CLARK COUNTY
FOREST STEWARDSHIP PLAN

WOOD WATER RECREATION WILDLIFE
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AMERICAN TREE FARM SYSTEM

CLARK COUNTY, WASHINGTON

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CLARK COUNTY
FOREST STEWARDSHIP PLAN

Clark County Master Plan

Forest Name:	Clark County
# Of Acres Plan Covers:	4,506
Forest Certification #:	SA-FM/COC-1394CC
Plan Prepared By:	Hunter Decker
Date Plan Prepared:	October, 2017
County & State:	Clark County, Washington

Previous Forest Management Plans

Plan Name	Date	Certification#	Authors
Camp Bonneville 1	June, 1967		Lester D. Hansen
Camp Bonneville 1 Rev.	June, 1973		Lester D. Hansen
Camp Bonneville 2	1998		Jim Vandling
Camp Bonneville 2 Rev.	2007		Jim Vandling
Camp Bonneville 3	November, 2011	WA-4455	Kirk Hanson & Jim Vandling
Camp Hope	December, 2012	WA-4482	Jim Vandling
Green Mountain	September, 2014		Kirk Hanson & Jim Vandling

Master Plan Revision Dates

Plan Revised	Monitoring Data Incorporated

THIS PLAN IS DEDICATED TO JIM VANDLING FOR HIS DEVOTION AND NEVER ENDING LOVE OF FORESTRY

James Ellis "Jim" Vandling passed away at his home in Battle Ground on April 6th, 2017. He was 64.

Jim was born January 13, 1953 in Syracuse, NY to Patricia and John Vandling. He married Jamie Patrice Gaul in 1973 and had 2 daughters. The couple later divorced. In 2003, he married Julie (Reagan) McCallister in Vancouver, WA.

Jim served in the US Army from 1971 until 1977 as a member of the 19th Special Forces Group Airborne Division and the Army National Guard.

Following his military service, he attended the University of Montana and graduated with a Bachelor of Science degree in Forestry in 1981. Jim worked in the forestry industry for over 44 years including nearly 20 years as the Clark County (Washington) Forester. He held certification with the Society of American Foresters, Sustainable Forestry Initiative and Forest Stewardship Council. He was also SW Washington Coordinator for Washington Tree Farm System at the time of his death.

His hobbies included boating, fishing, crabbing, cooking and spending time at a beach house that he and Julie own on the Washington Coast. He enjoyed teaching all aspects of forestry and mentoring others interested in the profession.

Through it all, his commitment to the forest never wavered. It is particularly fitting that we memorialize Jim's dedication and contribution to the Clark County's Forestry Program, the entire community of Clark County, as well as each and every one of us by dedicating this plan in his honor.

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SUSTAINABLE FORESTRY PROGRAM INTRODUCTION

PURPOSE

This document outlines key policies and goals for managing forests in the Clark County Sustainable Forestry Program managed by the Department of Public Works (DPW). This document also provides direction for land managers when developing forest stewardship plans for each forest.

BACKGROUND

Clark County has obtained several forested properties in recent years through the state's Trust Land Transfer program and through the acquisition of the former Camp Bonneville military installation.

Starting in late 2011, the county began implementation of the Sustainable Forestry Program at Camp Bonneville through the development of a Forest Stewardship Plan. Douglas-fir forests at Camp Bonneville tend to be even-aged stands that are 60+ years of age, densely planted, and lacking horizontal and vertical structural diversity.

Uneven-aged forest management techniques including selective thinning, small patch cuts, habitat creation, understory replanting are thought to help manage even-aged stands towards an increase in structural diversity. The Camp Bonneville Forest Stewardship Plan was designed to treat the even-aged Douglas-fir forests at the camp as an experimental forest using these structure-based management techniques.

Camp Bonneville's forest stewardship plan was certified by the American Tree Farm System under the requirements of the Sustainable Forestry Initiative® and by the Forest Stewardship Council™. These dual certifications provide a platform to implement rehabilitation of the 3,685 acre forest's health. As a result of the structure-based management techniques, it will emerge as a natural looking, multi-storied diverse forest that supports a variety of plants and animals while generating revenue from its wood products.

Implementation of the Camp Bonneville forest stewardship plan has begun with selective thinning in priority stands. In addition, the Sustainable Forestry Program has begun to expand with development of forest stewardship plans for the Camp Hope and Green Mountain properties (to be discussed later in this plan).

Besides Camp Bonneville the other properties covered in this plan are covered by dense, even-aged Douglas-fir stands with the majority of stands in the 60+ year age-class. These stands either naturally regenerated or where manually replanted following successive fires across the site and logging activities (clear cutting). Selective thinning has been recommended to utilize the forest resources on the sites in order to help fund the ongoing management of forest resources, optimize tree growth, simulate the successional pattern of the original Douglas fir forest type, maximize forest health, and minimize fire hazard. Other forest management goals include creating a multiple-canopy forest structure, increasing wildlife habitat, and optimizing growth and yield of high quality timber products for domestic mills.

Within the past 10 years the State of Washington executed a comprehensive modification of its Forest Practices Act. This followed the listing of several salmonoid species under the Endangered Species Act. At issue is the practice of even-aged silvicultural treatments (clear cutting), held as an industry standard for decades, and the impacts of intensive forest management practices near sensitive aquatic and wildlife habitat sites. Regulatory changes have primarily involved an increase in fixed buffer widths, which preclude silvicultural activity in critical areas such as riparian management zones, wetland buffers and habitats for rare, threatened and endangered species.

The region's long history of large-scale, even-aged clearcuts has created significant fragmentation of wildlife habitat, an epidemic of young, low quality Douglas-fir, and an oversimplification of the broad range of ecosystem services that historic, naturally diverse forests once provided. The industrial argument in favor of even-aged management has focused on the economic efficiencies of intensive plantation management. Smaller, non-industrial private forest (NIPF) landowners throughout the region follow a more diverse spectrum of silvicultural methods, including the industrial management policies of larger timber owners, as well as more of a natural, uneven-aged and mixed species approach to forestry.

There is a growing understanding of the ecosystem service benefits of structurally intact native forests. Natural forest ecosystems are highly resilient to and recover quickly from natural disturbance regimes, have superior storm water retention capacities, optimize the sequestration and long-term storage of carbon, provide a broad spectrum of habitat niches, produce multiple forest commodities, and supply recreational and hunting opportunities to local communities. However, the economics of uneven-aged management practices have not been studied in great depth or at length on the west side of the Cascade Mountains. A study of this nature would require a demonstration or experimental forest with a timber base large enough to accommodate a wide range of silvicultural strategies. Clark County is proposing to implement a plan of uneven-aged structure based management utilizing the Upper Lacamas Basin Management Block as experimental forests for these purposes.

REGIONAL LANDSCAPE, CLIMATE, VEGETATION, & GEOLOGY HISTORY

LANDSCAPE

Clark County lies in a long structural basin (Willamette-Puget Trough) between the Pacific Coast ranges to the west and the parallel Cascade Range to the east (Figure 1). The Columbia River, the major trunk stream of the Pacific Northwest, flows through the Cascade Range, borders Clark County as it crosses the trough, then passes through the Pacific Coast ranges into the Pacific Ocean to the west.

About 58 percent of Clark County is in forest land. About 93 percent of forest lands are privately owned, 6 percent is State owned, and about 1 percent is owned by the Federal Government.

Economic development in Clark County is diversified. Farming is important, but it is secondary in value of total products to industrial products, which include lumber, pulp, paper, aluminum, and chemicals. About 42 percent of the county is cleared and in farmland; the rest is forested or developed.

Figure 1 - Clark County in Washington State

CLIMATE

Clark County, approximately 70 miles inland from the Pacific Ocean and west of the Cascade Mountains, has the predominantly temperate marine climate typical of the West Coast. It has a dry season and pleasant temperature in summer, a mild but rather rainy winter, and a narrow range in temperature. Some of the factors that influence the climate are terrain and distance and direction from the ocean. The coastal mountains protect this area from the more intense winter storms that move inland from the ocean, and the Cascade Range shields it from the higher summer and lower winter temperatures of eastern Washington. Cold air in winter and the occasionally hot air in summer flowing west through the Columbia River Gorge has a decided influence on the climate.

Clark County has a mild marine climate that is typical of the northwestern part of Oregon and the western part of Washington. It has mild, wet winters and moderately warm, dry summers. The climate reflects the influence of the Cascade Mountains to the east and the parallel Coast Range to the west. Nearly 75 percent of the annual precipitation normally occurs from October 1 to March 31. The remaining 6 months, from April 1 to September 30, receive only 25 percent of the total precipitation.

The average annual precipitation differs greatly from place to place. This difference is directly related to the effects of the two bordering mountain ranges. The average annual precipitation on much of the Coast Range and the Cascade Mountains exceeds 100 inches. Precipitation at lower altitudes and toward the center of the basin between the two mountain ranges is much less. The annual precipitation at Vancouver is about 37 inches; the precipitation reaches 114 inches in the Cascade Mountains in the northeastern corner of the county. During the growing season, however, the range in precipitation is small. For example, precipitation for July and August combined averages 1.40

inches at Vancouver, the driest station, in comparison with 2.77 inches at Cougar, the wettest station. The average annual snowfall at Vancouver is 8.4 inches, and it is estimated to exceed 200 inches at an elevation of 3,000 feet in the eastern and northeastern parts of the county.

Late in spring and in summer large high-pressure centers over the North Pacific Ocean bring a prevailing flow of cool and comparatively dry air from a northwesterly direction. As the air moves inland, it becomes warmer and drier. As a result a dry season begins late in spring and reaches a peak in midsummer. In July and August, it is not unusual for 2 or 3 weeks to pass without measurable rainfall.

In fall and winter, low-pressure centers in the Gulf of Alaska intensify and high-pressure centers become smaller and move south. Circulation of air around these pressure centers in the north Pacific bring a prevailing flow of warm, moist air into this part of the State from a southwesterly direction. As a result, winter temperatures are mild and the rainy season begins in fall, reaches a peak in midwinter, and decreases in spring.

In the warmest summer months, afternoon temperatures range from the middle seventies to the lower eighties, and nighttime temperatures are in the fifties. Maximum temperatures exceed 90° F. on 5 to 15 days each summer and reach 100° or slightly higher in one summer out of three. Temperatures in the foothills and higher elevations of the county are slightly lower than those recorded in the valleys.

The hottest weather generally occurs when hot, dry, easterly winds reach the area. In this kind of weather, humidity is low and the risk of forest fires is high. Following 1 or 2 days of unusually warm weather, cooler air from the ocean moves inland and afternoon temperatures return to the seventies and eighties.

In the coldest months, afternoon temperatures range from the upper thirties to the middle forties, and nighttime readings from 25° to 35°. In most winters, a minimum temperature of below freezing occurs on 40 to 75 nights and a maximum temperature of freezing or below occurs on a few days. The coldest weather generally occurs when a high pressure area develops over the Pacific Northwest and cold air from east of the Cascades reaches this area. The sky is frequently clear under these conditions; minimum temperatures range from 5° to 15° and maximum temperatures remain below freezing. In an average year, the relative humidity ranges from about 50 percent in midafternoon to 85 percent at sunrise in the warmest and driest months and from 75 percent in midafternoon to 85 percent or higher early in the morning in winter.

The average annual precipitation ranges from approximately 40 inches in the vicinity of Vancouver to between 75 and 110 inches along the foothills and higher elevations in the eastern part. Available records indicate that the heaviest precipitation probably occurs in the northeastern part of the county. The annual precipitation near Cougar, in the Lewis River valley, ranges from 72 to 172 inches. Rain fall of more than half an inch per hour can be expected once in 2 years. During the rainy season, precipitation is usually moderate in intensity and continuous over a period of time, rather than a downpour for a brief period. Rainfall of heavy intensity, however, occurs occasionally as the more intense weather systems move across the area. Precipitation amounting to 2 to 4 inches in a 24-hour period is recorded in the areas of heavier rainfall almost every year.

VEGETATION

Historic trends of the vegetation of western Washington since the recession of the Pleistocene glaciers have been inferred from pollen records in lake sediments. The lowland forests across much of Western Washington during the Pleistocene were composed of mountain hemlock, spruces and pines. Grass, sedge, and sagebrush pollen was also present, indicating an open steppe community. As climate warmed between 18,000 and 12,000 years BP, pine pollen increased, and Douglas-fir and Sitka spruce are present as well.

The Holocene, or modern glacial period, marked a series of changes culminating in the modern vegetation assemblage. The early Holocene period (10,000-6,000 BP) was likely warmer and drier than at present, and was characterized by Douglas-fir, red alder, oak, bracken fern, grasses, and various prairie herbs. This community type is still present today, likely sustained through the more mesic late Holocene period by a combination of edaphic factors and application of fire by Native American groups.

Cooling temperatures and increasing precipitation in the late Holocene, or last 4-6,000 years, ushered in a final set of changes to the regional forest composition. Douglas-fir, western hemlock, and red alder increase dramatically in the pollen profile, and western red-cedar joined the assemblage about 5,000 years BP.

Pollen cores analysis taken north of the site reveals an initial community of pine, spruce, and mountain hemlock resulting from post-glacial conditions. Western hemlock is present, but is a minor component of the pollen record until the cooler period of the late Holocene (4000 years BP until present). Western red cedar is the last major tree species to arrive on the scene, completing the modern assemblage.

Based on this history, it can be inferred that the forests have the arboreal diversity necessary to adjust to climatic change, as it has many times before. The key difference today is that there is a broader range of anthropogenic impacts than ever before which will influence the response of the biotic community to changes in moisture and temperature regimes. The vegetation may experience dramatic changes over the next millennium due to climate change and forest management; however, a few species will certainly be represented. Douglas-fir and red alder would be present. Western red cedar and western hemlock, preferring cooler and moister sites, may eventually recede from the site and seek higher ground or north facing slopes.

GEOLOGY

Clark County lies in a long structural basin (Willamette-Puget Trough) between the Pacific Coast ranges to the west and the parallel Cascade Range to the east. The Columbia River, the major trunk stream of the Pacific Northwest, flows through the Cascade Range, borders Clark County as it crosses the trough, then passes through the Pacific Coast ranges into the Pacific Ocean to the west. The western part of the county consists of a series of gently rolling alluvial terraces that form plains and benches rising steplike from the present level of the Columbia River. The elevations in these areas range from a few feet to more than 800 feet above sea level. The eastern part of the county consists of high old alluvial terraces against volcanic foothills and mountains of the western slopes of the Cascade Range. Along the eastern margin of the county, some of the higher peaks rise to an elevation of nearly 4,000 feet. Mountain ridges 2,000 to 3,000 feet in elevation are common. Much of this area is very steep, and a fall of 1,000 feet within a lateral distance of half a mile is not uncommon. The mountainous terrain is heavily dissected by streams that originate in this area and to the east.

Most of the important streams drain the county flow in a westerly direction and the more prominent streams are:

- The North Fork of the Lewis River
- The East Fork of the Lewis River
- The Washougal and Little Washougal Rivers
- Lacamas, Salmon, Big Tree, Cedar, Canyon, Mason, and Lockwood Creeks.

GUIDELINES FOR FOREST MANAGEMENT PLAN

The following guidelines will direct the management of forestlands owned by DPW to assure that they meet the programs overarching goal and both the short-term and long-term objectives. DPW land managers will follow these guidelines in their management actions.

TIMBER PRODUCTION

- Meet Washington State Forest Practice Act standards to protect water quality, riparian habitat, and other non-timber values of the forest, and to reduce the invasion of non-native vegetation into newly disturbed areas.
- Design timber harvests to make effective use of existing access and minimize the impacts of new and existing roads.
- Maintain the long-term timber production capability of the site by maintaining and/or improving forest health.
- Before commercial harvest or thinning, analyze the economic costs and benefits. The cost-benefit analysis should include: project planning and design, volume and value estimates by species; the extraction costs, including logging, trucking, permits, road building/maintenance/decommissioning, culvert fish passage assessment/removal/replacement, permitting, and reforestation. This analysis should also determine if the timing is appropriate. If the analysis concludes that harvesting costs exceed revenue generation and the overall ecological health of the forest will not be materially improved, harvesting will not be pursued until a future time when these conditions can be met.

- Develop an efficient mechanism for contracting forest practices, including harvest.
- Dedicate revenue from harvests for the continued management of the Sustainable Forestry Program. Net revenue above and beyond the needs of the program will be dedicated to the County's general fund, with the exception of Camp Bonneville where revenues are required to be reinvested in the camp according to the memorandum of agreement between Clark County and the Department of Army for early transfer of the property. See Appendix 1 for the a Forest Management Timetable.
- Use a multidisciplinary team approach to implement forest practices. The team may include the expertise of County, State or private ecologists, hydrologists and other professionals in addition to silviculturists and foresters.

CONSERVATION AND RESTORATION OF RESOURCES

- Protect, and where possible, enhance and restore sensitive areas, ecological and cultural resources, and fish and wildlife habitats.
- Consider cumulative impacts on ecological resources within the context of surrounding land uses.
- Manage to create a native vegetation community for each sustainable forest site that includes a range of tree species and age diversity.
- Meet the requirements of federal and state laws and other legal requirements to identify and protect endangered, threatened, sensitive, candidate species, and species of concern, and their habitats.

PUBLIC USE

Provide opportunities for education and appropriate recreation.

- Where it does not conflict with sustainable timber production and conservation of resources, provide public access and opportunities for recreation on sustainable forest properties[1].
- Public access may be closed, restricted or limited to protect public safety during a timber harvest; to prevent theft, vandalism and garbage dumping; to protect soils, water quality, plants and animals; or to meet other objectives identified in the individual Forest Stewardship Plan.
- Appropriate recreation may include: hiking, mountain biking, horseback-riding, picnicking, bird watching, orienteering, and recreation opportunities that require only limited development (e.g., access, parking lot, trail-building and trail improvements). Allowed recreation will be determined for each site based on sensitivity of the site and potential conflicts with other uses.
- Assure that any allowed public use of trails and roads is not resulting in damage to public resources. Decommission trails that cause damage to sensitive areas. When possible, make trail and road maps available to the public.
- When possible, provide interpretive information on each site as appropriate, including signs, maps, etc. that describe the features of the site, sustainable forestry practices, and the Clark County Sustainable Forestry Program.
- Work with community groups and individuals to help monitor, maintain, and steward sustainable forest properties.
- Consider recreation use when planning the location of a timber harvest. When forest practices occur near recreational areas, post signs to educate, protect and inform visitors.

[1] Camp Bonneville is currently implementing clean-up operations for unexploded ordnance or munitions and explosives of concern. The site does not allow for public access at this time.

PROVIDE OPPORTUNITIES FOR RESEARCH & FORESTRY DEMONSTRATION

- Make sites available for forestry education.
- Offer sustainable forests as research sites for the University of Washington, Washington State University, Clark College and other academic institutions to pursue mutually beneficial opportunities.
- Use forest practices as opportunities for educating the general public and landowners about sustainable forestry through workshops, tours, signs, and/or press releases.

ADJACENT LANDOWNERS & SURROUNDING LANDSCAPES

- Consider the broader landscape and adjacent landowners in planning for and managing sustainable forestry sites.
- Consider land uses and forest management strategies on neighboring properties and the surrounding landscape when preparing a Forest Stewardship Plan. Stay apprised of surrounding management activities.
- Consider impacts to adjacent landowners and the surrounding landscape when developing a Forest Stewardship Plan. Encourage landowner participation in the planning process.
- Inform adjacent landowners when going forward with forest practice or site development activities that will affect them.
  Consider sharing resources and cooperating on forest practice activities with adjacent landowners to improve operational and economic feasibility of these practices.

FUTURE ADDITIONS TO THE PROGRAM

For each new property added to the program, the Sustainable Forestry Program will incorporate into this Clark County Forest Management Plan as a new Forest Management Unit tied to a landscape block. Each new Forest Management Unit will be developed by the County Forester and reviewed and approved by the Resource Enhancement & Permitting Manager.

Forest Stewardship Plans and their subsequent updates should include:

- Forest inventory data, including mapped sensitive areas and significant habitat features, collected with protocols consistent with industry standards and separated into management units;
- Survey and mapping of invasive non-native plant species
- Short and long-term maintenance and capital improvement needs and budgets;
- An assessment of sustainable timber production, growth and yield projections (harvest volume) and potential revenue (income/cost estimates);
- An assessment of ecological resources, forest stand health, forest habitat functions, and natural resource restoration opportunities;
- A list of management practices and time frames to address the identified goals, objectives, and priorities for at least the next 20 years.
- FMU's will be updated every ten years. Plans can be amended at any time if significant new conditions or technologies arise.
- Plan updates and monitoring indicators should be flexible and based on adaptive management principles.

FOREST MANAGEMENT GOALS & OBJECTIVES

GOALS OF THE FOREST MANAGEMENT PLAN

The goals of Clark County's forest management plan is to research and demonstrate how former even-aged Douglas-fir forests can be managed to produce a sustained yield of commercial forest products and increased ecosystem services through the implementation of uneven-aged forest management practices. Clark County's timber management plan, which combines habitat conservation and enhancement, improved ecosystem functions and the production of a diversity of forest products, will provide other forest owners and managers with tested and validated silvicultural options.

Clark County has found that the silvicultural standards defined within the Forest Stewardship Council's U.S. Forest Management Standards provide significant guidance to forest owners seeking to emulate natural forest dynamics through their forest management practices. Therefore, the County will seek to follow, at a minimum, FSC's guidelines for forest management as well as seek third party independent certification through the FSC. This forest management plan will also be used to qualify for third-party certification under the American Tree Farm System.

A critical component of any sustainable forestry model is long-term economic viability. The Board of County Councilors has required that the management of these forest tracts be financially self- sustaining while maintaining the natural environment at the site. Therefore, the primary financial goal of the forest management plan is to develop sufficient revenue to cover all management costs. However, it is anticipated that by conducting past-due thinning and moving towards actively managing forests, the forests can provide positive revenue back to the County. Therefore, timber revenue generated could also be used to provide essential services to the public.

SHORT TERM OBJECTIVES (1-10 YEARS)

The following short-term objectives will be implemented or achieved within the first 5-10 years after this plan has been approved:

1. Thin dense stands to enhance forest health and timber productivity.
2. Improve wildlife habitat through snag creation, distribution of downed woody debris and forage planting.
3. Begin restoring riparian forest cover by planting streamside areas with a mix of hardwoods and conifers.
4. Develop and implement control and eradication measures for noxious non-native plant species.
5. Begin a systematic monitoring program to inventory and assess forest resources and wildlife habitat.
6. Develop an annual or semi-annual commercial thinning plan that provides sufficient income to pay for all forest management expenses and provide positive revenue to the County.
7. Develop research and development program to demonstrate structure-based forest management principles.
8. Host educational forestry tours and events for the public, county stakeholders and county staff and officials.

LONG TERM OBJECTIVES (10+ YEARS)

The following long-term objectives are expected to be achieved over the next 10 – 100+ years:

1. Restore historic species composition and habitat complexity throughout forest.
2. Begin restoring areas of forest to late seral conditions.
3. Produce periodic income through commercial thinning.
4. Use forest resources as a model for structure-based forest management.
5. Recruit or retain legacy trees, old and large trees, snags and downed woody debris in order to sustain populations of native plants, fungi, and animals, both within individual forest stand and across the entire forest.
6. Monitor forest ecosystem dynamics, record and analyze trends and periodically update forest management plan to reflect new strategies for managing the forest.

CAMP BONNEVILLE

Portions of Township 03 North, Range 03 East, Sections 34, 35 & 36, and Township 02 North, Range 03 East, Sections 01, 02, 03 & 10.

At the turn of the century, 3,840 acres of Camp Bonneville was contained within 20 homesteads ownerships (Now 3,685 acres with the DNR owning 155 Acres within the fence line). Several of these families still reside in Clark County. Camp Bonneville was established in 1909 as a drill field and rifle range for the U.S. Army's Vancouver Barracks and has been used primarily as a training camp for various branches of the military. After the Army closed the facility in 1995, the property was selected for transfer and reuse by the Base Realignment and Closure Commission. On October 3, 2006, after ten years of dialog and negotiation with the Army and the state Department of Ecology, the Board of Clark County Commissioners accepted transfer of property ownership from the Army to the county.

Figure 2 - Camp Bonneville Entrance Sign

Table 1 – Timber Harvest Records

Year	FMU #	Vol. Bf	Acres	Prescription
1958*		393,000	114	Release Thin
1970		170,000	296	Release Thin
1971		125,000	N/A	Release Thin
1972		62,000	N/A	Release Thin
1973		63,000	N/A	Release Thin
1975		34,000	N/A	Release Thin
1978		8,000	N/A	Release Thin
1980		141,000	134	Release Thin & Salvage
1981		N/A	61	Release Thin
1982		N/A	159	Release Thin
1983		N/A	75	Release Thin
1984		N/A	102	Release Thin
1985		N/A	219	Release Thin
2012	19, 22	979,800	50	Release Thin
2013	4, 5, 22, 17, 18, 19	2,750,320	200	Release Thin
2014	4, 17, 18, 19	686,020	30	Release Thin

*There were no records kept from CCC plantings in 1930's & 1940's

Table 2 - Timber Stand Improvement Records

Year	Work Done	Acres	Method
1957	Pruning	N/A	Hand Saw
1969	Herbicide Application	370	Aerial
1970	Herbicide Application	378	Aerial
1978	Brush Control	111	Mechanical Slashing
1979	Brush Control	65	Mechanical Slashing
1980	Brush Control	300	Mechanical Slashing
Sub Total		**1,224+**	

Table 3 - Reforestation Records

Year	FMU#	Method	Species	Type	TPA	Spacing	Site Prep.	Acres
1951*		Planting					None	180
1952		Planting					None	190
1953		Planting					None	1,071
1958		Planting					Scarification	23
1969		Planting					Scarification	369
1969		Seeding					Scarification	40
1970		Planting					Scarification	300
1975		Planting					Scarification	245
1976		Planting					Scarification	95
2015	4-Skid Roads	Planting	WRC	P+0	200	15'	None	2.5
2015	4-Skid Roads/Landings	Planting	DF	1+1	200	15'	None	12.5
2016	28, 24	Planting	Willow	3' Live Stakes	194	15'	Tube Protectors	1
2017	16	Planting	PIPO	P+1	194	15'	Tube Protectors	4
							Total	**2,533**

Table 4 - Inventory Records

Year	Merchantable Standing Vol (bf)	Available CFL AC.S	Growth Per Acre/YR (bf)	Composite Growth/YR (mbf)
1966	3,892,000	794	650 (1)	516
1981	20,077,000	2,232	368 (2)	486
1998	27,411,000	2,450	188 (3)	387

(1) Based on 794 acres of inventoried merchantable timber
(2) Based on 1,320 acres of inventoried merchantable timber
(3) Based on 2,060 acres of inventoried merchantable timber

The U.S. Army has managed the forests and other vegetation on Camp Bonneville since 1957. Vegetation has been controlled by scarification and replanting subsequent to major forest fires which occurred in 1902, 1938, 1951, and 1979. Timber management activities by the Army ceased in 1981.

SPUD MOUNTAIN

Township 02 North, Range 04 East, Section 06.

The Spud Mountain tract was acquired by Clark County through a trust lands transfer agreement with the Washington Department of Natural Resources in 2015. The County has designated Spud Mountain as a Forest Tier II area through the County's Comprehensive Land Use Plan. This is defined as an area that is potentially capable of sustaining long term production of commercially significant forest products.

No reforestation records of the property.

GREEN MOUNTAIN

Township 02 North, Range 03 East, Section 16.

The Green Mountain tract was acquired by Clark County through a trust lands transfer agreement with the Washington Department of Natural Resources in 2003. The County has designated Green Mountain as a Forest Tier II area through the County's Comprehensive Land Use Plan. This is defined as an area that is potentially capable of sustaining long term production of commercially significant forest products.

Table 5 - Reforestation Records

Year	FMU#	Method	Species	Type	TPA	Spacing	Site Prep.	Acres
2016	5, 9	Planting	DF	1+1	200	15'	Scarification	40
							Total	**40**

Table 6 – Timber Harvest Records

Year	FMU #	Vol. Bf	Acres	Prescription
2014	6, 7, 8	1,047,550	51	Release Thin
2015	6, 7, 8	2,013,780	100	Release Thin

CAMP HOPE

Township 04 North, Range 02 East, Sections 22 & 23.

Clark County took ownership as part of the Lewisville Park acquisition in 1936. From 1946-1996 the site was used as a former Girl Scout camp which until recently had been vacant and was becoming forgotten and overgrown. Clark County has let a group of citizens organize an effort to involve local businesses and community members to support the new vision of Camp Hope.

Table 7 – Timber Harvest Records

Year	FMU #	Vol. Bf	Acres	Prescription
2014	2	142,110	20	Hazard Tree / Release Thin

BRATTON CANYON

Township 05 North, Range 01 East, Section 21.

In February of 2008, Western Pacific Timber, LLC sold this parcel to the Washington Department of Natural Resources and used the site as a recreational area. In July of 2011, the tract was acquired by Clark County through a trust lands transfer agreement with the Washington Department of Natural Resources. The County has designated Bratton Canyon as a Forest Tier II area through the County's Comprehensive Land Use Plan. This is defined as an area that is potentially capable of sustaining long term production of commercially significant forest products.

No reforestation records of the property.

LAKE ROSANNAH

Township 04 North, Range 01 East, Section 07.

In February of 2009, Ridgefield School District sold this parcel to Clark County. The County has designated Lake Rosannah as Rural-20 through the County's Comprehensive Land Use Plan. This is defined as an area to provide for small lot residential development in the rural zoning districts which maintains rural character, maintains and conserves larger remainder parcels, protects and/or enhances sensitive environmental and wildlife habitat areas, and minimizes impacts to necessary public services. This tract is potentially capable of sustaining long term production of commercially significant forest products.

No reforestation records of the property.

FOREST HEALTH

CAMP BONNEVILLE

The 3,685 acre property is located in Southwest Clark County and also located at the tip of a portion of prairie habitat that extends into the foothills of the Cascade Mountains.

Contained within the tract are the headwaters of the Lacamas Creek basin and its associated tributaries and wetlands. According to a recent GAP Analysis project completed by the Washington Cooperative Fish and Wildlife Unit of the University of Washington, the majority of the site is included in the "westside western hemlock" vegetation zone. However, since the area has burned periodically since 1900, the predominant forest types are comprised of even aged stands of Douglas fir.

Scattered stands of western red cedar and western hemlock, remnants of the original plant community, still exist on the facility. Typical understory species include vine maple (Acer circinatum), salmonberry (Rubus spectabilis), elderberry (Sambucus canadensis), hazelnut (Corylus sp.), salal (Gautheria shallon), and sword fern.

The majority of the site is densely forested. Valley floors associated with Lacamas Creek are occupied by old fields and emergent wetlands which are associated with small drainages and depressions in the floodplain of the Lacamas basin. This habitat is associated with remnant stands of Garry oak (Quercus garryana), a dominant tree in former forests that once occupied the area.

Common species associated with valley floor areas include red alder (Alnus rubra), Oregon ash (Fraxinus sp.), Douglas fir (Pseudotsuga menziesii), big leaf maple (Acer macrophyllum), Garry oak, cottonwood (Populus deltoides), crabapple (Malus sp.) and willow (salix sp.). Common understory species associated with valley floor habitats include vine maple, salmonberry, Indian plum (Oemleria cerasiformis), snowberry (Symphoricarpos albus), and Lady fern. Old fields are composed of native grasses and small shrubs including Scotch broom (Andropogon sp.).

SPUD MOUNTAIN

The Spud Mountain Forest is a 156-acre forested property located in southwest Clark County. The primary overstory species are of Douglas fir (Pseudotsuga menziesii), big leaf maple (Acer macrophyllum), and western hemlock (Tsuga heterophylla). Typical understory species include vine maple (Acer circinatum), salmonberry (Rubus spectabilis), elderberry (Sambucus canadensis), hazelnut (Corylus sp.), salal (Gautheria shallon), and sword fern (Polystichum munitum). There is an abundance of English English holly (Ilex aquifolium) throughout the property, which in some areas are heavy to almost no traces.

Although the site is included in the westside western hemlock vegetation zone, the area has burned periodically since 1900, and consequently the current forest is predominantly comprised of even aged stands of Douglas fir.

GREEN MOUNTAIN

The Green Mountain Forest is a 360-acre forested property located in southwest Clark County. The property extends from the eastern flank of Green Mountain (elevation 804'). The property is located along the margins of a portion of prairie habitat that extends into the foothills of the Cascade Mountains. Although the site is included in the westside western hemlock vegetation zone, the area has burned periodically since 1900, and consequently the current forest is predominantly comprised of even aged stands of Douglas fir.

Typical understory species include sword fern (Polystichum munitum), red huckleberry (Vaccinium parvifolium), vine maple (Acer circinatum), Oregon grape (Mahonia nervosa), hazelnut (Corylus sp.), snowberry (Symphoricarpos albus), and elderberry (Sambucus canadensis).

CAMP HOPE

The Camp Hope Forest is a 105-acre forested property located in northwest Clark County. Observations made at Lewisville Park which lies to the north of this tract indicate many stands of commercial species in viable quantities and merchantable quality. Some stands within the older conifer types (70-90 year age class) have developed advanced pathogenic conditions due to overstocked stand densities and root systems too old and crowded to support healthy tree growth. If the tree has bark on it, green foliage on lateral branches, and in the upright position, it may not necessarily indicate a healthy stem.

In areas near the Lewisville Park system roads and campgrounds, the presence of sporophores (fruiting bodies, or "conks"), was readily detectable on many stems of large diameter Douglas-fir. These "conks" are the best indicators for the presence of rot. An older Douglas-fir that is likely to be infected with conk rot, yet does not have it visible on the exterior bole of the stem, is a serious problem. The absence of sporophores may indicate decay is more advanced than if fruiting bodies remained on the tree, as they fall off after a period years. This was a problem when a few core samples were extracted from trees which had no visible external indicators. One was totally rotten; a second was perfectly sound, and the third core contained traces of laminated root rot (Polyporous anceps).

Many of these trees are considered to be high risk trees, which will not likely survive the next 15 to 20 years. Some of them may be classified as public hazards given the high use of the area. The presence of rot in these areas shows the need to balance aesthetics with the overall health of the forest ecosystem.

BRATTON CANYON

The Bratton Canyon Forest is an 80 acre site containing the upper reaches of small-unnamed streams in the North Fork Lewis River tributary which include perennial headwater seeps on the eastern side of the site and riparian seeps and wetlands along portions of the stream channels. The site appears to have been logged in the late 1940's or early 1950's but currently hosts a mature or nearly mature Douglas-fir forest with large areas of multi layered canopy and native understory. There are several canopy openings or clearings on the site that are dominated by Himalayan blackberry. In addition, there are some patches of blackberry at the existing culvert crossings of the western streams on the site.

This property was used as a Washington State Department of Natural Resources campsite area for many years until June 2011 when the park was transferred to the County. The County has been interested in getting a master plan put together to open it back up as a public park again. In additions to the existing roads and campground facilities on the site, there appears to be ongoing horseback riding through the forest and riparian areas. This activity is creating new trails through the forests, wetlands, and streams. White natural surface paths are exempt in habitat areas and wetland buffers, it is technically regulated in wetlands. Future use of the site should consider managing trail development to avoid wetland and in-stream impacts.

LAKE ROSANNAH

The Lake Rosannah Forest is a 118-acre forested property located in northwest Clark County. Douglas-fir is the predominant species in the merchantable timber type. Minor species include grand fir, big leaf maple, red alder, Oregon white oak, cherry, and pacific madrone. Stocking and age are highly variable. Douglas-fir ranges in age from 43 to over 128 years. Some of the older trees are very large, with diameters ranging to over 50 inches and heights to over 180 feet. The stand appears to have been commercially thinned one or more times. The understory is heavy throughout.

WILDFIRE HISTORY

One of the first major fires in this area was The Yacolt burn which ravaged Clark, Cowlitz and Skamania counties in southwest Washington during September 1902 (Figure 3). With no organized system for fighting wildfires, the fires spread across nearly 239,000 acres and caused 38 deaths and widespread property losses. An extended period of hot, dry weather; high wind; an over-accumulation of timber harvest slash; and human carelessness are among the frequently cited causes of these fires. In response, the Washington Legislature established a state fire warden the following year. In 1908, private landowners formed the Washington Fire Protection Association and funded a system of fire wardens and a program of fire prevention on private lands.

Figure 3 – Yacolt, WA 10 years after the Yacolt Burn (1912).

CLARK COUNTY FIRE HISTORY MAP

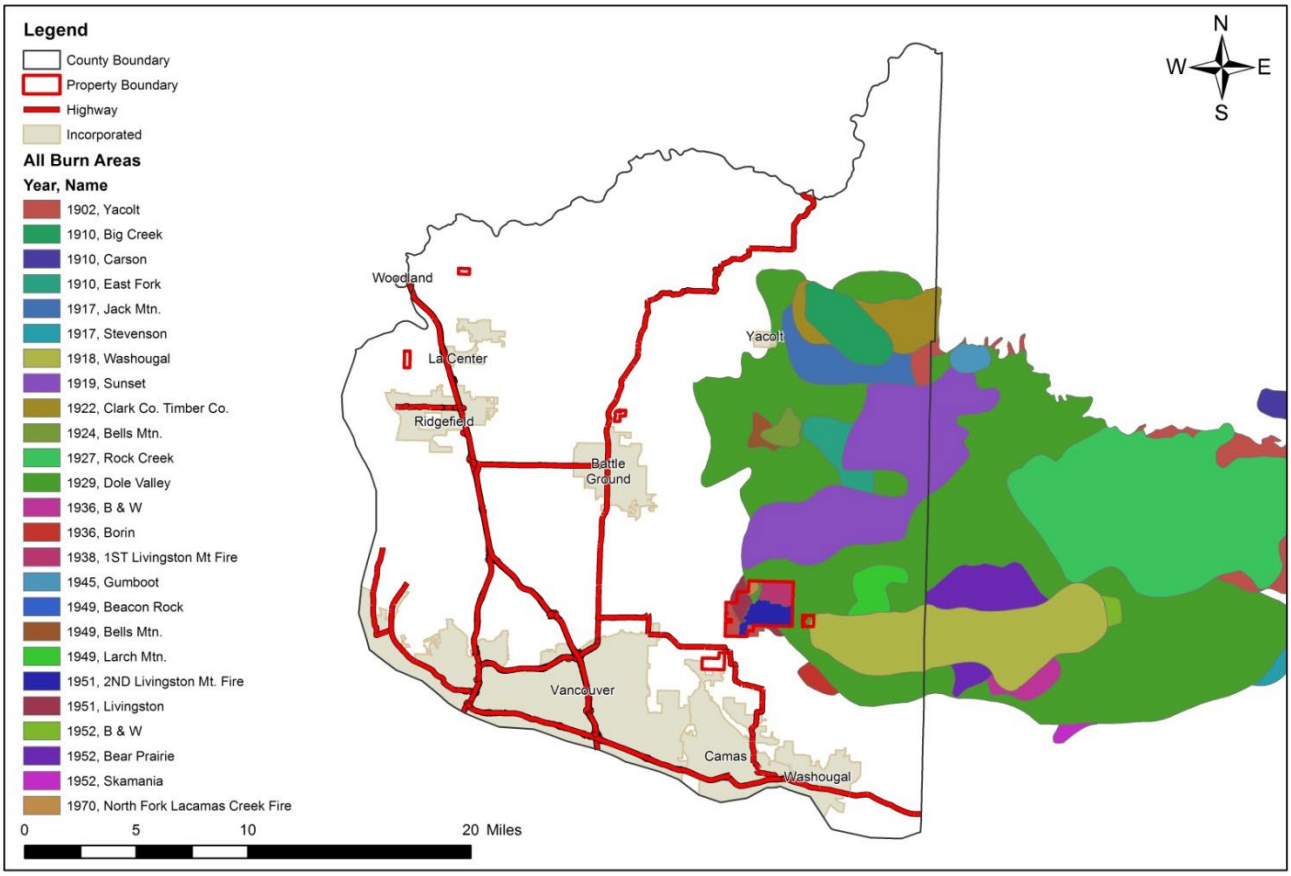


Figure 4 - Clark County Fire History Map

CAMP BONNEVILLE

In 1902 the Yacolt Fire destroyed virtually the entire original forest and homesteads. Some of the stakeholders simply gave up and abandoned their claims following the fire, with the remainder selling out to the War Department in 1918 when it expressed an interest in acquiring a training range. Table 5 shows the history of the fires at Camp Bonneville with how many acres were burned inside of the camps perimeter fence line and figure 4 shows the entire extent of the fires reach. To reduce the risk of fire a Wildfire Suppression Plan is located in appendix 4 of this document.

Table 8 - Wildfire Dates at Camp Bonneville

Year	Acres Burned	Area
1902	3,021	Yacolt Burn (238,000 Acres in 3 Counties)
1929	2,088	Dole Valley
1938	1,220	1st Livingston Mt. Fire
1951	1,400	2ND Livingston Mt. Fire
1970	160	North Fork Lacamas Creek Fire

Throughout Clark County we will be using different types of management practices to minimize wildfire risk from our forest stands by taking the following approaches when harvest occurs,

- **Thinning** – This lowers the risk of wildfire by reducing the density of standing trees (ladder-fuel) or woody debris that may accumulate on the forest floor. It also promotes forest health, aesthetics, and timber production by concentrating growth on fewer, faster growing trees and by reducing the time to final harvest.
- **Pruning** – This reduces the risk by removing low-hanging vegetation that could ignite shrubs, vines, and eventually the tops of trees. Pruning crop trees also helps improve timber value, appearance, and assess to the property.
- **Fuel Reduction Burning** – A fuel reduction burn lowers the risk by reducing the dangerous levels of combustible fuels under forest stands. This is balanced with leaving large woody debris & snags.
- **Firebreaks** – Develop a network of fire breaks, both natural and man-made, in order to reduce the risk of wildfire spreading. Firebreaks can also improve access to the property and enhance wildlife habitat.

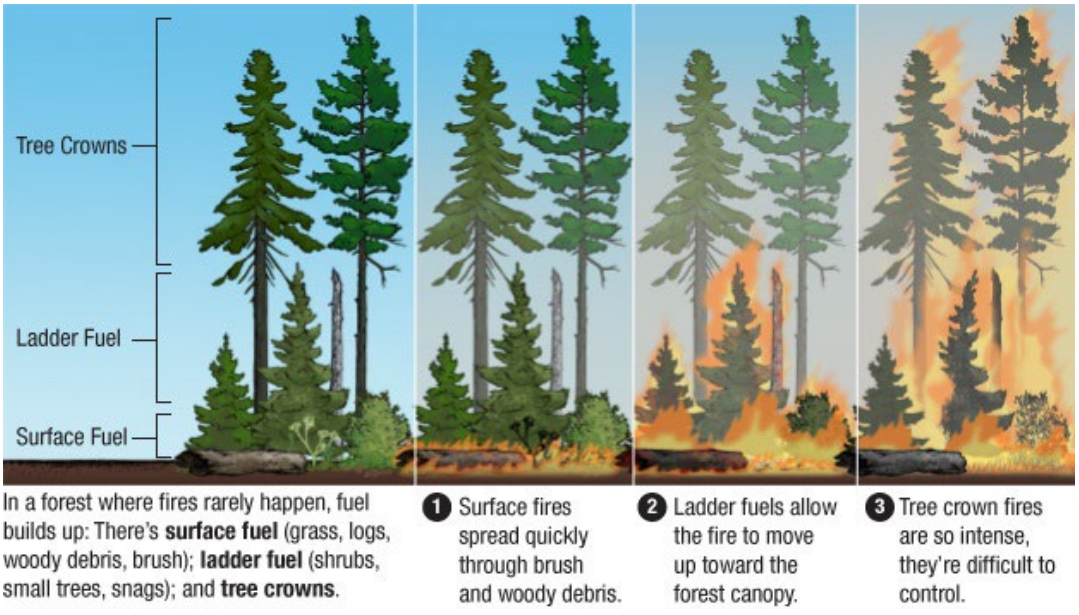


Figure 5 - Ladder Fuels Diagram

INTEGRATED PEST MANAGEMENT

Forest management on these properties will include Integrated Pest Management when addressing animal control, vegetation control, insect and disease outbreaks, invasive species and other pests affecting the forest's ability to achieve landowner forest management goals and objectives or otherwise threaten neighboring forest or landscape forest health.

Specifically, we will take the necessary steps to:

- Identify and implement silvicultural and other forest management actions that prevent the establishment of pests and associated damage.
- Develop and carry out a plan for periodically monitoring the forest for pests and pest damage from animals, insect and diseases and invasive species – especially invasive plants.
- Set thresholds for pest tolerance based on stand objectives so as to avoid taking control action against pests that are at levels below thresholds the meet objectives.
- Identify treatment options – mechanical and silvicultural – that when used lower the amount of pesticide use necessary to achieve control.
- Priortize those management actions that are part of an Integrated Pest Management strategy for controlling a particular pest.
- Implement aggressive Integrated Pest Management control treatments as the need arises.

INVASIVE VEGETATION CONTROL

The county is working to effectively control the following invasive and non-native species at Camp Bonneville:

- Bull thistle
- Canada thistle
- False brome
- Shiny geranium
- English English holly
- Meadow knapweed
- Mouse-ear hawkweed
- Non-native blackberry
- Queen Anne's lace
- Scot's broom
- Tansy ragwort

2016 CLARK COUNTY NOXIOUS WEED LIST

Class A Weeds: Non-native species whose distribution in Washington is still limited. Preventing new infestations and eradicating existing infestations are the highest priority. Eradication of all Class A plants is required by law (See Table 6 for Class A Weeds List).

Table 9 - Class A Weeds List

COMMON NAME	LATIN NAME	COMMON NAME	LATIN NAME
common crupina	*Crupina vulgaris*	meadow clary	*Salvia pratensis*
cordgrass, common	*Spartina anglica*	oriental clematis	*Clematis orientalis*
cordgrass, dense- flowered	*Spartina densiflora*	purple starthistle	*Centaurea calcitrapa*
cordgrass, saltmeadow	*Spartina patens*	reed sweetgrass	*Glyceria maxima*
cordgrass, smooth	*Spartina alterniflora*	ricefield bulrush	*Schoenoplectus mucronatus*
dyer's woad	*Isatis tinctoria*	sage, clary	*Salvia sclarea*
eggleaf spurge	*Euphorbia oblongata*	sage, Mediterranean	*Salvia aethiopis*
false brome	*Brachypodium sylvaticum*	Ravenna grass	*Saccharum ravennae*
floating primrose- willow	*Ludwigia peploides*	silverleaf nightshade	*Solanum elaeagnifolium*
flowering rush	*Butomus umbellatus*	Spanish broom	*Spartium junceum*

French broom	*Genista monspessulana*	spurge flax	*Thymelaea passerina*
garlic mustard	*Alliaria petiolata*	Syrian beancaper	*Zygophyllum fabago*
giant hogweed	*Heracleum mantegazzianum*	Texas blueweed	*Helianthus ciliaris*
goatsrue	*Galega officinalis*	thistle, Italian	*Carduus pycnocephalus*
hydrilla	*Hydrilla verticillata*	thistle, milk	*Silybum marianum*
Johnsongrass	*Sorghum halepense*	thistle, slenderflower	*Carduus tenuiflorus*
knapweed, bighead	*Centaurea macrocephala*	variable-leaf milfoil	*Myriophyllum heterophyllum*
knapweed, Vochin	*Centaurea nigrescens*	wild four-o'clock	*Mirabilis nyctaginea*
kudzu	*Pueraria montana* var. *lobata*		

Class B Weeds: Non-native species presently limited to portions of the State. Species are designated for control in regions where they are not yet widespread. Preventing new infestations in these areas is a high priority. In regions where a Class B species is already abundant, control is decided at the local level, with containment as the primary goal. Butterfly bush, Buddleja dacidii, is designated for control where located within 100 feet of a natural watercourse. Shiny Geranium, Geranium lucidum, is designated for control at select locations as designated by the Noxious Weed Control Board (See Table 7 for Class B Weeds List).

Table 10 - Class B Weeds List

COMMON NAME	LATIN NAME	COMMON NAME	LATIN NAME
blueweed	***Echium vulgare***	**knotweed, Japanese**	***Polygonum cuspidatum***
Brazilian elodea	***Egeria densa***	**kochia**	***Kochia scoparia***
bugloss, annual	***Anchusa arvensis***	lesser celandine	*Ficaria verna*
bugloss, common	***Anchusa officinalis***	**loosestrife, garden**	***Lysimachia vulgaris***
butterfly bush	*Buddleja davidii*	**loosestrife, purple**	***Lythrum salicaria***
camelthorn	***Alhagi maurorum***	**loosestrife, wand**	***Lythrum virgatum***
common fennel, (except bulbing fennel)	*Foeniculum vulgare* except F. vulgare var. azoricum)	**parrotfeather**	***Myriophyllum aquaticum***
common reed (nonnative genotypes only)	***Phragmites australis***	perennial pepperweed	*Lepidium latifolium*
Dalmatian toadflax	***Linaria dalmatica* ssp. *dalmatica***	**poison hemlock**	***Conium maculatum***
Eurasian watermilfoil	***Myriophyllum spicatum***	**policeman's helmet**	***Impatiens glandulifera***
fanwort	***Cabomba caroliniana***	**puncturevine**	***Tribulus terrestris***
gorse	***Ulex europaeus***	**rush skeletonweed**	***Chondrilla juncea***

grass-leaved arrowhead	***Sagittaria graminea***	**saltcedar**	***Tamarix ramosissima***
hairy willowherb	***Epilobium hirsutum***	Scotch broom	*Cytisus scoparius*
hawkweed, oxtongue	***Picris hieracioides***	**shiny geranium**	***Geranium lucidum***
hawkweed, orange	***Hieracium aurantiacum***	**spurge laurel**	***Daphne laureola***
hawkweeds: All nonnative species and hybrids of the meadow	***Hieracium,* subgenus *Pilosella and Hieracium***	**spurge, leafy**	***Euphorbia esula***
hawkweeds: All nonnative species and hybrids of the wall subgenus	***Hieracium,* subgenus Hieracium**	**spurge, myrtle**	***Euphorbia myrsinites***
herb-Robert	*Geranium robertianum*	**sulfur cinquefoil**	***Potentilla recta***
hoary alyssum	***Berteroa incana***	**tansy ragwort**	***Senecio jacobaea***
houndstongue	*Cynoglossum officinale*	**thistle, musk**	***Carduus nutans***
indigobush	***Amorpha fruticosa***	**thistle, plumeless**	***Carduus acanthoides***
knapweed, black	***Centaurea nigra***	**thistle, Scotch**	***Onopordum acanthium***
knapweed, brown	***Centaurea jacea***	**velvetleaf**	***Abutilon theophrasti***
knapweed, diffuse	***Centaurea diffusa***	**water primrose**	***Ludwigia hexapetala***
knapweed, meadow	***Centaurea* x *moncktonii***	**white bryony**	***Bryonia alba***
knapweed, Russian	***Acroptilon repens***	wild chervil	*Anthriscus sylvestris*
knapweed, spotted	***Centaurea stoebe***	yellow archangel	*Lamiastrum galeobdolon*
knotweed, Bohemian	***Polygonum* x *bohemicum***	**yellow floatingheart**	***Nymphoides peltata***
knotweed, giant	***Polygonum sachalinense***	**yellow nutsedge**	***Cyperus esculentus***
knotweed, Himalayan	***Polygonum polystachyum***	**yellow starthistle**	***Centaurea solstitialis***

Class C Weeds: Noxious weeds that are typically widespread in WA or are of special interest to the state's agricultural industry. The Class C status allows counties to require control if locally desired. Species in bold are designated for control in Clark County, Other counties may choose to provide education or technical consultation (See Table 8 for Class C Weeds List).

