alternative also proposes 39 stream crossings, and the construction of approximately 19 acres of rock quarries. Effects of these actions are discussed in detail under the preceding road construction effects section.

This alternative would have the second-lowest amount of conventionally harvested clearcuts, road construction, stream crossings, and rock quarry development; correspondingly, it would have the second lowest level of risk for invasive plant spread among the alternatives, based on these actions.

Alternative 5 – Direct and Indirect Effects

This alternative includes mostly clearcutting and a small amount of partial-cutting prescriptions, using conventional (cable and shovel) logging systems, as well as helicopter yarding to harvest old-growth timber on about 5,012 total acres. In addition, Alternative 5 includes commercial thinning of young growth on 2,081 acres using conventional harvesting systems. This alternative would result in 1,794 acres of conventionally harvested clearcut, which has the highest risk for invasive plant spread, considering harvest prescription and harvest method, (described in the Effects from Timber Harvest subsection above). This alternative proposes approximately 31 total miles of road construction and reconstruction consisting of 16 miles of reconstruction of stored system roads, 2 miles of new system road, 14 miles of temporary road, and 1 new mile of motorized trail use. This alternative also proposes 16 stream crossings, and the construction of approximately 16 acres of rock quarries. Effects of these actions are discussed in detail under the preceding road construction effects section.

This alternative would have the lowest amount of conventional clearcuts, road construction, stream crossings, and rock quarry development; correspondingly, it would have the lowest level of risk for invasive plant spread among the alternatives, based on these actions.

Cumulative Effects

The analysis area for cumulative effects is the project area, as this is where the majority of activities would originate that would cause invasive plant spread and the creation of vulnerable habitats subject to invasion.

Existing foreseeable projects that may contribute to invasive plant spread include the other timber sales, commercial thinning, and other projects (described in the Known Projects section), resulting in habitat alteration through timber harvesting, road construction, road

maintenance, stream crossings and rock quarry development. Effects of these projects would be similar to the effects previously described in the Environmental Consequences section. Microsales are generally located adjacent to existing roads and usually will not require new roads, although they could result in invasive plant spread as a result of altered habitat, habitat vulnerability and associated vectors from project activities. See harvesting effects section and risk assessment (in the project record) for additional details. Timber sales on state land are expected to occur, as noted in the section at the beginning of this chapter, and result in the construction of 4 miles of additional roads, which could result in the spread of invasive plants.

Habitat alteration and an increase in vectors through tree harvesting, road construction, stream crossings and rock quarry development would contribute to the cumulative effects of invasive plant spread as a result of the past, present and foreseeable projects in the project area. Cumulative effects due to timber harvesting include effects due to the proposed project, current projects, and foreseeable projects in the project area. Acres of past timber harvest are not included due to the relatively quick regeneration of harvested sites and the low likelihood of invasive plant persistence in old harvest units. Forested areas regenerate rapidly, resulting in dense native vegetation growth and a low likelihood of invasive plant persistence. For this reason, these areas are only temporarily susceptible. For this reason, only acres harvested since the year 2000 are considered to contribute to cumulative effects (approximately 2,355 acres).

These effects are described previously in the Environmental Consequences section and are cumulatively summarized in Table INV-5.

Table INV-5. Cumulative Timber Harvesting Impacts

Alternative	Cumulative Effects - Acres			
	Past Harvest[1/]	Big Thorne Harvest[2/]	Present & Reasonably Foreseeable Projects[3/]	Total
1	2,355	0	1,046	3,401
2	2,355	4,944	1,046	8,345
3	2,355	9,481	1,046	12,882
4	2,355	6,383	1,046	9,784
5	2,355	7,093	1,046	10,494

1/ Past harvest since the Year 2000.
2/ Harvest proposed by the Big Thorne Project
3/ Acres calculated based on projects described in the Known Projects Section

Implementation of the Prince of Wales Island ATM (see Transportation Section) on the Thorne Bay Ranger District would slowly reduce the spread of invasive plants where roads are closed or decommissioned, as a result of changing the type of use and maintenance the road receives. These changes would be expected to occur over a period of years, as decreased road use enables native vegetation to colonize the road and out-compete invasive plants or prevents their establishment. Over time canopy closure and native vegetation would out-compete invasive plants. The table below summarizes by alternative the results of implementation of the ATM. With implementation of this plan, there would be 101 miles of open and maintained road in the project area and 105 miles of road open and maintained for OHV use. Motorized trail use would vary by alternative,

with Alternative 1 the lowest with 44 miles and Alternative 3 the highest with 49 miles. The highest number of cumulative road miles would result from Alternative 3, followed by Alternatives 2, 4, and 5. The No-action Alternative would have the lowest cumulative effects. The cumulative effects of stream crossings and rock quarries are similar and also summarized in Table INV-6.

Table INV-6. Summary of Cumulative Acres Harvested, Road Construction, Number of Stream Crossings, and Acres of Rock Quarry as a result of the Big Thorne Project

Alternative	Total Acres Harvested 1/	Total Roads 2/	Number of Stream Crossings 3/	Acres of Rock Quarries 4/
Alternative 1	3,401	552	1,447	569
Alternative 2	8,345	586	1,532	604
Alternative 3	12,882	608	1,559	625
Alternative 4	9,784	571	1,486	588
Alternative 5	10,494	568	1,463	585

1/ Includes only present (harvest since 2000) and reasonably harvesting and that expected from the Big Thorne Project (including commercial thinning); see Table INV-5.
2/ Includes all roads, including state, private, NFS and temporary roads. Includes roads that are existing and those expected from present and reasonably foreseeable projects and the Big Thorne Project.
3/ Includes existing and new project crossings on open, stored, closed and decommissioned roads
4/ Assumes 1-acre of rock quarry development needed for every mile of road construction. Includes rock quarry acreages from existing and reasonably foreseeable projects, and the Big Thorne Project.

Following is a summary of the cumulative impacts by alternative including the acres harvested, road miles, stream crossings, and rock quarries in the project area.

Cumulative Effects of Alternative 1

For Alternative 1, the combination of past, present and reasonably foreseeable projects within the Big Thorne project area would result in cumulative impacts of 3,401 acres of timber harvest or commercial thinning (including past harvest since 2000), approximately 552 total road miles, 1,447 total stream crossings, and 569 total acres of rock quarries. This alternative would have the lowest amount of timber harvest and the lowest cumulative number of roads, stream crossings, and rock quarries. As a result, it would have the lowest cumulative risk of invasive plant spread.

Cumulative Effects of Alternative 2

For Alternative 2, the combination of past, present, and reasonably foreseeable projects with the Big Thorne project area would result in cumulative impacts of approximately 586 road miles, 1,532 stream crossings, and 604 acres of rock quarries. This alternative would result in 8,345 acres of harvest or commercial thinning (including past harvest since 2000). It would have the third-highest acreage of timber harvesting/thinning, the second-highest acreage of old growth harvest, and the second-highest number of total road miles, stream crossings and acres of rock quarry development, among the alternatives. Due to these disturbances, it would have the second-highest risk of invasive plant spread. The extent of this cumulative effect would be less than that experienced under Alternative 3, but more than under Alternatives 4 and 5.

Cumulative Effects of Alternative 3

For Alternative 3, the combination of past, present, and reasonably foreseeable projects within the Big Thorne project area would result in cumulative impacts of approximately 608 road miles, 1,559 stream crossings, and 625 acres of rock quarries. This alternative would result in 12,882 acres of new timber harvesting or thinning (including past harvest since 2000) and the highest cumulative amount of harvest, road miles, and acres of rock quarry development. Due to these disturbances, it would have the highest cumulative risk for invasive plant spread.

Cumulative Effects of Alternative 4

For Alternative 4, the combination of past, present, and reasonably foreseeable projects within the Big Thorne project area would result in cumulative impacts of approximately 571 total road miles in the project area, 1,486 stream crossings, and 588 acres of rock quarries. This alternative would result in 9,784 acres of timber harvesting (including past harvest since 2000). Of the action alternatives, this alternative would have the second-lowest amount of acreage of new timber harvesting/thinning. However, this alternative would have the lowest cumulative amount of old-growth harvest and the second-lowest amount of road miles, stream crossings, and acres of rock quarry development. Alternative 4 would have a slightly greater contribution to cumulative effects on invasive plant species compared to Alternative 5, due to more road miles, stream crossings and rock quarry development, but less than Alternatives 2 and 3.

Cumulative Effects of Alternative 5

For Alternative 5, the combination of the present and reasonably foreseeable projects with the Big Thorne project would result in cumulative impacts of approximately 568 total road miles, 1,463 stream crossings, and 585 acres of rock quarries. This alternative would result in 10,494 acres of timber harvesting (including past harvest since 2000). Of the action alternatives, this alternative would have the second-highest cumulative acres of new timber harvest/thinning and the lowest cumulative road mileage, stream crossings and rock quarry development. Primarily due to the reduction in road mileage and rock quarries, this alternative would cumulatively have the lowest risk of invasive spread of the action alternatives.

Timber and Vegetation

Introduction

Resource Analysis Area

The analysis area for direct, indirect and cumulative effects for timber and vegetation is the Big Thorne project area.

Inventory Methods and Units of Measure

Initial project area information was obtained from the Thorne Bay Ranger District GIS library, aerial photos, and Forest Activities Tracking System (FACTS). During the 2010 and 2011 field seasons, a silviculturist and other staff from the Thorne Bay Ranger District performed an inventory of the original unit pool in the project area using walk-through exams and a combination of basal area and fixed area stand exam sample plots, which were recorded at each plot location. Plots were located at a frequency of approximately one per 10 acres or at least six plots per proposed harvest unit for units less than 60 acres in size. The basal area plots were utilized to estimate the basal area per acre by species (both live and dead), and the fixed area plots were used to estimate the trees per acre by species in each unit. Volumes were estimated using average volume to basal area ratios for each species based upon whether the majority of the stand was in high, medium or low volume strata. Observations such as stand development stage, stand structure, windthrow potential, insect, disease and decay occurrence, site characteristics, and other information were incorporated into the exam procedure. Observations and plot data for each unit are stored in the planning record for this project. The information gathered by this inventory contributed to development of a site-specific silvicultural diagnosis and logging system feasibility for the proposed timber stands.

Forest Land Classification

NFS lands are defined by vegetative cover, soil type, and administratively designated land use. This classification scheme is intended to show the amount of land covered by forested vegetation with further divisions to show the amount land capable of timber production (Figure TBR-1).

To be considered suitable for timber management, lands must be determined tentatively suitable for timber management and must be within a LUD that allows timber harvest. For this project, these LUDs are Timber Production, Modified Landscape, Scenic Viewshed, Recreational River, and Scenic River. Although these LUDs allow timber harvest, some acres within each LUD would not be available for harvest due to protections defined in the Forest Plan standards and guidelines for other resources. Some of the protections in the Big Thorne project area include RMAs, over-steepened slopes, and retention of legacy forest structure. Figure TBR-1 shows the land classifications for the 217,679 acres of NFS land in the Big Thorne project area.

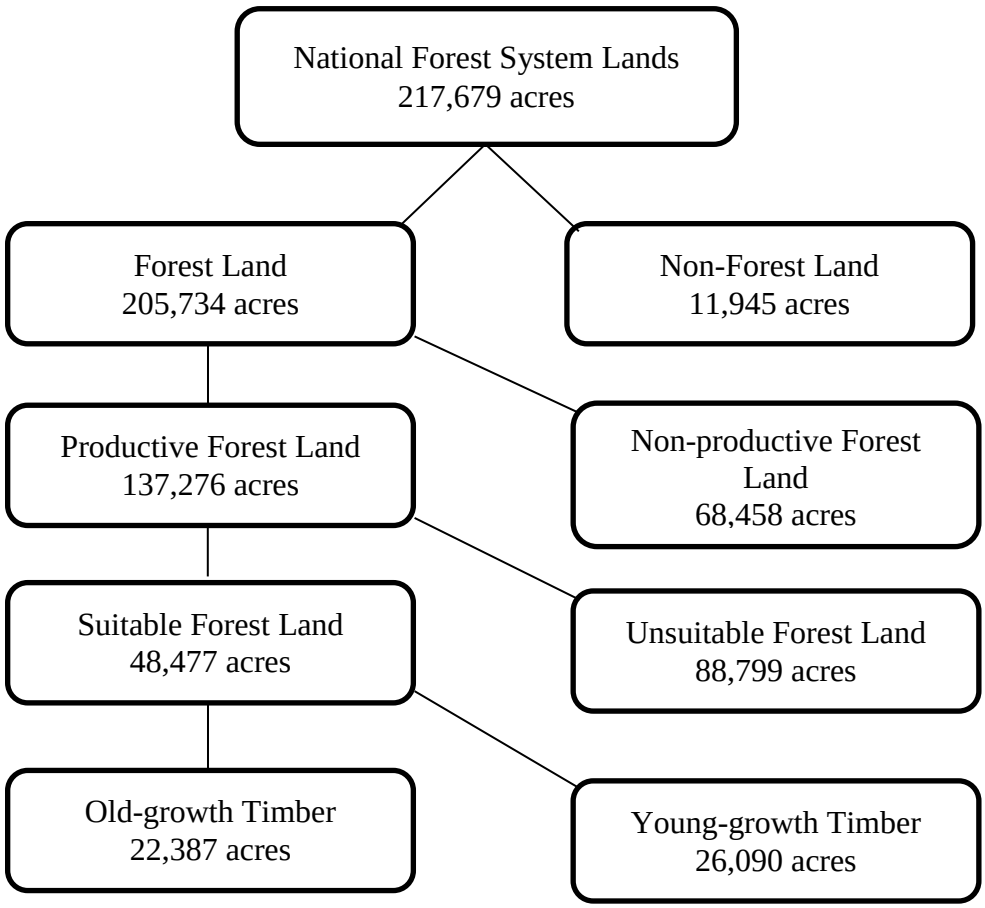

Figure TBR-1. Current NFS Land Classifications in the Big Thorne Project Area

Non-forest Land

About 5 percent (11,945 acres) of the NFS land in the Big Thorne project area is classified as non-forest. Non-forest land is land that is biologically unable to support at least a 10 percent tree cover. This land classification includes muskegs, rock outcrops, talus slopes, alpine vegetation, and river systems, among others.

Forest Land

About 95 percent (205,734 acres) of the NFS land in the Big Thorne project area is classified as forest land. Forest land has at least 10 percent tree cover of any size, or formerly had such tree cover and is not currently developed for non-forest use (36 CFR 219.3). Forest land is divided into productive (137,276 acres) and unproductive forest land (68,458).

Productive Forest Land

About 63 percent (137,276 acres) of the NFS land in the Big Thorne project area (67 percent of forest land) is classified as productive forest land. These lands have timber volumes of at least 8,000 board feet per acre or have the potential to achieve this volume and are capable of maintaining that volume. This land is capable of producing 20 cubic-

feet per acre, per year of tree growth. Productive forest land includes young-growth stands that have regenerated with conifer species after natural or human disturbance. There are 42,038 acres of young growth originating from harvest, 636 acres originating from natural disturbance, and 94,439 acres of POG. Productive forest lands are further classified as either suitable or unsuitable for timber production.

Suitable Forest Land / Suitable and Available Forest Land

The Forest Plan assigned LUDs that allow timber harvest in areas that were determined to be suitable for timber production. Some land was removed from the suitable timber base due to Forest Plan standards and guidelines within those areas. Appendix A of the Forest Plan describes the process that was used to identify suitable forest land. About 62 percent (85,530 acres) of the productive forest land in the Big Thorne project area is classified as tentatively suitable for timber production. However, only 35 percent (48,477 acres) of the productive forest lands are classified as tentatively suitable and are within LUDs that allow timber harvest; these lands are considered suitable for timber production. Approximately 46 percent of the suitable forest land (22,387 acres) is currently in POG while the remaining 54 percent (26,090 acres) is in young growth.

Unsuitable Forest Land

Unsuitable forest lands are lands that have resource concerns that preclude timber harvest or are in LUDs that preclude timber harvest. Areas with slopes greater than 72 percent that have unstable soils, high vulnerability karst lands, areas within riparian, beach and estuary buffers, and OGRs are examples of forest land classified as unsuitable for timber production. About 65 percent (88,799 acres) of the productive forest land in the Big Thorne project area is classified as unsuitable for timber production. Most of these lands are in POG, but 16,585 acres (19 percent) are in young growth, having been harvested 35-60 years ago.

National Forest System lands within the project area total 217,679 acres; these acres exclude saltwater and non-NFS acres (there are 14,169 acres of non-NFS land within the project area and these acres are not included in Figure TBR-1).

The Big Thorne project proposes to harvest a maximum of 25 percent (5,550 acres) of the remaining suitable old growth within the project area. In addition, two alternatives for the Big Thorne project area propose different levels of modification to the location of the Old-growth LUDs adding an additional potential harvest of 1,527 acres (in both alternatives) from what is currently classified as Old-growth Habitat LUD in the Forest Plan. Alternatives in the Big Thorne project also propose commercial thinning harvest on up to about 2,572 acres in young-growth stands when they are 50 years in age and older. None of the young growth is in RMAs or beach fringe; about 72 acres are in Old-growth Habitat LUD. Although this LUD is not considered suitable for timber production, thinning would be for the purpose of improving habitat quality in closed canopy stands and accelerating development of old-growth stand conditions. Combined, the maximum area under consideration for treatment in the Big Thorne project area includes approximately 9,649 acres.

Initially, the IDT identified 20,668 acres of potential harvest units within the Big Thorne project area (see Table TBR-1). These acres included old growth from suitable lands

based upon current Forest Plan LUDs, old growth that would be suitable after proposed Forest Plan changes to the OGR LUD in the project area, and young-growth thinning units identified in the project area. Of those original acres, about 9 percent were removed from harvest consideration in order to be consistent with the 2001 Roadless Rule, about 9 percent were removed due to Tongass Timber Reform Act (TTRA) buffers and other riparian buffers, and about 33 percent were removed due to other resource concerns such as soils, timber, economics, Forest Plan legacy requirements, wildlife, and karst. The remaining acres included in the Draft EIS unit pool consist of 7,364 acres that are primarily old-growth typical of Southeast Alaska and 2,572 acres of 40- to 60-year-old spruce-hemlock natural regeneration. The primary species in the old-growth and mature timber types are western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea sitchensis*), mountain hemlock (*Tsuga mertensiana*), western redcedar (*Thuja plicata*), and Alaska yellow cedar (*Callitropsis nootkatensis*). The primary species in the young-growth stands are western hemlock and Sitka spruce.

Table TBR-1. Original, Eliminated, and Resulting Big Thorne Unit Pool Acres

	Suitable Units (Old Growth)	OGR LUD Units (Old Growth)	Young Growth Thinning (current age 40-60)	Combined DEIS Unit Pool
Original LSTA Unit Pool Acres	13,710	3,262	3,696	20,668
Eliminated due to 2001 Roadless Rule	1,919	0	0	1,919
Eliminated for TTRA and other Riparian Buffers	1,554	163	228	1,945
Eliminated for other resource Concerns	4,436	1,536	896	6,868
Resulting Unit Pool Acres	5,801	1,563	2,572	9,936

Affected Environment

Existing Condition

The project area is a mosaic of coniferous forests in managed and unmanaged conditions, interspersed with muskeg, scrubland, and alpine plant communities. The forests are primarily western hemlock, with a Sitka spruce component and scattered Alaska yellow cedar and western redcedar. Higher percentages of Sitka spruce are found along streams and other well-drained sites. The understory shrubs are primarily blueberry, huckleberry, and rusty menziesia. Many species of vascular plants, lichens, and mosses occur throughout all habitat types. Forested muskeg with a high percentage of Alaska yellow cedar occurs throughout the project area. Red alder is found on disturbed sites such as roadsides, landslides, and along stream banks. Muskegs support shore (lodgepole) pine.

Old-Growth Species Composition

Plant associations are a type of vegetation classification system based on the climax plant community. Stands within a specified plant association are comprised of vegetation with

similar species composition and abundance. Plant associations can be used to predict site response to changes caused by management practices.

Most of the proposed harvest areas are a mosaic of two or more plant association series. The species composition in the project area, as computed from stand exam data is: western hemlock 47 percent, Sitka spruce 22 percent, western redcedar 21 percent, Alaska yellow cedar 9 percent, and mountain hemlock 1 percent. These percentages are based on the percent net board foot volume of live and dead trees in the proposed Big Thorne harvest units. Although Sitka spruce represents the fewest trees per acre among the listed species, this species has the highest quadratic mean diameter (QMD) and therefore represents the largest trees.

Old-Growth Volume Strata

The POG acres are stratified into high, medium, and low volume strata. Volume strata were determined by using the GIS volume class layer and combining it with GIS soils and aspect information. Gross volume (MBF) per acre by volume strata for the project area was determined by the re-aggregation of stand exam plot data by volume strata (Table TBR-2). The following parameters define each volume strata:

High Volume Strata—Areas within timber inventory volume classes 5, 6, and 7 on non-hydric soils, and on hydric soils with slopes greater than 55 percent.

Medium Volume Strata—Areas within timber inventory volume classes 5, 6, and 7 on hydric soils with slopes less than or equal to 55 percent; areas within timber inventory volume class 4 that are either on non-hydric soils, or are on hydric soils greater than 55 percent.

Low Volume Strata—Areas within timber inventory volume class 4 that are on hydric soils with slopes less than or equal to 55 percent.

Table TBR-2. Gross Volume per Acre by Volume Strata

Volume Strata	Average Gross Volume per Acre (MBF/Acre)[1/]	Suitable Project Area Acres
Low	31.78	5,549
Medium	39.50	6,522
High	44.67	10,316
All Suitable POG[2/]	39.97	22,387

1/ Gross volume for both live and dead trees based on re-aggregated stand exam plot data.
2/ This is a weighted average based on the suitable project area acres.

Young-Growth Stands

Young-growth stands in the project area are variable, depending on age. Young growth in the project area originated primarily from even-aged harvesting. Large-scale timber harvest in the project area began in the late 1950s and peaked in the 1960s (Figure TBR-2). The stands being considered for commercial thinning were harvested in the 1960s or earlier.

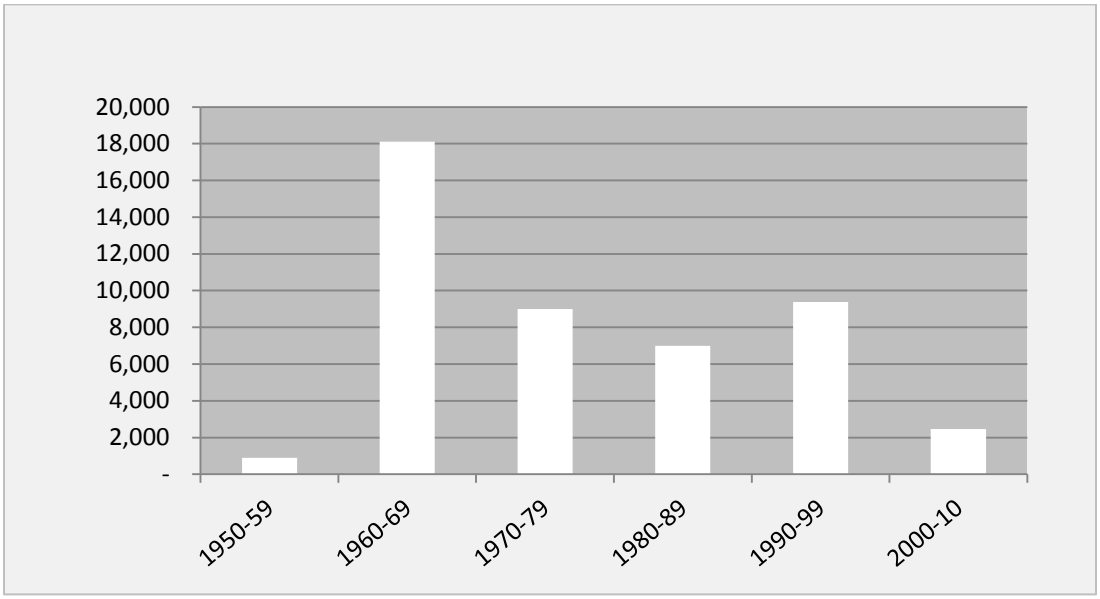

Figure TBR-2. Big Thorne Project Area Harvest Acres by Decade

These stands are dominated by either western hemlock or Sitka spruce, and contain lesser amounts of western redcedar, red alder, mountain hemlock, and Alaska yellow cedar. Many of the older stands have been pre-commercially thinned and these stands currently contain fewer trees per acre, larger average diameters, and lower volumes per acre. Average net volume for young-growth stands at age 50 ranges from about 9 to 13 MBF per acre on medium productivity sites and from about 13 to 21 MBF per acre on high productivity sites.

Forest Health and Natural Disturbance

Dwarf Mistletoe

The occurrence of dwarf mistletoe in late successional western hemlock stands is widespread throughout Southeast Alaska, including the Big Thorne project area. The small-scale (canopy gap) disturbance pattern in the old forests of coastal Alaska favors the short-range dispersal mechanism of hemlock dwarf mistletoe and may explain the common occurrence of the disease in this area (USDA Forest Service 2009). Dwarf mistletoe presence was recorded in all proposed harvest areas in the Big Thorne project area wherever western hemlock was present. The majority of units included in the unit pool were rated low for the occurrence of dwarf mistletoe, often because of the high western redcedar component. There were 129 units in the current unit pool that were rated low, 70 rated moderate, and 41 rated high.

Dwarf mistletoe reduces the vigor and growth rate of hemlock resulting in low quality timber. Cankerous swellings often occur at the point of infection on limbs and main stems. These cankers offer an entrance for wood-destroying fungi, which can lead to heart and stem decay.

Dwarf mistletoe progresses relatively slowly in Southeast Alaska; however, within partially harvested stands, there may be some infected trees. Clearcut harvesting is an

effective method of controlling hemlock dwarf mistletoe if reduction or eradication of the disease is consistent with management objectives (USDA 2001c). Managers using alternative harvest techniques (e.g., large residuals left standing in clearcuts, small harvest units, or partial harvests) should recognize the potential reduction in timber volume and value from hemlock dwarf mistletoe under some of these silvicultural scenarios. Substantial reductions to timber are only associated with high disease levels, however. High levels of hemlock dwarf mistletoe will only result if numerous large, intensely infected hemlocks are well distributed after harvest (Forest Health Conditions in Alaska-2007, page 44). In some situations, the Big Thorne project proposes to partially harvest stands with high mistletoe ratings in order to mitigate the effects of even-age harvest on wildlife and watershed resources.

Decay Fungi

Decay caused by heart and root-rotting fungi is probably the greatest single cause of disease-related timber volume loss in Alaska (Laurent 1974), and such damage is present within the Big Thorne project area. Approximately one-third of the old-growth timber volume in Southeast Alaska is defective, largely due to heart-rotting fungi. Heart decay causes considerable damage in all conifer species in Southeast Alaska, but is more common in western hemlock, mountain hemlock, and Sitka spruce (USDA Forest Service 2009).

Decay centered in the boles of trees can weaken the support structures, thereby leading to breakage. As the broken portion of the tree falls to the forest floor, it may wound adjacent trees and lead to eventual infection of the damaged trees. This is a continual process in old-growth forests in Southeast Alaska and contributes to the diversity of the stand structure. This process decreases the health and windfirmness of the stand, leading to decreased ability to provide a future timber supply and therefore reducing the stand's ability to reach its desired condition. The volume growth rate in most old-growth units in the Big Thorne project are currently being either offset or exceeded by decay.

Decay-causing fungi are present in all stands within the project area. There were 62 units in the current unit pool that were rated high for the occurrence of decay fungi, 168 units that rated moderate and 10 units rated low. A high rating was given when it appeared that the average defect per tree in the unit would exceed 31 percent, or what is considered the average defect within live old-growth trees in Southeast Alaska (Insects and Diseases of Alaska Forests, USDA R10-TP-140, 2009 p.159). A moderate rating was given when it appeared that the average defect would be about 31 percent. A low rating would have been given if a unit was determined to be somewhat less than 31 percent. A low rating would usually only be noted where a large amount of the live trees in the stand are young.

Wind Disturbance

Wind is the major natural disturbance agent affecting forest dynamics in Southeast Alaska. It causes the loss of trees, singly or in groups, and recycles forest stands and maintains and renews the forest ecosystem. However, timber harvest has the potential to exacerbate the rate of windthrow in adjacent forest stands. The severity and frequency of wind disturbance is determined by many interrelated factors. These influencing factors include tree size and vitality, tree height-diameter ratio and crown size, slope, aspect, soil

characteristics, stand composition, canopy structure and the characteristics of the surrounding topography, which may influence wind flow (Harris 1989).

Existing windthrow within a stand is an important indicator of windthrow hazard. Certain conditions are indicators of windthrow hazard for individual trees as well as stands. The windthrow history of a stand can be determined from field observations. These conditions, as well as a stand's windthrow history, were used to evaluate the windthrow hazard for each unit.

In the Big Thorne project area, high windthrow hazard was generally found in areas with exposure due to topography, vortex winds or adjacent logging. High ratings were often given to units with exposure to the southeast winds off Clarence Strait. There were 64 units rated high for windthrow. These stands were generally located where high wind speeds and turbulence are likely to occur and where the stand structure, composition and tree form make the stand more susceptible to wind damage. Units that were more topographically sheltered from direct storm winds and had less evidence of past wind damage were rated moderate for windthrow. There were 150 units that rated as moderate. Stands rated moderate have either factors that contribute to poor anchorage with low wind force, moderate resistance to overturning and moderate wind force or good resistance to overturning and high wind force. There were 26 units that were well sheltered with little evidence of past wind damage. These units were rated low.

Alaska Yellow cedar Decline

Alaska yellow cedar decline is a disease causing considerable mortality in Southeast Alaska. Mortality can be in small patches or can cover expansive areas. Affected trees may die quickly (in two to three years), or slowly over 15 years or longer with crowns progressively thinning.

Yellow cedar decline is characterized by extensive tree deaths occurring in and around open canopy forests on poorly drained soils. The distribution of yellow cedar decline suggests climate as a trigger with the presence of snow as the key environmental factor. Researchers currently believe this mortality is the result of a combination of factors centered around freezing injury to roots resulting from low spring snow pack and poor soil drainage. A change in climate about 5,000 years ago may be considered a predisposing factor as a shift to a cool and wet climate initiated peat development and poorer drainage (Hennon et al. 2012).

The 2010 Forest Health Conditions in Alaska report indicates that the Big Thorne project area has cumulative yellow cedar decline mainly in higher elevations with the heaviest concentrations on the west half of the project area and a strip along the eastern coastline. The walk-through stand exams within the Big Thorne unit pool indicate the heaviest concentrations south of the Thorne Bay to Control Lake highway. Areas with extensive decline are typically within lower productivity forest lands on slopes less than 25 percent. These areas have low site index, poor soils and low timber volume per acre which makes the majority unsuitable for timber production (Forest Health Report 2007).

Yellow cedar decline is estimated to be occurring on about 40,000 acres in the Thorne Bay Ranger District on Prince of Wales Island, an increase of approximately 5,500 acres from the 2004 survey. The cumulative mapping of yellow cedar decline indicates around

11,000 acres within the Big Thorne project area alone as of 2010 (Forest Health Reports 2004-2010). Current PCT activities in the Big Thorne project area and across Prince of Wales Island are favoring the retention of yellow cedar. This is expected to increase the amount of yellow cedar in future stands.

Environmental Consequences

Direct, indirect, and cumulative effects for timber and vegetation resources are estimated using quantifiable measures or indicators for actual effects, as appropriate. The analysis area for direct, indirect, and cumulative effects is the project area. The level (magnitude and intensity) of effects are also assessed in terms of how widespread the effect is likely to be and how long it is likely to last. The effects of timber harvest on forest vegetation vary by silvicultural prescription and the number of acres harvested by prescription. The following provides a discussion of effects related to the various components of the timber resources including stand structure, forest health and productivity, regeneration and species composition, and windthrow risk. Silvicultural Systems and Prescriptions

Silvicultural systems are used to manage, harvest, and re-establish stands of forest trees for the purpose of meeting pre-determined objectives. Silvicultural systems have been developed to produce more valuable commercial timber at a faster rate, maintain wildlife habitat, and either maintain or enhance scenery values. No single silvicultural system for a forest stand can be used to achieve all the desired combinations of amenities and products. Instead, a variety of treatments applied over a project area results in a mosaic of stands for different uses. Through the harvest of timber or other treatments, such as thinning or pruning, existing stands are altered by proposed management actions.

The Forest Plan standards and guidelines and USDA FSM 2400 (Timber Management) provide detailed information about three silvicultural systems recommended for the Tongass National Forest. Even-aged management results in the conversion of mature stands to faster growing stands of a single age. It generally includes clearcutting, seed tree, and shelterwood. Two-aged management results in a seedling stand with varying levels of older-aged residual trees. It includes clearcutting with reserves, seed tree with reserves, and shelterwood with reserves. Uneven-aged management results in a stand of younger trees interspersed with older trees, either in clumps or distributed across the stand. Uneven-aged systems include single-tree selection, group selection, and group selection with reserves.

The post-harvest conditions of the forest stand for all systems are dependent upon the existing plant community, the retained canopy structure, and advanced regeneration. Species composition is monitored to ensure that the mix of species is roughly the same as expected on the existing site.

The Big Thorne project uses even-aged management and uneven-aged management silvicultural systems. The criteria used to select the appropriate silvicultural system for each unit include the following:

- Forest Plan LUDs;
- Standards and Guidelines requirements;
- Operational feasibility (possible logging systems);

- Economics;
- Windthrow hazard (the presence of tree and stand attributes determining windthrow potential);
- Stand conditions (diseases and decay fungi); and
- Regeneration potential

In addition, the following site-specific objectives were considered as well:

- Obtaining favorable timber sale economics and logging feasibility.
- Retaining old-growth characteristics to maintain biodiversity.
- Protecting scenery, wildlife habitat, soil, or watershed, characteristics.
- Maximizing wood-fiber production for future human use.

Silvicultural prescriptions provide guidance through the entire rotation including natural regeneration certification, thinning, and monitoring. A complete silvicultural prescription has been written for the entire length of the rotation for each unit selected for harvest. These are designed to address site-specific conditions within the treatment area. For example, RMAs with concerns for watershed stream channel stability and windthrow potential have been identified and would have trees retained in expanded reasonable assurance of windfirmness (RAW) buffers as needed. The size and configuration of the RAW buffer would be determined during unit layout by an interdisciplinary team as identified in the unit cards. In some cases, RAW buffers are accomplished through unit design or silvicultural system. Another example is the prescription of wind firmness for visual buffers that are to be established in clearcut units along visual priority routes.

Silvicultural prescriptions sometimes vary by alternative in order to address the different management objectives being analyzed in the range of alternatives. These differences in alternatives are driven by issues identified during the scoping process for this project. For example, a harvest unit may be planned for even-aged management under an alternative emphasizing the maximum timber harvest from the project area or uneven-aged management under an alternative using helicopter yarding methods to minimize road impacts and retain forest structure in alternatives emphasizing wildlife or watershed issues. In most cases, the silvicultural prescription for a treatment area remains the same between the different alternatives. Table TBR-3 shows acres by silvicultural system and the regeneration method for each alternative.

Even-aged System

Under this system, clearcutting would be prescribed and all or the majority of the merchantable trees would be harvested. The objectives are to create a fast-growing stand of trees to maximize wood fiber production, and provide favorable timber sale harvest economics and logging feasibility. Stands would regenerate into a mostly single-aged stand.

Table TBR-3. Silvicultural System and Prescription Acres by Alternative and Yarding System

Silvicultural System, Prescription, and Alternative	Number of Units[1/]	Acres Treated		
		Total	Cable or Ground	Helicopter
Even-Aged Management:				
Alternative 2	151	4,232	3,301	931
Alternative 3	217	5,786	4,312	1,474
Alternative 4	76	1,899	1,389	510
Alternative 5	143	3,941	1,794	2,148
Uneven-Aged Management:				
Alternative 2	16	711	15	696
Alternative 3	22	1,123	15	1,108
Alternative 4	58	2,324	474	1,849
Alternative 5	22	1,070	0	1,070

1/ Note that some units have more than one prescription.

Areas where merchantable-sized trees are retained for resource protection requirements are generally external to final cutting unit boundaries or are along stream zones that protrude into the cutting unit. Reasonable Assurance of Windfirmness (RAW) buffers may also be applied to unit edges or stream and visual buffers that are determined to be at risk for wind damage after harvest.

VCUs that have had concentrated past timber harvest activity and are at risk for not providing the full range of Forest Plan matrix functions are subject to the Legacy Standard and Guideline. These VCUs are identified by the Forest Plan. The Big Thorne project area includes seven VCUs with both proposed harvest and legacy requirements, out of 15 total VCUs with proposed harvest in the project area. In legacy VCUs, harvest units with openings that are larger than 20 acres are required to leave 30 percent of the original unit opening size based on the LSTA boundary prior to field verification in legacy forest structure. Structure left inside of the unit for other resource concerns, excluding TTRA buffers, can be counted towards the 30 percent retention requirement (Forest Plan, page 4-90).

