

Ring Hill Forest Forest Stewardship Plan

July 2005



King County

Department of Natural Resources and Parks
Water and Land Resources Division

Office of Rural and Resource Programs

201 South Jackson Street, Suite 600

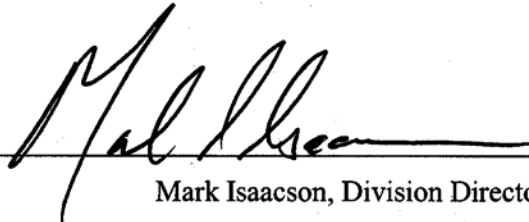
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Mark Isaacson, Division Director
King County Water and Land Resources Division



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Executive Summary

The Ring Hill Forest Stewardship Plan provides natural resource analysis and management recommendations to guide the long-term stewardship of Ring Hill Forest. Ring Hill Forest, 320 acres located east of Redmond, was acquired with funds dedicated to conserving working forestlands in King County.

Vision

Ring Hill Forest will serve as a model for private forest landowners by providing revenue from sustainable timber production while maintaining the ecological functions that forests provide.

Goals

- Provide revenue from timber harvest to fund the forestland management program
- Demonstrate progressive forest management
- Sustain and enhance the environmental benefits provided by forestland
- Provide a small system of trails for use by hikers and equestrians

General Property Information

Ring Hill Forest is comprised of 17 parcels totaling 320 acres located on the west wall of the Snoqualmie Valley east of Redmond. The property has been managed as a working forest since 1911 and was acquired by King County with assistance from the Trust for Public Land in 1997. The acquisition was accomplished with funds from the Arts and Natural Resources Initiative and Real Estate Excise Tax. Ring Hill Forest is categorized as a “working resource” land by the King County Department of Natural Resources and Parks and will be managed as a working forest.

The property is zoned RA-5 and RA-10 and is surrounded by rural residential development to the north, west and south, and the Agricultural Production District to the east. There are currently no roads entering the property, but legal access can be established at three sites. There is very limited use of the site by the public.

Natural Resource Analysis

Ring Hill Forest provides a buffer between rural residential development and agriculture in the Snoqualmie Valley. It provides forest cover that helps maintain hydrologic functions. It also provides habitat for the species that are normally found in a forested area of this size.

Forest Health

The forest stands on Ring Hill are the result of natural regeneration following two harvests on the site, the first in 1911 and the second between 1962 and 1965. From the condition of the residual trees and the forest cover that re-seeded from them, it appears that only trees of high value and volume were harvested, leaving undersized, deformed and/or diseased coniferous and deciduous trees standing. This has resulted in predominantly mixed coniferous/deciduous stands with mistletoe infected hemlock and bigleaf maple contributing the greatest volumes. Tree age varies from 40 to 85+ years with the predominant age class of 40 years. Development and disturbance adjacent to Ring Hill Forest has introduced noxious weeds and resulted in the illegal topping of a patch of trees on the edge of the forest.

Timber and Wood Products

Net timber volumes across the harvestable portions of Ring Hill Forest currently average 10.9 thousand board feet (MBF) per acre with a mean annual increment (MAI) of 273 board feet per acre. This represents significantly lower growth than would occur in a healthy forest at this altitude in this area. Harvesting and reforestation with mistletoe-resistant tree species will improve the productivity and health of Ring Hill Forest while providing revenue to support management activities.

Soils and Slopes

The soil types of Ring Hill Forest are very compatible with timber growth and management. Predominant site class is III (100-year site index 151 and 50-year site index 108), the middle range for productivity. The soils tend to be dry in the summer and have perched water tables in the winter. They also tend to support competing or invasive vegetation when disturbed. Steeper slopes have surface erosion concerns and can have moderate to severe erosion and slippage hazard if the soils are disturbed.

Roads

While the site has an extensive network of old logging grades and skid trails, they were all constructed from 1962 through 1965, prior to Washington State Department of Natural Resources Forest Practice Act, and are considered “orphan roads.” Orphan roads are to be identified under Forest and Fish Rules, but no other actions are required. The old grades are well vegetated and pose no discernable risk to any resources.

Riparian and Wetland Areas

Four stream tributaries flow east through Ring Hill Forest and into the Snoqualmie River. Spawning and rearing habitat is generally poor, as cascades and falls in the upper reaches of the

streams present natural barriers to fish use. No fish presence has been documented, but cutthroat trout are presumed to occupy one or more of the streams. Tuck Creek, which supports use by Coho and chum, flows for approximately 200 feet along the very northeast corner of the forest. There are four small Class 2 forested wetlands within the forest.

Fish and Wildlife Habitat

Though the streams in Ring Hill Forest do not provide significant habitat for fish, they are a source of clean cool water to Tuck Creek and the Snoqualmie River. The forested landscape and wetlands serve as a sponge, slowing and purifying rainwater and metering it down the stream system. Although Ring Hill Forest consists of second and third growth, it contains a diversity of species and some complexity of structure. The forest supports a range of wildlife species common to forests of this small size.

Management Recommendations

Ring Hill Forest will be managed to produce timber revenue while protecting the ecological benefits that forests provide. Management decisions will consider activities in the surrounding area.

Management will strive to create a forest stand that has a diversity of tree, shrub and forb species maintained at an optimal spacing based on stand age. Due to the infestation of dwarf mistletoe, it will be necessary to remove all or most of the infected western hemlock to improve forest health in the long term. During harvests, stands will be monitored for insect damage or noxious weed infestations, and appropriate actions will be taken to address any problems.