Table 11 - Class C Weeds List

COMMON NAME	LATIN NAME	COMMON NAME	LATIN NAME
absinth wormwood	*Artemisia absinthium*	jointed goatgrass	*Aegilops cylindrica*
Austrian fieldcress	*Rorippa austriaca*	lawnweed	*Soliva sessilis*
babysbreath	*Gypsophila paniculata*	longspine sandbur	*Cenchrus longispinus*

black henbane	*Hyoscyamus niger*	medusahead	*Taeniatherum caput-medusae*
blackgrass	*Alopecurus myosuroides*	nonnative cattail species and hybrids	*Typha* spp.
buffalobur	*Solanum rostratum*	old man's beard	*Clematis vitalba*
cereal rye	*Secale cereale*	oxeye daisy	*Leucanthemum vulgare*
common barberry	*Berberis vulgaris*	Pampas grass	*Cortaderia selloana*
common catsear	*Hypochaeris radicata*	perennial sowthistle	*Sonchus arvensis*
common groundsel	*Senecio vulgaris*	reed canarygrass	*Phalaris arundinacea*
common St. Johnswort	*Hypericum perforatum*	Russian olive	*Elaeagnus angustifolia*
common tansy	***Tanacetum vulgare***	scentless mayweed	*Matricaria perforata*
common teasel	*Dipsacus fullonum*	smoothseed alfalfa dodder	*Cuscuta approximata*
curlyleaf pondweed	*Potamogeton crispus*	spikeweed	*Centromadia pungens*
English hawthorn	*Crataegus monogyna*	spiny cocklebur	*Xanthium spinosum*
English ivy - four cultivars only	*Hedera helix*	Swainsonpea	*Sphaerophysa salsula*
evergreen blackberry	*Rubus laciniatus*	**thistle, bull**	***Cirsium vulgare***
field bindweed	*Convolvulus arvensis*	**thistle, Canada**	***Cirsium arvense***
fragrant waterlily	***Nymphaea odorata***	tree-of-heaven	*Ailanthus altissima*
hairy whitetop	*Lepidium appelianum*	ventenata	*Ventenata dubia*
Himalayan blackberry	*Rubus armeniacus*	white cockle	*Silene latifolia* ssp. *alba*
hoary cress	*Lepidium draba*	wild carrot (except where commercially grown)	*Daucus carota*
Italian arum	*Arum italicum*	yellowflag iris	*Iris pseudacorus*
Japanese eelgrass	*Zostera japonica*	yellow toadflax	*Linaria vulgaris*
jubata grass	*Cortaderia jubata*		

CONTROL METHODS

Control methods, such as the use of herbicides and power tools or pulling by hand, are used annually from May through October. All control efforts are carefully implemented to ensure that state-listed plant species, like the hairy-stemmed checker mallow, are not harmed. Herbicides are applied according to strict safety guidelines set by the manufacturer.

FOCUS AREAS

Control efforts are focused on Camp Bonneville's valley floor where Lacamas Creek flows through the property, gravel roads, trails and near buildings. Additional areas will be treated as necessary to maintain a healthy forest ecosystem. Some areas are not open for invasive species control due to ongoing cleanup of munitions of explosive concern and other hazardous materials. All of our forested sites have some component of invasive species which are being located and monitored for control by our vegetation management division.

CHEMICAL USE POLICY

The Vegetation Management Division of Clark County Public Works Department provides weed control across Camp Bonneville, primarily by chemical application, secondarily by cultural or mechanical methods. Most of the weed control work takes place in areas previously swept by ordinance removal contractors, with some work done along rights-of-way and fences and around structures. Most of the spray work is conducted using ATVs and trucks, with a small amount conducted by backpack. Extra care is exercised in areas where the hairy stemmed checker mallow, a state-listed endangered species, is known to occur. The bulk of time is spent controlling false brome, meadow knapweed, bull thistle, Canada thistle, non-native blackberry, Scot's broom, and tansy ragwort. Forest management systems will be developed over time to promote environmentally friendly non-chemical methods of pest management and strive to avoid the use of chemical pesticides in the future.

Herbicides used include:

- Triclopyr amine (Garlon 3A);
- Aminopyralid (Milestone), used primarily in open areas;
- Glyphosate (Aquamaster/Roundup), used along rights-of-way, fences, and for the control of false brome.
- Surfactants derived from either pine sap or soybean oil.

Figure 6 - Chemical Tank

World Health Organization Type 1A and 1B and chlorinated hydrocarbon pesticides; pesticides that are persistent, toxic or whose derivatives remain biologically active and accumulate in the food chain beyond their intended use; as well as any pesticides banned by international agreement, will be prohibited. If chemicals are used, proper equipment and training shall be provided to minimize health and environmental risks.

Records of chemical use will be maintained, including the type of chemical, when and where it was applied, on what species it was applied and the effectiveness of the application. Clark County will abide by the following guidelines for chemical use.

Table 12 - FSC Standards

Standard	Source
Chemical pesticides, fungicides, and herbicides will be used only when and where research or empirical experience has demonstrated that less environmentally hazardous, non-chemical pest/disease management practices are ineffective.	FSC U.S. Standards 6.6.b.
When and where chemicals are applied, the most environmentally safe and efficacious chemicals are used. Chemicals are narrowly targeted, and minimize affects on non-target species.	FSC U.S. Standards 6.6.c.
Chemicals will be used only when and where they pose no threat to supplies of domestic water, aquatic habitats, or habitats of rare species.	FSC U.S. Standards 6.6.d.

RESOURCE CATEGORY II - SOILS

The following soil descriptions have been excerpted from the *Soil Survey of Clark County, Washington by Dale A. McGee, Soil Conservation Service, November 1972*. Soils were surveyed by Dale A. McGee, Rudolph W. Mayko, Willard A. Call, Carl J. McMurphy, and John G. Krautscheid, with the Soil Conservation Service.

Soil maps for each property are listed in the "Soil Map" section of this document.

SOIL PROFILE/HORIZON

O Horizon – Surface Litter: Partially decomposed organic matter

A Horizon – Topsoil: Humus, living creatures, inorganic minerals

E Horizon – Zone of leaching, materials move downward

B Horizon – Subsoil: iron, aluminum humic compounds are accumulated and clay leached down from A and E horizons

C Horizon – Weathered parent material: Partial breakdown of inorganic minerals

R Horizon – Bedrock

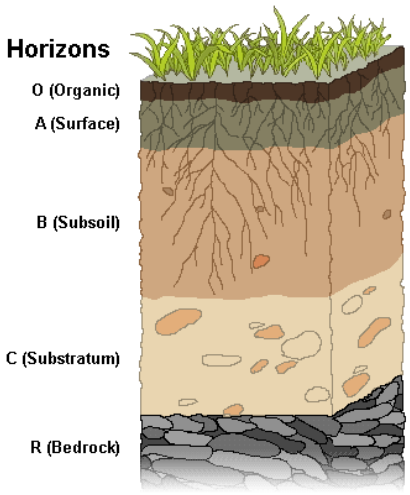


Figure 7 - Soil Horizon Profile Diagram

COVE SERIES

The Cove series consists of deep, very poorly drained, mostly nearly level soils. These soils have a clayey subsoil. They formed in water-laid deposits in old lakes and ponds. The native vegetation is deciduous trees, sedges, reeds, and water-tolerant shrubs and grasses. Cove soils are used primarily for pasture.

Site Index: Unknown

COVE SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES (CvA)

This soil is in concave drainageways and in large, flat, old lakebeds. The slope is generally less than 1 percent.

In a typical profile the surface layer is very dark gray silty clay about 4 inches thick. Below this is firm clay about 32 inches thick. It is black in the upper part and very dark gray and mottled in the lower part. The underlying material, to a depth of 54 inches, is mottled, light olive-gray gravelly silty clay loam.

Included in mapping were small areas where the surface layer is gravelly silt loam, silty clay, or clay. Also included were areas where the subsoil is gravelly clay.

This soil is very poorly drained and very slowly permeable. Tillage is difficult. The available water capacity and fertility are low. The effective rooting depth averages less than 15 inches. Surface runoff is very slow, and ponding is common in winter unless drainage is provided. There is no hazard of erosion.

Water-tolerant grasses and legumes are well suited, but these plants must also resist drought because this soil is droughty in summer. Tall fescue, meadow foxtail, birdsfoot trefoil, and white Dutch clover are suited grasses and legumes.

HESSON SERIES

The Hesson series consists of deep, well-drained soils that are mostly level to gently rolling. Some areas are hilly and very steep. These are moderately fine textured soils that have a fine textured subsoil. The parent material is deeply weathered, mixed old alluvium that contains varying amounts of gravel. The original vegetation is a heavy growth of Douglas-fir and a scattering of western redcedar and grand fir. The understory consists principally of vine maple, salal, Oregongrape, ferns, and red huckleberry. All the acreage has been logged. Areas not in cultivation are in second-growth timber. The understory is similar in composition to that of the native stands. Red alder is dominant in some areas. The annual precipitation ranges from 50 inches to more than 60 inches.

Large acreages of these soils are in cultivation. The principal crops are hay, pasture, and small grain. Some oats and corn for silage are grown in rotation with grasses and legumes. Strawberries and other truck crops are grown to some extent.

Douglas-fir Average Site Index: 120

HESSON CLAY LOAM, 0 TO 8 PERCENT SLOPES (HcB)

This is the dominant soil of the high terraces along the mountain foot slopes in the county. In most places the slope is 2 to 5 percent. The relief is undulating. Slopes are generally short to moderate in length. In a typical profile the surface layer is dark reddish brown clay loam about 8 inches thick. The subsurface layer is dark reddish-brown clay loam about 4 inches thick. Below this layer is friable, dark reddish-brown clay loam about 10 inches thick. The next layer, to a depth of about 91 inches, is reddish-brown clay. In sequence from the top, the uppermost 18 inches is friable, the next 39 inches is firm, and the lower 12 inches is very firm. Included in mapping were some areas that are nearly level or are slightly depressional and have a slightly mottled layer at a depth of 30 to 40 inches. This indicates reduced permeability and a temporary perched water table during rainy periods.

This soil is well drained and has moderately slow permeability. The available water capacity is high, and fertility is moderate. Problems arise in the proper scouring of tillage equipment when the soil is worked at about field capacity. Tillage is difficult when the surface layer is nearly dry. Surface runoff is slow, and the erosion hazard is slight.

Most of the acreage is cultivated. Hay and pasture are the chief crops, although other crops are grown, including strawberries, tree fruit, cane fruit, corn, and small grain. Red clover, white clover, subterranean clover, and birdsfoot trefoil are the common legumes. Tall fescue, ryegrass, and orchardgrass are the common grasses. Alfalfa is not well suited, because of the strong acidity and the low content of available calcium and phosphorus.

Douglas-fir Average Site Index: 120

HESSON CLAY LOAM, 8 TO 20 PERCENT SLOPES (HcD)

This soil is similar to Hesson clay loam, 0 to 8 percent slopes, except that the surface layer generally is 1 to 2 inches thinner. In places where erosion has been active, the surface layer is 2 to 4 inches thinner. The slopes are generally single and are moderate in length. Most areas of this soil are cleared and in cultivation, but use is less intensive than on Hesson clay loam, 0 to 8 percent slopes. Runoff is medium, and the erosion hazard is moderate where the surface is left bare in winter. Most of the acreage is in hay and pasture because the slope limits use for other crops.

Douglas-fir Average Site Index: 120

HESSON CLAY LOAM, 20 TO 30 PERCENT SLOPES (HcE)

This soil is similar to Hesson clay loam, 0 to 8 percent slopes, except that the surface layer is 2 to 3 inches thinner. Included in mapping were some areas where the surface layer is gravelly clay loam. The slopes are generally moderate in length where they lead into drainageways, but they are longer on the terrace breaks. Surface runoff is medium to rapid, and the erosion hazard is moderate to severe where the surface is left bare in winter. Little of this soil is cultivated. Cleared areas are mostly in pasture or hay.

Douglas-fir Average Site Index: 120

HESSON CLAY LOAM, 30 TO 55 PERCENT SLOPES (HcF)

This soil is similar to Hesson clay loam, 0 to 8 percent slopes, except that the surface layer is 2 to 4 inches thinner. Included in mapping were some areas where the surface layer is gravelly clay loam. This soil occurs on terrace breaks that lead into valleys. The slopes are long. Surface runoff is rapid to very rapid, and the erosion hazard is severe to very severe where the surface is left bare. This soil is too steep for cultivation, but it is suited to timber.

Douglas-fir Average Site Index: 120

HESSON GRAVELLY CLAY LOAM, 0 TO 8 PERCENT SLOPES (HgB)

This soil is similar to Hesson clay loam, 0 to 8 percent slopes, except that tillage is more difficult. Permeability is moderately slow, and the available water capacity is high. Hay and pasture are the chief crops, although other crops are grown, including strawberries, tree fruit, cane fruit, corn, and small grain. Red clover, white clover, subterranean clover, and birdsfoot trefoil are the common legumes. Tall fescue, ryegrass, and orchardgrass are the common grasses. Alfalfa is not well suited, because of the strong acidity and the low content of available calcium and phosphorus.

Douglas-fir Average Site Index: 120

HESSON GRAVELLY CLAY LOAM, 8 TO 20 PERCENT SLOPES (HgD)

This soil is similar to Hesson clay loam, 0 to 8 percent slopes, except that the surface layer is gravelly and the subsoil contains more gravel. Surface runoff is medium, and the erosion hazard is moderate. The available water capacity is moderate. This soil is used less intensively than Hesson clay loam, 0 to 8 percent slopes.

Douglas-fir Average Site Index: 120

MCBEE SERIES

The McBee series consists of deep, somewhat poorly drained and moderately well drained, nearly level to gently sloping soils.. These are loamy soils in back-bottom positions along streams and rivers. They formed in alluvium derived from quartzite and basalt. The native vegetation is western redcedar, hemlock, vine maple, red alder, Oregon ash, wild rose, spirea, willow, blackberry, grasses, and sedges. The annual precipitation amounts to about 50 inches. McBee soils are used for barley, oats, truck crops, hay, and pasture

Red Alder Average Site Index: 90

MCBEE SILT LOAM, 0 TO 5 PERCENT SLOPES (McB)

This soil is closely associated with McBee silty clay loam, 0 to 3 percent slopes. It is in slightly higher positions on bottom lands in most places than that soil and has slightly better drainage. It is moderately well drained, and workability is good. Red clover, alsike clover, and white clover mixed with ryegrass, orchardgrass, and tall fescue are used for hay and pasture. Oats are also grown for hay in a cropping system that includes clover and grass. Some grain and truck crops are also grown. This soil is somewhat easier to manage and warms up earlier in spring than McBee silty clay loam, 0 to 3 percent slopes.

Red Alder Average Site Index: 90

MCBEE SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES (MeA)

This soil occurs on bottom lands along Salmon Creek, Lockwood Creek, and the Little Washougal River. It is on flats and depressions that are sometimes subject to flooding from adjacent streams. In a typical profile the surface layer is silty clay loam about 11 inches thick. It is very dark brown in the uppermost part and dark brown in the lower part. The next layer is about 41 inches thick. In sequence from the top, the upper 10 inches is friable, very dark reddishbrown silty clay loam; the next 11 inches is firm, dark-brown silty clay loam ; and the lower 20 inches is firm, grayishbrown and dark yellowish-brown silty clay loam. The underlying material, to a depth of 65 inches, is gray and brown clay. Included in mapping were some areas where the surface layer is silt loam, and some areas in which mottling begins at a depth of 8 inches. Also included were areas where the surface layer is gravelly, and some where the subsoil is gravelly. This soil is somewhat poorly drained and moderately permeable. It can be tilled only within a rather narrow range of moisture content. The available water capacity is very high. Fertility is moderate. Surface runoff is ponded or very slow. The erosion hazard is slight, except in areas where the soil is subject to flooding from adjacent streams.

This soil is in low positions and requires drainage before most cultivated crops can be grown. Red clover, alsike clover, and white clover mixed with ryegrass, orchardgrass, and tall fescue are used for hay and pasture. Oats are also grown for hay in cropping system that includes clover and grass. Some grain and truck crops are also grown. The principal Fertilizer treatment is a yearly application of barnyard manure at a rate of 5 to 6 tons per acre.

Red Alder Average Site Index: 90

MINNIECE SERIES

The Minniece series consists of deep, poorly drained, nearly level to moderately steep soils. These soils have a clayey subsoil and are underlain by basalt bedrock at a depth of 40 inches or more. They formed in upland basins and drainageways from material of basic igneous origin. 'The original vegetation was Oregon white oak, willow, Oregon ash, hardhack, snowberry, sedges, and ferns. The annual precipitation is 55 to 90 inches. Minniece soils are used for grain, hay, and pasture.

MINNIECE SILTY CLAY LOAM, 3 TO 20 PERCENT SLOPES (MnD)

Much of this soil is very wet. Seep spots are numerous. Surface runoff is slow to medium, and the erosion hazard is slight to moderate. The areas of this soil are generally too small to be managed separately from the surrounding Olympic or Hesson soils. Where cleared, the soil is suited to perennial pasture. Wetness and the slope severely limit farming use.

Average Site Index: Unknown

OLEQUA SERIES

The Olequa series consists of deep, well-drained, gently undulating to very steep soils on terraces above the flood plains. These are loamy soils that formed in parent material largely of basic igneous origin. Along the Lewis River and in the Battle Ground areas, the soils are predominantly derived from basic igneous material. In the Little Washougal River area, they contain some quartzite but are otherwise much the same as in the other areas. The original vegetation was chiefly Douglas-fir, redcedar, and grand fir.

The understory is oceanspray, hazel, vine maple, salal, and Oregongrape. Nearly all of the original stands have been logged, and the second growth is composed of Douglas-fir, red alder, redcedar, and grand fir. Many areas are dominated by red alder. The annual precipitation is 50 to 65 inches.

Most of the nearly level to sloping areas are used for crops. Hay and pasture are the principal crops, but there are small acreages of nuts, fruits, and row crops.

Douglas-fir Average Site Index: 115-124

OLEQUA SILT LOAM, 3 TO 20 PERCENT SLOPES (OeD)

This is the dominant soil on terraces 50 to 150 feet above the level of the North Fork of the Lewis and Washougal Rivers. In a typical profile the surface layer is very dark grayish- brown silt loam about 10 inches thick. The next layer is 68 inches thick. In sequence from the top, the upper 13 inches is friable, dark-brown silt loam, and the next 55 inches is firm, mottled, brown silty clay loam. The underlying material, to a depth of 90 inches, is mottled, dark-brown heavy silt loam. Included in mapping were small areas of a poorly drained soil that occurs above the level of the North Fork of the Lewis and the Washougal Rivers. Also included were stony areas north of Battle Ground.

This soil is well drained and moderately slowly permeable. It is easily tilled. Fertility is moderately high, and the available water capacity is very high. Surface runoff is slow to medium, and the hazard of erosion is slight to moderate.

Most of this soil is cleared and in cultivation. Long-lived hay and pasture, composed of legumes and grasses, are the principal crops. Fertilization and careful management are needed to maintain good pasture and hay. A small acreage is used for strawberries and filberts.

Douglas-fir Average Site Index: 124

OLEQUA SILTY CLAY LOAM, HEAVY VARIANT, 3 TO 20 PERCENT SLOPES (OhD)

This soil is on ridgetops and benches. In most places the slopes are long and smooth, and the slope ranges from 3 to 8 percent. In a typical profile the surface layer is dark reddish- brown silty clay loam about 11 inches thick. The next layer is 60 inches thick. In sequence from the top, the upper 9 inches is friable, dark reddish-brown silty clay loam ; the next 12 inches is firm, mottled, brown silty clay loam; the next 12 inches is firm, mottled, grayishbrown silty clay; the next 11 inches is firm, mottled, light brownish-gray clay; and the lower 16 inches is firm, mottled gray clay. The underlying material, to a depth of 82 inches, is light olivegray clay. Included in mapping were small areas where the surface layer is silt loam. This soil is somewhat poorly drained and easily tilled. Permeability is moderately slow above the clay horizons and very slow in the clay horizons. There are very few roots in the clay. The available water capacity is high, and fertility is moderate. Surface runoff is slow to medium, and the erosion hazard is slight to moderate. A high water table is common in winter.

Douglas-fir Average Site Index: 115

OLYMPIC SERIES

The Olympic series consists of well-drained, gently sloping to very steep soils underlain by basalt bedrock at a depth of 40 inches or more. These are moderately fine textured soils that formed on mountainous foot slopes in weathered igneous lava flows. Most of the soils formed in place, but in small areas they formed in material moved by gravity. The original vegetation was Douglas-fir, grand fir, hemlock, western redcedar, and Oregon white oak. The understory plants were vine maple, salal, Oregongrape, ferns, and grasses. The annual precipitation is 45 to 80 inches. Olympic soils are used for timber, bay, pasture, and row crops.

Douglas-fir Average Site Index: 125-133

OLYMPIC CLAY LOAM, 3 TO 8 PERCENT SLOPES (OiB)

This soil is on ridgetops and benches. It is similar to Olympic clay loam, 8 to 20 percent slopes, except that it is not so steep and the surface layer is generally 1 to 3 inches thicker. In a few small areas, the slope is less than 3 percent. Surface runoff is slow, and the hazard of erosion is slight. Row crops, such as corn, strawberries, and pole beans, are grown in rotation with clover and grass. In many areas sprinkler irrigation is used to increase crop production.

Douglas-fir Average Site Index: 133

OLYMPIC CLAY LOAM, 8 TO 20 PERCENT SLOPES (OiD)

This soil is on rolling, strongly sloping mountain foot slopes and long straight side slopes below ridgetops. In most places the slope is 10 to 15 percent. In a typical profile the surface layer is dark reddish- brown clay loam about 13 inches thick. The next layer is 46 inches thick. In sequence from the top, the upper 7 inches is friable, dark reddish-brown clay loam; the next 12 inches is firm, reddish-brown heavy clay loam; and the lower 15 inches is very firm, dark-brown gravelly clay loam. The underlying material is weathered basalt bedrock. This soil is well drained and moderately slowly permeable. It is easily tilled. Roots penetrate to the bedrock. The available water capacity is high, and fertility is moderate. Surface runoff is medium, and the hazard of erosion is moderate if the surface is left bare. Clover, ryegrass, orchardgrass, and tall fescue are the principal crops. Oats are grown as part of the common cropping sequence of 1 year of oats and 4 to 5 years of legumes and grass. Row crops are suited, but they are not generally grown where the slope is more than 10 percent.

Douglas-fir Average Site Index: 133

OLYMPIC CLAY LOAM, 20 TO 30 PERCENT SLOPES (OiE)

This soil is on long valley slopes and short slopes along drainageways. It is similar to Olympic clay loam, 8 to 20 percent slopes, except that it is steeper and the surface layer is generally 1 to 2 inches thinner. Surface runoff is medium to rapid, and the hazard of erosion is moderate to severe if the surface is left bare. This soil is used for timber. Some cleared areas are in pasture.

Douglas-fir Average Site Index: 133

OLYMPIC STONY CLAY LOAM, 3 TO 30 PERCENT SLOPES (OmE)

This soil is on ridgetops, on long side slopes, and on short slopes along drainageways. It is similar to Olympic clay loam, 8 to 20 percent slopes, except that the surface layer is stony and the slope range is greater. The available water capacity is moderate. Surface runoff is slow to rapid, and the hazard of erosion is slight to severe. The stony surface limits use of the soil mostly to timber or to light grazing in clear-cut areas.

Douglas-fir Average Site Index: 125

OLYMPIC STONY CLAY LOAM, 30 TO 60 PERCENT SLOPES (OmF)

This soil is on long side slopes in the mountains and on short slopes along drainageways in the foothills. It is similar to Olympic clay loam, 8 to 20 percent slopes, except that it is very steep and the surface layer is stony. In places this soil developed in material moved through gravity. Some of these areas are still unstable. Surface runoff is rapid to very rapid, and the hazard of erosion is severe to very severe if the surface is left bare. The slope and the stony surface layer limit use of this soil to timber.

Douglas-fir Average Site Index: 125

OLYMPIC VERY STONY CLAY LOAM, SHALLOW VARIANT, 5 TO 15 PERCENT SLOPES (OrC)

This soil is in mountainous terrain on ridgetops and benches. It is similar to Olympic clay loam, shallow variant, 3 to 15 percent slopes, except that the surface is very stony. Timber is suited to this soil.

Douglas-fir Average Site Index: 110

POWELL SERIES

The Powell series consists of moderately well drained, nearly level to steep soils underlain by a fragipan at a depth of 23 to 36 inches. These are medium-textured soils that formed in old alluvial silt. The terrain is rolling. The original vegetation was Douglas-fir, grand fir, western redcedar, Oregon ash, and Oregon white oak. The understory was vine maple, salal, Oregongrape, grasses, and ferns. The annual precipitation is about 50 inches. Powell soils are used for row crops, hay, pasture, and timber.

Douglas-fir Average Site Index: Unknown

POWELL SILT LOAM, 0 TO 8 PERCENT SLOPES (PoB)

This soil is on ridgetops, benches, and gently sloping side slopes that lead into valleys in the Prune Hill area. In most places the surface layer is smooth and convex, and the slope is less than 6 percent. In a typical profile the surface layer is dark-brown silt loam about 17 inches thick. Below the surface layer is friable, mottled, grayish-brown and brown silt loam about 6 inches thick. The next layer is brittle and about 22 inches thick. It is firm, dark yellowish-brown silt loam in the upper part, and firm, mottled, brown heavy silt loam in the lower part. Below this layer, to a depth of 63 inches, is firm, mottled, dark-brown heavy silt loam. This soil is moderately well drained. The subsoil is slowly permeable. Roots penetrate to the subsoil, but very few go into it. The available water capacity and fertility are moderate. This soil is easily tilled, except early in spring, when the soil tends to be wet and, in some areas,

seepy. A perched water table during the rainy season normally limits use of deep-rooted crops. Surface runoff is slow, and the hazard of erosion is slight.

Douglas-fir Average Site Index: Unknown

PUYALLUP SERIES

The Puyallup series consists of somewhat excessively drained, mostly nearly level to gently sloping soils that are shallow or moderately shallow over sand and gravel. These are loamy, stratified soils that formed in material of mixed origin on alluvial bottom lands along the Lewis River and the East Fork of the Lewis River. The original vegetation was cottonwood, willow, grasses, and weedy plants. The annual precipitation is 40 to 60 inches. Puyallup soils are used for row crops, hay, pasture, and orchards.

Douglas-fir Average Site Index: 125

PUYALLUP FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES (PuA)

This soil is on low terraces along the Lewis River and the East Fork of the Lewis River. In a typical profile the surface layer is about 18 inches thick. In sequence from the top, the upper 4 inches is very dark brown fine sandy loam; the next 4 inches is very dark grayish-brown loam; and the lower part is darkbrown fine sandy loam. Below the surface layer is loose, darkbrown loamy sand about 9 inches thick. The under lying material, to a depth of 60 inches, is very dark grayish-brown gravelly sand. Included in mapping were a few small areas of Newberg and Cloquato soils. This soil is somewhat excessively drained. Permeability is moderately rapid in the uppermost part of the profile and rapid in the lower part. The available water capacity and fertility are moderate. The soil is easy to work and can be cultivated throughout a wide range of moisture content. Surface runoff is very slow, and there is no erosion hazard. Undiked low areas next to the rivers are subject to flooding in winter.

Douglas-fir Average Site Index: 125

SARA SERIES

The Sara series consists of deep, moderately well drained, nearly level to very steep soils. These are loamy soils that formed on terraces in old alluvial deposits that contained volcanic ash in the upper part. The original vegetation was Douglas-fir, grand fir, and a few stands of redcedar and Oregon white oak. The understory plants were vine maple, salal, Oregongrape, ferns, and grasses. The annual precipitation is about 45 inches. Sara soils are used for hay, pasture, and row crops

Douglas-fir Average Site Index: 116

SARA SILT LOAM, 0 TO 8 PERCENT SLOPES (SlB)

This soil is on the tops of ridges. In most places the slopes are long and smooth. In a typical profile the surface layer is dark-brown silt loam about 10 inches thick. The next layer is firm, mottled, dark-brown silty clay loam about 7 inches thick. The next layer is about 53 inches thick. The first 8 inches of this layer is firm, mottled, dark grayish-brown silty clay loam; the next 13 inches is very firm, mottled, dark grayish-brown silty clay; the next 10 inches is extremely firm, mottled, dark grayish-brown silty clay loam; the next 22 inches is very firm, dark-brown silty clay loam; and the lower 26 inches, to a depth of 96 inches, is very firm, strong-brown silty clay loam. This soil is moderately well drained and easily tilled. It is moderately permeable in the upper layers and very slowly permeable in the lower layers. The available water capacity is moderately high, and fertility is moderate. A perched water table in winter and early in spring severely limits the growth of such deep-rooted crops as alfalfa. Seep areas are numerous in winter and spring. Surface runoff is slow, and the hazard of water erosion is slight.

Douglas-fir Average Site Index: 116

SARA SILT LOAM, 8 TO 20 PERCENT SLOPES (SlD)

This soil is on the edges of ridges and on sidehills. It is similar to Sara silt loam, 0 to 8 percent slopes, except that the surface layer is 2 to 3 inches thinner. Most slopes are medium in length. Surface runoff is medium, and the hazard of erosion is moderate. Hay, pasture, and grain are the principal crops, but grasses and legumes are grown more extensively on this soil than on Sara silt loam, 0 to 8 percent slopes. Some row crops are grown, but the acreage is small. Contour and cross-slope planting reduces the erosion hazard when the soil is used for row crops.

Douglas-fir Average Site Index: 116

SARA SILT LOAM, 30 TO 50 PERCENT SLOPES (SlF)

This soil is on slopes that lead into drainageways. It is similar to Sara silt loam, 0 to 8 percent slopes, except that the surface layer is about 6 or 7 inches thick. The slopes are generally short. Surface runoff is rapid to very rapid, and the erosion hazard is severe to very severe on areas without vegetative cover. The slope limits use mostly to timber.

Douglas-fir Average Site Index: 116

WASHOUGAL SERIES

The Washougal series consists of somewhat excessively drained, nearly level to very steep soils underlain by sand and gravel at a depth of 26 to 40 inches. These are loamy soils that formed on low terraces in alluvium deposited by swiftly flowing rivers and streams. Most of the material is of volcanic origin. The original vegetation was Douglasfir, vine maple, dogwood, snowberry, blackberry, grasses, and ferns. The annual precipitation is 50 to 85 inches. Washougal soils are used for grain, hay, pasture, and forestry.

Douglas-fir Average Site Index: 114-119

WASHOUGAL LOAM, 0 TO 3 PERCENT SLOPES (WaA)

This soil is in the same areas as Washougal gravelly loam, 0 to 8 percent slopes, and is similar to that soil except that the surface layer is free of gravel, and gravelly sand is at a depth of 20 to 36 inches. Included in slapping were a few areas that are deeper. Surface runoff is very slow, and there is no hazard of erosion. This soil has a higher available water capacity than Washougal gravelly loam, 0 to 8 percent slopes. It is used mainly for forestry, hay, and pasture.

Douglas-fir Average Site Index: 114

WASHOUGAL GRAVELLY LOAM, 0 TO 8 PERCENT SLOPES (WgB)

This soil is on gravelly stream terraces along the East Fork of the Lewis, Little Washougal, and Washougal Rivers. It is nearly level except for old, narrow stream channels that formed meandering, depressional troughs. In a typical profile the surface layer is gravelly loam about 22 inches thick. It is black in the upper part and very dark brown in the lower part. Below the surface layer is friable, dark-brown very gravelly loam about 8 inches thick. The next laver is dark-brown very gravelly coarse sandy loam about 6 inches thick. The underlying material, to a depth of 60 inches, is brown and gray sand, pebbles, and cobblestones. Included in mapping were a number of sandy areas that are less than 1 acre in size and are generally along terrace breaks. Also included were small areas that are nongravelly. This soil is somewhat excessively drained. It is generally moderately permeable, but it is very rapidly permeable in the substratum. The available water capacity is moderate. Roots penetrate to the gravelly sand layer. Tillage is easy, but fertility is low. Surface runoff is slow, and the hazard of erosion is slight. The soil occurs at an elevation high enough in most places to be above the normal high water stages of adjacent rivers.

Most of this soil is in second-growth Douglas-fir, but red alder, grand fir, vine maple, and other shrubs fill in. Small tracts have been cleared for hay and pasture. Generally, oats are planted with red clover and ryegrass for hay. Pastures are mixtures of subterranean clover, tall fescue, and ryegrass. Barnyard manure is the common fertilizer.

Douglas-fir Average Site Index: 119

WASHOUGAL GRAVELLY LOAM, 8 TO 30 PERCENT SLOPES (WGE)

This soil is on terrace fronts along the East Fork of the Lewis and Washougal Rivers. It is similar to Washougal gravelly loam, 0 to 8 percent slopes, except that the surface layer is generally 1 to 2 inches thinner. Surface runoff is moderate to rapid, and the hazard of erosion is moderate to severe if the surface is left bare. This soil is used almost exclusively for timber. Areas that were formerly cleared have reverted to trees.

Douglas-fir Average Site Index: 119

ROCK LAND & WATER

ROCK LAND (Rk) & WATER (W)

Rock land (Rk) consists of steep and very steep areas made up largely of rock outcrops and very shallow soil. Most of this land type is in the mountainous eastern and northeastern parts of the county. The areas are valuable for recreational purposes, wildlife habitat, and water yield.

Water (W) consists of open streams and bodies of water.

Douglas-fir Average Site Index: None

RESOURCE CATEGORY III – WATER QUALITY / RIPARIAN AND FISH HABITAT / WETLANDS.

WATERSHEDS

Clark County has been divided into 78 subwatersheds that make up 10 watershed areas (Figure 8). Recent monitoring conducted between 2004 and 2009 summarizes overall stream health in Clark County watersheds. This general map shows that many of our streams are degraded and that our community faces challenges in improving and protecting these valuable resources.

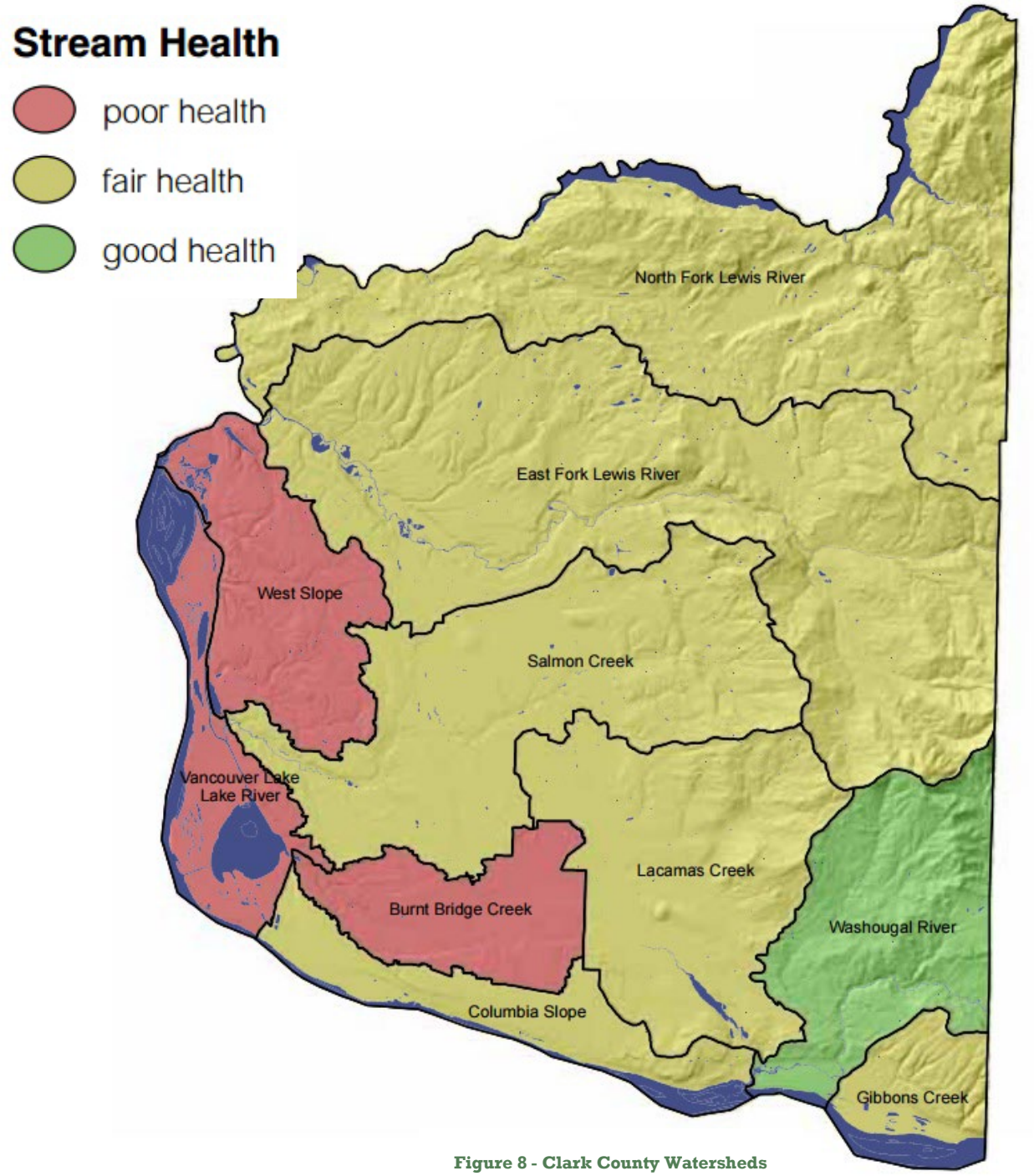


Figure 8 - Clark County Watersheds

UPPER LACAMAS BASIN MANAGEMENT BLOCK

The topography in the Upper Lacamas Basin Management Block is highly variable with elevations ranging from a high of about 1,800 feet National Geodetic Vertical Datum (NGVD) at Livingston Mountain to a low of about 300 feet NGVD along Lacamas Creek. With the exception of short stream reaches north of Camp Bonneville, the Camp effectively serves as the headwaters to Lacamas Creek. Lacamas Creek drops approximately 400 feet per mile as it passes through the Camp. The area generally drains towards the west and southwest through the tributaries of Buck Creek and David Creek into Lacamas Creek. All the surface water drainage eventually empties into the Washougal River and flows southwest into the Columbia River near Camas, Washington.

Figure 9 - Lacamas Creek Stream Health

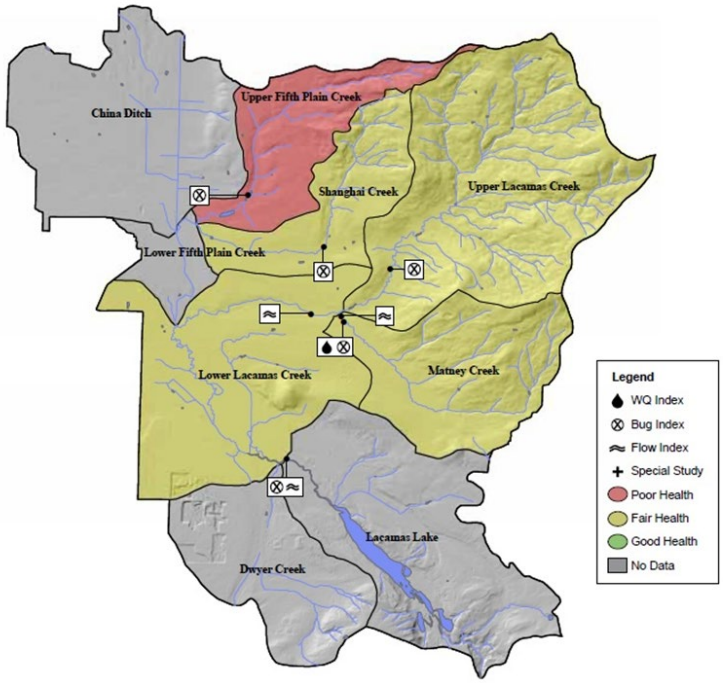
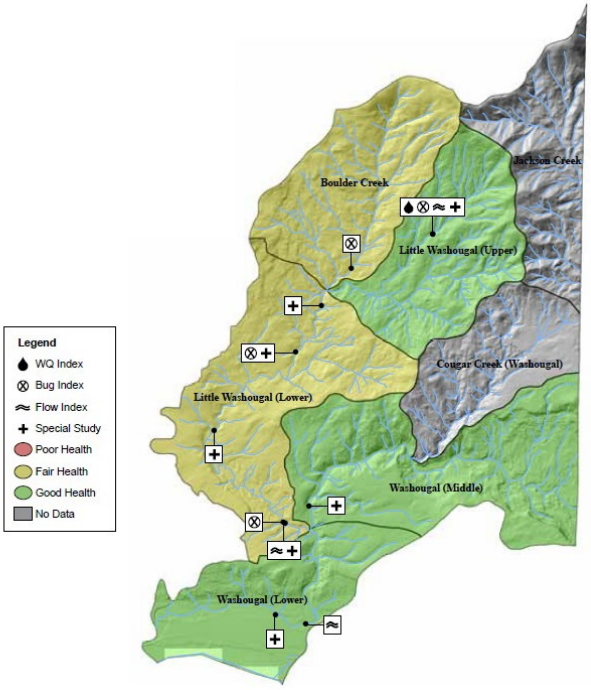


Figure 10 - Washougal River Stream Health



Lacamas Creek Stream Health Score Card

Subwatershed	Water Quality	Biological Health	Flow	Subwatershed Rating
Lower Lacamas Creek	--	Poor	Good	Fair
Matney Creek	Fair	Fair	Good	Fair
Upper Fifth Plain Creek	--	Poor	--	Poor
Shanghai Creek	--	Fair	--	Fair
Upper Lacamas Creek	--	Fair	Good	Fair
Indicator Rating	Fair	Fair	Good	
Overall Watershed Rating:				Fair

Data were not collected from the following subwatersheds: China Ditch, Dwyer Creek, Lacamas Lake, and Lower Fifth Plain Creek.

Washougal River Stream Health Score Card

Subwatershed	Water Quality	Biological Health	Flow	Subwatershed Rating
Washougal (Lower)	--	--	Good	Good
Little Washougal (Lower)	--	Fair	Good	Fair
Little Washougal (Upper)	Good	Good	Good	Good
Boulder Creek	--	Fair	--	Fair
Washougal (Middle)	--	--	Good	Good
Indicator Rating	Good	Fair	Good	Good
Overall Watershed Rating:				Good

Data were not collected from the following subwatersheds: Cougar Creek and Jackson Creek.

Figure 9 - North Fork Lewis River Stream Health

North Fork Lewis River Stream Health Score Card

Subwatershed	Water Quality	Biological Health	Flow	Subwatershed Rating
Cedar Creek (Upper)			--	
Chelatchie			--	
Cedar Creek (Middle)	--		--	
Pup Creek	--		--	
Little Fly Creek	--		--	
Indicator Rating			--	
Overall Watershed Rating:				Fair

Data were not collected from the following subwatersheds: Siouxon Creek, Canyon Creek, Cedar Creek (lower), Lake Merwin, North Fork Lewis River (lower), Yale Dam and Yale Lake.

Special Study: Cedar Creek Subwatersheds Summer 2006 Stream Temperature

Study Description: 7 stations within Cedar Creek Watershed; June 2006 – October 2006. Stream temperature data were analyzed using the state criterion.

Report link: www.clark.wa.gov/waterresources/documents

Why is this important? Salmon need cold water to survive. Prolonged exposure to stream temperatures above 63.5 °F can harm or kill salmon.

Results:

- Stream temperature did not meet the 2006 Washington state criterion at any site, for extended periods of time (1 - 8 weeks).
- The lower reaches of Cedar Creek were warmer than the upper reaches.

Score Summary:

- There are no poor ratings
- Most data and impacts are concentrated in Cedar Creek tributary
- Areas without data in the forested upper watershed likely have relatively good health

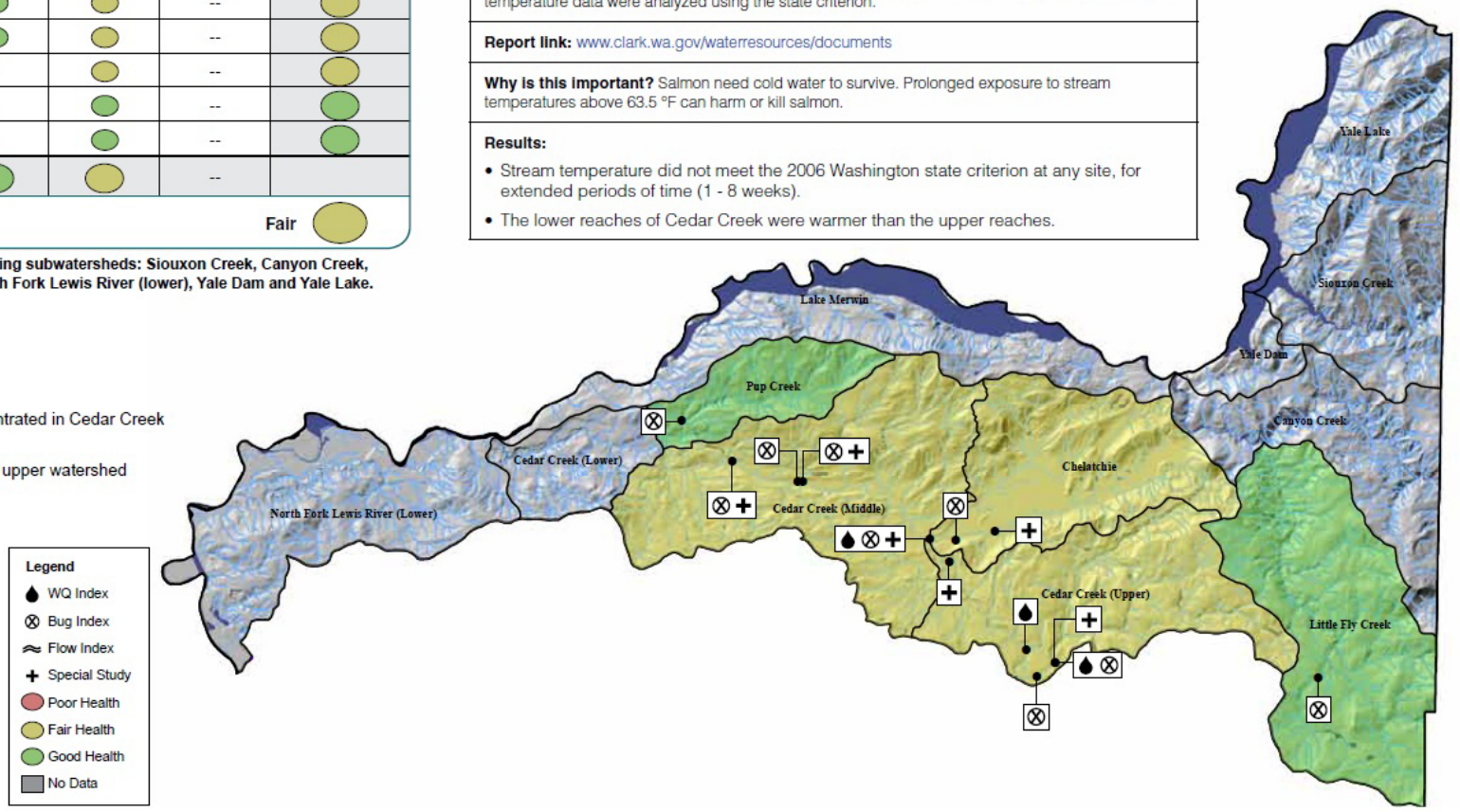


Figure 10 - West Slope Stream Health

West Slope Stream Health Score Card

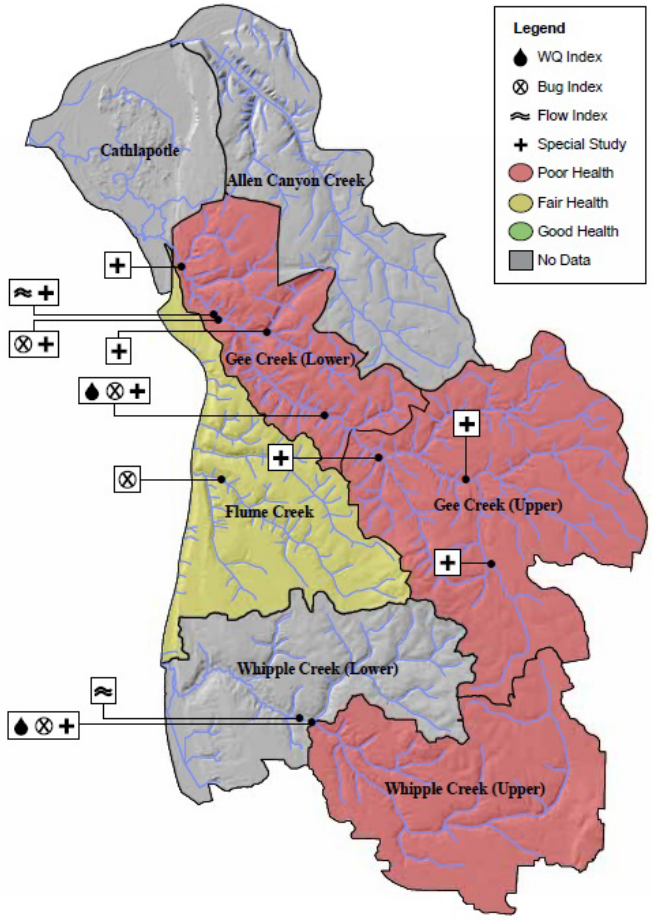
Subwatershed	Water Quality	Biological Health	Flow	Subwatershed Rating
Gee Creek (Upper)	●	●	--	●
Gee Creek (Lower)	--	●	●	●
Whipple Creek (Upper)	●	●	●	●
Flume Creek	--	●	--	●
Indicator Rating	●	●	●	

Overall Watershed Rating: Poor ●

Data were not collected from the following subwatersheds: Allen Canyon Creek, Cathlapotle, and Whipple Creek (lower).

Score Summary:

- There are no good ratings
- Poor water quality and biological health ratings are common in areas where agriculture and development are most prevalent
- Subwatersheds without data are largely cleared, rapidly developing, and likely have poor health



Special Study: Gee Creek Focused Bacteria and Turbidity Study

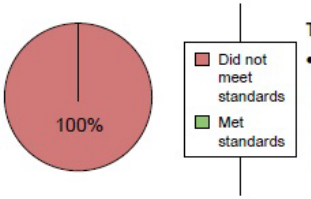
Study Description: 8 sites within Gee Creek subwatershed; 2007 – 2008

Report link: www.clark.wa.gov/waterresources/documents

Why is this important? The presence of fecal coliform bacteria indicates the stream has been contaminated with human or animal waste. Turbidity is a measure of cloudiness in water.