Legacy retention areas were identified and allocated in areas that were subject to other resource concerns where possible. RMAs, probable RAW areas, areas with unstable soils, and visual buffers were often identified as legacy. Areas with high wildlife habitat values, sensitive plant populations, and areas with higher logging difficulty and cost were also allocated to meet the legacy forest structure retention requirements. Adjustment to the planned legacy locations may occur during implementation to best implement multiple objectives.

Within even-aged harvest areas, natural regeneration is expected to be abundant and represent approximately the original species composition of the stand. Additional silvicultural treatments that follow harvest may include tree planting, PCT, girdling and/or pruning. These treatments can be used to influence species composition, increase individual tree growth, promote wood quality and enhance wildlife habitat. These activities will most likely be completed between 15-35 years after harvest.

NFMA regulations provide that 100 acres is the maximum size of created openings allowed for the forest types of coastal Alaska, unless specific conditions exist (see Timber

and Silviculture Resource Report; Barnhart and Hitner 2012). The 2008 Forest Plan, page 4-72, defines these conditions. With Forest Supervisor approval, where it is determined by environmental analysis that exceptions to the size limit are warranted, the actual size of openings may total 150 acres if increased unit size will produce more desirable benefits.

One proposed opening in this project exceeds 100 acres. Unit 71 is 103 acres in Alternatives 2, 3, and 5 and represents a long, relatively narrow unit with a maximum width of about 1,200 feet. Reconstruction of the road through the unit is necessary to access additional units beyond Unit 71. This road is planned for storage following harvest. Harvesting this timber now would reduce the cost and minimize the effects on closing and reopening the road at a later date. Therefore, the unit meets the criteria for exceeding 100 acres.

Justification for Clearcutting: Even-aged clearcutting is being prescribed in the Big Thorne project area to preclude or minimize the risk of post-harvest windthrow, promote natural regeneration, minimize logging damage, improve site productivity through increased soil temperature, and minimize defect and disease in the future stand to the maximum extent possible (Forest Plan, page 4-72).

Uneven-aged System

This prescription usually involves more intensive management than even-aged prescriptions. There is no final rotation age as in even-aged systems but instead regular, periodic entries designed to maintain three or more distinct age classes and a range of diameter classes in a reasonably well dispersed manner across the stand. This results in a stand of high structural diversity due to the high variability in tree sizes and individual tree characteristics. Trees may be removed individually, or in small groups or narrow corridors generally 2 acres or less in area. The goal of uneven-aged management is to economically harvest a percentage of the stand while retaining timber for future economically viable and sustainable entries. The next harvest under uneven-aged management would likely be in 50 to 100 years. This prescription would regenerate an uneven-aged stand (a stand with at least three age classes) by partial harvest in areas specified for this prescription. This silvicultural system is the least effective for reducing the distribution of and minimizing the loss of timber volume associated with dwarf mistletoe infection and decay fungi.

Single-tree or small group selection is used in units that have an uneven-aged management prescription and are utilizing a helicopter logging system. Helicopter yarding has been proposed to reduce road construction and associated costs, reduce the impact harvest activities might have on watersheds and wildlife, and also meet objectives for scenery. Uneven-aged management would be achieved by leaving either approximately 50 or 75 percent of the setting pretreatment basal area, based on standing live trees left uncut. Healthy, young trees in the intermediate crown class would be a priority for retention to promote economic future entries. Older trees with low timber, but high wildlife value would also be a priority for retention. The canopy gaps and disturbance created by harvest of the remaining trees would promote new tree regeneration to facilitate future harvest entries as well as promote the growth of understory plants important for wildlife. A retention level of 75 percent is used in units that were identified as having particular windthrow, wildlife, or visual concerns. A retention level of 50 percent was used in units

with wildlife or visual concerns, but not requiring the higher level of retention. Future entries would continue the process of developing additional age classes. The next entry would likely occur in 50 years for units with 75 percent retention, and 100 years for units with 50 percent retention. This would allow the intermediate age class to develop into mature trees and provide for another economical harvest. The silvicultural prescription would maximize the flexibility of helicopter yarding to allow for the removal of a higher percentage of more economically valuable trees, while retaining a higher percentage of trees that have higher value for wildlife, or smaller diameter trees that would be more economically valuable in the future.

Group selection is used in units where uneven-aged management is the preferred prescription, and the unit is operationally feasible for conventional logging systems. Group selection involves removing trees in small groups, up to 2 acres in size, well dispersed through the stand. It is used in conjunction with conventional logging systems because it allows sufficient room for the equipment to operate; however, helicopter yarding is used with this prescription in some settings where economics prohibited road construction to allow conventional logging systems to be used. Uneven-aged management would be achieved by leaving approximately 67 percent of the setting pretreatment area, based on standing live trees left uncut. Intermediate trees would also be retained, and canopy gaps created would allow for increased understory regeneration. The next entry would likely occur in 50 to 100 years, when another 33 percent removal would occur in small groups. This prescription would allow for a more economical harvest by allowing conventional logging systems to be used with uneven-aged management, which often has lower yarding costs than helicopter logging systems. The larger openings associated with this prescription may result in a better mixture of shade tolerant and intolerant regeneration than with single tree or small group selection.

Intermediate Treatments – Young Growth Units

There are approximately 2,600 acres of young-growth stands within the Big Thorne project area that are proposed for intermediate commercial thinning treatments. All of these proposed units are anticipated to be age 50 or older at the time of harvest. The objectives of these treatments are to improve stand composition, health, value, and growth. Stand value includes both wildlife habitat value as well as future timber value. The objectives of the intermediate treatments will vary depending upon where they fall in the landscape (high-value deer winter range, or upper slopes). No treatments are being proposed in the RMA and beach fringe.. Logging system capabilities will also be a consideration when selecting the intermediate treatment prescription for a stand (ground, uphill cable, or downhill cable). No helicopter logging is proposed due to the high logging costs, and subsequently poor overall economics. Timber volume removed from areas available for timber harvest during these treatments will count towards the allowable sale quantity (ASQ). An exception is 70 acres of thinning under Alternative 3 and 105 acres of thinning under Alternative 4 that would occur in Old Growth Habitat LUD. The volume derived from OGRs would not contribute to the ASQ.

The timing of the majority of the young-growth treatments most likely will be during the second half of the implementation of the Big Thorne project. The approximate 5-year delay in timing will 1) allow the stands to continue to grow, which will increase thinning

removal volumes and improve thinning economics; 2) allow the industry time to gear up with equipment suitable for completing the thinning treatments; and 3) allow more time for small log markets to develop for local utilization of the wood.

Export market conditions could have a significant effect on the economics of young-growth treatments. Export markets were fairly strong in 2011, and are expected to persist with fluctuations into the future. The conditions of these markets at the time of implementation could greatly impact the young-growth treatments at that time. The development of more domestic small log markets could reduce some of the dependence on export, and serve to stabilize the long-term market conditions.

The management goal of young-growth treatments in the Big Thorne project area is to produce an industrial wood supply while improving wildlife habitat in treated stands, improve stand growth and vigor, and aid in the transition to young-growth focused equipment and markets. The removal of an industrial wood supply would help meet the timber supply objectives of this project, as well allow value to be captured from wood lost to mortality. The density of trees in the treated young-growth stands would be reduced by uniform or systematic thinning. The resulting stands with more open canopies and more widely spaced conifers would be healthy and growing at optimum rates to produce forest products and more abundant and diverse understories, providing improved winter forage conditions for deer. Thinning would help to reduce the homogeneous stand structure, and to modify the stand to impart a trajectory towards a landscape that more closely mimics the historical stand structure. These treatments would create healthier stands that would have more sustainable stand growth, and would allow for more long-term flexibility in wood supply. The alder component would be minimal, but would be present (until succession converts it to conifers) for habitat diversity; conifers would be released where they are being suppressed.

It is desired that at the end of the planned rotation, stands would be in a condition that regeneration harvests using even-aged, two-aged, or uneven-aged silvicultural systems are feasible and appropriate. Stands should have live crown ratios of 30 percent or higher and height-to-diameter ratios of less than 90 in order to be suitable for partial cutting. In addition, it is desired that the stands mature at different rates or have flexible rotation lengths so that harvests can be spread out and contribute to an even-flow, long-term sustained yield. This would also contribute to a greater mix of age classes and deer forage conditions following the next rotation.

The IDT has identified two different types of intermediate treatments to be conducted in project area young-growth units: a uniform crown thin and a systematic thin. . Unit-level silvicultural prescriptions are being developed and will be approved by a Region 10 Forest Service–certified silviculturist to meet the objectives identified by the IDT.

Uniform Crown Thin Treatment

Young-growth units planned for this treatment will be at least 50 years of age at the time of the treatment. The objectives of these treatments are to:

- Increase diameter-growth rate of remaining crop trees.
- Create temporary canopy gaps to increase light to the forest floor and promote crown expansion.

- Improve tree characteristics that promote windfirmness possibly allowing future partial harvests.
- Reduce the effects of stem exclusion stage on wildlife winter forage and habitat.
- Remove poor quality trees from the upper and middle crown to favor the best codominant and dominant trees.
- Provide a volume of merchantable product in a manner that is operationally and economically feasible.

Logging systems used for this treatment will be ground-based and cable thinning. The majority of the cable thinning will be uphill yarding with narrow skyline corridors cut to a width between 12 and 16 feet. This treatment is only used in downhill cable yarding settings where full suspension of the logs can be achieved, which occur in Units 550 and 551.

The uniform thin treatment is being used with a "crown thinning" treatment where most cut trees will consist of poor quality trees from the middle and upper crown. High quality dominant and codominant trees will be retained with the exception of trees that need to be removed for yarding corridors and skid trails. In general, neither Sitka spruce nor western hemlock would be favored and the spruce/hemlock leave trees would be the most vigorous individuals. Cedars and red alder would generally be retained within the leave areas. These treatments would result in stands which typically have between 100 and 135 trees per acre that are 8 inches diameter at breast height and larger.

Skips or thickets will be left where logging system difficulties occur, in portions of stands where windthrow risk is expected to be unacceptable after thinning, and in any areas where wildlife dens or nest sites are found. Gaps might occur where cable corridors come together at landings or other areas where extra room is needed to facilitate yarding or to meet wildlife or other objectives.

Systematic Thin Treatment

Young-growth units planned for this treatment will be at least 50 years of age at the time of the treatment. The objectives of these treatments are to:

- Increase diameter-growth rate of remaining crop trees.
- Create side lighting and temporary canopy gaps in leave corridor to increase light to the forest floor and promote crown expansion.
- Increase stand diversity by creating early seral conditions in cut corridors.
- Provide a volume of merchantable product in a manner that is operationally and economically feasible.
- Remove poor quality codominant and dominant trees.

Although uniform thinning is the preferred treatment, systematic thinning may be used to reduce residual tree damage, allow operational feasibility, or reduce treatment costs. Systematic thinning would primarily be used in cable settings with downhill yarding that are unable to achieve full suspension. Systematic thinning for this project would remove all merchantable trees within a 20- to 60-foot-wide corridor. The corridor width would

depend on operational feasibility, visual concerns, and/or windthrow risk. Where visuals or windthrow are of concern, harvested corridors may be limited to a width of 20 feet. A 60- to 120-foot-wide corridor would be retained between each harvested corridor. The retention corridor would be thinned where operationally feasible. Typically the trees removed from the leave areas would be within 50 feet of the edge of a corridor cut and the cut trees would consist of primarily low quality codominant and dominant trees. At least approximately 50 percent of the setting pretreatment basal area would be retained, including what is removed in the corridors.

The density of trees in these young-growth stands would be reduced by some thinning, but primarily by corridor cutting. The resulting stands, with more open canopies and more widely spaced conifers, would be healthy and growing at optimum rates to produce forest products, and would produce more abundant and diverse understories providing improved winter forage conditions for deer.

Direct and Indirect Effects on Forest Structure

Alternative 1

No new harvest activity would occur under Alternative 1. Old-growth stands would remain in a predominantly Old-growth condition. Small-scale, frequent disturbance events resulting from disease and decay would continue in these stands. At some point in the future it is expected that some stands in the project area would experience larger-scale damage from a severe storm event, leading to the regeneration of the stands in what would likely be a two-aged or possibly, in an extreme case, an even-aged condition.

No commercial thinning would occur in young-growth stands. Based on stand modeling, young-growth stands without commercial thinning, and particularly those without PCT treatments, would grow through a period of extended stem exclusion before gradually developing a more complex stand structure where understory plants return. Without commercial thinning, young growth stands will be prone to develop tall thin trees with short crowns that have little weather resistance, limiting future rotational harvest options to primarily the even-aged system. The Culmination of Mean Annual Increment (CMAI) is estimated to be reached at 95 to 105 years old for stands with no previous PCT, and at approximately 120 years old for stands that had previous PCT. In most stands where commercial thinning does not occur, stem exclusion structure would dominate most of the entire rotation. Untreated stands will reach CMAI at a younger age and then see a decrease in growth rate.

This alternative would not meet many of the young-growth stand structure objectives. Stands would remain in a relatively homogeneous stand structure, and there would be no opportunity to modify the stand structure to achieve a more diverse landscape that more closely mimics historical stand structure. Leaving the young-growth stands in their current state would also cause diminished productivity and stand health, and decrease the flexibility for future timber supply and harvest options.

Alternatives 2, 3, 4, and 5 Old-growth Harvest

The structure of the forest would be changed by timber harvest under all of the action alternatives. The change would vary by alternative based on the silvicultural prescription and the number of acres harvested.

Even-aged Management:

Where even-aged management is prescribed, harvest would result in the creation of relatively homogenous young-growth stands primarily without any older residual trees present within the boundary. The new stands would naturally grow through a number of structural changes in the future, beginning with a brushy stage where tree regeneration is becoming established and understory plants flourish. This stage would be followed by a period of stem exclusion where inter-tree competition shades out the understory. After that the stand would enter a stage where tree mortality opens growing space and an understory, as well as some old-growth characteristics return. The time that any young-growth forest spends in any structural stage would be dependent on the natural growing capability of the land and any future treatments that are applied, such as thinning.

Uneven-aged Management:

Where uneven-aged management is prescribed, numerous residual trees would be left, mainly dispersed across the stands. Small openings, up to 2 acres in size, may occur. The number of trees would depend on the amount of retention. Retention of 50 percent of the live basal area is planned for low and moderate wind risk areas. Retention of 75 percent live basal area is planned for high windthrow potential stands, as well as some stands with wildlife or scenery concerns. There is no final rotation age as in even-aged systems but instead regular, periodic entries designed to maintain three or more distinct age classes and a range of diameter classes in a reasonably well dispersed manner across the stand. This results in a stand of high structural diversity due to the high variability in tree sizes and individual tree characteristics. The next harvest under uneven-aged management would likely be in about 50 to 100 years.

In the 50 percent retention areas, the stand structure would be expected to change from old-growth to a structure similar to what is naturally seen when stands are transitioning between understory re-initiation and old-growth. The understory re-initiation stage is the structural stage just before a naturally developing stand attains true old-growth structure (Oliver and Larson 1996, p.259-275). These stands would have three age classes, consisting of residual old-growth trees, residual intermediate and suppressed trees, and the understory that would be initiated by opening the canopy.

Where 75 percent retention is prescribed, it is expected that the structural change post-harvest would be only minor and the stand would remain in the old-growth structural stage after harvest and through to the next rotation if unaffected by a major natural disturbance event.

Due to the considerable overstory that would remain in the 50 and 75 percent retention areas, the brushy stage seen after even-aged harvesting would generally not occur. The stem exclusion stage would generally not occur to the same magnitude seen in even-age stands either.

After harvest in the 50 percent retention units, the stands would continue to develop and should regain old-growth characteristics quickly if unaffected by a major natural disturbance event. As noted above, 75 percent retention units, should maintain old-growth structure

Where group selection occurs and 67 percent retention is prescribed, understory development and tree regeneration would occur rapidly inside the groups or corridors. Where 1-acre or larger openings are created, the brushy stage may occur. The majority of larger openings may reach a stem exclusion stage in 20 to 25 years after harvest. Within unharvested old growth along the edges of these openings, understory re-initiation would occur because of increased light.

Alternatives 3, 4, and 5 Young-growth Treatment

Where a uniform crown thin prescription is prescribed in young-growth stands, the canopy of the stands would be opened up allowing more light to reach the forest floor. Trees would generally be evenly spaced across the stand. The stand structure would be expected to change from stem exclusion to more like understory re-initiation. Residual trees would receive more direct sunlight and most defective codominant and dominant trees would be removed from the stand.

Understory vegetation would increase for a period of time until the crown of the residual trees expanded and closed the canopy again. The heavier the level of thinning, the longer the increase in understory vegetation would occur. Some natural regeneration of conifer (primarily hemlock) would occur.

The diameter growth on dominant and codominant trees would increase. Epicormic branching would likely occur to some extent on the Sitka spruce but is expected to be minimal.

The culmination of mean annual increment (CMAI) and the 95 percent CMAI would be achieved, on average, approximately 5 to10 years later than in an untreated stand (Tetra Tech and Stuntzner 2011). Figure TBR-3 shows how the percent of CMAI is expected to change over time after the treatment. The growth rate will temporarily be less than the untreated stands due to trees being removed; however, the rate increases and maintains over time, while the untreated stands see a significant decrease in growth after approximately age 110.

Where a systematic thin prescription is prescribed in young-growth stands, the canopy of the stands would be opened up, allowing more light to reach the forest floor. There would be a mosaic of stand structures including small openings with understory initiation, thinned stands with understory re-initiation, and unthinned stands in stem exclusion.

Understory vegetation would increase for a period of time within the corridor cuts and along the edges of the corridors. Natural regeneration of conifer would occur within the corridor cut (likely proportional to the corridor width) and, to a lesser extent, on each side of the corridor cut. In 20 to 25 years, it is expected that the corridor-cut areas would enter a stem exclusion stage as the regeneration developed without any further treatment to control stand density. These corridors could be pre-commercially thinned at this time.

Direct and Indirect Effects on Forest Health and Productivity

Alternative 1

Under Alternative 1 no new timber harvest is planned. It is expected that forest growth would continue to be offset by decay. Insect and disease processes would persist at approximately current levels but due to the general lack of thrift, the forest remains at risk and vulnerable to insect and disease attack. Hemlock dwarf mistletoe, where present, would remain in the stand and may infect hemlock stems that regenerate in the gaps adjacent to infected overstory trees.

No commercial thinning of young-growth would occur in the project area. These stands would remain in a stem exclusion stage. The relatively small spacing between each tree causes stress that would allow for insects and diseases to more easily spread, and the productivity of the stand would be less than its potential due to this overcrowding. There would also be a forfeiture of any opportunity to remove trees with high amounts of defect, such as hemlock fluting. These trees may out-compete nearby trees with little defect, reducing the economic potential for future harvest.

There would be no noticeable increase or decrease in the productivity of the stand for the production of timber products except that stands that were never pre-commercially thinned would have significantly fewer merchantable sized stems at potential rotation age. Abundance of non-merchantable stems reduces the economic feasibility of harvesting and decreases the opportunity for a future timber supply. At some point in the future it is expected that some stands in the project area would experience larger-scale damage from a severe storm event, leading to the regeneration of those stands. Diseases present in trees that remain standing would likely infect the new stand to some degree.

Alternatives 2, 3, 4, and 5 Old-growth Harvest

Where even-aged management is prescribed, the productivity of the stand for timber production would be maximized. The risk of insect, disease, and decay within the newly established growing timber crop would be minimized. The new trees that regenerate after even-aged treatments would be vigorous and free from decay. The insect and disease processes at work in the stands previous to harvest, including hemlock dwarf mistletoe, would be mostly eliminated.

Where uneven-aged management is prescribed, forest health concerns can be used as factors to determine which trees to harvest. An attempt would be made to remove the trees that pose the greatest risk to the health of the new stand, but it would have to be balance with maintaining an economic sale, as well as meeting wildlife objectives. Due to the amount of disease and decay found within the old-growth stands proposed for harvest and constraints for visuals, economics, and wind risk, it is unlikely that all or even a significant proportion of the trees with disease and decay would be removed. Productivity of these stands would be reduced in proportion to the amount of old trees that remain and occupy growing space.

In uneven-aged management stands, and in single-tree selection areas in particular, there would be a risk of the new stands being infected with the same diseases and decays present in the stands at harvest. This risk would generally be proportional to the amount of basal area retained. Decay organisms would be transferred between trees when decay-

ridden trees fall and strike adjacent healthy trees either during harvesting operations or during weather events post-harvest. Hemlock dwarf mistletoe would remain in the stand and likely infect the hemlock regeneration even with selection criteria favoring the removal of infected overstory trees first. The larger old trees retained for wildlife would be of low vigor. These trees are not expected to grow or change in any way as a result of the growing space created by harvest. These trees would occupy space and restrict the regeneration of new trees.

Alternatives 2, 3, 4, and 5 Young-growth Treatment

Where a uniform crown thin or systematic corridor thin prescription is used in young-growth stands, stresses on trees due to overcrowding would be reduced. Trees would be better spaced, and individual trees that exhibit signs of disease or decay would be a priority for removal. Commercial thinning requires careful planning and implementation to avoid bole wounding and root damage to the residual crop trees. Some trees would likely be injured regardless. These wounds may attract insects such as bark beetles, and would be places for decay organisms to enter the tree. When conducted correctly, commercial thinning would promote stand health and disease resistance long term by removing any diseased trees and opening growing space that reduced competition stress and mortality. Uniform thinning treatment would carry a greater risk for residual tree injury compared to systematic thinning. Stand mortality caused by overcrowding would decrease in the thinned portion of the stand. Stands are expected to be more resistant to insect and disease infestation. However, injuries to trees resulting from thinning operations, particularly in the uniform thin, could make some trees more susceptible to insects and disease. Stand volumes at harvest age would likely decrease, but tree diameters would be larger and trees would be more resistant to windthrow. Wildlife habitat value of the stand would increase due to increases in understory vegetation.

Direct and Indirect Effects on Regeneration and Species Composition

Alternative 1

Under Alternative 1, no harvest would occur. Openings in the forest canopy would be created by windthrow and trees falling as a result of decay. Hemlock regeneration would have a competitive advantage over other species when small openings in the canopy occur. At some point in the future, it is expected that some stands in the project area would suffer larger scale damage from a severe storm event, leading to the regeneration of those stands. Regeneration would likely be prolific with species composition similar to the former stand. Sitka spruce regeneration may have somewhat of a competitive advantage due to soil disturbance from upturned trees. There would be little opportunity to redirect where yellow cedar is currently growing to more suitable long-term sites.

Alternatives 2, 3, 4, and 5 Old-growth Harvest

Where even-aged management is prescribed, the resulting tree regeneration is expected to be vigorous and representative of the approximate species mix of the former stand. Even-aged management creates conditions that are favorable for tree planting. There would be a good opportunity to plant yellow cedar on sites favorable for the long-term survival of the species. These sites often occur where yellow cedar does not currently exist, and

given the slow regeneration of the species, it would be expected to naturally occupy these sites very slowly.

Where uneven-aged management is prescribed, growing space would be limited by the retention of overstory trees. Natural regeneration would occur in the stand in satisfactory amounts; however, the limited openings in the canopy combined with the low ground disturbance of helicopter yarding would favor hemlock regeneration and may limit the regeneration of the cedars and spruce. To offset this, the retention of spruce and cedar advance regeneration would be important. Additionally, smaller diameter intermediate spruce and cedar trees with good vigor would be important to retain (Deal and Tappeiner 2002). Due to the good species mix and the flexibility of single tree selection and group selection in the stands proposed for uneven-aged management, it is unlikely that a significant change in species composition would occur. Uneven-aged single tree selection does not offer a good opportunity to plant yellow cedar due to the heavy residual canopy cover and larger tree competition. Group selection areas would, however, offer a good opportunity, particularly where groups are over one acre in size.

Alternatives 3, 4, and 5 Young-growth Treatment

Where a uniform thin prescription is used in young-growth stands, minor changes to species composition may occur. In general, neither Sitka spruce nor western hemlock would be favored and the spruce/hemlock leave trees would be the most vigorous individuals, although individual stand prescriptions may vary based on site specific stand characteristics. Cedars and red alder would generally be retained as much as possible within the leave areas. Because Sitka spruce often represents the most vigorous and less defective trees in the stand, it may be selected for retention more frequently than western hemlock.

Where a systematic thin prescription is used in young-growth stands, no significant changes to species composition is expected. Trees removed within the corridors would be representative of the species composition of the entire stand. Trees thinned from the matrix near the corridors would be removed as a uniform crown thin, and may cause only slight changes to species composition as described in the uniform thin prescription.

Direct and Indirect Effects on Windthrow Risk

Alternative 1

Under the No-action Alternative, stands would remain in a predominantly old-growth condition. Small-scale, frequent disturbance events would continue in the stand until a large-scale event occurs. The inherent windthrow risk within stands would not change appreciably.

No commercial thinning would occur in this alternative. Because of overcrowding, trees would generally have a high height to diameter ratio, which would decrease their long-term resistance to windthrow. In the short term, the stand would maintain its dense structure, which decreases the intensity of wind within the stand.

Alternatives 2, 3, 4, and 5 Old-growth Harvest

Where even-aged management is prescribed, windthrow risk would be eliminated within the harvest unit by the removal of all large trees (Table TBR-4). The future young-growth stands created would typically be more windfirm than the old-growth stands they replace.

Exposed stand edges would, however, have increased risk of windthrow in the first few years after harvest due to the adjacent opening. In units where windthrow risk has been determined to be of concern (Table TBR-4), specific measures have been prescribed in the unit cards to reduce or minimize windthrow risk adjacent to unit edges or along stream buffers that protrude into the harvest opening.

Table TBR-4. Pre-Harvest Wind Risk Rating by Silvicultural System and Alternative (acres)

Silvicultural System and Prescription	Wind Risk	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Uneven-Aged with 25% Removal	High	375	651	375	441
	Moderate	13	22	381	155
	Low	0	0	36	0
Uneven-Aged with 33% Removal (Group and Corridor Cuts)	High	0	0	79	0
	Moderate	0	0	447	0
	Low	15	15	119	0
Uneven-Aged with 50% Removal	High[1/]	0	45	86	28
	Moderate	215	300	656	265
	Low	88	88	145	181
Even-Aged Management Clearcut	High	917	1,572	627	775
	Moderate	2,809	3,396	1,001	2,529
	Low	838	818	271	637

1/ Acreage with high wind risk in stands prescribed for uneven-aged management with 50% removal represent settings with lower wind risk that were carved out of larger units with high wind risk ratings.

Where uneven-aged management is prescribed, the basal area retention requirements were increased to offset the potential for blowdown in high windthrow risk areas. As a result, it is expected that wind risk would remain approximately the same as in the stand prior to harvest. Monitoring results from the Alternatives to Clearcutting Study, 5 years post-harvest in wind-prone areas, reveal approximately 5 percent loss of basal area with the 75 percent basal area retention prescription (McClellan 2007). Based on these results, only minor amounts of windthrow are expected to occur following harvest within proposed uneven-aged management units with high windthrow risk.

A mostly unbroken, continuous canopy would remain after harvest in 75 percent retention uneven-aged management units. This would reduce the risk of windthrow along unit edges and adjacent to stream buffers that protrude into the harvest area. In most cases, the uneven-aged prescription would eliminate the need for additional windfirming treatments in RAW zones.

In all even-aged harvest areas, RMAs that have stream channel stability concerns and potential for windthrow were evaluated for RAW. Those RMAs determined to be at risk will be reviewed in the field once preliminary unit boundaries are in place. The specific windfirming prescription for that RMA would be determined at that time.

The regenerated even-aged management stands in current high to moderate wind risk areas are expected to be low risk after conversion to even-aged stands. The lower wind risk in these stands is expected to last through the next rotation (approximately 100 years in the future).

Alternatives 2, 3, 4, and 5 Young-growth Treatment

Where young-growth thinning occurs, windthrow risk would increase immediately after harvest; however, over time, the windfirmness of the stand would increase significantly compared with unthinned stands. This is a result of the lower height-diameter ratios and higher crown ratios in the stand at rotation age, making it more windfirm, especially if partial harvest is desired.

Cumulative Effects

The analysis area for cumulative effects is the entire Big Thorne project area. The following are the only activities expected to have cumulative effects to forest vegetation.

- Continued micro-sales from the Roadside EA that will occur throughout the project area along existing roads;
- Firewood cutting and free use wood removal along existing and proposed roads;
- Continued PCT throughout the project area;
- Completion of the Control Lake project in the southwestern portion of the project area; and
- About 600 acres of harvest during the next 5 years on adjacent State lands east and south of Thorne Bay.

The Big Thorne project area (including non-NFS lands) has approximately 49,546 acres of young growth resulting from timber harvest and originating mostly from even-aged harvesting. Large-scale timber harvest in the project area began around 1953 and peaked about 45 years ago. The State of Alaska plans to harvest approximately 600 acres of old growth using even-aged management within the next 5 years and about 350 unharvested acres from the Control Lake project that remains could be harvested. Most of this harvest would result in the creation of even-aged forests in addition to that proposed in the Big Thorne project.

Slight changes in species composition in the project area may occur as a result of harvest operations and follow up treatments such as pre-commercial and commercial thinning. It is expected that Sitka spruce would occur at slightly higher levels than in the former stand due to the excellent regeneration of this species under even-aged management and favoring of this species for crop trees during thinning operations. Conversely, the hemlock component would likely be reduced in proportion to the amount of Sitka spruce in the stand. Hemlock is not considered a favorable crop tree but is usually well represented due to the high numbers of stems available. Both cedar species are expected to be represented in amounts slightly above or approximately the same as their current levels. Planting of Alaska yellow cedar may be used when necessary (as determined by the District Silviculturist) to maintain its composition in the stand or group of stands and reduce the effects of yellow cedar decline. Scattered windthrow has occurred along

exposed stand boundaries after past harvest and recent road reconstruction activities. No effort to buffer or stabilize these exposed boundaries was made. Older, exposed stand boundaries have stabilized naturally and recently created edges along the new road construction are expected to stabilize also. Where abrupt stand edges are created, either by timber harvest or road construction, some blowdown would occur. Efforts to minimize blowdown are incorporated in the prescriptions but would not completely eliminate it. Large-scale wind events that significantly modify large areas of old-growth stand structure in the project area may occur in the future regardless of the alternative selected. If events of this magnitude do occur, it is unlikely that measures to assure reasonable windfirmness of stands edges or stream buffers proposed by this project will be effective.

Micro-sales, firewood cutting, and Free Use sawtimber removal will likely occur along existing and proposed roads. Any openings created by removal of these trees would be small and would likely have effects similar to uneven-aged management, single-tree selection timber harvests.

Not all previous harvest areas contain trees 5 feet tall or greater, and therefore do not meet NFMA adjacency requirements. These prior harvest areas are still considered openings for the purposes of scheduling or locating additional created openings (Forest Plan, p. 4-72). Previous harvest unit acreage that did not meet these requirements was added to any adjacent planned harvest unit acreage to ensure that the NFMA maximum opening size was not exceeded. These previous harvest units have not met NFMA requirements because they are recent harvests. These stands are growing and may meet the NFMA adjacency requirements by the time of implementation.

Future PCT would provide an opportunity to maintain stand growth and productivity, improve windfirmness, alter species composition, and promote or maintain understory vegetation growth. PCT of even-aged young growth stands would occur across the Big Thorne project area into the future. Currently, there are a total of approximately 12,300 acres that are expected to need PCT over the next 10 years (M. Sheets 2011). About 1,500 acres of young growth has received NEPA clearing and is currently planned for PCT over the next 5 years in the Big Thorne project area (B. Case, Young Growth Coordinator-Silviculture, personal communication, October 2011).

Prescriptions would be developed to manage for multiple resource values with spacing of leave trees based on site-specific objectives. Prescriptions would maintain a minimum 10-foot buffer adjacent to streams and would often maintain unthinned travel corridors for deer and legacy forest structure patches. In non-development LUDs, prescriptions would often include creation of gaps and retention of unharvested thickets. These treatments may also be considered in development LUDs on a case-by-case basis. Practices for retaining and promoting yellow cedar will be incorporated into harvest and thinning prescriptions to compensate for the poor regeneration characteristics of the species and yellow cedar decline.

These future actions, when combined with any of the action alternatives, would result in greater structural diversity of forest stands in the project area and should have negligible overall effects on species composition. As noted under Direct and Indirect Effects, they should have beneficial effects on forest health and productivity.

SOCIAL ENVIRONMENT

Transportation

Introduction

National Forest Transportation System roads are constructed to provide access to NFS lands and are included in the Forest Development Transportation Plan (see Transportation Standards and Guidelines in Chapter 4 of the Forest Plan). They are considered NFS roads as are other roads that are wholly or partially on NFS lands and are intended to be maintained for the long term (see Chapter 4 for a glossary with transportation terms). With the exception of a few administrative sites and campgrounds, most forest roads are single lane, constructed with blasted quarry rock, and designed for off-highway loads.

The NFS roads in the analysis area were originally built for logging and the associated administration, though incidental recreational and subsistence use occurs throughout the area. Road construction in support of logging activities began in the 1960s. Road construction peaked during the 1970s and 1980s in support of the pulp mill in Ketchikan.

This analysis considers the effects of the new construction and reconstruction of roads used to access the proposed timber harvest. It also analyzes the status of these roads after timber harvest (open or closed). The units used in this report for measuring the effects and comparing the alternatives include the following:

- Miles of NFS road construction,
- Miles of temporary road construction,
- Miles of NFS road reconstruction,
- Miles of road to remain open to motorized vehicle traffic,
- Miles of road to be closed associated with these timber harvest activities, and
- Cost including maintenance of open roads, reconstruction, and new (NFS and temporary) road construction.

Methodology

The analysis area for the transportation system includes the project area and road segments leading into the project area. Roads extending from within the project area and terminating outside the project area are also included, as travel within the project area is required to reach these road segments.

Information sources for transportation analysis include the transportation GIS records which house the spatial data for road locations. A complete list of road attributes and definitions of these attributes is located in the project record.

The Forest Service has conducted road condition surveys on many of the existing roads in the Big Thorne project area. These surveys supply site-specific detailed information about each road (and section of road) surveyed as of the date of the survey, including the following:

- Whether the road, or a particular section of the road, is drivable;

- Number, size, and condition of drainage structures and bridges;
- Barriers to vehicle access (vegetation, barrier ditches, pulled bridges, slides, etc.);
- Maintenance requirements; and
- Barriers to fish passage through road drainage structures.

This information is used to (1) identify maintenance trends, (2) provide information for problem analysis, and (3) set priorities for scheduling and funding work. The detailed road condition surveys can be found in the planning record. The majority of the road condition surveys within the project area were completed between 1998 and 2002. Updates to the road condition survey data on some road segments were completed by the Forest Service as recently as 2008.

Proposed new road construction routes were laid out by transportation specialists and field reviewed by resource specialists during 2010 and 2011. Specific comments and concerns along with site-specific mitigation measures are discussed in the respective resource reports and in the road cards for system roads or the unit cards for temporary roads. Roads are included or excluded from each alternative based on access needed for the alternative and the alternative design criteria.

Affected Environment

Forest roads are classified as NFS roads, temporary roads, and unauthorized roads by 36 CFR 212.1. The definitions for these road types are provided below.

- *National Forest System road*: "A forest road other than a road which has been authorized by a legally documented right-of-way held by a State, county, or other local public road authority." NFS roads are generally required to provide long-term or intermittent motor vehicle access. These roads receive constant or intermittent use depending upon the timing of the timber harvest(s) and other activities. NFS roads form the primary transportation network in the project area. When a road is not needed in the short term but future use is anticipated, it is closed and placed in storage.
- *Temporary road or trail:* "A road or trail necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road or trail, and that is not included in a forest transportation atlas." Temporary roads are intended for short-term use and maintained for a limited time usually to access a timber harvest unit. Temporary roads are decommissioned after a timber harvest. Road decommissioning activities result in the stabilization and restoration of unneeded roads to a more natural state. The term "decommissioned roads" generally refers to temporary roads constructed for timber harvests that have had stream courses restored, culverts removed, waterbars added where needed, and cut and fill slopes re-vegetated.
- *Unauthorized Road or Trail:* "A road or trail that is not a forest road or trail or a temporary road or trail and that is not included in a forest transportation atlas." These include unplanned roads and off-road vehicle tracks that have not been designated and managed as roads or trails. Roads that are no longer under permit

or authorization and have not been decommissioned are also considered unauthorized.

Road Maintenance and Reconstruction

The maintenance and reconstruction of the existing system roads depend largely on the volume of timber hauled and, to a lesser extent, on public use. Road maintenance consists of periodic repairs to an existing road surface, brushing, cleaning, and repairing drainage features. Maintenance can include reconditioning the original road template, grading the road surface, cleaning roadside ditches, and removing vegetation that may encroach upon the road or block vision.

NFS roads are managed by a system of maintenance levels (ML), depending on their intended use and suitability for various types of vehicles. These levels range between ML 1 (closed and in storage), ML 2 (suitable for high-clearance vehicles), ML 3 (suitable for passenger vehicles, rough surface), ML 4 (suitable for passenger vehicles, smooth surface), and ML 5 (suitable for passenger cars, dust free, possibly paved). Grading and other maintenance would generally take place more often on a maintenance level 4 road than on a level 3 road, and would be expected to occur less often on a level 2 road. ML 1 roads are left to a self-maintaining condition that requires little or no maintenance. These tasks are performed to keep the roads in the safe and useful condition for which they were designed. Repairs may be accomplished as annual maintenance.