Bacteria Results

- No site met the state water quality criteria for bacteria levels.
- Wet season, wet weather had the highest bacteria levels.



Turbidity Results

- Over 50 percent of turbidity measurements were higher than background levels; the higher the turbidity, the more cloudy the water.

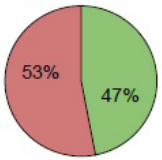


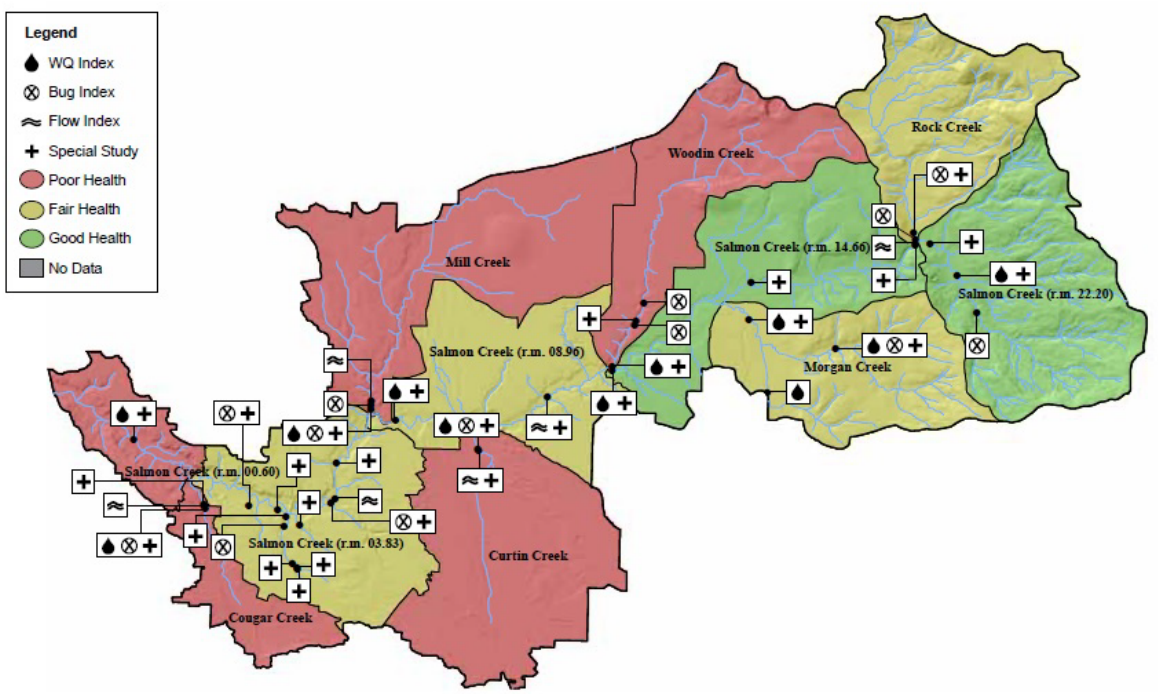
Figure 11 - Salmon Creek Stream Health

Salmon Creek Stream Health Score Card

Subwatershed	Water Quality	Biological Health	Flow	Subwatershed Rating
Mill Creek				
Cougar Creek				
Salmon Creek (r.m. 03.83)	--			
Salmon Creek (r.m. 08.96)		--		
Salmon Creek (r.m. 14.66)		--		
Curtin Creek				
Woodin Creek			--	
Rock Creek	--		--	
Morgan Creek			--	
Salmon Creek (r.m. 22.20)				
Salmon Creek (r.m. 00.60)		--	--	
Indicator Rating				
Overall Watershed Rating:			**Fair**	

Score Summary:

- Ratings range from poor to good
- Poor water quality and biological health ratings are common in areas where development is most prevalent
- This watershed includes some of the most healthy, and least healthy, streams in Clark County
- Local jurisdictions are implementing a state Water Cleanup Plan for bacteria, turbidity, and temperature



Special Study: Salmon Creek Focused Fecal Coliform and Turbidity

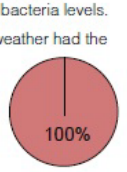
Study Description: 8 sites within the lower Salmon Creek Watershed; October 2007 – September 2008

Report link: www.clark.wa.gov/waterresources/documents

Why is this important? The presence of fecal coliform bacteria indicates the stream has been contaminated with human or animal waste. Turbidity is a measure of cloudiness in water.

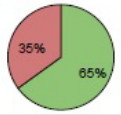
Bacteria Results

- No site met the state water quality criteria for bacteria levels.
- Dry season, wet weather had the highest bacteria levels.
- Bacteria levels increased from upstream to downstream.



Turbidity Results

- Thirty-five percent of turbidity measurements were higher than background levels; the higher the turbidity, the more cloudy the water.



STREAMS & WETLANDS

The biological health of Upper Lacamas Creek has been defined as "fair" in the 2010 Clark County Stream Health Report. Recommendations for improving stream health identified in the Report include:

1. Protect remaining forested areas in watershed.
2. Restore stream channels and riparian forests.
3. Increase infiltration and storm water runoff.
4. Promote healthy forest practices.

Figure 12 - Lacamas Creek

Water quality has been monitored in the Lacamas Creek watershed since 1991. Based on data collected in 1991 and 1992 Lacamas, Dwyer, Fifth Plain, Matney and Shanghai Creeks, and China Ditch and China Lateral were included on the 1998 303(d) list, the listing of impaired surface waters in the state. Subsequent data collected by Clark County and Ecology show continued exceedances of water quality standards, and these creeks are included on the 2008 303(d) list.

In-stream and riparian conditions observed during an August, 2011 site visit are as follows:

1. Vegetation within the RMZ is comprised of sparsely populated hardwoods (primarily red alder), brush (primarily vine maple and hazelnut) and grass (primarily reed canary).
2. There is very little conifer cover along the creek as likely the majority of the conifer was harvested during a previous regulatory environment that allowed for harvesting streamside corridors.
3. The Lacamas Creek stream channel is deeply incised in many areas, particularly through the reaches in the northern part of the property. This is likely due to a lack of large woody debris throughout the stream system and increased "flashiness" of water flow due to poor water retention in the heavily logged upper part of the watershed.
4. The substrate in the stream channel is comprised of cobbles and fine gravel.

Seven different wetland types were identified during the National Wetland Inventory conducted by the U.S. Fish and Wildlife Service. The majority of wetlands consist of temporarily or seasonally flooded palustrine forested wetlands associated with the Lacamas Creek floodplain. The other types of habitats include palustrine emergent, palustrine open water, and riverine. An extensive emergent wetland system is located near the upper end of Lacamas Creek.

STREAMS & WETLANDS MANAGEMENT RECOMMENDATIONS

Forest management within the riparian zone of all streams, ponds and wetlands will, at a minimum, adhere to the following guidelines as set forth within the Forest Stewardship Council's U.S. Forest Management Standards.

1. Forest management will retain and recruit sufficient large, green trees; snags; understory vegetation; down logs; and other woody debris in riparian zones to provide shade, erosion control, and in-channel structures.
2. For Type F & S (fish bearing and Shorelines of the state) streams, and for lakes and wetlands larger than one acre, an inner buffer zone is maintained. The inner buffer is at least 50 feet wide (slope distance) from the

active high water mark (on both sides) of the stream channel and increases depending on forest type, slope stability, steepness, and terrain. Management activities in the inner buffer:

a. Maintains or restore the native vegetation.
b. Are limited to single-tree selection silviculture.
c. Retain and allows for recruitment of large live and dead trees for shade and stream.
d. Structure.
e. Retain canopy cover and shading sufficient to moderate fluctuations in water temperature, to provide habitat for the full complement of aquatic and terrestrial species native to the site, and maintain or restore riparian functions.
f. Exclude use of heavy equipment, except to cross streams at designated places, or where the use of such equipment is the lowest impact alternative.
g. Avoid disturbance of mineral soil; where disturbance is unavoidable, mulch and seed are applied before the rainy season.
h. Avoid the spread of pathogens and noxious weeds.
i. Avoid road construction and reconstruction.

3. For lakes and wetlands larger than one acre, an outer buffer zone is maintained. This buffer extends from the outer edge of the inner buffer zone to a distance of at least 150 feet from the edge of the active high water mark (slope distance, on both sides) of the stream channel. In this outer buffer, harvest occurs only where:
    a. Single-tree or group selection silviculture is used.
    b. Post-harvest canopy cover maintains shading sufficient to moderate fluctuations in water temperature, provide habitat for the full complement of aquatic and terrestrial species native to the site, and maintain or restore riparian functions.
    c. New road construction is avoided and reconstruction enhances riparian functions and reduces sedimentation.
    d. Disturbance of mineral soil is avoided; where disturbance is unavoidable, mulch and seed are applied before the rainy season.
4. For Np streams, a 25-foot (slope distance) inner buffer is created and managed according to provisions for inner buffers for Type F & S waters. A 75-foot (slope distance) outer buffer (for a total buffer of 100 feet) is created and managed according to provisions for outer buffer for Type F & S waters.
5. For Ns streams that support aquatic species, and for lakes and wetlands smaller than one acre, a buffer zone 75 feet wide (on both sides of the stream) is established that constrains management activities to those that are allowed in outer buffer zones of Type F & S streams.
6. For Ns streams that do not support aquatic species, management:
    a. Maintains root strength and stream bank and channel stability.
    b. Recruits coarse wood to the stream system.
    c. Minimizes management-related sediment transport to the stream system.

Table 13 summarizes the minimum riparian buffer guidelines that will be applied across Clark County:

Table 13 - Minimum Riparian Buffer Guidelines

Stream type	Management Guidelines
Type F & S	Total Riparian management zone width: 200’ 50’ inner zone 150’ outer zone Single-tree selection in inner zone. No equip. in inner zone. Single & group tree selection in outer zone.
Type Np	25’ inner buffer. 75’ outer buffer. Single tree selection in inner buffer. Single & group tree selection in outer buffer
Type Ns	Stream supports aquatic species: 75’ buffer. Single & group tree selection.
Type X (Drainage Ditches)	Stream does not support aquatic species: BMP’s

RESOURCE CATEGORY IV – FOREST INVENTORY / TIMBER / WOOD PRODUCTS

Forest management units (FMU's) are discrete polygons on a landscape that are defined by natural disturbances and forest management practices. The forest stands within Camp Bonneville were originally identified and inventoried in 1978 by Lester Hansen, the Post Forester for the Army at Fort Lewis.

Note: Priority: refers to the management priority of an FMU. Priority I indicates an FMU that should be thinned within the next 1- 5 years in order to maintain the health and vigor of the stand. Priority II should be thinned within the next 5 – 15 years. Priority III may not require additional thinning, or can be selectively thinned for specialty products.

FMU maps are located in the map section of this document.

**Missing information to be collected in next inventory.*

CAMP BONNEVILLE

FMU 1

Category	Priority	Acres	Age 2016	Soil Type	Site Index	Site Class	TPA
Commercial II	II	431		OmF	125	II	
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
*	*	*	*	*	*	*	*
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
*		*		*		*	*

These series of FMU's occur along the hilly slopes on the southeastern fence line of Camp Bonneville. The stands are dominated by Douglas-fir and Red Alder comprising in at least two distinct age classes. The older age class was established in the 1960's following logging activities, but then the young plantation was met with very poor survival. The sites were replanted in early 1980's and this time the seedlings took and there was a normal survival rate.

Very small diameter and low quality red alder occurs in patches and as individuals fairly consistently throughout the units and big leaf maple is naturally regenerating sporadically. Stem density is variable throughout the units, ranging from 150 – 350 trees per acre. In areas of higher density, suppression mortality is beginning to thin the suppressed and intermediate classes of fir, many of which are remaining vertical as small diameter snags. The composition of understory vegetation also varies depending on the density.

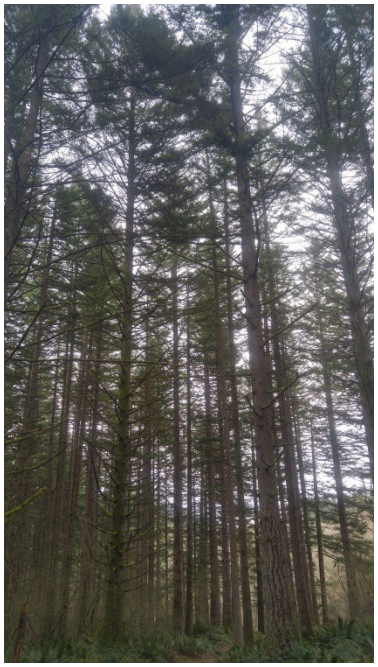


Figure 13 - FMU 1

MANAGEMENT RECOMMENDATIONS

This is a Priority II FMU, which indicates that minimal management will be required into the foreseeable future.

1. Commercially thin 20% - 30% basal area within next 1-5 years by thinning from below. Thinning intensity should vary across the site based on stocking density and aspect in order to minimize future wind throw potential.
2. Use of processor or feller-buncher will minimize soil disturbance, ground impacts and damage to residual trees.
3. Create snags and downed logs during thinning operations. Target: 3-10 snags and downed logs per acre.
4. Conduct second-entry variable density thinning in 5 - 10 years.
5. Conduct third-entry variable density thinning in 10-15 years and reduce canopy to 30% to allow for natural (or planted) understory regeneration of a 2nd conifer cohort.

6. Follow other structure-based management practices as described later in this plan.

FMU'S 2, 6, 7

Category	Priority	Acres	Age 2016	Soil Type	Site Index	Site Class	TPA
Commercial I	I	443	34, 50	OmF	139	III	180
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
13.2	*	*	*	*	95	18	86
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
1.01		232.7		103,088		23.04	10,207

These series of FMU's occur across the hill slopes southeast of Lacamas Creek. The stands are dominated by dense Douglas-fir comprising two distinct age classes of timber. The older age class was established in 1962 following clearcut harvesting, but the young plantation was met with very poor survival. The sites were replanted in 1978 and this time the seedlings took and there was a normal survival rate. Very small diameter and low quality red alder occurs in patches and as individuals fairly consistently throughout

Figure 14 - FMU 6

to no coarse woody debris on the ground.

Figure 15 - FMU 2

the units and big leaf maple is naturally regenerating sporadically. Stem density is variable throughout the units, ranging from 250 – 400 trees per acre. In areas of higher density, suppression mortality is beginning to thin the suppressed and intermediate classes of fir, many of which are remaining vertical as small diameter snags. The composition of understory vegetation also varies depending on the density of the canopy, with some areas nearly bare of vegetation with the exception of random clumps of sword fern, and other areas having much more robust growth and species, including hazelnut, vine maple, sword fern and salal. There is little

MANAGEMENT RECOMMENDATIONS

This is a Priority I FMU, which indicates that short-term management will be essential to improving forest health and vigor.

1. Commercially thin 20% - 30% basal area within next 1-5 years by thinning from below. Thinning intensity should vary across the site based on stocking density and aspect in order to minimize future wind throw potential.
2. Use of processor or feller-buncher will minimize soil disturbance, ground impacts and damage to residual trees.
3. Create snags and downed logs during thinning operations. Target: 3-10 snags and downed logs per acre.
4. Conduct second-entry variable density thinning in 5 - 10 years.

5. Conduct third-entry variable density thinning in 10-15 years and reduce canopy to 30% to allow for natural (or planted) understory regeneration of a 2nd conifer cohort.
6. Follow other structure-based management practices as described later in this plan.

FMU 3

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial II	III	34	38	OmF	139	III	180
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
19.7	*	*	*	*	128	42	42
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
1.05		203.9		6,105		17.10	581

This FMU is comprised of a mix of 95 percent Douglas-fir and 5 percent red alder. Red alder occurs in patches and as individuals throughout the FMU. The stand appears to have been high graded in the past, and current timber quality is fairly low. Stand density varies significantly throughout this FMU, with an average stocking of >450 TPA. Despite the high stocking density for the age of the timber, LCR's remain high and the HDR is low. Understory vegetation is comprised of vine maple, hazelnut and sword fern. Root rot is evident throughout this stand.

MANAGEMENT RECOMMENDATIONS

This is a Priority III FMU indicating that no management activity will be required for another 10-15 years.

1. Commercially thin 30% basal area from below in 10-15 years.
2. Patch cut red alder at maturity and replant with white pine and western red cedar
3. Harvest all Douglas-fir within at least one tree length of root rot pockets and replant sites with western red cedar and Douglas-fir
4. When thinning stand, maintain higher densities along property lines to minimize wind effects from non-forested neighboring lands.
5. Follow other structure-based management practices as described later in this plan.

Figure 16 - FMU 3

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial I	I	184	38	HgD	139	II	*
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
10.7	*	*	*	*	97	45	86.3
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.83		146.08		26,879		17.60	3,238

This large FMU covers a diverse topography in the Northwest corner of the property. This FMU was clear cut in approximately 1972 and replanted with Douglas-fir in 1973. Likely natural reseeding took place, thus resulting in the current excessively high stocking density (600+ tpa). Patches of dense red alder (800+ tpa) occur in the southeast portion of the FMU. Soil moisture is higher in this area resulting in a more robust understory of sword fern, hazelnut and salal. Additionally, there is no understory regeneration of a second conifer cohort. Snags and downed coarse woody debris are largely absent throughout this FMU.

Since this stand has developed under high density, the height-to-diameter ratio (HDR) of the majority of the trees is very high (86.3). These two factors, stand density and high HDR, contribute to a very unstable stand that is becoming more susceptible to wind storms and other natural disturbances.

Figure 17 - FMU 4

MANAGEMENT RECOMMENDATIONS

Note: See Appendix 1 for 2012 harvest plan

This FMU is a Priority I, indicating that short-term management will be necessary to improve stand conditions, forest health and vigor.

1. Commercially thin 20% - 30% basal area within next 1-5 years by thinning from below. Thinning intensity should vary across the site based on stocking density and aspect in order to minimize future wind throw potential.
2. Use of processor or feller-buncher will minimize soil disturbance, ground impacts and damage to residual trees.
3. Create snags and downed logs during thinning operations. Target: 3-10 snags and downed logs per acre.
4. Conduct second-entry variable density thinning in 5 - 10 years.
5. Conduct third-entry variable density thinning in 10-15 years and reduce canopy to 30% to allow for natural (or planted) understory regeneration of a 2nd conifer cohort.
6. Follow other structure-based management practices as described later in this plan.

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial I	I	32	35	OiD	154	III	76
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
*	*	*	*	*	*	*	*
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
*		*		*		*	*

FMU 5 combines approximately five non-contiguous parcels along the western property line. These areas were clearcut in approximately 1977-1978 and immediately replanted. Likely natural reseeding took place, thus resulting in the current excessively high stocking density (600+ TPA). The species composition of the dominant trees runs approximately 75% Douglas-fir and 25% red alder. The red alder occurs in clumps and as individuals throughout the FMU. Soil moisture is higher in this area resulting in a more robust understory of sword fern, hazelnut and salal. Additionally, there is no understory regeneration of a second conifer cohort. Snags and downed coarse woody debris are largely absent throughout this FMU.

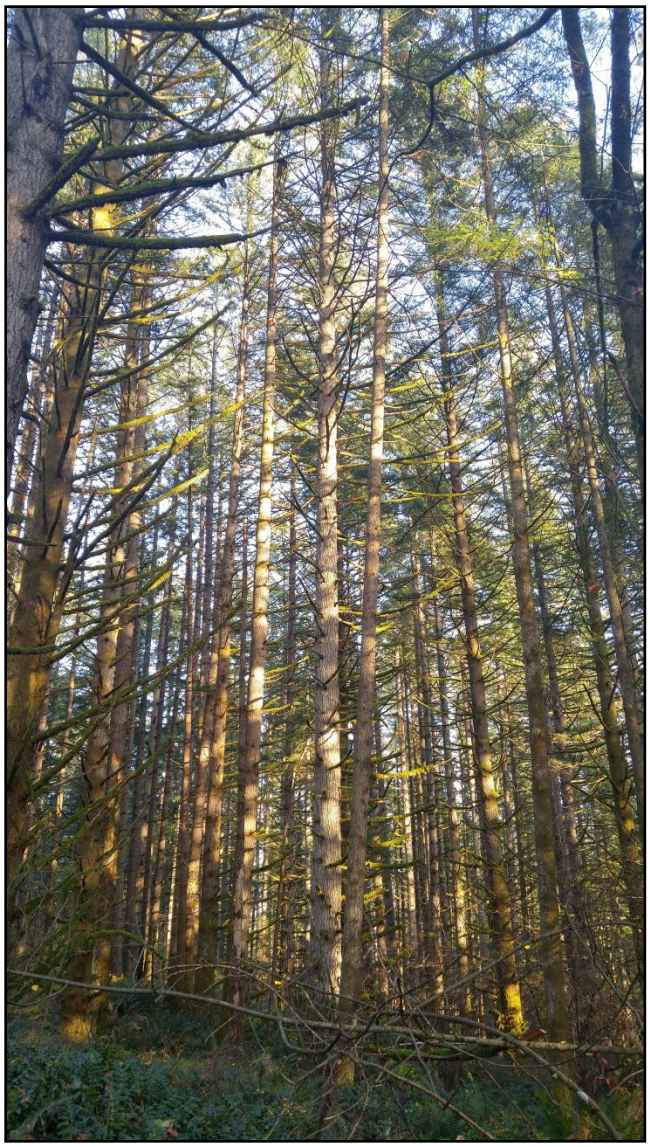


Figure 18 - FMU 5

MANAGEMENT RECOMMENDATIONS

This is a Priority I FMU indicating that it should be commercially thinned within 1-5 years in order to bring stand density down and promote stand growth, vigor and health.

1. Commercially thin 30% basal area from below within 1-5 years. Target majority of commercially viable alder for removal as quality is low and life-span short on these soils. Leave small component of red alder as part of biological matrix.
2. Create snags and downed logs during thinning operations. Target: 3-10 snags and downed logs per acre.
3. Conduct 2nd entry thinning in 5-10 years to thin an additional 30% basal area from below
4. Begin Variable density thinning in 10-15 years.
5. Follow other structure-based management practices as described later in this plan.

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial II	III	136	65	OiB	154	II	85
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
23.3	*	*	*	*	126	25	66
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.68		314.4		42,763		46.24	6,289

This series of FMU's occur along the base of the hill slopes southeast of Lackamas Creek. In general, the stands have a very low stocking density of mature Douglas-fir, indicating they have been thinned in the past. Stocking is higher along swales and stream sides that lead down from the hills. Some mature big leaf maple and red alder occur throughout the stands, and big leaf maple is naturally regenerating sporadically throughout the understory. Most of the understory along the main haul roads has been mowed recently as part of military ordinance clearing, resulting in a low-growing mat of sword fern. Elsewhere, where understory vegetation is still intact, species tend towards salal, elderberry, snow berry and hazelnut. There are few to no snags or downed logs throughout these units and no natural regeneration of shade tolerant conifers.

Figure 19 - FMU 8

MANAGEMENT RECOMMENDATIONS

This is a Priority III FMU, which indicates that no short term timber management is necessary to improve the health or vigor of timber across the FMU. The following recommendations address Clark County's structure-based forest management objectives and long-term timber production goals:

1. Understory will be replanted in order to manually initiate a second cohort of shade-tolerant conifers. Depending on shade conditions, western red cedar, grand fir and Douglas-fir will be planted at approximately 250 tpa.
2. Following initiation of understory conifers, overstory thinning may be used to manage canopy structure and support growth of understory cohort.
3. Create snags by topping or girdling lower value dominant and co-dominant trees. Target: 3-10 snags/acre.
4. Create coarse downed woody debris by cutting and leaving lower value dominant and co-dominant trees. Target: 3-10 snags/acre.
5. Follow other structure-based management practices as described later in this plan.

FMU 9

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial I	I	60	47	OmF, OmE	II	II	*
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
*	*	*	*	*	*	*	*
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
*		*		*		*	*

These small FMUs are tucked up on the southeast side of Little Baldy. The stands are dominated by Douglas-fir where the stocking density is relatively light and is continuing to promote robust growth. Mature big leaf maple occur sporadically throughout the site and are naturally regenerating in the understory. Other understory vegetation includes hazelnut, vine maple, sword fern and salal.

Figure 20 - FMU 9

MANAGEMENT RECOMMENDATIONS

This is a Priority II FMU, which indicates that minimal management will be required into the foreseeable future.

1. Pre-commercially thin red alder within 1-5 years, favoring dominant trees with the best form class.
2. Thin more heavily around residual conifer to release conifer to achieve dominance in the canopy
3. In areas where alder are not expected to respond to thinning, patch cuts may be used to reintroduce either Douglas-fir or a combination of western red cedar and western hemlock.
4. Thinned material can either be left on site or may be extracted as merchantable biomass for local co-gen or CHP facilities.
5. Thinned material can also be piled into habitat piles and constructed downed logs to optimize habitat for amphibians and small mammals.
6. Follow other structure-based management practices as described later in this plan.

FMU 10

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial III	III	8	83	OmF	125	II	*
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
*	*	*	*	*	*	*	*
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
*		*		*		*	*

This small FMU is tucked up on a relatively steep slope southeast of Lackamas Creek. The stand is dominated by a mature single cohort of Douglas-fir that somehow escaped both logging and the various catastrophic fires comprising the Yacolt burns early in the 20th century. The stocking density is relatively light, which is continuing to promote robust growth. Mature big leaf maple occur sporadically throughout the site and are naturally regenerating in the understory. Other understory vegetation include hazelnut, vine maple, sword fern and salal. No snags or significant downed woody debris was observed through this site.

Figure 21 - FMU 10

MANAGEMENT RECOMMENDATIONS

Given the age of the trees on this site, this stand will be conserved as a genetic reserve and no harvesting will be conducted.

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial III	II	33	93	HgB	154	III	250
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
30.1	*	*	*	*	131	44	52.4
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
1.2		631.2		20,830		52.60	1,736

This FMU is comprised of a well-spaced (approx. 250 TPA) mature Douglas-fir with a small component big leaf maples scattered as individuals. As with FMU 23, this stand has benefited from past active management and therefore has a much more robust LCR and lower HDR. Annual growth throughout the stand is strong and the quality of timber is superior to other FMU's. Despite the more open condition of this FMU, understory vegetation is limited to sword fern. This may be due to droughty soils. Additionally, snags and downed logs are largely absent throughout the majority of the FMU with the exception of small pockets of root rot.

Figure 22 - FMU 11

MANAGEMENT RECOMMENDATIONS

Note: see Appendix 1 for 2012 harvest plan

This is a Priority II FMU, which indicates that minimal management will be required into the foreseeable future. The small root rot pockets should be thinned around and isolated in order to control the spread of the disease. Given the advanced age of this stand, as well as the history of past thinning and active management, this stand lends itself more readily to management for late successional characteristics. Additionally, given the unique size and quality of the timber throughout this stand, management will be focused on the production of specialty log products, in particular oversize dimension, clear lumber and poles.

1. Within 1-5 years salvage log root rot pockets and thin heavily around perimeter in order to control spread of disease. Replant root rot areas with western red cedar and big leaf maple.
2. Use individual tree selection for harvest of specialty products
3. Use variable density thinning across the diameter classes to promote greater stand level structural heterogeneity and to open the canopy in places to allow for understory regeneration of a 2nd conifer cohort.
4. Plant understory with western red cedar and big leaf maple
5. Follow other structure-based management practices as described later in this plan.

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial I	I	87	25	OmF	II	*	800+
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
*	*	*	*	*	*	*	*
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.72		40.5		6,076		5.6	844

This FMU was clearcut approximately 25 years ago and the resulting pioneering hardwoods were not controlled. Thus, this FMU is primarily dominated by extremely dense red alder (approx. 800+ TPA). Residual Douglas-fir occur as individuals throughout the stand, but are struggling to compete with the alder and are generally in poor condition. Understory vegetation is dominated by sword fern, with a small component of elderberry.

Figure 23 - FMU 14

MANAGEMENT RECOMMENDATIONS

This is a Priority I FMU, which indicates that short-term management will be essential to improving forest health and vigor. Given the lack of hardwoods across the majority of Camp Bonneville, the following recommendations are intended to facilitate the rehabilitation of this FMU as a hardwood dominated forest type.

1. Pre-commercially thin red alder within 1-5 years, favoring dominant trees with the best form class.
2. Thin more heavily around residual conifer to release conifer to achieve dominance in the canopy
3. In areas where alder are not expected to respond to thinning, patch cuts may be used to reintroduce either Douglas-fir or a combination of western red cedar and western hemlock.
4. Thinned material can either be left on site or may be extracted as merchantable biomass for local co-gen or CHP facilities.
5. Thinned material can also be piled into habitat piles and constructed downed logs to optimize habitat for amphibians and small mammals.
6. Follow other structure-based management practices as described later in this plan.

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial I	III	197	73	OmF	139	II	<200
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
19.7	*	*	*	*	150	30	94
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.53		245.92		46,971		46.40	8,862

This FMU encompasses three discrete stands in the Northeast corner of the property. This FMU has been thinned in the past and stocking density is much lower than the majority of the stands across Camp Bonneville (<200 TPA). As with most stands across the property, the stands in this FMU are dominated by single cohort of mature Douglas-fir. A small component of mature red alder and big leaf maple occur as individuals or in small patches sporadically throughout the site. Small ¼ acre gaps occur throughout the FMU, which tend to be colonized by vine maple. The dense canopy and droughty soils is effectively suppressing understory vegetation, with sword fern and salal being the dominant species. Additionally, there is no understory regeneration of a second conifer cohort. Snags and downed coarse woody debris are largely absent throughout this FMU.

Figure 24 - FMU 17

Although timber across this FMU was thinned, the height-to-diameter ratio (HDR) remains very high (94) and the live crown ratio is still very low. There was no evidence of blow down throughout this FMU, so wind firmness remains strong despite the high HDR. The low crown ratio will limit annual volume growth, but increase the density and long-term quality of the timber. Short-term log quality will be relatively low due to large branches that are still being retained by the majority of the trees.

The North Fork of Lacamas Creek bisects the FMU running from North to South.

MANAGEMENT RECOMMENDATIONS

This is a Priority III FMU, which indicates that no short term timber management is necessary to improve the health or vigor of timber across the FMU. The following recommendations address Clark County's structure-based forest management objectives:

1. Conduct small (1- 2 acre) patch cuts to regenerate Douglas-fir and create a patch mosaic of age classes and canopy structures throughout the FMU.
2. Variable density thinning can be used to diversify spatial complexity and open the canopy to allow for more robust understory regeneration of a second conifer cohort as well as groundcover and understory shrubs.
3. Thin dominant and co-dominant timber classes around big leaf maple and other hardwoods in the understory to promote a more viable hardwood component throughout the FMU.
4. Where soils will support western red cedar, western hemlock or grand fir, these shade tolerant species can be underplanted to introduce a second conifer cohort
5. Where hardwoods are absent, underplant big leaf maple at a spacing of no more than 1 per two acres.
6. Create snags by topping or girdling lower value dominant and co-dominant trees. Target: 3-10 snags/acre.
7. Create coarse downed woody debris by cutting and leaving lower value dominant and co-dominant trees. Target: 3-10 snags/acre.
8. Follow other structure-based management practices as described later in this plan.

Figure 25 - FMU 17

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial II	II	89	63, 93	HgD	III	154	*
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
21.4	*	*	*	*	120	35	67
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.42		237.72		21,157		56.60	5,037

FMU's 18 & 20 follow the main access road through the central part of the property. These stands share common characteristics with others across the property given that they are dominated by an even-age class of Douglas-fir, have minimal understory development, and minimal to no snags and downed logs. Understory vegetation is comprised of sword fern, salal, and vine maple. There is a small, dispersed population of big leaf maple beginning to emerge in the understory through FMU 18 and the north portion of FMU 20.

FMU 18 is younger (approx. 63 years old) and more densely stocked than FMU 20 with an average of >600 TPA. Given the high stocking density, the LCR is low. There is greater diameter class differentiation throughout this stand, with a higher percentage of trees expressing dominance. Although the majority of intermediate and suppressed trees have a very high HDR, the dominant class is better established with an average HDR of 67.

Figure 26 - FMU 18

Trees across FMU 20 tend to be older (approx. 93 years, and more lightly stocked). This stand was thinned from below approximately 30 years ago, therefore the average LCR is higher and the average HDR is lower, thus making this stand much more stable against wind-based natural disturbances. Given the lighter canopy, understory development on the north side of the road is much more robust. The south side of the road shows evidence of past grazing as there is little to now understory development. Additionally, this section of FMU 20 has been thinned much more heavily, and currently has a stocking density of approx. 100 – 150 TPA.

Figure 27 - FMU 20 (North Side of Road)

MANAGEMENT RECOMMENDATIONS

These are high visibility stands with easy access from the road and therefore will receive a higher level of management attention in order to demonstrate structure-based forest management practices. The long-term objective is to manage these stands for late successional characteristics.

1. Thin across diameter classes 30% of basal area in FMU 18 and north portion of FMU 20 within 5-10 years.
2. Thin more heavily around hardwoods to promote growth and position in canopy.
3. Create snags and large wood debris – targets: 3-10 snags and downed logs per acre over time.
4. Variable density thin 30 % basal area in 10-15 years across both FMU's to favor multiple diameter classes and increased spatial heterogeneity. Bring stocking density down to <200 TPA.
5. Follow other structure-based management practices as described later in this plan.

Figure 28 - FMU 20 (South Side of Road)

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial I	I	175	73	OiD	III	154	*
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
29.0	*	*	*	*	122	20	50.4
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.42		200.64		35,112		35.20	6,160

FMU 19 is a large stand that straddles a diverse topography. Soils tend to be wetter, contributing to higher growth potential and trees that are larger in diameter for their height (HDR of 50%). However, as with other stands across the property, stocking density is high (>450 TPA) contributing to a live crown ratio of only 20%. Therefore, the current growth of this stand is very stagnant. The dense canopy is suppressing development of understory vegetation and a 2nd cohort of conifers. Current understory vegetation is limited to hazelnut, vine maple and sword fern. Big leaf maple occurs as individuals sporadically throughout the stand. Decadence is low throughout the stand, with minimal to no snags or large woody debris.

Figure 29 - FMU 19

MANAGEMENT RECOMMENDATIONS

This is a Priority I FMU due to the high stocking density and low crown ratio. In order to optimize the growth on these higher productivity soils, the stand should be thinned soon and frequently over the next 15 years.

1. Thin 30% of basal area from below within 1-5 years.
2. Variable density thin 30% of basal area across diameter classes in 5-10 years after stand has regained wind-firmness.
3. Variable density thin 30% of basal area across diameter classes in 10-15 years. Utilize small patch cuts (<6 acres) to begin introducing greater stand level structural hetereogeneity and opportunities for Douglas-fir regeneration.
4. After 2nd thinning, being underplanting grand fir, western red cedar and western hemlock in low spots and wetter sites
5. Thin more heavily around hardwoods to promote growth and position in canopy.
6. Create snags and large wood debris – targets: 3-10 snags and downed logs per acre over time.
7. Follow other structure-based management practices as described later in this plan.

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial II	II	102	63	HgB	III	154	*
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
26.1	*	*	*	*	120	32	54.5
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.4		160.4		16,361		40.10	4,090

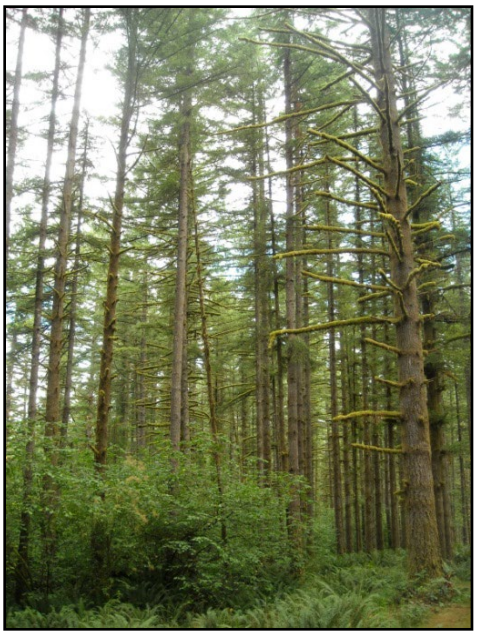


Figure 32 - FMU 21

This FMU is spread across three distinct stands in the southwest corner of the property. The composition of the dominant tree species is approximately 95% Douglas-fir and 5% red alder. The alder is generally of poor condition, which is typical for rocky, well drained soils. The stand is heavily stocked for its age (350 – 450 TPA), but not as heavily stocked as other FMU's throughout the property. There is greater differentiation amongst dominant, co-dominant and intermediate trees, as well as across the diameter classes. The HDR tends to be lower across this site, but the LCR is also lower, indicating that stand growth is slowing significantly due to canopy competition. Root rot is quite prevalent throughout this site, and is beginning to create gaps ranging from ¼ acre to ¾ acre in size. Red alder and hazelnut are dominating the root rot pockets. Big leaf maple occurs as individuals sporadically throughout the stand. Despite the prevalence of root rot, snags are still minimal throughout the stand as it appears that trees tend to blow over versus persist as standing dead. Beyond the root rot pockets, downed logs are minimal to non-existent.

Figure 303 - Root Rot Pocket

MANAGEMENT RECOMMENDATIONS

This is a Priority II FMU, indicating that thinning should occur in approximately 5-10 years after all Priority I FMU's have been treated.

1. Commercially thin 30% basal area from below within 5-10 years.
2. Patch cuts of 1-6 acres may be utilized to increase stand-level heterogeneity and regenerate Douglas-fir. Patch cuts can be focused on root rot pockets, however, in these locations western red cedar and red alder should be replanted.
3. Create snags and downed logs during thinning operations. Target: 3-10 snags and downed logs per acre.
4. Conduct 2nd entry variable density thinning of 30% basal area in 10-15 years, focusing thinning across the diameter classes.
5. Conduct 3rd entry variable density thinning of 30% basal area in 15-20 years.
6. Follow other structure-based management practices as described later in this plan.

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial I	I	23	38	HgB	III	154	
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
12.3	*	*	*	*	96	15	93
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
1.1		243.1		5,591		22.10	508

This FMU is comprised of a young and highly stocked (450+ TPA) stand of Douglas-fir. This stand has been in the stem exclusion phase for over 10 years, resulting in an LCR of <30 percent and an HDR of 93. This stand is highly susceptible to wind-based natural disturbance, especially given its location along a property line where urban development has significantly reduced the buffering effect of the adjacent forest. The low LCR and high stocking density is also contributing to stagnant growth. Understory vegetation is comprised of ocean spray, vine maple, hazel nut and salal. Root rot is evident in scattered pockets throughout the FMU, with the aforementioned brush species heavily colonizing these areas. Despite the effects of root rot, very few snags or downed logs occur throughout the site.

Figure 31 - FMU 22 before 2012 Treatment

MANAGEMENT RECOMMENDATIONS

Note: See Appendix 1 for 2012 harvest plan

This is a Priority I FMU, indicating that commercial thinning should be conducted within the next 1-5 years in order to reduce the stocking density and improve the growth, vigor and health of this stand.

1. Commercially thin 30% basal area from below within 1-5 years
2. Thin more lightly along stand boundaries to minimize wind disturbance.
3. Underplant stand boundaries with grand fir to begin developing more complex edge and canopy to further mitigate wind disturbance.
4. Conduct small patch cuts in root rot pockets. Replant with western red cedar.
5. Create snags and downed logs during thinning operations. Target: 3-10 snags and downed logs per acre.
6. Conduct 2nd entry variable density thinning in 5-10 years of 30% basal area. Begin thinning across diameter classes to create more complex stand and canopy structure.
7. Conduct 3rd entry variable density thinning in 10-15 years.
8. Follow other structure-based management practices as described later in this plan.

Figure 32 - FMU 22 after 2012 Treatment

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial III	III	47	98	HgD	III	154	250
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
30.5	*	*	*	*	114	45.6	44.8
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
2.4		1161.6		54,595		48.40	2,275

This FMU comprises the oldest stand at Camp Bonneville. The stand has been thinned at least once over the past 30 years and the average stocking density is very reasonably below 250TPA. This FMU provides a good example of how active management can improve stand productivity, vigor, health and quality of timber products. The LCR is high for the age of the timber, thus contributing to optimal growth across the stand. This is evidenced by the low HDR and high average DBH. The more open canopy also has resulted in much more robust understory vegetation, predominantly hazelnut and sword fern. However, understory regeneration of a 2nd conifer cohort is non-existent, as are any signs of decadence (e.g. snags and downed logs).

Figure 36 – FMU 23

MANAGEMENT RECOMMENDATIONS

This is a Priority III FMU, which indicates that little to no management will be required for the foreseeable future. Given the advanced age of this stand, as well as the history of past thinning and active management, this stand lends itself more readily to management for late successional characteristics. Additionally, given the unique size and quality of the timber throughout this stand, management will be focused on the production of specialty log products, in particular oversize dimension, clear lumber and poles.

1. Use individual tree selection for harvest of specialty products
2. Use variable density thinning across the diameter classes to promote greater stand level structural heterogeneity and to open the canopy in places to allow for understory regeneration of a 2nd conifer cohort.
3. Plant understory with western red cedar, big leaf maple
4. Follow other structure-based management practices as described later in this plan.

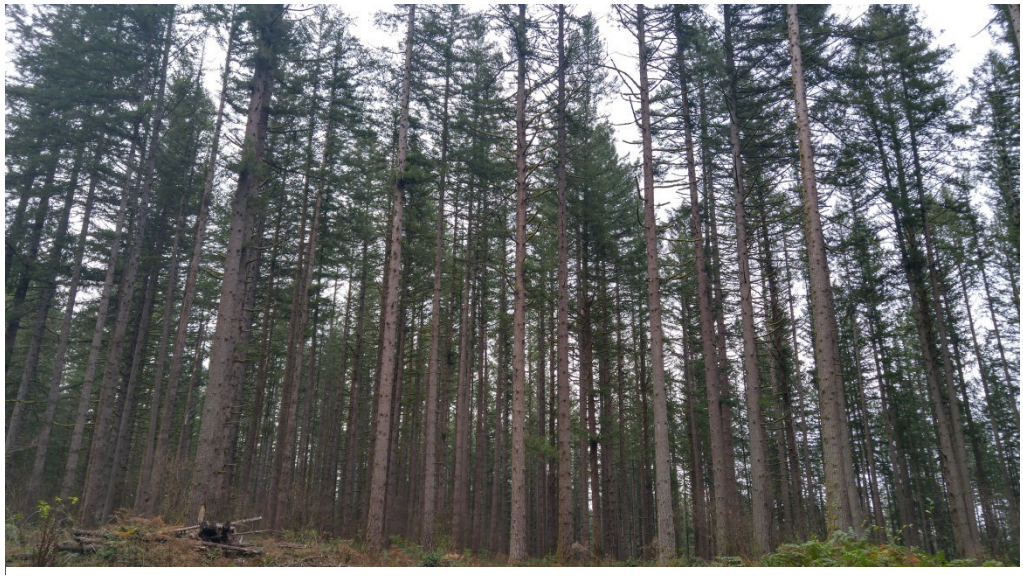


Figure 37 - FMU 23 after individual tree selection

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial III	III	119	38	OmF	II	121	NA
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
NA	NA	NA	NA	NA	NA	NA	NA
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.72		40.5		6,076		5.6	844

FMU 26 is almost completely comprised of naturally regenerated red alder that colonized the both the riparian areas along Buck and David Creek and a series of small perched wetlands along the hill slopes southeast of Lacamas Creek. Mature and naturally regenerating big leaf maple occurs periodically throughout the site, with many mature maples in a low-quality coppice form. Given the relatively open hardwood canopy and wet soils, understory vegetation is very thick and robust and comprised primarily of hazelnut, salmon berry and cascara.

Figure 33 - Example of Red Alder Colonized in RMZ Areas

There are several seeps in FMU 26 the stand and some of the area is forested wetland with salamander use. The red alder is a nitrogen fixer and will help build soils with added nutrients and increased micro and macro invertebrates. There is a good distribution of Douglas-fir coming up within the alder stand. The understory is comprised mainly of salmonberry and vine maple. The stand is in good health and growing with vigor. There is concern to control noxious weeds in this stand as scot's broom and yellow tansy have been noted.

MANAGEMENT RECOMMENDATIONS

This is a Priority III FMU, which indicates that there are no short-term plans for managing this stand. Given that the majority of these sites are on relatively sensitive hydric soils, conservation for wildlife habitat and riparian function will be the primary objective. Some sites may be considered for a hardwood conversion, according to the Washington DNR's guidelines, in order to establish more long-lived and functionally valuable conifers along the streams.

Figure 39 - Red Alder

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial III	III	130	NA	OmF	II	II	NA
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
NA	NA	NA	NA	NA	NA	NA	NA
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
NA		NA		NA		NA	NA

This 130 acre FMU comprises the riparian management zone along Lacamas Creek. The FMU follows Lacamas creek and its tributaries, Buck Creek and David Creek. Vegetation within the RMZ is comprised of sparsely populated hardwoods (primarily red alder), brush (primarily vine maple and hazelnut) and grass (primarily reed canary). There is very little conifer cover along the creek as likely the majority of the conifer was harvested during a previous regulatory environment that allowed for harvesting streamside corridors.

The Lacamas Creek stream channel is deeply incised in many areas, particularly through the reaches in the northern part of the property. This is likely due to a lack of large woody debris throughout the stream system and increased "flashiness" of water flow due to poor water retention in the heavily logged upper part of the watershed. The substrate in the stream channel is comprised of cobbles and fine gravel.

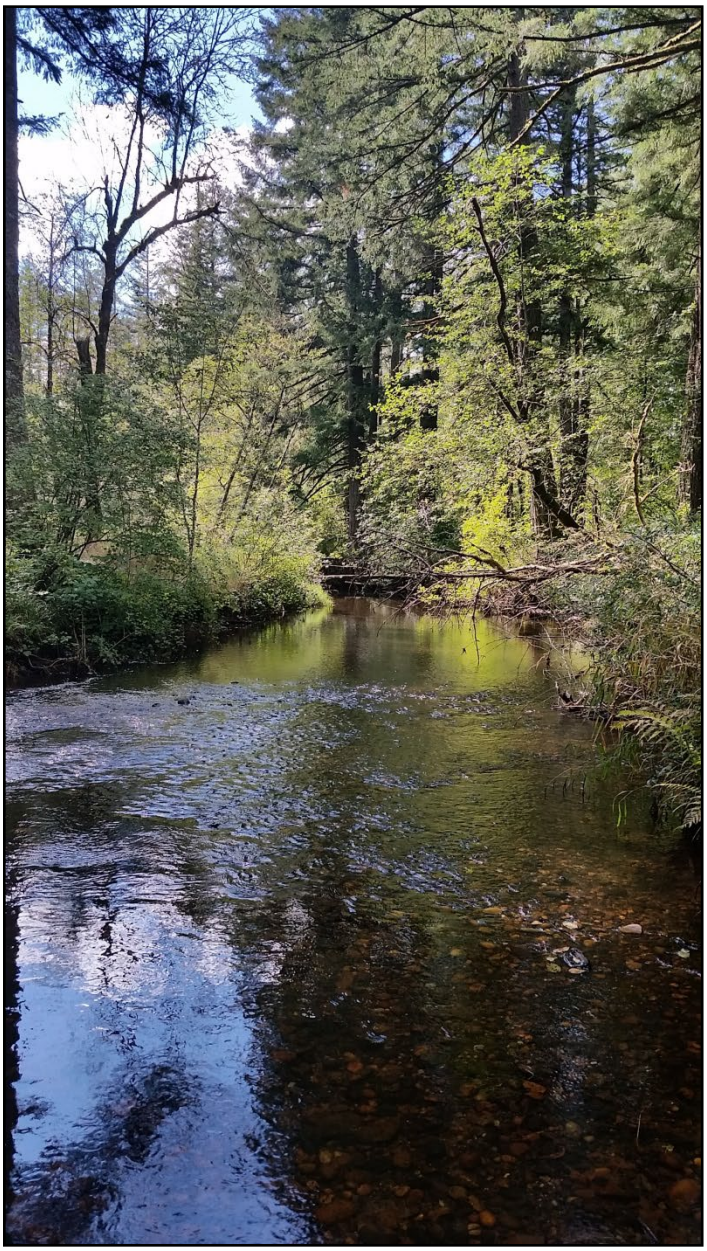


Figure 40 - North reach of Lacamas Creek

MANAGEMENT RECOMMENDATIONS

1. Within 1-5 years replant RMZ's with a mix of conifers and hardwoods, including: Douglas-fir, Western Red Cedar, Western Hemlock, Grand fir, Sitka Spruce, red alder, big leaf maple, cottonwood and Oregon ash.
2. Add large wood debris to stream channel to slow water velocity and create pool's and riffles.

Category	Priority	Acres	Age 2016	Soil Type	Site Index	Site Class	TPA
Commercial I	I	23	*	OiE	133	II	76
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
21.7	22.6	165	221	35	87.1	61	54
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.9		*		*		23.5	541

These areas are constrained lands, as management will only take place when the opportunities present themselves.

FMU 15 & 32 is an old shooting range sites that have been cleaned up and future plans haven't been discussed on these sites.

Figure 35 - FMU 32

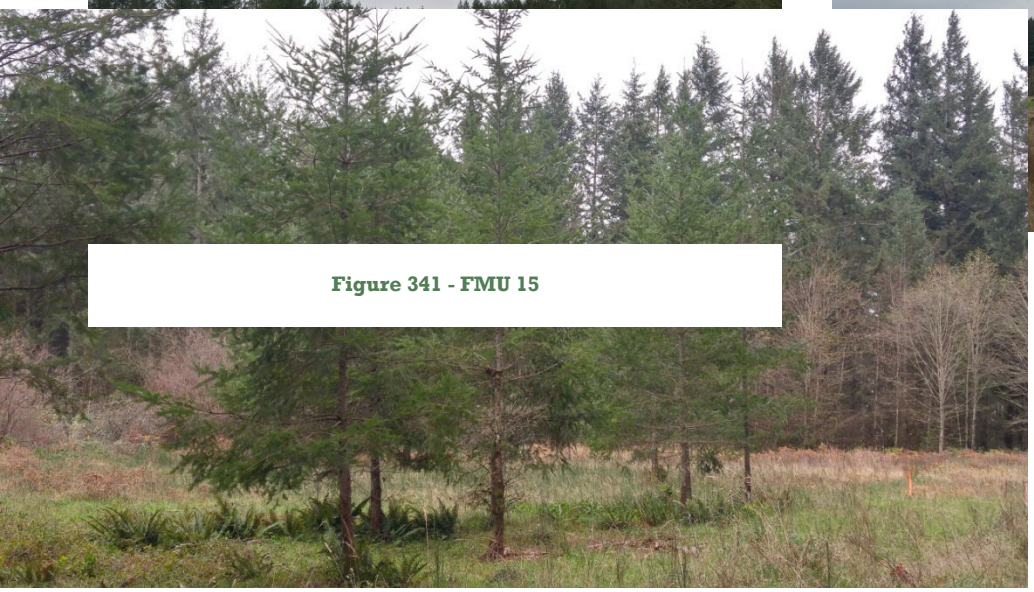


Figure 341 - FMU 15

Figure 43 - FMU 16

FMU 16 is sites that have been cleaned up in the past 5 years from UXOs (Unexploded Ordnances). These sites are small and have natural regeneration of Douglas-fir. One site (near FMU 22 & 3) is going to be planted with Willamette Valley Ponderosa Pine in 2017 as an experiment to see if the species takes to the area or not. There will be other sites as well totaling 4 acres with a density of 194 TPA.

FMU 30 is the Central Impact Target Area (CITA) which comprises of 545 Acres of UXO. This site is scheduled to be cleaned up by 2021. After thoughts of the site haven't been discussed in depth other than no entry will be allowed. If that's the case, we could possible turn this site into a reserve for wildlife.

The table above is data for FMU 31 which is the new expansion of the CITA. This stand is scheduled to be harvested in the next few years as the Central Impact Target Area (CITA) gets expanded an additional 107 acres, it will be the 5th expansion in the camps history. This will not have any future management associated to it after planting takes place, as it will be inside of the new CITA fence line, which prohibits future entries without special approval.

Figure 4436 - FMU 30

MANAGEMENT RECOMMENDATIONS

This is a Priority I FMU, because of the timeliness of the CITA expansion.

1. A Variable Retention Harvest (VRH) will be scheduled when the CITA team is ready.
2. Planting density will depend on survey after harvest, but planning on 400 TPA to account for mortality.
3. Planting species will vary on site location after harvest survey.
4. Scarify open sites and replant to Douglas-fir at a stocking of 250 stems / acre upon 1st harvest entry.

Figure 45 - FMU 31

Category	Priority	Acres	Age 2016	Soil Type	Site Index	Site Class	TPA
Commercial II	III	98	35-70	OiE, OmF	125	II	61
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
26.1	26.8	189	237	37	101	40	48
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
*		*		*		27.4	2,738

This entire section (section 36) was acquired from the State DNR as a Trust Land Transfer back in 2011. Recently the stand had a small inventory done this year and from that was divided into 4 different management units based on different attributes.

Figure 4637 - FMU 33

Although many of the Douglas fir has DBH > 24 inches, these areas have slopes as high as 30%, and road access is poor, except along the Upper and Lower DNR Roads that travel through the section. Special care would be needed to harvest any of the trees on the steeper slopes. Trees in these areas fully occupy the site and some thinning from below would be possible, and would ensure that the dominant trees continue to grow well. Care should be taken to avoid damaging the site. Timing of harvest depends on markets and the financial needs.

Figure 47- FMU 34

Trees in some areas are too densely spaced along portions of the Upper DNR Road, so thinning is the first priority. Just over 10% of the Douglas-firs measured during the sampling were ≥ 10 inches DBH, so some of the trees are marketable. As access is good, harvesting these trees could offset some of the costs of thinning. Some portions of the property are stocked with non-merchantable species, damaged or poorly-formed trees. This part of the forest will require some additional work to delineate what needs to be done in each part. These areas will still be fully stocked after thinning. Other areas that are opened up sufficiently will

be planted with a variety of conifer tree species, depending on the amount of light and the site-specific growing conditions.

Since the overstory is tall in some of these areas, there is a lot of sun penetrating through to the forest floor allowing the non-native Himalayan blackberry to invade and overtake the natural seedling and saplings of the Douglas-fir. In the denser spots of the stand there is Cascade Oregon grape, Salal, Salmonberry, Sedge, Vine maple and, Western sword fern as native species were present.

MANAGEMENT RECOMMENDATIONS

The stand is commercial size and no specific management activity is suggested for the type during the current planning period. Access into and through the stand will be improved during planned timber harvests in adjacent timber types. The area should be reevaluated when adjacent forest areas are logged. The first entry into the stand should be a commercial thinning and improvement cut.

Maintain the conifer stands until the young regeneration has reached a level of maturity providing structural diversity. Under planting shade tolerant conifer species in pockets of smaller alder and in larger openings of the stand will better position the site to respond to hardwood mortality. This will improve use of the site's productive capability.

As this part of the property is treated, Douglas fir, hemlock and western red cedar will be planted.

Figure 48 - FMU 35

Figure 49 - FMU 36

FMU 1

Category	Priority	Acres	Age 2016	Soil Type	Site Index	Site Class	TPA
Commercial II	II	48	45	OiD		II	131
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
18.7	19.1	239	341	55	114	48	74
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
NA		NA		NA		41.9	2,012

Within each of the stands, the understory is almost entirely common, native species: ferns, mosses, Salmon berry, huckleberry, native bleeding heart, and trillium. In areas with more light, the Salmon berry in particular has dominated. Along the road, some invasive species are trying to establish themselves, primarily blackberry (evergreen and Himalayan). Otherwise, the only invasive noted within the forest has been some heavy English holly seedlings which will be difficult to remove when they are found for the size vary from small (2-5ft) to very large (5-20ft).

Figure 50 - FMU 1

MANAGEMENT RECOMMENDATIONS

This is a Priority II FMU, indicating that thinning should occur in approximately 5-10 years after all Priority I FMU's have been treated.

1. Commercially thin 30% basal area from below within 5-10 years.
2. Patch cuts of 1-6 acres may be utilized to increase stand-level heterogeneity and regenerate Douglas-fir. Patch cuts can be focused on root rot pockets, however, in these locations western red cedar and red alder should be replanted.
3. Create snags and downed logs during thinning operations. Target: 3-10 snags and downed logs per acre.
4. Conduct 2nd entry variable density thinning of 30% basal area in 10-15 years, focusing thinning across the diameter classes.
5. Conduct 3rd entry variable density thinning of 30% basal area in 15-20 years.

6. Follow other structure-based management practices as described later in this plan.

FMU 2

Category	Priority	Acres	Age 2016	Soil Type	Site Index	Site Class	TPA
Commercial II	II	85	45	OiE		II	137
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
17.7	18.3	211	308	50	106	57	69
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
NA		NA		NA		32.2	2,737

Within each of the stands, the understory is almost entirely common, native species: ferns, mosses, Salmon berry, huckleberry, native bleeding heart, and trillium. In areas with more light, the Salmon berry in particular has dominated. Along the road, some invasive species are trying to establish themselves, primarily blackberry (evergreen and Himalayan). Otherwise, the only invasive noted within the forest has been some heavy English holly seedlings which will be difficult to remove when they are found for the size vary from small (2-5ft) to very large (5-20ft).

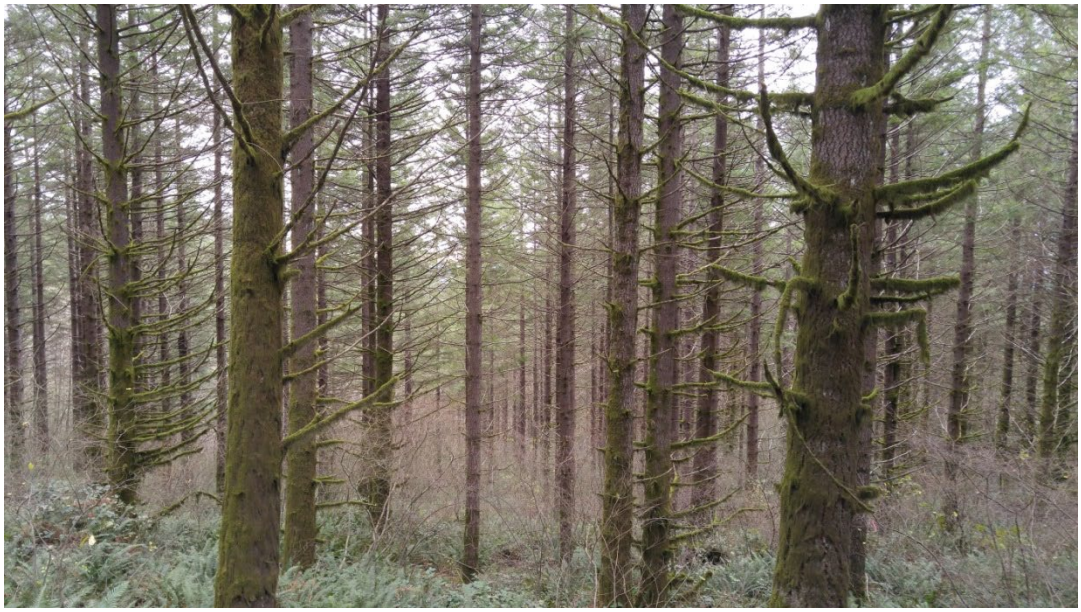


Figure 51 - FMU 2

MANAGEMENT RECOMMENDATIONS

This is a Priority II FMU, indicating that thinning should occur in approximately 5-10 years after all Priority I FMU's have been treated.

1. Commercially thin 30% basal area from below within 5-10 years.
2. Patch cuts of 1-6 acres may be utilized to increase stand-level heterogeneity and regenerate Douglas-fir. Patch cuts can be focused on root rot pockets, however, in these locations western red cedar and red alder should be replanted.
3. Create snags and downed logs during thinning operations. Target: 3-10 snags and downed logs per acre.
4. Conduct 2nd entry variable density thinning of 30% basal area in 10-15 years, focusing thinning across the diameter classes.

5. Conduct 3rd entry variable density thinning of 30% basal area in 15-20 years.
6. Follow other structure-based management practices as described later in this plan.

FMU 3

Category	Priority	Acres	Age 2016	Soil Type	Site Index	Site Class	TPA
RMZ	III	21	45				112
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
19	19.4	118	180	30	79	60	60
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
NA		NA		NA		11.7	247

FMU 3 is almost completely comprised of naturally regenerated red alder that colonized both the riparian areas along the unnamed creeks typed as Fp, Np, Ns, and the Little Washougal River, and also a series of small perched wetlands or seeps along the hill slopes east of creeks. Scattered mature conifers and naturally regenerating red alder occur periodically throughout the site. Given the relatively open hardwood canopy and wet soils, understory vegetation is very thick and robust and comprised primarily of vine maple, hazelnut, salmon berry, salal, and cascara. Himalaya blackberry patches are scattered about the forested area and dominate along the property line on the western side of the property. Individual blackberry plants are scattered throughout the alder thickets and Douglas-fir areas. Tansy and an unidentified thistle species occur randomly around the property with the greatest occurrence in or around the edges and roads within the stand.

Figure 52 - FMU 3 RMZ Buffer

MANAGEMENT RECOMMENDATIONS

This is a Priority III FMU, which indicates that there are no short-term plans for managing this stand. Given that the majority of these sites are on relatively sensitive hydric soils, conservation for wildlife habitat and riparian function will be the primary objective. Some sites may be considered for a hardwood conversion, according to the Washington DNR's guidelines, in order to establish more long-lived and functionally valuable conifers along the streams.

FMU 1

Category	Priority	Acres	Age 2014	Soil Type	Site Index	Site Class	TPA
Commercial II	III	23	69	HcB	154	II	20
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
9.2	*	*	*	*	52		68
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.031		272.8		6274		8.80	202

Stand 1 consists of 23 acres in the southeast corner of the property. It contains a widely scattered overstory of Douglas fir. This stand initiated approximately 60 years ago in a field/pasture, hence tree stocking is poor probably due to grass competition. Stocking of trees 6 inches DBH and greater is 20 TPA, all of which were Douglas-fir. Average tree diameter for all size classes is 9.2 inches DBH. Tree stocking is improving in places with in-growth from younger trees including red alder, Douglas fir, and cherry. These smaller tree classes contain 136 TPA among trees < 6 inches DBH. Due to the open development of this stand, commercial value is lower than most other forested areas on the property. Net stand volume averages approximately 8 MBF/acre. Average tree defect was 9 percent, the highest of all stands on the ownership.

Figure 54 - FMU 1

Understory vegetation cover (shrubs, forbs, and grass) in Stand 1 averaged 60 percent and 4 percent among two canopy strata that averaged 4 and 7 feet, respectively. The top three dominant species by percent cover included Himalayan blackberry (22%) hazel (12%) and grass (9%).

No snags or down wood were inventoried in Stand 1. The low levels of dead wood in Stand 1 likely results from the lack of suppression mortality in this stand due to its open condition, and the lack of biological legacies because this stand initiated in a field. Total down wood was 4.6 tons/acre, and 304 ft^3/acre, distributed among logs with an average diameter of 8 inches and a length of 23 feet. All down wood were from Douglas-fir.

MANAGEMENT RECOMMENDATIONS

1. Control Himalayan blackberry using a combination of a rubber-tracked skid steer with brush masticator followed by herbicide application of resprouts.
2. Pre-commercially thin red alder to a 15 x 15 foot spacing.
3. Replant area with Douglas fir to bring total stocking density (existing trees plus planted seedlings) to a total stand density of 240 TPA.
4. As second cohort matures, follow structure-based management practices as described later in this plan.

FMU 2

Category	Priority	Acres	Age 2014	Soil Type	Site Index	Site Class	TPA
Commercial II	III	22	75	HcB	154	II	60
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
13.8	*	*	*	*	62	*	54
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.004		7.6		167		1.90	42

Stand 2 is the only hardwood dominated stand on the Green Mountain property. The main canopy is composed of an even-age tree cohort of big leaf maple that initiated approximately 60 years ago. Douglas-fir of the same age class occurs widely scattered throughout the stand. Tree stocking of trees 6 inches DBH and greater is 60 TPA of which big leaf maple comprises 48 percent and 29 TPA. The remaining tree stocking contains Douglas-fir, red alder and willow. Understory tree canopy is sparse with only 20 TPA, of an equal mix big leaf maple and willow. Average tree diameter for all size classes is 9.2 inches dbh.

Figure 55 - FMU 2

Due to hardwood dominance in Stand 2, board foot volume is the lowest of all inventoried areas on the property. Net board foot volume averages 7.4 MBF, with 6.8 percent defect.

Understory vegetation cover is extensive in Stand 2 and the highest of all stands. Percent cover is 143 percent and 7 percent among two canopy layers averaging 5 and 19 feet, respectively. The top three dominant species by percent cover include sword fern (48%), hazel (31 %), and willow (30%).

Down woody debris levels were low compared with mature natural Douglas-fir stands. Total down wood was 4.3 tons/acre, and 290 ft3/acre, distributed among logs with an average diameter of 7 inches and a length of 22 feet. Down wood were from a mix of species including Douglas-fir, red cedar, red alder, and willow.

Forest inventory showed Stand 2 had 3.3 snags/acre. Average diameter was 12 inches DBH. Snags were equally represented by Decay Class 2, 3, and 5. The largest snag diameter class recorded was 21 inches dbh.

MANAGEMENT RECOMMENDATIONS

1. Pre-commercially thin big leaf maple by removing the lowest quality trees (e.g. excessive wane, low branches, etc.).
2. Cut back understory vegetation with a brush masticator. Replant unit with western red cedar at 200 TPA. Monitor seedlings to ensure survival and cut back competing vegetation as necessary until seedlings reach a free-to-grow height.
3. As second cohort matures, follow structure-based management practices as described later in this plan.

FMU 3

Category	Priority	Acres	Age 2014	Soil Type	Site Index	Site Class	TPA
Commercial II	III	15	81	HcB	154	II	56
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
25.1	*	*	*	*	151	*	72
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.015		865.65		12,985		59.70	896

Stand 3 consists of 15 acres of well-stocked even-aged approximately 70 year old Douglas fir in the northwest area of the property. Stocking of trees 6 inches DBH and greater is 56 TPA, all Douglas-fir. Average tree diameter for all size classes is 25 inches dbh. The < 6 inch DBH class contains 8 TPA of big leaf maple. Net stand volume averages approximately 56.7 MBF/acre. Tree defect was calculated at 5%.

Stand 3 has a dense understory vegetation cover. Percent cover is 108 percent and 26 percent among two canopy layers averaging 4 and 17, respectively. The top three dominant species by percent cover include sword fern (63%) vine maple (52%), hazel (6%).

Figure 56 - FMU 3

Down woody debris levels were low compared with mature natural Douglas-fir stands. Stand 3 had a high density of snags (167 snags/acre) due to normal suppression mortality in smaller diameter classes. Average snag diameter is 10 inches DBH. Most snags (75%) are in hard stages of decay. Only 3 percent of snags are heavily decayed (class 4 and 5). The largest snags were 46 inches DBH.

MANAGEMENT RECOMMENDATIONS

1. Retain dominant Douglas fir indefinitely as legacy trees.
2. Cut back understory vegetation with a brush masticator. Replant unit with western red cedar at 200 TPA. Monitor seedlings to ensure survival and cut back competing vegetation as necessary until seedlings reach a free-to-grow height.
3. As second cohort matures, follow structure-based management practices as described later in this plan.

FMU 4

Category	Priority	Acres	Age 2014	Soil Type	Site Index	Site Class	TPA
NA	III	4-7	*	*	*	*	*
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
*	*	*	*	*	*	*	*
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
*		*		*		*	*

FMU 4 is currently considered non-commercial as the entire 4-7-acre unit is dominated by dense hardwood shrubs and trees. This unit may be considered a forested wetland by WA DNR standards. Scrubby, poorly growing willow, bitter cherry, and red alder have naturally regenerated in a dense thicket across this unit. Based on the presumed age of the trees and brush, this site was likely logged 25 – 35 years ago and either not replanted, or the existing hardwoods outcompeted the planted conifer seedlings. It is also possible that root rot may have a latent presence in the soil. There is currently no evidence of the fungal disease in the Douglas fir surrounding the site, but further monitoring is recommended.

Figure 57 - Hardwood dominated pocket within Douglas fir stand.

MANAGEMENT RECOMMENDATIONS

This small unit lends an important amount of biodiversity and wildlife habitat value to the Green Mountain forest. The much wider range of hardwood trees and shrubs provide more forage for birds and mammals and a unique structural composition that supports different plant and wildlife species. Given its small scale relative to the other management units across this forest, it is recommended that this site be conserved as- is and allowed to naturally develop on its own.

1. Retain a minimum of a 75 foot forested buffer on either side of the seasonal stream. Avoid heavy equipment use within 75 feet of stream.
2. Conserve FMU 4 as-is and retain a 75' forested buffer around unit.
3. Prohibit road building across or adjacent to stream.
4. Protect water retention function of soils by maintaining perpetual forest cover across Green Mountain by limiting timber harvesting to thinning or small patch cuts of less than six acres

Category	Priority	Acres	Age 2014	Soil Type	Site Index	Site Class	TPA
Commercial II	I	88	65	HcB	154	II	93
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
21.7	*	*	*	*	134	*	74
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.008		407.2		35,834		50.9	4,479

Stand 5 is the largest stand on the property, covering 88 acres of well- stocked even-aged Douglas fir. This stand includes areas south of the powerline from the central to east line of the property. Stand age is approximately 60 - 65 years. Stocking of trees greater than 6 inches DBH is 93 TPA. The composition of the dominant species is 78 percent Douglas-fir with the remainder in big leaf maple. Average tree diameter for all size classes is 22 inches dbh. Understory tree stocking is very sparse. Net stand volume averages approximately 47.5 MBF/acre. Tree defect was calculated at 7 percent.

Stand 5 has a dense understory vegetation cover. Percent cover is 107 percent and 8 percent among two canopy layers averaging 4 and 13 feet, respectively. The top three dominant species by percent cover include sword fern (37%) vine maple (36%), hazel (23%).

Down woody debris levels were low compared with mature natural Douglas-fir stands. However, Stand 5 has the highest level of down wood among stands on the property. Total down wood was 10.2 tons/acre, and 683 ft3/acre, distributed among logs with an average diameter of 10 inches and a length of 16 feet. Down wood included Douglas-fir, big leaf maple, and various hardwoods.

Stand 5 had 11snags/acre. Snags were distributed across a wide range of diameters (6 - 54"). The largest snags were all highly decayed and remnants from the original old growth stand. Most snags (67%) are in hard stages of decay. Thirty percent of snags are heavily decayed (class 4 and 5).

Figure 58 - FMU 5

MANAGEMENT RECOMMENDATIONS

This is a Priority I FMU, which indicates that short-term management activities are scheduled for this unit.

1. Commercially thin 20 – 30 percent of the basal area within next 1-5 years by thinning across the diameters. Underplant stand with Douglas fir at 100 TPA following harvest (completed 2015).
2. Create snags and downed logs during thinning operations. Target: 3-10 snags and downed logs per acre (completed 2015).
3. Conduct second-entry variable density thinning in 10 - 20 years, removing 20 – 30 percent of basal area.
4. Conduct third-entry variable density thinning in another 10 - 20 years and reduce canopy to 30 percent to allow for natural (or planted) understory regeneration of a second conifer cohort.
5. Follow other structure-based management practices as described later in this plan.

Category	Priority	Acres	Age 2014	Soil Type	Site Index	Site Class	TPA
Commercial II	I	50	75	HcB	154	II	151
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
15.2	*	*	*	*	112	*	88
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.009		540		27,000		60.0	3,000

Stand 6 contains 50 acres of well-stocked even-aged Douglas fir, in the southwest corner of the property. This stand has the highest tree density on the property. Stocking of trees 6 inches DBH and greater is 151 TPA. Tree composition in this class is 85 percent Douglas-fir, with remainder in big leaf maple (14%) and grand fir (1%). Average tree diameter for all size classes is 15 inches DBH. Understory tree stocking in the less than 6 inch DBH class is 81 TPA of a mix of species (from highest to lowest density) including big leaf maple, cascara and Douglas-fir. Net stand volume averages approximately 55.3 MBF/acre. Average tree defect was 8 percent.

Figure 59 - Douglas fir dominated area within FMU 6 with big leaf maple and grand fir in understory.

Figure 60 - High timber quality.

Stand 6 has a dense understory vegetation cover. Percent cover is 113 percent and 15 percent among two canopy layers averaging 3 and 11 feet, respectively. The top three dominant species by percent cover include sword fern (36%) vine maple (49%), and trailing blackberry (17%). Down woody debris levels were low compared with mature natural Douglas- fir stands. Total down wood was 3.3 tons/acre, and 221 ft3/acre, distributed among logs with an average diameter of 8 inches and a length of 13 feet. Down wood included Douglas-fir, big leaf maple, and various hardwoods. Stand 6 had 20 snags/acre. Snags were distributed across a wide range of diameters (6-30"), although most snags were in the 6 – 10 inch DBH class, resulting from suppression mortality. Most snags (92%) are in hard stages of decay. Eight percent of snags are heavily decayed (class 4).

MANAGEMENT RECOMMENDATIONS

This is a Priority I FMU, which indicates that short-term management activities are scheduled for this unit.

1. Commercially thin 20 – 30 percent of the basal area within next 1-5 years by thinning across the diameters (completed 2015).
2. Create snags and downed logs during thinning operations. Target: 3-10 snags and downed logs per acre (completed 2015).
3. Conduct second-entry variable density thinning in 10 - 20 years, removing 20 – 30 percent of basal area.
4. Conduct third-entry variable density thinning in another 10 - 20 years and reduce canopy to 30 percent to allow for natural (or planted) understory regeneration of a second conifer cohort.

5. Follow other structure-based management practices as described later in this plan.

FMU 7

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial II	II	84	61	OmF	139	II	79
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
12.1	*	*	*	*	68	*	67
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.028		663.6		55,742		23.70	1,991

Stand 7 includes 84 acres of well- stocked to open even-aged Douglas fir. The stand occupies forestland south of the powerline from the center of ownership to the west property.

Figure 61 - Lightly stocked Douglas fir stand in FMU 7.

Stocking of trees 6 inches DBH or greater DBH is 79 TPA. Tree composition in this class is 64 percent Douglas-fir, with remainder in big leaf maple (19%) and a mix of grand fir, red alder and cherry (17%). Average tree diameter for all size classes is 12 inches DBH. Understory tree stocking in the less than 6 inch DBH class is 110 TPA of a mix of species (from highest to lowest density) including willow, grand fir, big leaf maple, and Douglas-fir. The variable stocking of Douglas-fir is evident in the low stand volume. Net stand volume averages approximately 22.3 MBF/acre. Tree defect was calculated at 5 percent. Stand 7 has a dense understory vegetation cover. Percent cover is 109 percent and 6 percent among two canopy layers averaging 6 and 13 feet, respectively. The top three dominant species by percent cover include sword fern (33%) vine maple (23%), and hazel (21%).

Figure 382 - Dense patch of big leaf maple in FMU 7.

Down woody debris levels were low compared with mature natural Douglas-fir stands. Total down wood was 4 tons/acre, and 264 ft3/acre, distributed among logs with an average diameter of 10 inches and a length of 16 feet. Down wood included Douglas-fir, big leaf maple, and various hardwoods.

Stand 7 has an average of 10 snags per acre. Snags were evenly distributed across a wide range of diameters (6-54"), although snags in the largest diameter classes were greater than 10 feet tall. Snags are well distributed across decay classes as well with 50 percent in hard and remainder in soft stages of decay.

Himalayan blackberry has colonized several open gaps in the canopy.

MANAGEMENT RECOMMENDATIONS

This is a Priority II FMU, indicating that thinning or other management activities should be delayed until all Priority I FMU's have been treated.

1. Control Himalayan blackberry using a combination of a rubber-tracked skid steer with brush masticator followed by herbicide application of resprouts. Re-establish native vegetation in areas of heavy blackberry infestation after control of weeds.
2. Commercially thin 30 percent basal area by thinning across the diameters and species in 5-10 years. Patch cuts of 1-6 acres may be utilized to increase stand- level heterogeneity and regenerate Douglas fir.
3. Following thinning, underplant unit with a 50:50 combination of Douglas fir and western red cedar.
4. Increase downed log volumes by retaining non-merchantable log segments throughout the unit.
5. Conduct second entry variable density thinning of 30 percent basal area no sooner than 10 years following previous harvest.
6. Conduct third entry variable retention harvest of 30 percent basal area no sooner than 10 years following previous harvest.
7. Follow other structure-based management practices as described later in this plan.

Category	Priority	Acres	Age 2014	Soil Type	Site Index	Site Class	TPA
NA	NA	17	NA	NA	NA	NA	NA
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
NA	NA	NA	NA	NA	NA	NA	NA
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
NA		NA		NA		NA	NA

This 17-acre unit encompasses the Bonneville Power Administration's (BPA) high-tension power line and service road easement. The BPA has sole maintenance authority over this site, and management is strictly limited to suppression of tree growth. As such, both native and non-native shrubs proliferate across the site. Scotch broom and Himalayan blackberry are the most pernicious non-natives.

Figure 63 - FMU 8 Planting

Figure 64 - BPA Right-of-Way

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Commercial II	II	52	78	HgD	154	II	126
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
16.6	*	*	*	*	108	*	78
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.013		478.4		24,877		36.80	1,914

Stand 9 includes 52 acres of well- stocked to open even-aged Douglas fir. The stand occupies forestland along a narrow east-west corridor along the north edge of the powerline, extending the entire length of the property. Average age of overstory trees is approximately 70 years. Stocking of trees 6 inches DBH and greater is 126 TPA. Tree composition in this class is 52 percent Douglas-fir, with remainder in big leaf maple (29%) and a mix of red alder, Oregon white oak, and western hemlock (18%). This stand contains the greatest concentration of Oregon white oak on the property. Average tree diameter for all size classes is 17 inches DBH. Understory tree stocking in the greater than 6 inch DBH class is very sparse and contains only 4 TPA of big leaf maple. Net stand volume averages approximately 34.5 MBF/acre. Tree defect was calculated at 6 percent.

Figure 39 - Edge of FMU 9 along BPA power line easement.

Stand 9 has a dense understory vegetation cover. Percent cover is 120 percent among two canopy layers averaging 4 and 12 feet, although understory cover is composed mainly of vegetation in the 4 foot strata dominated by sword fern. The top three dominant species by percent cover include sword fern (65%) vine maple (32%), and hazel (14%).

Down woody debris levels were low compared with mature natural Douglas-fir stands. Total down wood was 4 tons/acre, and 276 ft3/acre, distributed among logs with an average diameter of 11 inches and a length of 15 feet. Down wood included Douglas-fir, big leaf maple, and various hardwoods.

Stand 9 had 127 snags/acre, less than 2 percent of which are greater than 13 inches DBH. Snags occurred across a wide range of diameters (6 - 43" DBH). Snags tended to be in low decay classes with 80% in hard and remainder in soft stages of decay.

Figure 66 - Interior of FMU 9

MANAGEMENT RECOMMENDATIONS

This is a Priority II FMU, indicating that thinning and other management activities should occur in approximately 5-10 years after all Priority I FMU's have been treated.

1. Commercially thin 30 percent basal area by thinning across the diameters in 5 – 10 years. Thin more heavily around Oregon Oak in order to release this species. Patch cuts of 1 - 6 acres may be utilized to increase stand-level heterogeneity and regenerate Douglas-fir.
2. Increase downed log volumes by retaining non-merchantable log segments throughout the unit.

3. Conduct second entry variable density thinning of 30 percent basal area in no less than 10 years following previous harvest. Underplant unit with a 50:50 mix of Douglas fir and western red cedar at 100 tpa.
4. Conduct third entry variable density thinning of 30 percent basal area in no less than 10 years following previous harvest.
5. Follow other structure-based management practices as described later in this plan.

FMU 1

Category	Priority	Acres	Age 2012	Soil Type	Site Index	Site Class	TPA
	II	22	75	WgE	105	*	42
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
22.8	*	120	*	*	125	*	*
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.027		*		6.3		10.59	233

The unit has a current annual sustained yield of approximately 6.3 Mbf representing approximately $2,700 in net operating revenue at current market prices. Species composition is predominately Douglas-fir and total growing stock is 233 Mbf with a Basal Area of 120 Sq.ft/Acre. Average side slopes ranges from 5% to 30%. The average age of this stand is 75 years and was select tree harvested 25-30 years ago. Douglas-fir Bark Beetle is present at an endemic level in this unit. Average crown closure is 10%.

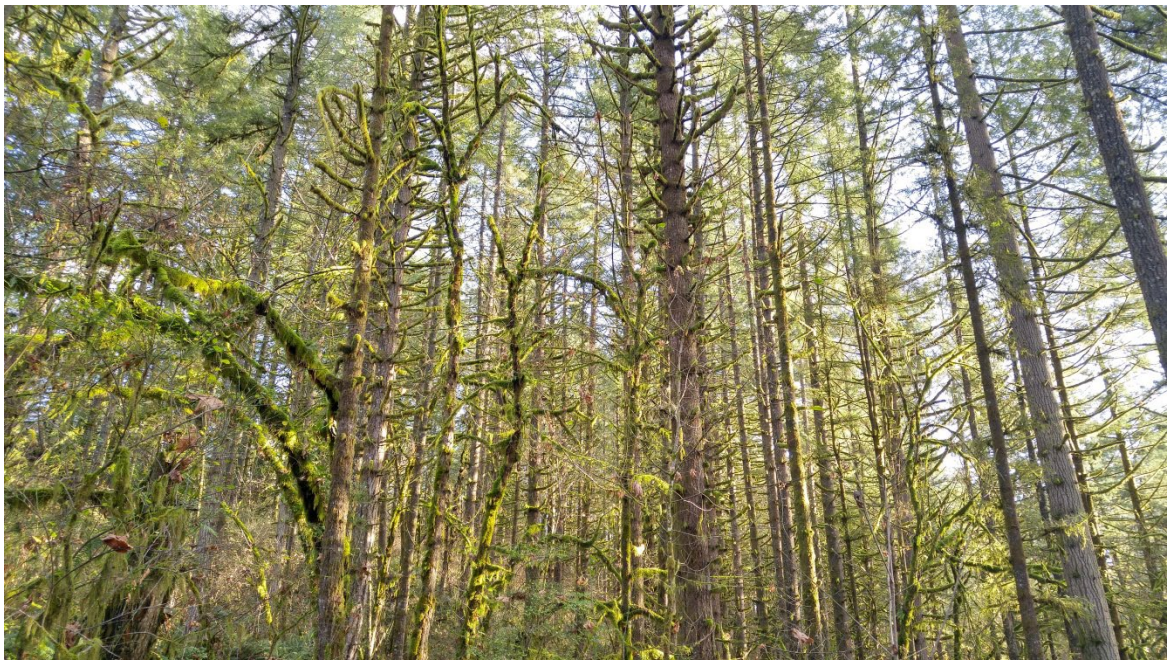


Figure 67 - FMU 1

MANAGEMENT RECOMMENDATIONS

3 equally spaced harvest entries within the first ten years of this plan. Eaxh entry will harvest 20.9 Mbf on a Basal Area of 238 Sq.F.t

1. Remove infested and risk trees
2. Interplant on scarified sites with Dougas-fir at a rate of 120 stems per acre.
3. Maintain a 25 foot buffer along both sides of the unnamed Type 5 Stream (Ns).
4. Lop & Scatter Slash.
5. Protect Type 3 snags where possible

FMU 2

Category	Priority	Acres	Age 2012	Soil Type	Site Index	Site Class	TPA
	II	20	62	WgB	91	*	*
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
18.2	*	166	*	*	110	*	*
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.029		*		9.9		17.13	343

The unit has a current annual sustained yield of approximately 9.9 Mbf representing approximately $4,200 in net operating revenue at current market prices. Species composition is predominately Douglas-fir and total growing stock is 343 Mbf with a Basal Area of 166 Sq.ft/Acre. Average side slopes ranges from 5% to 10%. The average age of this stand is 62 years in age, and was commercially thinned approximately 25 years ago. Average crown closure is 25%.

Figure 68 - FMU 2

MANAGEMENT RECOMMENDATIONS

3 equally spaced harvest entries within the first 10 years of this plan. Each entry will harvest 32.9 Mbf on a Basal Area of 318 Sq.Ft.

1. Thin for release and open for understory establishment.
2. Interplant on scarified sites with a mix of Grand fir and Douglas-fir at a rate of 120 stems per acre.
3. Lop & Scatter Slash.
4. Protect Type 3 snags where possible.

FMU 3

Category	Priority	Acres	Age 2012	Soil Type	Site Index	Site Class	TPA
	II	34	72	WgE	120	*	*
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
27.5	*	144	*	*	139	*	*
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.028		*		16.3		16.87	574

The unit has a current annual sustained yield of approximately 16.3 Mbf representing approximately 6,900 in net operating revenue at current market prices. Species composition is predominately Douglas-fir and total growing stock is 574 Mbf with a Basal Area of 144 Sq.ft/Acre. Average side slopes ranges from 10% to 35%. The average age of this stand is 72 years and was group tree select harvested 30 years ago. Average crown closure is 10%.

Figure 69 - FMU 3

MANAGEMENT RECOMMENDATIONS

3 equally spaced harvest entries within the first 10 years of this plan. Each entry will harvest 53.6 Mbf on a Basal Area of 457 Sq.Ft.

1. Remove at risk trees and open for understory establishment
2. Interplant on scarified sites with a mix of Grand fir and Douglas-fir at a rate of 120 stems per acre.
3. Maintain a 25 foot buffer along both sides of the unnamed Type 5 Stream (Ns).
4. Lop & Scatter Slash.
5. Protect Type 3 snags where possible.

FMU 4

Category	Priority	Acres	Age 2012	Soil Type	Site Index	Site Class	TPA
	III	6	*	*	*	*	*
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
*	*	*	*	*	*	*	*
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
*		*		*		*	*

The unit is currently not forested.

Figure 70 - FMU 4

MANAGEMENT RECOMMENDATIONS

Scarify and replant to Douglas-fir at a stocking of 250 stems / acre upon 1st harvest entry.

Figure 71 - FMU 4

FMU 5

Category	Priority	Acres	Age 2012	Soil Type	Site Index	Site Class	TPA
	III	25	65	WgB	95	II	43
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
29.3	*	200	*	*	105	*	*
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
0.035		*		12.8		14.63	366

The unit has a current annual sustained yield of approximately 12.8 Mbf representing approximately $9,400 in net operating revenue at current market prices. Species composition is predominately Western Red Cedar and total growing stock is 366 Mbf with a Basal Area of 200 Sq.Ft./Acre. Average side slopes ranges from 0% to 12%. This stand comprises the shoreline and riparian management zone on the East Fork of the Lewis River. Average crown closure is 35%.

Figure 72 - FMU 5

Figure 403 - FMU 5

MANAGEMENT RECOMMENDATIONS

3 equally spaced harvest entries within the first 10 years of this plan with the outer 100 feet of the 200 foot SMZ/RMZ of at a distance equal to 2/3rd of the Site Potential Tree Height exclusive of the 50 foot inner zone no-cut and 100 foot intermediate management area. Each entry will harvest 17.05 Mbf on a Basal Area of 233 Sq.Ft.

1. Reduce stocking for understory establishment
2. Interplant on scarified sites with a mix of Grand fir and Western Red Cedar at a rate of 120 stems per acre.
3. Maintain all parameters of Temperature and Shading Guidelines as per WAC 222-30.

FMU 1

Category	Priority	Acres	Age 2016	Soil Type	Site Index	Site Class	TPA
Commercial I	II	32	*	HcD	120	II	104
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
23.3	24	296	387	61	109	40	63
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
*		*		*		48.3	1,547

This FMU comprises most of the trees in the merchantable areas which are healthy and are growing well. Trees in this area fully occupy the site and some thinning from below is needed and would ensure that the dominant trees continue to grow well. Care should be taken to avoid damaging the high value sorts as well as timing the harvest depends on markets and the financial needs of the property.

At least one conk has been found at the root of a tree within stand 1. Other than that, the trees are in good health, considering how densely spaced they are. No apparent insect infestations or animal damage has been noted.

Figure 74 - Douglas-fir Stand

MANAGEMENT RECOMMENDATIONS

This is a Priority II FMU, which indicates that minimal management will be required into the foreseeable future. The small conk rot pockets should be thinned around and isolated in order to control the spread of the disease. Given the advanced age of this stand, as well as the history of past thinning and active management, this stand lends itself more readily to management for late successional characteristics. Additionally, given the unique size and quality of the timber throughout this stand, management will be focused on the production of specialty log products, in particular oversize dimension, clear lumber and poles.

1. Within 1-5 years salvage log root rot pockets and thin heavily around perimeter in order to control spread of disease. Replant root rot areas with western red cedar and big leaf maple.
2. Use individual tree selection for harvest of specialty products.
3. Use variable density thinning across the diameter classes to promote greater stand level structural heterogeneity and to open the canopy in places to allow for understory regeneration of a 2nd conifer cohort.
4. Plant understory with western red cedar and big leaf maple
5. Follow other structure-based management practices as described later in this plan.

FMU 2

Category	Priority	Acres	Age 2016	Soil Type	Site Index	Site Class	TPA
Hardwood	III	6	*	HcB	120	II	*
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
*	*	*	*	*	*	*	*
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
*		*		*		*	*

FMU 2 is almost completely comprised of naturally regenerated red alder that colonized near the riparian areas along and a series of small wet areas along the hill slopes.

Figure 75 - FMU 2

Mature and naturally regenerating big leaf maple occurs periodically throughout the site, with many mature maples in a low-quality coppice form. Given the relatively open hardwood canopy and wet soils, understory vegetation is very thick and robust and comprised primarily of hazelnut, salmon berry and cascara.

Himalayan blackberry has colonized several open gaps in the canopy.

MANAGEMENT RECOMMENDATIONS

This is a Priority III FMU, which indicates that there are no short-term plans for managing this stand. Given that the majority of these sites are on relatively sensitive hydric soils, conservation for wildlife habitat and riparian function will be the primary objective. Some sites may be considered for a hardwood conversion, according to the Washington DNR's guidelines, in order to establish more long-lived and functionally valuable conifers along the streams.

FMU 3

Category	Priority	Acres	Age 2016	Soil Type	Site Index	Site Class	TPA
Constrained	III	17	*	HcB	120	II	104
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
*	*	*	*	*	*	*	*
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
*		*		*		*	*

FMU 3 is dominated by hardwood shrubs and trees. Based on the age of the trees and brush, this site was likely logged 20-30 years ago and either not replanted, of the existing hardwoods outcompeted the planted conifer seedlings.

Figure 76 - FMU 3

Himalayan blackberry has colonized several open gaps in the canopy.

MANAGEMENT RECOMMENDATIONS

These small units lend an important amount of biodiversity and wildlife habitat value to the forest. The much wider range of hardwood trees and shrubs provide more forage for birds and mammals and a unique structural composition that supports different plant and wildlife species. Given its small scale relative to the other management units across this forest, it is recommended that this site be conserved (other than road building for logging access) as- is and allowed to naturally develop on its own.

FMU 4 - RMZ

Category	Priority	Acres	Age 2016	Soil Type	Site Index	Site Class	TPA
RMZ	III	19	*	HcF, HcE	120	II	49
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
26.9	27.4	200	245	38	114	42	53
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
*		*		*		33.2	630.8

Vegetation within the RMZ is comprised of sparsely populated hardwoods (primarily red alder) and brush (primarily vine maple and hazelnut). There is very little conifer cover along the creek as likely the majority of the conifer was harvested during a previous regulatory environment that allowed for harvesting streamside corridors.

Figure 77 - FMU 4

MANAGEMENT RECOMMENDATIONS

Note: see Streams & Wetlands Management Recommendations

FMU 1

Category	Priority	Acres	Age 2016	Soil Type	Site Index	Site Class	TPA
Commercial	II	68	43, 128	SiB/WgB	120	II	141
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
22.2	23	270	375	61	111	50	67
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
NA		NA		NA		49.1	3,340

The trees in the merchantable areas are healthy and are growing well. However, about five acres in the northeast part of the property appear to be affected by laminated root disease. Several trees in this area have died due to the disease. Some of the older trees contain butt rot and other defects. Many are open-grown, which consequently contain numerous large limbs, which result in rough logs and reduced log quality and value. The stand has been thinned at least once over the past 30 years and the average stocking density is below 200 TPA. This stand also has a Bald Eagle Rooting Site of about 17.7 acres, to which the buffer covers another 24 acres, of which 15.2 are in the merchantable timber and 8.8 are in the plantation. The roost site and buffer area contain the largest trees on the property.

Figure 78 - FMU 1

Figure 79 - FMU 1

MANAGEMENT RECOMMENDATIONS

This is a Priority II FMU, which indicates that minimal management will be required into the foreseeable future. The small root rot pocket should be thinned around and isolated in order to control the spread of the disease. Given the advanced age of this stand, as well as the history of past thinning and active management, this stand lends itself more readily to management for late successional characteristics. Additionally, given the unique size and quality of the timber throughout this stand, management will be focused on the production of specialty log products, in particular oversize dimension, clear lumber and poles.

1. Management will be done to provide habitat for bald eagles as per WDFW recommendations and USFWS policy. See Bald Eagle Management in appendix 5 for recommended bald eagle roost buffer guidelines.
2. Within 1-5 years salvage log root rot pockets and thin heavily around perimeter in order to control spread of disease. Replant root rot areas with western red cedar and big leaf maple.
3. Use individual tree selection for harvest of specialty products.
4. Use variable density thinning across the diameter classes to promote greater stand level structural heterogeneity and to open the canopy in places to allow for understory regeneration of a 2nd conifer cohort.
5. Plant understory with western red cedar and big leaf maple.
6. Follow other structure-based management practices as described later in this plan.

Category	Priority	Acres	Age 2016	Soil Type	Site Index	Site Class	TPA
Plantation	II	35	12-15	SiB, SiF, CvA, WgB	120	II	NA
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
NA	NA	NA	NA	NA	NA	NA	NA
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
NA		NA		NA		NA	NA

The plantation is stocked almost exclusively with Douglas-fir. It appears to have been planted more than once. The trees range in age from 12-15 years. Most areas appear to be stocked with trees, although spacing is wide in some spots. Brush competition is heavy throughout, although most trees are above the brush, some are partially or fully suppressed by it.

Figure 80 - FMU 2

MANAGEMENT RECOMMENDATIONS

This is a Priority I FMU, which indicates that short-term management will be essential to improving forest health and vigor.

1. Pre-Commercial Thin (PCT) entire plantation where conifer trees are being choked out by the competing brush and hardwood species.
2. Interplant with shade tolerant species like Western Red Cedar or Western Hemlock.

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
Constrained	*	12	*	*	*	*	*
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
*	*	*	*	*	*	*	*
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
*		*		*		*	*

FMU 3 is dominated by dense hardwood shrubs and trees. Based on the age of the trees and brush, this site was likely logged 20-30 years ago and either not replanted, of the existing hardwoods outcompeted the planted conifer seedlings. It is also possible that root rot or landing compaction may have impacted the site.

FMU 6 is considered non-commercial for the Olympic Pipeline that travels underneath. The Olympic Pipeline is a 400-mile interstate pipeline system that includes 12-inch, 14-inch, 16-inch, and 20-inch pipelines. The pipeline runs along a 299-mile corridor from Blaine, Washington to Portland, Oregon. The system transports gasoline, diesel, and jet fuel. This fuel originates at four Puget Sound refineries, two in Whatcom County and two in Skagit County, and is delivered to Seattle's Harbor Island, Seattle-Tacoma International Airport, Renton, Tacoma, Vancouver Washington, and Portland Oregon.

MANAGEMENT RECOMMENDATIONS

This small unit lends an important amount of biodiversity and wildlife habitat value to the Lake Rosannah forest. The much wider range of hardwood trees and shrubs provide more forage for birds and mammals and a unique structural composition that supports different plant and wildlife species. Given its small scale relative to the other management units across this forest, it is recommended that this site be conserved (other than logging access, ie road building) as- is and allowed to naturally develop on its own.

There are no management recommendations on FMU 6 but to keep invasive species controlled.

Figure 81 - FMU 3

Category	Priority	Acres	Age 2011	Soil Type	Site Index	Site Class	TPA
RMZ / WMZ	III	2	*	*	*	*	*
DBH	**QMD**	**BA**	**SDI**	**Curtis RD**	**HT**	**LCR %**	**HDR %**
*	*	*	*	*	*	*	*
PAI %		**Growth/Acre/Yr (BF)**		**Total Growth/Yr (MBF)**		**Total Vol/ Acre (MBF)**	**Total Vol. Gross (MBF)**
*		*		*		*	*

A Small stream that appears to be seasonal originates on the property, also near its east edge. The stream is classified as non-fish bearing by DNR. Non-fish bearing, seasonal streams are classified Ns. Type Ns water does not require a leave-tree buffer under the state Forest Practices Rules. However, an equipment limitation zone is required. Heavy equipment cannot operate within 30 feet of the stream. If the stream is disturbed, on site mitigation is required. Mitigation must replace the equivalent of lost functions, especially prevention of sediment delivery.

A Small wetland is located along the east boundary in the southern part of the property. According to DNR, it is classified as a Type B Wetland. A wetland with this classification is non-forested and greater than 0.25 acres in size. In addition, it is not a bog or associated with at least 0.5 acres of ponded or standing open water that is present for at least seven consecutive days between April 1 and October 1. The Forest Practices Rules require a 25-foot wide Wetland Management Zone (WMZ) that extends from the wetland edge. Limited thinning may be allowed in the WMZ.

There is a small area in the southern portion of the site adjacent to that wetland that had bald eagle perching and some roosting from survey data David Anderson (DFW) collected in the past (see appendix 5). These strips of trees are to be a protected stand in the wetland management area.

Figure 412 – FMU 4

MANAGEMENT RECOMMENDATIONS

Note: see Streams & Wetlands Management Recommendations

MANAGEMENT GOALS

The long term management goal of maintaining and enhancing the riparian and upland forest habitat types in an uneven-aged configuration will be carried out over an intermediate rotation. Functionality of the wildlife habitat will be improved with the resulting multi-canopied stand structure and improvement of the forests production of solid wood fiber will be extended decades into the future.

The amount of harvest in each consecutive 10 year period will be equal to or less than the 10 year Periodic Annual Increment (PAI) of growth for that period.

The timing of harvest will correlate to the timing of subsequent timber stand improvement activities for each preceding harvest on any given management unit. This provides improved economies for equipment utilization and manpower needs. It is foreseeable that post-harvest, stand improvement activities will become part of a contractors harvesting requirements, and allowance has been made for these in the operation budget.

There will be a reliance on stocking and crown closure ration control to provide the understory platform for the establishment of a multi-tiered canopy structure.

Semi-annual monitoring though Continuous Forest Inventory (CFI) Plots will yield managers the data necessary to make changes or alterations to any multi-decade plan.

MANAGEMENT UNITS 2ND DECADE THROUGH 5TH DECADE

Beginning in the 10th year of this plan an understory and second canopy layer should be evident from the previous interplantings and natural regeneration of the residual stand. Some care should be exercised from this point onward to monitor areas of overstocked understory which may require limited precommercial thinnings. Continued removal of the periodic annual increment will be allowed in the overstory at the same volume and basal area for each unit, however only on the basis of 2 entries during the course of the second decade; years 10 through 20. This is to ensure the maintenance of the preceding genotype and preserve the viewshed qualities of the subsequent timber type.

Beginning in the 20th year of this plan, the understory should be at a height of 40% of the overstory canopy, with almost 50 percent of the land area being managed to the preceding silvicultural prescriptions. For the next ten years, only 2 more entries based on the original volume and basal area will be allowed as in the years 10 through 20. In year 25, it is projected that some commercial thinning will begin on the first understory areas interplant in the beginning of the plan.

Beginning in the 3rd decade, harvest in the original stand's overstory will be limited to individual tree selection in one entry, based on the original unit volume and basal area calculations. Although this will only yield one third of each of the 1st decades harvests, the diameter and basal area of the co-dominant understory should provide a second source of periodic annual increment which should equal or exceed the initial production of the stand.

Beginning in the 4th decade, the harvest of the original overstory will cease, however almost 25% of its basal area will remain. These will form the basis of the green recruitment wildlife tree element. The co-dominate understory will be at the same sustained yield as the plan, when initiated. Continued monitoring of the CFI plots will provide the basis for new growth and yield information.

The 5th decade will initiate the start of the third rotation in areas entered during the initiation of this plan, and the establishment of a 3 tiered stand.

STRUCTURE-BASED MANAGEMENT

The Douglas-fir forest types across Clark County tend to be even-age, older stands (60+ years) that are very dense with homogenous and highly simplified stand structures. Clark County proposes to implement a plan of uneven-aged *structure based management* that will utilize Clark County properties as experimental forests with the goal of demonstrating strategies for managing structurally homogenous stand types towards increasing heterogeneity.

Structure-Based Management (SBM) prescribes a mix of active forest management techniques that produce an array of forest stand structures across the landscape - from areas where new trees are being established, to older forest structure featuring "old growth", or late successional characteristics such as numerous large trees, multi-layered canopies, and substantial numbers of down logs and large snags. Individual stand types may change constantly, through management and natural disturbance, but the range of stand types and their relative abundance across the land base is reasonably stable. Because the structures are in a dynamic balance across the landscape, the forest provides a steady flow of forest products, habitats, clean air and clean water.