Maintenance and reconditioning of existing NFS roads is an ongoing process that occurs on a periodic basis. Normally this type of work is determined to fit the category of routine repair and maintenance of roads that do not individually, or cumulatively have a significant effect on the quality of the human environment and may be categorically excluded (FSH 1909.15, 31.12). The maintenance and reconditioning of NFS roads in the project area may occur before, during, and after the project analysis. This work is done through separate service contracts to reduce the backlog of deferred maintenance, recondition roads to comply with best management practices, and maintain the existing infrastructure for National Forest management activities. The timing of this work may coincide with this project's analysis, but is not part of this project. Any effects from ongoing road maintenance and reconditioning work are included in the cumulative effects analysis for this project.

Management of NFS roads is dynamic in the sense that roads are given both an operational maintenance level (OPML) and an objective maintenance level (OBML). The purpose of maintenance levels is to define the level of service provided by, and maintenance required for, a specific road or segment. Roads are often built and operated at a higher maintenance level during the timber sale or other activities than they are afterwards.

OPML is the maintenance level currently assigned to a road considering current needs, road condition, budget constraints, and environmental concerns. It defines the level to which the road is currently being maintained. It reflects the current condition.

OBML is the maintenance level to be assigned at a future date considering future road management objectives, traffic needs, budget constraints, and environmental concerns. The objective maintenance level may be the same as, or higher or lower than, the

operational maintenance level (FSH 7709.58, Sec. 12.3 – Transportation System Maintenance Handbook).

Roads can be changed from the OPML status to the designated OBML through a variety of activities. Road storage is the most common activity, which redesignates a road from a ML 2 to ML 1. This can occur at any time due to the analysis completed in the POW Access Travel and Management DN/FONSI and based on resource needs, funding, and management direction.

The current OPML and OBML of NFS roads in the Big Thorne project area are displayed in Table TRAN-1.

Table TRAN-1. Big Thorne Analysis Area NFS Roads

Operational Maintenance	Objective Maintenance	Miles
1 - Basic Custodial Care (Closed)	1-Basic Custodial Care (Closed)	119
	2-High Clearance Vehicles	2
	D-Decommission	7
2 - High Clearance Vehicles	1-Basic Custodial Care (Closed)	85
	2-High Clearance Vehicles	133
	3-Suitable For Passenger Cars	1
	D-Decommission	10
3 - Suitable For Passenger Cars	2-High Clearance Vehicles	5
	3-Suitable For Passenger Cars	67
Total		**429**

Marine Access Facility

An MAF is an area used by humans to transfer items from land to saltwater or vice versa, that contains a structure such as a mooring buoy, dock, LTF, boat ramp, or a combination of these. An LTF is used to transfer logs and timber products from land-based transportation forms to water-based transportation forms (or vice-versa). These facilities are often used for the movement of equipment needed for logging and road building. There are two existing LTFs in or near the Big Thorne project area, one at Coffman Cove and one at Thorne Bay. Both are viable options for a timber purchaser to move logs off Prince of Wales Island.

Rock Quarries

There is a need for a rock source during the construction of the new system and temporary roads, and reconstruction and maintenance of the existing NFS roads in this project. It is preferred that the rock source is close to the site of road construction or maintenance, usually within 2 miles.

There are numerous rock quarries throughout the project area and usually there is one within a few miles of the proposed site. The easy accessibility of existing rock quarries may eliminate the need to develop some new rock quarries. New rock quarries may be developed to support new road construction and road maintenance. Quarry sites would be developed within 500 feet of a road and avoid Class I and Class II stream buffers, old-growth habitat reserves, eagle and goshawk nest tree buffers, and non-developmental LUDs. With either the expansion of an existing quarry or the development of a new site, the area footprint would not exceed 5 acres.

Approximately 15 percent (35,074 acres) of the Big Thorne project area is underlain by the Descon Formation. The Descon Formation is an Ordovician to Silurian aged black, thin-bedded shale and/or chert. Most of the Descon Formation area indicated on the geologic map of the Big Thorne project area contains disseminated pyrite. Some shear and fault zones within this formation are more heavily mineralized than others. The Coffman Cove Road project (a Federal Highways project) utilized a rock source from this Formation within a mineralized shear zone for a portion of the construction. The use of this pyritic material in the road's subgrade resulted in the generation of ARD, which negatively impacted water quality and aquatic environments downstream of the construction. Subsequent testing of the waters above the Coffman Cove Road cleanup effort showed some metal values exceeding Alaska State Water Quality Standards, suggesting that mineralization exists in other zones within the watersheds. Existing Forest roads and quarries in this area are constructed from the Descon Formation. It is estimated that 254 miles of existing road likely constructed from the Descon Shale exist within the project area. It is not known if the material sources used in this construction contained mineralization. However, no previous problems have been observed (Jim Baichtal 2011).

Road construction and quarry development within the project area would utilize and excavate into the underlying Descon Shale (see individual alternative discussions for amount of road built across Descon Shale bedrock). Any existing material source or newly developed source within the Descon Formation and used to construct access to the proposed harvest areas shall be assessed as to its ARD potential.

Travel Analysis Process

The desired condition for the forest transportation system is guided in part by 36 CFR 212.5 - Road System Management. Part b provides guidance for determining the minimum road system needed.

The Travel Analysis Process (TAP), formerly referred to as the Roads Analysis Process (RAP), is a tiered, science-based system of analysis. The first tier is the Forest-wide Roads Analysis, which is an analysis for the entire Tongass National Forest (USDA Forest Service 2003). The Forest-wide Roads Analysis provided management recommendations for maintenance level (ML) 3, 4, and 5 roads. The second tier, or mid-level tier, is the Prince of Wales Roads Analysis, which includes the Big Thorne project area (USDA Forest Service 2005). This report details the analysis methods and recommendations for travel management for ML 1 and 2 roads on the Thorne Bay and Craig Ranger Districts. Copies of these analyses are located in the project record. Combined, these analyses recommend road management objectives for all existing NFS roads on Prince of Wales Island. Recommendations documented in the Prince of Wales roads analysis, supplemented by input from public comment, led to the proposed action developed for the ATM for Prince of Wales and surrounding islands (USDA Forest Service 2009).

The third tier is the project-level analysis. The proposed road management objectives (RMO) for the project area are included in this analysis. The RMO plan for each proposed system road in the project area is also detailed in the road cards of this EIS (Appendix C) and those roads selected will become part of the Record of Decision.

The Big Thorne travel management plan incorporates the Decision Notice for the Prince of Wales ATM (2009). The ATM institutes a system of routes designated for motor vehicle use including class of vehicle, and if appropriate, time of year for motor vehicle use. The designated route system is shown on a Motor Vehicle Use Map. The map can be updated annually and will be adjusted as conditions change. These maps are available at the Craig and Thorne Bay Ranger District offices.

Descriptions of Travel Management Designations are as follows:

- *Open And Maintain* – Maintain open for use by high clearance vehicles; OHV use will not be allowed.
- *Open and Maintain with OHV* – Maintain open for mixed use by high clearance vehicles and OHVs. Engineering suitability study has been conducted prior to designation of mixed use on the motor vehicle use map.
- *Storage* – Each drainage structure is evaluated to determine the appropriate storage strategy. Drainage structures may be removed or bypassed with waterbars to restore natural drainage patterns. Additional water bars or rolling dips may be added to control runoff. Seed and fertilize disturbed soils. This is intended to be the primary maintenance strategy applied on intermittent use roads during their closure cycle. ML 1, closure and basic custodial maintenance, is assigned. This level of maintenance is synonymous with Alaska Forest Resources Practices Act designation of inactive roads.
- *Decommission* – This takes the road out of the National Forest Road System. Decommissioning roads involves restoring roads to a more natural state. Activities used to decommission a road may include, but are not limited to, the following: reestablishing former drainage patterns, stabilizing slopes, restoring vegetation, blocking the entrance to the road, installing water bars, removing culverts, reestablishing drainage-ways, removing unstable fills, pulling back road shoulders, or other methods designed to meet the specific conditions associated with the unneeded road. This level of maintenance is synonymous with Alaska Forest Resources Practices Act designation of closed roads.
- *Motorized Trail* – NFS road will be stored as ML 1 road, but will be dual-designated as motorized trail for OHV use. Site-specific designs may be required prior to designation on the motor vehicle use map.
- *Hiking Trail* – This takes a road out of the National Forest Road System and places it into a recreational trail. No motorized access is allowed.
- *Seasonal Closure* – NFS road will remain drivable with most structures remaining; however, the road will be seasonally closed by designating it as such on the MVUM map. The road will have an OPML of 1. Additional water bars or rolling dips may be added to control runoff.

RMOs define the intended purpose of an individual road based on management area direction and access management objectives. RMOs contain design criteria, operation criteria, and maintenance criteria. The proposed travel management designations for each existing NFS road segment in the project area are included in the Record of Decision for

the Prince of Wales ATM. The RMOs for existing roads with proposed changes and proposed new NFS roads are included in the Big Thorne Travel Analysis Report (see project record). No changes were made to the existing road RMOs as defined in the Prince of Wales ATM.

Best Management Practices

BMPs are used to ensure soil and water resources are considered in transportation planning activities. Specific BMPs are listed by resource on the road cards in Appendix C of the Draft EIS. Effects of roads on resources are reduced through application of standards and guidelines and BMPs. The standards and guidelines particularly relevant to transportation can be found in the Forest Plan (USDA Forest Service 2008) beginning on page 4-80.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects

Under Alternative 1, no new road construction or reconstruction would occur as a result of the Big Thorne project and current management plans would continue to guide the management of NFS roads. All system roads would be managed as directed by the Forest Plan, RMOs, and previous NEPA decisions. This alternative would neither increase nor decrease access to the area for recreational and subsistence activities. A decision to implement this alternative would not impact projects that are already planned or currently being implemented.

No changes would be made to the ATM for existing roads. The OBML is the maintenance level to be assigned at a future date considering future road management objectives, traffic needs, budget constraints, and environmental concerns. The OBML may be the same, higher, or lower than the operational maintenance level. Each NFS road has an OBML assigned. The current OBMLs assigned to each road would guide the future management of that road. As resources and funding become available, roads would be stored or upgraded to match the currently assigned OBML. Table TRAN-2 summarizes the miles of road available for each type of travel.

Cumulative Effects

Cumulative effects of past and proposed timber harvest result in a total of 429 miles of NFS road and 118 miles of temporary road grades within the Big Thorne project area.

The Forest Plan's transportation goal is to "Develop and manage roads and utility systems to support resource management activities; recognize the potential for future development of major Transportation and Utility Systems." Alternative 1 proposes no new development of roads. This alternative would forfeit any opportunity to develop or enhance the current road system. Road maintenance, culvert replacement, and timber micro-sales would continue, and road closures prescribed by the Access Travel Management Plan would continue as funding allows.

Table TRAN-2. Big Thorne Analysis Area OBML and RMO Plan

Objective Maintenance Level	Travel Management	Miles
1 – Basic	Seasonal Closure	11
	Motorized Trail	41
	Storage	153
	Total	**205**
2 – High Clearance Vehicles	Open & Maintain	33
	Open & Maintain With OHV	105
	Storage	1
	Total	**139**
3 – Suitable for Passenger Cars	Open & Maintain	68
	Total	**68**
D - Decommission	Decommission	14
	Motorized Trail	3
	Total	**17**
Grand Total		**429**

Another cumulative effect of the No-action Alternative would be a forfeiture of any opportunity to integrate implementation of the Prince of Wales ATM plan with Big Thorne stewardship contracts. This may reduce funding opportunities and slow the implementation process for placing roads in storage and for the completion of road restoration projects.

Effects Common to all Action Alternatives

In addition to using existing roads, some new NFS and temporary road construction would be needed to access harvest units within the project area for silvicultural activities. All new construction would be off of the existing road system.

New System Roads

All newly constructed NFS roads would have an OBML of 1, but would be managed as a ML 2 during timber sale activities. After completion of the timber sale activities, these roads would be placed in a self-maintaining hydrologic status as they may remain open an additional 1 to 5 years to allow for regeneration surveys and firewood removal. This would include the placement of drivable water bars or dips at all drainage culvert locations to direct water across the road in event that the culvert plugs. During this period the road would be seasonally closed, and would be open only from May 1 to November 30. Each of the closed NFS roads would be needed periodically in the future for timber salvage and/or expansion into timber production LUDs.

New Temporary Roads

Temporary roads are not needed for long-term management of the National Forest. Temporary roads do not access future timber lands and do not have resource concerns that require engineering controls in construction. All temporary roads would be decommissioned after timber harvest. This involves removing culverts and bridges, restoring natural drainage patterns, and allowing the roadway to re-vegetate.

Road Reconstruction

Roads proposed for reconstruction are existing NFS roads currently in storage; most drainage structures have been removed to restore natural drainage patterns and the

roadway has re-vegetated with alders in some cases. Reconstruction activities would include brushing, clearing of alders and replacing drainage structures. Reconstruction would keep the roads in a safe and useful condition for which they are managed, while meeting Forest Plan standard and guides and following the applicable BMPs (see RMO road cards for road site-specific items). No changes are being proposed to the OBML and RMO designated in the Prince of Wales ATM.

All reconstructed roads would be managed as ML 2 during timber sale activities. After completion of the timber sale activities, these roads would be placed in a self-maintaining hydrologic status as they may remain open an additional 1 to 5 years for regeneration surveys and firewood removal. This would include the placement of drivable water bars or dips at all drainage culvert locations to direct water across the road in event that the culvert plugs. During this period the road would be a seasonally closed, and would be open only from May 1 to November 31. 30. Other design elements like oversized culverts may be used to help reduce the need for routine drainage maintenance. Each of the closed NFS roads would be needed periodically in the future for timber salvage and/or expansion into timber production LUDs.

These roads would be reviewed annually and would be categorized as intermittent service roads (ML 1) after the completion of timber sale and additional activities and physically blocked or natural vegetation allowed to eliminate motorized access. Drainage structures would remain in place with additional cross drains (water bars and dips), and the road would be considered stored. A review would be conducted at the time of closure for any additional resource concerns needing to be addressed.

Wetlands Avoidance

An analysis was completed for the location of all new roads to minimize impacts to soils, water and associated resources in accordance with BMPs. Road location will be completed to avoid wetlands whenever practicable. Wetlands were unavoidable on some portions of the location due to safety, engineering design constraints, and consideration for other resources. Alternatives to the location on wetlands would mean longer, higher-cost roads that may have impacted similar areas of wetlands. High-value wetlands were particularly avoided wherever practicable.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Alternative 2 proposes construction of 11 miles of NFS road, of which 1 mile would be constructed over decommissioned existing road beds. Future harvest along these roads is a possibility, as well as future extensions. This alternative would enhance opportunities for other timber harvest projects by providing access through suitable timber lands. This alternative proposes construction of 23 miles of temporary road, of which 4 miles would be constructed over existing decommissioned road beds. All temporary roads would be decommissioned after timber haul is complete. This alternative would reconstruct and temporarily open 19 miles of NFS road currently in storage. New and reconstructed NFS roads would remain open shown on the Motor Vehicle Use Map, to highway legal vehicles, seasonally from May 1 to November 30 for 1 to 5 years to allow for firewood removal. Approximately 4 miles of roads would be converted to motorized trails when

the roads are stored. With full ATM implementation, a total of 48 miles of motorized trails would exist in the project area.

Of the four action alternatives, Alternative 2 proposes the second highest amount of new road construction (Table TRAN-3). This alternative also ranks second highest in transportation development costs (Table TRAN-4). The road development proposed in this alternative would satisfy the minimum requirements needed to allow cost effective and efficient timber harvest. This alternative has a high proportion of conventional logging systems, as opposed to helicopter, relative to Alternatives 4 and 5. Conventional logging systems require more road development to allow access to the harvest units. The additional road development costs are offset by the lower harvest costs achieved by these systems. In areas where road development costs or resource concerns outweighed the benefits of road development, helicopter logging systems were used to allow harvest without additional road development.

Borrow pits and quarries would be needed for road construction. Every 2 miles of new road construction would require about a 2-acre rock quarry. This equates to about 35 acres of developed rock sources. Where feasible existing quarries would be used, however, most new road construction would require the development of new rock quarries. All newly developed borrow quarries would be reviewed and cleared by resource specialists prior to development. Reconstruction of decommissioned road grades would require significantly less rock. Typically this type of construction will utilize existing borrow quarries.

Road construction and quarry development within the project area would utilize and excavate into the underlying Descon Shale. It is estimated that 1.1 miles of new road construction, and 2.5 miles of stored NFS road reconstruction would be across Descon Shale bedrock. Any existing material source or newly developed source within the Descon Formation and used to construct access to the proposed harvest areas shall be assessed as to its ARD potential.

Table TRAN-3. Big Thorne Area Existing and Proposed Roads[1/]

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Proposed New – new construction	0.0	10.5	15.2	2.5	1.7
Proposed New – on existing decommissioned roads	0.0	1.5	2.3	0.6	0.0
Existing NFS roads	429	429	429	429	429
Total NFS roads after implementation	429	441	446	432	431
Proposed Temp – new construction	0.0	19.2	26.0	9.1	7.7
Proposed Temp – existing decommissioned roads	0.0	3.8	12.6	7.3	6.1
Current Decommissioned Temp	118	118	118	118	118
Total Decommissioned Temp after implementation	118	141	157	134	132
Total Proposed – new construction	0.0	29.7	41.2	11.6	9.4
Total Proposed existing decommissioned roads	0.0	5.3	14.9	7.9	6.1
Total Proposed Road Development	0.0	35.0	56.1	19.5	15.5
Reconstruction of Stored NFS Roads	0.0	19.3	39.0	21.5	15.6

1/ Numbers may not sum correctly due to rounding.

Table TRAN-4. Big Thorne Road Development Costs

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
NFS Road Construction	$0	$1,869,000	$2,788,000	$455,000	$301,000
Temporary Road Construction	$0	$2,312,000	$3,268,000	$1,182,000	$992,000
NFS Stored Road Reconstruction	$0	$1,319,000	$2,411,000	$1,265,000	$1,009,000
Total Road Development Cost	**$0**	**$5,500,000**	**$8,467,000**	**$2,902,000**	**$2,302,000**

Note: Costs are estimated by road, but are not exact values; these values are presented to provide a relative comparison between the alternatives. All costs are subject to change.

New road construction crosses seven fish streams. All fish streams would be crossed with a bridge or log culvert structure. These structures would be evaluated on a case-by-case basis and would either be removed during road storage or remain in place. Storage would occur approximately 1 to 5 years after harvest unless the road is designated for immediate storage in the road card due to resource concerns.

Cumulative effects of past road development plus Alternative 2 would result in a total of 440 miles of NFS road and 141 miles of decommissioned temporary road grades within the Big Thorne project area (see Table TRAN-3). This is the second highest amount of NFS and temporary roads created by an alternative. The increase in the cumulative amount of NFS roads would help achieve 2008 Forest Plan objectives and desired conditions for transportation, timber, and economics. With reasonably foreseeable projects, total NFS and temporary roads on NFS lands would only increase by about 1 mile.

Alternative 3

Direct and Indirect Effects

Alternative 3 proposes construction of 17 miles of NFS roads, of which 2 miles would be constructed over decommissioned road beds. All new construction would be from the existing or proposed road system with the exception of 3 miles which are constructed

from a state road east of Thorne Bay (Proposed 3000145 and 3000147 roads). This alternative would reconstruct and temporarily open 39 miles of NFS road currently in storage. New and reconstructed NFS roads would remain open, as shown on the Motor Vehicle Use Map, to highway legal vehicles, seasonally from May 1 to November 30 for 1 to 5 years to allow for firewood removal. Approximately 5 miles of roads would be converted to motorized trails when the roads are stored. With full ATM implementation, a total of 49 miles of motorized trails would exist in the project area.

This alternative proposes construction of 39 miles of temporary road, of which 13 miles would be constructed over decommissioned road beds. All temporary roads would be decommissioned after timber haul is complete.

Of the four action alternatives, Alternative 3 proposes the highest amount of new road construction (Table TRAN-3). This alternative also ranks highest in transportation development costs (Table TRAN-4). The road development proposed in this alternative is the minimum amount of road required to harvest the units in accordance with the objectives of this alternative. This alternative harvests the largest amount of timber of any alternative. This alternative also has a high proportion of conventional logging systems being used, as opposed to helicopter. Conventional logging systems require more road development to allow access to the harvest units. The additional road development costs are offset by the lower harvest costs achieved by these systems. In areas where road development costs or resource concerns outweighed the benefits of road development, helicopter logging systems were used to allow harvest without additional road development. Borrow pits and quarries would be needed for road construction. Every 2 miles of new road construction would require about a 2-acre rock quarry. This equates to 56 acres of developed rock sources. Where feasible, existing quarries would be used; however, most new road construction would require the development of new rock quarries. All newly developed borrow quarries would be reviewed and cleared by resource specialists prior to development. Reconstruction of decommissioned road grades would require significantly less rock. Typically, this type of construction would utilize existing borrow quarries.

Road construction and quarry development within the project area would utilize and excavate into the underlying Descon Shale. It is estimated that 5.1 miles of new road construction, and 4.9 miles of stored NFS road reconstruction would be across Descon Shale bedrock. Any existing material source or newly developed source within the Descon Formation and used to construct access to the proposed harvest areas shall be assessed as to its ARD potential.

New road construction crosses 12 fish streams. All fish streams would be crossed with a bridge or log culvert structure. These structures would be evaluated on a case-by-case basis and would either be removed during road storage or remain in place. Storage would occur approximately 1 to 5 years after harvest unless the road is designated for immediate storage in the road card due to resource concerns.

Cumulative Effects

Cumulative effects of past and proposed timber harvest result in a total of 446 miles of NFS road and 157 miles of decommissioned temporary road grades within the Big Thorne

project area (see Table TRAN-3). This is the highest amount of NFS and temporary road created by an alternative. The increase in the cumulative amount of NFS roads would help achieve 2008 Forest Plan objectives and desired conditions for transportation, timber, and economics by developing a transportation system that could be utilized for future timber sales and silvicultural treatments. With reasonably foreseeable projects, total NFS and temporary roads on NFS lands would only increase by about 1 mile.

Alternative 4

Direct and Indirect Effects

Alternative 4 proposes construction of 3 miles of NFS road, of which 1 mile would be constructed over decommissioned road beds. All new construction would be from the existing and proposed road system. This alternative proposes construction of 16 miles of temporary road, of which 7 miles would be constructed over decommissioned road beds. All temporary roads would be decommissioned after timber haul is complete. This alternative would reconstruct and temporarily open 22 miles of NFS road currently in storage. New and reconstructed NFS roads would remain open, as shown on the Motor Vehicle Use Map, to highway legal vehicles, seasonally from May 1 to November 30 for 1 to 5 years to allow for firewood removal. Approximately 2 miles of roads would be converted to motorized trails when the roads are stored. With full ATM implementation, a total of 46 miles of motorized trails would exist in the project area.

Of the four action alternatives, Alternative 4 proposes the second lowest amount of new road construction (Table TRAN-3). This alternative also ranks second lowest in transportation development costs (Table TRAN-4). The road development proposed in this alternative is the minimum amount of road required to harvest the units in accordance with the objectives of this alternative. This alternative harvests the smallest amount of timber of any alternative. In areas where road development costs or resource concerns outweighed the benefits of road development, helicopter logging systems were used to allow harvest without additional road development. This alternative emphasized minimal impacts on wildlife resources, which was achieved using a higher proportion of partial cut harvests with helicopter logging systems. Helicopter logging generally requires minimal additional road building. Longer yarding distances can be achieved, allowing timber to be yarded to the closest existing road in most cases. The lower road development costs are offset by the higher harvest costs associated with this system.

Borrow pits and quarries would be needed for road construction. Every 2 miles of new road construction would require about a 2-acre rock quarry. This equates to 19 acres of developed rock sources. Where feasible existing quarries would be used; however, most new road construction would require the development of new rock quarries. All newly developed borrow quarries would be reviewed and cleared by resource specialists prior to development. Reconstruction of decommissioned road grades would require significantly less rock. Typically, this type of construction would utilize existing borrow quarries.

Road construction and quarry development within the project area would utilize and excavate into the underlying Descon Shale. It is estimated that 0.9 mile of new road construction, and 1.8 miles of stored NFS road reconstruction would be across Descon Shale bedrock. Any existing material source or newly developed source within the

Descon Formation and used to construct access to the proposed harvest areas shall be assessed as to its ARD potential.

New road construction crosses two fish streams. All fish streams would be crossed with a bridge or log culvert structure. These structures would be evaluated on a case-by-case basis and would either be removed during road storage or remain in place. Storage would occur approximately 1 to 5 years after harvest unless the road is designated for immediate storage in the road card due to resource concerns.

Cumulative Effects

Cumulative effects of past and proposed timber harvest result in a total of 432 miles of NFS road and 134 miles of decommissioned temporary road grades within the Big Thorne project area. This is the second lowest amount of NFS and temporary road created by an alternative (Table TRAN-3). The decrease in the cumulative amount of NFS roads would reduce access to more areas for future timber harvests or silvicultural treatments. This would reduce opportunities to move towards achieving the Forest Plan desired conditions for timber, transportation, and economics, resulting in higher transportation development costs to implement future timber sales and silvicultural activities. With reasonably foreseeable projects, total NFS and temporary roads on NFS lands would only increase by about 1 mile.

Alternative 5

Direct and Indirect Effects

Alternative 5 proposes construction of 2 miles of NFS road. All new construction would be from the existing and proposed road system. This alternative proposes construction of 14 miles of temporary road, of which 6 miles would be constructed over decommissioned road beds. All temporary roads would be decommissioned after timber haul is complete. This alternative would reconstruct and temporarily open 16 miles of NFS road currently in storage. New and reconstructed NFS roads would remain open, as shown on the Motor Vehicle Use Map, to highway legal vehicles, seasonally from May 1 to November 30 for 1 to 5 years to allow for firewood removal. Approximately 1 mile of road would be converted to motorized trails when the roads are stored. With full ATM implementation a total of 45 miles of motorized trails would exist in the project area.

Of the four action alternatives, Alternative 5 proposes the least amount of new road construction (Table TRAN-3). This alternative also ranks lowest in transportation development costs (Table TRAN-4). The road development proposed in this alternative is the minimum amount of road required to harvest the units in accordance with the objectives of this alternative. This alternative harvests the least amount of timber of any action alternative. In areas where road development costs or resource concerns outweighed the benefits of road development, helicopter logging systems were used to allow harvest without additional road development. This alternative emphasizes minimal impacts on watersheds, which was achieved by minimizing stream crossings, road development, and the use of ground-based equipment. Helicopter logging would be used more extensively to accomplish these objectives. Helicopter logging generally requires minimal additional road building. Longer yarding distances can be achieved, allowing

timber to be yarded to the closest existing road in most cases. The lower road development costs are offset by the higher harvest costs associated with this system.

Borrow pits and quarries would be needed for road construction. Every 2 miles of new road construction would require about a 2-acre rock quarries. This equates to 16 acres of developed rock sources. Where feasible existing quarries would be used; however, most new road construction would require the development of new rock quarries. All newly developed borrow quarries would be reviewed and cleared by resource specialists prior to development. Reconstruction of decommissioned road grades would require significantly less rock. Typically, this type of construction would utilize existing borrow quarries.

New road construction crosses one fish stream. All fish streams would be crossed with a bridge or log culvert structure. These structures would be evaluated on a case-by-case basis and would either be removed during road storage or remain in place. Storage would occur approximately 1 to 5 years after harvest unless the road is designated for immediate storage in the road card due to resource concerns.

Cumulative Effects

Cumulative effects of past and proposed timber harvest would result in a total of 431 miles of NFS roads and 132 miles of decommissioned temporary road grades within the Big Thorne project area (see Table TRAN-3). The decrease in the cumulative amount of NFS roads would reduce access to more areas for future timber harvests or silvicultural treatments. This would reduce opportunities to move towards achieving the Forest Plan desired conditions for timber, transportation, and economics resulting in higher transportation development costs to implement future timber sales and silvicultural activities. With reasonably foreseeable projects, total NFS and temporary roads on NFS lands would only increase by about 1 mile.

Comparison of Alternatives

Table TRAN-3 summarizes the miles of proposed road construction along with the miles of existing road for both NFS and temporary roads. Proposed construction is broken out to show the number of miles of new road location (new construction) and the number of miles that is reconstruction of a decommissioned road. Reconstruction of decommissioned roads typically results in less site impacts and is significantly lower in cost than new construction. Temporary roads are decommissioned after their period of use has expired; they will not be open and drivable and are not counted as part of the NFS roads network. Temporary roads are not needed for future access and are typically constructed to a lower design standard than system roads resulting in a lower construction cost. Temporary roads will not provide the public access to firewood after timber harvest is complete. System roads may remain open an additional 1 to 5 years for regeneration surveys and firewood removal.

Estimated costs for construction of roads are shown in Table TRAN-4. NFS roads in Southeast Alaska are more expensive to build than in other parts of the nation. The major factor that contributes to higher costs is obtaining the rock for the roadbed. Rock is obtained by blasting bedrock, which is then hauled and shaped into a road over typically soft, uneven terrain. Other factors that contribute to the high cost of constructing

Southeast Alaskan roads include the higher costs of shipping and labor, the numerous drainage structures needed, and more complex logistics involved.

Road development costs are based upon regional average costs for constructing roads in Southeast Alaska. Costs are applied based upon an average cost per mile for different classifications of road construction and reconstruction with an additional cost per fish stream crossing. The following costs were used for estimating the road development costs for each alternative (Reeves 2011):

- New NFS road construction $175,000/mile
- NFS road constructed over decommissioned road grade $30,000/mile
- New temporary road construction $110,000/mile
- Temporary road construction over decommissioned road grade - $20,000/mile
- NFS stored road reconstruction $30,000/mile
- Additional cost for fish stream crossings (temp. bridges) $20,000/bridge

Road storage can reduce annual and deferred road maintenance costs by removing drainage structures, installing waterbars, and other means to stabilize the road surface until the road is needed again. Decommissioning will remove the road from the NFS inventory. When a road is decommissioned work items include a combination of the following: reestablishing former drainage patterns, stabilizing slopes, restoring vegetation, blocking the entrance to the road, installing water bars, removing culverts, reestablishing drainage-ways, removing unstable fills, pulling back road shoulders, or other methods designed to meet the specific conditions associated with the unneeded road.

Costs for road storage are estimated at $4,000/mile and are based on recent bids received for the POW road storage work (R. Jacobson, 2011). Temporary road decommissioning is estimated at $3,000/mile. These costs are based on Davis-Bacon wages. Costs can vary depending on necessary work items, location, fuel prices and other factors. Existing roads that are considered to be stored are surveyed to measure the effectiveness of the storage measures. When necessary, additional storage work may be prescribed to stabilize a road. Table TRAN-5 displays the estimated costs for road storage of the proposed roads and decommissioning of the temporary roads.

Table TRAN-5. Estimated Costs of Road Storage and Decommissioning

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Storage of NFS Roads After Use	$0	$124,000	$225,000	$98,000	$69,000
Decommission Temporary Roads	$0	$69,000	$115,000	$49,000	$42,000
Total Storage and Decommissioning	$0	$193,000	$330,000	$147,000	$111,000

Table TRAN-6 displays the RMOs for the Big Thorne project area based on full implementation of the proposed travel management plan. The RMOs for each existing road are found in the Prince of Wales ATM. The RMOs for proposed roads can be found on the road cards in Appendix C of this Draft EIS as well as the Travel Analysis Report found in Appendix B of the Transportation Resource Report (Barnhart and Hitner 2012).

All action alternatives increase the miles of road in storage, Alternative 3 having the largest increase and Alternative 5 having the least increase. No changes were made to the ATM for existing NFS roads.

Table TRAN-6. Travel Management Plan for Project Area after Implementation of Proposed RMOs (miles)

Travel Management	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Open & Maintain	101	101	101	101	101
Open & Maintain With OHV	105	105	105	105	105
Storage	165	172	177	166	166
Seasonal Closure	11	11	11	11	11
Motorized Trail	44	48	49	46	45
Decommission	14	14	14	14	14
Total	**429**	**440**	**446**	**432**	**431**

Recreation

Affected Environment

Recreation use in the Big Thorne project area includes freshwater fishing, big game and waterfowl hunting, OHV use, kayaking and canoeing, hiking and wildlife viewing, picnicking, and camping among other activities. The following section is divided into five parts that provide an overview of regional and local tourism and describe Recreation Opportunity Spectrum (ROS) settings, recreation places and sites, OHV use, and outfitter/guide use in the project area.

Tourism

Southeast Alaska

The visitor industry in Alaska is very seasonal, with the majority of visitation taking place between May and September. An estimated 1,160,000 out-of-state visitors came to Southeast Alaska in summer 2006, the most recent year that regional data are available, with the majority of these visitors arriving by cruise ship (McDowell Group 2007). In addition to experiencing the Tongass from the deck of the cruise ship and exploring ports of call, many passengers also take at least one trip to the Forest during their visit (McDowell Group 2005). Non-cruise visitors tend to either use package deals designed to provide transportation, lodging, meals, and activities, or visit as independent travelers. Independent travelers tend to design their own travel itineraries, utilize public transportation systems, and stay in local communities. For the majority of Alaska visitors, it is important to experience the natural resources, cultural history, and wildness of the region. The McDowell Group (2010) estimated that total visitor-related employment supported 10,600 jobs and $373 million in labor income in Southeast Alaska from October 2008 through September 2009, about 21 percent of total regional employment and 17 percent of total labor income. Supplemental analysis of the USDA Forest Service National Visitor Use Monitoring (NVUM) program data estimated that the Tongass received 2.3 million annual visits, with average spending per party of $287.20. This analysis estimated that every 10,000 visits supported 13.7 direct local jobs (White and Stynes 2010).

Prince of Wales Island

Prince of Wales Island offers world class fishing and one of the highest populations of black bear in the country, as well as more than 1,500 miles of logging roads, most of which are gravel. The Alaska Marine Highway does not stop at any ports on Prince of Wales Island and large cruise ships, which, as noted above, account for the majority of visitors to Southeast Alaska, do not visit the island either. Most visitors to Prince of Wales Island arrive either by float plane from Ketchikan or via the Inter-Island Ferry between Ketchikan and Hollis. In 2011, a 50- to 75-passenger cruise ship began visiting Prince of Wales Island, stopping at El Capitan Cave, Klawock, and the Naukati West Shellfish Nursery, a private oyster farm in Sea Otter Sound.

An estimated 15,000 out-of-state residents visited Prince of Wales Island in summer 2006, about 1.5 percent of total visitors to Southeast Alaska (McDowell Group 2007). A study by the University of Alaska Institute of Social and Economic Research (ISER) estimated that

12,326 visitors participated in nature-based tourism on Prince of Wales Island in 2007, bringing in more than $30 million in gross revenues, with most of this revenue related to sport fishing (Dugan et al. 2009). The majority of this revenue (over 80%) comes from the remote lodges on islands scattered around Prince of Wales Island. Craig also has large lodges with this type of clientele. All of these lodges have direct waterfront access and focus on saltwater fishing. These operations are accessed by float plane from the larger communities with jet service (Ketchikan, Wrangell and Petersburg). The experience is self-contained; clients typically do not visit any of the recreation sites in the project area or use the road system (Dugan et al. 2009).

Most sport fish visitors stay in one of the island's lodges, with a smaller number staying in cabins or other local accommodations. Fishing lodges are located in Craig, Klawock, Thorne Bay, and Coffman Cove, as well as in more remote locations scattered around the island. Sport fish visitors to Craig, Klawock, and the remote lodges focus on saltwater fishing. Lodges and day charter operators in Thorne Bay and Coffman Cove offer a combination of saltwater and freshwater fishing (Dugan et al. 2009).

Bear hunting is popular on the island, with guided black bear hunting and drop-off and transporter services available. The number of visitors and revenues associated with bear hunting are, however, much lower than those associated with sport fishing (Dugan et al. 2009). More than 80 percent of all guided hunts are conducted by motorized boat in shoreline areas; only one guide provides hunting on the Prince of Wales Island road system. The number of hunting guides is limited based on an administrative cap on the number of guided black bear hunts allowed on the Craig and Thorne Bay Ranger Districts (USDA Forest Service 2010). In addition, no outfitter/guide hunting is allowed in much of the Big Thorne project area based on the Big Game EA closure of the central WAAs (1318 and 1319) on Prince of Wales Island (USDA Forest Service 1993).

The existing road system on Prince of Wales Island offers opportunities for sightseeing and exploring, as well as providing access for hunters and OHV enthusiasts. All roads designated as open under the Prince of Wales Island ATM process have been identified as important to local users for recreation and subsistence hunting and gathering of firewood. Visitors are able to travel to Prince of Wales Island with their vehicles via the Inter-Island Ferry between Ketchikan and Hollis; access has also been available in the past from Wrangell and Petersburg via limited ferry service to Coffman Cove.