Using an SBM approach, stand density is actively managed to accelerate stand successional development while simulating natural conditions and disturbance regimes. This is done through a combination of variable retention and variable density thinning. SBM techniques can be used to produce a variety of results. Some prescriptions will result in fast-growing, well-stocked stands with higher structural homogeneity. Other prescriptions will develop more complex stand structures, with rapid tree diameter growth, enough sunlight on the forest floor to maintain understory plants, and a complex forest canopy. The latter will be the dominant approach used by Clark County. Thinning can also be used to create or maintain other important structural components, such as snags, down wood, gaps in the canopy, and multiple canopy layers. A diversity of stand structures will provide for a broad range of ecosystems and biodiversity -- including a wide range of wildlife habitats. The structural components associated with the range of stand structures will benefit long-term forest productivity by maintaining the key structural linkages for nutrient cycling and soil structure. The high level of biodiversity should result in a more resilient forest that will be less prone to large-scale disturbance from environmental or climatic stresses.

The main emphasis of SBM is on the use of sound silvicultural approaches for producing timber, but equally combined with the production of a range of habitat types or forest structures that will provide for the vast majority of species and biodiversity. Instead of focusing on individual species, forest managers focus on producing habitats that will accommodate the range of indigenous species. If forest managers find that the broad scale production of habitats may be inadequate to provide for some indigenous species, then they use more site-specific or species-specific strategies as needed.

SBM emulates many aspects of natural stand development and produces structural components found in natural stands, but does so in a shorter period of time through active management. By anticipating future patterns of forest development, foresters predict the potential for individual stands to produce specific characteristics, such as a multi-layered canopy. Foresters can then develop appropriate silvicultural prescriptions, and influence the rates of stand development and the types of structures and products that forest stands actually produce. Individual stand management will vary greatly under SBM. Stands will be managed to emulate habitat conditions normally associated with older forests. These stands will also produce highly viable timber yields. A major emphasis in managing stand structures will be to move stands through the early and middle forest stages as quickly as possible. This emphasis will require extensive thinning. These activities will produce significant volumes of smaller diameter timber from young stands. Final harvests of stands that have been intensively managed will result in the harvest of high volumes of large diameter wood. The stand structures are not an end in themselves: they represent the diversity of conditions historically associated with conifer forests in the Coast and Cascade ranges of Washington and Oregon. The management techniques used to produce the structures are sound timber management approaches that encourage vigorous tree and stand growth and that are applied to produce more diverse understory vegetation, snags, and coarse woody debris.

PRIMARY SILVICULTURAL OBJECTIVES

The primary silvicultural objectives for these forests are to develop, at a landscape level, a forest structure that emulates natural forest conditions that would result under typical natural disturbance regimes for the site, while producing a steady flow of high quality timber products. To this end, the sites will be managed to provide a variety of habitat types, including: early, mid and late seral forests, and forested and non-forested wetlands. To achieve these habitat types, it will be necessary to gradually alter existing forest conditions to achieve the desired results. Given the long history of even-aged management, some dramatic alterations may be necessary in order to introduce greater spatial and structural complexity into otherwise fairly homogenous stands.

The County is interested in developing a silvicultural system that allows the forest to achieve habitat conditions that would have resulted through normal natural disturbance regimes for the area. The primary natural disturbance regimes for the areas include high winds, ice storms and fire. Forests that evolve naturally under these conditions tend to achieve a *patchiness* of varying age-classes, stocking densities and species mixes.

STRUCTURE-BASED MANAGEMENT STRATEGIES

Restoring structural and plant species complexity into even-age, single species stands can facilitate the development of habitat features that attract a broader range of wildlife. Strategies such as variable density thinning, patch cuts, snag creation, downed coarse woody debris augmentation and underplanting can allow younger forests to begin providing similar habitat functions as much older forests.

Carey (1998) defines four key structuring processes that contribute to greater habitat diversification:

1. **Crown class differentiation** - Competition among trees of the same age results in dominant, codominant, subordinate, and suppressed trees.
2. **Decadence** - Trees get damaged, infected with fungi, break down, and recycle within the ecosystem.
3. **Understory development** - Variability in light, temperature, and soil moisture promotes structurally-diverse growth on the forest floor.
4. **Canopy stratification** - Trees of different ages and growth habits produce multiple layers of vegetation, including a well-developed midstory.

Providing for these four key processes can lead to two primary levels of structural complexity within a forest - individual and stand level. Examples include:

1. **Individual structures**
    a. Trees of diverse heights, diameters, branch sizes, and bark characteristics.
    b. Large, dead standing trees (snags).
    c. Coarse woody debris (stumps and logs) in various states of decay.
2. **Stand-level structures**
    a. Vertical Heterogeneity - ever-changing distributions of foliage from the forest floor to the tree tops.
    b. Horizontal Heterogeneity - patchiness in the overstory, midstory, and understory.

Additionally, Carey (1998) identifies two key processes influencing vegetative species composition that can lead to greater habitat diversification:

1. **Development of habitat breadth** - Patchy canopies produce variability in light, temperature, and soil moisture, leading to patches of different types in the understory.
2. **Pre-interactive niche diversification** - Expansion in forest structure and plant species composition provides diverse niches for animals, plants, and fungi; additional niche diversification occurs after species interact.

Complex forest structure and complex species composition lead to greater complexity in forest function. Primary benefits of more complex forest function include:

1. High carrying capacities for diverse animals
2. High productivity for plants
3. Effective regulation of nutrients and water cycling
4. Healthy, resilient forests

GENERAL SILVICULTURAL PRESCRIPTIONS

In early 2012 Clark County embarked on a process of variable density thinning within the Priority I forest types. In general, stands will thinned from below to reduce stocking density and create a spacing pattern that will allow the remaining trees to develop late seral characteristics over the next 50+ years. Groups of trees in root rot pockets, as well as poorly performing sites, will be targeted for removal. This combination of thinning from below and group tree selection, also called "skip and gap" harvesting, will result in a highly variable structure to the forest with small openings (gaps), small patches of dense trees (skips) and otherwise a generally well-spaced stand throughout. This approach will, over time, effectively break up the homogenous structure of the stands and set them on a trajectory to achieve greater spatial, structural and species diversity than the stands would have achieved if left unmanaged.

Clark County is committed to managing its forests to the highest silvicultural standards in the world as certified by the Forest Stewardship Council (FSC). The following chart of generalized silvicultural prescriptions has been extrapolated from the FSC U.S. Forest Management Standards and applies to all forest stands where active forest management activities will take place.

Table 14 – FSC Silvicultural Prescriptions Relevant to Clark County

Prescription	Source
If patch cuts exceed 6 acres in size, 10-30% of pre-harvest basal area will be retained following harvest. The levels of green-tree retention will depend on such factors as: opening size, legacy trees, adjacent riparian zones, slope stability, upslope management, presence of critical refugia, and extent and intensity of harvesting across the forest management unit. Retention will be distributed as clumps and dispersed individuals, appropriate to site conditions. Retained trees will comprise a diversity of species and size classes, which includes large and old trees.	FSC U.S. Standards 6.3.e.5.
Streams, vernal pools, lakes, wetlands, seeps, springs, and associated riparian areas are managed to maintain and/or restore hydrologic processes, water quality, and habitat characteristics. Forested riparian buffers will be maintained around all rivers, streams, ponds and wetlands as per the guidance provided below.	FSC U.S. Standards 6.5.m
Legacy trees, old and large trees, snags and woody debris will be retained (or, if absent, recruited) to sustain populations of native plants, fungi, and animals, both within the harvest unit and across the FMU.	FSC U.S. Standards 6.3.e.1.
Habitat components necessary to support native species (e.g. vertical and horizontal structural complexity, understory species diversity, food sources, nesting, denning, hibernating, and roosting structures, habitats and refugia for sedentary species and those with special habitat requirements) will be protected, maintained, and/or enhanced within each harvest unit and across the entire forest management unit.	FSC U.S. Standards 6.3.b.3
Where necessary to protect against wind throw and to maintain microclimate, green trees and other vegetation are retained around snags, down woody debris, and other retention components.	FSC U.S. Standards 6.3.e.2.
Native hardwoods and understory vegetation will be retained as needed to maintain and/or restore the natural mix of species and forest structure.	FSC U.S. Standards 6.3.e.3.
Live trees and native understory vegetation will be retained within the harvest unit in proportions and configurations that are consistent with the characteristic natural disturbance regime in each community type, unless retention at a lower level is necessary for purposes of restoration.	FSC U.S. Standards 6.3.e.4.
Logging operations and the use of roads and skid trails occur only when soil compaction, erosion, and sediment transport do not result in degradation of water quality, site productivity, or habitats.	FSC U.S. Standards 6.5.a.
Silvicultural systems, integrated pest management, and strategies for controlling pests and/or unwanted vegetation will be developed that result in the least adverse environmental impact, with the goal of reducing or eliminating chemical use.	FSC U.S. Standards 6.6.b.
All major forestry operations (e.g. thinning, road building, etc.) will only occur outside the primary bird breeding season (April 15th – June 15th).	BMP

THINNING

When thinning, stands will either be thinned from below or thinned across the diameters in order to promote greater structural complexity in the stand. This approach to thinning will employ a best tree selection approach where the healthiest and most dominant trees are retained within the stand, almost regardless of species. Groups of trees in root rot pockets, as well as poorly performing sites will be targeted for removal. This combination of thinning from below and group tree selection will result in a highly variable structure to the forest with small openings (gaps), small patches of denser trees (skips) and otherwise a generally well-spaced stand throughout. This approach will set all stands on a trajectory to achieve greater spatial, structural and species diversity than the stands would have achieved if left unmanaged. Additionally, while contractors are thinning with mechanized equipment, they can create snags by topping trees at a minimum of 20 ft, as well as scatter non-merchantable large logs throughout the understory. Through successive thinning entries, the targets for snag and downed log recruitment described later in this document will eventually be met.

THINNING FROM BELOW

Thinning from below is a technique typically used during the first commercial thinning entry in a stand. Approximately one-third of the overall trees are removed, typically from the suppressed and intermediate canopy classes, in order to promote the growth of the co-dominant and dominant trees. Best Tree Selection methods are used similar to pre-commercial thinning. This means that co-dominant or dominant trees may be removed if they have defect or will release more desirable species in the understory. Thinning from below is across the species, retaining the best quality tree of each species, both hardwood and conifer allows for a simple, close, and logical relationship to the natural course of stand development. 20 – 30 percent of pre-harvest basal area, or approximately 1/3 of the existing trees are removed during harvest. For example, if pre-thinning stand density is approximately 350 TPA, then stands will be thinned to approximately 200 – 250 TPA.

VARIABLE DENSITY THINNING

Variable-density thinning involves varying the thinning intensity across an ecologically appropriate scale (1⁄4 to 1 acre in size) to produce a mosaic of unthinned, moderately thinned, and heavily thinned patches. Thinning with skips and gaps can also create this mosaic. Variable density thinning helps generate complex structures by promoting tree growth at different rates. It also encourages understory development through a diversity of species, a variety of patch types, and growth of tree seedlings and saplings. Variable-density thinning can improve forest health by increasing,

a) Resistance to disturbance
b) Ability to recover after disturbance, and
c) Biological diversity that allows ecosystems to function well through climatic variation (Carey, 1998).

Variable density thinning typically occurs across both species and diameters, reducing stand density by no more than one-third of the standing trees per entry. If pre-thinning stand density is approximately 200 – 250 TPA, then the second entry will reduce the density to 120 – 160 TPA. During the third entry thinning, stand density will be reduced further to approximately 90 – 105 TPA. The following thinning entry will likely follow variable retention harvesting methods as per below. In selecting for harvest across the diameters, most thinning is still conducted from below. However, dominant overstory trees may be selected for harvest if they will release a vigorous understory tree that has ample live crown. Thinning in this manner produces a more complex forest canopy and stimulates natural regeneration in the understory, thereby minimizing the need for manual planting.

The majority of the Douglas-fir stands that occur across the county have a high stocking density for their age (avg. 450 - 600+ trees per acre). This high density is contributing to a number of issues that are increasingly affecting the forests health, stability and ability to support a diverse range of wildlife species. Applying variable density thinning across the majority of the Douglas-fir dominated stands can help mitigate these issues. Some of these issues are:

- **High height/diameter ratio**
  The height/diameter ratio of a tree is measured by dividing the tree height by the stem diameter at breast height with height and diameter in the same units (e.g., centimeters). This ratio changes with the degree of competition over time. At a given height, trees that have been crowded will not have as large a diameter as trees that have not been crowded. The crowded trees will therefore have a higher height/diameter ratio. Height/diameter ratios are indicative of a tree's ability to withstand wind and snow and ice loading. Concerns should be raised when ratios are above 80.

  Competition between trees in the dense forests has caused the Douglas-fir to grow tall and skinny. Average *height-diameter ratios routinely exceed* 85:1, which is approaching the stage where wind throw becomes a significant concern. Routine thinning of the Douglas-fir stands to gradually draw their stocking density down to below 200 trees per acre will allow the crowns of the remaining trees to fill out and promote diameter growth that will reduce the risk of wind throw.

- **Laminated root rot**
  Laminated root rot (*Phellinus weirii*) is a naturally occurring soil based fungus that infects the roots and lower stems of Dougals-fir and Western hemlock. As per the name, the fungus de-laminates the soft sapwood between the rings of a trees roots and stem, essentially weakening the trees support system. Root rot systematically spreads through a stand via root grafts and almost always eventually kills the host tree. Root rot "pockets" in a Douglas-fir stand are distinguishable by sudden openings in the stand that are occupied by snags, downed logs and/or regenerating in hardwoods (typically alder and/or big leaf maple). Left unmitigated, root rot can create significant impacts to forests that are predominantly stocked with Douglas-fir.

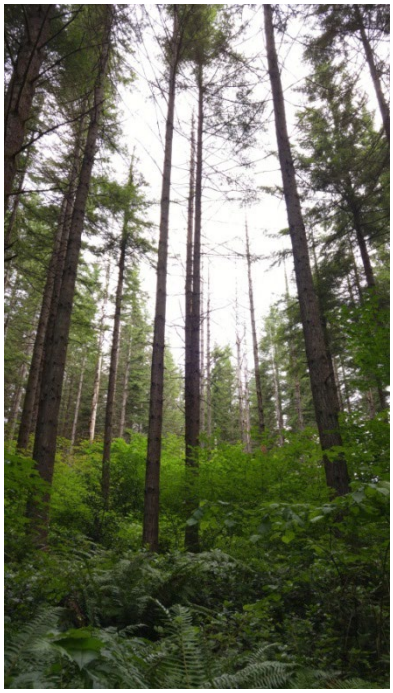
  

  Figure 83 - Laminated Root Rot Pocket in Spud Mountain

  Attempting to completely eradicate root rot from a forest is difficult and can lead to significant impacts in the way of large patch cuts within the forest. Limiting its spread and impact is typically the preferred approach and can be accomplished through removing infected trees within a root rot pocket, and heavily thinning potentially infected trees around the perimeter of the pocket. Additionally, introducing non-host conifer species such as western cedar or white pine, or hardwood species such alder or big leaf maple can also help mitigate laminated root rot's effect in the forest.

  Clark County recognizes laminated root rot as a naturally occurring soil fungus that functions as an agent of stand diversification. Therefore, management practices will be adapted to accommodate its effects. When root rot pockets occur in areas where optimum timber production is preferred, more aggressive thinning and mitigation measures will be employed. Where root rot pockets do not pose a threat to facilities, public safety, or long-term timber production objectives, they will be allowed to recruit snags and coarse woody debris into the forest system. As openings in the stand occur, they will be replanted as necessary with western cedar, white pine and/or a mix of hardwoods and wildlife forage.

- **Lack of canopy stratification**
  Given that the Douglas-fir stands were managed as even-age plantations by previous owners, and that little natural disturbance has affected the stands until currently, the stands have a single dominant canopy that has effectively suppressed the regeneration of low or mid story trees and second or third cohorts.

  Forests that have a diverse mid-story provide greater vertical heterogeneity and more habitat niches, especially for a wider range of bird species that prefer specific strata within a forest's canopy. Root rot is an agent of canopy stratification as it introduces openings in a homogenous forests and therefore opportunities for a wider mix of tree and shrub species of varying ages to occupy the opening. Additionally, thinning a dense stand to open the canopy allows more sunlight to reach the forests floor, thereby promoting regeneration and height growth of more tree and shrub species.

EXTEND ROTATION AGE OF TIMBER HARVEST

Longer harvest rotations can produce healthy, complex forest landscapes and are biologically reasonable in the Pacific Northwest because Douglas-fir and its associates are very long-lived and can maintain rapid growth to rather advanced ages.

On industrial and private lands, rotations of 40 to 50 years are used to maximize profits and maintain cash flow. Public ownerships, which must consider other values in addition to timber revenues, use rotations of 60 to 80 years or longer. A shift to extended harvest rotations of 70 to 230 or more years has the advantages of:

1. Producing a variety of tree sizes and wood products over time,
2. Improving the age distributions of trees in the landscape,
3. Promoting healthier wildlife habitat,
4. Increasing carbon storage, and
5. Preserving options for adaptive management. Thinning also helps to establish diversity and minimize tree overcrowding.

VOLUME & VALUE INCREAS WITH AGE

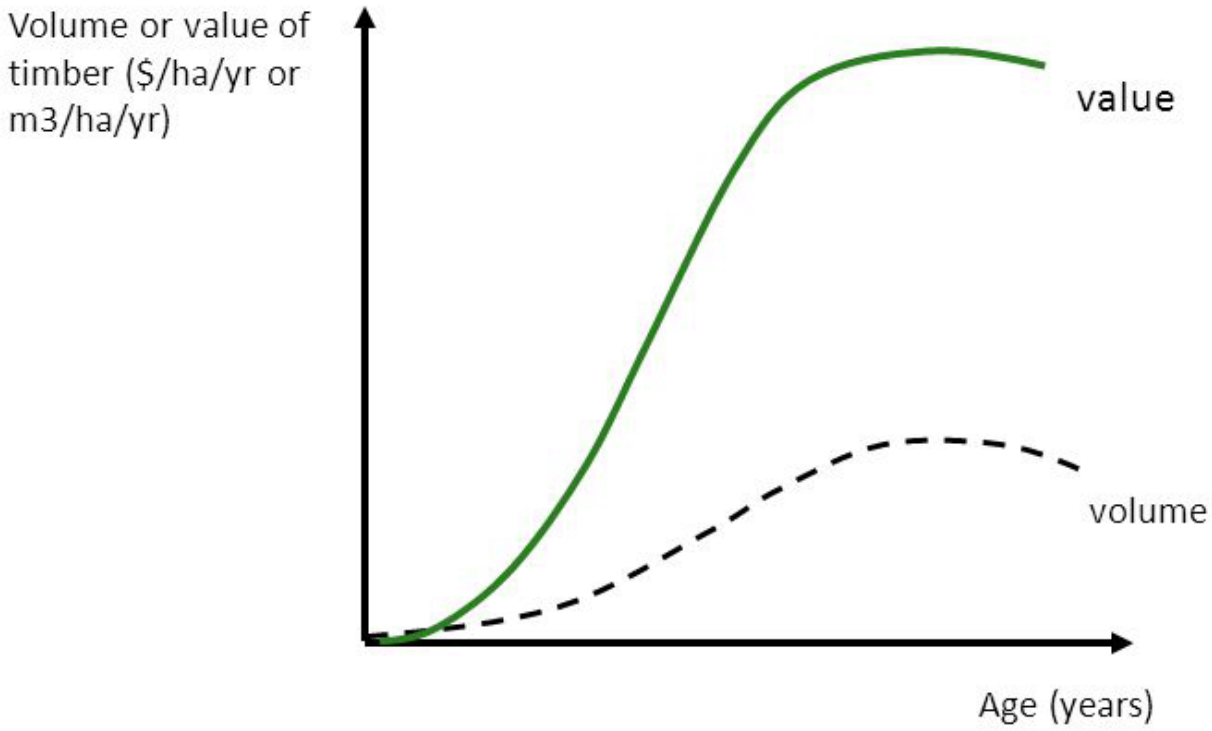


Figure 424 - Volume/Value over Age Graph

INCREASE SNAGS AND DOWNED WOODY DEBRIS

Given the history of even-age management and the necessity to protect public safety, large snags (>10" DBH) are uncommon through the majority of the forest. Additionally, large coarse woody debris (>10" diameter) are also lacking throughout the forest floor. Snags can provide important structure for cavity dependent bird and small mammal species, a food source for woodpeckers and other foragers and a slow release nutrient source for the forest in general. West of the Cascades in Oregon and Washington, 39 species of birds and 14 species of mammals depend on cavity trees for their survival. Terrestrial amphibians, small mammals, and birds also depend on large coarse woody debris for protection and foraging for insects, fungi, and seeds.

Snags fall into two primary decay class categories:

1. **Hard snags**, with the bark is still intact and with firm heart and sapwoods, and
2. **Soft snags**, which may have some bark remaining but with the wood beginning to soften.

Figure 43 - Hard Snags in Camp Hope

Figure 86 - Soft Snag in Camp Hope

Downed logs fall into four primary categories based on their decay class:

1. **Class 1** - Bark is still intact and heart and sapwood is still firm
2. **Class 2** - Log is in contact with ground; bark is beginning to deteriorate and inner wood is soft.
3. **Class 3** - Log is in contact with ground; bark has completely fallen off and log is beginning to become incorporated into the forest floor
4. **Class 4** - Log is partially buried and wood is very soft
5. **Class 5** - Log is barely distinguishable from surrounding forest floor

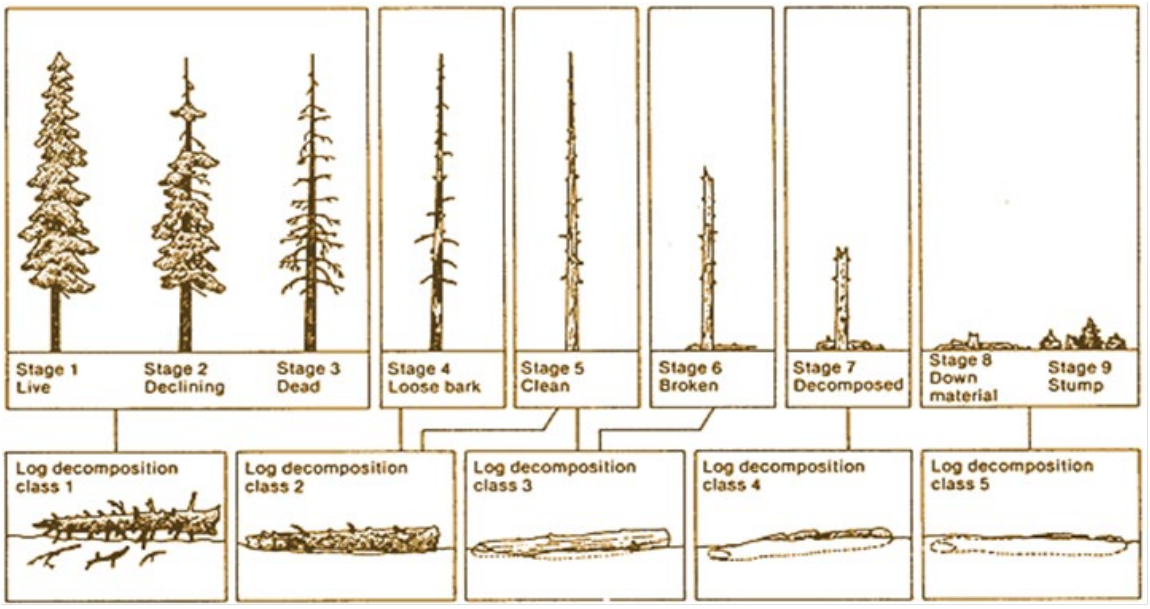


Figure 87 - Decay classes of snags and downed logs.

Clark County will strive to recruit an average of 3-10 snags and 3-10 downed logs across each decay class per acre. Where snags and downed logs either don't exist, or exist in insufficient numbers or dimensions, manual recruitment will be necessary. Downed logs can be artificially created by cutting live trees and bucking the logs into a minimum of 16' sections. Snags can be artificially created through two primary methods:

1. **Girdling**
   With a chainsaw, two horizontal rings are cut six inches apart entirely around the circumference of a tree deep enough to severe the cambium layer.
2. **Topping**
   Using either a mechanical harvester or by climbing, a tree is topped a minimum of 30' above the ground.

Table 15 summarizes snag and downed woody debris targets for the forests in Clark County:

Table 15 – Sang & Downed Woody Debris Targets

Snags	Minimum Size	#/Acre
Hard	17' tall x 15" DBH	2-5
Soft	17' tall x 15" DBH	2-5
Down logs	**Minimum Size**	**#/Acre**
Class 1	16' x 20" DBH	1-3
Class 2	16' x 20" DBH	1-3
Class 3	16' x 20" DBH	1-3
Class 4	16' x 20" DBH	1-3
Class 5	16' x 20" DBH	1-3

UNDERPLANTING

Planting multiple species of native trees promotes diversity and structural complexity in a forest. Managed stands often have insufficient tree regeneration to provide a midstory of shade-tolerant trees. The midstory connects the lower branches of the tree crowns to the upper branches of the tall shrubs, establishing a full vertical foliage profile. Underplanting helps to increase a forest's resistance and resilience to disturbance and also improve wildlife forage and habitat.

As root rot pockets and wind events continue to create openings in the forests, as well as following thinning operations, Clark County will continue to underplant a variety of native conifer and hardwood trees, as well as shrubs that provide wildlife forage. The following table lists some of the species that are endemic to the area and will be considered for introduction back into the park's forests:

Table 16 - Native plant species recommended for planting in understory

Common name	Taxonomic name	Shade tolerance class	Function	Location
Western red cedar	Thuja plicata	Very shade tolerant	Canopy stratification	Understory of thinned Doug-fir, canopy gaps
Western hemlock	Tsuga heterophylla	Shade tolerant	Canopy stratification	Understory of thinned Doug-fir
Grand fir	Abies grandis	Shade tolerant	Canopy stratification	Understory of thinned Doug-fir
Western white pine	Pinus monticola	Moderately shade tolerant	Canopy stratification	Understory of thinned Doug-fir, canopy gaps
Douglas-fir	Pseudotsuga menziesii	Moderately shard tolerant	Canopy stratification	Canopy gaps greater than 1 acre
Pacific yew	Taxus brevifolia	Very shade tolerant	Canopy stratification	Understory of thinned Doug-fir
Big leaf maple	Acer macrophyllum	Shade tolerant	Canopy stratification, wildlife forage, nutrient cycle	canopy gaps
Red alder	Alnus rubra	Intolerant	Canopy stratification, wildlife forage, nutrient cycle	Canopy gaps greater than 1 acre
Oregon ash	Fraxinus latifolia	Moderately shade tolerant	Canopy stratification, wildlife forage	Canopy gaps
Pacific madrone	Arbutus menziesii	Shade tolerant	Canopy stratification, wildlife forage	Understory of thinned Doug-fir on dry sites
Pacific dogwood	Cornus nuttallii	Shade tolerant	Canopy stratification, wildlife forage	Understory of thinned Doug-fir
Hazelnut	Corylus cornuta var. californica	Shade tolerant	Canopy stratification, wildlife forage	Understory of thinned Doug-fir
Cascara	Cascara sagrada	Shade tolerant	Canopy stratification, wildlife forage	Understory of thinned Doug-fir

Bitter cherry	Prunus emarginata	Intolerant	Canopy stratification, wildlife forage	Canopy gaps
Western crab apple	Malus fusca	Intolerant	Canopy stratification, wildlife forage	Canopy gaps
Service berry	Amelanchier alnifolia	Shade tolerant	Wildlife forage	Understory of thinned Doug-fir
Indian plum	Oemlaria cerasiformis	Shade tolerant	Wildlife forage	Understory of thinned Doug-fir
Red elderberry	Sambucus racemosa	Shade tolerant	Wildlife forage	Understory of thinned Doug-fir
Blue elderberry	Sambucus caerulea	Intolerant	Wildlife forage	Canopy gaps
Red osier dogwood	Cornus sericea	Shade tolerant	Wildlife forage	Understory of thinned Doug-fir in wet sites
Pacific rhododendron	Rhododendron macrophyllum	Shade tolerant	Aesthetics	Understory of thinned Doug-fir
Ocean spray	Holidscus discolor	Shade tolerant	Wildlife forage	Understory of thinned Doug-fir on wetter sites

Figure 448 - Pacific Yew in Camp Bonneville

RESOURCE CATEGORY V – PROPERTY ACCESS, ROADS & SKID TRAILS

An extensive network of forest access roads has been established throughout Clark County's forested properties that provide easy access to most of all the forest stands (see the map section for existing roads). The road systems are well maintained with good drainage systems.

Figure 89 - Horse trail

The Green Mt. property as a network of horseback riding trails through the forest, but there are no established or maintained forest access roads. A power line maintenance easement road bisects the property from east to west, and provides opportunity for access along its route through the northern extent of the parcel. The closest access by County road is from NE 222nd Ave to the south of the property.

Future timber management activities across the counties properties will require the construction of forest access roads and landings. As such, the following guidelines will be adhered to during road construction and subsequent maintenance.

The topographic layout of most of the properties will accommodate large segments of existing road networks for the purposes of accessing the timber. Minimal new construction will be required, of which other multi-use benefits will result through non-timber activities. The following table outlines basic forest road planning and maintenance guidelines that will be followed by Clark County.

Table 17 - Forest road construction and maintenance

Standard	Source
The forest road system will be pre-planned, designed, located, constructed, maintained, and/or reconstructed to minimize the extent and impact of the system and its potential cumulative adverse effects on the surrounding environment.	FSC U.S. Standards 6.5.g.
Logging operations and the use of roads and skid trails occur only when soil compaction, erosion, and sediment transport do not result in degradation of water quality, site productivity, or habitats.	FSC U.S. Standards 6.5.a.
Landings will be designed and constructed to minimize soil erosion.	FSC U.S. Standards 6.5.h.
Access to temporary and permanent roads will be controlled to minimize impacts to soil and biota while simultaneously allowing legitimate access (e.g. recreationalists, forest workers, etc).	FSC U.S. Standards 6.5.i.
Access will be restricted and erosion controlled on infrequently used roads.	FSC U.S. Standards 6.5.k.
Unnecessary roads will be permanently decommissioned or put to bed.	FSC U.S. Standards 6.5.l.

RESOURCE CATEGORY VI - WILDLIFE

Results are based on where the species is believed to or known to occur. The FWS feels utilizing this data set is a better representation of species occurrence. Note: there may be other federally listed species that are not currently known or expected to occur in this state but are covered by the ESA wherever they are found; Thus if new surveys detected them in this state they are still covered by the ESA. USFWS has been contacted to gather a list of species but no formal surveys have been completed to date.

Figure 92 - Fawn at Camp Bonneville

The FWS is using the best information available on this date to generate this list. The following federally-listed species may occur on or in the vicinity of Clark County (Table 54):

There are no known threatened or endangered species, cultural, or historical resource protection issues on these properties. A formal review, to identify these resources, if any, and their potential protection requirements, will be conducted by the State Department of Natural Resources if and when the landowner proposes to conduct significant forestry activities which require a DNR-approved Forest Practices Application. We will pursue this type of work on these properties as funding becomes available from thinning operations.

Figure 93 – Elk at Camp Bonneville

Figure 94 - Gardner Snake

CONSTRUCT WILDLIFE HABITAT PILES

Brush piles provide similar habitat provided by naturally occurring logs on the forest floor and can either be substituted when natural logs are not available or used in conjunction with naturally occurring or constructed downed logs. Widely distributed brush piles can also be an effective method for utilizing and dispersing slash that has been collected at a landing following logging operations.

To construct brush piles:

1. Lay at least four 6 ft logs, 6 - 10 inches in diameter parallel to each other 8 – 12 inches apart,
2. Lay an equal number of similarly sized logs on and perpendicular to the 1st base logs,
3. If desired, 4 feet section of 6 inch drainage tile, cinder blocks, or stumps can be placed under the base to allow easier access,
4. Add large limbs and then smaller branches on the top to create an intertwining tangle of brush 4 – 6 feet in height,
5. Piles should be placed no closer than 200 of each other, within 1000 feet of surface water if possible,
6. Should not exceed 3 piles per acre,
7. Maintain brush piles by periodically adding new limbs and branches.

Figure 95 - Composition of Wildlife Habitat Pile

Note: circular brush piles 12 or more feet in diameter or rectangular piles greater than 25 feet in length provide better cover but can attract large mammals such as coyote or black bear.

INSTALL BIRD BOXES

It may take several years before natural and artificial snag recruitment produces the softer snags necessary for cavity nesters to occupy. In the interim, bird boxes can be placed throughout the forest to simulate cavities in trees. Bird boxes of varying sizes attract birds and small mammals of various sizes. If the park chooses to place bird boxes throughout the forest, the following guidelines will apply:

1. No more than four bird boxes will be placed per acre.
2. Boxes will be located primarily along the edges of clearings, roads, wetlands and lakes.
3. Small, medium and large boxes will be placed in the following ratio, respectively: 1:4:15.
4. Boxes will be inspected annually to remove old nests and debris.

Bird box dimensions for small, medium and large boxes should be based on optimum cavity dimensions for the following species:

1. Small: Western blue bird
2. Medium: Kestrel
3. Large: Wood duck

Figure 96 - Example of Bird Box

THREATENED OR ENDANGERED SPECIES

According to the U.S. Fish and Wildlife Service & Washington Department of Fish and Wildlife, several threatened or endangered species either live or likely live in Clark County.

Table 18 – Washington's Threatened or Endangered Species

Type	Species/ Habitats	State Status	Federal Status
Fishes	Pacific Lamprey		Species of Concern
	River Lamprey	Candidate	Species of Concern
	Green Sturgeon		Threatened
	White Sturgeon		
	Leopard Dace	Candidate	
	Mountain Sucker	Candidate	
	Eulachon	Candidate	Threatened
	Bull Trout/ Dolly Varden	Candidate* *Bull Trout only	Threatened* *Bull Trout only
	Chinook Salmon	Candidate	Threatened (Upper Columbia Spring run is Endangered)
	Chum Salmon	Candidate	
	Coastal Res./ Searun Cutthroat		
	Coho		
	Kokanee		
	Pink Salmon		
	Rainbow Trout/ Steelhead/ Inland Redband Trout	Candidate** ** Steelhead only	Threatened** ** Steelhead only
	Sockeye Salmon	Candidate	Threatened – Ozette Lake Endangered – Snake River
Amphibians	Cascade Torrent Salamander	Candidate	
	Larch Mountain Salamander	Sensitive	Species of Concern
	Oregon Spotted Frog	Endangered	Candidate
	Western Toad	Candidate	Species of Concern
Reptiles	Pacific Pond Turtle (also known as Western Pond Turtle)	Endangered	Species of Concern
Birds	Western grebe	Candidate	
	Great Blue Heron		
	Cavity-nesting ducks: Wood Duck, Barrow's Goldeneye, Common Goldeneye, Bufflehead, Hooded Merganser		
	Western Washington nonbreeding concentrations of: Barrow's Goldeneye, Common Goldeneye, Bufflehead		
	Trumpeter Swan		

	Tundra Swan		
	Waterfowl Concentrations		
	Bald Eagle	Sensitive	Species of Concern
	Golden Eagle	Candidate	
	Northern Goshawk	Candidate	Species of Concern
	Peregrine Falcon	Sensitive	Species of Concern
	Mountain Quail		
	Sooty Grouse		
	Sandhill Crane	Endangered	
	W WA nonbreeding concentrations of: Charadriidae, Scolopacidae, Phalaropodidae		
	Band-tailed Pigeon		
	Spotted Owl	Endangered	Threatened
	Vaux's Swift	Candidate	
	Pileated Woodpecker	Candidate	
	Purple Martin	Candidate	
	Slender-billed White-breasted Nuthatch	Candidate	Species of Concern
	Roosting Concentrations of: Big-brown Bat, Myotis bats, Pallid Bat		
	Townsend's Big-eared Bat	Candidate	Species of Concern
Mammals	Gray-tailed Vole	Candidate	
	Fisher	Endangered	Candidate
	Marten		
	Columbian Black-tailed Deer		
	Elk		

RESOURCE CATEGORY VIII – AESTHETICS, RECREATION & EDUCATION

Figure 97 - Little Baldy

Many recreational activities are compatible on the forested properties in Clark County (except for Camp Bonneville which is going through the ongoing UXO clean up and will be open once a master plan is completed on the property). Each activity will be managed to minimize impact on the resources, meet recreational demand and reduce visitor conflicts. Visitor carrying capacity of the sites and the social carrying capacities are major elements in planning for the recreation component of the overall management plan. Data on human carrying capacity are not currently available for use in planning the recreation component. Because of the lack of this information, great care and a conservative approach must be taken in making the area available for recreation. Throughout the years, properties have been used for a variety of outdoor recreational activities. The acquisitions by the county will increase public knowledge and interest in the properties and request for access from a wide variety of interest groups will also increase. Each case will be evaluated based upon the impact on the natural characteristics of the site and its relationship with other user groups.

Recreation is a "quality of life" issue and is important to local residents and county residents who will be visiting the property. Recreation on the properties will not be measured solely by the amount or variety of recreation provided. It will primarily be measured by the quality of the experience made possible by interacting with the natural resource.

There are many possible educational opportunities for visitors. While recommendations on recreational and particularly educational opportunities are outside the scope of a forest management plan, opportunities have been listed below:

Level I

- Installation of interpretative signage describing the property's forests and the management that is occurring in it. Should research partnerships be made with outside organizations signage could also be used, as long it does not impact research or bring unintended attention to the project. An example of interpretative signage can be found at: http://envirosigns.com/
- Scheduled naturalist hikes that are open to the public. Hikes initially could be announced using local news sources to encourage County residents to explore the property. Advertisement campaigns could be extended in the future to attract visitors to recreate. These walks could be led by local naturalists or the County's Forest Technicians or Foresters.

Level II

- Wooden benches could be built around the property to allow users a place to rest. A picnic table and benches could be constructed near the primitive camping area and/or at the parking areas.
- Creating overnight primitive camping areas. There are several possible areas that could be selected for this purpose. Camping could be made by permit only with permits obtained from the County.

Level III

- Development of Interpretative and environmental educational programs for local youth. Programs could be part of the local school system as well as partnerships with regional educational groups (ex. WSU, UW, etc) and other summer camps. Interpretative and environmental educational programs could expand to the County's visitors.

RESOURCE CATEGORY IX – SPECIALIZED FOREST PRODUCTS

The properties have significant potential for the production of special forest products. Salal and other floral greens are common. These products are in demand commercially and could be sold. Clark County is uncertain whether they will pursue this option or not.

At Camp Bonneville there are also several fruit trees, which are the only non-native food bearing trees on the property.

Figure 98 - Fruit Trees at Camp Bonneville

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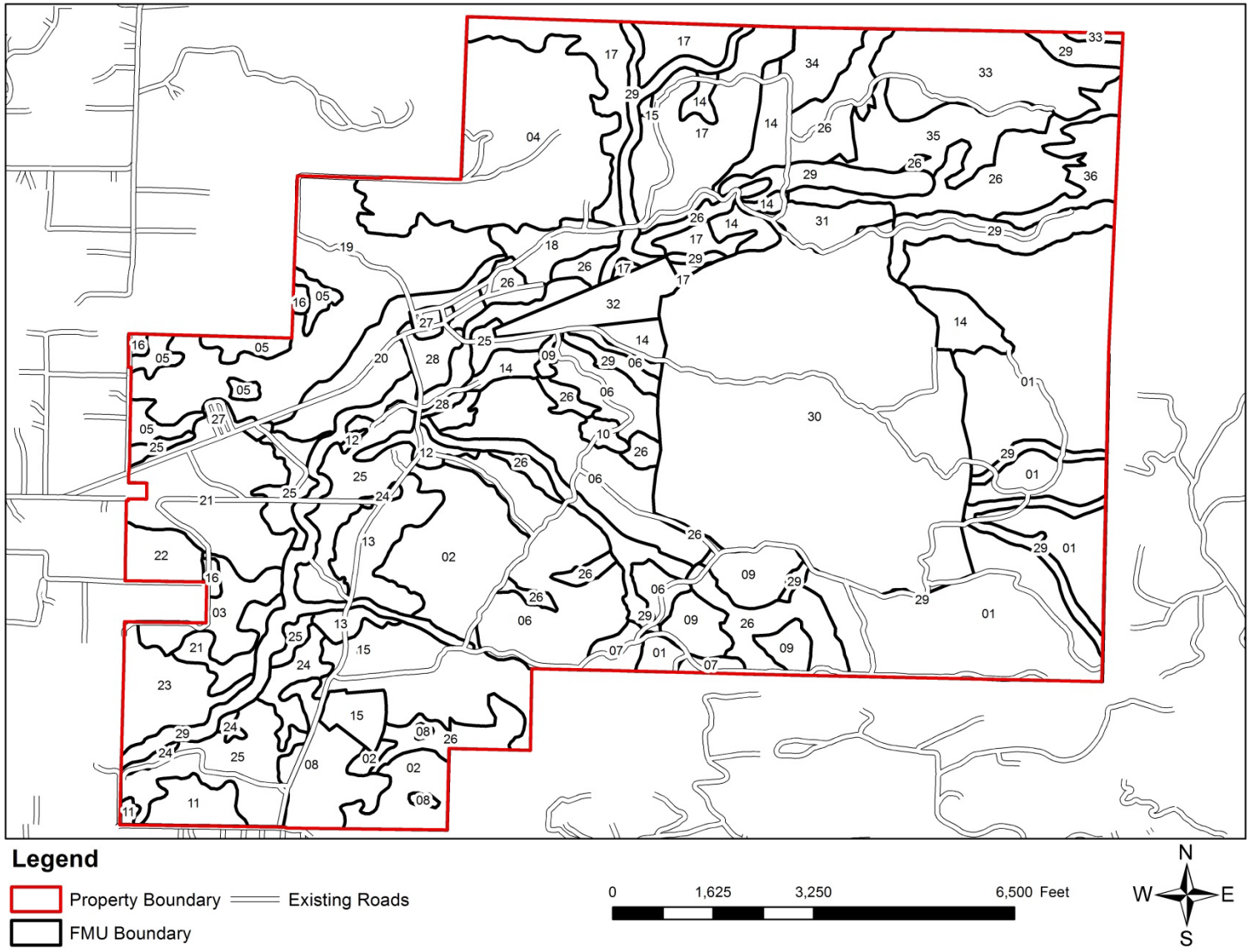
Figure 99 - Salmon Berries at Camp Bonneville