Recreation Opportunity Spectrum

The ROS system is a land classification system developed by the Forest Service to help identify and describe possible combinations of recreation activities, settings, and experiences for management purposes (USDA Forest Service 1982). The ROS system portrays the appropriate combination of activities, settings, and experiences along a continuum that ranges from primitive to highly modified environments. Seven classifications are identified along this continuum:

- Primitive (P)
- Semi-Primitive Non-Motorized (SPNM)
- Semi-Primitive Motorized (SPM)

- Roaded Natural (RN)
- Roaded Modified (RM)
- Rural (R)
- Urban (U)

ROS classes represent a spectrum of possible experiences, from those with a high probability of self-reliance, solitude, challenge, and risk to those with a relatively high degree of interaction with other people. The settings, activities, and probable recreation experience opportunities associated with each ROS setting are described in Appendix A to the Recreation Resource Report (Dadswell 2012) prepared for this project.

The ROS does not specify or prescribe what types of activities are allowed in an area. The LUDs assigned in the Forest Plan prescribe allowable management activities, along with federal, state, and local laws and regulations. Therefore, if a LUD allows for increased development, timber harvest, or increased recreation use, then the descriptive ROS character may change to reflect the new development. Since expanded development is allowed within the project area based on the area's LUDs, a change in ROS setting is allowed as a management objective of the existing plan. In addition, changes to existing ROS allocations were anticipated as part of the management objectives and direction incorporated in the Forest Plan (USDA Forest Service 2008b).

The Big Thorne project area encompasses approximately 232,000 acres, including 14,300 acres of non-NFS lands. These non-NFS lands are not included in the ROS analysis, leaving approximately 217,700 acres of NFS land within the project area. More than half (58 percent) of this area has been inventoried as Roaded Modified (RM) (Table REC-1). Community road systems, including the existing networks of Forest Service roads, provide access to developed and dispersed recreation opportunities in these areas. The Semi-Primitive Non-Motorized (SPNM) setting accounts for 32 percent of the project area, with the Primitive (P) and Semi-Primitive Motorized (SPM) settings each accounting for about 5 percent. The areas inventoried as P and SPM, where opportunities for more remote recreation are available, largely coincide with the Thorne River, Karta, and Ratz IRAs, and encompass much of the Honker Divide Canoe Route (Figure REC-1). The remaining land in the project area, less than 1 percent, has been inventoried as Roaded Natural (RN) (0.4 percent), Rural (R) (0.2 percent), and Urban (U) (0.1 percent) (Table REC-1). The RN areas are located along the shoreline near Sandy Beach. The R and U areas are located near and adjacent to the city of Thorne Bay (Figure REC-1).

Table REC-1. ROS Designations within the Big Thorne Project Area

ROS Class	Acres	Percent of Project Area
Primitive (P)	10,509	5
Semi-Primitive Non-Motorized (SPNM)	69,231	32
Semi-Primitive Motorized (SPM)	10,826	5
Roaded Natural (RN)	976	0
Roaded Modified (RM)	125,501	58
Rural (R)	503	0
Urban (U)	133	0
Total	**217,679**	**100**

1/ ROS designations are presented for NFS lands within the project area only.

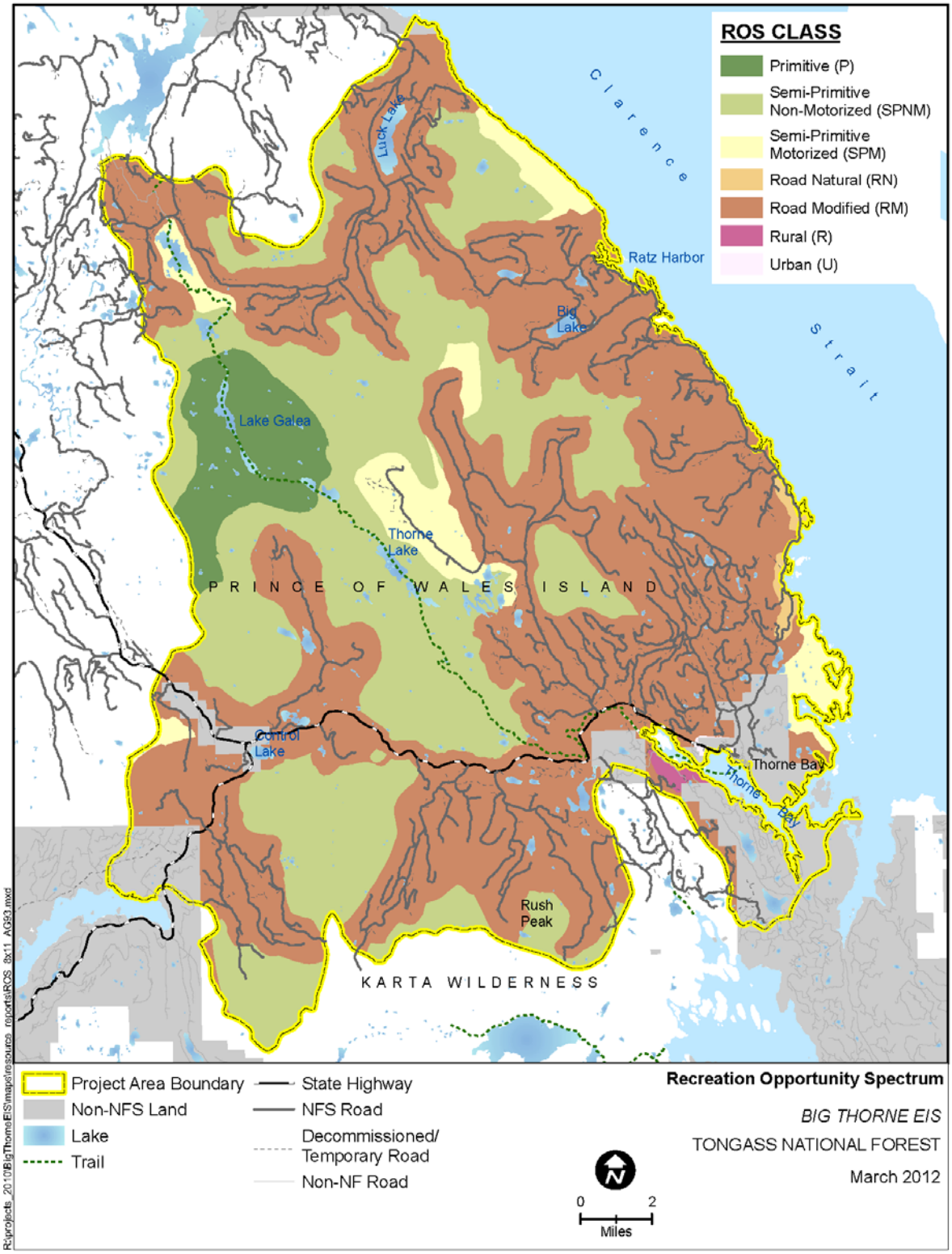

Figure REC-1. Recreation Opportunity Spectrum Settings within the Big Thorne Project Area

Recreation Places and Sites

The majority of the Tongass National Forest is undeveloped and primarily used for dispersed recreation activities. Viewing scenery and wildlife, boating, fishing, beachcombing, hiking, and hunting are the primary dispersed recreation activities that take place on the Forest. While most areas of the Forest have the potential to provide recreation opportunities to a varying degree, patterns of use tend to be associated with existing road systems, known protected boat anchorages, boat landings, and aircraft landing sites. These types of locations, with one or more physical characteristics that are particularly attractive to people for recreation activities, were identified as recreation places as part of the planning analysis for the 1997 Forest Plan and incorporated as part of the process that resulted in the current Forest Plan (USDA Forest Service 2008a).

Four main types of recreation places were identified: marine, hunting, fishing, and tourism (USDA Forest Service 2008a). In the Big Thorne project area, marine recreation places are located at the mouth of Thorne Bay and also extend along the shore from Sandy Beach to Ratz Harbor. Recreation places important for hunting include the road system that extends north of the city of Thorne Bay, as well as portions of the Thorne River and Ratz IRAs.

Fishing recreation places extend along portions of the Thorne River and Hatchery Creek system, and encompass Luck Lake. These areas are also identified as Tourism recreation places, as are the Marine recreation places at Thorne Bay and Ratz Harbor, and the area around Control Lake, Eagles Nest Campground, and Balls Lake Picnic Area.

Recreation sites are specific sites and/or facilities where recreation activities are localized. Recreation sites include, but are not limited to, developed recreation sites, such as trails, picnic sites, campsites, interpretive sites, and Forest Service cabins. They also include undeveloped sites with significant natural features like waterfalls or geologic formations that are destinations for National Forest visitors. Like recreation places, developed and undeveloped recreation sites on the Tongass were identified as part of the planning process for the 1997 Forest Plan. Developed recreation sites are identified by name in Figure REC-2. Recreation sites are discussed in the following sections.

Developed Recreation Sites

Thirteen developed recreation sites are located in the Big Thorne project area (Table REC-2). The locations of 10 of these sites are identified on Figure REC-2. The three sites not labeled on the map are the Falls Creek Fishing Access point, the Boyscout Multiuse Trail, and the Cutthroat Road Trail.

The Forest Service does not charge fees for recreation sites or trails, other than the cabin reserve system, and there are no trail counters or other devices to calculate use at these locations. As a result, there is no systematic estimation of use for most recreation areas on the Thorne Bay Ranger District. For the purposes of this analysis, each of the developed recreation sites within the project area was assigned a rating of high, medium, or low use by the Recreation Planner for the Craig and Thorne Bay Ranger Districts based on observations and professional judgment (Table REC-2). The following sections provide summary information for each of the 13 developed recreation sites identified in the Big Thorne project area.

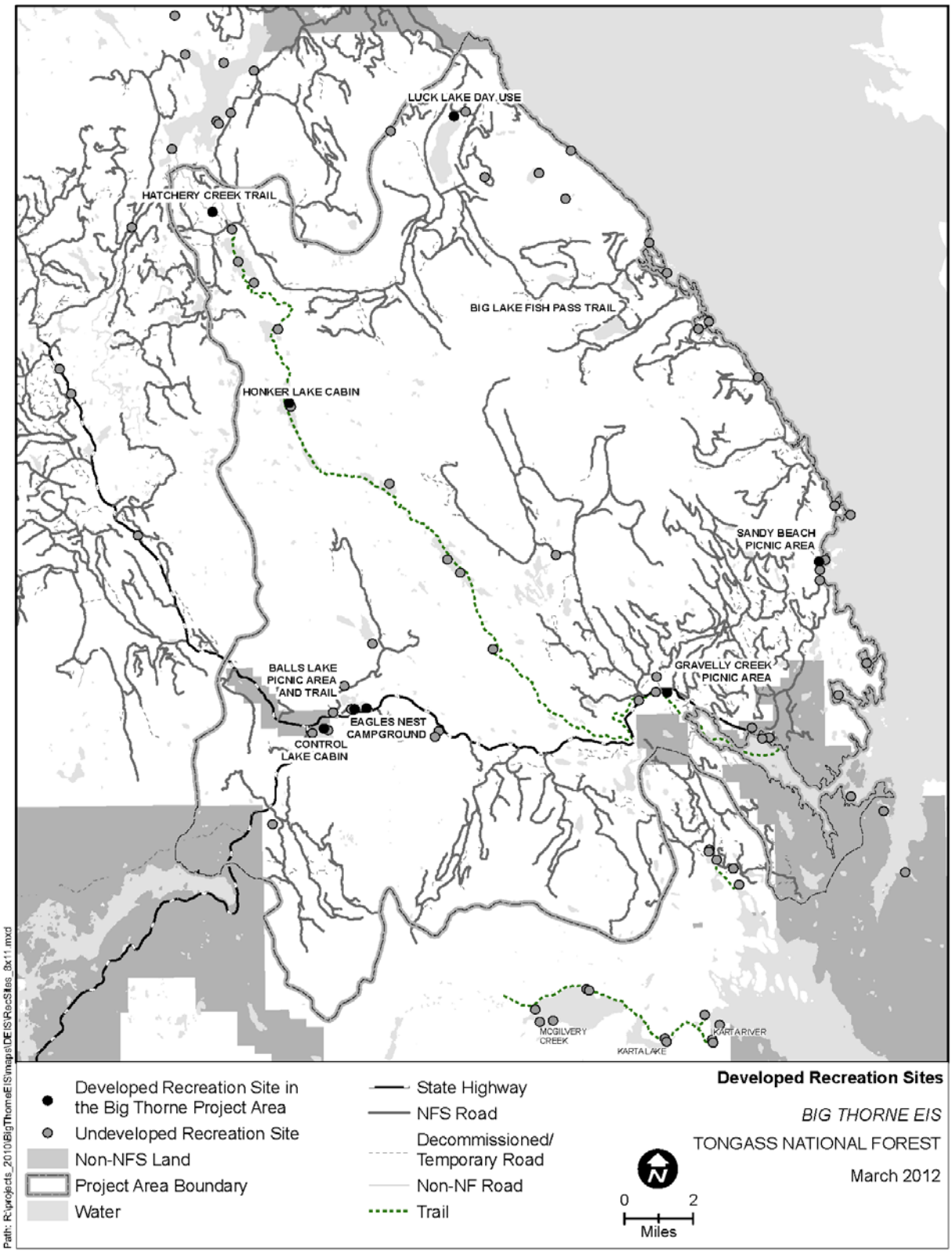

Figure REC-2. Recreation Sites in the Big Thorne Project Area

Table REC-2. Developed Recreation Sites in the Big Thorne Project Area

Site Name	Description	Site Use Rating[1/]
Gravelly Creek Picnic Area	Large day-use area with fishing access to Gravelly Creek and Thorne River	High
Sandy Beach Picnic Area	Large day-use area with beach and water access	High
Honker Divide Canoe Route	30-mile-long canoe route and hiking trail on the Hatchery Creek/Thorne River system	Low
Eagles Nest Campground	Campground with 12 sites and a short interpretive trail	Medium
Balls Lake Picnic Area and Trail	Picnic area with a community shelter and 2.2 mile trail around the lake	Low
Fishing Access Falls Creek	Fishing access at the confluence of Thorne River and Falls Creek	High
Luck Lake Day Use	Primitive boat launch on the north end of Luck Lake	Medium
Big Lake Fish Pass Trail	Short gravel trail to fish passage viewing area	Low
Boyscout Multiuse Trail	OHV trail system	Medium
Cutthroat Road/Trail	5-mile-long road/trail closed to motorized use; used by hikers, bikers, and skiers	Medium
Hatchery Creek Trail	0.5-mile-long boardwalk trail to Hatchery Creek Falls	High
Honker Lake Cabin	Recreation cabin on the northeast side of Honker Lake	**
Control Lake Cabin	Recreation cabin on the north shore of Control Lake	**

Notes:
1/ High is over 500 visitors per year, medium is estimated at 100-500, and low is anything under 100 visitors per year. Estimates are based on extrapolations from limited informal observations in the field.
** Use for recreation cabins is recorded by reserved nights at each cabin. In 2008, the Honker Lake and Control Lake cabins were reserved for 27 nights and 69 nights, respectively. These totals were generally consistent with the average number of reservations at these cabins from 2004 to 2008.
Source: USDA Forest Service 2011

Gravelly Creek Picnic Area

A large day use picnic area located about 3 miles from the city of Thorne Bay (adjacent to State Highway 929), this site provides fishing access to Gravelly Creek and the Thorne River. A short wheelchair-accessible trail leads from a paved parking area to the river where there are several picnic sites, restrooms, and a shelter. Four species of salmon, rainbow and cutthroat trout, Dolly Varden char and spring and fall runs of steelhead occur in the Thorne River. Recreation use at this site is considered high (Table REC-2).

Sandy Beach Picnic Area

A large day use, picnic area located about 6 miles north of the city of Thorne Bay, this site is situated among a stand of Sitka spruce and cedar adjacent to Sandy Beach. Picnic area facilities include a shelter and restroom facilities. Visitors use the beach and enjoy the view of Clarence Strait. Sandy Beach Picnic Area is a popular location and use is considered high (Table REC-2).

Honker Divide Canoe Route

The Honker Divide Canoe Route starts at the Hatchery Creek Bridge on Coffman Cove Road (Forest Road 30) and travels southeast over 30 miles of streams and lakes in the Hatchery Creek/Thorne River system before ending at the city dock in the city of Thorne Bay. Thorne River and Hatchery Creek are connected by a low divide that affords a 2- to 3-mile canoe portage. The Honker Divide Canoe Route is entirely located within the Big Thorne project area.

Fishing opportunities on the Thorne-Hatchery system are nationally known. The area receives extensive use as a recreational fishery for a variety of species, including coho, sockeye, chum, and pink salmon, as well as cutthroat, rainbow, and steelhead trout and Dolly Varden char. Thorne River produces the largest run of steelhead on Prince of Wales Island and is considered one of five high-quality freshwater fishing areas on the island. Opportunities for wildlife viewing are also a draw and subsistence hunting is a common activity in the surrounding area.

The Honker Divide Canoe Route is part of the Thorne River/Hatchery Creek/Barnes Lake, which was recommended for inclusion in the Wild and Scenic River System during the 1997 Forest Plan revision. This river was recommended for the following outstandingly remarkable values: scenery, recreation, fish, and wildlife (see the Wild and Scenic Rivers section, below).

Compared to some of the other developed recreation areas in the Big Thorne project area, the Honker Divide Canoe Route receives relatively low levels of use (Table REC-2). However, this type of comparison is somewhat misleading because the Honker Divide Canoe Route offers a challenging, remote recreation experience that relies upon limited encounters with other parties.

Eagles Nest Campground

Located on Balls Lake, about 16 miles west of Thorne Bay on State Highway 929, Eagles Nest Campground has 12 campsites, restroom facilities, an accessible interpretive trail, and a boat launch on Balls Lake for canoes or kayaks. There are also opportunities to fish for trout and Dolly Varden from the shore. Recreation use at this location is considered medium (Table REC-2).

Balls Lake Picnic Area and Trail

Also located on Balls Lake, this picnic area is located about 0.5 mile from the Eagles Nest Campground. The picnic area includes two picnic tables, a large community shelter, and a vault toilet. The trailhead for the 2.2-mile Balls Lake Trail is located near the shelter. Day users can also follow a 0.5-mile trail to Eagles Nest Campground, interpretive trail, and boat launch. Recreation use at this location is considered low (Table REC-2).

Fishing Access Falls Creek

This is a widened pull-off for parking along the Thorne Bay Highway (State Highway 929). A somewhat hardened, 500-foot trail leads from the pull-off to the confluence of the Thorne River and Falls Creek. This is a popular location for fishing access and recreation use at this location is considered high (Table REC-2).

Luck Lake Day Use Area

This area consists of a primitive boat launch and small parking area that provide access to the north end of Luck Lake. Located about 6 road miles south of Coffman Cove, this area is used by canoeists and kayakers. There is also a swimming area near the access site, and people fish the lake for sockeye salmon and cutthroat and lake trout. Recreation use at this location is considered medium (Table REC-2).

Big Lake Fish Pass Trail

This short, accessible gravel trail takes visitors to a platform viewing area that overlooks a fish ladder on Ratz Creek. Interpretive signs provide information about the life cycle of salmon and fish passage. During the late summer and fall salmon runs, visitors can see salmon leap up the fish pass. This trail is located about 22 road miles north of Thorne Bay. Recreation use at this location is considered low (Table REC-2).

Boyscout Multiuse Trail

The Boyscout Multiuse Trail is an old road system (3017-3018 Roads) that has been closed to highway vehicles but left open for OHV use, with an 85-foot-long OHV bridge installed in the mid-1990s. Easily accessible from Thorne Bay, the trail climbs in elevation and provides views of Clarence Strait. Recreation use at this location is considered medium (Table REC-2).

Cutthroat Road/Trail

Cutthroat Road/Trail is a relatively flat, higher elevation former logging road that is gated, preventing motor vehicles from entering. This 5-mile-long road/trail is used by walkers, bikers, and skiers. Recreation use at this location is considered medium (Table REC-2).

Hatchery Creek Trail

This 0.5-mile-long boardwalk trail leads to Hatchery Creek Falls. The falls offer opportunities for salmon fishing and wildlife viewing. Recreation use at this location is considered high (Table REC-2).

Honker Lake Cabin

Located on the northeast side of Honker Lake (also known as Lake Galea), about 6 miles downstream of the put-in location for the Honker Divide Canoe Route, this Forest Service cabin is isolated and accessible only by floatplane or canoe. Waterfowl are abundant, especially the Canada goose or "honker." There is good fishing in the lake for cutthroat, rainbow, and Dolly Varden trout, as well as coho and sockeye salmon; Sitka black-tailed deer, black bear, and wolves are often sighted here. Consistent with its remote location, the Honker Lake Cabin receives relatively low levels of use, with 27 nights reserved in 2008.

Control Lake Cabin

This cabin, located on the north shore of Control Lake, is about 18 road miles from Thorne Bay and accessed from State Highway 929. The Lower Thorne River, which offers fishing and boating opportunities, is located a short drive away and the cabin is a popular staging location for recreation activities in the area. The lake has resident populations of cutthroat and Dolly Varden trout and sockeye salmon. The Control Lake Cabin receives relatively high use, with 69 nights reserved in 2008.

Undeveloped Recreation Sites

In addition to the developed recreation sites discussed above, the planning process for the 1997 Forest Plan identified a number of undeveloped recreation locations in the Big Thorne project area (Figure REC-2). These locations include sites that are recognized sites for undeveloped recreation opportunities, including hunting and fishing, as well as

sites that offer developed recreation facilities that are not managed or maintained by the Forest Service. There are also two developed sites in the project area not managed by the Forest Service: the old Colby Cabin, a non-Forest Service cabin on the Honker Divide Canoe Route, which is popular with Honker Divide users; and the boat launch at Ratz Harbor, used for small boats to access Clarence Strait.

Other undeveloped sites identified on Figure REC-2, include a series of locations along the Honker Divide Canoe Route that have been identified as good fishing spots. The locations identified along Sandy Beach Road (Forest Road 30) represent popular beaches, many with hammocks and fire pits established by local users. Other undeveloped sites shown on Figure REC-2 mainly provide opportunities for dispersed recreation opportunities, including fishing and hunting. Other recreation sites in the project area not identified on Figure REC-2 include well-beaten, user-made paths along the lower Thorne River that provide access to fishing opportunities.

Table REC-3 lists a number of the undeveloped recreation sites in the project area that have been identified as receiving consistent use in recent years. The table also presents approximate estimates of site use based on the site rating criteria used to evaluate the developed sites in Table REC-2, above.

Table REC-3. Estimated Use of Undeveloped Recreation Sites in the Big Thorne Project Area Identified as Receiving Consistent Use

Site Name	Site Use Rating[1/]
Steelhead Gravel Pit	Medium
301500 Pit	Medium
Eightmile Fishing Hole	Medium
Goose Creek Fishing Hole	High
Thorne River Bridge	High
North Thorne Falls	Medium
Snakey Lakes	Low
Thorne River Trapper's Cabin[2/]	Low
Lava Creek Multiuse Trail	Medium
Tory Shores Beach	Low
Sal Creek Beach	Low
Sandy Beach North	Medium
Eagle Creek	Medium
Luck Creek	Medium

Notes:
1/ High is over 500 visitors per year, medium is estimated at 100-500, and low is anything under 100 visitors per year. Estimates are based on extrapolations from limited informal observations in the field.
2/ This cabin is also known as the old Colby Cabin.
Source: USDA Forest Service 2011

Off-Highway Vehicle Use

The extensive road system in the project area offers opportunities for OHV use. While State of Alaska OHV laws state that OHVs may not be used on any state highway or open road connected to a state highway, OHV use is a common mode of access on Prince of Wales Island. OHVs travel almost entirely on the hardened road surfaces on Prince of Wales Island. The Forest Service recently addressed OHV use on the island, as well as other road management objectives, through the ATM process. The Environmental

Assessment prepared for this process indicated that there has been an increase in the number of OHV users on Prince of Wales Island in recent years, which has led to the development of the Prince of Wales Island Off-Road Vehicle Club (USDA Forest Service 2009).

The Road Management Objectives (RMOs) for the existing roads in the Big Thorne project area include 105 miles of road open and maintained with OHV use and 44 miles of motorized trail for OHV use. Popular locations for OHV use in the Big Thorne project area include the Boyscout Multiuse Trail (about 16 miles long). The Steelhead and North Thorne road systems (approximately 12 miles and 50 miles long, respectively) are also popular for hunting and driving. All roads designated as open under the ATM process have been identified as important to local users for recreation and subsistence hunting and gathering of firewood.

Special Use Permits and Outfitter/Guide Use

A recent Recreation Visitor Capacity Analysis prepared for the Craig and Thorne Bay Ranger Districts identified 186 locations on these Districts used by outfitters and guides between 2004 and 2008. Seven of these locations are in the Big Thorne project area (Table REC-4). Between 2004 and 2008, a total of 1,553 days of use were recorded at these seven locations, with total use over this period ranging from just 3 clients at Angel Lake to 867 clients on Thorne River (USDA Forest Service 2010). Fishing was the only recorded activity at five of the seven locations, and accounted for the vast majority of the location days at the other two locations, Ratz Creek and Thorne River (Table REC-4).

Viewed in terms of the 186 locations identified on Prince of Wales and surrounding islands, Thorne River ranked second in terms of total recorded location days between 2004 and 2008, with Luck Lake and Hatchery Creek ranked ninth and tenth, respectively (USDA Forest Service 2010). An EA is currently being undertaken to determine the amount of outfitter and guide use to allow within the Craig and Thorne Bay Ranger Districts.

Table REC-4. Outfitter and Guide Locations and Use in the Big Thorne Project Area

Outfitter and Guide Location	2004-2008			
	Total Use[1/]	Fishing[1/]	Camping[1/]	Hunting[1/]
Thorne River	867	861	6	0
Luck Lake	248	248	0	0
Hatchery Creek	240	240	0	0
Trumpeter Lake	110	110	0	0
Ratz Creek	80	62	6	12
Big Lake	5	5	0	0
Angel Lake	3	3	0	0

Note:
1/ Use is reported in location days; a location day represents one client in one location, regardless of the time spent on NFS lands.
USDA Forest Service 2010

Environmental Consequences

The analysis area for direct, indirect, and cumulative effects to recreation is the Big Thorne project area. Effects are assessed in terms of changes in the ROS settings in the

project area, as well as potential impacts to Recreation Places and Sites, OHV Use, and Special Use Permits and Outfitter/Guide Use. Changes in ROS settings are quantified in acres; other potential impacts are discussed in qualitative terms.

Recreation Opportunity Spectrum

The distribution of ROS settings in the project area would change under all of the action alternatives (Table REC-5). Viewed in terms of the project area, the resulting changes would represent a small share of the affected settings under any of the alternatives. Change to existing ROS settings would occur where land allocated to the SPNM and SPM ROS settings is within 0.5 mile of a new system or temporary road. Changes would also occur to areas currently allocated to the RN ROS setting. These areas would all change to RM. In addition, harvest units in SPNM would also change to RM because the SPNM setting is not a compatible ROS class for areas with timber harvest. Change from a more primitive ROS represents a change in recreation resources in the affected areas. People are likely to have a different type of experience in these sites following timber harvest. More visitors may be able to access these locations due to harvest-related developments. More use is likely to lead to more encounters, which is consistent with a more developed ROS.

Table REC-5. ROS Settings by Alternative

ROS Setting	Alternative (acres)				
	1	2	3	4	5
Primitive (P)	10,509	10,509	10,509	10,509	10,509
Semi-Primitive Non-Motorized (SPNM)	69,231	67,224	66,374	68,201	68,310
Semi-Primitive Motorized (SPM)	10,826	10,408	9,031	10,631	10,653
Roaded Natural (RN)	976	371	180	803	968
Roaded Modified (RM)	125,501	128,531	130,949	126,900	126,603
Rural (R)	503	503	503	503	503
Urban (U)	133	133	133	133	133
Grand Total	**217,679**	**217,679**	**217,679**	**217,679**	**217,679**
Net Change in Acres					
SPNM to RM	0	2,007	1,795	195	921
SPM to RM	0	418	2,857	1,030	173
RN to RM	0	605	796	173	8

Recreation Places and Sites

The action alternatives could potentially result in short- and long-term impacts to recreation places and sites. Short-term impacts would result from the presence of crews and equipment on roads in the project area, which may have temporary impacts on recreation access, as well as the quality of the recreation experience for affected users. Impacts would also occur in the areas directly affected by new road construction, reconstruction of existing roads, and timber harvest activities. The presence of road building and logging crews and the noise associated with their activities are likely to affect the quality of the recreation experience in adjacent and nearby areas. These types of impacts would generally be limited to the immediate area of activity and limited in duration. Recreation users engaged in dispersed recreation activities, like hunting, fishing,

and OHV use, would likely be temporarily displaced to other similar locations in the general vicinity.

Long-term impacts could result from changes in access, particularly where new system roads would remain open for a period of years following harvest to allow for wood gathering and other uses. Long-term impacts would also result from changes in scenery as a result of harvest activities. These impacts are more likely to occur in old-growth harvest units because commercial thinning of young growth units is not expected to have long-term impacts to scenery. Impacts to scenery are addressed in the Scenery section of this document.

Developed Recreation Sites

Thirteen developed recreation sites are located within the Big Thorne project area (Table REC-2; Figure REC-2). With the exceptions of the Honker Divide Canoe Route and Honker Lake Cabin, these sites are all accessed from the existing road system. Most of these sites would experience short-term impacts from the presence of road building and logging crews and equipment on nearby roads, as well as from log trucks. In addition, harvest units are proposed in relative proximity to several of these sites under one or more of the action alternatives. These sites are discussed below.

Gravelly Creek Picnic Area

Timber harvest is proposed across State Highway 929 from the Gravelly Creek Picnic Area. Although located on a slope facing the road, the proposed harvest unit is unlikely to be visible from the picnic area because of the vegetation screening on both sides of the highway. Noise and other activity associated with harvest in this area, which includes temporary road construction, would be apparent to people using the picnic area. These impacts would occur under all of the action alternatives and would be temporary.

Sandy Beach Picnic Area

Timber harvest is proposed across Sandy Beach Road (Forest Road 30) from the Sandy Beach Picnic Area. The proposed harvest units are not expected to be visible from the picnic area, mainly due to vegetation screening and local topographic relief. Further, recreation activities at this picnic area are oriented toward the beach and Clarence Strait, away from the proposed harvest units. However, noise and other activity associated with harvest near this area, which includes temporary road construction, would likely be apparent to people using this picnic area. Log trucks using Sandy Beach Road would also be apparent to people using this area.

Harvest would occur in these units under Alternatives 2 and 3 using ground based logging systems. Under Alternative 4, the proposed harvest units would become part of a new Old Growth Reserve. The units would be helicopter logged under Alternative 5.

Honker Divide Canoe Route

Timber harvest, road reconstruction, and new road construction is proposed off the 3015 road, north of State Highway 925 under Alternatives 2 through 4. Harvest would occur in this area under Alternative 5, but would only involve limited road construction, as the units closest to the Canoe Route would be helicopter logged. These harvest units are located outside the Thorne River IRA. Activity in these areas is unlikely to be visible

from the Canoe Route and there are no associated scenery concerns. Noise generated by logging and road construction/reconstruction could be audible to recreationists traveling the Canoe Route and would likely affect the quality of their remote recreation experience. Helicopter logging under Alternative 5 would be apparent to recreationists traveling the Canoe Route and would affect the quality of their recreation experience. These impacts would be temporary.

Additional harvest near the Canoe Route is proposed under Alternative 3. Under this alternative, harvest would occur along Honker Road, northeast of Thorne Lake. Limited road construction would be required in this area, and a small part of the overall harvest area would be logged by helicopter. Four of the proposed units, located between 0.75 and 1 mile from the river corridor, could be partially visible from some portions of the lakes along the Honker Divide Canoe Route. Harvest in these areas is not expected to affect the quality of the recreation experience along the canoe route. Noise and other activity associated with harvest in this area would, however, be apparent to people traveling this part of the Canoe Route and would affect the quality of their remote recreation experience. These impacts would be temporary.

Eagles Nest Campground and Balls Lake Picnic Area and Trail

No harvest units are proposed in the immediate vicinity of these recreation sites under any of the action alternatives. Units are proposed across the Craig Thorne Bay Highway from these sites and sounds of timber harvest activities would be heard by campers and day use site visitors.

Fishing Access Falls Creek

This site, located near the Gravelly Creek Picnic Area, would experience similar impacts to the picnic area. These impacts would occur under all of the action alternatives and would be temporary.

Luck Lake Day Use Area

Old-growth timber harvest is proposed near this day use area under Alternatives 2, 3, and 5. Alternatives 3 through 5 include young-growth units that follow Forest Road 3030 and extend along the entire length of the west side of the lake. In addition, Alternative 3 includes harvest units in the OGR located immediately north of the lake. Noise and other activity associated with harvest in this area would be apparent to people using the day use area and recreating on the lake. Harvest in the old growth units near the lake would also have long-term impacts to the scenery in this area as viewed from the day use area and lake. Commercial thinning of young growth units is not expected to have long-term impacts to scenery.

Big Lake Fish Pass Trail

Timber harvest is proposed in the vicinity of this trail under all of the action alternatives. Alternatives 3 through 5 include young-growth units located either side of the road that provides access to the trail. Harvest in these areas would likely require temporary closure of this road to allow safe access for logging equipment and crews and would block access to the trail. These impacts would be temporary. Impacts to scenery are discussed in the Scenery section of this document.

Boyscout Multiuse Trail

Parts of the old road systems (3017-3018 Roads) that comprise the Boyscout Multiuse Trail would be used to access proposed harvest units under all of the action alternatives. This is especially the case under Alternatives 3 through 5, which include young-growth units along Forest Road 3018. Harvest in these areas would likely require temporary closure of these roads to allow safe access for logging equipment and crews and would block access to the trail. Logging activity in nearby areas would also be apparent to users of the Boyscout Multiuse Trail. These impacts would be temporary. A number of roads that branch off Forest Road 3018 would require reconstruction, but Forest Road 3018 itself would not need any reconstruction work.

Logging could also result in some long-term impacts to scenery in old-growth units near the trail, which could affect the quality of the OHV recreation experience. Commercial thinning in young-growth areas along the road system is not expected to have long-term impacts to scenery.

Control Lake Cabin

No harvest units are proposed in the immediate vicinity of this recreation site under any of the action alternatives. The closest proposed harvest unit is located the other side of the lake and across Control Lake-Klawock highway. Some timber harvest planned for units across the state highway would be partially visible in the background or middleground (see Scenery Section) and audible from across Control Lake.

Other Developed Recreation Sites

No harvest units are proposed in the vicinity of the other developed recreation sites in the Big Thorne project area—Cutthroat Road/Trail, Hatchery Creek Trail, and Honker Lake Cabin—under any of the alternatives. These sites are, therefore, not expected to be affected under any of the alternatives.

Undeveloped Recreation Sites

With the exception of the undeveloped recreation sites along the Honker Divide Canoe Route, the majority of the undeveloped recreation sites discussed in the Affected Environment section are accessed from the existing road system (Figure REC-2). Most of these sites would experience short-term impacts from the presence of road building and logging crews and equipment on nearby roads, as well as from log trucks. Long-term impacts to these sites would primarily result from changes to scenery, which could potentially affect the quality of the recreation experience, especially in more remote areas where harvest has not occurred in the recent past. Impacts to scenery are evaluated in the Scenery section of this document. Impacts to undeveloped sites along the Honker Divide Canoe Route would be similar to those discussed for the Canoe Route as a whole, above.

Implementation of the applicable Forest Plan standards and guidelines and BMPs would mitigate potential impacts to fisheries. As a result, none of the alternatives are expected to have measurable effects on fish habitat and are, therefore, unlikely to affect sport fishing or businesses that focus on sport fishing.

Off-Highway Vehicle Use

Potential impacts to road systems that receive recreational OHV use in the project area are likely to be similar to those described above for the Boyscout Multiuse Trail. The action alternatives would likely require temporary closure of parts of the road/trail system to allow safe access for logging equipment and crews. Logging activity in nearby areas would be apparent to users of this road/trail system. Long-term visual impacts could result from harvest in nearby old-growth units, but much of the area adjacent to these roads has been harvested in the past. Commercial thinning in young-growth areas along the road system under Alternatives 3 through 5 is not expected to have long-term impacts to scenery.

Most of the new roads proposed under the action alternatives would be temporary and would be decommissioned after timber harvest and hauling is completed. Some of the new roads would be system roads and would remain seasonally open (May 1 to November 30) for 1 to 5 years to allow for firewood removal. These new roads would be seasonally open to highway legal vehicles only and would not provide additional OHV opportunities. However, full implementation of the proposed Road Management Objectives (RMOs) for the proposed roads would result in a small increase in the miles of motorized trail suitable for OHV use in the project area under all four action alternatives. There would be no changes to the ATM for existing NFS roads.

Special Use Permits and Outfitter/Guide Use

Seven locations in the Big Thorne project area are currently authorized for outfitter/guide use under special use permits. These locations are identified in Table REC-4. Fishing was the primary outfitter/guide activity at all seven locations. Increased traffic and temporary road closures could have an impact on the locations that outfitter/guides choose for access. These impacts would be localized and temporary. None of the proposed alternatives are expected to result in long-term impacts to the ability of outfitter/guides to use these areas.

Alternative 1 – No Action

Direct and Indirect Effects

Alternative 1 would have no direct or indirect effects on recreation because there would be no timber harvest or road construction/reconstruction under this alternative.

Cumulative Effects

Alternative 1 would have no cumulative effects on recreation because there would be no timber harvest or road construction/reconstruction under this alternative.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Under Alternative 2, a total of 2,007 acres would change from the SPNM ROS setting to RM (Table REC-5). This represents approximately 3 percent of the 69,231 acres currently allocated to SPNM in the project area. In addition, an estimated 418 acres would change from the SPM ROS setting to RM and 605 acres would change from the RN ROS setting

to RM; these changes represent approximately 4 percent and 62 percent of the total acres in the project area currently allocated to these ROS settings, respectively (Table REC-5).

This alternative would result in short-term impacts to recreation places and sites, as described in the Recreation Places and Sites section, above. This alternative does not include young-growth thinning and would harvest fewer total acres than the other action alternatives (Alternatives 3 through 5). It would harvest fewer old-growth acres than Alternative 3, more than Alternative 4, and nearly the same amount as Alternative 5. Long-term impacts to recreation places and sites would primarily be related to changes in scenery.

Alternative 2 would have short-term impacts on OHV users, as described in the Off-Highway Vehicle Use section, above. There would be no increase in the miles of roads/trails available for OHV use in the short-term under this alternative. Full implementation of the proposed RMOs for proposed roads would result in a small increase (3 miles) in the miles of motorized trail suitable for OHV use.

This alternative would have short-term impacts on outfitter/guide use, but is not expected to have long-term impacts on the ability of outfitter/guides to use currently permitted locations.

Recreation use patterns in the project area are not expected to change greatly as a result of this alternative because the popular recreation sites in the project area would not experience long-term effects and access to fishing and hunting activities is likely to remain relatively consistent. Potential impacts to wildlife populations and the availability of hunting and fishing species are summarized above and addressed in more detail in the Issue 2: Wildlife and Subsistence Use and Fisheries sections of this document.

Cumulative Effects

The existing road systems and harvested areas have heavily influenced the character and value of recreation use in the Big Thorne project area. Past land management activities in the area have involved moderate to intensive timber management and road development. The influence of these activities on recreation opportunities in the area is reflected in the current ROS settings shown in Figure REC-1. Remote recreation opportunities are primarily available in the IRAs, which comprise about 40 percent of the project area. The roaded parts of the project area are mainly allocated to the RM setting. Harvest and road building activities proposed under this alternative are located outside the existing IRAs and, as noted above, would result in a reduction in SPNM, SPM, and RN acres in the project area (Table REC-5).

The reasonably foreseeable projects identified in the project area would also be largely concentrated outside the IRAs in the project area. As a result, this alternative is not expected to contribute to long-term changes to overall patterns of recreation use in the project area. Existing opportunities would continue to be available for those seeking remote and primitive recreation experiences and those seeking access to fishing and hunting opportunities would continue to have those opportunities.

Short-term cumulative impacts could occur if one or more of the reasonably foreseeable projects were to coincide in time and space with the project. This could result in additional temporary disruptions to recreation use and could affect the quality of the

recreation experience in localized areas. These types of impacts would be limited to the duration of road building and harvest activities in a particular location.

Alternative 3

Direct and Indirect Effects

Under Alternative 3, a total of 1,795 acres would change from the SPNM ROS setting to RM (Table REC-5). This represents approximately 3 percent of the 69,231 acres currently allocated to SPNM in the project area. In addition, an estimated 2,857 acres would change from the SPM ROS setting to RM and 796 acres would change from the RN ROS setting to RM; these changes represent approximately 26 percent and 82 percent of the total acres in the project area currently allocated to these ROS settings, respectively (Table REC-5).

This alternative would result in short-term impacts to recreation places and sites, as described in the Recreation Places and Sites section, above. Alternative 3 would harvest more total acres (old growth and young growth) than the other action alternatives (Alternatives 2, 4, and 5), ranging from 1.3 times (Alternative 5) to 1.9 times as many (Alternative 2). This alternative would also require more road construction and reconstruction.

Assuming that short-term impacts to recreation sites and places would increase with the amount of logging and road building, impacts resulting from temporary closures to road and trail systems to allow safe access for logging equipment and crews would likely be higher under this alternative than under the other action alternatives. This would also be the case with other impacts related to the presence of road building and logging activities.

Logging activities may also be more apparent to recreation users under this alternative than under Alternative 2 because this alternative involves commercial thinning of young-growth units, which tend to be located closer to existing road systems than old-growth stands. Commercial thinning in young-growth areas is expected to have short-term impacts on recreation. In addition, the commercial thinning prescribed under this alternative may increase the deer forage in the area and provide more opportunities for hunting. Impacts to deer are discussed in the Issue 2: Wildlife and Subsistence Use section of this document. This alternative includes a larger area of commercial thinning than Alternatives 4 and 5, the other alternatives that have a commercial thinning component.

Alternative 3 has the potential to affect recreation users traveling the Honker Divide Canoe Route because it includes harvest units and road building along Honker Road, northeast of Thorne Lake. These potential impacts are discussed further in the Recreation Places and Sites section, above.

Alternative 3 would have short-term impacts on OHV users, as described in the Off-Highway Vehicle Use section, above. Logging activities may be more apparent to OHV users under this alternative than under Alternative 2 because it involves commercial thinning of young growth along existing road systems that are used by OHVs. Short-term road closures would also be required on some popular OHV trail systems. There would be no increase in the miles of roads/trails available for OHV use in the short term under

this alternative and full implementation of the proposed RMOs for proposed roads would result in a small increase (4 miles) in the miles of motorized trail suitable for OHV use.

This alternative would have short-term impacts on outfitter/guide use, but is not expected to have long-term impacts on the ability of outfitter/guides to use currently permitted locations.

Recreation use patterns in the project area are not expected to change greatly as a result of this alternative because the popular recreation sites in the project area would not experience long-term effects and access to fishing and hunting activities is likely to remain relatively consistent. Potential impacts to wildlife populations and the availability of hunting and fishing species are addressed in the Issue 2: Wildlife and Subsistence Use and Fisheries sections of this document.

Cumulative Effects

Harvest and road building activities proposed under this alternative are located outside the existing IRAs and, as noted above, would result in a reduction in SPNM, SPM, and RN acres in the project area (Table REC-5).

In conjunction with other reasonably foreseeable projects, this alternative is not expected to contribute to long-term changes to overall patterns of recreation use in the project area. Existing opportunities would continue to be available for those seeking remote and primitive recreation experiences and those seeking access to fishing and hunting opportunities would continue to have those opportunities.

Short-term cumulative impacts could occur if one of more of the reasonably foreseeable projects were to coincide in time and space with the project. This could result in additional temporary disruptions to recreation use and could affect the quality of the recreation experience in localized areas. These types of short-term cumulative impacts would likely be larger under Alternative 3 because more acres would be harvested and more miles of road would be constructed and reconstructed under this alternative.

Alternative 4

Direct and Indirect Effects

Under Alternative 4, a total of 195 acres would change from the SPNM ROS setting to RM (Table REC-5). This represents approximately 0.3 percent of the 69,231 acres currently allocated to SPNM in the project area. In addition, ,an estimated 1,030 acres would change from the SPM ROS setting to RM and 173 acres would change from the RN ROS setting to RM; these changes represent approximately 10 percent and 18 percent of the total acres in the project area currently allocated to these ROS settings, respectively (Table REC-5).

This alternative would result in short-term impacts to recreation places and sites, as described in the Recreation Places and Sites section, above. Alternative 4 would involve the lowest amount of old-growth harvest among the action alternatives, and would thin fewer acres of young growth than Alternatives 3 and 5. Long-term impacts to recreation places and sites would primarily be related to changes in scenery. These impacts are discussed in the Scenery Resource Report (Evans 2012).

Logging activities may also be more apparent to recreation users under this alternative than under Alternative 2 because this alternative involves commercial thinning of young-growth units, which tend to be located closer to existing road systems than old-growth stands. Commercial thinning in young growth areas is expected to have short-term impacts on recreation. In addition, the commercial thinning prescribed under this alternative may increase the deer forage in the area and provide more opportunities for hunting. Impacts to deer are discussed in the Issue 2: Wildlife and Subsistence Use section of this document. This alternative involves fewer commercial thinning acres than Alternative 3 and more than Alternative 5.

Alternative 4 would have short-term impacts on OHV users, as described in the Off-Highway Vehicle Use section, above. Logging activities may be more apparent to OHV users under this alternative than under Alternative 2 because it involves commercial thinning of young growth along existing road systems that are used by OHVs. These impacts would be short term. There would be no increase in the miles of roads/trails available for OHV use in the short term under this alternative and full implementation of the proposed RMOs for proposed roads would result in a relatively small increase (2 miles) in the miles of motorized trail suitable for OHV use.

This alternative would have short-term impacts on outfitter/guide use, but is not expected to have long-term impacts on the ability of outfitter/guides to use currently permitted locations.

Recreation use patterns in the project area are not expected to change greatly as a result of this alternative because the popular recreation sites in the project area would not experience long-term effects and access to fishing and hunting activities is likely to remain relatively consistent. Potential impacts to wildlife populations and the availability of hunting and fishing species are addressed in the Issue 2: Wildlife and Subsistence Use and Fisheries sections of this document.

Cumulative Effects

Harvest and road building activities proposed under this alternative are located outside the existing IRA and, as noted above, would result in a reduction in SPNM, SPM, and RN acres in the project area (Table REC-5). Viewed in conjunction with other reasonably foreseeable projects, this alternative is not expected to contribute to long-term changes to overall patterns of recreation use in the project area. Existing opportunities would continue to be available for those seeking remote and primitive recreation experiences and those seeking access to fishing and hunting opportunities would continue to have those opportunities.

Short-term cumulative impacts could occur were one of more of the reasonably foreseeable projects to coincide in time and space with the project. This could result in additional temporary disruptions to recreation use and could affect the quality of the recreation experience in localized areas. These types of impacts would be limited to the duration of road building and harvest activities in a particular location.

Alternative 5

Direct and Indirect Effects

Under Alternative 5, a total of 921 acres would change from the SPNM ROS setting to RM (Table REC-5). This represents approximately 1 percent of the 69,231 acres currently allocated to SPNM in the project area. In addition, an estimated 173 acres would change from the SPM ROS setting to RM and 8 acres would change from the RN ROS setting to RM; these changes represent approximately 2 percent and 10 percent of the total acres in the project area currently allocated to these ROS settings, respectively (Table REC-5).

This alternative would result in short-term impacts to recreation places and sites, as described in the Recreation Places and Sites section, above. This alternative would involve the second largest number of total acres harvested, ranking second to Alternative 3 in terms of old-growth and young-growth acres. This alternative would require fewer miles of new road construction and road reconstruction than the other action alternatives because a larger portion of the units would be helicopter logged. Long-term impacts to recreation places and sites would primarily be related to changes in scenery. These impacts are discussed in the Scenery Resource Report (Evans 2012).

Logging activities may also be more apparent to recreation users under this alternative than under Alternative 2 because this alternative involves commercial thinning of young-growth units, which tend to be located closer to existing road systems than old-growth stands. Commercial thinning in young-growth areas is expected to have mostly short-term impacts on recreation and is not expected to have long-term impacts on scenery. In addition, the commercial thinning prescribed under this alternative may increase the deer forage in the area and provide more opportunities for hunting. Impacts to deer are discussed in the Issue 2: Wildlife and Subsistence Use section of this document. This alternative involves fewer commercial thinning acres than the other action alternatives (Alternatives 3 and 4) that include commercial thinning.

Alternative 5 would have short-term impacts on OHV users, as described in the Off-Highway Vehicle Use section, above. Logging activities may be more apparent to OHV users under this alternative than under Alternative 2 because it involves commercial thinning of young growth along existing road systems that are used by OHVs. These impacts would be short term. There would be no increase in the miles of roads/trails available for OHV use in the short term under this alternative and full implementation of the proposed RMOs for proposed roads would result in a relatively small increase (1 mile) in the miles of motorized trail suitable for OHV use.

This alternative would have short-term impacts on outfitter/guide use, but is not expected to have long-term impacts on the ability of outfitter/guides to use currently permitted locations.

Recreation use patterns in the project area are not expected to change greatly as a result of this alternative because the popular recreation sites in the project area would not experience long-term effects and access to fishing and hunting activities is likely to remain relatively consistent. Potential impacts to wildlife populations and the availability of hunting and fishing species are addressed in the Issue 2: Wildlife and Subsistence Use and Fisheries sections of this document.

Cumulative Effects

Harvest and road building activities proposed under this alternative are located outside the existing IRA and, as noted above, would result in a reduction in SPNM, SPM, and RN acres in the project area (Table REC-5). Viewed in conjunction with other reasonably foreseeable projects, this alternative is not expected to contribute to long-term changes to overall patterns of recreation use in the project area. Existing opportunities would continue to be available for those seeking remote and primitive recreation experiences and those seeking access to fishing and hunting opportunities would continue to have those opportunities.

Short-term cumulative impacts could occur were one or more of the reasonably foreseeable projects to coincide in time and space with the project. This could result in additional temporary disruptions to recreation use and could affect the quality of the recreation experience in localized areas. These types of impacts would be limited to the duration of road building and harvest activities in a particular location.

Scenery

Introduction

This section provides an assessment of the current condition of the project area and the potential effects of implementing the proposed action and the alternatives on scenery resources. Scenery resource direction for the project area is contained in the 2008 Forest Plan and described in the Scenery Forest-wide Standards and Guidelines (Chapter 4) for each specific management prescription or LUD (Chapter 3). The process of planning harvest units and how scenery resources were taken into account is documented in the Scenery Resource Report in the project record, as well as in the unit and road cards of Appendices B and C.

Methodology

The scenic resource objectives are based on the visibility of landscapes from identified Visual Priority Routes and Use Areas (VPRs) listed in Appendix F of the Forest Plan, incorporating management objectives of the Forest Plan land use designations. The scenic resource evaluation of the project area initially reviewed the GIS mapping data of inventoried visual resource attributes for content and accuracy. The adopted scenic integrity objectives (SIOs) for the project were formulated in GIS incorporating the Forest Plan land use designations and the distance zone visual resource attribute.

The analysis area for the scenery analysis is represented by the project area, because it contains the viewsheds used in the assessment.

Field reconnaissance surveys were conducted in 2011 by visiting VPRs and observing potential harvest areas. Project area landscapes were documented from key viewing points along VPRs using a digital single-lens reflex camera. Individual photographs were combined to create panoramic views of the proposed unit locations and the surrounding landscape. These photographs were used to evaluate the area visible from VPRs, existing scenery integrity, and the conditions needed to achieve the SIOs identified in the Forest Plan (Table SCEN-1).

Table SCEN-1. Scenic Integrity Objectives (SIOs) for the primary LUDs in the project area as identified in the Forest Plan .

LUD	Foreground	Middleground	Background	Seldom Seen
Old-growth Habitat	High	High	High	High
Scenic River	High	Moderate	Moderate	Low
Recreational River	Moderate	Low/Moderate	Low/Moderate	Very Low
Scenic Viewshed	High	Moderate	Moderate	Very Low
Modified Landscape	Moderate	Low	Low	Very Low
Timber Production	Low	Very Low	Very Low	Very Low

Affected Environment

Landscape Character

Tongass National Forest is divided into 11 geographic areas defined as "landscape character types" that have general or distinguishing physical, biological, and cultural characteristics which, help define the visual significance of a landscape (USDA Forest Service 2005). Most of Prince of Wales Island and all of the project area falls into what is defined as the Prince of Wales Mountains/Lowlands landscape character type. This landscape character type consists of rounded, but often rugged mountains to 3,000 feet and higher, separated by hilly or rolling terrain and lowlands and dominated by forest vegetation. Hemlock and hemlock-spruce forests occur on well-drained sites, while mixed conifers and lodgepole pine forests occupy wetter areas. The forests are often moderately to highly productive on the steeper slopes and valley bottoms and nonproductive or low productive in the wetter lowlands. Open shrubby bogs and fens occur on the wettest spots and open alpine areas occur on mountain tops. Past timber harvest has produced many stands in various successional stages. Thorne Bay, Coffman Cove, Naukati, Klawock, and other settlements occur within or adjacent to the area, and roads, buildings, and other structures are very visible in or near these communities.

Scenic Attractiveness

Scenic attractiveness is the primary indicator of the intrinsic beauty of a particular landscape character type and of the positive responses it evokes in people. It helps determine landscapes that are important for scenic beauty, as well as those that are of lesser value, based on commonly held perceptions of the beauty of landform, vegetation pattern, composition, surface water characteristics, and land use patterns and cultural features (USDA Forest Service 2005).

The scenery management system provides a process that rates the inherent scenic attractiveness based on the values listed above as either Class A – Distinctive, B – Typical or C – Indistinctive. The inventory for the project area identifies 11 percent of its landscape as Class A – Distinctive, 89 percent as Class B – Typical, and none as Class C – Indistinctive.

Visual Priority Routes and Use Areas (VPRs)

Appendix F of the Forest Plan identifies routes and use areas from which scenery is to be emphasized for each Ranger District. They include popular roads people drive, cabins or recreation areas that people use, and trails on which they hike or canoe. They also include cruise ship, ferry boat, and personal watercraft routes that are frequently travelled, or popular saltwater anchorages. VPRs specific to Thorne Bay Ranger District are identified on page F-18 in Appendix F of the Forest Plan.

There is a high concentration of VPRs in the project area (Figure SCEN-1). They include the following:

- Main roads through the project area, including Klawock to Control Lake Junction, Control Lake Junction to El Capitan, Control Lake Junction to Thorne Bay, Thorne Bay to Sandy Beach, and Sandy Beach to Coffman Cove.

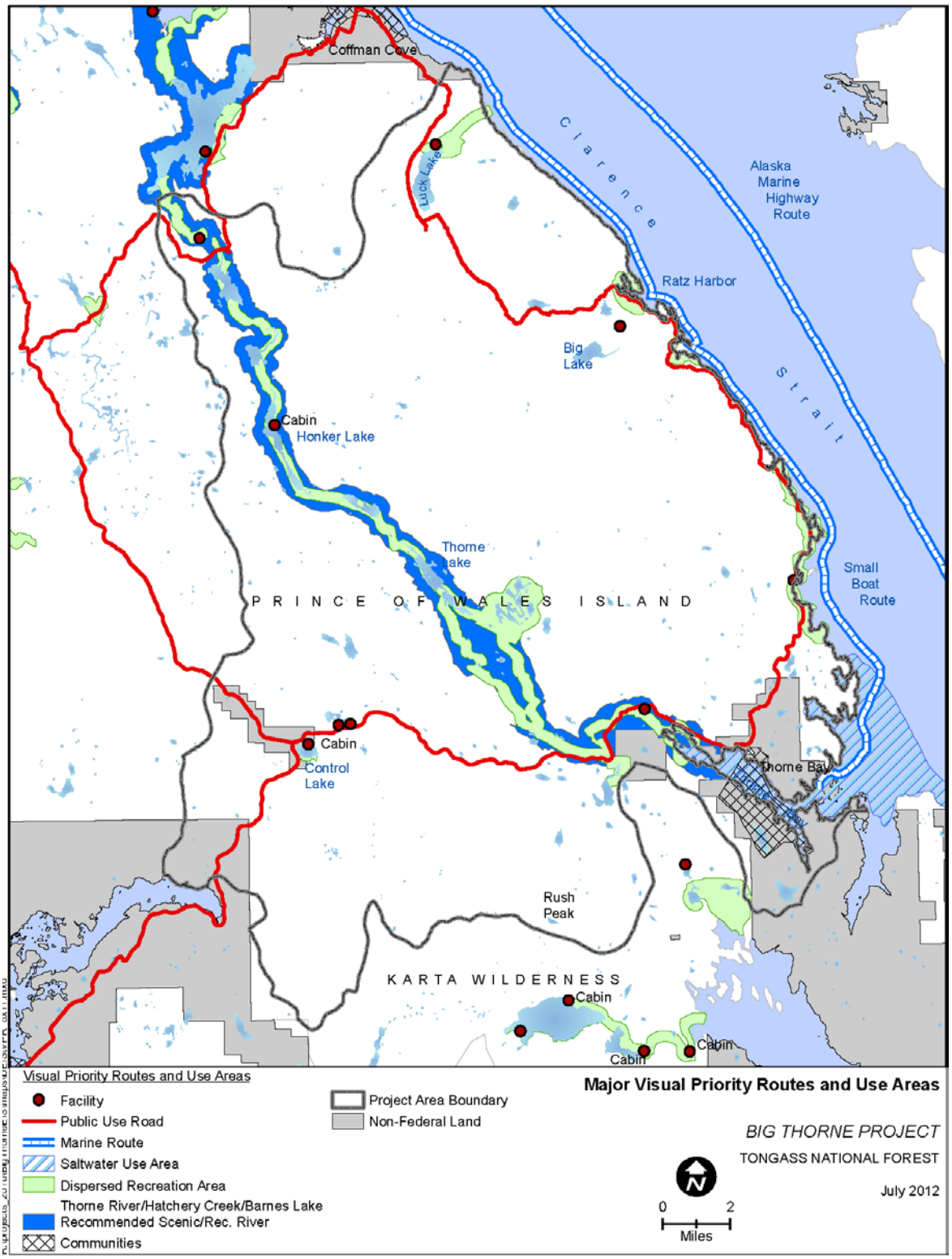

Figure SCEN-1. Major Visual Priority Routes & Use Areas in Big Thorne Project Area

- Dispersed recreation areas including Sandy Beach, Ratz Harbor, Salt Chuck, Control Lake, Snakey Lakes, Honker Lake, Honker Canoe Route, lower Thorne River, and Eagle Creek.
- Developed recreation areas including Eagles Nest Campground (Balls Lake), Balls Lake Picnic Area, Gravelly Creek Picnic Area, Sandy Beach Picnic Area, and Ratz Harbor Boat Launch.
- Forest Service recreation cabins including the ones at Control Lake and Honker Lake.
- Hiking trails including Eagles Nest Trail, Balls Lake Trail, Honker Divide Canoe Trail, and Gravelly Creek Trail.
- Communities including Thorne Bay.
- Recommended Wild and Scenic Rivers including the Thorne River/Hatchery Creek/Barnes Lake.
- Alaska Marine Highway Routes and Small Boat and Mid-size Tour Boat Routes including Clarence Strait.
- Saltwater Use Areas including Thorne Bay to Snug Anchorage.
- Boat Anchorages including Big Ratz Harbor and Little Ratz Harbor.

Visibility and Distance Zones

The SIO for a given area is dependent on the LUD, as described above, together with its visibility (i.e., seen vs. not seen areas) and distance zones (i.e., foreground, middleground, and background) from VPRs. Therefore, visibility and distance zones must be mapped and combined with LUD to determine SIO. They are mapped by measuring foreground, middleground, and background distances from the identified VPRs. The percentage of the project area mapped in the different distance zones are as follows: Foreground 9 percent, Middleground 24 percent, Background 2 percent, and Not Seen 65 percent.

Scenic Integrity Objectives (SIOs)

The Forest Service developed and implemented the Visual Management System in 1974. This long-serving system was replaced by the newer (but similar) Scenery Management System in 1995. Under this new system, SIO is the term used to describe the visual condition of the landscape.

The SIO is used to also describe the degree of acceptable alteration of the characteristic landscape, and is assigned to the combination of LUDs and distance zones, as seen from visual priority travel routes and use areas.

SIOs for the Tongass National Forest LUDs can be found on pages 4-56 to 4-59 of the Forest Plan. The acreages of SIOs found in the project area are presented in Table SCEN-2.

Table SCEN-2. Acreage of Scenic Integrity Objectives (SIOs) in the Project Area

SIO	Project Area Acres
High	83,633
Moderate	8,036
Low	33,487
Very Low	92,523
Total NFS	**217,679**
Non-National Forest	14,169
Total All Lands	**231,848**

Figure SCEN-2 spatially displays the SIOs adopted by the Forest Plan for the project area. The SIOs adopted by the Forest Plan are defined as follows:

- Very High SIO: Landscapes where the landscape character is intact with only minute, if any, deviations.
- High SIO: Landscapes where the landscape character "appears" intact. Deviations are not readily evident to the casual observer.
- Moderate SIO: Landscapes where the landscape character "appears slightly altered." Deviations are noticeable to the casual observer, but do not dominate landscape.
- Low SIO: Landscapes where the landscape character "appears moderately altered." Deviations can begin to dominate a scene, but must blend with surrounding landscape, as viewed by the casual observer.
- Very Low SIO: Landscapes where the landscape character "appears heavily altered." Deviations clearly dominate, but must blend to some degree.

Existing Scenic Integrity (ESI)

The Forest Plan (p. 4-56) states that it is important to compare the existing scenic integrity of the project area to the SIO of the land use designation. This is to determine if existing condition conflicts with Forest Plan SIOs and how much additional disturbance is allowed.

Existing scenic integrity (ESI) is defined as the current state of the landscape, considering previous human alterations (USDA Forest Service 1995, p. I-2). The latest spatial data on record that represents ESI is the existing visual conditions layer (EVC) (Table SCEN-3).

Table SCEN-3. Existing Visual Condition/Existing Scenic Integrity in the Project Area

EVC/ESI Type	Project Area Acres
Type 1 - Natural	86,330
Type 2 - Naturally Appearing	128
Type 3 - Slightly Altered	14,016
Type 4 - Altered	49,660
Type 5 - Heavily Altered	67,545
Total NFS	**217,679**
Non-National Forest	14,169
Total All Lands	**231,848**

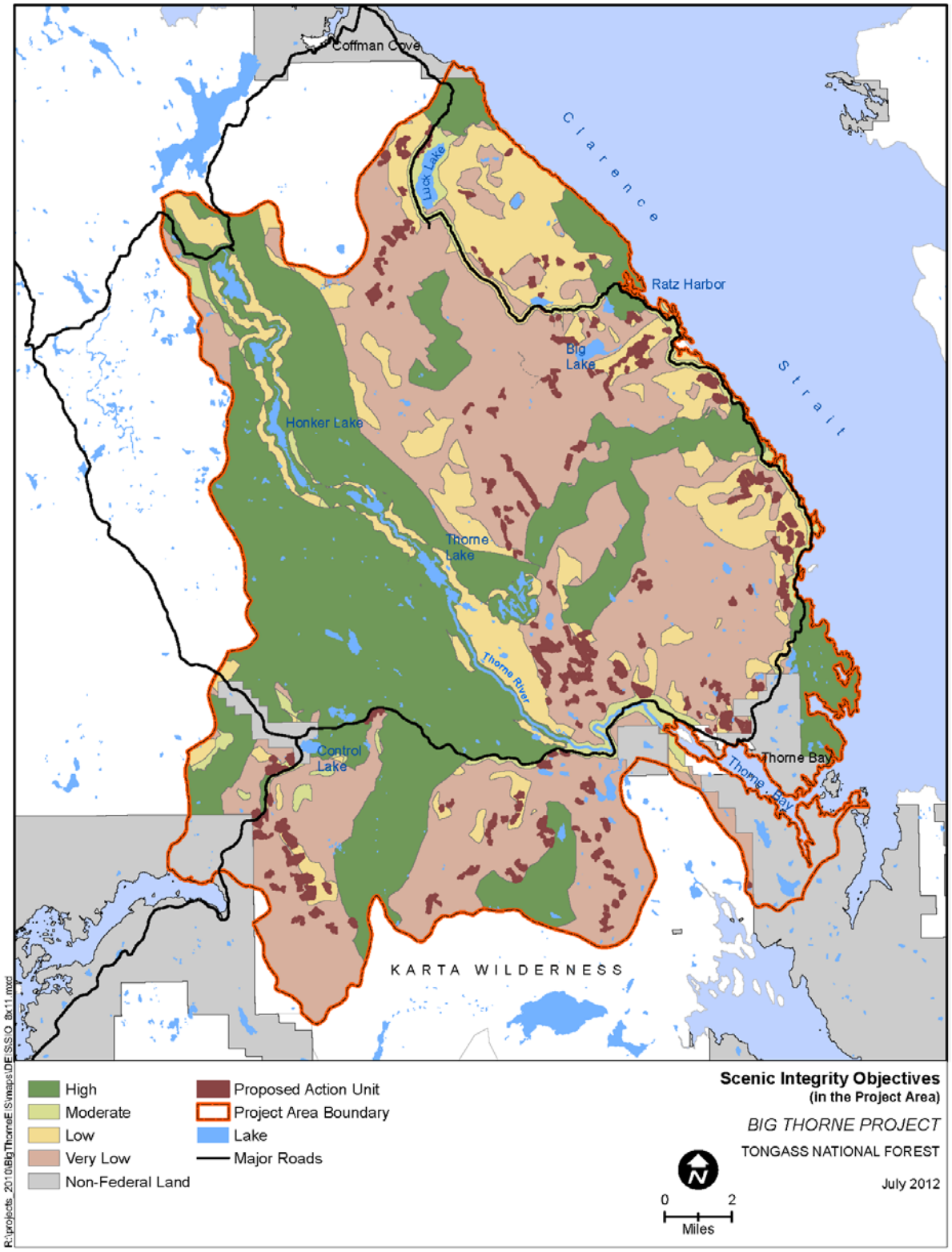

Figure SCEN-2. Scenic Integrity Objectives in the Big Thorne Project Area

Visual Absorption Capability

Visual absorption capability (VAC) is defined as an index of the relative ability of a landscape to accept alteration (e.g., timber harvesting) without significantly affecting its visual character, and is classified as being High, Intermediate, or Low. For example, High VAC means that landscape has the greatest ability to absorb change, where Low VAC means a low ability to absorb change generally due to steep slope conditions.

Timber harvest unit sizes can be influenced by the VAC settings in combination with SIOs (see Forest-wide Standards and Guidelines for Scenery), and referring to these factors in the unit layout and design portion of the planning process is recommended.

Environmental Consequences

Direct, indirect and cumulative effects for scenery in all affected viewsheds are estimated using quantifiable measures or indicators for actual effects, as supported by the references (for example, percent of visible areas are an indicator for increased visibility under each alternative). The level (magnitude and intensity) of effects is also characterized by measures/indicators which account for how measurable the effect would be, how widespread the effect is likely to be, and how long it is likely to last.

Direct and Indirect Effects

Effects Common to the Action Alternatives

The effects of the Big Thorne project would be limited through the site-specific application of Forest Plan standards and guidelines in all alternatives. In particular, the LUD-specific measures identified in Chapter 3 and the Forest-wide measures identified in the Scenery section of Chapter 4 would be implemented.

For the Big Thorne project, mitigation to reduce scenery effects was incorporated into harvest unit design and harvest unit prescriptions for all alternatives. Units with moderate or high SIOs were given priority for mitigation. Primary measures included: 1) deferring harvest of a setting or group of settings; 2) modifying unit size and/or shape; 3) changing prescription to partial harvest with 25 to 50 percent removal; 4) use of vegetative screening or buffers adjacent to VPRs; and 5) when needed, have the Forest landscape architect involved in final unit design. Where new roads are proposed or existing roads are reconstructed, the expansion of existing rock quarries would be required; final design of this expansion would be reviewed by the Forest landscape architect. , if there are scenery concerns.

In general, the effects of the alternatives on scenery would be derived from the harvest of old growth, thinning of young growth, and road construction and reconstruction. Among these actions, the harvest of old growth and new road construction would have the greatest effect. Thinning of young growth would have very minimal effects on scenery because from half to two-thirds of the original stand would remain, including the tallest trees. This definitely applies to uniform thinning, which was the preferred method. However, strip thinning is used where necessary because of logging system requirements, and it has the potential to create visual issues. The resolution is that where strips could be a visual concern, the strip width was adjusted to be 20 feet wide. A width slightly less than the expected spacing between leave trees in the other thinning prescriptions, thus their

visibility would be minimized. For these reasons, the discussions that follow emphasize the effects of old-growth harvest and road construction.

All alternatives would meet the level of scenic quality prescribed by the SIOs adopted for the affected landscapes in the Forest Plan. The overall effects from management activities within the project area would be visually evident to varying degrees dependent upon distance at which observed, type and extent of harvest, and weather conditions at the time observed. Visual disturbance would be dispersed throughout the project area with no single area impacted beyond maximum disturbance thresholds at any one time.

A general measure of the direct effects of the alternatives is the acreage of harvest units and miles of road by SIO. Because Old-growth Habitat LUDs would change under Alternatives 3 and 4, there would be changes in the SIOs that need to be achieved in specific areas (see Issue 2 scenery discussions, earlier in this chapter). The new SIO allocations under Alternatives 3 and 4 are mapped in Figures SCEN-3 and SCEN-4. These can be compared with the existing SIOs in Figure SCEN-2.

Table SCEN-4 presents these acreages and categorizes them by method of harvest. This information is referred to in the following alternative-specific discussions. In general, Alternative 3 includes the highest acreage of harvest in both High and Moderate SIO, while Alternative 4 includes the lowest acreage. Alternatives 2 and 5 would be intermediate.

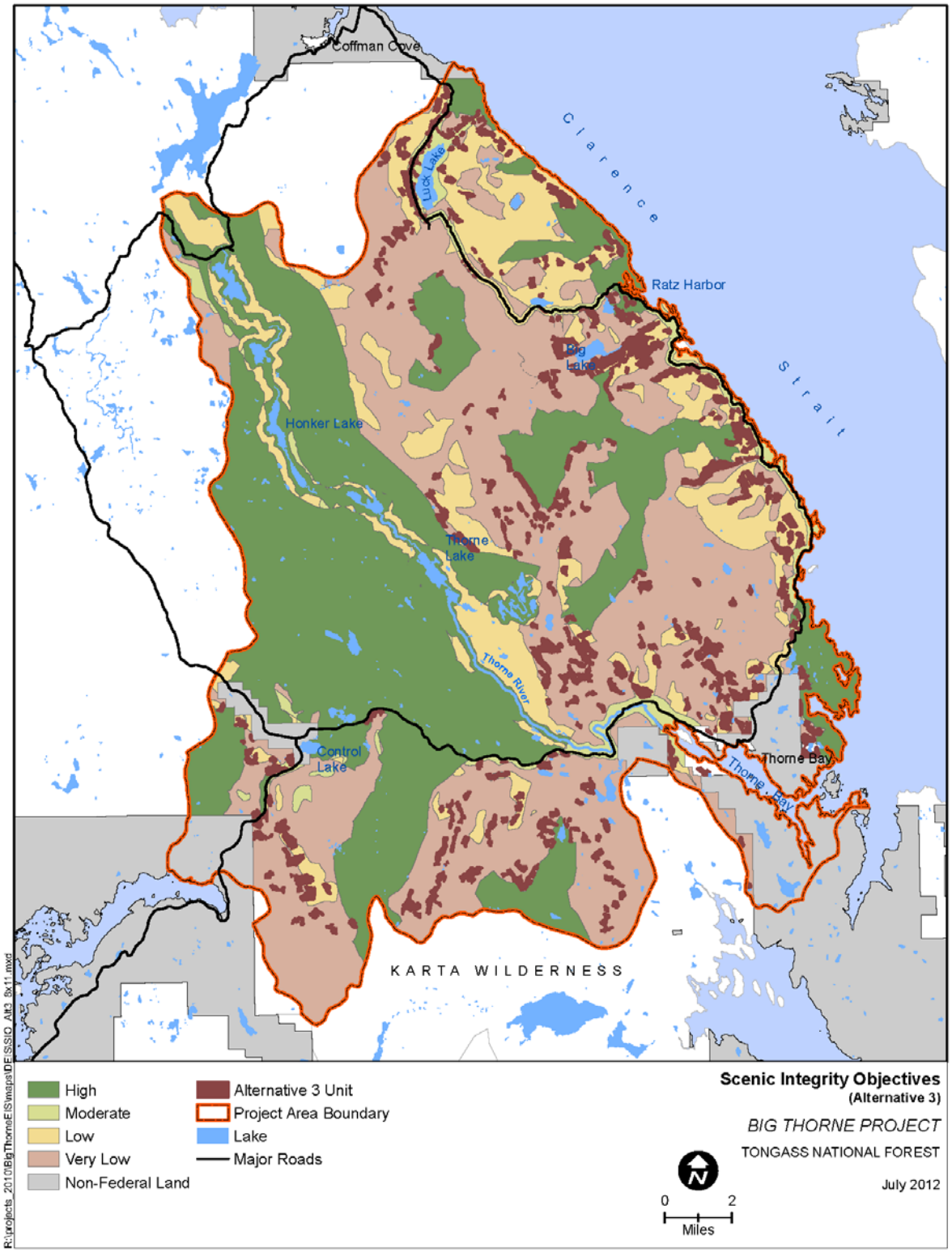

Figure SCEN-3. Scenic Integrity Objectives with Alternative 3 in the Big Thorne Project Area

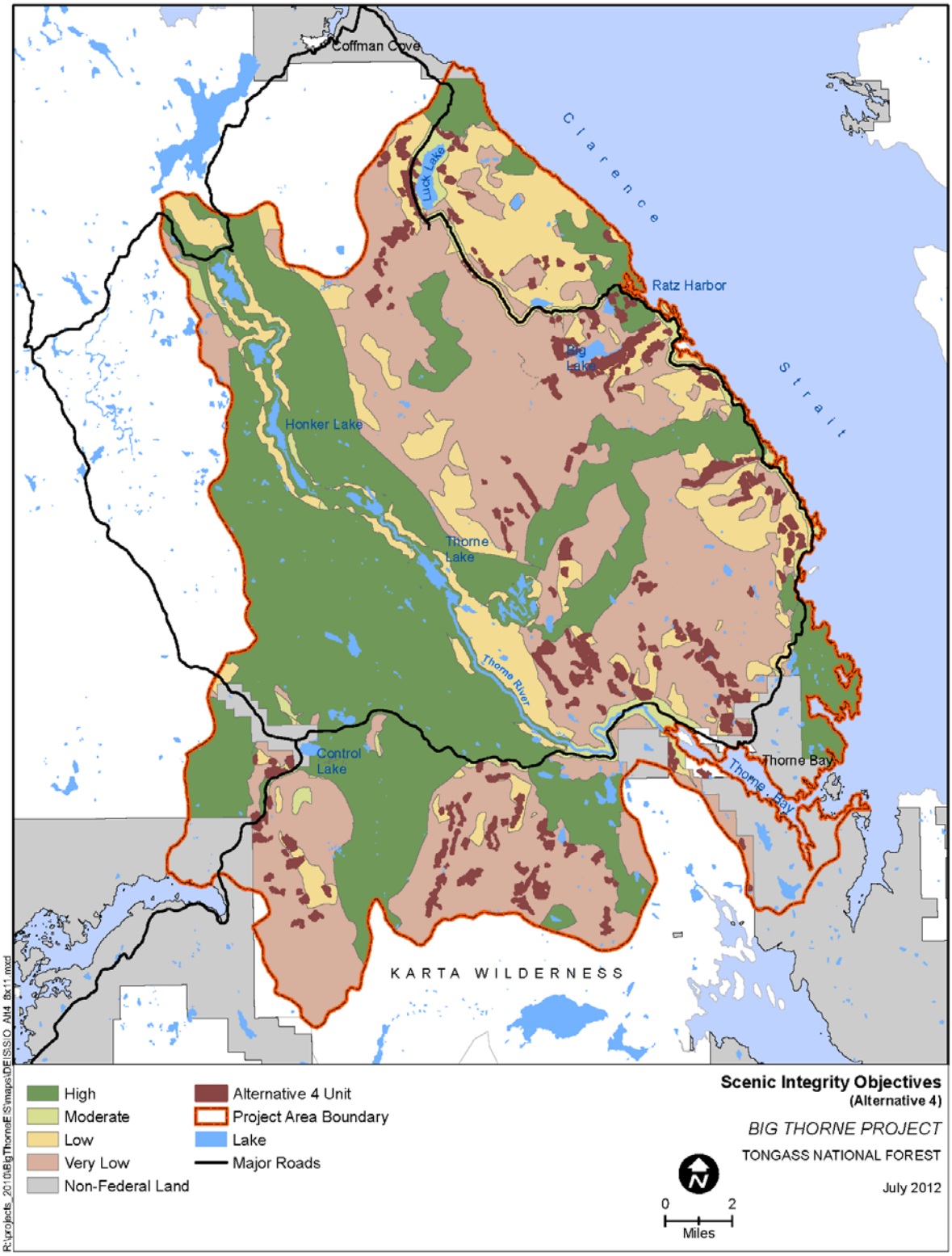

Figure SCEN-4. Scenic Integrity Objectives with Alternative 4 in the Big Thorne Project Area.