Figure 100 - Salmon Berries at Spud Mountain

CAMP BONNEVILLE

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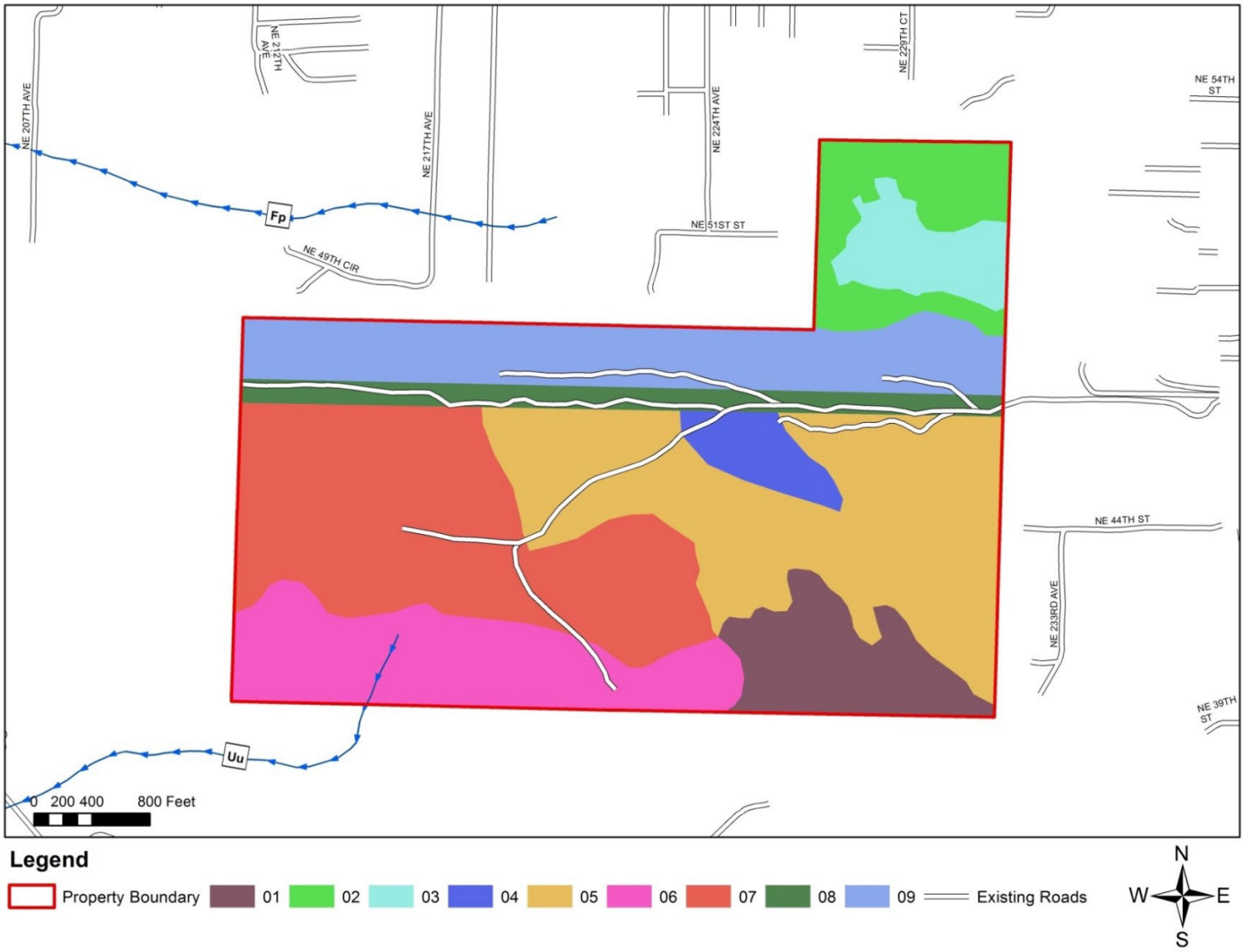
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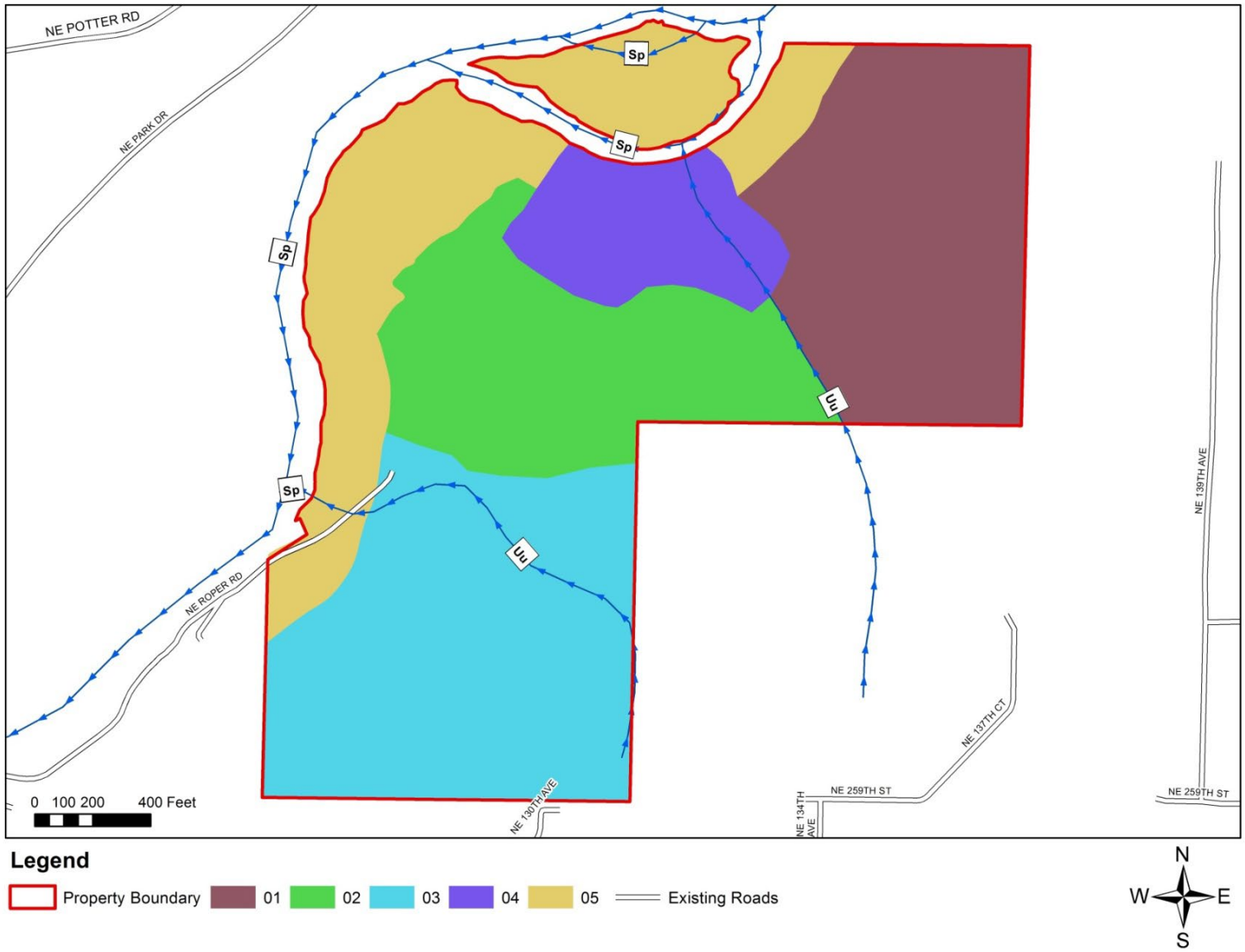
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NE ROPER RD
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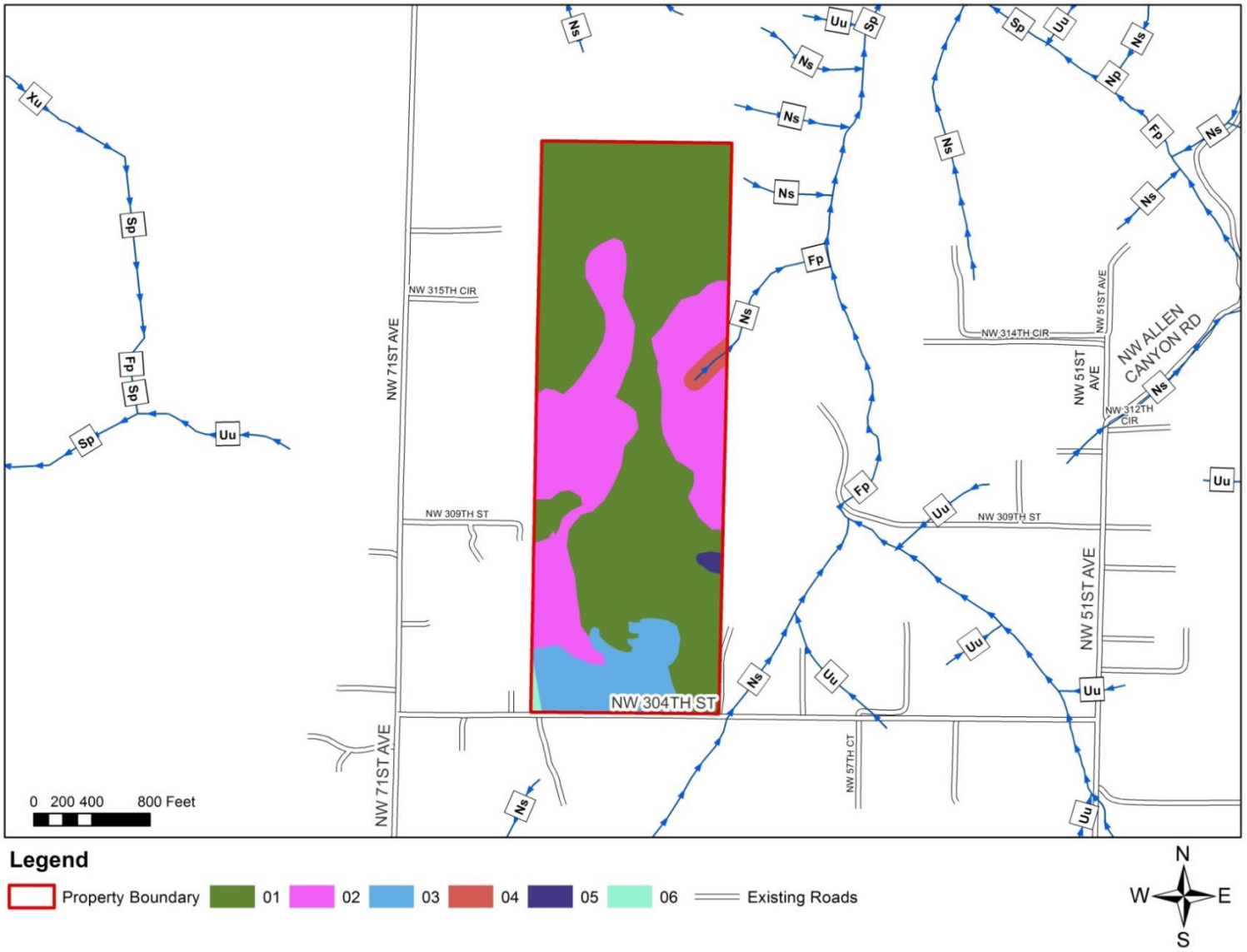
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NW 314TH CIR
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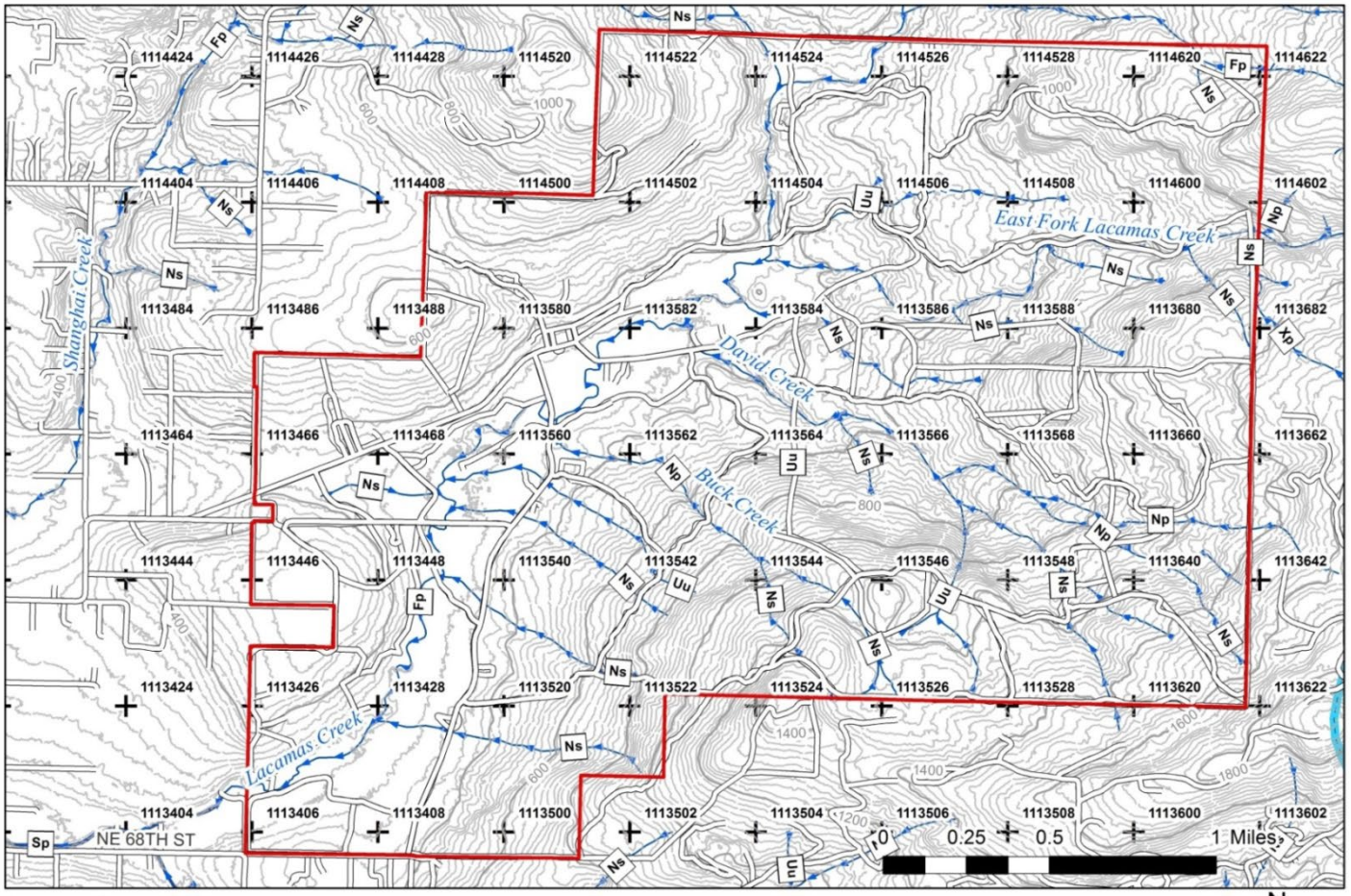
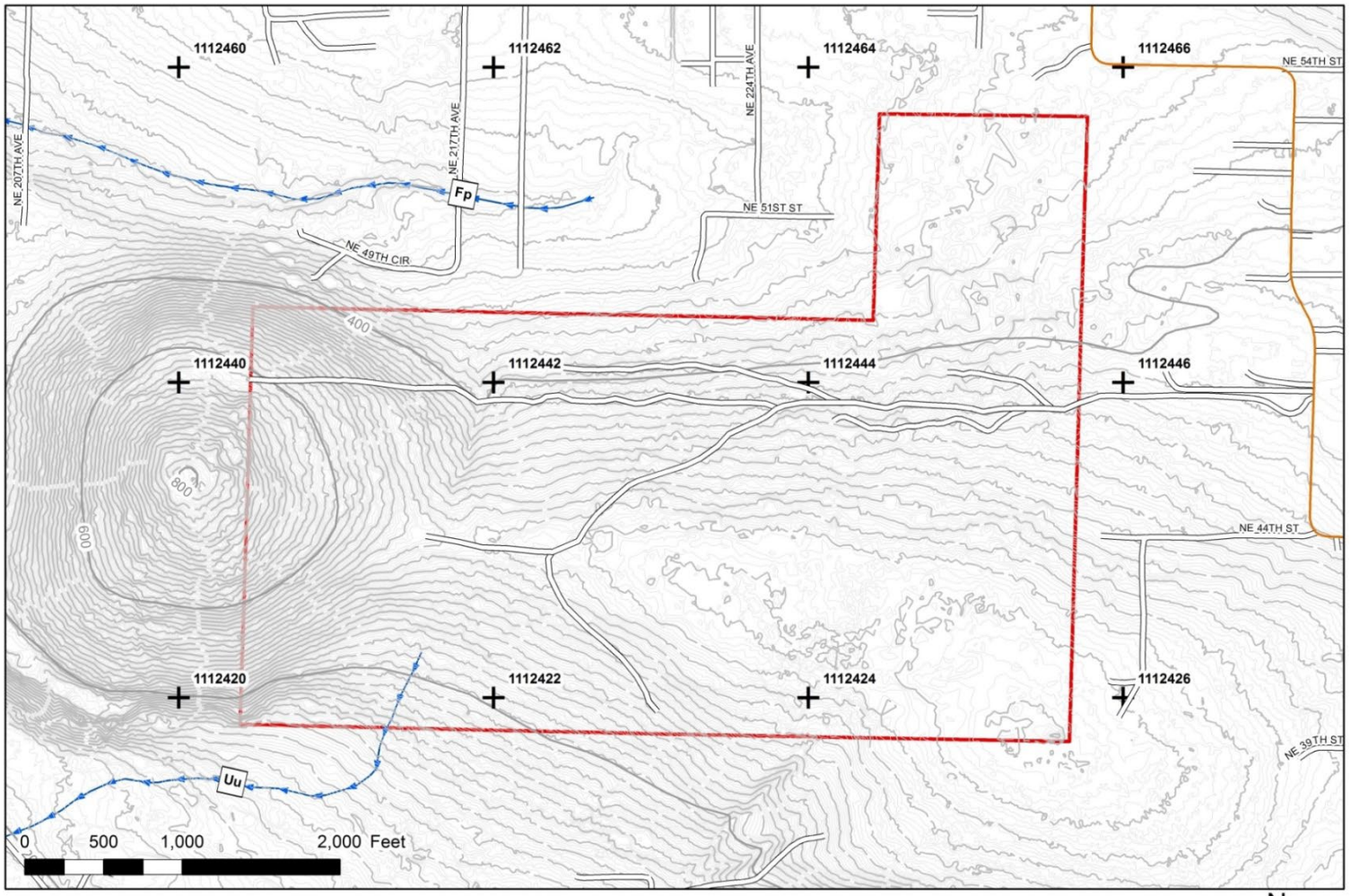
CAMP BONNEVILLE

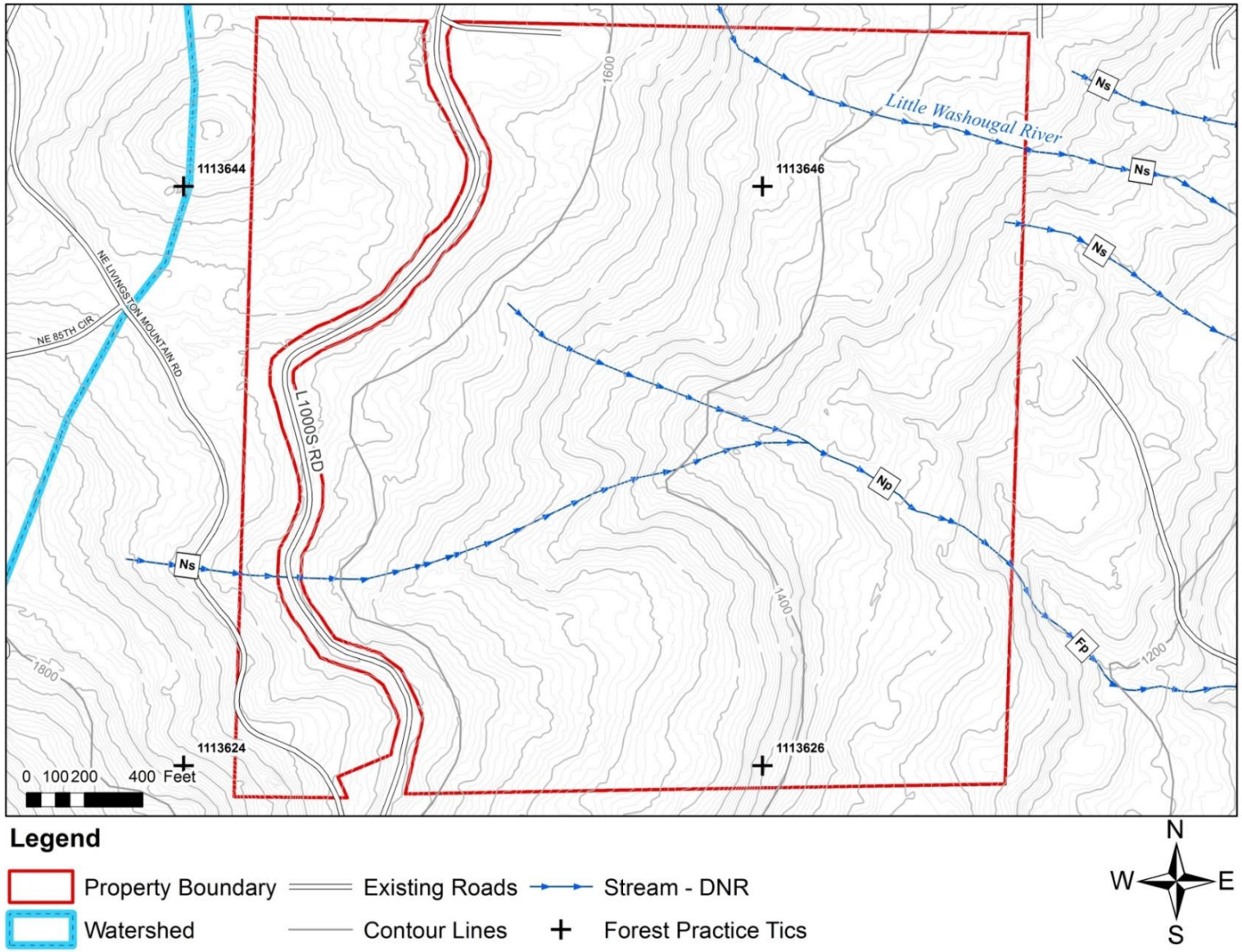




Legend

Property Boundary
Existing Roads
Stream - DNR
Watershed
Contour Lines
Forest Practice Tics

N
W E
S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Little Washougal River
NE LIVINGSTON MOUNTAIN RD
NE 85TH CIR
L1000S RD
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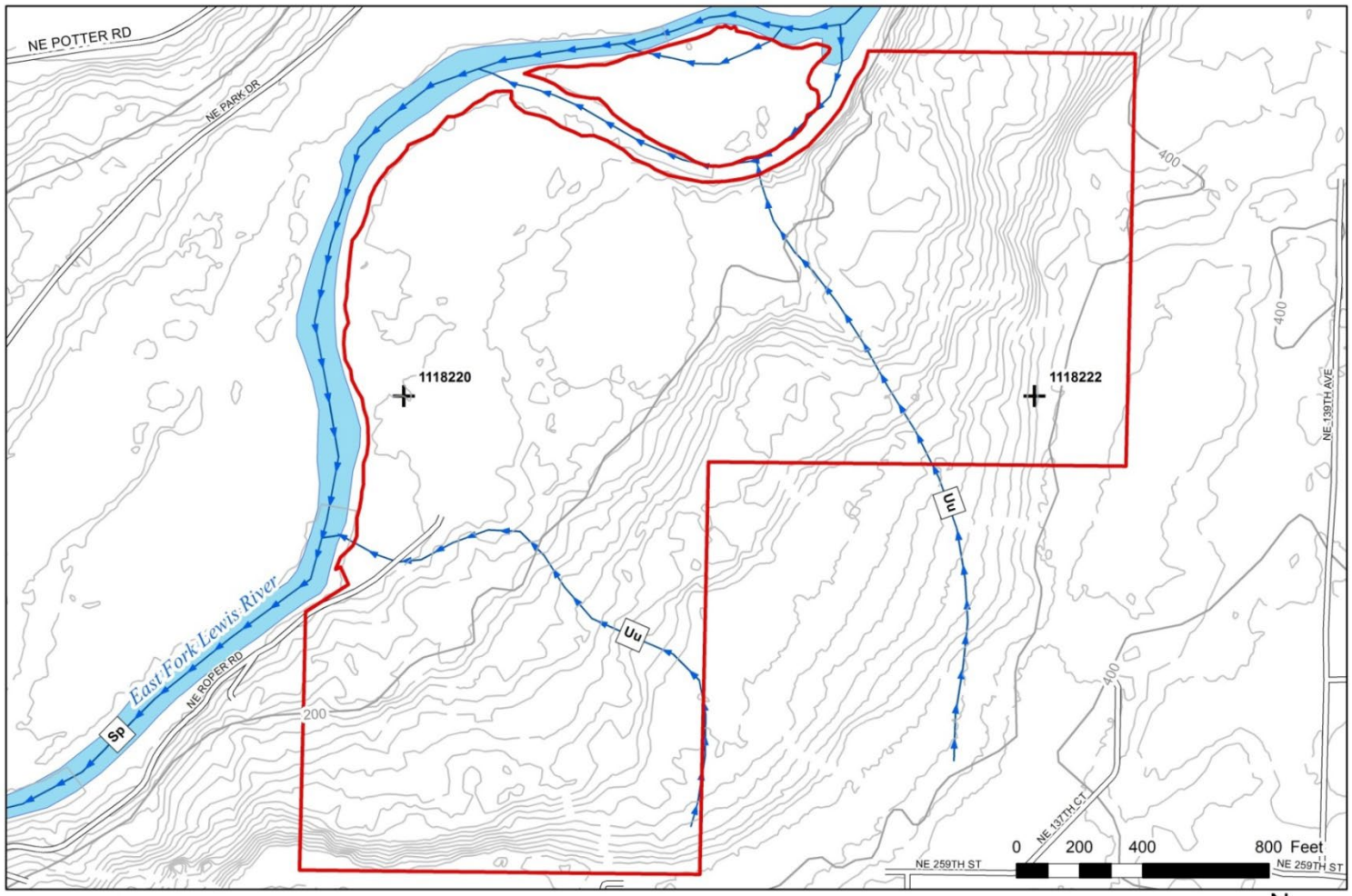
Np
Fp
1600
1400
1200
1800
0 100200 400 Feet
Legend
Property Boundary
Existing Roads
Stream - DNR
Watershed
Contour Lines
Forest Practice Tics
N
W
E
S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NE PARK DR
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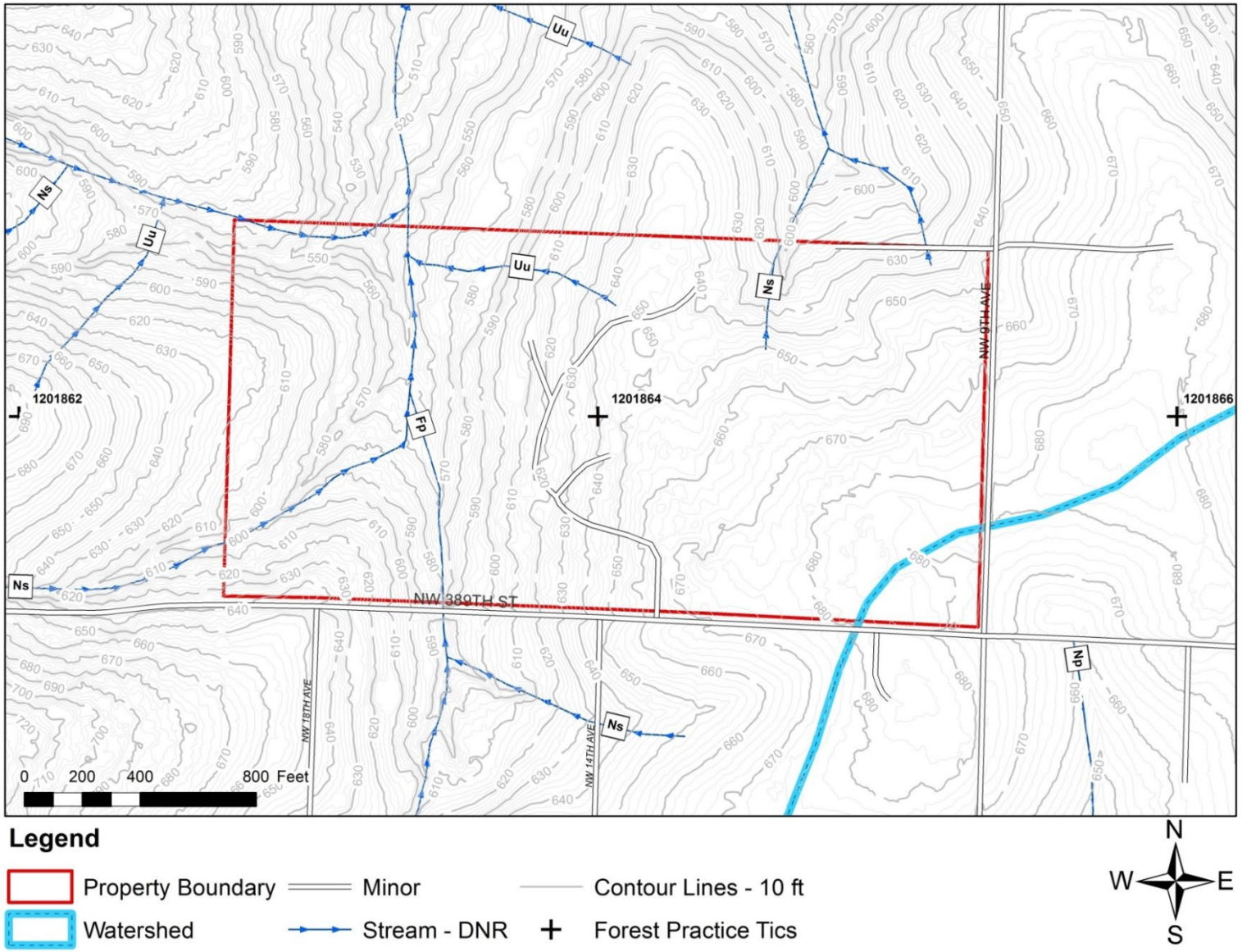
1118222
East Fork Lewis River
NE ROPER RD
Sp
Uu
Uu
200
400
400
400
NE 139TH AVE
NE 137TH CT
NE 259TH ST
NE 259TH ST
0
200
400
800 Feet
Legend
Property Boundary
Existing Roads
Stream - DNR
Watershed
Contour Lines
Forest Practice Tics
N
W
E
S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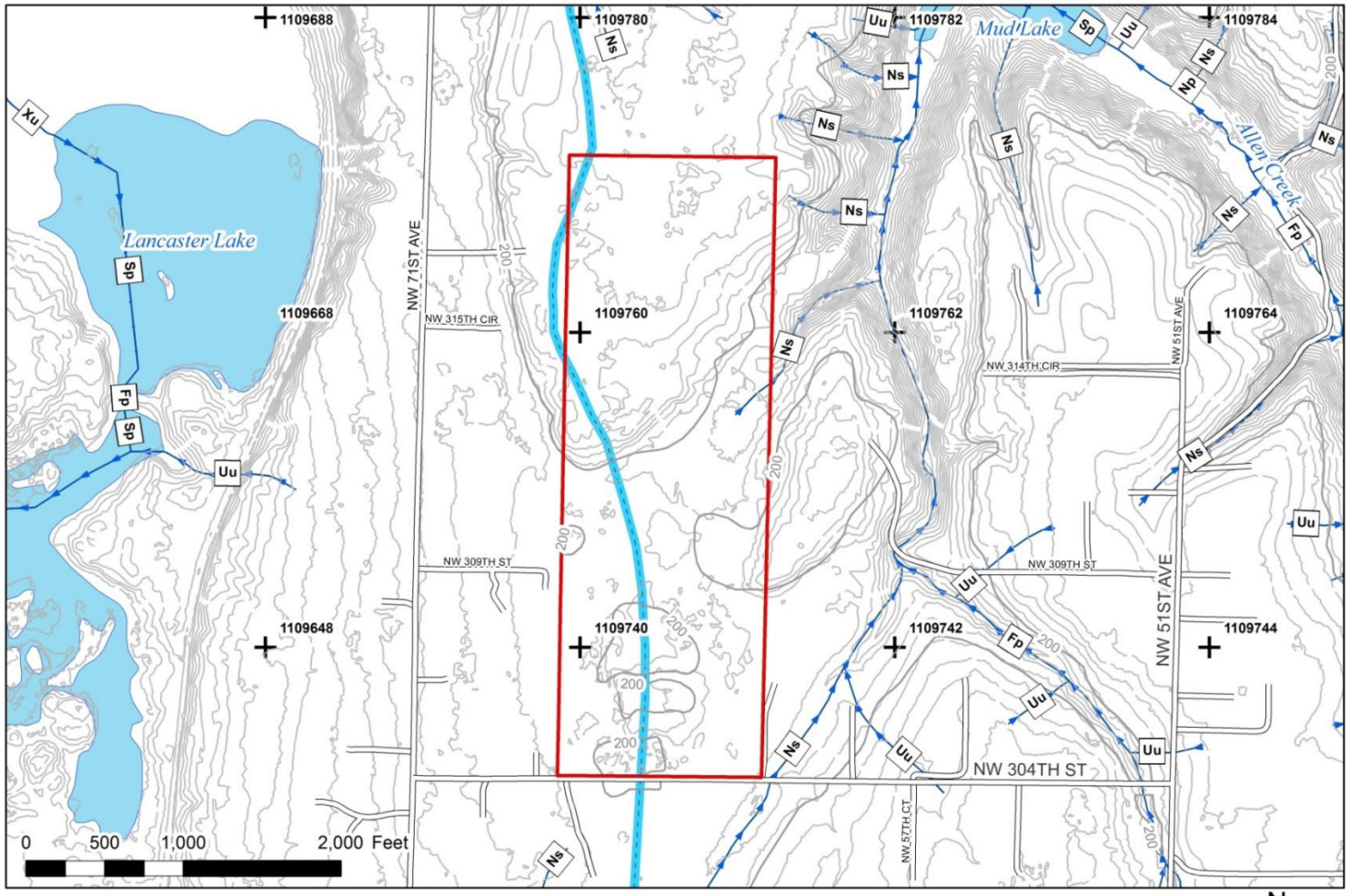
1201864
1201866
NW 389TH ST
NW 9TH AVE
NW 18TH AVE
NW 14TH AVE
Uu
Ns
Fp
Np
0 200 400 800 Feet
Legend
Property Boundary
Watershed
Minor
Stream - DNR
Contour Lines - 10 ft
Forest Practice Tics
N
W
E
S

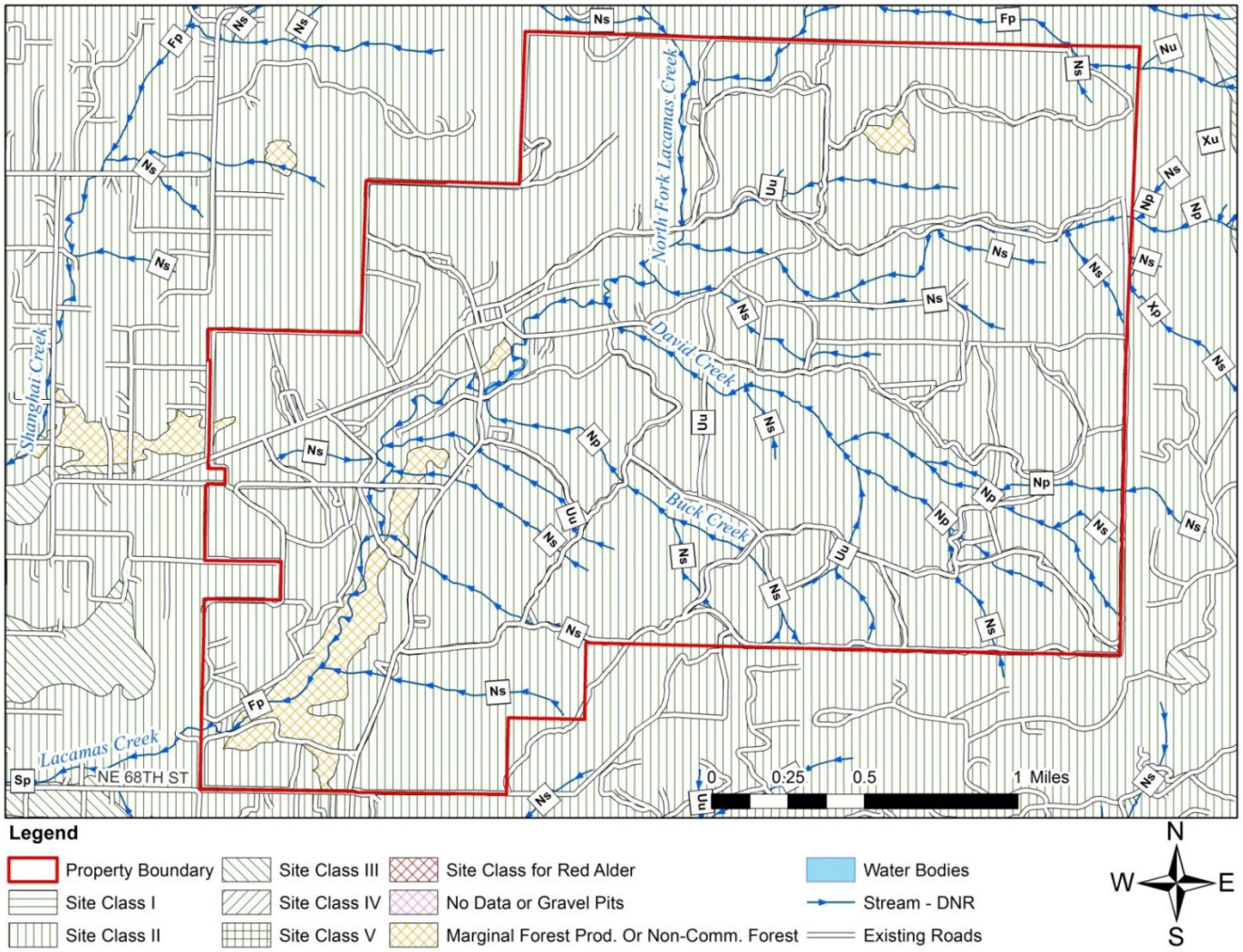


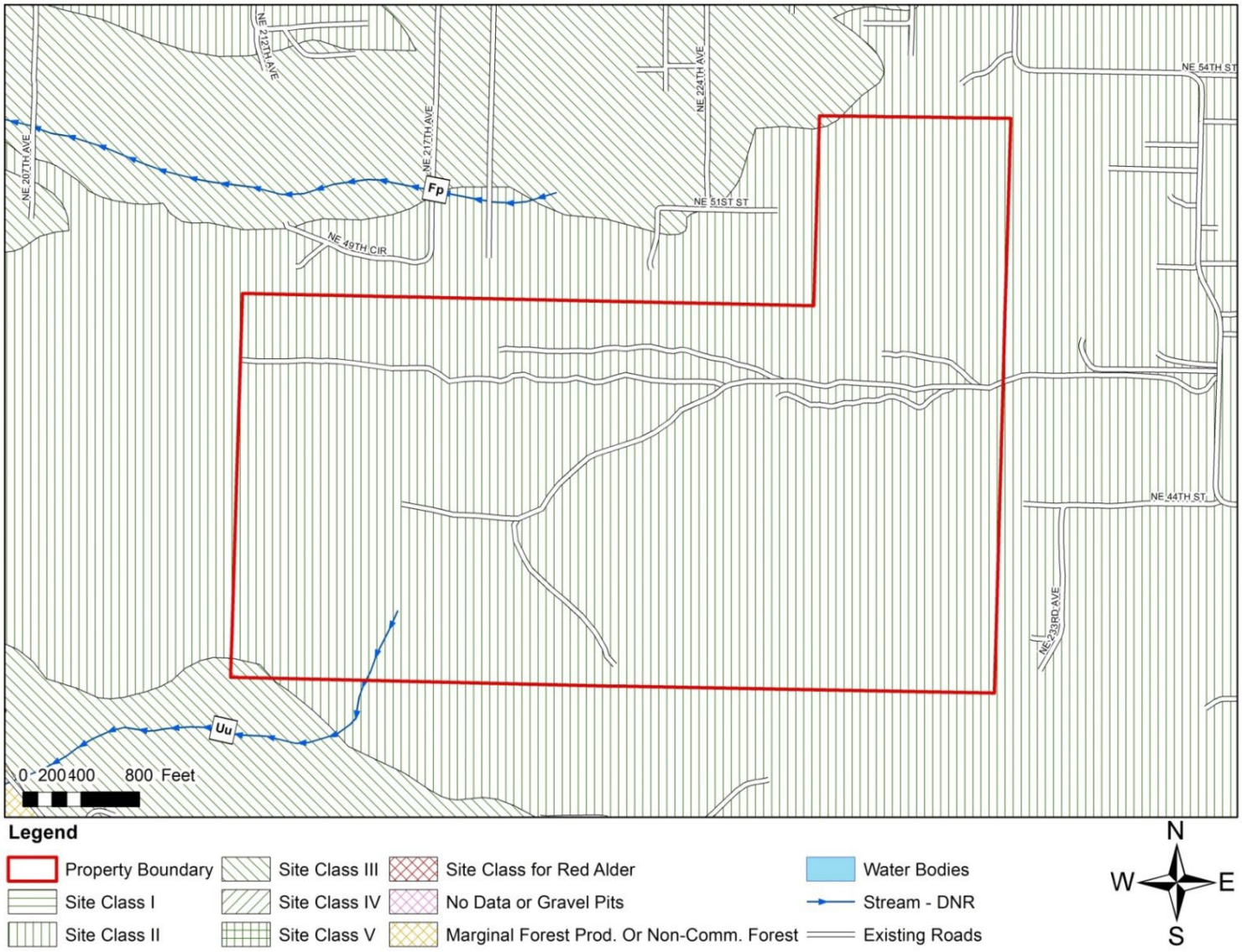
Legend

Property Boundary
Watershed
Existing Roads
Contour Lines
Stream - DNR
Forest Practice Tics

N
W
E
S

CAMP BONNEVILLE

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NE 207TH AVE
NE 217TH AVE
NE 224TH AVE
NE 54TH ST
NE 51ST ST
NE 49TH CIR
NE 44TH ST
NE 233RD AVE
Fp
Uu
0 200 400 800 Feet
Legend
Property Boundary
Site Class I
Site Class II
Site Class III
Site Class IV
Site Class V
Site Class for Red Alder
No Data or Gravel Pits
Marginal Forest Prod. Or Non-Comm. Forest
Water Bodies
Stream - DNR
Existing Roads
N
W
E
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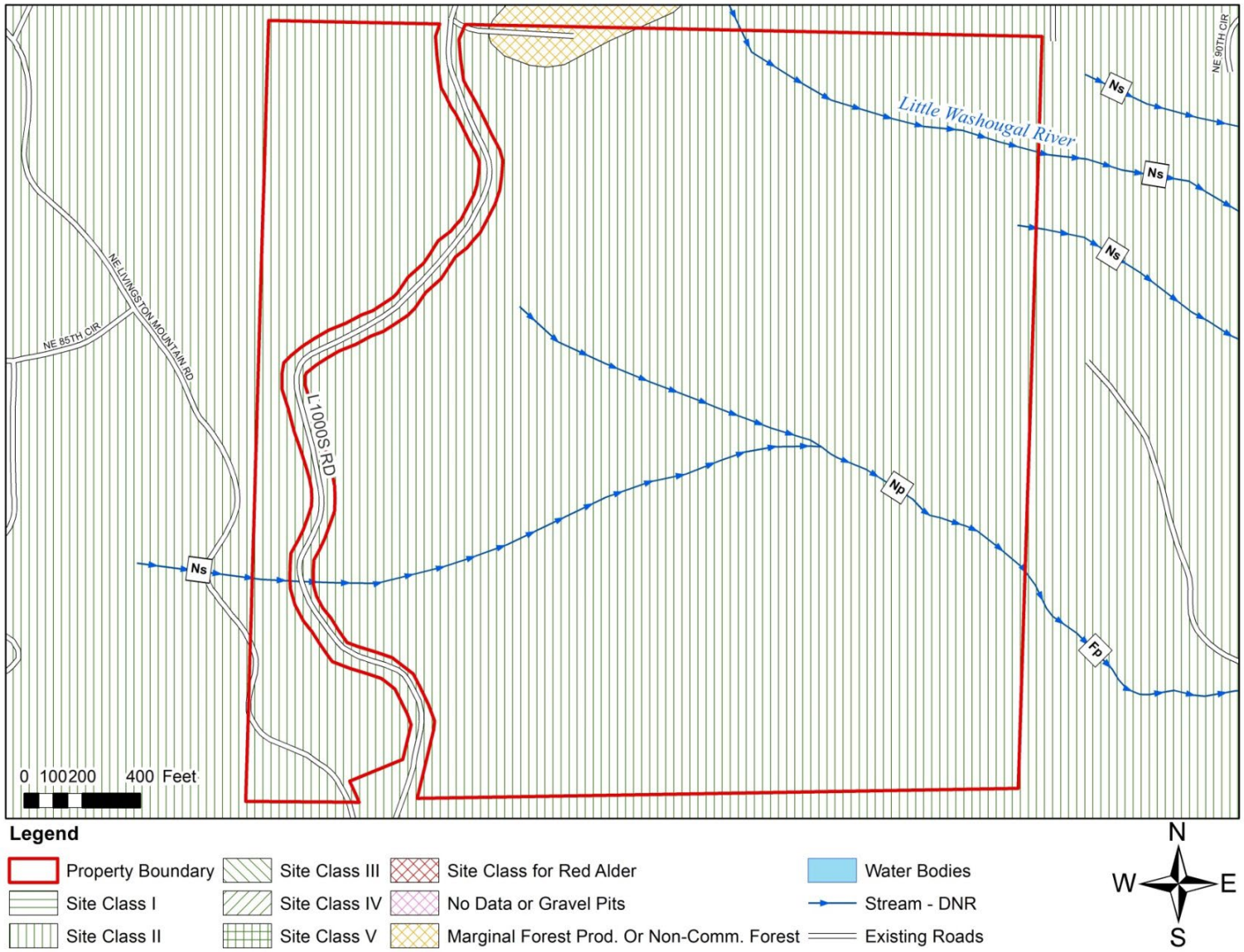
Little Washougal River
NE LIVINGSTON MOUNTAIN RD
NE 85TH CIR
NE 90TH CIR
L1000S RD
Ns
Np
Fp
0 100200 400 Feet
Legend
Property Boundary
Site Class I
Site Class II
Site Class III
Site Class IV
Site Class V
Site Class for Red Alder
No Data or Gravel Pits
Marginal Forest Prod. Or Non-Comm. Forest
Water Bodies
Stream - DNR
Existing Roads
N
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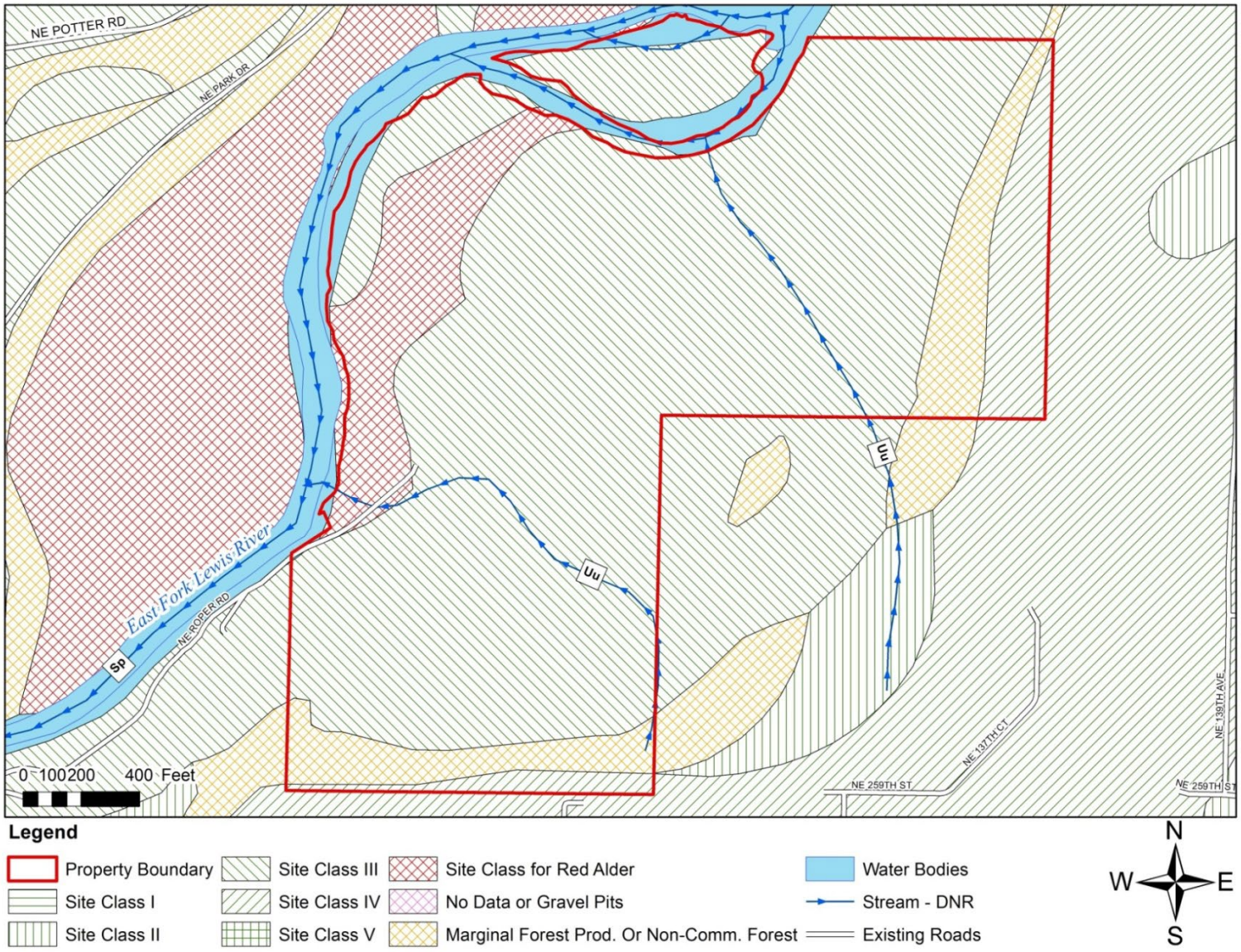
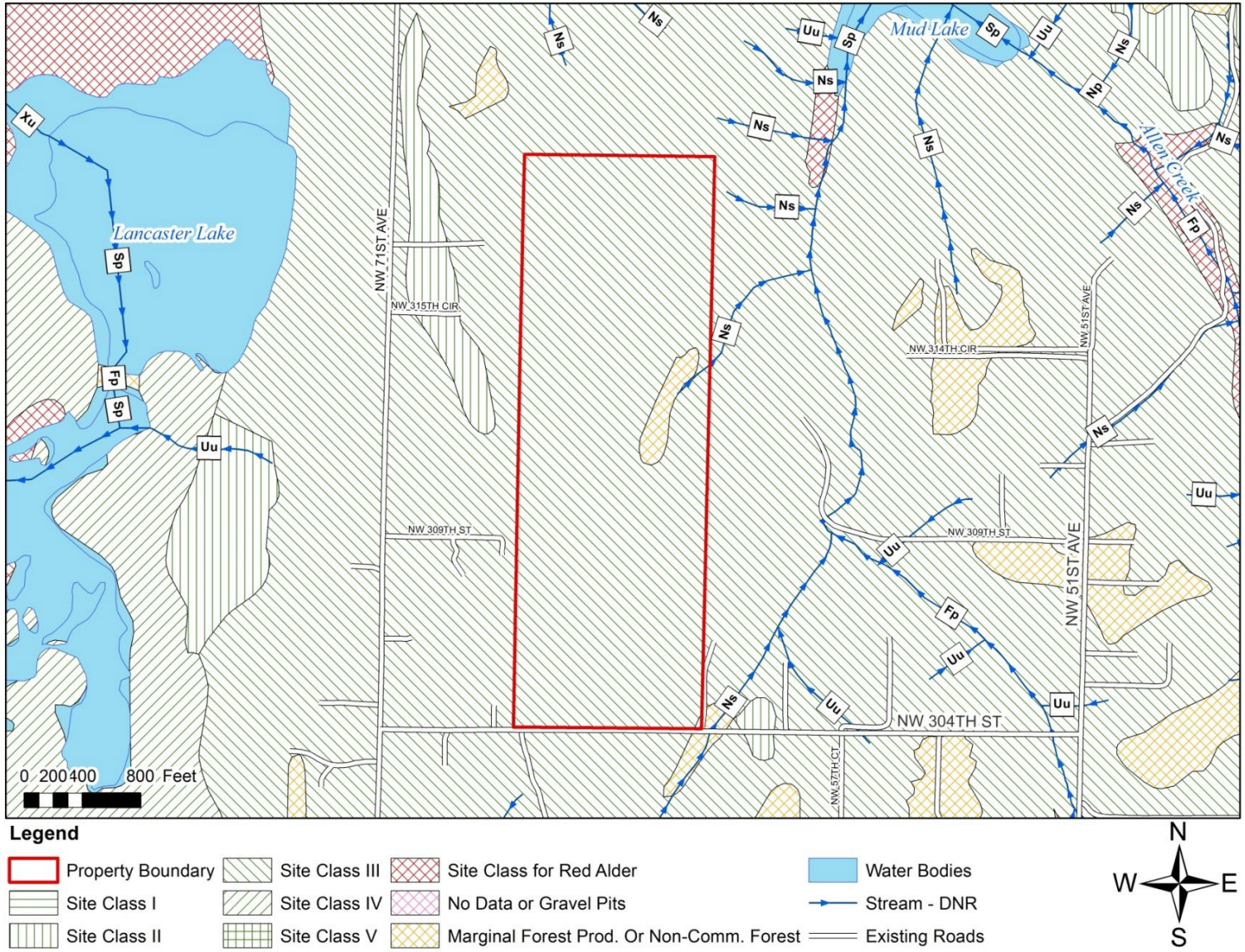
S

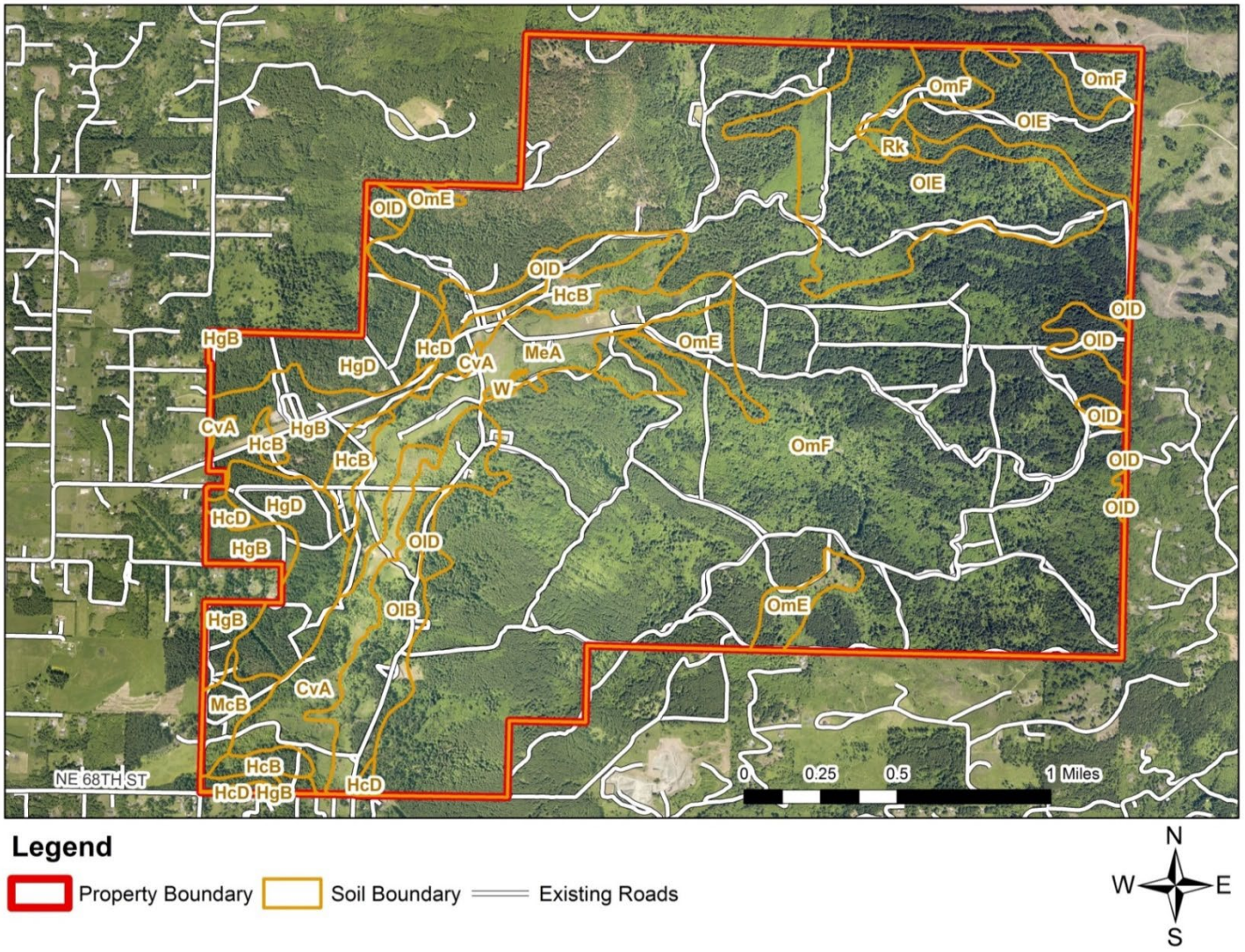

NE POTTER RD
NE PARK DR
East Fork Lewis River
NE ROPER RD
SP
Uu
Uu
0 100200 400 Feet
NE 259TH ST
NE 137TH CT
NE 139TH AVE
NE 259TH ST
Legend
Property Boundary
Site Class I
Site Class II
Site Class III
Site Class IV
Site Class V
Site Class for Red Alder
No Data or Gravel Pits
Marginal Forest Prod. Or Non-Comm. Forest
Water Bodies
Stream - DNR
Existing Roads
N
W
E
S


Uu
Np
Ns
Uu
NW 9TH AVE
Uu
Ns
Fp
Ns
NW 389TH ST
NW 18TH AVE
NW 14TH AVE
Ns
Np
0 100200 400 Feet
Legend
Property Boundary
Site Class I
Site Class II
Site Class III
Site Class IV
Site Class V
Site Class for Red Alder
No Data or Gravel Pits
Marginal Forest Prod. Or Non-Comm. Forest
Water Bodies
Stream - DNR
Existing Roads
N
W
E
S

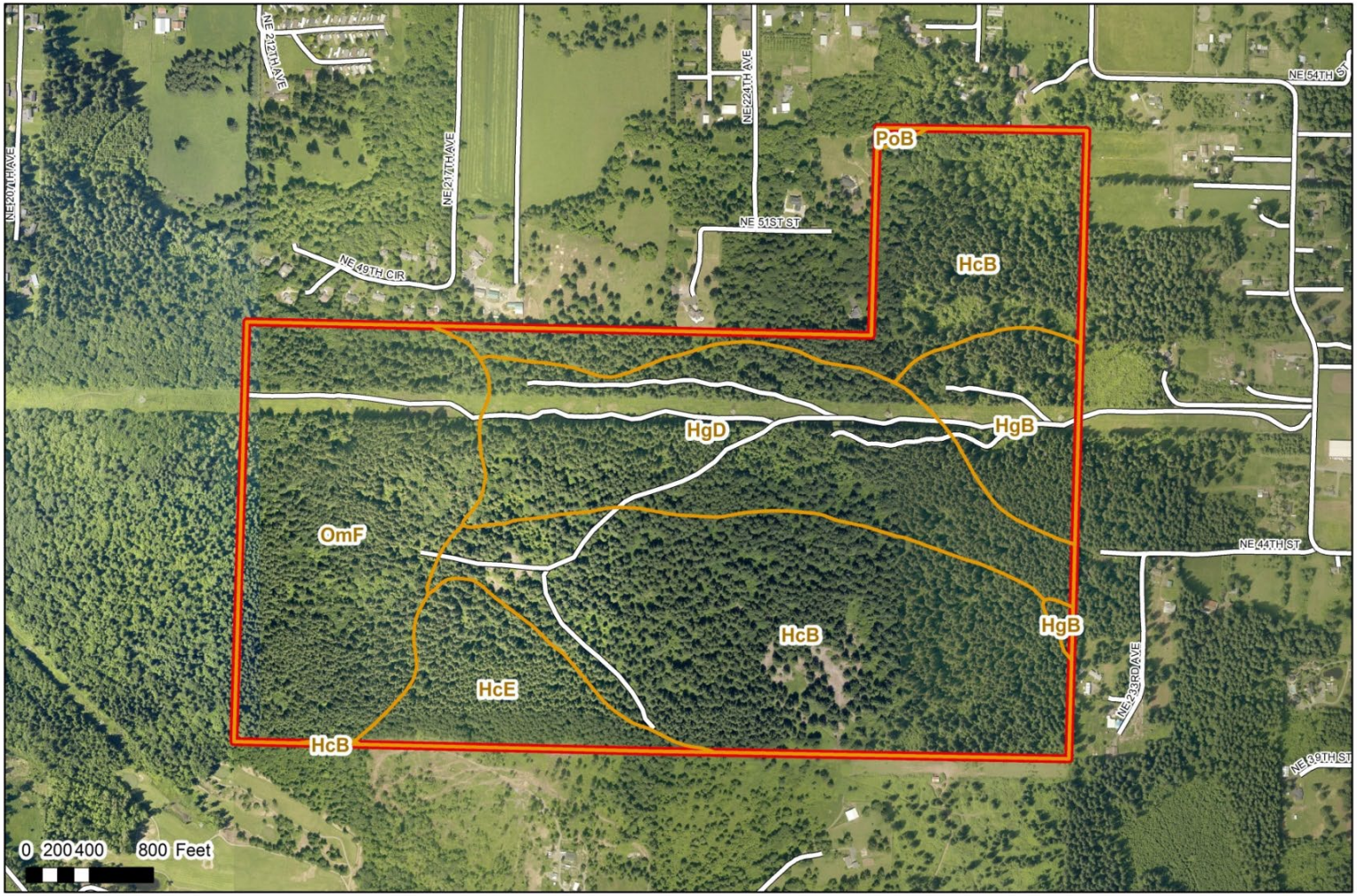

Lancaster Lake
Mud Lake
Allen Creek
NW 71ST AVE
NW 315TH CIR
NW 309TH ST
NW 314TH CIR
NW 51ST AVE
NW 304TH ST
NW 57TH CT
Xu
Sp
Fp
Uu
Ns
Np
0 200400 800 Feet
Legend
Property Boundary
Site Class I
Site Class II
Site Class III
Site Class IV
Site Class V
Site Class for Red Alder
No Data or Gravel Pits
Marginal Forest Prod. Or Non-Comm. Forest
Water Bodies
Stream - DNR
Existing Roads
N
W
E
S

SOILS MAP

CAMP BONNEVILLE



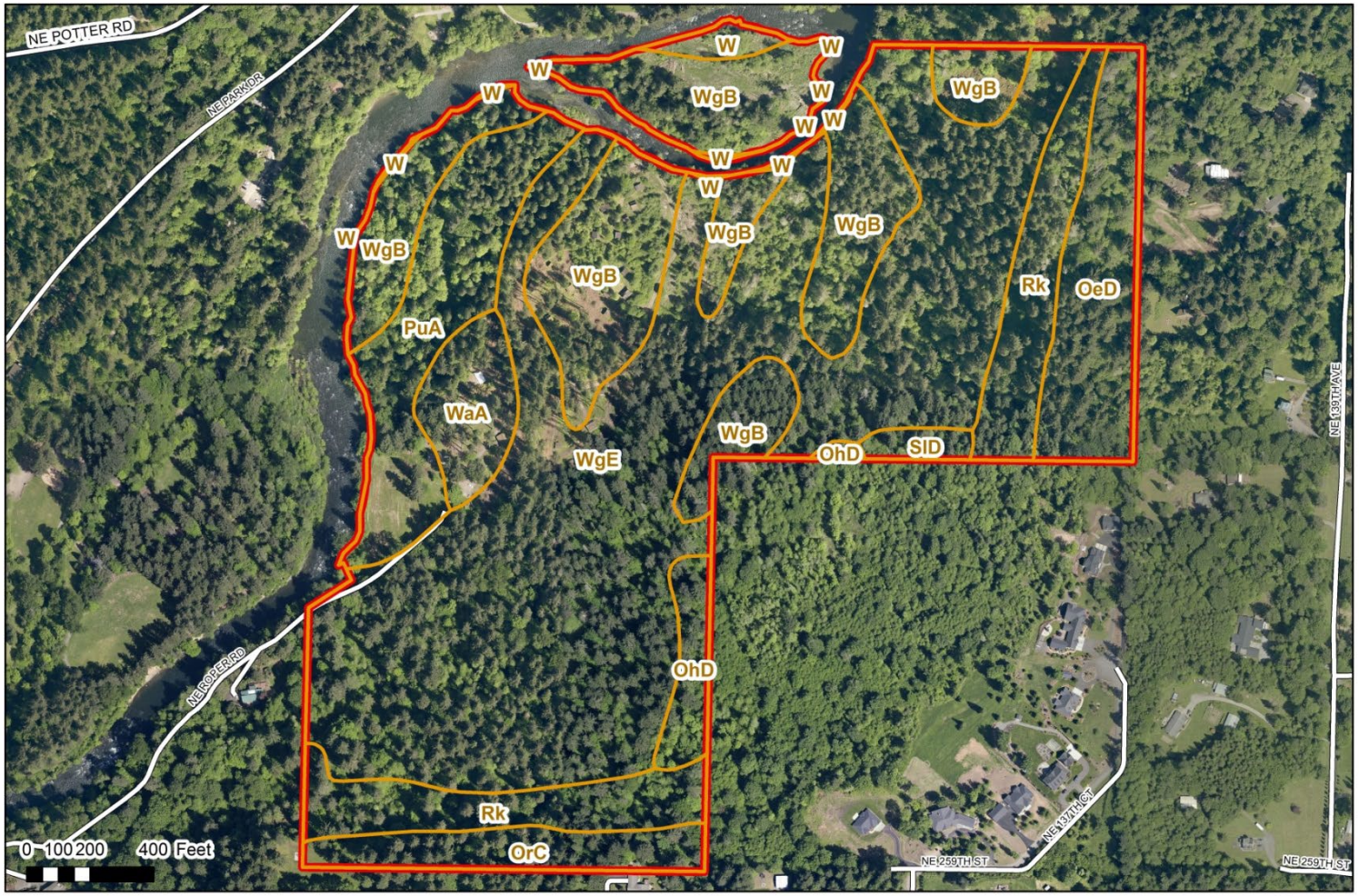

MnD
OIE
OID
OIE
OIE
NE LIVINGSTON MOUNTAIN RD
NE 85TH CIR
L1000S RD
OmF
OmF
OID
OID
OmF
0 100 200 400 Feet
Legend
Property Boundary
Soil Boundary
Existing Roads
N
W
E
S

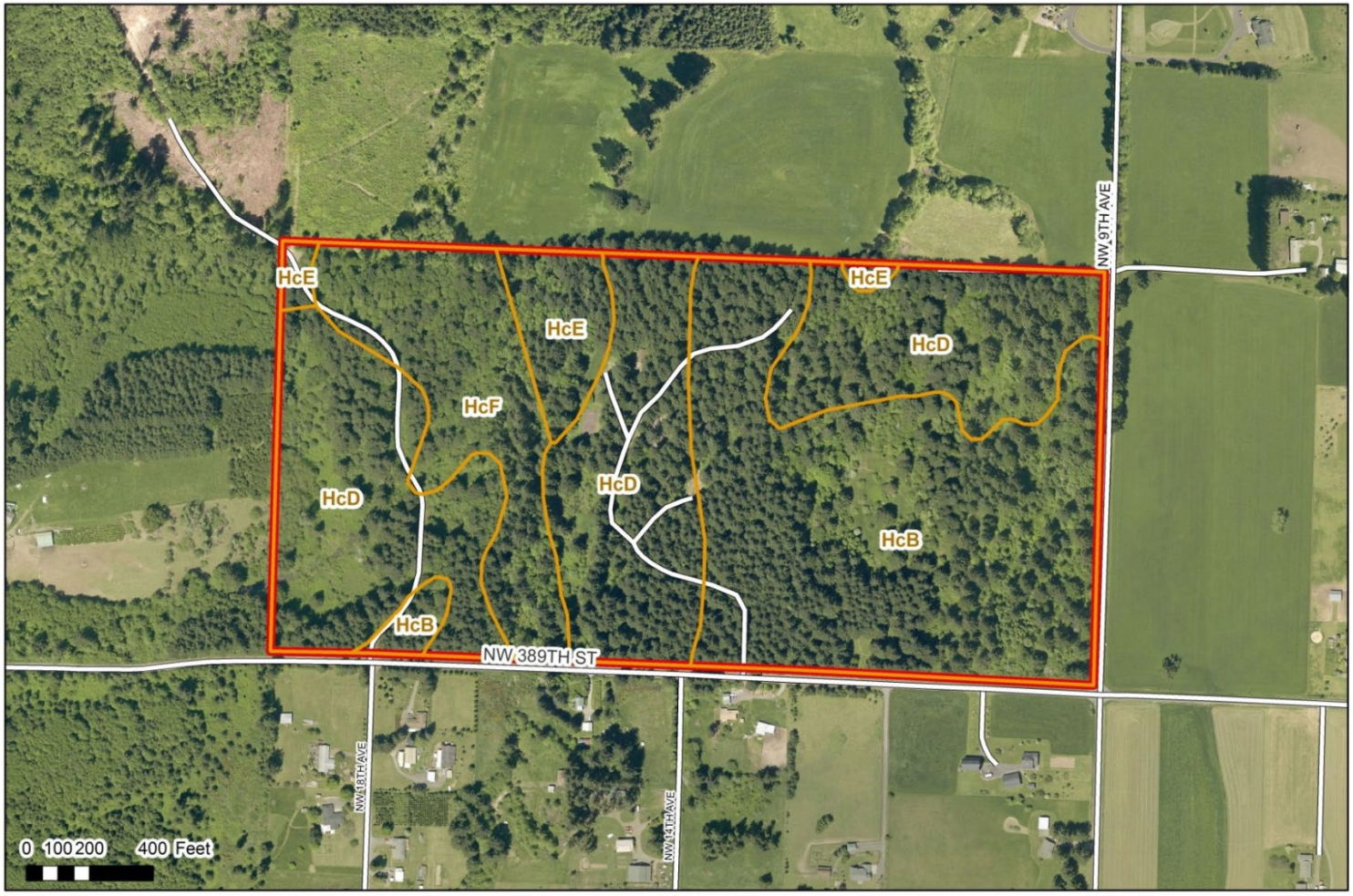


Legend

Property Boundary | Soil Boundary | Existing Roads

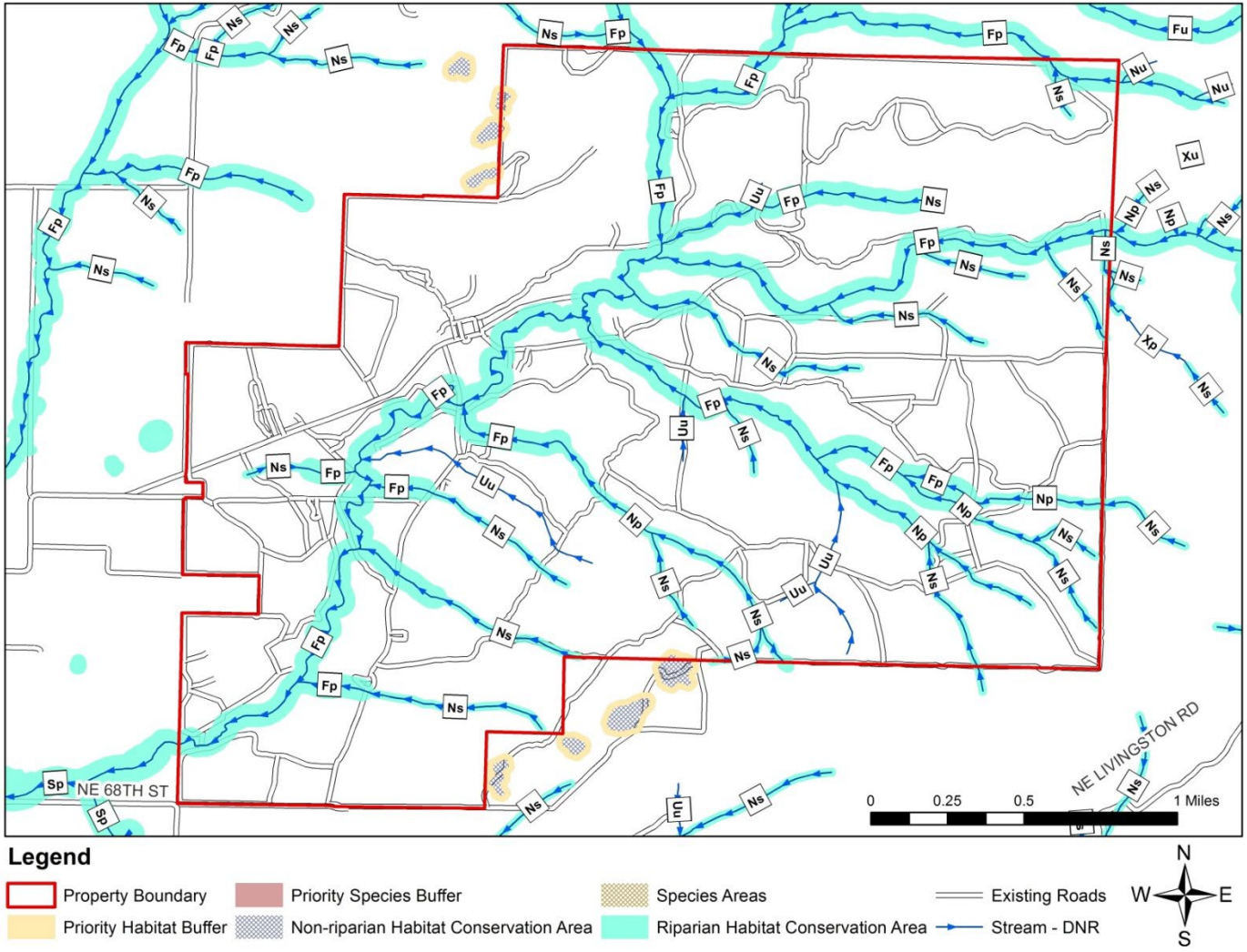
N
W E
S

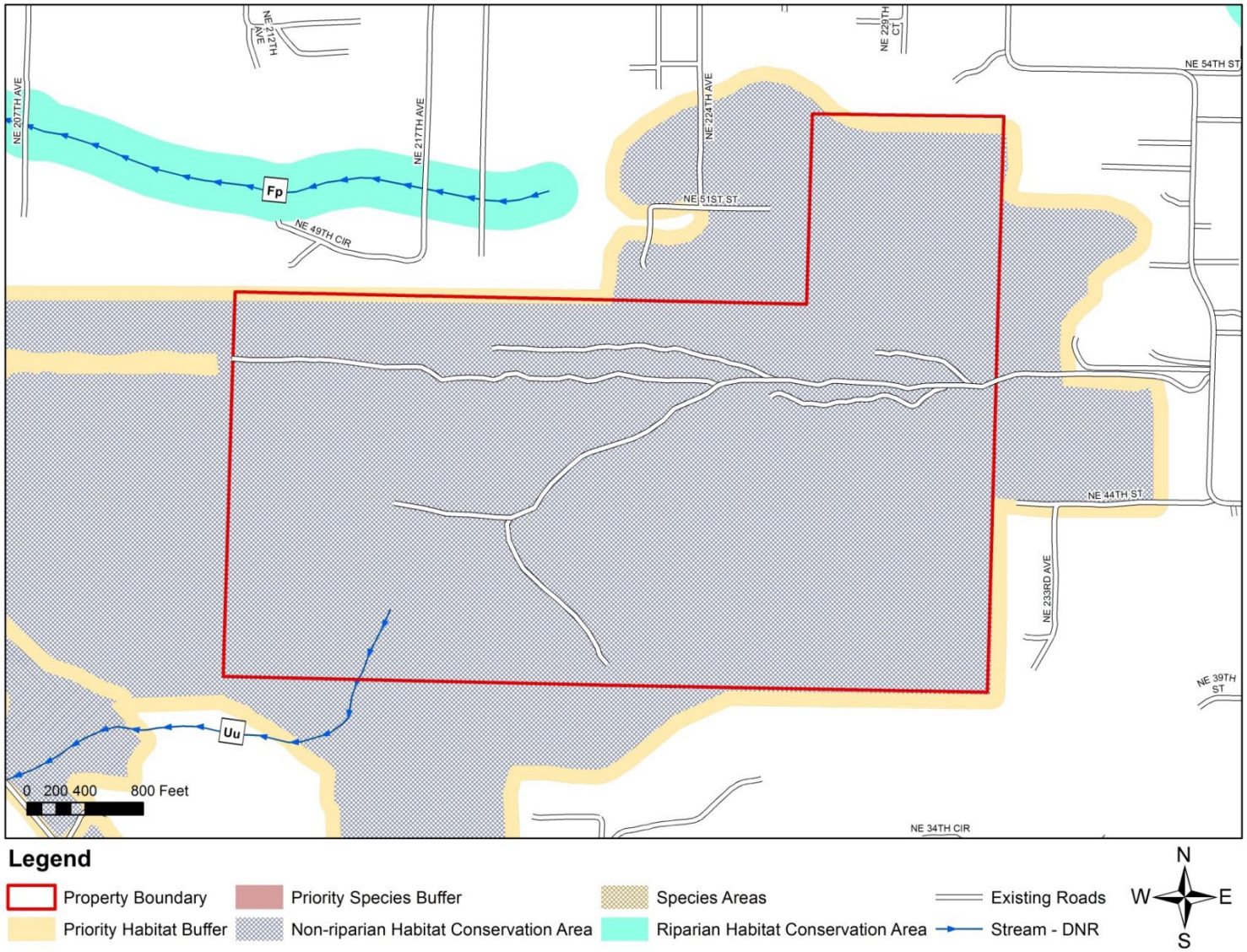

NE POTTER RD
NE PARK DR
NE ROPER RD
NE 139TH AVE
NE 137TH CT
NE 259TH ST
NE 259TH ST
W
WgB
PuA
WaA
WgE
OhD
SlD
Rk
OeD
OrC
0 100 200 400 Feet
Legend
Property Boundary
Soil Boundary
Existing Roads
N
W
E
S


HcE
HcE
HcE
HcD
HcF
HcD
HcD
HcB
HcB
NW 9TH AVE
NW 389TH ST
NW 13TH AVE
NW 14TH AVE
0 100 200 400 Feet
Legend
Property Boundary
Soil Boundary
Existing Roads
N
W
E
S


SIB
SIF
SIF
CvA
SIF
WgB
NW 71ST AVE
NW 315TH CIR
NW 309TH ST
NW 304TH ST
NW 71ST AVE
NW 314TH CIR
NW 51ST AVE
NW ALLEN CANYON RD
NW 309TH ST
NW 51ST AVE
NW 304TH ST
NW 51ST CT
0 200 400 800 Feet
Legend
Property Boundary
Soil Boundary
Existing Roads
N
W
E
S

CAMP BONNEVILLE

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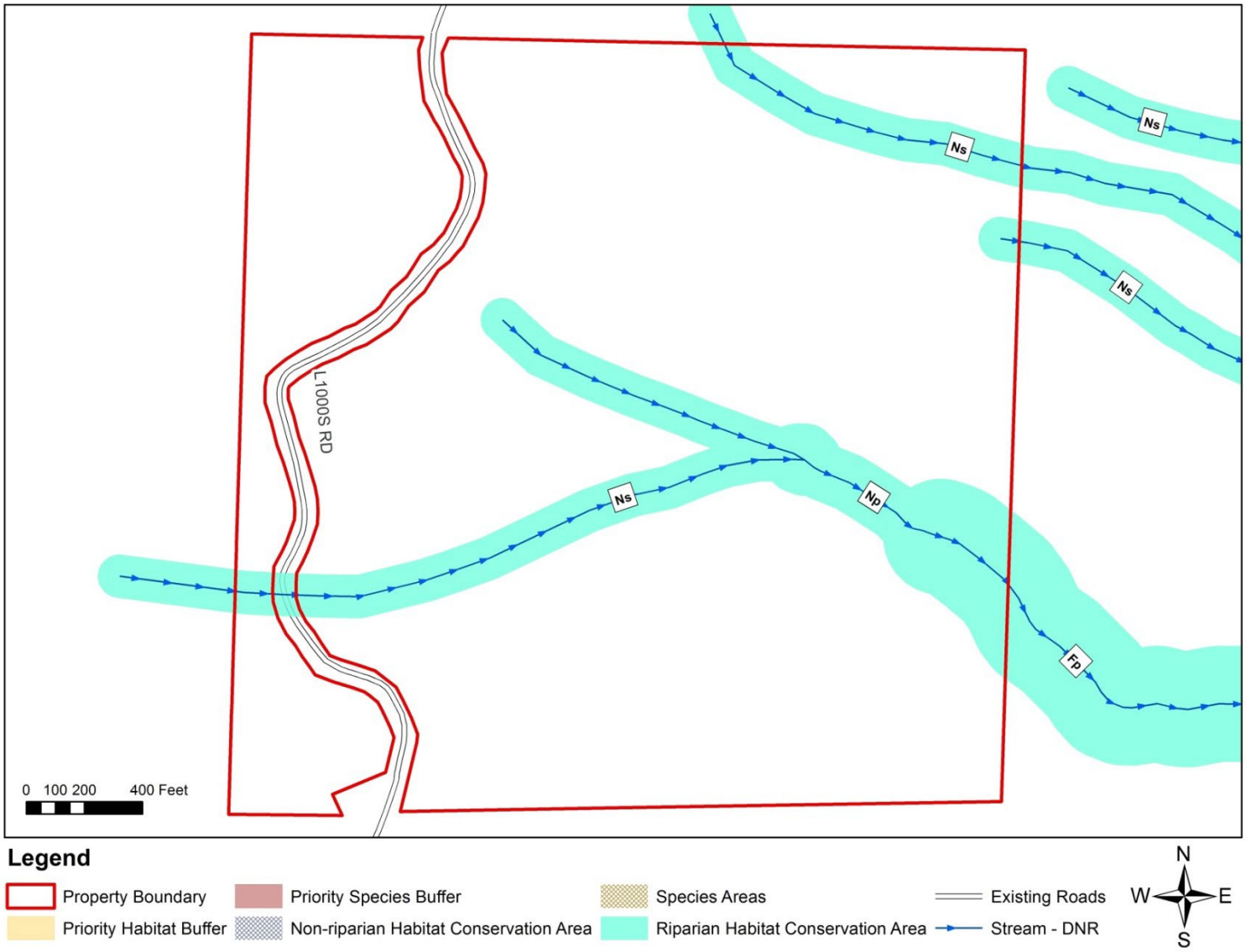
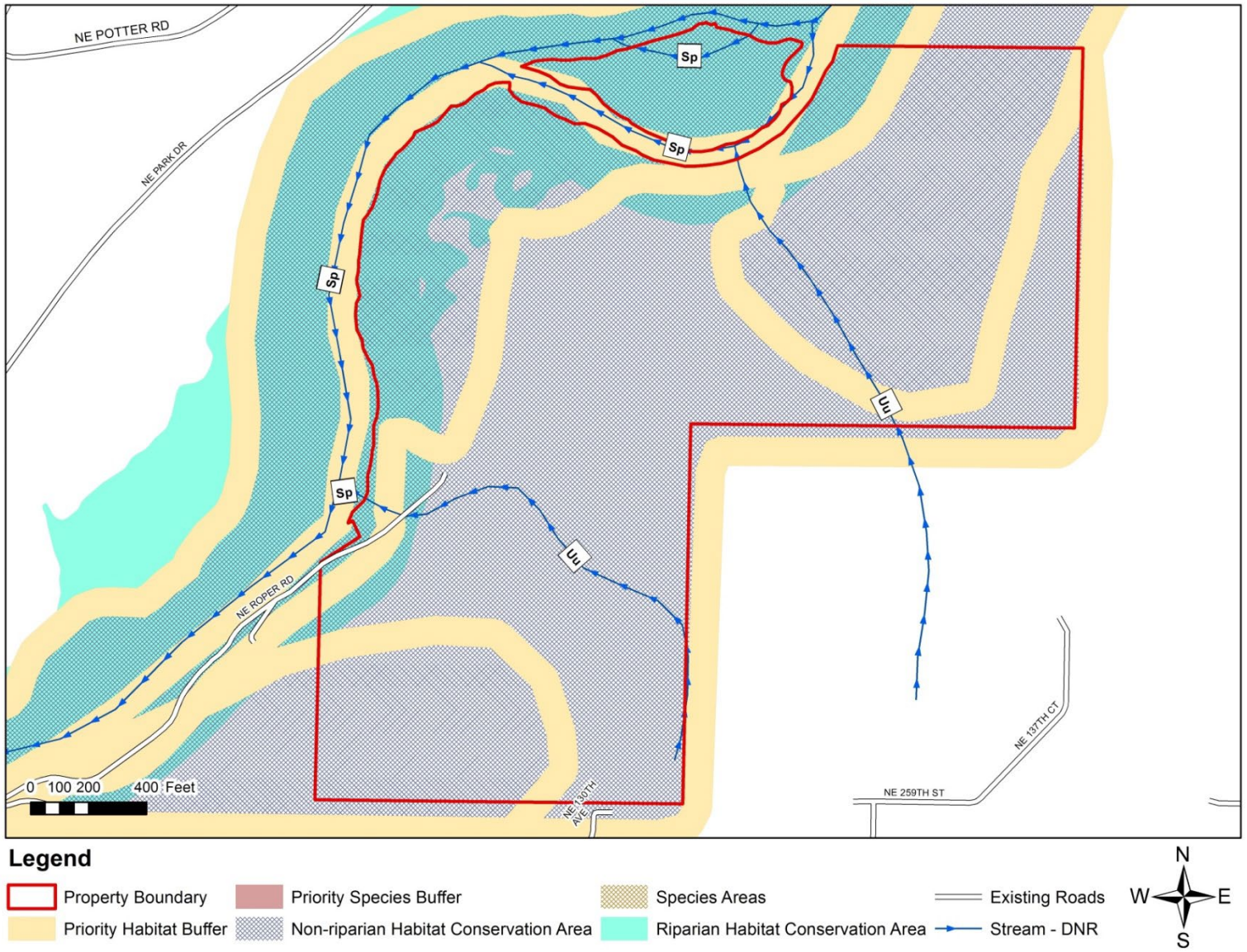
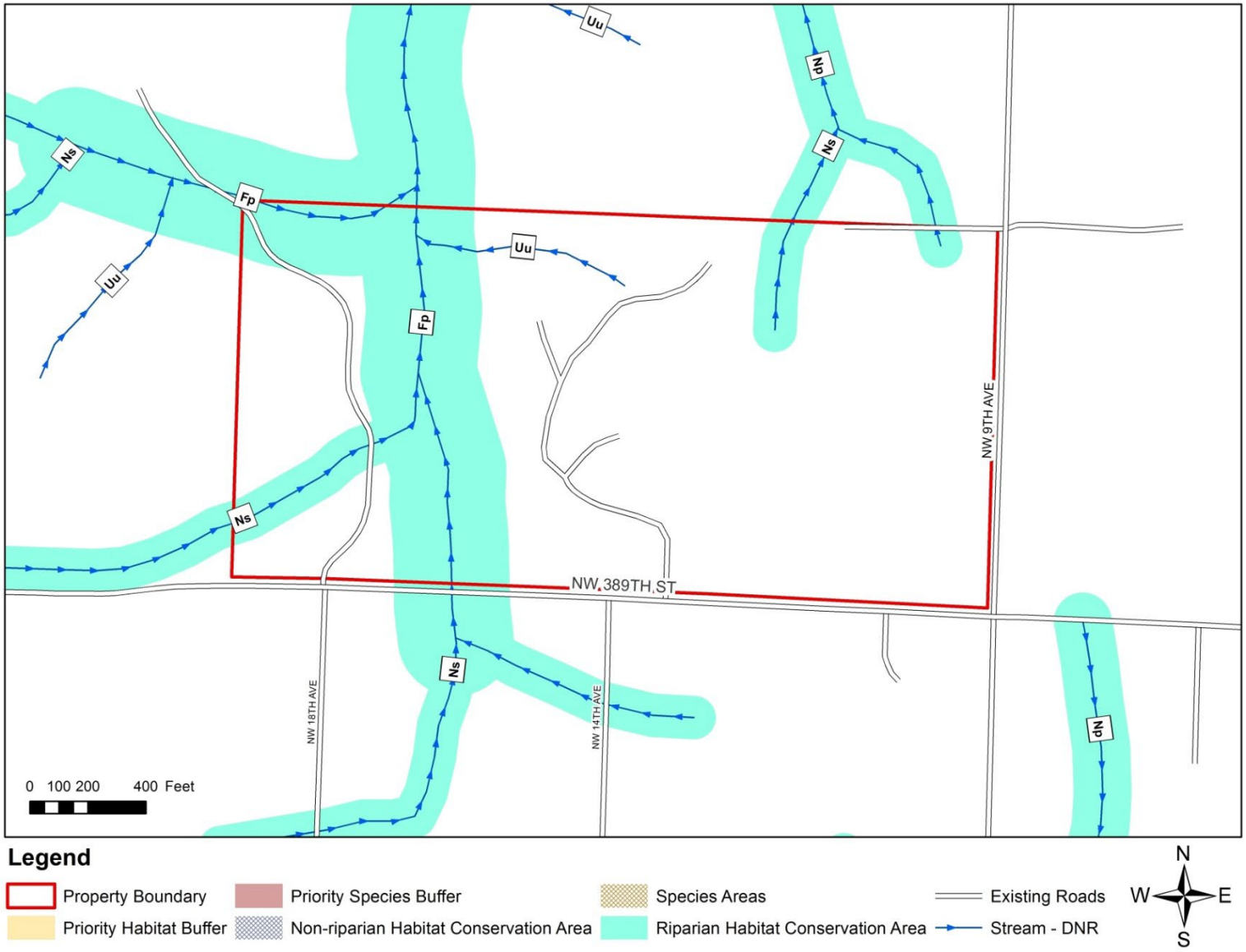
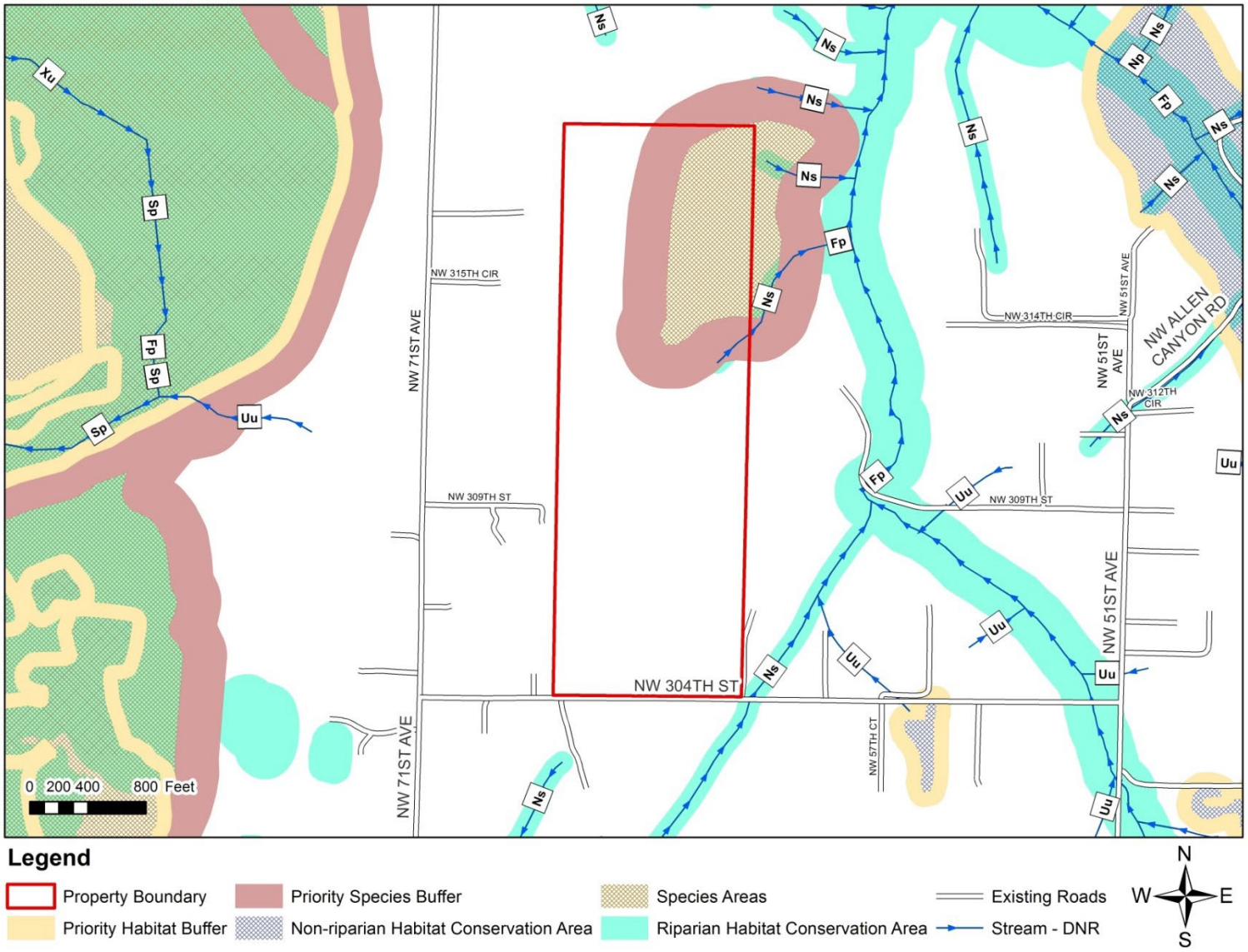
NE 207TH AVE
NE 217TH AVE
NE 229TH CT
NE 224TH AVE
NE 54TH ST
Fp
NE 51ST ST
NE 49TH CIR
NE 44TH ST
NE 233RD AVE
NE 39TH ST
Uu
0 200 400 800 Feet
NE 34TH CIR
Legend
Property Boundary
Priority Habitat Buffer
Priority Species Buffer
Non-riparian Habitat Conservation Area
Species Areas
Riparian Habitat Conservation Area
Existing Roads
Stream - DNR
N
W
E
S


L1000S RD
Ns
Ns
Ns
Ns
Np
Fp
0 100 200 400 Feet
Legend
Property Boundary
Priority Species Buffer
Species Areas
Existing Roads
Priority Habitat Buffer
Non-riparian Habitat Conservation Area
Riparian Habitat Conservation Area
Stream - DNR
N
W
E
S


NE POTTER RD
NE PARK DR
Sp
Sp
Sp
Sp
Uu
Uu
NE ROPER RD
NE 137TH CT
NE 259TH ST
NE 137TH AVE
0 100 200 400 Feet
Legend
Property Boundary
Priority Habitat Buffer
Priority Species Buffer
Non-riparian Habitat Conservation Area
Species Areas
Riparian Habitat Conservation Area
Existing Roads
Stream - DNR
N
W
E
S


Uu
Np
Ns
Ns
Fp
Uu
Uu
Fp
NW 9TH AVE
Ns
NW 389TH ST
NW 18TH AVE
NW 14TH AVE
Ns
Np
0 100 200 400 Feet
Legend
Property Boundary
Priority Species Buffer
Species Areas
Existing Roads
Priority Habitat Buffer
Non-riparian Habitat Conservation Area
Riparian Habitat Conservation Area
Stream - DNR
N
W
E
S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NW 71ST AVE
NW 309TH ST
NW 304TH ST
NW 71ST AVE
NW 57TH CT
NW 51ST AVE
NW 314TH CIR
NW 51ST AVE
NW ALLEN CANYON RD
NW 312TH CIR
NW 309TH ST
NW 51ST AVE
0 200 400 800 Feet
Legend
Property Boundary
Priority Species Buffer
Species Areas
Existing Roads
Priority Habitat Buffer
Non-riparian Habitat Conservation Area
Riparian Habitat Conservation Area
Stream - DNR
N
W
E
S

PLAN APPROVAL SIGNATURES

LANDOWNER

I have reviewed this plan and believe the management recommendations will help me meet my goas and objectives for my property. I agree to follow this plan to ensure the sustainability of my management.

_____

Landowner Signature *Date Signed*

FOREST STEWARDSHIP PROGRAM

I certify that this Forest Management Plan meets the requirements of the federal Forest Stewardship Program.

_____

Plan Author Signature *Date Signed*

I certify that this Forest Management Plan meets the requirements of the federal Forest Stewardship Program.

_____

State Forestry Representative Signature *Date Signed*

Print Name: _____

Affiliation: _____

Address: _____

Phone: _____

E-mail: _____

Forest Stewardship Tracking Number: (if necessary) _____

NRCS INCENTIVE PROGRAMS

I certify that this Forest Management Plan meets the requirements of the USDA Environmental Quality Incentives (EQIP) Program and/or the Quality Criteria for forest activity plans in Section III of the USDA NRCS Field Office Technical Guide.

_____

Technical Service Provider Signature *TSP Number* *Date Signed*

Print Name: _____

Affiliation: _____

Address: _____

Phone: _____

E-mail: _____

AMERICAN TREE FARM PROGRAM

I certify that this Forest Management Plan meets the requirements of the American Forest Foundations American Tree Farm System.

_____

ATFS Inspecting Forester Signature *ATFS Number* *Date Signed*

Print Name: _____

Affiliation: _____

Address: _____

Phone: _____

E-mail: _____

_____

Certified Tree Farm Number ATFS Number Date of ATFS Certification

CURRENT USE TIMBER MANAGEMENT PLAN APPROVAL (IF APPLICABLE)

I certify that this Forest Management Plan meets the requirements of Clark County's Current Use Programs.

_____

Authorized County Government Rep. Signature *Date Signed*

Print Name: _____

Affiliation: _____

Address: _____

Phone: _____

E-mail: _____

APPENDIX 1 - FOREST MANAGEMENT TIMETABLE

For the next 20 years (longer at the County Foresters discretion) indicate planned management practices and anticipated year to be implemented.

If applying for NRCS-administered Farm Bill financial assistance programs (e.g. EQIP) to implement practices, be sure to indicate NRCS Practice Code here and indicate location of practice on attached map or photo.

See individual FMU descriptions for more detailed prescriptions.

Location	**Time line**	**FMU #**	**Acres**	**Management Practice or Activity**	**NRCS Practice Code (If Applicable)**
Camp Bonneville	Any time	17		Implement variable density thinning to diversify stand structure.	
Camp Bonneville	Any time	23		Implement variable density thinning to diversify stand structure.	
Camp Bonneville	Any time	11		Implement variable density thinning to diversify stand structure.	
Camp Bonneville	1-5 years	14		Pre-commercially thin red alder. Implement habitat enhancement practices.	
Camp Bonneville	1-5 years	2, 4, 5, 6, 11, 19, 22		1st entry commercial thin & habitat enhancements	
Camp Bonneville	1-5 years	29		Replant RMZ's and place wood within stream channel.	
Camp Bonneville	5-10 years	2, 4, 5, 6, 19, 22		2nd entry commercial thinning	
Camp Bonneville	5-10 years	18, 20, 21		1st entry commercial thin & habitat enhancements	
Camp Bonneville	10-15 years	18, 20, 21		2nd entry commercial thinning	
Camp Bonneville	10-15 years	14		1st entry commercial thin & habitat enhancements	
Camp Bonneville	10-15 years	2, 4, 5, 6, 19, 22		3rd entry commercial thinning	
Camp Bonneville	10-15 years	3		1st entry commercial thin & habitat enhancements	
Camp Bonneville	15-20 years	21		3rd entry commercial thinning	
Camp Bonneville	15-20 years	8, 12, 13		1st entry variable retention overstory thin	
Green Mountain	2014 - 2015	5, 6	138	Variable density commercial thin.	

Green Mountain	2015 - 2016	5	88	Underplant unit with DF at 100 tpa	
Green Mountain	2015 - 2020	7	84	Variable density commercial thin. Underplant site with 50:50 DF & RC at 100 tpa.	
Green Mountain	2015 - 2020	1	23	PCT dense alder. Control Himalayan blackberry. Replant open areas to DF at 100 tpa.	
Green Mountain	2015 - 2020	2	22	PCT maple. Control brush and replant unit to RC at 200 tpa	
Green Mountain	2015 - 2020	3	15	Control brush and replant unit to RC at 200 tpa.	
Green Mountain	2020 - 2025	9	52	Variable density commercial thin. Release Oregon Oak.	
Green Mountain	2025 - 2030	6	50	Variable density commercial thin. Underplant units with DF at 100 tpa.	
Green Mountain	2030 - 2035	5	88	Variable density commercial thin. Underplant units with DF at 100 tpa.	
Green Mountain	2035 - 2040	6	50	Variable density commercial thin. Underplant units with DF at 100 tpa.	
Green Mountain	2035 - 2040	7	84	Commercial variable density thin.	
Green Mountain	2040 - 2045	9	52	Variable density commercial thin. Underplant with 50:50 mix of DF and RC at 100 tpa.	
Spud Mountain	2019- 2024	1 & 2	133	1st entry commercial thin & habitat enhancements, Underplant site with 50:50 DF & RC at 100 tpa.	
Spud Mountain	2019- 2024	3	21	1st entry variable density commercial thin. Replant RMZ's (Shade Tolerant Species) and place wood within stream channel.	
Spud Mountain	2024- 2029	1 & 2	133	2nd entry commercial thinning	
Spud Mountain	2024- 2029	3	21	2nd entry variable density commercial thinning.	
Spud Mountain	2029- 2034	1 & 2	133	3rd entry commercial thinning	
Camp Hope	2018	2, 4	20	2nd entry commercial thinning, control root rot pocket. Interplant site with Western Red Cedar	

Camp Hope	2020-2025	3	34	1st entry commercial thin & habitat enhancements, Interplant site with Western Red Cedar	
Bratton Canyon	2020-2025	1	31	1st entry commercial thin & habitat enhancements	
Bratton Canyon	2020-2025	3	17	Control brush and replant unit to RC at 300 tpa.	
Bratton Canyon	2025-2030	2	6	Pre-commercially thin red alder. Implement habitat enhancement practices.	
Bratton Canyon	2025-2030	1	31	2nd entry commercial thinning	
Bratton Canyon	2035-2040	3	17	Pre-commercially thin Red Cedar.	
Bratton Canyon	2035-2040	1	31	2nd entry commercial thinning	
Lake Rosannah	2020-2025	1	68	1st entry commercial thin & habitat enhancements, Interplant site with Western Red Cedar, control invasive ivy in stand.	
Lake Rosannah	2020-2025	2	35	1st entry Pre-Commercially Thin Douglas-fir.	
Lake Rosannah	2030-2035	1, 2	103	2nd entry commercial thinning.	
Lake Rosannah	2035-2040	1	68	3rd entry commercial thinning	
Lake Rosannah	2040-2045	2	35	3rd entry commercial thinning	

ALLOWABLE CUT

Currently 2,498 acres have been inventoried out of 4,506 acres identified in this comprehensive plan update. The inventoried area is predominately Site Class II with an average Site Index of 130 with ingrowth PAI at 880 bf/ac/yr. This provides an annual yield of 2.2 mmbf / yr.

The current business model of the County's Sustainable Forestry Program is to maintain a "Small Forest Landowner" profile with the WA State Dept. of Natural Resources per RCW 76.09.450 This requires a maximum 3 year average annual harvest of an amount not to exceed 2 mmbf. The status also carries positive tax rates which further compliment the business model.

Approximately 600 of the uninventoried acres are in a overstocked 40+ year old age class on the Camp Bonneville Forest. Since thinning began in 2012, slightly over 200 acres of the same timber type has been thinned under a structure based prescription. The 2011 inventory of those acres indicated a PAI of < 0.9% ingrowth. The current inventory on the same units indicates the stands are responding with a PAI of 3.1 % ingrowth. The expected total improvement in PAI is >5% within the next 4 years.

Given the above facts the program is choosing to cap its annual average Harvest at 2mmbf until such a time both silvicultural and business planning objectives can be mutually achieved.

FUTURE MANAGEMENT ACTIVITY TRACKING

Location & FMU#	Acres	NRCS Practice Code*	Treatment Activity Short Description (or reference to description in Plan)	Dates		Incentive Programs (s) Used?	Net Cash Flow	
				Planned	Completed		Cost	Income

APPENDIX 2 – ROAD MAINTENANCE TIMETABLE

Location	Year	Season	Road Segment #	Maintenance Activity

APPENDIX 3 – MONITORING DATA SUMMARIES

Date	Monitoring Notes

APPENDIX 4 - CAMP BONNEVILLE WILDFIRE SUPPRESSION PLAN

(Updated 02/23/2024)

GENERAL OVERVIEW

During the Department of Army's ownership since the early 1900's, areas within Camp Bonneville have been used as a live fire exercise range. The Department of Natural Resources has fire protection responsibilities within the boundaries of Camp Bonneville.

DUE TO THIS HIGH POTENTIAL OF UNEXPLODED ORDINANCE (UXO), ENTRANCE TO LANDS LOCATED WITHIN THE BOUNDARIES OF CAMP BONNEVILLE SHOULD BE MADE ONLY AFTER CONTACT WITH A MEMBER OF CLARK COUNTY DEPARTMENT OF PUBLIC WORKS.

SUPPRESSION PLAN OBJECTIVES - SAFETY

- Priority suppression objectives will be to provide for safety first, at all times.
- Protection of Human Life.
- Protection of Natural Resources on DNR protected lands.
- Minimize Resource Losses and Fire Costs.
- Ground forces should only be allowed into the boundaries of the Camp with qualified and knowledgeable guides after notification of a member of the Clark County Department of Public Works.
- Unified Command-(under the ICS system) by the responding agencies -should be initiated as soon as possible.

FIRE NOTIFICATION

All wildfires occurring within Camp Bonneville will require notification of the Clark County Department of Public Works Representative:

CLARK COUNTY DEPARTMENT OF PUBLIC WORKS CONTACT LIST, PRIORITY ORDER

Priority Order	Name	Title	Office	Cell
1	Erik Harrison	Clark County Camp Bonneville Site Manager	(360) 566-6993 (Mon-Fri 8:00AM – 5:00PM) (564) 397-4944	
2	Curtis Eavenson	Clark County Interim Fire Marshal	(564) 397-3320	
3	Hunter Decker	Clark County Forester	(564) 397-4852	(360) 624-7533

All wildfires within the boundaries of Camp Bonneville require notification of a DNR – Pacific Cascade Region Fire Manager:

DEPARTMENT OF NATURAL RESOURCES FIRE MANAGERS

Priority Order	Name	Title	Office	Cell
1	Trent Crossland	Clark/Skamania Fire Unit Forester		(360) 827-0001

2	Kasey Bond	Clark/Skamania Fire Assistant Forester		(360) 827-2207
3	Dave Hubbard	Clark/Skamania Fire Assistant Forester		(360) 669-6271
4	Paul Tester	Fire Operations District Manager	(360) 577-5020	(360) 355-5433
5	Rex Happala	PC Region Wildfire and Forest Practices (WFP) Assistant Region Manager	(360) 575-5002	(360) 749-2552
6	Pacific Cascade – Dispatch Center	Pacific Cascade Region Dispatch Center (Open Monday thru Friday 0700 hours to 1730) (Communications Center will be open 7 days a week 0700-1830 beginning 6/28 and will continue those hours through Fire Season)	(360) 575-5089	

The County Fire Districts will be responsible for protection and suppression of structures and calls for medical assistance within the boundaries of Camp Bonneville:

CLARK COUNTY FIRE DISTRICT PROTECTION

Fire District	Location	Phone Number
#3	On the north side of Camp Bonneville	(360) 892-2331
#5	On west side, is contracted out to Vancouver Fire Department	(564) 397-2100; (360) 487-7304
East County Fire & Rescue Station 91	On south side and east side	(360) 834-4908

PRE-SUPPRESSION ACTIONS

- Every year the suppression plan will be reviewed, and a copy will be included in the Region MOB Guide each year.
- A pre-season briefing concerning suppression in Camp Bonneville will be conducted with permanent district personnel, seasonal fire suppression personnel, and Larch Camp Crew supervisors. A copy of this plan and maps will be disseminated at those briefings. These briefings will be done in coordination with the Clark/Skamania Fire Unit Forester.
- All region fire staff should be familiar with the Incident Response Pocket Guide, pages 1-12, green pages.
- Unexploded Ordnance (UXO) Safety information is also in the Incident Response Pocket Guide, page 27, gray pages.

GROUND FORCES

The Incident Commander should not consider placing ground forces on any fire within the boundaries of Camp Bonneville without a member of the Clark County Department of Works on site with Incident Commander. **The entrance to Camp Bonneville is at NE Pluss Road, this would be the staging area for all fire personal before fire engagement, see staging areas on map.** Each firefighter will be briefed by the Incident Commander on Unexploded Ordnance Safety and Reporting procedures.

CONTROL LINES

- The Incident Commander will not consider placement of any control lines without consulting with a representative from Clark County Department of Public Works.
- Use of existing roads, trails, and natural fuel breaks should be utilized wherever possible.
- Aerially placed chemical retardant control lines or helicopter bucket drops could be limited from 500 feet or higher above the drop area and should be used where appropriate to construct control lines.

- Consult with a Clark County Department of Public Works representative before the use of any explosives for fire line construction.
- Consult with a Clark County Department of Public Works representative before engaging in any fire suppression activities on or near any no entry areas.

ACCESS AND LOCATION

- Vehicular access to Camp Bonneville is limited to the main entrance off of Pluss Road, address is 23201 NE Pluss Rd. Consult with a Clark County Department of Public Works representative before using all roads in the camp boundary, see map for all road locations.
- Camp Bonneville is located entirely in Sections 35 and 36 and the southeast quarter of Section 34 of Township 3 North, Range 3East. Additionally Camp Bonneville covers all of Sections 1,2, and 3 of Township 2 North, Range 3 East, as well as the North half of sections 10 and 11 of Township 2 North, Range 3 East, W. M., see map.