Similarly, Table SCEN-5 presents the road miles to be constructed and reconstructed by SIO for each alternative. Again in general, Alternative 3 includes the highest road construction and reconstruction mileage in High and Moderate SIOs; however, Alternative 5 would include the lowest mileages. Alternatives 2 and 4 would be intermediate.

A description of each alternative, with specific information regarding units of special visual concern, is provided in the following subsections.

Table SCEN-4. Clearcut (CC) and Partial Cut (PC) Harvest Acreage by Scenery Integrity Objective under the Action Alternatives

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
SIO	CC	PC	CC	PC	CC	PC	CC	PC	CC	PC
High	0	0	57	15	58	16	24	16	57	15
Moderate	0	0	151	52	331	84	49	52	155	50
Low	0	0	1,007	494	1,418	873	680	628	974	602
Very Low	0	0	3,016	150	3,979	150	1,145	1,627	2,756	402
TOTAL	**0**	**0**	**4,232**	**711**	**5,786**	**1,123**	**1,899**	**2,324**	**3,941**	**1,070**

Table SCEN-5. Road Construction (Con) and Reconstruction (Rec) Mileage by Scenery Integrity Objective under the Action Alternatives

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
SIO	Con	Rec	Con	Rec	Con	Rec	Con	Rec	Con	Rec
High	0	0	0.6	0.7	0.8	1.3	0.4	0.2	0.7	0.5
Moderate	0	0	1.3	0.2	4.8	0.5	2.0	0.4	1.7	0.3
Low	0	0	8.6	3.4	15.7	6.4	7.6	2.3	5.0	3.3
Very Low	0	0	24.4	14.7	33.8	30.1	9.1	18.3	8.0	11.2
Non-NFS	0	0	0.1	0.3	1.0	0.8	0.4	0.3	0.1	0.3
TOTAL	**0**	**0**	**34.9**	**19.3**	**56.1**	**39.0**	**19.5**	**21.5**	**15.5**	**15.6**

Alternative 1

Under the No-action Alternative, no timber harvest or thinning and no road construction or reconstruction would occur under the Big Thorne project. Therefore, no direct or indirect effects on scenery would occur, except for those associated with small roadside sales, thinning, and road maintenance and storage activities, which would result in insignificant changes. This alternative defers timber harvest in the project area and maintains the existing visual character of the landscape. Previously harvested units within the project area would continue to mature and develop the visual characteristics of a more natural appearing and undeveloped forest.

Alternative 2

Alternative 2 would meet the SIOs adopted by the Forest Plan. Timber harvest and road construction would occur as described in Tables SCEN-4 and SCEN-5. Clearcut harvest would occur on 58 acres of High SIO and 171 acres of Moderate SIO (Table SCEN-4). In addition, 0.6 mile of road would be constructed in High SIO and 1.3 miles would be constructed in Moderate SIO; an additional 0.9 mile of existing road would be reconstructed in High and Moderate SIO (Table SCEN-5). No commercial harvest of young growth would occur in this alternative. Specific harvest unit mitigation measures

for visually sensitive units that are designed to meet the adopted SIO are described in the following paragraphs.

Units 5950-1, 5950-2, and 5950-22, along the highway from Klawock to Control Lake Junction, are partially or entirely (595-22) within Scenic Viewshed LUD and portions of them are included in High SIO. All units were modified to include a visual buffer along the highway to partially screen views into the units from the VPR.

Unit 5950-24 is also along the highway from Klawock to Control Lake Junction and is partially within Scenic Viewshed LUD with the remainder in Modified Landscape. As a result, most of the unit is either Moderate or High SIO. The unit is set back 200 to 500 feet from the highway, but is on a slope that rises 300 or so feet above the highway and is visible from highway straight stretches. Therefore, this unit was prescribed for uneven-aged management with 50 percent basal area retention.

Unit 5960-27 is along the highway from Control Lake Junction to Thorne Bay and is entirely within the Scenic Viewshed LUD. As a result, most of the unit has an adopted SIO of High and the unit was modified to include a visual buffer along the highway, which in conjunction with a riparian buffer, would partially screen views into the unit from the VPR.

About 11 acres of Unit 59701-62 and about 27 acres of Unit 5790-119 are inside the outer edge of the Recreational River LUD and have Moderate SIOs. Neither of these units is visible from anywhere near the river and both would meet SIOs. No other units in this alternative are expected to be visible from the Scenic or Recreational River corridor and no effect on the outstandingly remarkable scenery value is expected.

Unit 5790-119 is near the highway from Control Lake Junction to Thorne Bay and is also close to the Thorne River and the Gravelly Creek Picnic Area. This unit is screened by a wide (400- to 700-foot) buffer along the highway, which is established for other resource reasons and identified as legacy.

Units 5850-138 and 5850-139 are located about ¼-mile inland from Sandy Beach. These units are clearcut, but two settings were deferred to reduce the size of the visible portion and legacy was added in many areas to partially screen the harvest. The units contain areas with Moderate, Low, and Very Low SIOs.

Units 585-140, 585-141, 585-142, and 584-143 are located about a mile north of the previous two units and are also close to the Sandy Beach to Coffman Cove Road and are generally over 1,500 feet from saltwater. These units were modified by deferring settings, changing some prescriptions to uneven-aged management, and adding substantial legacy areas between the units and the road and saltwater. The remaining harvest areas are mostly Low with some Very Low and 2 acres of Moderate SIOs. Overall, the visibility of some harvest areas would be a distraction from the natural scenic environment but confined to relatively small areas.

Units 584-153 and 584-154 are located further north along the Sandy Beach to Coffman Cove Road, south of Ratz Harbor. They are about 1,200 feet from saltwater. Unit 584-153 would be clearcut, but is 72 percent in Low and Very Low SIO with 13 acres in Moderate SIO. Unit 584-153 would be partial cut (uneven-aged management).

Units 584-149, 584-161, 584-171, and 583-174 are units on slopes along Clarence Strait that are varying distances from saltwater. These are all prescribed for uneven-aged management.

Units 581-191, 581-192, and 581-193 are along the Sandy Beach to Coffman Cove Road adjacent to Luck Lake. They are small clearcut units ranging from 9 to 20 acres in size and would be visible to some degree from the road. Unit 581-192 contains some screening along the road. All of the units are screened by riparian buffers and legacy from Luck Lake.

Units 581-194, 581-195, 581-197, and 581-200 are located on the mid- to upper-slopes to the west of Luck Lake. These units contain clearcut and partial cut (uneven-aged management) settings and include a large portion of helicopter harvest. The adopted SIO for these units consists entirely of Low and Very Low.

Alternative 3

Alternative 3 would meet the SIOs adopted by the Forest Plan. Timber harvest and road construction would occur as described in Tables SCEN-4 and SCEN-5. Clearcut harvest would occur on 59 acres of High SIO and 362 acres of Moderate SIO (Table SCEN-4). In addition, 0.7 mile of road would be constructed in High SIO and 5.0 miles would be constructed in Moderate SIO; an additional 1.8 mile of existing road would be reconstructed in High and Moderate SIO (Table SCEN-5). Thinning of young growth would occur in this alternative. Specific harvest unit mitigation measures for visually sensitive units that are designed to meet the adopted SIO are described in the following paragraphs.

Units 595-1, 595-2, 595-22, 595-24, 596-27, and 579-119, along the highways from Klawock to Control Lake Junction and from Control Lake Junction to Thorne Bay, would be treated the same as described under Alternative 2. In addition, Alternative 3 includes Units 5972-115, 5972-116, and 5972-117, which also occur along the Control Lake Junction to Thorne Bay highway. These units include portions in Moderate SIO as well as Low SIO. Screening from the highway is provided by visual buffers, in the form of legacy, that follow the highway, complementing existing riparian buffers.

Portions of Units 575-380, 575-381, 575-382, 575-383, 575-384, 575-386, 575-387, and 575-394 may be visible in the middleground at distances of a mile or more from the Honker Divide Canoe Route from a few locations on lakes near the middle of the route. They have Low and Very Low SIOs. Large portions of the more visible upper slopes were deferred to reduce their visibility and reduce opening size. Although these units could slightly reduce visual quality from a few locations along this portion of the route, for the vast majority of the canoe route and the Scenic River corridor (even in this portion of the route), they would not be visible. The slight change in distance views is not expected to affect the overall classification of the Scenic River as having outstandingly remarkable scenery values. The visibility of Units 597.1-62 and 579-119, partially in the Recreational River LUD, would be the same as described under Alternative 2.

Units 585-138, 585-139, 585-140, 585-141, 585-142, and 584-143, located near and to the north of Sandy Beach, would be treated the same as described under Alternative 2. Similarly, Units 584-153 and 584-154, located further north along the Sandy Beach to

Coffman Cove Road, south of Ratz Harbor, would also be treated the same as for Alternative 2.

Units 584-149, 584-161, 584-171, and 583-174, located on slopes along Clarence Strait at varying distances from saltwater, would be treated the same as described under Alternative 2.

Units 584-452, 584-454, 584-455, 584-456, and 584-457 are also located on slopes along Clarence Strait, generally 1,000 to 4,000 feetfeet from saltwater. They include some acreage with Moderate SIO, but they are mostly in Low SIO. The two largest units with the majority of the Moderate SIO area would be partial cut (uneven-aged management), while the smaller units would be clearcut.

Units 582-207, 582-212, 582-213, and 582-463 are located on slopes close to Clarence Strait between Ratz Harbor and Eagle Creek. All of these units are generally about 1,000 ft from saltwater, but are allocated to Low SIO. However, all of the units, except for 582-207, which is only 12 acres, would be partial cut (uneven-aged management).

Units 581-191, 581-192, and 581-193, along the Sandy Beach to Coffman Cove Road adjacent to Luck Lake, and Units 581-194, 581-195, 581-197, and 581-200, located on the mid- to upper-slopes to the west of Luck Lake, would be treated as for Alternative 2.

Units 581-464, 581-465, and 581-466 are located along Eagle Creek, between Luck Lake and Clarence Strait. These clearcut units consist primarily of Moderate and Low SIO. They are generally screened along the creek by its riparian buffer, a number of legacy patches on the steam-side of the units, and the relatively flat topography.

Units 581-469, 581-470, and 581-471 are located along the Sandy Beach to Coffman Cove Road north of Luck Lake. These clearcut units are almost entirely in Moderate and Low SIO. They are screened along the road with a visual buffer, which is incorporated into the units as legacy.

Alternative 4

Alternative 4 would meet the SIOs adopted by the Forest Plan. Timber harvest and road construction would occur as described in Tables SCEN-4 and SCEN-5. Clearcut harvest would occur on 25 acres of High SIO and 49 acres of Moderate SIO (Table SCEN-4). These acreages are by far the lowest among the action alternatives. In addition, 0.2 mile of road would be constructed in High SIO and 1.8 miles would be constructed in Moderate SIO; an additional 0.6 mile of existing road would be reconstructed in High and Moderate SIO (Table SCEN-5). Thinning of young growth would occur in this alternative. Specific harvest unit mitigation measures for visually sensitive units that are designed to meet the adopted SIO are described in the following paragraphs.

Units 595-1, 595-2, 595-22, and 579-119, along the highways from Klawock to Control Lake Junction and from Control Lake Junction to Thorne Bay, would be treated the same as described under Alternative 2. Similarly, the visibility of Units 597.1-62 and 579-119, partially in the Recreational River LUD, would be the same as described under Alternative 2.Units 585-139, 585-140, 585-142, and 584-143, located near Sandy Beach and to the north of it, would be treated the same as described under Alternative 2. Note that Units 585-138 and 585-141, which are described with this group, were dropped from

Alternative 4. Similarly, Unit 584-154, located further north along the Sandy Beach to Coffman Cove Road, south of Ratz Harbor, would also be treated the same as for Alternative 2. Again, note that Unit 584-153 is not included in Alternative 4.

Units 584-149, 584-171, and 583-174, located on slopes along Clarence Strait varying distances from saltwater, would be treated the same as described for Alternative 2. Unit 584-161, which is described in this group, is not included in Alternative 4.

Units 582-212 and 582-213, located on slopes close to Clarence Strait between Ratz Harbor and Eagle Creek, would be treated the same as described for Alternative 3. Note that Units 582-207 and 582-463, which are part of this group, are not included in Alternative 4.

Units 582-207, 582-212, 582-213, and 582-463 are located on slopes close to Clarence Strait between Ratz Harbor and Eagle Creek. All of these units are generally about 1,000 ft from saltwater, but are allocated to Low SIO. However, all of the units, except for 582-207, which is only 12 acres, would be partial cut (uneven-aged management).

Units 581-194, 581-195, 581-197, and 581-200, located on the mid- to upper-slopes to the west of Luck Lake, would be treated as described for Alternative 2.

Alternative 5

Alternative 5 would meet the SIOs adopted by the Forest Plan. Timber harvest and road construction would occur as described in Tables SCEN-4 and SCEN-4. Clearcut harvest would occur on 58 acres of High SIO and 175 acres of Moderate SIO (Table SCEN-4). In addition, 0.4 mile of road would be constructed in High SIO and 2.5 miles would be constructed in Moderate SIO; an additional 0.8 mile of existing road would be reconstructed in High and Moderate SIO (Table SCEN-5). Thinning of young growth would occur in this alternative. Specific harvest unit mitigation measures for visually sensitive units that are designed to meet the adopted SIO are described in the following paragraphs.

Units 595-1, 595-2, 595-22, 595-24, 596-27, and 579-119, along the highways from Klawock to Control Lake Junction and from Control Lake Junction to Thorne Bay, would be treated the same as described under Alternative 2. Similarly, the visibility of Units 597.1-62 and 579-119, partially in the Recreational River LUD, would be the same as described under Alternative 2. In addition, Alternative 5 includes Units 5972-115, 5972-116, and 5972-117 are along the highway from Control Lake Junction to Thorne Bay highway. These units would be treated as described under Alternative 3.

Units 585-138, 585-139, 585-142, and 584-143, located near Sandy Beach and to the north of it, would be treated the same as described under Alternative 2. Note that Units 585-140 and 585-141, which are described with this group, were dropped from Alternative 5.

Units 584-149, 584-161, 584-171, and 583-174, located on slopes along Clarence Strait varying distances from saltwater, would be treated the same as described for Alternative 2.

Units 582-212 and 582-213, located on slopes close to Clarence Strait between Ratz Harbor and Eagle Creek, would be treated the same as described for Alternative 3. Note

that Units 582-207 and 582-463, which are part of this group, are not included in Alternative 5.

Units 581-191, 581-192, and 581-193, along the Sandy Beach to Coffman Cove Road adjacent to Luck Lake, and Units 581-194, 581-195, 581-197, and 581-200, located on the mid- to upper-slopes to the west of Luck Lake, would be treated as for Alternative 2.

Cumulative Effects

Cumulative effects consider the overall scenic effects expected as a result of past, present, and reasonably foreseeable future development. These effects include timber harvest, roads, rock pits, associated construction activities, and existing effects of adjacent non-National Forest System lands. Previous development in the project area has modified the scenic environment of many areas from a natural condition to a condition where some landscapes appear heavily altered. These effects of past timber harvest would continue to lessen over time, becoming more natural appearing during the reasonably foreseeable future.

The scale or spatial extent from which to consider cumulative effects for the scenery resource can be represented as a viewshed, or for the purpose of this analysis, the VCUs, which have similar boundaries. Reasonably foreseeable activities such as thinning and road maintenance would not add additional scenic effects to the point of changing the overall scenic integrity as cumulative effects change over time (temporal extent) as young-growth stands mature. After a period of 30 years, young-growth stands are considered to have visually recovered.

Percent Allowable Visual Disturbance represents an index of cumulative effects modeled as the expected visual consequences of timber harvest during the analysis, and is described in Appendix B of the Forest Plan Final EIS, page B-23. Visual disturbance outcomes vary by the scenic objectives for each of the LUDs available for timber harvest. Using this model it was assumed for viewsheds within the Timber Production LUD that up to 50 percent of a viewshed may be under development at one time. For viewsheds within the Modified Landscape LUD, up to 25 percent may be under development at one time. This is calculated by adding the past, present, and reasonably foreseeable harvest acres and dividing by the acres of a viewshed or VCU. Table SCEN-6 represents a comparison of the expected cumulative visual disturbance by alternative. As noted above, all harvest areas 30 years old or younger were included as past disturbance. Because uneven-aged management and commercial thinning do not add to cumulative effects on a viewshed or landscape scale, only even-aged management is included.

Table SCEN-6 Cumulative Visual Disturbance in terms of Cumulative VCU Harvest (<30 yr-old young growth) and Percent of VCU Area Harvested for All Lands (includes past harvest, future Big Thorne harvest, other future NF harvest, and future State harvest)[1/]

VCU	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	Cum. Acres[3/]	Cum. %	Cum. Acres[3/]	Cum. %	Cum. Acres[3/]	Cum. %	Cum. Acres[3/]	Cum. %	Cum. Acres[3/]	Cum. %
5740	1,706	6	1,706	6	1,706	6	1,706	6	1,706	6
5750	403	2	403	2	609	3	403	2	403	2
5760	546	4	559	4	559	4	546	4	559	4
5780	1,016	16	1,558	24	1,558	24	1,030	16	1,483	23
5790	1,170	11	1,549	14	1,618	15	1,422	13	1,526	14
5800	928	6	1,268	8	1,596	10	1,110	7	1,387	9
5810	2,046	10	2,439	12	2,715	13	2,243	11	2,383	12
5820	-	0	12	0	12	0	-	0	-	0
5830	1,172	9	1,437	12	1,445	12	1,267	10	1,361	11
5840	1,206	9	1,485	11	1,540	11	1,364	10	1,500	11
5850	735	7	961	9	1,052	10	833	8	872	8
5860[2/]	2,314	14	2,617	16	2,861	18	2,546	16	2,658	16
5950[2/]	4,550	21	5,194	24	5,303	25	4,938	23	5,116	24
5960[2/]	279	2	341	3	341	3	309	2	341	3
5971	213	7	239	7	239	7	213	7	239	7
5972[2/]	2,663	12	3,413	16	3,582	16	2,916	13	3,354	15
ALL VCUs	**20,948**	**9**	**25,180**	**11**	**26,734**	**12**	**22,847**	**10**	**24,889**	**11**

1/ Includes past harvest between 1981 and 2010; excludes past harvest greater than 30 years old as visually recovered. For the action alternatives, includes all proposed old-growth even-aged management acres; does not include commercial thinning of young growth or uneven-aged management.
2/ These VCUs include past harvest on state and private lands.
3/ 1,047 acres of future non-Big Thorne harvest is included on state and NFS lands.

As shown in Table SCEN-6, all VCUs in all alternatives are below the total allowable visual disturbance thresholds of 50 percent for Timber Production areas and all are equal to or below the 25 percent for Modified Landscape areas. Only two VCUs (5780 and 5950) have values above 18 percent for any of the alternatives. VCU 5780 (North Thorne River) has a cumulative percent of 24 percent in Alternatives 2 and 3, and 23 percent in Alternative 5. VCU 5950 (Steelhead Creek) has a cumulative percent of 21 percent in Alternative 1, 23 percent in Alternative 4, 24 percent in Alternatives 2 and 5, and 25 percent in Alternative 3. The high values for VCU 5950 are partially caused by a high percentage of harvest on private lands in the western portion of the VCU, which is not connected to most of the viewsheds in the VCU.

The visual effects of timber harvest are greatest immediately following completion of the project. Within 5 years, vegetation would begin to grow, transitioning in color from brown to light green. Green tree retention in the harvested areas (especially in uneven-aged management areas, but also due to legacy, visual buffers, riparian buffers, and other leave areas) would reduce the overall contrast of new growth with the surrounding forest. From 5 to 20 years after tree removal, young trees become established reaching a height of approximately 15 to 30 feet and further reducing the color contrast with adjacent forested areas. After 50 years, the emerging forest would achieve a height of approximately 50 to 100 feet. Although still a lighter green in color than mature or old-growth forest, the color contrast at this point is less and textural differences are more apparent because the young-growth stands appears much more uniform. Edge lines forming the boundary of harvested areas also become less apparent, with the appearance further reduced by asymmetrical design. At 80 years after a harvest, stand vegetation achieves 75 percent of its mature height. At 100 years, the stand would reach approximately 100 feet in height and appearance of the past harvest would not be evident.

Assuming implementation of the Forest Plan, harvest of all suitable timber lands within the Big Thorne project area would occur within the next 100 to 120 years. During this period, the project area would be transitioning towards meeting the desired condition for the development LUDs. The landscape would be characterized by a mixture of stands ranging in stages of development. Age-classes of these stands would include recently harvested or regenerating stands, stands of young-growth composed of pole sized trees, to more mature young-growth and old-growth stands. The appearance of the activities associated with timber harvest within the Timber Production LUD will present a landscape highly modified by this change. To a lesser degree, landscapes within the Modified Landscape LUD and Scenic Viewshed LUDs will appear less modified by change. Landscapes within the Old-Growth Habitat and Semi-remote Recreation LUDs would remain unchanged.

Inventoried Roadless Areas and Wilderness

Introduction

Inventoried roadless areas (IRAs) are defined as undeveloped areas typically exceeding 5,000 acres that meet the minimum criteria for wilderness consideration under the Wilderness Act and were inventoried during the Forest Service's Roadless Area Review and Evaluation (RARE II) process and during subsequent updates and forest planning analyses. The Tongass is currently using the IRA boundaries associated with the 2001 Roadless Rule (USDA Forest Service 2001), which are identified in a set of maps, associated with the Forest Service Roadless Area Conservation, Final EIS, Volume 2, dated November 2000. These maps identify 9.3 million acres in IRAs on the Tongass and correspond closely with the 1996 roadless area inventory that was prepared for the 1997 Forest Plan Revision (USDA Forest Service 1997). Including Wilderness, the Tongass National Forest is currently more than 90 percent roadless.

There is no designated Wilderness located within the Big Thorne project area. The Karta River Wilderness forms the southern boundary of the project area.

Analysis Methods

This project-level analysis does not evaluate roadless areas for wilderness recommendation. It does, however, summarize the roadless characteristics associated with the IRAs in the project area. Detailed descriptions of the IRAs on the Tongass are included in Appendix C to the Tongass Land Management Plan Revision, Final Supplemental EIS (SEIS), Roadless Area Evaluation for Wilderness Recommendations (USDA Forest Service 2003). These characteristics are also discussed in more detail in the individual resource sections in this EIS. Table IRA-1 summarizes the roadless characteristics considered and the section in this chapter where potential effects are discussed.

Table IRA-1. Roadless Characteristics and Discussion Sections

2001 Roadless Rule Characteristics	Chapter 3 Section
Biological Values	
Diversity of plant and animal communities	Issue 2: Wildlife and Subsistence Use, Botany, Fisheries
Habitat for threatened, endangered, proposed, candidate, and sensitive species, and for those species dependent on large, undisturbed areas of land	Issue 2: Wildlife and Subsistence Use, Botany, Fisheries
Physical Values	
High quality or undisturbed soil, water, and air	Issue 3: Cumulative Watershed Effects, Soils
Sources of public drinking water	Aquatics
Social Values	
Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized classes of dispersed recreation opportunities	Recreation
Reference landscapes	Scenery
Natural appearing landscapes with high scenic quality	Scenery
Traditional cultural properties and sacred sites	Heritage Resources
Other locally identified unique characteristics	Recreation and Heritage Resources

Source: USDA Forest Service 2000

None of the alternatives propose old-growth harvest units, young-growth thinning units, new roads, or reconstructed roads within IRAs and there would be no direct impacts to IRAs under any of the alternatives. The 2001 Roadless Rule does not prohibit development outside of IRAs; however, development close to an IRA could indirectly affect roadless area characteristics. The following analysis assessed these potential indirect effects by assessing the "zones of influence" that would be associated with activities outside but close to an IRA. The zones of influence considered in this analysis are a 600-foot buffer around old-growth harvest units and a 1,200-foot buffer placed around roads (USDA Forest Service 2003).

The analysis focuses on potential impacts to the unique or outstanding biological, physical or social values of the IRAs. Roadless characteristics (i.e., values or features that make the area meet the minimum criteria for wilderness consideration under the Wilderness Act) are described in the Roadless Area Conservation Final EIS (USDA Forest Service 2000, Vol. 1, pp. 3-3 to 3-7).

Affected Environment

There are three IRAs partially located within the 232,000-acre Big Thorne project area: 509 – Kogish, 510 – Karta, and 511 – Thorne River. One IRA – 512 – Ratz is entirely located in the project area. These areas are shown in Figure IRA-1. Summary data are presented in Table IRA-2. Approximately 47 percent of the area within these IRAs (92,232 acres) is located within the Big Thorne project area, ranging from just 5 percent (2,974 acres) of the Kogish IRA to all of the Ratz IRA (Table IRA-2).

IRAs comprise approximately 40 percent (92,232 acres) of the Big Thorne project area, including 29 percent of the project area's Development LUDs and 60 percent of the Non-Development LUDs.

Table IRA-2. Inventoried Roadless Areas Located within the Big Thorne Project Area (partially or wholly)

Roadless Area Number	Name	Total Acres	Acres in the Project Area	Percent of IRA in the Project Area[1/]	IRA as a Percent of the Project Area[2/]
509	Kogish	64,466	2,974	5%	1%
510	Karta	51,212	19,684	38%	8%
511	Thorne River	72,970	64,252	88%	28%
512	Ratz	5,322	5,322	100%	2%
Total		**193,970**	**92,232**	**47%**	**40%**

Notes:
1/ This represents the IRA acres in the project area as a percentage of each IRA.
2/ This represents the IRA acres in the project area as a percentage of the entire project area.
Source: 2001 Roadless Rule Inventoried Roadless Information

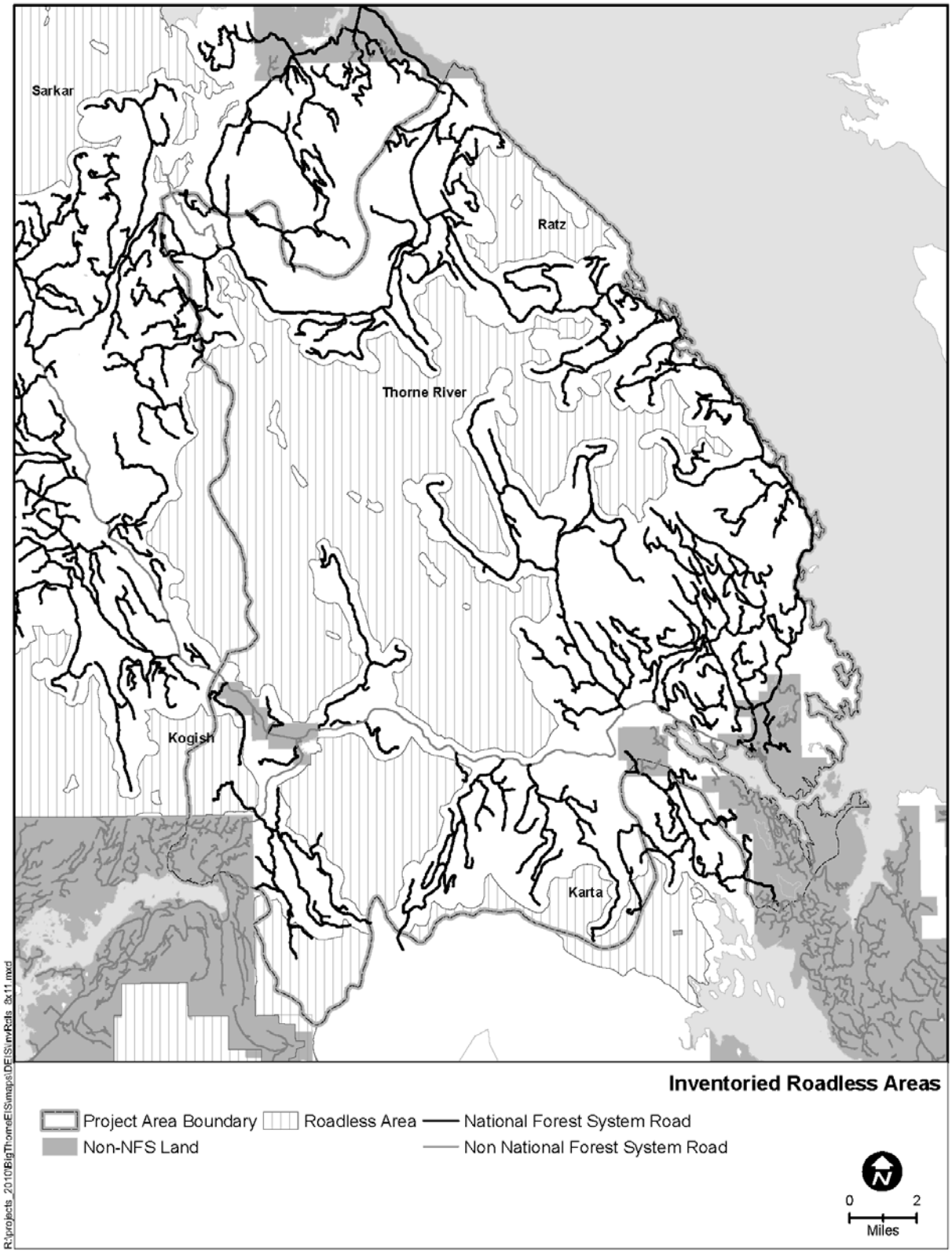

Figure IRA-1. Inventoried Roadless Areas in the Big Thorne Project Area

The following subsections describe the four IRAs that are partially or fully within the Big Thorne project area. These descriptions draw upon the 2003 Final SEIS IRA characteristics that were incorporated by reference into the 2008 Forest Plan Final EIS (USDA Forest Service 2003, Volume III Appendix C). For those IRAs only partially located within the project area—the Kogish, Karta, and Thorne River IRAs—the following discussions mainly focus on the portions of the IRA within the project area. The other IRA – Ratz – is entirely located within the project area.

Kogish IRA

The Kogish IRA (#509) is located on the west side of central Prince of Wales Island (Figure IRA-1). The area is bounded to the south by non-NFS lands managed by the State of Alaska and the San Cristoval Channel. The west boundary is formed by the West Coast Waterway, including the Gulf of Esquibel, Tonowek Bay, and Tonowek Narrows. Roads and harvested areas form the boundaries to the north and east of the area. Access to the area is primarily from the Staney Creek road system to the north or via boat or floatplane to the south and west. Only the easternmost portion of this IRA is located within the Big Thorne project area, and the portion of the IRA within the project area comprises just 5 percent of the total IRA acres (Table IRA-2).

More than half of the Kogish IRA (59 percent) is allocated to development LUDs, with the remaining 41 percent allocated to non-development LUDs (Table IRA-3). Less than half (40 percent) of the portion of this IRA located within the Big Thorne project area is allocated to development LUDs, with the remaining 60 percent allocated to non-development LUDs.

Table IRA-3. Kogish IRA Acres by LUD

Land Use Designation	Total IRA Acres	IRA Acres in the Project Area
Development LUD		
Timber Production	36,270	164
Modified Landscape	834	237
Scenic Viewshed	699	787
Development LUD Total	**37,802**	**1,188**
Non-Development LUD		
Old-growth Habitat	4,345	1,787
Semi-remote Recreation	22,319	0
Non-Development LUD Total	**26,664**	**1,787**
Overall Total	**64,466**	**2,974**

The 2003 Forest Plan SEIS discusses all the values used to rate the Wilderness potential of this IRA (USDA Forest Service 2003, pp. C2-357 to C2-367). Most of the Kogish IRA appears natural and unmodified; however, the eastern portion, which is in the project area, and the northern boundary, are heavily influenced by nearby developments. In addition, there are approximately 3.4 miles of existing road and 196 acres of past harvest within the portion of the IRA that is in the project area. However, the overall area has high natural integrity and moderate apparent naturalness. When rated separately, the western portion rates out with very high natural integrity and apparent naturalness. The opportunity for solitude is considered high and the opportunity for primitive recreation is very high. Approximately 14 percent of the landscape is considered distinctive for the character type

from a scenery standpoint. The area associated with the western shoreline is rich in cultural history and the roadless area has a few areas of karst development.

Biological Values

There are no unique ecological values in the Kogish IRA. The major fish-producing waters in this IRA are Staney Creek, Shaheen Creek, the streams of Salt Lake Bay, Elevenmile Creek, Big Salt Lake, and Shinaku Creek. The area also includes portions of the Staney Creek headwaters; Staney Creek is a major fish producer. These waters provide habitat for coho, pink, and chum salmon, steelhead trout, and Dolly Varden char. Sitka black-tailed deer, black bear, wolves, marten, mink, river otter, and bald eagles are the best known species that inhabit the area. A number of bald eagle nest sites have been documented along the coastline and inland along Elevenmile Creek.

The only federally listed T&E species likely to occur within or adjacent to the roadless area are the humpback whale (endangered) and the Steller sea lion (threatened). These species, along with the Pacific herring (a candidate species), are found in adjacent marine waters.

Physical Values

Two areas of limestone with potential karst have been identified in this IRA at the head of Nossuk Bay and the Peninsula to Point Swift. Both of these areas are outside the Big Thorne project area. There are no glaciers or unique geologic features known within this area. There are no recreation or other facilities located in this IRA. As a result, demand does not currently exist for domestic water use. There are no existing or planned hydroelectric or domestic water projects.

Social Values

Areas of scientific and educational value in this IRA are limited to the cultural sites along the shoreline. These sites are outside the Big Thorne project area.

Recreation use in this IRA is not well documented and is generally believed to be low because of access difficulties and the lack of recreation attractions, such as major stream or lake systems. Some recreation use occurs along the shoreline, outside the project area.

The existing visual condition of the area is predominantly natural; however, the northern and eastern edges of the IRA have been modified by developments. The more scenic parts of the IRA are concentrated around the relatively rugged and diverse terrain of Kogish Mountain and Staney Cone, and along the intricate shorelines and island groups in Salt Lake Bay and Nossuk Bay. These areas are outside the Big Thorne project area.