FIRE REHABILITATION

All rehabilitation activities will be done with a Clark County Department of Public Works representative.

KNOWN SAFETY HAZARDS

- Review the safety hazards as identified in the Fireline Handbook, Chapter 1,Firefighting Safety and also in the Incident Response Pocket Guide (gold pages-specific hazards).
- In the southwest corner of Camp Bonneville boundary is a natural gas pipe line owned and operated by Williams-Northwest Pipeline. There are two lines, a 30 inch and 26 inch.

Emergency contact number for Northwest Pipeline is (800) 972-7733

General information number is (360) 687-3156

ADDITIONAL CONSIDERATIONS

- There's one area on the attached map listed as **CENTRAL IMPACT TARGET AREA** due to the high probability of containing Unexploded Ordinance, (UXO).
- All other areas should also be considered to have a high probability of containing Unexploded Ordinance. All Camp Bonneville boundaries should not be entered without Clark County Department of Public representative on site.
- The Clark County Departments of Public Works and Environmental Services are in the process of doing silvicultural activities and road maintenance. In 1995, the Military discontinued its road maintenance activities.
- From the late 1980's to present there have been many rural developments that have been placed close to the boundaries of Camp Bonneville. Careful planning and consideration of these developments should drive the operations plan in extended attack. Preplanning and coordination with local rural Fire districts should be implemented- should evacuation of these developments need to take place.

APPENDIX 5 – BALD EAGLE MANAGEMENT

BACKGROUND

Timber harvest and the construction of roads and buildings are the main habitat alterations that negatively affect roosting eagles in Washington. The long-term goal in managing these alterations is to maintain suitable roost trees and roost components over time in areas inhabited by bald eagles in order to ensure their continued use. Key roost components included core roost stands, buffer trees, flight corridors and staging trees, and prey bases associated with roosts (Stalmaster 1987). Roost tree species vary with geographic area, but communal roost stands are generally uneven-aged with a multi-layered canopy and are often on leeward-facing hillsides or in valleys.

TIMBER HARVEST

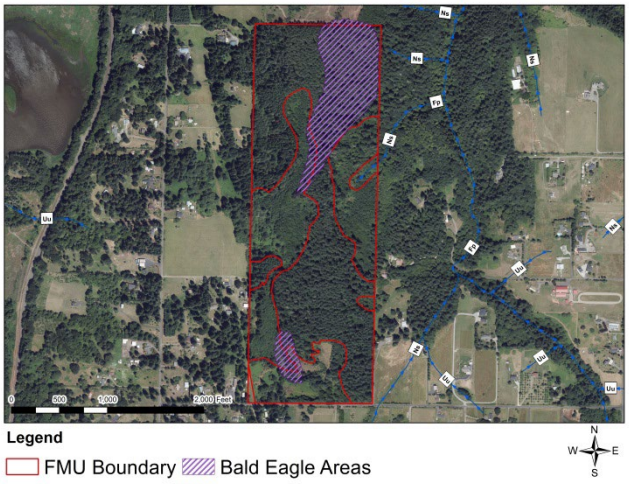
Avoid timber harvest within the core stands of communal roost trees and staging areas. Maintain vegetative buffer zones within 120 m (400 ft) from the edge of such stands. Buffer stand density and width should be based on wind throw potential and the need for effective visual screening (see Breeding Habitat). Eleven of 12 roosts studied throughout Washington by Knight et al. (1983) had experienced some degree of timber harvest. These researchers also noted roost abandonment when roost areas were harvested. Anthony et al. (1982) concluded that perpetuating roost habitat with trees that average 131-300 years old was incompatible with 40-80-year stand rotations typical of forest management west of the Cascade Mountain crest.

HUMAN DISTURBANCE

Activities that produce noise or visual effects within 120 m (400 ft) of the edges of communal roost trees or staging trees should be conducted outside of the critical roosting period (November 15 - March 15). This corresponds to the time when most eagles begin to arrive in eastern and western Washington, with numbers peaking in December and January and declining rapidly by mid-March (Biosystems, Incorporated 1980, 1981; Fielder and Starkey 1980; Garrett et al. 1988; Stalmaster 1989).

MANAGEMENT GUIDELINES

- Retain all known perch and roost trees (including snags) identified within the stand based on periodic wildlife surveys.
- Provide for a select number conifers ≥32 inches DBH (size class threshold 100-300 yr old trees), distributed throughout the bald eagle management area to provide for long term nesting and roosting habitat.



The enclosed map is a reference to David Andersons (DFW) comments:

1. The small area in the southern portion of the map is a group of trees adjacent to that wetland that had bald eagle perching and some roosting from survey data I have from the past. It was a thin strip of timber that we came upon soon after we walked into the stand.
2. The larger area to the north that is the main roost management area to follow your stand management recommendations.

GLOSSARY OF FORESTRY TERMS

ACRE	An area of land measuring 43,560 square feet. A square 1-acre plot measures 209 feet by 209 feet; a circular acre has a radius of 117.75 feet.
ADAPTIVE MANAGEMENT	A type of forest land management in which, as an ongoing process, the monitoring of results of management decisions, in relation to sustaining ecosystem characteristics and changes in societal goals, is used to modify management approach.
ADVANCE REGENERATION (REPRODUCTION) SYN. ADVANCE GROWTH	Seedlings or saplings that develop or are present in the understory.
AESTHETICS	(a) Sensitivity to or appreciation of the forest's beauty through recognition of its unique and varied components. (b) Beauty through an orderly appearance.
AFFORESTATION	Establishment of a forest or stand in an area not recently forested
AGE CLASS (COHORT)	A distinct aggregation of trees originating from a single natural event or regeneration activity, or a grouping of trees, e.g. 10-year age class, as used in inventory or management.
ALL-AGED OR UNEVEN-AGED MANAGEMENT	The practice of managing a forest by periodically selecting and harvesting individual trees or groups of trees from the stand while preserving its natural appearance. Most common in hardwood forests.
ALL-AGED OR UNEVEN-AGED STAND	A forest stand composed of trees of different ages and sizes.
AMPHIBIAN	Any of a class of vertebrates that regulate their body temperature externally; lay shell-less eggs in wet areas; live in water during early development and live both in water and on land as adults; and use lungs, gills and their skin for breathing. Most have four legs and smooth, moist skin without scales.
ANGIOSPERM	A plant that has true flowers and bears its seeds in fruits. In temperate zones, many angiosperms are deciduous trees, while in tropical zones, many are evergreen trees. Examples include oaks, willows, maples and birches.
ANNUAL	A plant that lives or grows for only one year or one growing season.
ANNUAL RING	The combination of one earlywood layer (light colored) and one latewood layer (dark colored) seen in a cross-section of a tree. One annual ring usually represents one year of growth.
ANNUAL WILDLIFE SEED MIXTURE	A mixture of soybean, millet, cow pea, sorghum, lespedeza, buckwheat, and other seeds from which single-season plants are grown to serve as food or protective cover for wildlife. Some mixtures reseed naturally, while others require reseeding, light disking, and fertilization.
ARTIFICIAL REGENERATION	The growth of new trees through seeding and planting.
ARTIFICIAL REGENERATION (REPRODUCTION)	An age class created by direct seeding or by planting seedlings or cuttings.

BARK The tough exterior covering of a woody root or stem that protects the tree from injury caused by insects and other animals, by other plants, by disease and by fire.

BASAL AREA (a) The cross-sectional area (in square feet) of a tree trunk at breast height (4.5 feet above the ground). For example, the basal area of a tree that measures 14 inches in diameter at breast height is about 1 square foot. (b) The sum basal areas of the individual trees within 1 acre of forest. For example, a well-stocked pine stand might have a basal area of 80 to 120 square feet per acre.

BEST MANAGEMENT PRACTICES Procedures employed during harvesting and/or timber stand improvement activities that reduce erosion and prevent or control water pollution.

BILTMORE STICK A stick similar to a yardstick in appearance, but usually about 25 inches long. One side is scaled to read a tree's diameter by holding the stick horizontally at arm's length and against the tree at breast height. A Merritt hypsometer runs along one edge of the stick and is scaled to read a tree's height from 66 feet away from the tree's base. These two measurements are then used to find the tree's volume according to the volume table printed on one face of the stick.

BIODIVERSITY The variety of life forms in a given area; can be categorized in terms of number of species, variety of plant and animal communities, genetic variability or some combination of these categories.

BIOLOGICAL DIVERSITY The variety and abundance of life forms, processes, functions, and structures including the relative complexity of species, communities, gene pools, and ecosystems at spatial scales that range from local through regional to global (syn. Biodiversity).

BIRD Any of a class of vertebrates that regulate their body temperature internally, have bodies that are covered almost entirely with feathers and have forelimbs modified as wings that enable most to fly.

BOARD FOOT A unit of wood measuring 144 cubic inches. A 1-inch by 12-inch shelving board that is 1 foot long is equal to 1 board foot. Board foot volume is determined by: length (feet) x width (inches) x thickness (inches)/divided by 12

BOLE The main trunk of a tree.

BREAST HEIGHT A standard height from ground level for recording diameter, girth, or basal area of a tree, generally 4.5 feet.

BROADLEAF A class of trees that have broad, flat leaves of many different shapes; most are deciduous; also called hardwood because most broad-leaved trees have harder wood than do conifers. Examples include oak, hickory, maple and ash.

BUFFER STRIP A narrow zone or strip of land, trees, or vegetation bordering an area. Common examples include visual buffers, which screen the view along roads, and streamside buffers, which are used to protect water quality. Buffers may also be used to prevent the spread of forest pests.

BURNING, PRESCRIBED The application of fire, usually under existing stands and under specified conditions of weather and fuel moisture, in order to attain silvicultural or other management objectives.

CAMBIUM A thin layer of specialized cells within a tree's trunk that divide to produce new inner bark cells to the outside and new sapwood cells to the inside. The narrow band of cells that is responsible for the tree's growth in circumference.

CANOPY A layer or multiple layers of branches and foliage at the top or crown of a forest's trees.

CANOPY The foliar cover in a forest stand consisting of one or several layers.

CANOPY CLOSURE see Crown Cover

CAPITAL GAINS Profit on the sale of an asset such as timber, land, or other property. Reporting timber sales as capital gains provides certain tax advantages over reporting revenues as ordinary income.

CARRYING CAPACITY The maximum number of healthy wildlife that a given habitat or area can support without degradation of the habitat.

CELLULOSE The scientific name for wood fiber.

CHAIN A distance of 66 feet.

CHANNEL MIGRATION ZONE A dynamic physical processes of rivers can cause channels in some areas to move laterally, or "migrate," over time. The area within which a river channel is likely to move over a period of time is referred to as the channel migration zone (CMZ).

CLEANING A release treatment made in an age class not past the sapling stage in order to free the favored trees from less desirable individuals of the same age class which overtop them or are likely to do so (see Improvement Cutting, Liberating, Weeding).

CLEARCUT A harvesting and regeneration method that removes all trees within a given area. Most commonly used in pine and hardwood forests that require full sunlight to regenerate and grow efficiently.

CLEARCUTTING (see Regeneration Methods)

CLIMAX COMMUNITY A relatively stable and undisturbed plant community that has evolved through stages and adapted to its environment.

CLINOMETER An instrument that is held at eye level to read stump height and merchantable or total height when standing 50 and 66 feet from the base of the tree. The difference between the two readings yields the height.

CODOMINANT (see Crown Class)

COHORT (see Age Class)

COMPETITION The struggle between trees to obtain sunlight, nutrients, water and growing space. Every part of the tree, from the roots to the crown, competes for space and food.

COMPOSITION, STAND The proportion of each tree species in a stand expressed as a percentage of either the total number, basal area, or volume of all tree species in the stand.

CONIFER A class of trees that are evergreen, have needle or scalelike foliage and conelike fruit; often called softwood. Examples include pine, hemlock, cedar and cypress.

CONSERVATION The protection, improvement, and wise use of natural resources for present and future generations.

CONTROLLED BURN See Prescribed Burn.

COPPICE (see Regeneration Methods)

CORD A stack of round or split wood consisting of 128 cubic feet of wood, bark, and air space. A standard cord measures 4 feet by 4 feet by 8 feet. A face cord or short cord is 4 feet by 8 feet by any length of wood under 4 feet.

COST-SHARE ASSISTANCE An assistance program offered by various state and federal agencies that pays a fixed rate or percentage of the total cost necessary to implement some forestry or agricultural practice.

COVER (a) Any plant that intercepts rain drops before they reach the soil or that holds soil in place. (b) A hiding place or vegetative shelter for wildlife from predators or inclement weather.

CROP TREE Any tree selected to grow to final harvest or to a selected size. Crop trees are selected for quality, species, size, timber potential, or wildlife value.

CROWN The part of a tree or woody plant bearing live branches and foliage; The branches and foliage at the top of a tree.

CROWN CLASS A class of tree based on crown position relative to the crowns of adjacent trees.

EMERGENT Trees with crowns completely above the general level of the main canopy receiving full light from above and from all sides.

DOMINANT Trees with crowns extending above the general level of the main canopy of even aged even-aged stands or, in uneven-aged stands, above the crowns of the tree's immediate neighbors, and receiving full light from above and partly from the sides.

CODOMINANT Trees with crowns forming the general level of the main canopy in even-aged stands or, in uneven-aged stands, the main canopy of the tree's immediate neighbors, receiving full light from above and comparatively little from the sides.

INTERMEDIATE Trees with crowns extending into the lower portion of the main canopy of even-aged stands or, in uneven-aged stands, into the lower portion of the canopy formed by the tree's immediate neighbors, but shorter in height than the codominants. They receive little direct light from above and none from the sides.

OVERTOPPED (SUPPRESSED) Trees of varying levels of vigor that have their crowns completely covered by the crowns of one or more neighboring trees.

CROWN COVER The ground area covered by the crowns of trees or woody vegetation as delimited by the vertical projection of crown perimeters and commonly expressed as a percent of total ground area (syn. Canopy Cover).

CROWN DENSITY	The amount and compactness of foliage of the crowns of trees and/or shrubs.
CRUISE	A survey or inventory of forestland to locate timber and estimate its quantity by species, products, size, quality or other characteristics.
CULL	A tree or log of marketable size that is useless for all but firewood or pulpwood because of crookedness, rot, injuries, or damage from disease or insects.
CUTTING CONTRACT	A written, legally binding document used in the sale of standing timber. The contract specifies the provisions covering the expectations and desires of both buyer and seller.
CUTTING CYCLE	The planned interval between partial harvests in an uneven aged stand (see Thinning Interval).
DAYLIGHTING	A practice in which trees shading an access road are removed to increase the sunlight on the roadway and along its periphery. This relatively inexpensive practice maximizes forest edge and cover for wildlife and maintains passable roads year- round.
DECIDUOUS	A group of trees that lose all of their leaves every year.
DECOMPOSITION	The process by which organic material such as leaves and branches are broken down by bacteria, fungi, protozoans and the many different kinds of animals that live in the soil.
DENDROLOGY	The study of trees; tree identification.
DESIRED FUTURE CONDITION (DFC)	The Desired Future Condition (DFC) describes what the Forest should be like given implementation of management direction contained in the Plan.
DIAMETER AT BREAST HEIGHT (DBH)	The diameter of a tree measured in inches at breast height - a standard 4.5 feet above the ground.
DIAMETER TAPE	A steel measuring tape that has a scale calibrated to read a tree's diameter when wrapped around the tree's circumference.
DIAMETER-LIMIT CUTTING	A selection method in which all marketable trees above a specified diameter are harvested. Diameter-limit cutting can lead to long-term degradation of the stand.
DIRECT OR BROADCAST SEEDING	(a) Sowing seed for broad coverage from the air or on the ground. (b) Seeding of forest stands, roadways, or specified plots for wildlife.
DOMINANT	(see Crown Class)
DRUM CHOPPING	A site preparation technique in which logging debris is leveled by a bulldozer pulling a large drum filled with water. Chopped areas are often burned to further reduce debris and control sprouting before seedlings are planted.
EARLYWOOD	Wood cells produced at the beginning of a tree's growing season that are generally light in color. Also called springwood.
ECOLOGICAL APPROACH	A type of natural resource planning, management, or treatment that ensures consideration of the relationship between all organisms (including humans) and their environment.

ECOLOGICAL CLASSIFICATION	A multi-factor approach to categorizing and delineating, at different levels of resolution, areas of land and water having similar characteristic combinations of physical environment (such as topography, climate, geomorphic processes, geology, soil, and hydrology), biological communities (such as plants, animals, microorganisms, and/or potential natural communities), and human factors (such as social, economic, cultural, and infrastructure.
ECOLOGICAL PROCESS	A series of natural biological, physical, and social actions or events that link the growth and development of organisms (including humans) within their environments.
ECOLOGICAL SUCCESSION	The gradual change of plant and animal communities over time.
ECOLOGY	The science or study of the relationships between organisms and their environment.
ECOREGION	A contiguous geographic area having similar macroclimate, possibly with several vegetation types, and used as an ecological basis for management or planning.
ECOSYSTEM	A conceptual unit comprised of organisms interacting with each other and their environment having the major attributes of structure, function, complexity, interaction and interdependency, temporal change, and no inherent definition of spatial dimension.
ECOSYSTEM MANAGEMENT	The use of an ecological approach to resource management at the landscape level that blends social, physical, economic, and biological processes to ensure the sustainability of healthy ecosystems while providing desired values, goods, and services.
EDGE	The transition between two different types or ages of vegetation
EMERGENT	(see Crown Class)
ENDANGERED SPECIES	Any species that has been classified by the U.S. Fish and Wildlife Service or a state wildlife agency as being in danger of extinction throughout all or a significant portion of its range. A species is endangered when the total number of remaining members may not be sufficient to reproduce enough offspring to ensure survival of the species.
ENVIRONMENT	The interaction of climate, soil, topography, and other plants and animals in any given area. An organism's environment influences its form, behavior, and survival.
EPHEMERAL STREAMS	Waterbodies that flow only during significant rainfall. They flow in natural channels, but the channel bottom of an ephemeral stream is usually below the water table.
EROSION	The wearing away or removal of land or soil by the action of wind, water, ice or gravity.
EVAPOTRANSPIRATION	The evaporation of water from the soil and the transpiration of water from the plants that live in that soil. Approximately one-quarter of a forest's annual rainfall returns to the air through evapotranspiration.
EVEN AGED STAND	A stand of trees containing a single age class in which the range of tree ages is usually less than 20 percent of rotation.

EVEN-AGED MANAGEMENT A forest management method used to produce stands that are all the same age or nearly the same age by harvesting all trees in an area at one time or in several cuttings over a short time. This management method is commonly applied to shade-intolerant conifers and hardwoods.

EVEN-AGED SYSTEM A planned sequence of treatments designed to maintain and regenerate a stand with one age class. The range of tree ages is usually less than 20 percent of the rotation. (see Clearcutting, Seed Tree, Shelterwood, Coppice).

EVERGREEN A group of trees that do not lose all of their leaves every year but go through a gradual replacement by dropping only their oldest leaves each year. Instead of being bare in winter, these trees have leaves all year.

FIREBREAK Any nonflammable barrier used to slow or stop fires. Several types of firebreaks are mineral soil barriers; barriers of green, slow-burning vegetation; and mechanically cleared areas.

FLAT OR STRAIGHT PLANTING Planting trees directly into the ground without beds or, in some cases, without first moving logging debris.

FOLIAGE The leaves of a tree or other plant.

FORAGE Vegetation such as leaves, stems, buds, and some types of bark, that can be eaten for food and energy.

FORB Any herb other than grass.

FOREST FERTILIZATION The addition of nutrient elements to increase growth rate or overcome a nutrient deficiency in the soil.

FOREST FLOOR The lowest level of the forest that is made up of tree seedlings, dead leaves and needles, grasses, ferns, flowers, fungi, and decaying plants and logs.

FOREST HEALTH A forest condition that has overall structure, function, and characteristics that enable it to be resilient to disturbance and to maintain normal rates of change commensurate with its stage of development.

FOREST MANAGEMENT (a) Proper care and control of wooded land to maintain health, vigor, product flow, and other values (soil condition, water quality, wildlife preservation, and beauty) in order to accomplish specific objectives. (b) The practical application of scientific, economic, and social principles to forest property.

FOREST MANAGEMENT PLAN Written guidelines for current and future management practices recommended to meet an owner's objectives.

FOREST STEWARDSHIP PLAN A written document listing activities that enhance or improve forest resources (wildlife, timber, soil, water, recreation, and aesthetics) on private land over a 5- year period.

FOREST STEWARDSHIP PROGRAM A cooperative, technical-assistance program designed to encourage multiple resource management on private forestland. Emphasis is placed on preharvest planning to enhance and protect forest-based resources. Authorized under the 1990 Farm Bill, the program is based on national guidelines but is set by individual states.

FOREST TYPE	A designation or name given to a forest based on the most abundant tree type or types in the stand; groups of tree species commonly growing in the same stand because their environmental requirements are similar. Examples of North Carolina forest types include (a) pine; (b) mixed hardwood; (c) cypress, tupelo and black gum; and (d) oak and hickory.
FORESTRY	The art and science of managing forests to produce various products and benefits including timber, wildlife habitat, clean water, biodiversity and recreation.
FRAGMENTATION	The process, through cutting or natural processes, of reducing the size and connectivity of stands that compose a forest or landscape.
FUEL LOADING	A buildup of easily ignited leaves, pine straw, branches and trees on the forest floor.
GENOTYPE	The genetic constitution of an organism in terms of its hereditary characteristics as distinguished from its physical appearance or phenotype.
GEOTEXTILE OR GEOWEB	a synthetic material placed on the flat, under road fill. Its primary use is to keep layers separate, confine the road aggregate and to distribute the weight of the load.
GIRDLING	A physical cutting or disruption of the cambial sap flow within a tree. Girdling by humans, animals, or insects can often kill a tree.
GIS	A geographic information system (GIS) is a computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface. GIS can show many different kinds of data on one map. This enables people to more easily see, analyze, and understand patterns and relationships.
GREEN TREE RETENTION	(see Reserve Trees)
GROUP SELECTION	(see Regeneration Methods)
GYMNOSPERM	A plant whose seeds are not enclosed in flowers. Most gymnosperms produce their seeds on the surface of the scales of female cones and are pollinated by wind. Conifers are the most common type of gymnosperm.
HABITAT	An area in which a specific plant or animal naturally lives, grows and reproduces; the area that provides a plant or animal with adequate food, water, shelter and living space.
HABITAT TYPE	An aggregation of units of land capable of producing similar plant communities at climax.
HARDWOODS (DECIDUOUS TREES)	Trees with broad, flat leaves as opposed to coniferous or needled trees. Wood hardness varies among the hardwood species, and some are actually softer than some softwoods.
HARVESTING METHOD	A cutting by which a stand is logged. Emphasis is on meeting logging requirements while concurrently attaining silvicultural objectives (see Regeneration Methods).
HEARTWOOD	The central core of a tree, which is made up of dense, dead wood and provides strength to the tree.

HIGH-GRADING A harvesting technique that removes only the biggest and most valuable trees from a stand and provides high returns at the expense of future growth potential. Poor quality, shade-loving trees tend to dominate in these continually high-graded sites.

HYPSOMETER Any device used for measuring tree height.

IMPROVEMENT CUT An intermediate cut made to improve the form, quality, heath, or wildlife potential of the remaining stand.

IMPROVEMENT CUTTING A cutting made in a stand pole sized or larger primarily to improve composition and quality by removing less desirable trees of any species (see Cleaning, Liberating, and Weeding).

INCENTIVE A reward for improving forest management. Incentives include reimbursement of some expenses but can also take the form of an abatement of property or income tax.

INCREMENT BORER A hollow auger-like tool with a screw bit used to remove core samples from trees.

INGROWTH Trees that during a specified period have grown past an arbitrary lower limit of (usually) diameter or height. Ingrowth is usually measured as basal area or volume per unit area.

INTERMEDIATE (see Crown Class)

INTERMEDIATE TREATMENTS (TENDING) A collective term for any treatment designed to enhance growth, quality, vigor, and composition of the stand after establishment or regeneration and prior to final harvest (see Tending, Stand Improvement).

LANDSCAPE A viewed area of land of generally large size and commonly a mosaic of land forms and plant communities irrespective of ownership or other artificial boundaries.

LATEWOOD Wood cells produced at the end of the growing season that make up the darker section of an annual ring. Also called summerwood.

LIBERATING A release treatment made in a stand not past the sapling stage in order to free the favored trees from competition of older, overtopping trees.

LIMITING FACTOR Any requirement for wildlife survival that is in limited supply.

MAMMAL Any of a class of higher vertebrates whose bodies are covered with hair, who give birth to live young, nourish their young with milk from mammary glands, regulate their body temperature internally, have four types of well-developed teeth and typically have four well-developed legs with toes that have nails, claws or hoofs.

MARGINAL LAND Land that does not consistently produce a profitable crop because of infertility, drought, or other physical limitations such as shallow soils.

MARKETING The selling of timber or other forest resources. Successful sellers seek a satisfactory price through competition, skillful negotiation, knowledge of timber markets, and the aid of a competent broker or consultant.

MARKING (a) The physical process of selecting trees to be cut or left during a harvest. (b) Delineating a boundary. Marking is usually done by spraying a spot of bright paint on a prominent part of the tree.

MAST	Fruits or nuts used as a food source by wildlife. Soft mast include most fruits with fleshy coverings, such as persimmon, dogwood seed, or blackgum seed. Hard mast refers to nuts such as acorns and beech, pecan, and hickory nuts.
MATURE TREE	A tree that has reached a desired size or age for its intended use. Size, age, or economic maturity varies depending on the species and intended use.
MBF	Abbreviation denoting 1,000 board feet. MBF is a typical unit of trade for dimension lumber and sawtimber stumpage. (It takes 11 MBF of wood to build an average 1,900-square-foot house.)
MENSURATION OR BIOMETRICS	(a) The measurement and calculation of volume, growth, and development of individual trees or stands and their timber products. (b) A measurement of forestlands
MERCHANTABLE HEIGHT	The stem length, normally measured from the ground to a 10-, 6-, or 4-inch diameter top, above which no other saleable product can be cut. Diameter, local markets, limbs, knots, and other defects collectively influence merchantable height.
MERRITT HYPSOMETER	A scale that measures the number of 16-foot logs in a tree.
MIXED STAND	A timber stand in which less than 80 percent of the trees in the main canopy are of a single species.
MMBF	Abbreviation denoting 1,000 thousand board feet. MMBF is a typical unit of trade for dimension lumber and sawtimber stumpage.
MONOCULTURE	A stand of a single species, generally even aged.
MULTIPLE USE	The management of land or forest for more than one purpose, such as wood production, water quality, wildlife, recreation, aesthetics, or clean air. (See Stewardship.)
MYCORRHIZAE	The symbiotic association between certain fungi and plant roots which enhances the uptake of water and nutrients.
NATURAL REGENERATION	The growth of new trees in one of the following ways without human assistance: (a) from seeds carried by wind or animals, (b) from seeds stored on the forest floor, or (c) from stumps that sprout.
NATURAL STAND (NATURAL REGENERATION)	A stand of trees grown from natural seed fall or sprouting.
NAVAL STORES	Products such as turpentine, pitch and rosin that come from pine trees and are used in the construction and maintenance of wooden sailing vessels.
NURSE TREE (NURSE CROP)	A tree, group or crop of trees, shrubs or other planes, either naturally occurring or introduced, used to nurture, improve survival or improve the form of a more desirable tree or crop when young by protecting it from frost, insolation, or wind.
NUTRIENTS	Elements necessary for growth and reproduction. Primary plant nutrients are nitrogen, phosphorus, and potassium.
OLD GROWTH	Forest ecosystems distinguished by old trees and related structural features characteristic of later stages of stand and successional development. Some have large trees, snags, large down woody material,

	multiple tree canopy layers, associated herb and shrub components and canopy gaps. Some of these attributes may also be found in stands of earlier stages of development.
ON THE STUMP	Standing, uncut timber.
OVERSTORY REMOVAL	The cutting of trees comprising an upper canopy layer in order to release trees or other vegetation in an understory (see Clearcutting).
OVERTOPPED	(see Crown Class)
PERENNIAL	Plants that live or grow for more than one year. Some resprout from a root system or reseed themselves every year.
PERENNIAL WILDLIFE MIXTURE	A mixture of all or some of the following: shrub lespedeza, partridge pea, cowpea, annual lespedeza, reseeding soybeans, and other perennial plants that are beneficial to wildlife.
PEST	Any organism that is out of place or causes stress to a desired organism.
PESTICIDE	Any chemical used to kill or control pests.
PHENOTYPE	The observed expression of a trait in an individual resulting firm developmental interaction of the individual's genotype and its operational environment.
PHLOEM	The part of a tree that carries sap from the leaves to the rest of the tree. Also called inner bark.
PHOSPHATE	A chemical compound that aids root growth and is essential in energy transfer. It is commonly incorporated into beds as triple super phosphate (TSP) at time of planting.
PHOTOSYNTHESIS	The process by which a plant or tree combines water and carbon dioxide with energy from the sun to make glucose and oxygen.
PLANT OR HABITAT DIVERSITY	A variety of food or cover for wildlife. Variation may occur at one point in time or over a period of time such as during the course of a season. Seasonal diversity of food and cover is often critical to the survival of a species.
PLANT SUCCESSION	The progression of plants from bare ground to mature forest.
PLANTATION	Planted pines or hardwoods, typically in an ordered configuration such as equally spaced rows.
POLE	A tree between the size of a sapling and a mature tree.
POLES OR POLETIMBER (PINE)	Trees from 5 to 7 inches in diameter at breast height.
PRECOMMERCIAL THINNING (PCT)	A thinning that does not yield trees of commercial value, usually designed to reduce stocking in order to concentrate growth on the more desirable trees.
PREDATOR	An animal that preys on and devours other animals.
PREDATOR GUARD	A physical barrier used to keep one animal from eating another. Usually refers to protection devices on nest boxes.

PRESCRIBED BURNING The practice of using regulated fires to reduce or eliminate material on the forest floor, for seedbed preparation or to control competing vegetation. Prescribed burning simulates one of the most common natural disturbances. Also called controlled burning.

PRESENT USE VALUATION Property tax relief classification based on the land's productivity for agriculture, horticulture, or forestry production, rather than for market value. Can result in substantial tax savings in areas where land values are high. Some restrictions and penalties apply, including a 3-year roll back provision with interest. Consult your county tax supervisor for details.

PRESERVATION An attempt to keep forests in an undisturbed state through the control of internal and external influences.

PRODUCTIVITY A term describing the relative capacity of an area to sustain a supply of goods and/or services in the long run.

PULPWOOD Wood used in the manufacture of paper, fiberboard, or other wood fiber products. Pulpwoodsized trees are usually a minimum of 4 inches in diameter.

PURE STAND A timber stand in which at least 75 percent of the trees in the main crown canopy are of a single species

QUADRATIC MEAN DIAMETER Quadratic Mean Diameter (Dq) is the diameter of the tree of average per tree basal area. This becomes a convenient in that we often have basal are per acre and trees per acre but not the diameters of all the trees.
$Dq=\sqrt{(BA/TPA)/0.005454154}$
where: Dq is the Quadratic Mean Diameter in inches, BA is the Basal Area in square feet per acre, TPA is the Trees Per Acre, and 0.005454154 is a constant.

REFORESTATION Reestablishing a forest by planting or seeding an area from which forest vegetation has been removed; The natural or artificial restocking of an area with trees (syn. Regeneration).

REGENERATION Seedlings or saplings existing in a stand; or the act of establishing young trees naturally or artificially (syn. Reforestation).

REGENERATION (REPRODUCTION) METHOD A cutting method by which a new age class is created. The major methods are Clearcutting, Seed Tree, Shelterwood, Selection, and Coppice (see Harvesting Method).

COPPICE METHODS Methods of regenerating a stand in which the majority of regeneration is from stump sprouts or root suckers.

COPPICE A method of regenerating a stand in which all trees in the previous stand are cut and the majority of regeneration is from sprouts or root suckers.

COPPICE WITH RESERVES A coppice method in which reserve trees are retained to attain goals other than regeneration. The method normally creates a two aged stand.

EVEN AGED METHODS Methods to regenerate a stand with a single age class.

CLEARCUTTING A method of regenerating an even aged stand in which a new age class develops in a fully-exposed microclimate after removal, in a single cubing, of all trees in the previous stand. Regeneration is from natural seeding, direct seeding, planted seedlings, and/or advance reproduction. Cutting

may be done in groups or patches (Group or Patch Clearcutting), or in strips (Strip Clearcutting). In the Clearcutting System, the management unit or stand in which regeneration, growth, and yield are regulated consists of the individual clearcut stand (see Group Selection). When the primary source of regeneration is advance reproduction, the preferred term is Overstory Removal.

CLEARCUTTING WITH RESERVES (SEE TWO AGED METHODS)

SEED TREE

An even aged regeneration method in which a new age class develops from seeds that germinate in fully exposed micro environments after removal of all the previous stand except a small number of trees left to provide seed. Seed trees are removed after regeneration is established.

SEED TREE NINTH RESERVES (SEE TWO-AGED METHODS)

SHELTERWOOD

A method of regenerating an even aged stand in which a new age class develops beneath the moderated micro environment provided by the residual trees. The sequence of treatments can include three distinct types of cuttings: 1) an optional preparatory cut to enhance conditions for seed production; 2) an establishment cut to prepare the seed bed and to create a new age class; and 3) a removal cut to release established regeneration from competition with the overwood. Cutting may be done uniformly throughout the stand (Uniform Shelterwood), in groups or patches (Group Shelterwood), or in strips (Strip Shelterwood).

SHELTERWOOD WITH RESERVES (SEE TWO AGED METHODS)

TWO-AGED METHODS

Methods designed to maintain and regenerate a stand with two age classes. In each case the resulting stand may be two aged or tend towards an uneven aged condition as a consequence of both an extended period of regeneration establishment and the retention of reserve trees that may represent one or more age classes.

CLEARCUTTING WITH RESERVES

A clearcutting method in which varying numbers of reserve trees are not harvested to attain goals other than regeneration.

SEED TREE WITH RESERVES

A seed tree method in which some or all of the seed trees are retained after regeneration has become established to attain goals other than regeneration.

SHELTERWOOD WITH RESERVES

A variant of the Shelterwood Method in which some or all of the shelter trees are retained, well beyond the normal period of retention, to attain goals other than regeneration.

UNEVEN AGED (SELECTION) METHODS

Methods of regenerating a forest stand, and maintaining an uneven aged structure, by removing some trees in all size classes either singly, in small groups, or in steps.

GROUP SELECTION

A method of regenerating uneven aged stands in which trees are removed, and new age classes are established, in small groups. The maximum width of groups is approximately twice the height of the mature trees, with small openings providing microenvironment suitable for tolerant regeneration and the larger openings providing conditions suitable for more intolerant regeneration. In the Group Selection System, the management unit or stand in which regeneration, growth, and yield are regulated consists of a landscape containing an aggregation of groups (see Clearcutting).

GROUP SELECTION WITH RESERVES	A variant of the Group Selection Method in which some trees within the group are not cut to attain goals other than regeneration within the group.
SINGLE TREE SELECTION	A method of creating new age classes in uneven aged stands in which individual trees of all size classes are removed more or less uniformly throughout the stand to achieve desired stand structural characteristics.
REGENERATION (REPRODUCTION) PERIOD	The time between the initial regeneration cutting and the successful re establishment of a new age class by natural means, planting, or direct seeding.
REGENERATION CUT	A cutting strategy in which old trees are removed while favorable environmental conditions are maintained for the establishment of a new stand of seedlings.
REGULAR UNEVEN AGED (BALANCED) STAND	A stand in which three or more distinct age classes occupy approximately equal areas and provide a balanced distribution of diameter classes.
RELEASE	To free a tree from competition with its immediate neighbors by removing the surrounding trees. This occurs naturally and artificially; A treatment designed to free young trees from undesirable, usually overtopping, competing, vegetation. Treatments include cleaning, liberating, and weeding (see Stand Improvement).
RENEWABLE RESOURCE	A naturally occurring raw material or form of energy that has the capacity to replenish itself through ecological cycles and sound management practices.
REPRODUCTION	(a) The process by which young trees grow to become the older trees of the future forest. (b) The process of forest replacement or renewal through natural sprouting or seeding or by the planting of seedlings or direct seeding.
REPTILE	Any of a class of vertebrates that regulates its body temperature externally, has dry, glandless skin covered with scales, breathes through lungs and lays large eggs that develop on land.
RESERVE TREES (GREEN TREE RETENTION)	Trees, pole sized or larger, retained in either a dispersed or aggregated manner after the regeneration period under the Clearcutting, Seed Tree, Shelterwood, or Coppice Methods (syn. Standards).
RESIDUAL STAND	Trees left in a stand to grow until the next harvest. This term can refer to crop trees or cull trees.
RESILIENCY	The capacity of an ecosystem to maintain or regain normal development following disturbance.
RESIN	A group of sticky liquid substances secreted by plants that appear on the plant's external surface after a wound.
RMZ	A Riparian Management Zone (RMZ) is the area that is located on each side of a Type S, F or Np stream where trees are left to provide protection from disturbance when forest practices activities are conducted. It is important to protect this area because it provides a mix of food and cover for aquatic species and protects water quality. The trees that are left provide shade and nutrients for the stream, as well as habitat for many wildlife species.

ROOT COLLAR	The transition zone between stem and root at the ground line of a tree or seedling.
ROOT PRUNING	The root pruning of seedlings in a nursery bed to limit the extension of roots in depth or laterally (see Undercutting).
ROOTS	The underground portion of a tree that helps anchor the tree in the ground and absorbs water and nutrients from the soil.
ROTATION	The number of years required to establish and grow trees to a specified size, product, or condition of maturity. A pine rotation may range from as short as 20 years for pulpwood to more than 60 years for sawtimber; In even aged systems, the period between regeneration establishment and final cutting.
SALE UNIT	A timber sales arrangement in which the buyer pays for forest products removed in units (measured in cords, MBF, or units of weight). Determination of units removed from the area is verified by mill tally, scale tickets, and buyer's or seller's tally.
SALE, LUMP SUM (BOUNDARY)	The sale of specified timber on a specified area. The volume may or may not be estimated and published. The buyer is responsible for determining correct volume. The seller guarantees ownership and boundaries.
SALVAGE CUT	The harvesting of dead or damaged trees, or the harvesting of trees in danger of being killed by insects, disease, flooding or other factors in order to save their economic value.
SANITATION CUTTING	The removal of trees to improve stand health by stopping or reducing actual or anticipated spread of insects and disease (see Stand Improvement).
SAPLING	A tree, usually young, that is larger than a seedling but smaller than a pole. Size varies by region; A small tree, usually between 2 and 4 inches diameter at breast height.
SAWLOG OR SAWTIMBER	A log or tree that is large enough (usually 10 to 12 inches in diameter) to be sawed into lumber. Minimum log length is typically 8 feet.
SCARIFICATION	Mechanical removal of competing vegetation and/or interfering debris, or disturbance of the soil surface, designed to enhance reforestation.
SCARIFYING	For soil: The removal of the top litter layer of an area (usually in strips) for site preparation. For seed: The abrasion or weakening of the seed coat to encourage germination.
SEDIMENTATION	The deposition or settling of soil particles suspended in water.
SEED TREE	(see Regeneration Methods)
SEED TREE CUT	A harvesting method in which a few scattered trees are left in the area to provide seed for a new forest stand. Selection of seed trees should be based upon growth rate, form, seeding ability, wind firmness, and future marketability. This harvesting method produces an evenaged forest.
SEED YEAR	A year in which a given species produces a large seed crop over a sizable area. Some species of trees produce seeds irregularly.

SEEDLING (a) A tree, usually less than 2 inches diameter at breast height, that has grown from a seed rather than from a sprout. (b) A nursery-grown tree that has not been transplanted in the nursery.

SELECTIVE CUTTING The periodic removal of individual trees or groups of trees to improve or regenerate a stand.

SHADE-INTOLERANT SPECIES Trees that require full sunlight to thrive and cannot grow in the shade of larger trees.

SHADE-TOLERANT SPECIES Trees that have the ability to grow in the shade of other trees and in competition with them.

SHEARING Slicing or cutting trees or stumps at the ground line. Shearing may be done at harvest or with a KG blade during site preparation.

SHELTERWOOD (see Regeneration Methods)

SHELTERWOOD CUT Removing trees in the harvest area in a series of two or more cuttings so that new seedlings can grow from the seeds of older trees. This method produces an even-aged forest.

SILVICULTURAL SYSTEM A planned process whereby a stand is tended, harvested, and re established. The system name is based on the number of age classes (see Even Aged, Two-Aged, Uneven Aged), and/or the regeneration method used (see Clearcutting, Seed Tree, Shelterwood, Selection, Coppice, Coppice with Reserves).

SILVICULTURE The art, science, and practice of establishing, tending, and reproducing forest stands of desired characteristics. It is based on knowledge of species characteristics and environmental requirements; The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis.

SINGLE TREE SELECTION (see Regeneration Methods)

SITE CLASS A classification of site quality, usually expressed in terms of ranges of dominant tree height at a given age or potential mean annual increment at culmination.

SITE INDEX A measure of actual or potential forest productivity expressed in terms of the average height of a certain number of dominants and co dominants in the stand at an index age; A relative measure of forest site quality based on the height (in feet) of the dominant trees at a specific age (usually 25 or 50 years, depending on rotation length). Site index information helps estimate future returns and land productivity for timber and wildlife.

SITE PREPARATION Preparing an area of land for planting, direct seeding, or natural reproduction by burning, chemical vegetation control, or by mechanical operations such as disking, bedding, scarifying, windrowing, or raking; A hand or mechanized manipulation of a site designed to enhance the success of regeneration. Treatments may include bedding, burning, chemical spraying, chopping, disking, drainage, raking, and scarifying. All treatments are designed to modify the soil, litter, and vegetation and to create microclimate conditions conducive to the establishment and growth of desired species.

SITE QUALITY (PRODUCTIVITY)	The productive capacity of a site, usually expressed as volume production of a given species.
SIZE CLASS	Tree size recognized by distinct ranges, usually of diameter or height.
SLASH	(a) Tree tops, branches, bark, or other residue left on the ground after logging or other forestry operations. (b) Tree debris left after a natural catastrophe.
SNAG	A standing dead tree from which the leaves and most of the branches have fallen; A standing dead or dying tree.
SOFTWOOD	A tree belonging to the order Coniferales. Softwood trees are usually evergreen, bear cones and have needles or scalelike leaves. Examples include pines, spruces, firs and cedars. See conifer.
SOIL TEXTURE	The feel or composition of the soil (sand, silt, or clay) as determined by the size of the soil particles.
SOIL TYPE	Soils that are alike in all characteristics, including texture of the topsoil. Soil maps and information on site index, erodibility, and other limiting properties are available from your county Soil Conservation Service offices.
SPECIES	A group of related organisms having common characteristics and capable of interbreeding. Loblolly and Virginia pine are common tree species that can interbreed.
SPRINGWOOD	See earlywood.
STAND	A contiguous group of trees sufficiently uniform in age class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit (see Mixed, Pure, Even Aged, and Uneven Aged Stands).
MIXED STAND	A stand in which there is a mixture of species.
PURE STAND	A stand composed of essentially a single species.
STRATIFIED MIXTURE	A stand in which different species occupy different strata of the total crown canopy.
STAND DENSITY	A quantitative, absolute measure of tree occupancy per unit of land area in such terms as numbers of trees, basal area, or volume.
STAND IMPROVEMENT	A term comprising all intermediate cuttings made to improve the composition, structure, condition, health, and growth of even or uneven aged stands.
STEWARDSHIP	Caring for land and associated resources in a manner that enables their passing on to future generations in a healthy condition.
STEWARDSHIP FOREST	A privately owned forest tract that exhibits integrated forest management to protect and enhance wildlife, timber, recreation, natural beauty, and soil and water quality.
STEWARDSHIP INCENTIVE PROGRAM (SIP)	A cost-sharing program available to forest landowners who have a multi resource forest stewardship plan. Practices include cost-sharing assistance for the enhancement of forest recreation, fisheries, wildlife, and timber

	production and the protection of soil and water, wetlands, riparian zones, and rare and endangered species.
STOCKING	A description of the number of trees, basal area, or volume per acre in a forest stand compared with a desired level for balanced health and growth. Most often used in comparative expressions, such as well-stocked, poorly stocked, or overstocked; An indication of growing space occupancy relative to a pre established standard. Common indices of stocking are based on percent occupancy, basal area, relative density, and crown competition factor.
STRATUM (CANOPY LAYER)	A distinct layer of vegetation within a forest community.
STREAMSIDE MANAGEMENT ZONE (SMZ)	An area adjacent to a stream in which vegetation is maintained or managed to protect water quality. Trees may be removed from SMZs as long as the stream bed is not disrupted and sufficient vegetation is left to protect water quality.
STRUCTURE	The horizontal and vertical distribution of components of a forest stand including the height, diameter, crown layers and stems of trees, shrubs, herbaceous understory, snags, and down woody debris.
STUMPAGE	The value or volume of a tree or group of trees as they stand uncut in the woods (on the stump).
SUCCESSION	The natural sequence of plant community replacement beginning with bare ground and resulting in a final, stable community in which a climax forest is reached. Foresters, wildlife biologists, and farmers constantly battle ecological succession to try to maintain a particular vegetative cover; A series of dynamic changes by which Organisms succeed one another through a series of plant community (seral) stages leading to potential natural community or climax.
SUCCESSIONAL DISKING OR MOWING	A wildlife enhancement practice in which a disk harrow or rotary mower is used to knock down existing vegetation every 1 to 3 years to promote the regrowth of annuals, legumes, forbes, and perennials.
SUMMERWOOD	See latewood.
SUPPRESSED	(see Crown Class)
SUPPRESSION	The process by which a tree loses its vigor due to inadequate light, water and nutrients.
SUSTAINABILITY	The capacity of forests, ranging from stands to ecoregions, to maintain their health, productivity, diversity, and overall integrity, in the long run, in the context of human activity and use.
SUSTAINABLE FORESTRY	an approach to forest management that focuses on the long term health and value of the forest and its inhabitants. Goals include: providing revenue from timber and non-timber forest products; maintaining and restoring biodiversity and a healthy ecosystem; protecting water quantity and quality; providing for aesthetic enrichment for future generations.
SUSTAINED YIELD	Management of forestland to produce a relatively constant amount of wood products, revenue or wildlife.
TENDING	See Intermediate Treatments.

THINNING	A cultural treatment made to reduce stand density of trees primarily to improve growth, enhance forest health, or to recover potential mortality.
CROWN THINNING (THINNING FROM ABOVE, HIGH THINNING)	The removal of trees from the dominant and codominant crown classes in order to favor the best trees of those same crown classes.
FREE THINNING	The removal of trees to control stand spacing and favor desired trees using a combination of thinning criteria without regard to crown position.
LOW THINNING (THINNING FROM BELOW)	The removal of trees from the lower crown classes to favor those in the upper crown classes.
MECHANICAL THINNING (GEOMETRIC THINNING)	The thinning of trees in either even or uneven aged stands involving removal of trees in rows, strips, or by using fixed spacing intervals.
SELECTION THINNING (DOMINANT THINNING)	The removal of trees in the dominant crown class in order to favor the lower crown classes.
THINNING INTERVAL	The period of time between successive thinning envies, usually used in connection with even aged stands (see Cutting Cycle).
THREATENED SPECIES	Any species that has been classified by the U.S. Fish and Wildlife Service or a state wildlife agency as likely to become endangered within the foreseeable future throughout all or a significant portion of its range. A threatened species has declining or dangerously low populations but still has enough members to maintain or increase numbers.
TIMBER CRUISE	A survey of forestland to locate timber and estimate its quantity by species, products, size, quality, or other characteristics.
TIMBER STAND IMPROVEMENT (TSI)	Improving the quality of a forest stand by removing or deadening undesirable species to achieve desired stocking and species composition. TSI practices include applying herbicides, burning, girdling, or cutting.
TOLERANCE, SHADE	The relative capacity of a plant to become established and grow beneath overtopping vegetation.
TOLERANT SPECIES	A species of tree that has the ability to grow in the shade of other trees and in competition with them.
TPA	Trees Per Acre
TRANSPIRATION	The loss of water through leaves.
TREE CALIPER	A metal or wooden device consisting of an arm and two prongs, one of which is free to slide along a graduated scale on the arm. The prongs are placed against opposite sides of a tree to read its diameter on the scale.
TREE FARM	A privately owned forest or woodland in which timber crop production is a major management goal. Many tree farms are officially recognized by the American Tree Farm System, an organization sponsored by the American Forestry Foundation.
TREE SPACING	The distance between trees, which is most often regulated at the time of planting or during a harvest or thinning operation. Spacing, like stand density, affects understory vegetation, seed production, growth rate, and wildlife habitat.

TURPENTINE	A distilled chemical produced from tapping into a living pine and harvesting the sap.
TWO AGED STAND	A stand composed of two distinct age classes that are separated
TWO-AGED SYSTEM	A planned sequence of treatments designed to maintain and regenerate a stand with two age classes.
UNDERCUTTING	The root pruning of seedlings in a nursery bed to limit root depth extension (see Root Pruning).
UNDERSTORY	The area below the forest canopy that comprises shrubs, snags and small tree. Because the understory receives little light, many of the plants at this level tolerate shade and will remain part of the understory. Others will grow and replace older trees that fall.
UNEVEN AGED STAND	A stand of trees of three or more distinct age classes, either intimately mixed or in small groups.
UNEVEN AGED SYSTEM	A planned sequence of treatments designed to maintain and regenerate a stand with three or more age classes (see Single Tree Selection, Group Selection).
WATER BAR	A diagonal ditch or hump in a trail that diverts surface water runoff to minimize soil erosion.
WATER CONTROL	Management of water (both surface and subsurface) to maintain plant growth, water quality, wildlife habitat, and fire control.
WATERSHED	an area where all water running off the land drains to a specific location. Sometimes called basin.
WATERSHED	An area of land with a single drainage network.
WEEDING	A release treatment in stands not past the sapling stage that eliminates or suppresses undesirable vegetation regardless of crown position.
WILDLIFE	A broad term that includes non domesticated vertebrates, especially mammals, birds, and fish.
WINDROW	A long, narrow row of vegetation, debris, and some soil created during site preparation and clearing operations.
WINDTHROW	Trees uprooted by excessive wind. Shallow-rooted trees are almost always affected.
WMZ	A Wetland Management Zone (WMZ) is the area located around the perimeter of a wetland where trees are left to provide protection from disturbance. It is important to protect this area because it provides a mix of food and cover for aquatic species and protects water quality. The trees that are left provide shade and nutrients for the wetland, as well as habitat for many wildlife species.
WOOD	The solid interior of a tree.
WOOD CHEMICALS	Chemicals that are found naturally in the various parts of a tree.

WRENCHING The disturbance of seedling roots in a nursery bed (e.g. with a tractor drawn blade) with the objective of stimulating the development of a fibrous root system.

XYLEM The part of a tree that transports water and nutrients up from the roots to the leaves. Older xylem cells become part of the heartwood. Also called sapwood.