There is evidence of prehistoric and historic use of this roadless area, particularly along the saltwater shorelines. The Tlingit people maintain strong connections with specific locations and general areas along the west coast of Prince of Wales Island. Many areas have been identified by local people as important for resource gathering and hunting, including Elevenmile, Salt Lake Bay, and Nossuk Bay, and numerous prehistoric and historic sites have been identified in these areas. None of these areas are in the Big Thorne project area.

Karta IRA

The Karta IRA (#510) consists of several unconnected roadless sections that surround the Karta Wilderness (Figure IRA-1). The unconnected sections are separated by roads and harvested areas or by wilderness. This IRA includes the Rio Roberts watershed, which is part of a mostly undeveloped, old-growth connection between the Karta Wilderness to the south and Calder Holbrook LUD II area located on the northwest tip of Prince of Wales Island (USDA Forest Service 2003).

Access to the Karta IRA is via boat or floatplane along Twelvemile Arm and Karta Bay, floatplane via Control Lake or Black Bear Lake, and via the roads along the north, south, and west area boundaries.

The majority of the Karta IRA (78 percent) is allocated to development LUDs, with the remaining 22 percent allocated to non-development LUDs (Table IRA-4). More than half (59 percent) of the portion of this IRA located within the Big Thorne project area is allocated to development LUDs, with the remaining 41 percent allocated to non-development LUDs.

Table IRA-4. Karta IRA Acres by LUD

Land Use Designation	Total IRA Acres	IRA Acres in the Project Area
Development LUDs		
Timber Production	24,820	9,028
Experimental Forest	6,016	0
Modified Landscape	6,533	2,086
Scenic Viewshed	2,387	401
Development LUD Total	**39,757**	**11,515**
Non-Development LUDs		
Old-growth Habitat	10,922	8,169
Municipal Watershed	314	0
Semi-remote Recreation	219	0
Non-Development LUD Total	**11,456**	8,169
Overall Total	**51,212**	**19,684**

The 2003 Forest Plan SEIS discusses all the values used to rate the Wilderness potential of this IRA (USDA Forest Service 2003, pp. C2-368 to C2-378). The Karta Roadless Area appears natural and unmodified, especially near the wilderness, but is often influenced by developments adjacent to most of the other boundaries. In addition, there are approximately 5.4 miles of existing road and 206 acres of past harvest within the portion of the IRA that is in the project area. However, the overall area has moderate natural integrity and apparent naturalness. The opportunity for solitude is high, and the opportunity for primitive recreation is very high; however, during the peak season there is daily floatplane traffic transporting visitors in and out of the wilderness area, and this affects solitude in the Karta Roadless Area.

Biological Values

There are no unique ecological values in the Karta IRA. The primary fish-bearing waters in this roadless area are Control Lake, Steelhead Creek, Rio Roberts Creek, Paul Young Creek, upper Maybeso Creek, and upper Harris River. These waters provide habitat for

coho, pink, chum, and sockeye salmon as well as steelhead and cutthroat trout. Four of the eight VCUs in this area have been identified by ADF&G as primary salmon and sportfish producers, with two others listed as primary sportfish producers.

This area has large populations of Sitka black-tailed deer, black bear, wolves, otter, marten, mink, loon, and common waterfowl. Bald eagle nest sites have been located along the coastline and inland along Rio Roberts Creek. Marbled murrelet, Queen Charlotte goshawk, and harlequin duck may also occur in the area.

The only federally listed threatened and endangered species likely to occur within or adjacent to the roadless area are the humpback whale (endangered) and the Steller sea lion (threatened). These species, along with the Pacific herring (a candidate species) are found in adjacent marine waters.

Physical Values

There are no known karst or cave resources, glaciers, or unique geologic features in this roadless area. Two public recreation cabins in this area create a demand for water. Approximately 373 acres of the area are allocated to the Municipal Watershed LUD and managed to preserve water quality for the community of Klawock.

Social Values

The Maybeso Experimental Forest, one of only two experimental forests on the Tongass National Forest, is partly located in this roadless area, and there are also opportunities to study fish, wildlife, forests, and geologic processes.

This roadless area, which mainly provides semi-primitive recreation opportunities, contains 17 inventoried recreation places; these places cover 10,134 acres, about 18 percent of the roadless area. The historic cabin on Salmon Lake is a one-of-a-kind structure on the National Historic Register. The area is important for subsistence hunting and gathering to the communities of Hydaburg, Klawock, Thorne Bay, and Craig. Ketchikan residents also use the area, primarily for deer hunting.

The existing visual condition of the area is predominantly natural; however, the landscape in approximately 22 percent of the area appears moderately to heavily modified due to logging and roading activity along the northern and southern boundaries.

The roadless area has a rich cultural history of native prehistoric and historic usage. There are prehistoric village sites, rock art, and other physical indications of native occupancy of sites within the area.

Thorne River IRA

The Thorne River IRA (#511) is located approximately 5 air miles northwest of Thorne Bay (Figure IRA-1). Most of the Thorne River drainage is included within this IRA. The IRA is bordered by State Highway 929 to the south, State Highway 925 to the west, and forest roads to the east and north, affording road access to all sides of the area. Two closed road systems provide non-motorized access to the interior of the IRA. The Honker Divide Canoe Route provides water access through the area along Hatchery Creek and the Thorne River.

The majority of the Thorne Bay IRA (71 percent) is allocated to non-development LUDs, with the remaining 29 percent allocated to development LUDs (Table IRA-5). This is also the case with the portion of this IRA located within the Big Thorne project area, with 71 percent of the area allocated to non-development LUDs and 29 percent to development LUDs.

The 2003 Forest Plan SEIS discusses all the values used to rate the Wilderness potential of this IRA (USDA Forest Service 2003, pp. C2-379 to C2-390). The Thorne River IRA is mostly unmodified and appears natural. Roaded areas form all the boundaries and influence the area to some degree, especially in the eastern portion. In addition, there is approximately 0.8 mile of existing road and 86 acres of past harvest within the portion of the IRA that is in the project area. However, the area has overall high natural integrity and apparent naturalness. Separating the eastern lobe out of the area would increase the natural integrity rating to very high. The opportunity for solitude is high, and the opportunity for primitive recreation is very high within the area.

Table IRA-5. Thorne River IRA Acres by LUD

Land Use Designation	Total IRA Acres	IRA Acres in the Project Area
Development LUD		
Timber Production	9,276	7,931
Modified Landscape	9,788	9,814
Scenic Viewshed	2,293	696
Development LUD Total	**21,356**	**18,441**
Non-Development LUD		
Old-growth Habitat	39,386	33,652
Research Natural Area	1,620	1,620
Special Interest Area	68	0
Scenic River	10,540	10,540
Non-Development LUD Total	**51,614**	**45,811**
Overall Total	**72,970**	**64,252**

Biological Values

The major fish-bearing waters in this area are Thorne River, Thorne Lake, Hatchery Creek, Lake Galea, and Logjam Creek. The headwaters for Logjam Creek provide habitat for coho salmon. This area has large populations of Sitka black-tailed deer, black bear, wolves, otter, marten, mink, and bald eagles. The only known inland-nesting bald eagles in Southeast Alaska are located in the Thorne-Hatchery Creek area.

The Thorne River connects a series of large lakes that are a special feature of this roadless area. This IRA also includes a large block of old-growth habitat that is part of the Forest-wide conservation strategy.

The only federally listed threatened and endangered species in the Tongass are the humpback whale (endangered) and the Steller sea lion (threatened), both marine species. In addition, Pacific herring is a candidate species. There is no marine habitat available in the Thorne River Roadless Area. Four Forest Service Region 10 Sensitive Species are suspected or known to occur within the area: the trumpeter swan, osprey, Peale's peregrine falcon, and the Queen Charlotte goshawk.

Physical Values

Three small areas of karst are located in the hills southwest of Cutthroat Lake and several small caves have been mapped in this roadless area. The topography of the lower Thorne River is dominated by drumlins, which control the vegetation and hydrology of the area. There are no glaciers in the area.

The one public recreation cabin on Honker Lake creates the only water demand in the entire area. There are no existing or planned hydroelectric or domestic water projects within the roadless area.

Social Values

The Rio Roberts Research Natural Area is located within the roadless area. This Research Natural Area contains riparian flood plain spruce stands, upland old growth forest, natural second-growth stands, and upland hemlock on drumlin fields (glacial features). Research Natural Areas provide opportunities for baseline monitoring of ecological processes and non-manipulative observation.

This Research Natural Area provides primarily semi-primitive recreation opportunities. Opportunities for solitude and serenity are high, especially along the Thorne River corridor and adjacent upland areas. The natural integrity of this area is intact and largely unmodified except for one recreation use cabin (Honker Lake Cabin) and a small trail system. The majority of the area appears natural, with the exception of areas around the boundaries of the IRA where the landscape character is influenced by adjacent development.

At least one cultural site along the Thorne River, a prehistoric campsite, has been determined to be eligible for listing on the National Register of Historic Places. Because of the high-value fish resources of the Thorne River, the prehistoric and historical use of this area was probably relatively high.

Ratz IRA

The Ratz IRA (#512) is located on the east side of Prince of Wales Island, approximately 5 air miles south of Coffman Cove and 15 air miles north of Thorne Bay (Figure IRA-1). This IRA is bounded to the northeast by Clarence Strait, with roads and harvested areas forming the IRA's other boundaries. Access to the area is via boat or floatplane through Ratz Harbor, by floatplane and the unnamed lake located north of Baird Peak within the IRA, or by foot from the roads along the boundaries of the area.

The majority of the Ratz IRA (85 percent) is allocated to development LUDs, with the remaining 15 percent allocated to non-development LUDs (Table IRA-6). The entire IRA is located within the project area.

Table IRA-6. Ratz IRA Acres by LUD

Land Use Designation	Total IRA Acres	IRA Acres in the Project Area
Development LUD		
Modified Landscape	4,515	4,515
Development LUD Total	**4,515**	**4,515**
Non-Development LUD		
Old-growth Habitat	808	808
Non-Development LUD Total	**808**	**808**
Overall Total	**5,322**	**5,322**

The 2003 Forest Plan SEIS discusses all the values used to rate the Wilderness potential of this IRA (USDA Forest Service 2003, pp. C2-391 to C2-399). The Ratz IRA has moderate to low scenic quality; none of the landscape is classified as distinctive from a scenery standpoint. The karst on Baird Peak is a special feature of this roadless area. This small roadless area is in a natural, unmodified condition and has a high level of natural integrity. The opportunity for solitude within the area is moderate due to the area's relatively small size. Nearby management activities and road traffic may be heard especially along the north, south and western boundaries. The opportunity for primitive recreation is relatively high, but decreases toward the edges of the area. This IRA includes approximately 0.3 mile of existing road and 12 acres of past harvest.

Biological Values

There are no unique ecological values in the area. There are no anadromous fish-bearing waters in this roadless area. The area has populations of Sitka black-tailed deer, black bear, wolves, and other animals and birds common to Prince of Wales Island. Migrating trumpeter swan and goshawks use this area.

The only federally listed threatened and endangered species in the Tongass are the humpback whale (endangered) and the Steller sea lion (threatened), both marine species. These species, along with the Pacific herring (a candidate species), are found in adjacent marine waters.

Physical Values

The northeast flank of Baird Peak is underlain by marble into which extensive karst systems have developed. The karst in the northeastern portion of the roadless area contains several small caves. There are no sources of public drinking water in this IRA.

Social Values

The intensely developed karst on the northeast face of Baird Peak, as well as forests and wildlife, are of scientific interest.

This IRA provides primarily semi-primitive recreation opportunities. There are no developed recreation facilities in this area. The area receives some dispersed recreation and subsistence use, primarily hunting and fishing.

About 60 percent of the landscape in this roadless area appears natural and unaltered by human activity. The visual condition of the remainder of the area appears moderately to heavily altered due to developments around the periphery of the area.

It is likely that there has been some native prehistoric and historic use within the roadless area but this has not been confirmed through cultural resource investigations.

Unroaded Areas

Unroaded areas are generally less than 5,000 acres in size and do not meet the minimum criteria for wilderness consideration under the Wilderness Act. The inventory for the 2003 Forest Plan Revision SEIS, which was subsequently updated for the 2008 Forest Plan Amendment, identified five unroaded areas that are partially within the Big Thorne project area, with a combined total area of 12,284 acres, 6,554 acres of which are located within the project area. The 2003 Forest Plan Revision SEIS analyzed these unroaded areas and found they did not have wilderness potential due to their size and/or configuration.

No standards and guidelines to maintain the physical, biological and social characteristics of unroaded areas have been established in the Forest Plan or national direction. Therefore, changes to these areas, as a result of timber harvest activities, are acceptable under the Forest Plan and effects are generally expected to be similar to those in nearby roaded areas.

Wilderness

Karta River Wilderness

The Big Thorne project area is bordered to the south by the Karta River Wilderness. The Karta River Wilderness consists of 39,894 acres located about five miles by water from Kassan and Hollis. The area includes the drainage of the Karta River system (which empties into the southwest corner of Karta Bay) and two major lakes, Salmon and Karta. The Karta River Wilderness is known for its rugged, alpine beauty and the Karta River drainage is considered to be a high quality fishery. Wildlife in the area includes wolves, black bears, black-tailed deer, beavers, otters, mink, marten, and trumpeter swans and other waterfowl are often seen on the river. The Karta River Wilderness is a popular destination for subsistence fishing and recreation. The majority of use in this Wilderness occurs along the Karta River corridor.

Environmental Consequences

Inventoried Roadless Areas

None of the alternatives propose old-growth harvest units, young-growth thinning units, new roads, or reconstructed roads within IRAs and, as a result, there would be no direct impacts to IRAs. Two of the alternatives (Alternatives 3 and 4) would, however, involve adjustments to the boundaries of small OGRs outside of IRAs so that more of these OGRs are placed within IRAs in the project area. The potential effects of these changes to IRAs are discussed below by alternative.

Indirect effects on the roadless area character may occur as a result of project activities that take place outside the boundaries of the IRA. The analysis presented in this section assesses indirect effects on roadless area characteristics as a result of “zones or areas of influence” that include a 600-foot buffer around old growth units and a 1,200-foot buffer

placed around roads (USDA Forest Service 2003). Table IRA-7 identifies the IRA acres that would fall within these buffers by alternative.

Table IRA-7. Area of Influence by Alternative (acres)

Inventoried Roadless Area[1/]	Total IRA Acres in the Project Area	Area of Influence by Alternative (acres)				
		1	2	3	4	5
509 - Kogish	2,974	0	10	123	10	11
510 - Karta	19,684	0	436	437	342	272
511 - Thorne River	64,252	0	793	1,176	647	800
512 - Ratz	5,322	0	227	435	209	113
Total	**92,232**	**0**	1,466	2,171	1,208	1,196

Note:
1/ The Zone of Influence for each alternative is the total area within 1,200 feet of a new road or within 600 feet of an old-growth harvest unit (including helicopter harvest units).

Wilderness

None of the proposed alternatives would affect the Karta River Wilderness because no timber harvest or related activities are planned within the Wilderness area. In addition, the Karta River Wilderness character is primarily centered around the productive Karta River system. Sights and sounds of timber harvest activities within the Big Thorne project area to the north would not travel to the river system. As a result, the biological, physical, and social aspects of the Karta River Wilderness would not be affected by any of the proposed alternatives. Therefore, there would be no direct, indirect, or cumulative effects to the Karta River Wilderness under any of the alternatives and the following alternative-specific discussions address IRAs only.

Alternative 1 – No Action

Direct and Indirect Effects

Alternative 1 would have no direct or indirect effects on IRAs because there would be no timber harvest or road construction/reconstruction under this alternative.

Cumulative Effects

Alternative 1 would have no cumulative effects on IRAs because there would be no timber harvest or road construction/reconstruction under this alternative.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Alternative 2 would not include any old-growth harvest units, young-growth thinning units, new roads, or reconstructed roads within any of the IRAs in the Big Thorne project area and therefore, it would not have any direct effects. There are no proposed changes to IRAs under this alternative. Road construction and timber harvest under this alternative could indirectly influence roadless characteristics on about 1,466 acres or 1.6 percent of the 92,232 acres in the four IRAs located in the project area (Table IRA-7). This acreage represents less than 1 percent of the 195,614 total acres within the four IRAs (including

areas outside the project area). This alternative is not expected to adversely impact the biological, physical, and social values associated with the IRAs in the project area.

Cumulative Effects

Alternative 2 would not directly affect the IRAs in the project area and indirect effects are not expected to adversely impact the biological, physical, and social values associated with the IRAs. As a result, this alternative is not expected to incrementally add to cumulative effects to IRAs. Present and reasonably foreseeable projects in the Big Thorne project area are discussed at the beginning of Chapter 3 in the Known Projects in the Big Thorne Project Area section.

Alternative 3

Direct and Indirect Effects

Alternative 3 would not include any old-growth harvest units, young-growth thinning units, new roads, or reconstructed roads within any of the IRAs in the Big Thorne project area. Changes to existing LUDs would occur within the IRAs in the project area as a result of changes to the boundaries of small OGRs. These changes should have the effect of providing additional protection to these IRAs due to stronger LUD protections. Changes to existing LUDs would occur in all four IRAs in the project area under this alternative. These changes may be summarized as follows, with changes in LUDs compared to the entire IRA, not just the portion in the Big Thorne project area.

- Kogish IRA—644 acres currently allocated to the Timber Production, Modified Landscape, and Scenic Viewshed LUDs would be changed to the Old-growth Habitat LUD, a net gain of about 2 percent in total non-development LUD acres in this IRA.
- Karta IRA—231 acres currently allocated to the Timber Production LUD would be changed to the Old-growth Habitat LUD, a net gain of about 2 percent in total non-development LUD acres in this IRA.
- Thorne River IRA—4,490 acres currently allocated to the Timber Production and Modified Landscape LUDs would be changed to the Old-growth Habitat LUD, a net gain of about 9 percent in total non-development LUD acres in this IRA.
- Ratz IRA—1,002 acres currently allocated to the Modified Landscape LUD would be changed to the Old-growth Habitat LUD, more than doubling the 808 acres (a net gain of 124 percent) currently allocated to non-development LUDs in this IRA.

Road construction and timber harvest under this alternative could indirectly influence roadless characteristics on about 2,171 acres or about 2.4 percent of the 92,232 acres in the four IRAs located in the project area (Table IRA-7). This acreage represents about 1.1 percent of the 195,614 total acres within the four IRAs (including areas outside the project area). This alternative is not expected to adversely impact the biological, physical, and social values associated with the IRAs in the project area.

Cumulative Effects

Changes to existing LUDs within IRAs would occur under Alternative 3, but these changes should have the effect of providing additional protection to these IRAs due to stronger LUD protections. Alternative 3 would not directly affect the IRAs in the project

area and indirect effects are not expected to adversely impact the biological, physical, and social values associated with the IRAs. As a result, this alternative is not expected to incrementally add to cumulative effects to IRAs.

Alternative 4

Direct and Indirect Effects

Alternative 4 would not include any old-growth harvest units, young-growth thinning units, new roads, or reconstructed roads within any of the IRAs in the Big Thorne project area. Changes to existing LUDs would occur within the IRAs in the project area as a result of changes to the boundaries of small OGRs. These changes should have the effect of providing additional protection to these IRAs due to stronger LUD protections. Changes to existing LUDs would occur in three of the four IRAs in the project area under this alternative. These changes may be summarized as follows, with changes in LUDs compared to the entire IRA, not just the portion in the Big Thorne project area.

- Kogish IRA—1,041 acres currently allocated to the Timber Production, Modified Landscape, and Scenic Viewshed LUDs would be changed to the Old-growth Habitat LUD, a net gain of about 4 percent in total non-development LUD acres in this IRA.
- Karta IRA—666 acres currently allocated to the Timber Production, Modified Landscape, and Scenic Viewshed LUDs would be changed to the Old-growth Habitat LUD, a net gain of about 6 percent in total non-development LUD acres in this IRA. In addition, 121 acres of Modified Landscape and Scenic Viewshed would be changed to Timber Production.
- Ratz IRA—442 acres currently allocated to the Modified Landscape LUD would be changed to the Old-growth Habitat LUD, a net gain of about 55 percent in total non-development LUD acres in this IRA.

Road construction and timber harvest under this alternative could indirectly influence roadless characteristics on about 1,208 acres or about 1.3 percent of the 92,232 acres in the four IRAs occurring within the project area. This acreage represents less than 1 percent of the 195,614 total acres within the four IRAs (including areas outside the project area). This alternative is not expected to adversely impact the biological, physical, and social values associated with the IRAs in the project area.

Cumulative Effects

Changes to existing LUDs within IRAs would occur under Alternative 4, but these changes should have the effect of providing additional protection to these IRAs due to stronger LUD protections. Alternative 4 would not directly affect the IRAs in the project area and indirect effects are not expected to adversely impact the biological, physical, and social values associated with the IRAs. As a result, this alternative is not expected to incrementally add to cumulative effects to IRAs.

Alternative 5

Direct and Indirect Effects

Alternative 5 would not include any old-growth harvest units, young-growth thinning units, new roads, or reconstructed roads within the IRAs. Road construction and timber harvest under this alternative could indirectly influence roadless characteristics on about 1,196 acres or about 1.3 percent of the 92,232 acres in the four IRAs located in the project area. This acreage represents less than 1 percent of the 195,614 total acres within the four 2001 IRAs (including areas outside the project area). This alternative is not expected to adversely impact the biological, physical, and social values associated with the IRAs in the project area.

Cumulative Effects

Alternative 5 would not directly affect the IRAs in the project area and indirect effects are not expected to adversely impact the biological, physical, and social values associated with the IRAs. As a result, this alternative is not expected to incrementally add to cumulative effects to IRAs.

Wild and Scenic Rivers

Introduction

There are no designated Wild and Scenic Rivers on Prince of Wales Island and associated islands. However, during the 1997 Forest Plan revision, five river/lake systems were determined eligible and suitable for designation, and have been recommended for inclusion in the Wild and Scenic River System: Essowah Lakes and streams, Kegan Lake and streams, Salmon Bay Lake and stream, Sarkar Lakes, and Thorne River/Hatchery Creek/Barnes Lake.

Affected Environment

Within the project area is a portion of the Thorne River/Hatchery Creek/Barnes Lake recommended Wild and Scenic River that, in its entirety, runs up the Thorne River from Thorne Bay to its headwaters and down Hatchery Creek through Sweetwater Lake to Lake Bay near Coffman Cove. The segments that fall within the project area are classified as scenic and recreational and allocated to the Scenic River and Recreational River LUDs, respectively. The recreational segment represents the lower Thorne River and the remainder, which represents the majority in the project area, is scenic. This river is recommended for the following outstandingly remarkable values:

- Fish—Fishing opportunities exist throughout most of the year. Sport species include coho, sockeye, chum, and pink salmon, as well as cutthroat, rainbow, and steelhead trout and Dolly Varden char. Thorne River produces the largest run of steelhead on Prince of Wales Island, and the watershed is listed among the 19 “high quality” watersheds identified by ADF&G in Southeast Alaska for fisheries values.
- Wildlife—Extensive wetlands areas provide habitat for waterfowl, loons, great blue herons, and trumpeter swans. Sweetwater Lake is important wintering area for trumpeter swans. Other wildlife species that occur in the corridor are bald eagles, black bear, wolves, river otter, seals, marten, mink, weasels, beaver, and Sitka black-tailed deer. The only known inland-nesting bald eagles in Southeast Alaska occur in the Thorne-Hatchery area.
- Recreation—Sport fishing use is extensive due to the diverse sport species available. Convenient road access and three public reservation cabins along the corridor bring visitors to the area. Extensive canoe opportunities exist with the Honker Divide Canoe Route, which starts at Hatchery Creek Bridge on the Coffman Cove Road and traverses 30 miles of streams and lakes ending at the city dock in Thorne Bay. Opportunities for wildlife viewing are also a draw and subsistence hunting is a common activity in the area.
- Scenery—The river corridor offers a diverse landscape for scenery with contrasting elements of rock, old-growth forest, muskegs, alpine, meadows, and rounded mountains. The chain of lakes along the Honker Divide Canoe Route are interconnected by streams and portages and allow visitors to view unique wetlands, and diverse shorelines and stream channels.

The goals for the Scenic River and Recreational River LUDs include managing the scenic or recreational river "segments to maintain their outstandingly remarkable values and classification eligibility until Congress designates the segments or decides not to designate them" (USDA Forest Service 2008a, p. 3-81, 3-88).

Environmental Consequences

Direct and Indirect Effects

Scenic River LUD

The major portion of the Scenic River LUD lies inside the Big Thorne project area boundary. None of the alternatives propose timber harvest or road construction within the Scenic River LUD, resulting in no direct, indirect, or cumulative impacts.

Recreational River LUD

The Recreational River LUD includes the lower Thorne River from about a mile upstream of the mouth of Goose Creek to Thorne Bay, including the estuary of the Thorne River. The LUD generally includes lands within 0.25 mile of the stream or estuary. Two proposed old-growth harvest units and one proposed commercial thinning unit for the Big Thorne project are partially within the Recreational River LUD. Approximately 11 acres of old-growth Unit 597.1-62 is within the Recreational River LUD along the north side of the Thorne River just west of the beginning of the North Thorne River Road. The closest portion of the unit is about 1,000 feet from the Thorne River. The southern 27 acres of old-growth Unit 579-119 is within the Recreational River LUD in the vicinity of Gravelly Creek. The closest portion of this unit is about 900 feet from the Thorne River and on the other side of the highway. A portion of young-growth thinning Unit 586-516 is within the Recreational River LUD, near the southwest shore of the Thorne River mouth. Table WSR-1 shows harvest acres proposed by alternative in Recreational River LUD.

Table WSR-1. Harvest and Thinning Acres Proposed within the Recreational River LUD

Unit	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
5971-62	0	11	11	11	11
5790-119	0	27	27	27	27
5860-516	0	0	35	35	35
Total Old-Growth Harvest Acres	**0**	**38**	**38**	**38**	**38**
Total Young-Growth Thinning Acres	**0**	**0**	**35**	**35**	**35**

Alternative 1 does not propose harvest or road construction and would not affect the Recreational River LUD. All of the action alternatives propose timber harvest within this LUD. Timber harvest is compatible with the Recreational River LUD, as long as the adjacent LUD allows it. and the activity emphasizes enhancement or maintenance of the outstandingly remarkable river values. The adjacent LUD to these harvest and commercial thinning units is Modified Landscape, which allows timber harvest. The alternatives proposed in the Big Thorne project would not significantly affect the outstandingly remarkable conditions for which the Thorne River-Hatchery Creek segments were recommended, and would not affect the eligibility of this river for inclusion in the Wild and Scenic River System (as discussed below).

The Thorne River and Hatchery Creek system is recommended as eligible for inclusion in the Wild and Scenic River System because it is outstandingly remarkable for fish, wildlife, recreation, and scenery. These outstandingly remarkable values are described in the Affected Environment section, above. The following paragraphs assess the potential impact of the proposed action alternatives on these outstandingly remarkable values.

- Fish—Implementation of the applicable Forest Plan standards and guidelines and best management practices would mitigate potential impacts to fisheries. As a result, none of the alternatives are expected to have measurable effects on fish habitat and are, therefore, unlikely to affect the outstandingly remarkable fishing opportunities in the Thorne-Hatchery system or elsewhere in the Big Thorne project area.
- Wildlife—None of the alternatives would affect the wetland areas along the river corridor that provide habitat for waterfowl, loons, great blue herons, and trumpeter swans. There would also be no effect to Sweetwater Lake, which is identified as an important wintering area for trumpeter swans or the other wildlife species that are identified as occurring in the corridor. Potential reductions in deer habitat capability in the WAAs that coincide with the Big Thorne project area could have minor project area-wide impacts on Sitka black-tailed deer populations, but are unlikely to noticeably affect populations along the river corridor.
- Recreation—None of the alternatives would affect sport fishing opportunities or use of the Honker Divide Canoe Route, both of which are important aspects of the recreation activities along this river corridor that are considered outstandingly remarkable. There would also be no effect to potential wildlife viewing and hunting opportunities along the river corridor.
- Scenery None of the alternatives would affect the diversity of the landscapes that are visible from the river corridor or the wetlands, diverse shorelines, and stream channels that characterize the river corridor itself. Under Alternative 3, four to eight units (located between 0.75 and 1 mile from the river corridor) would be partially visible in the middleground from some portions of the lakes along the Honker Divide trail near the middle of the corridor. Harvest in these areas would be consistent with the Forest Plan and not expected to affect the scenic values that are considered outstandingly remarkable.

Cumulative Effects

Past, present, and reasonably foreseeable future actions considered in this analysis are listed at the beginning of this chapter. None of the alternatives would affect the eligibility of the Thorne River-Hatchery Creek segments for inclusion in the Wild and Scenic River System and would, therefore, not add incrementally to cumulative impacts on wild and scenic rivers.

3 Environment and Effects

Heritage Resources

Introduction

This section provides an overview of the archaeological investigation of the potential effects of the proposed Big Thorne project on extant historical properties eligible to the National Register of Historic Places (NRHP), as required by the Act and its application guidance.

Heritage resources include a wide array of historic and prehistoric cultural sites and traditional cultural properties. The Forest Service conducts heritage resource investigations under the provisions set in the Third Programmatic Agreement (as amended) between the Alaska Region of the USDA Forest Service, the Alaska State Historic Preservation Officer and the Advisory Council on Historic Preservation (Programmatic Agreement). This agreement was developed to utilize more cost-effective, streamlined steps and procedures than those outlined in 36 CFR 800 and to develop a flexible programmatic approach for expeditiously implementing Section 106 of the National Historic Preservation Act (NHPA). This agreement is in keeping with and adheres to the guidance provided in Forest Service policy FSM 2360.

Consideration of the effects of the Big Thorne undertaking consisted of (1) defining the Area of Potential Effects (APE); (2) conducting a review of existing historic and archaeological information about the project area including the results of past heritage surveys, and through consultations with affected tribes and groups; (3) implementation of additional fieldwork deemed necessary to assess potential effects; (4) development of recommendations based on the results of 1, 2, and 3; and (5) consultation with the State Historic Preservation Officer to seek concurrence with recommendations regarding significance and effect.

Methodology

Past and Current Archaeological Survey in Big Thorne Project Area

The lands immediately surrounding the Big Thorne project area have received substantial archaeological survey coverage during the planning process of several major timber harvest proposals, some of which included areas within the currently proposed project. They include the North Thorne Timber Harvest Project (2005), Logjam Timber Sale Project (2008), *Archaeology of Thorne Bay: A Survey of 22 Timber Harvest Units on Prince of Wales Island* (1987), *Southeast Alaska, The Control Lake Environmental Impact Statement, Prince of Wales Island* (1994), *The Coffman Cove Archaeological Survey, Archaeology of Coffman Cove: A Survey of 15 Timber Harvest Units on Prince of Wales Island* (1987), Southeastern Alaska, the Cobble Timber Project (2004) and numerous cultural resource surveys reported in the Central Prince of Wales Environmental Impact Statement (1987-1995).

The North Thorne timber sale project was located northwest of the community of Thorne Bay and covered about 35,750 acres of NFS lands which included portions of the Big Thorne Project. Archaeologists surveyed over 1,400 acres but did not find any significant cultural remains.

The Thorne Bay archaeological survey conducted by William Ackerman in 1987 included an area extending from the head of Kasaan Bay northward into the Thorne River Valley and west to Control Lake. A total of 1,420 acres were surveyed and 193 test pits dug. No historic or prehistoric sites were found.

The Coffman Cove archaeological survey conducted by William Ackerman in 1987 included an area extending from Luck Lake on the east coast of Prince of Wales Island to Hatchery and Logjam Creeks south of Sweetwater Lake and then to Tuxekan Passage on the western coast of the island. A total of 450 acres were surveyed and 127 test pits dug. No artifacts or cultural remains were identified.

The Control Lake project was located west of the Big Thorne Project and included much of the western portion of the project area. A total of 1,800 acres were intensively surveyed as part of the Control Lake project immediately west of the North Thorne project in VCUs 571, 574, 575, 576, 577, and 597. An additional 250 acres in the same area received reconnaissance survey. No cultural resources were identified.

Archaeological survey was undertaken for the Logjam Timber Sale which was located northwest of the Big Thorne project. Survey of proposed timber harvest units included 334 acres of pedestrian survey. The only cultural properties located were cultural modified trees (CMTs).

The formerly proposed Cobble Timber Project covered 40,394 acres including sections of the proposed Big Thorne project area. Of these acres, 2,770 were surveyed and 520 acres were cleared during past surveys. Despite extensive survey coverage, there was only one poorly defined fish trap, 22 CMTs and one abandoned logging camp for the entire project area. Most recent survey was done in 2003. It included 13 low probability units over approximately 118 acres and produced no cultural materials.

During the field seasons from 2009 to 2011, a team of Forest Service archaeologists conducted intensive surveys of the Big Thorne project area using the methodology stipulated in the Programmatic Agreement, covering the necessary areas considered high sensitivity and a percentage of areas considered low sensitivity. Through the Programmatic Agreement, the Forest Service recognizes two sensitivity zones in the Alaska Region: high and low. Sensitivity zones are dynamic estimates or approximations based on interpretation of data from previous cultural resource investigations. Over 2,300 acres of high and low sensitivity acres were cleared by Forest Service Heritage archaeological crews. As a direct result of the fieldwork conducted, 11 prehistoric sites and 3 three CMTs were recorded. None of the sites or CMTs found during the investigation was evaluated as to eligibility to the NHRP and as such are considered eligible to the Register for management purposes.

Monitoring

The Programmatic Agreement stipulates how archaeological monitoring is to be conducted for the proposed project. The agreement states that a sample of all areas of high archaeological sensitivity will be subject to direct impact is to be monitored during and/or after the actual ground disturbance. The impact areas to be monitored will be determined on a case-by-case basis. For areas considered low sensitivity a sample of all areas of actual ground disturbance are to be subjected to post-disturbance monitoring.

The locations and acreage sampled will be determined on a case-by-case basis. Monitoring of these areas will commence with the start of the project's harvest work and will conclude with some post-disturbance surveys.

Affected Environment

Heritage Resources in the Project Area

There are 25 recorded sites within a 2-mile radius of the proposed Big Thorne project. These include the following sites:

CRG-00019	CRG-00162	CRG-00223	CRG-00317	CRG-00388
CRG-00033	CRG-00177	CRG-00265	CRG-00318	CRG-00547
CRG-00035	CRG-00191	CRG-00314	CRG-00319	CRG-00582
CRG-00053	CRG-00192	CRG-00315	CRG-00340	CRG-00602
CRG-00158	CRG-00193	CRG-00316	CRG-00350	CRG-00603

These sites are predominantly prehistoric in nature and include shell middens, petroglyphs, house pits, a trail and multiple fish weirs or traps (both wooden and stone in composition). Two of the sites are historic mines. Only a very small portion of the recorded sites have been evaluated as to their eligibility for the NRHP and are considered eligible for management purposes. In close proximity to the project area is the historic Salt Chuck Mine (CRG-019) which has been evaluated in the past as eligible for the NRHP. The prehistoric Thorne River Site (CRG-177) is found within the overall boundary of the project, but not in the project APE. No project activities are within 1 mile of its location. It has been evaluated and is considered eligible for the NRHP.

Additionally, found adjacent to the northern boundary of the project area is a large group of CMTs. An archaeological team recorded 352 CMTs during surveys conducted in 2001.

Environmental Consequences

The APE for all alternatives is considered to be the project area as defined in this document. Direct effects include damage due to harvest activities and road construction activities. Therefore, areas of direct effect are defined as planned harvest units and road corridors. Indirect effects result from activities peripheral to the harvest itself. These would include the risk of increased damage of historic properties due to increased visitation of the project area. Increased visitation might result from higher numbers of workers in the area during harvest or from increased accessibility to the area due to road improvements.

Cumulative effects to heritage resources result from the collective impacts of natural decay, erosion, and forest processes as well as modern cultural processes, which may include recreational artifact collection and vandalism of historic properties and developments such as timber harvest and road construction. Portions of the Big Thorne project area have road access and receive recreation use at present. The planned timber harvest will not significantly increase the use of the project area by the public, nor will it contribute to increased potential impacts to heritage resources.

As stated in the Programmatic Agreement Section VII B and the 2008 Tongass Land and Resource Management Plan, Heritage Resource Activities, section HSS1B, the preferred management of sites listed in, nominated to, or eligible for the NRHP is avoidance and protection. All of the sites previously recorded within the APE of the project and the sites found during the survey for the project will be fully avoided. As per the Programmatic Agreement, while there are historic properties present in the APE, the project would have no effect upon them as defined at 36 CFR 800.16(i).

The imposition of a 1,000-foot coastal buffer aids in the avoidance of heritage properties because it removes the majority of the harvest and road construction activities from most of the areas with the highest potential for the occurrence of heritage sites. Planned harvest units are, for the most part in low-sensitivity areas for heritage resources.

Direct and Indirect Effects (All Alternatives)

Alternative 1, Direct and Indirect Effects

Alternative 1, the No-action Alternative, would result in no changes to the existing condition. Recreation and subsistence uses associated with modern lake and marine shorelines, as well as activities associated with existing roads facilitate access to locales of high sensitivity for heritage resources. Alternative 1 would not change that situation.

Alternatives 2, 3, 4 and 5, Direct and Indirect Effects

Based on the results of the archaeological examination of the APE for the undertaking, Alternatives 2 through 5 contain no proposed harvest units or roads that would have a direct and significant effect on extant historic properties. All historic properties found during the field investigation or prior to investigation were used to modify the project to totally avoid project effects. For heritage purposes, the effects of the alternatives are No Historic Properties Affected. For Alternatives 2, 3, 4, and 5, there would be no direct effects.

Harvest and road construction would not significantly increase access and visitation to areas of high sensitivity for heritage resources. All proposed roads would be decommissioned or put into storage after harvest activities are complete. No indirect effects are anticipated from these alternatives.

Cumulative Effects (All Alternatives)

Cumulative effects of the Big Thorne project are considered minimal in all alternatives. The majority of the harvest and road construction activities are in areas not considered high potential for heritage resources or near known historic properties. Project activities are not considered to contribute significantly to the degradation of historic properties in the project area. This will be confirmed or refuted by the monitoring activities conducted during the implementation of the project and after it has concluded.

Tribal Consultation

Consultations have been and continue to be conducted with the tribal governments and Native corporations of Craig, Klawock, Hydaburg, and Kasaan. The details of the project have been offered to all of the tribes on the island yearly at the Prince of Wales Forest

Service Tribal Consultation Meeting beginning in 2009. No concerns have been forwarded to the Forest Service from the associated tribes relative to the project.

The Heritage Resource Report (R2009100554008) will be sent for review and consultation to the Alaska State Historic Preservation Officer. As per the Programmatic Agreement if there are historic properties present but the undertaking will have no effect upon them as defined at 36 CFR 800.16(i), then the Heritage Specialist may make a determination of "No Historic Properties Affected" and the Forest may proceed with the undertaking in lieu of a consensus determination of eligibility pursuant to 36 CFR 800.4. 36 CFR 800.16(1) states that "effect" means alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register. Since all the known historic properties have been removed from the APE for this undertaking and will be fully avoided, the characteristics of the historic properties eligible to the NRHP will not be impacted.

NHPA Section 106 Compliance

In previous years heritage resource surveys of various intensities were conducted in the project APE. For this undertaking over 2,300 acres of applicable areas of the APE had archaeological investigations according to the guidance provided in the Programmatic Agreement. A finding of "no historic properties affected" was recommended for all alternatives for the Big Thorne project. Under the terms of the existing Programmatic Agreement, the Forest will proceed with the project in lieu of a consensus determination of eligibility pursuant to 36 CFR 800.4.

Socioeconomics

Affected Environment

The primary social and economic area of influence for the Big Thorne project includes those communities located in close proximity to the project area (within 12 miles) whose residents use the project area for subsistence, recreation, and other activities. It also includes communities with economic activities that could be affected by the proposed project, primarily wood products operations that could use the timber from the project area. The communities that fall into one or more of these categories are Thorne Bay, Coffman Cove, Klawock, Craig, Hollis, Kasaan, and Naukati Bay. Profiles are presented for each of these communities in the Community Profiles section, at the beginning of this chapter.

The following sections address demographic characteristics and trends, economic conditions, and non-market values. The discussion and analysis presented in these sections tiers to the detailed socioeconomic information and analysis presented in Chapter 3 of the 2008 Forest Plan EIS (USDA Forest Service 2008).

Demographic Characteristics and Trends

Population Trends

Southeast Alaska had an estimated population of 71,664 in 2010, with slightly more than two-thirds (67 percent) of that total concentrated in three cities: Juneau, Ketchikan, and Sitka (Alaska Department of Labor 2011). The remaining population is distributed throughout the region in more than 30 small communities, most with populations of less than 1,000 residents. Wrangell, Petersburg, and Ketchikan are the closest of the larger population centers to the project area.

The Big Thorne project area is located on Prince of Wales Island and is part of the Prince of Wales-Hyder CA.[1] The Prince of Wales-Hyder CA consists of Prince of Wales Island and the communities of Metlakatla and Hyder, and encompasses approximately 3,900 square miles, with an average population density of 1.4 persons per square mile (U.S. Census Bureau 2011a). In 2010, total population in the Prince of Wales-Hyder CA was 5,559, with 4,012 or 72 percent of this total residing on Prince of Wales Island (Table SOC-1). Total population in the communities located in or near the project area ranged from 49 in Kasaan to 1,201 in Craig (Table SOC-1). Thorne Bay had a total population of 471 in 2010.

Total population increased by 13 percent in Alaska over the past decade (2000 to 2010), with much of this increase due to natural increase (more births than deaths in the existing population). The state also saw small gains in population through net in-migration (more people moving to the area than leaving) (Alaska DOL 2010). Population in Southeast Alaska decreased by about 2 percent between 2000 and 2010; population grew through

[1] In 2010, Southeast Alaska was divided into seven boroughs and three census areas. The seven boroughs correspond with the county governments found elsewhere in the United States. The remaining unorganized area was allocated to three CAs: Hoonah-Angoon, Petersburg, and Prince of Wales-Hyder. CAs are statistical units that are generally recognized as county equivalents from a data reporting standpoint.

natural increase (6 percent), but these gains were outweighed by the number of people leaving the region (8 percent) (Alaska DOL 2010).

Table SOC-1. Population, 2000 and 2010

Geographic Area/Community[1/]	2000	2010	Absolute Change	Percent Change
Coffman Cove	199	176	-23	-12%
Craig	1,397	1,201	-196	-14%
Hollis CDP	139	112	-27	-19%
Kasaan	39	49	10	26%
Klawock	854	755	-99	-12%
Naukati Bay CDP	135	113	-22	-16%
Thorne Bay	557	471	-86	-15%
Prince of Wales Census Subarea[2/]	**4,581**	**4,012**	**-569**	**-12%**
Prince of Wales-Hyder CA[3/]	6,146	5,559	-587	-10%
Southeast Alaska	**73,082**	**71,664**	**-1,418**	**-2%**
Alaska	626,932	710,231	83,299	13%

Notes:
CA – Census Area
CDP – Census Designated Place
1/ CDPs are unincorporated communities identified by the Census for statistical purposes. Two of the seven communities within 12 miles of the project area—Hollis and Naukati Bay—are designated CDPs. The other five—Coffman Cove, Craig, Kasaan, Klawock and Thorne Bay—are incorporated cities.
2/ Prince of Wales Census Subarea consists of Prince of Wales Island.
3/ The Prince of Wales-Hyder CA includes Prince of Wales Island, Metlakatla, and Hyder. Data for 2000 are for the Prince of Wales-Outer Ketchikan CA. Parts of this area were annexed in May 2008 by the Ketchikan Gateway Borough and the newly formed Wrangell City and Borough.
Sources: Alaska DOL 2009; U.S. Census Bureau 2000, 2011a

Prince of Wales Island experienced a larger relative decrease in population than the region as a whole, with 569 fewer people recorded in the 2010 Census than a decade earlier, a decrease of 12 percent (Table SOC-1). A similar decrease was recorded in the Prince of Wales-Hyder CA, with total population dropping by 10 percent. However, population increased by a total of 440 between 2007 and 2011, which a recent article in Alaska Economic Trends suggests may be an indication that the local economy is stabilizing (Abrahamson 2012; 11).

This decrease in population between 2000 and 2010 was evident in all the communities in or near the project area, with the exception of Kasaan. Reductions in population in these communities ranged from about 12 percent (Coffman Cove and Klawock) to 19 percent (Hollis) (Table SOC-1). The largest absolute decrease occurred in Craig, the largest community on the island, which experienced a net decrease of 196 residents (14 percent). There were 86 fewer residents in Thorne Bay in 2010 than in 2000, a 15 percent reduction.

Population projections developed by the State of Alaska anticipate continued population growth statewide, but expect population to continue to decline in the boroughs and CAs in Southeast Alaska, including Prince of Wales-Hyder (Mercer 2010). Southeast Alaska is the only regional population in Alaska expected to decline over the forecast period (2009 to 2034). This decrease is projected because low birth rates and the highest median age in the state mean that a sharp rise in net in-migration would be required for growth to occur in the future (Mercer 2010).

Race and Ethnicity

The majority of the population in Alaska, almost two-thirds, identified as White in the 2010 Census. Alaska Natives were the largest minority group, accounting for 14 percent of the total population (Table SOC-2). The share of total population that identified as White in Southeast Alaska (65 percent) and on Prince of Wales Island (63 percent) was very similar to the State overall (64 percent), but Alaska Natives accounted for a larger share of the total population on Prince of Wales Island (24 percent versus 14 percent, statewide) (Table SOC-2).

The percentage of the population in nearby communities identifying as Alaska Native in 2010 ranged from less than 10 percent in Coffman Cove, Hollis, Naukati Bay, and Thorne Bay, to 35 percent in Kasaan and 48 percent in Klawock, both of which are home to Federally recognized tribes. Craig also had a relatively high concentration of Alaska Native residents, with 232 people or 19 percent of the population identifying as Alaska Native in 2010 (SOC-2). These data are discussed in the Environmental Justice section below.

Table SOC-2. Race and Ethnicity 2010

Geographic Area/Community[1/]	Total Population	Percent of Total Population			
		White[2/]	American Indian and Alaska Native[2/]	Other Race[2/3/]	Two or More Races[2/]
Coffman Cove city	176	93	4	1	2
Craig city	1,201	64	19	5	12
Hollis CDP	112	88	4	3	4
Kasaan city	49	53	35	2	10
Klawock city	755	37	48	4	11
Naukati Bay CDP	113	88	6	1	5
Thorne Bay city	471	91	2	3	4
Prince of Wales Census Subarea	**4,012**	**63**	**24**	**4**	**9**
Prince of Wales-Hyder CA	5,559	50	39	3	8
Southeast Alaska	**71,664**	**65**	**16**	**10**	**8**
Alaska	710,231	64	14	15	6

Notes:
1/ See footnotes to Table SOC-1.
2/ Non-Hispanic only. The Federal Government considers race and Hispanic/Latino origin (ethnicity) to be two separate and distinct concepts. People identifying as Hispanic or Latino origin may be of any race. In this table people identifying as Hispanic or Latino are included in the Other Race category only.
3/ The "Other Race" category presented here includes census respondents identifying as Hispanic or Latino, Black or African American, Asian, Native Hawaiian and Other Pacific Islander, or Some Other Race.
Source: U.S. Census Bureau 2011a

Economic Conditions

This section provides an overview of local employment and income for Southeast Alaska and more specifically Prince of Wales Island, where the impacts of the Big Thorne project are most likely to be experienced. The following subsections focus on those economic sectors—forest products, commercial fishing, and recreation and tourism—that could be affected by the project.

Direct employment in natural resource-based industries accounted for an estimated 26 percent of total employment in Southeast Alaska in 2004 (USDA Forest Service 2008). This total includes estimated wood products, mining, recreation and tourism, salmon harvesting, and seafood processing employment, but underestimates the importance of resource-based employment to the region because it does not include the share of government employment that is resource-based. Overall, the government sector accounted for 38 percent of covered employment in Southeast Alaska in 2010 (Alaska DOL 2011b).

A total of 1,943 non-agricultural wage and salary (NAWS) jobs were identified in the Prince of Wales-Hyder CA in 2010, with a total combined payroll of $67.3 million (Table SOC-3). These data are compiled from unemployment insurance coverage data and do not include self-employed workers. The government sector dominates the Prince of Wales-Hyder CA economy, accounting for 49 percent of total NAWS employment and 54 percent of total annual earnings (Table SOC-3). These totals include federal, state, and local jobs, with most of this employment concentrated in local government sector, which accounted for 42 percent of annual employment and wages in 2010 (Table SOC-3). The private sector (identified as Private Ownership in Table SOC-3) accounted for 51 percent and 46 percent of total employment and income, respectively, with the highest concentration of total employment (12 percent) in the Retail Trade sector (Table SOC-3).

Table SOC-3. Annual Employment and Earnings in the Prince of Wales-Hyder CA, 2010[1/]

Economic Sector	Annual Average Employment		Annual Earnings		Average Monthly Earnings ($)
	Number of Jobs	Percent of Total	Millions of Dollars	Percent of Total	
Natural Resources and Mining	81	4	3.4	5	3,490
--Forestry and Logging[2/]	59	3	2.7	4	3,776
Construction	67	3	2.8	4	3,503
Manufacturing	116	6	2.9	4	2,102
Trade/Transportation/Utilities	340	17	9.6	14	2,341
--Retail Trade[3/]	226	12	4.7	7	1,726
Information	10	1	0.3	1	2,820
Financial Activities	84	4	3.5	5	3,491
Professional & Business Services	41	2	1.5	2	3,102
Educational & Health Services	80	4	3.4	5	3,494
Leisure & Hospitality	130	7	2.9	4	1,869
Other Services	38	2	0.4	1	1,420
Total Private Ownership	**987**	**51**	**30.7**	**46**	**2,594**
Federal Government	112	6	6.4	10	4,782
State Government	36	2	1.9	3	4,333
Local Government	808	42	28.3	42	2,923
Total Government	**956**	**49**	**36.6**	**54**	**3,193**
Overall Total	**1,943**	**100**	**67.3**	**100**	**2,889**

Note:
1/ These data are compiled from unemployment insurance coverage data and exclude self-employed workers because they are not covered by unemployment insurance. Occupations with relatively high shares of self-employment include the fish harvesting and construction sectors.
2/ Forestry and Logging is part of the Natural Resources and Mining sector.
3/ Retail Trade is part of the Trade/Transportation/Utilities sector.
Source: Alaska DOL 2011c

The seasonally unadjusted unemployment rate in Alaska was lower than the national average in September 2011, 6.7 percent versus 8.8 percent. The corresponding rate for Southeast Alaska was 5.8 percent, lower than the state and national averages. The unemployment rate in Prince of Wales-Hyder CA was more than twice the regional average, 12.9 percent versus 5.8 percent, and the highest in the boroughs and CAs that comprise Southeast Alaska (Alaska DOL 2011d).

An estimated 9.1 percent of the population was below the poverty line in Alaska in 2009. In Southeast Alaska, the percent of the population in boroughs/CAs below the poverty line ranged from just 4 percent in the Skagway Municipality to 17.2 percent in the Hoonah-Angoon CA. The Prince of Wales-Hyder CA had the second highest poverty rate in the region, with 15.4 percent below the poverty line in 2009 (U.S. Census Bureau 2011b).

Median household income in Alaska was $66,712 in 2009. Median household incomes in Southeast Alaska boroughs/CAs ranged from 63 percent of the State median in the Hoonah-Angoon CA to 109 percent of the State median in Juneau. The Prince of Wales-Hyder CA had the second lowest median household income in the region, equivalent to 65 percent of the State median (U.S. Census Bureau 2011b).

Forest Products Industry

The forest products industry, the natural resource-related economic sector that would be directly affected by the action alternatives proposed for this project, is discussed in the Issue 1: Timber Supply and Timber Sale Economics section of this EIS. As discussed in that section, regional employment in the forest products sector peaked at the end of the 1980s, dropped sharply in the 1990s, and has continued to decline over the past decade. This has also been the case locally on Prince of Wales Island. Forestry and logging and sawmill jobs accounted for 6 percent of total employment in the Prince of Wales-Hyder CA in 2010, down from 15 percent of total jobs in 2000. Viking Lumber remains one of the Prince of Wales-Hyder's largest private employers, with an estimated workforce of 32 full-time equivalent employees in 2010, (Abrahamson 2012, Alexander and Parrent 2012). In addition, data compiled by the Forest Service and the State of Alaska identified 25 mills and timber operators on the island (including the eight noted above) and a review of the Alaska Department of Commerce's business license database identified an additional 19 forestry-related businesses (ADCCED 2012, Alexander and Parrent 2012, Peterson 2012, USDA Forest Service 2012).

Commercial Fishing

The commercial fishing industry is a significant part of Alaska's economy, and this is also the case for Southeast Alaska. Seafood processing employed 1,450 people in Southeast Alaska in 2010, with an estimated 9,182 people in Southeast Alaska employed in fish harvesting (Alaska DOL 2011b; Warren and Kreiger 2011). This combined total (10,632 jobs) was equivalent to about 30 percent of total covered employment in Southeast Alaska in 2010.[2]

[2] Total covered employment estimates prepared by the Alaska DOL do not include the majority of fish harvesting jobs because most of these jobs are exempt from state unemployment insurance laws.

Commercial fishing is an important part of the economy on Prince of Wales Island. Salmon, halibut, herring, and shellfish are all harvested in waters surrounding the island. Much of this harvest is taken by off-island fishers and processed in Ketchikan, Wrangell, and Petersburg, but processing also takes place in Craig. An estimated 564 residents on Prince of Wales Island were employed in fish harvesting in 2000 (Gilbertson and Robinson 2001). In 2010, 224 residents in the seven communities within 12 miles of the project area (Thorne Bay, Coffman Cove, Klawock, Craig, Hollis, Kasaan, and Naukati Bay) held commercial fishing permits, including 151 residents in Craig, 44 residents in Klawock, and 20 residents in Thorne Bay. In addition, 159 residents in these communities held crew member licenses in 2010, including 107 residents in Craig, 29 residents in Klawock, and 18 residents in Thorne Bay (Alaska Commercial Fisheries Entry Commission 2011). Alaska Fish and Game reported that Prince of Wales-Hyder harvested 19.6 million pounds of fish in 2011, including 15.4 million pounds of salmon, resulting in earnings of $15.9 million (Abrahamson 2012),

Recreation and Tourism

Recreation and tourism on Prince of Wales Island is discussed above in the Recreation section. As discussed in that section, recent estimates of visitors to Prince of Wales Island indicated that 15,000 out-of-state residents visited Prince of Wales Island in summer 2006, and an estimated 12,326 visitors participated in nature-based tourism on Prince of Wales Island in 2007 (McDowell Group 2007; Dugan et al. 2009). The nature-based tourism study estimated that these visitors brought in more than $30 million to Prince of Wales Island in gross revenues, with most of this revenue related to sport fishing (Dugan et al. 2009). Fishing lodges and sport fish charter operators are located in Craig, Klawock, Thorne Bay, and Coffman Cove, as well as in more remote locations around the island. Recreation and Tourism are discussed in more detail in the Recreation section, above, and the Socioeconomics Resource Report prepared for this project (Dadswell 2012).

Ecosystem Services

Ecosystem services are the products of functioning ecosystems that often are available without direct costs to people who benefit from them (Kline 2006). These services have been described in a number of different ways including the typology developed by the Millennium Ecosystem Assessment (2005), which is featured on the Forest Service's Ecosystem Services web site (http://www.fs.fed.us/ecosystemservices/) and identifies four general categories of ecosystem services: provisioning, regulating, cultural, and supporting. Provisioning services include wild food, fresh water, and fiber. Regulating services are the benefits obtained from ecosystem impacts on natural processes, such as air quality, climate stabilization, water quality, and erosion. Cultural services include recreation, aesthetic, educational, and spiritual and religious benefits. Supporting services are the underlying processes that maintain the conditions for life on Earth, such as nutrient cycling and soil formation (Smith et al. 2011).

The concept of ecosystem services has emerged as a way of framing and describing the comprehensive set of benefits that people receive from nature. The Forest Service has been exploring use of these concepts to describe the benefits provided by forests, but the ecosystem service approach has not been applied operationally in a management context.

The Forest Service's Pacific Northwest Research Station issued a technical report that attempts to define an economics research program to describe and evaluate ecosystem services (Kline 2006). More recently, the Pacific Northwest Research Station and the Deschutes National Forest have partnered to develop a place-based application to explore how this type of approach might be implemented by a national forest to enhance forest stewardship. Ecosystem services are discussed at the forest planning level for the Tongass National Forest in the 2008 Forest Plan EIS (USDA Forest Service 2008, p. 3-544 to 3-556).

Environmental Consequences

The analysis area for direct, indirect, and cumulative effects to the socioeconomic resources addressed in this section varies by resource. Effects to the timber industry are assessed in terms of employment and income at the regional scale (i.e., Southeast Alaska). where effects are expected to occur. Effects to the commercial fishing and recreation and tourism sectors are assessed in terms of the analysis areas assessed for those resources. Ecosystem services are assessed by resource throughout this EIS, with analysis areas established for each resource.

Economic Conditions

Forest Products Industry

Potential impacts related to the forest products industry are discussed in the Issue 1: Timber Supply and Timber Sale Economics section, which summarizes impacts in terms of direct employment in logging and processing.

Commercial Fishing

Potential impacts to fish habitat are assessed in the Fisheries section of this EIS. Implementation of the applicable Forest Plan standards and guidelines and best management practices would mitigate potential impacts to fisheries. As a result, none of the action alternatives are expected to have measurable effects on fish habitat and are, therefore, unlikely to affect the commercial fishing or fish processing sectors. Potential impacts to commercial fishing and fish processing from timber harvest at the forest planning level are discussed in the 2008 Forest Plan EIS (USDA Forest Service 2008).

Recreation and Tourism

A recent study estimated that nature-based tourism brought in more than $30 million to Prince of Wales Island in gross revenues in 2007, with most of this revenue related to sport fishing (Dugan et al. 2009). The majority of sport fish visitors focus on saltwater fishing, which accounts for most of the nature-based tourism revenue generated on the island. As noted with respect to commercial fishing, the fisheries analysis prepared for this project found that none of the alternatives are expected to have measurable effects on fish habitat and are, therefore, unlikely to affect businesses that focus on saltwater sport fishing.

Although none of the action alternatives are expected to have measurable effects on fish habitat, road building and timber harvest activities could affect access to freshwater fishing outfitter-guide locations in the project area, as well as the quality of the recreation

experience of outfitter-guide clients in these areas. These impacts would be localized and temporary. None of the proposed alternatives are expected to result in long-term impacts to the ability of outfitter/guides to use these areas, but may temporarily displace some use.

Bear hunting is popular on Prince of Wales Island, with guided black bear hunting and drop-off and transporter services available (Dugan et al. 2009). However, the majority (80 percent) of guided hunts on the island are conducted by motorized boat in shoreline areas, with just 12 hunting location days recorded in the Big Thorne project area between 2004 and 2008 (USDA Forest Service 2010). Potential impacts to black bears are evaluated in the Issue 2: Wildlife and Subsistence Use section, which assumes that black bears would primarily be impacted by new road construction and reconstruction, with new and improved roads expected to improve hunter access and potentially result in over harvesting. There are a number of access restrictions on black bear hunting within the project area, as determined by ADF&G. However, none of the alternatives are expected to affect businesses that offer guided black bear hunting and related services.

Potential impacts to recreation and tourism from timber harvest at the forest planning level are discussed in the 2008 Forest Plan EIS (USDA Forest Service 2008).

Ecosystem Services

Ecosystem services are those services and benefits provided by healthy ecosystems. Under the 2008 Forest Plan, timber management activities are governed by a large number of rules and regulations designed to protect or mitigate negative impacts to natural resources that provide ecosystem services. This is discussed further in the 2008 Forest Plan EIS (USDA Forest Service 2008, p. 3-553 to 3-556). As noted in the Issue 1: Timber Supply and Timber Sale Economics section, the financial efficiency analysis prepared for this project in accordance with FSH 2409.18 does not account for non-market benefits or other values, benefits, and costs that are not easily quantifiable. This is not to imply that such values are not significant or important, but to recognize that non-market values are difficult to represent by appropriate dollar figures. Although the Forest Service has been exploring use of ecosystem services concepts to describe the benefits provided by forests, this type of approach has not been applied operationally in a management context (Kline 2006; Smith et al. 2011).

The effects of the action alternatives on these types of services are assessed in the sections of this EIS that address watersheds, fisheries, soils, wildlife and subsistence use, heritage resources, and timber and vegetation, among others. Monetary values are not assigned to these services, but this does not lessen their importance in the decision making process. Decision-makers will consider the economic values presented in the Issue 1: Timber Supply and Timber Sale Economics section within the context of the information presented elsewhere in this document, much of which cannot readily be translated into economic terms.

Direct and Indirect Effects

Alternative 1 – No Action

There would be no proposed Big Thorne project under the no action alternative and the project would not meet the Purpose and Need, which is to contribute to a long-term supply

of economic timber industry on Prince of Wales Island and on the Tongass National Forest in general (including both large and small operators). As discussed in the Issue 1: Timber Supply and Timber Sale Economics section, the provision of a long-term stable and economic timber supply is intended to support local operators and encourage investment in the wood products industry as it transitions to second growth harvesting and restoration activities. Long term in this context is defined as approximately 10 years (see the project Purpose and Need statement).

Current utilization rates at the mills included in the 2010 mill survey are low, with just 13.9 percent of existing active capacity utilized in 2010 (Alexander and Parrent 2012). In the absence of a long-term (i.e., multiple year) stable supply of economic timber from the Big Thorne project or elsewhere, the future viability of existing mill operators could be adversely affected. Closure of one or more of the existing mills would result in a further reduction in jobs in the logging and sawmilling industries and could also affect local businesses that provide goods and services to these industries.

The absence of a long-term supply of economic timber could also adversely affect future investment and the potential for increased wood products employment in the future, as well as the anticipated transition of the wood products industry to second growth harvesting and restoration activities.

There would be no timber harvest or road construction/reconstruction under this alternative and no impacts to the commercial fishing or recreation and tourism industries on Prince of Wales Island or elsewhere in the region.

Alternatives 2, 3, 4, and 5

The Issue 1: Timber Supply and Timber Sale Economics section includes an assessment of potential impacts in terms of direct logging and sawmill/export employment that would be supported by the projected harvest volumes under each alternative. This analysis is based on average job/MMBF ratios developed using harvest and employment data from 2007 to 2010 and assumes that all the units and volume identified for each alternative would be harvested over time. The resulting estimates are approximate numbers that allow a comparison of alternatives. Total estimated direct employment ranges from 391 to 455 jobs under Alternative 4 to 792 to 915 jobs under Alternative 3, reflecting the relative volumes that would be made available under each alternative (see Table TSE-13 in the Issue 1: Timber Supply and Timber Sale Economics section). Direct employment is presented as a range for each alternative to account for the effect of the limited interstate shipment policy and export, which allows the purchaser to ship up to 50 percent of the total sale volume out of state in whole log form. This is discussed further in the Issue 1: Timber Supply and Timber Sale Economics section. The Big Thorne project would also support indirect jobs elsewhere in the region.

The potential impact to nearby communities with processing facilities that may utilize the timber will depend on many elements associated with the competitiveness and efficiency of individual operations. Such factors are dependent upon private business decisions, as well as market conditions for forest products. The Forest Service cannot predict which firms will successfully bid for a timber sale, and thus potential jobs and incomes are estimated at a regional scale, not for individual communities.

Nature-based tourism on Prince of Wales Island is mainly related to saltwater fishing. Saltwater fishing-related recreation and tourism is not expected to be affected under the action alternatives. The action alternatives would all have short-term impacts on recreation and outfitter-guide use in the project area, but these impacts are not expected to have long-term impacts (i.e., impacts that extend beyond the duration of localized project activities) on the ability of outfitter-guides to use currently permitted locations. Potential impacts to ecosystem services other than timber are not addressed in monetary terms, but are discussed in the other resource-specific sections of this EIS.

Cumulative Effects

Alternative 1 – No Action

Under Alternative 1, there would be no timber made available under the Big Thorne project and timber operators on Prince of Wales Island and elsewhere in Southeast Alaska would not be able to bid on future timber offerings under this project. Timber projects listed in Appendix D, Part II and discussed above in the Issue 1: Timber Supply and Timber Sale Economics section would also contribute to the timber supply. As discussed above, in the absence of this project and other sources of long-term (multiple-year) economic timber, the future viability of existing operators in Southeast Alaska could be adversely affected. Closure of one or more mills would result in a further reduction in jobs in the logging and sawmilling industries and could also affect local businesses that provide goods and services to these industries. Further, the absence of a multiple-year timber supply could adversely affect the anticipated transition of the wood products industry to young growth harvesting and restoration activities

Alternatives 2, 3, 4, and 5

Past timber sales have contributed to the development of the existing road system in the Big Thorne project area that would be used under this alternative. Timber harvest under this alternative would contribute to meeting projected market demand for timber in Southeast Alaska and support logging and sawmill or export jobs. The other reasonably foreseeable projects identified that involve timber harvest would also help meet this demand and support logging and sawmill or export jobs. Other reasonably foreseeable projects would also support jobs and income in the vicinity of the project area.

Short-term cumulative impacts to recreation and outfitter-guide use could occur if one or more of the reasonably foreseeable projects were to coincide in time and space with the project. This could result in additional temporary disruptions to recreation use and could affect the quality of the recreation experience in localized areas. These types of impacts would be limited to the duration of road building and harvest activities in a particular location. The reasonably foreseeable Prince of Wales Outfitter/Guide Management EA would allocate commercial recreational use on Prince of Wales Island. None of the alternatives are expected to affect the implementation or outcome of this project.

Environmental Justice

Background and Affected Environment

Environmental justice refers to the fair treatment of people of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The CEQ's Environmental Justice: Guidance under the National Environmental Policy Act (CEQ 1997) indicates that environmental justice concerns may arise from impacts on the natural or physical environment, such as human health or ecological impacts on minority and low-income populations, or from related social or economic impacts.

The Big Thorne project is a federal action that has potential environmental effects. The following environmental justice assessment considers whether there is a disproportionately high and adverse effect from any of the alternatives on low-income and minority populations in communities near the project area, and tiers to the analyses presented in the Wildlife and Subsistence, Fisheries, and Heritage Resource Reports prepared for this project (Woeck 2012; Knutzen 2012; Marshall 2012).

The guidelines provided by the CEQ (1997) and similar direction provided by the EPA (1998) indicate that a minority community may be defined where either 1) the minority population comprises more than 50 percent of the total population, or 2) the minority population of the affected area is meaningfully greater than the minority population in the general population of an appropriate benchmark region used for comparison. Minority communities may consist of a group of individuals living in geographic proximity to one another, or a geographically dispersed set of individuals who experience common conditions of environmental effect.

Race and ethnicity is discussed by community in the Socioeconomics section of this document. Minority communities in the vicinity of the project area include Kasaan and Klawock, both of which are home to federally recognized tribes. Thorne Bay, the only community located in the project area, is predominantly White, with 91 percent of the population identifying as White in the 2010 Census (see Table SOC-2).

The CEQ guidance clarified that such analyses should recognize the interrelationships between cultural, social, occupational, historical, and economic factors that may amplify the environmental impacts. For example, subsistence in Alaska Native communities is not only important economically, it is also important for reasons of tradition and culture; consequently, impacts on subsistence resource use also impact the social and cultural lives of residents. The CEQ guidance clarified that the identification of disproportionate effects does not preclude the agency from going forward with the proposed action, but should heighten attention to project alternatives, mitigation and monitoring needs, and the preferences of the affected communities (CEQ 1997, p. 10).

Environmental Consequences

Direct, Indirect, and Cumulative Effects

Timber harvest has the potential to affect subsistence use in the project area, which could disproportionately affect Alaska Native subsistence users. Potential impacts to

subsistence resources are discussed in detail in the section of this document that evaluates Issue 2: Wildlife and Subsistence Use. As discussed in that section, none of the alternatives are expected to affect subsistence use of fish and marine invertebrates, plants, or timber and firewood for personal use.

Impacts to the wildlife component of subsistence food resources are addressed in terms of potential impacts to Sitka black-tailed deer, the largest component of wildlife subsistence resources in the project area. The action alternatives would all result in a reduction in deer habitat capability, with the largest reduction occurring under Alternative 3. The Issue 3: Wildlife and Subsistence Use analysis found that under all action alternatives, reductions in deer habitat capability due to the Big Thorne project in combination with past, present, and reasonably foreseeable actions would further reduce the ability of WAAs 1315 and 1420 to sustain current harvest levels.

These potential reductions could result in changes to consumption patterns of resource use in the project area, but none of the alternatives are expected to have a disproportionately high and adverse effect on the health or well-being of the minority or low-income populations that use the project area. Any changes in consumption patterns and wild food resources, as well as other project effects, would be equally applicable to the general population.

Other Environmental Considerations

Relationship between Short-term Uses and Long-term Productivity

The intensity and duration of the effects described in this EIS depend on the alternative and the mitigation measures applied to protect the resources. Most unavoidable effects are expected to be short-term. Short-term effects usually last less than 2 to 5 years. Effects would be managed to comply with established legal limits in all cases, such as maximum time for regeneration. Monitoring procedures and mitigation measures have been planned for those areas that may be affected to reduce these effects. Specific mitigation measures are documented in the unit and road cards (Appendices B and C of the Draft EIS; if a decision is made to harvest, mitigation measures for harvest units and roads will be listed in the ROD).

Some localized adverse effects may occur on a recurring, though temporary, basis. Effects such as road construction, timber harvest, timber hauling, recreation traffic on untreated roads, and the operation of internal combustion engines may cause temporary adverse effects to air quality.

All alternatives would come under the mandate of the Multiple Use and Sustained Yield Act of 1960. This act requires the Forest Service to manage NFS lands for multiple uses including timber, recreation, fish and wildlife, range, and watershed. All renewable resources are to be managed in such a way that they are available for future generations. The harvesting and use of standing timber can be considered a short-term use of a renewable resource. Trees can be reestablished and grown again as a renewable resource if the productivity of the land is not impaired.

Maintaining the productivity of the land is a complex, long-term objective. All alternatives protect the long-term productivity of the project area through the use of specific standards and guidelines, mitigation measures, and BMPs. Long-term productivity could change as a result of various management activities proposed in the alternatives. Timber management activities would have direct, indirect, and cumulative effects on the economic, social, and biological environment.

Soil and water are two key factors in ecosystem productivity, and these resources would be protected in all alternatives to avoid damage that could take many decades to rectify. Sustained yield of timber, wildlife habitat, and other renewable resources all rely on maintaining long-term soil productivity. Quality and quantity of water from the project area may fluctuate as a result of short-term uses, but no long-term effects to the water resource are expected to occur as a result of timber management activities.

Timber harvest is a short-term use of wetland resources. Harvest activities are expected to slightly alter the hydrology of harvested wetlands for several years after harvest. Soil moisture levels are expected to rise slightly following harvest due to the loss of canopy interception. Soil moisture levels are anticipated to return to near pre-harvest levels as young-growth establishes and provides canopy cover across the site.

Irreversible and Irretrievable Commitments of Resources

"Irreversible commitments" is a term that describes the loss of future options. It applies primarily to the effects of the use of non-renewable resources, such as minerals or cultural resources, or to those factors such as soil productivity that are only renewable over long periods of time.

Loss of soil due to erosion and mass failures is an irreversible commitment of resources. The loss of soil resources has been minimized to the extent feasible in all action alternatives by following Region 10 Soil Quality Standards, incorporating BMPs and applying mitigation measures specified in this document.

Road construction is an irreversible action because of the time it takes for a constructed road to revert to natural conditions. Irreversible actions also include the associated rock quarries which are developed in conjunction with these roads.

Soils and wetlands displaced by road construction activities are irreversible commitments of project resources, due to the long-term loss of soil productivity. It is irreversible because the soils and wetland resources have deteriorated to the point that renewal can occur only over a long period of time or at a great expense, or because the wetland soils have been destroyed or removed. In road construction, wetland soils are either scraped away or are buried beneath road fill, greatly limiting their pre-disturbance productivity.

Loss of heritage resource sites resulting from accidental damage or vandalism would be an irreversible commitment of resources. Standards and guidelines, survey methodology prior to activities, and mitigation measures specified in this document provide reasonable assurance that no irreversible loss of heritage resources would occur.

"Irretrievable commitments" is a term that applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume timber production.

Old-growth forest structure converted to even-aged forest structure by timber harvest can be considered an irretrievable commitment of the old-growth structure, especially if the land is continually managed for optimum timber production. It is not expected that old-growth characteristics would naturally reoccur within harvest areas for 150 years or more; however, old-growth forest structure would eventually return to the landscape. However, foregoing timber harvest opportunities at this time in certain areas, due to resource concerns or economics, may represent an irretrievable commitment of resources because that volume cannot be harvested. The commitment is irretrievable rather than irreversible because future entries could harvest those areas if they are still classified as part of the suitable timber base.

The reduction in the visual quality of an area due to timber harvesting would be an irretrievable commitment of resources. The commitment is irretrievable because viewsheds will typically heal from a visual quality standpoint after about 40 years. Second-growth trees will have the color and height needed so as not to be evident to the casual observer after this time.

Unavoidable Adverse Environmental Effects

Implementation of any of the action alternative would result in some adverse environmental effects that cannot be effectively mitigated or avoided if the proposed action or alternatives are implemented. The interdisciplinary procedure used to identify specific harvest units and roads was designed to eliminate or reduce significant adverse consequences. In addition, the application of Forest Plan standards and guidelines, BMPs, mitigation measures, and a monitoring plan are intended to further limit the extent, severity, and duration of these effects. The specific environmental effects of the alternatives were discussed earlier in this chapter, and mitigation measures are discussed in Chapter 2. Formulation of alternatives includes the avoidance of potentially adverse environmental effects; however, some adverse impacts to the environment that cannot be completely mitigated would occur.