All wetlands and streams will be buffered as required by Washington State Forest Practice Rules and according to best available science. Streams will be buffered according to presumed fish habitat.

Forest management that improves forest health will be beneficial to wildlife. Harvest activities will improve forage for some species and will provide additional large snags and woody debris, of which there is currently a shortage.

Five harvests are planned, and they will occur every seven to ten years. Proposed harvest units range in size from 15 – 55 acres, but design constraints will result in variations in projected unit acreage. Slope stability analysis will occur where necessary, and unstable slopes will be buffered. Up to 10,000 feet of forest roads will be designed according to Washington State Department of Natural Resources Forest Practice Rules.

If financial resources are available, a low impact trail system will be developed on the site using post-harvest forest roads to the extent possible.

Table of Contents

Executive Summary	i
Table of Contents	iv
Acknowledgements	vi
Introduction	1
Vision	1
Goals	1
General Property Information	2
History	2
Acquisition	2
Access	3
Easements	3
Parcels	4
Zoning and Surrounding Land Uses	4
Natural Resource Analysis	6
Landscape Context	6
Forest Health	7
Dwarf Mistletoe	7
Insect Damage	8
Noxious Weeds	9
Fire and Animal Damage	9
Timber Trespass	9
Water Quality, Riparian and Wetland Areas	9
Streams	9
Wetlands	11
Fish and Wildlife Habitat	12
Fish	12
Wildlife	13
Threatened and Endangered Species	14
Timber and Wood Products	14
Soils and Slopes	15
Roads	16
Agro-forestry/Special Forest Products	16
Cultural Resources	16
Aesthetics and Recreation	16
Management Recommendations	17
Landscape Considerations	17
Forest Health Considerations	17
Control Dwarf Mistletoe	17
Monitor Insect Damage	18
Control Noxious Weeds	18
Reduce Risk from Fire or Animal Damage	18
Prevent Trespass	18
Ecological considerations	18
Riparian and Wetland Areas	18
Fish	19
Wildlife	19
Threatened and Endangered Species	19
Timber and Wood Products	20
Reforestation and silvicultural strategies for all harvest areas	21
Roads	22
Unit #1	22
Unit # 2	23
Unit #3	23

Unit #4	24
Unit #5	24
Cultural Resources	25
Aesthetics and Recreation	25
References	26
Appendix A	28
Appendix B	31
List of Figures	
Figure 1. Ring Hill Forest Vicinity Map	
Figure 2. Ring Hill Forest Parcel Map	
Figure 3. Ring Hill Forest Streams and Wetlands	
Figure 4. Ring Hill Forest Timber Stands	
Figure 5. Ring Hill Forest Soils	
Figure 6. Ring Hill Forest Topography	
Figure 7. Ring Hill Forest Harvest Units	

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Introduction

Ring Hill Forest is located in unincorporated King County, east of Redmond and west of Duvall (Figure 1). The property is located on the western valley wall above the Snoqualmie River; its forest cover draping from the plateau in the west, down steep slopes, and to the valley floor to the east. Four tributaries have their headwaters in the property and flow to Tuck Creek and the Snoqualmie River. King County acquired the 320-acre Ring Hill Forest in 1997 to keep the land forested and demonstrate sustainable forestry. The purpose of this stewardship plan is to provide guidance for managing the multiple resources of Ring Hill Forest.

Vision

Ring Hill Forest will serve as a model for private forest landowners by providing revenue from sustainable timber production while maintaining the ecological functions that forests provide.

Goals

- Provide revenue from timber harvest to fund the forestland management program
- Demonstrate progressive forest management
- Sustain and enhance the environmental benefits provided by forestland
- Provide a small system of trails for use by hikers and equestrians

When managing Ring Hill Forest, King County land managers will “balance sustainable¹ timber production with conservation and restoration of resources, and with public use.” (King County Executive Order, 2002)

The Ring Hill Forest Stewardship Plan is intended to be adaptive. The environment, society and economy are in a constant state of flux. The plan recognizes that management goals and objectives will be revised over time to reflect changes in conditions and scientific knowledge.

¹ “Sustainable” is defined for the purposes of this plan as: *maintaining healthy forests through silvicultural practices that sustain or improve ecological, economic, and social functions.*

General Property Information

History

Ring Hill Forest is named for its early owner Tom Ring, the operator of T. M. Ring Logging Company in Duvall at the turn of the century. It is believed that Ring established his logging operation in 1911 at what is now Ring Hill Forest (Miller, 1980). The old growth timber was logged at that time. Historical photo and map analysis by Hart-Crowser, Inc. (1997) showed that the property was forested in 1940. Siler Logging Company owned the site between 1940 and the 1960s. During this time, the surrounding lands were rural agricultural operations or forests. The two main roads in the area were 232nd Ave. NE along the western boundary and West Snoqualmie Valley Road to the east.

Siler Logging Company logged the site between 1962 and 1965, introducing a network of logging roads and skid trails into the property. These roads may be used informally today for passive recreation, but they have not been maintained for motorized use. Hart-Crowser's historical photo analysis documented no evidence of further logging after 1965. Port Blakely Tree Farms acquired the property in the mid to late-1960s.

Small farms along 232nd Ave NE and large farms along the Snoqualmie River Valley characterized the vicinity until the 1980s. Residential development intensified in the 1980s and 1990s to the west of the property along 232nd Ave NE. The Snoqualmie River Valley retained its agricultural character and remains relatively unchanged today. Commercial activities in the area include a General Telephone and Electric switching station to the southwest of the site, and a gravel pit ¼ mile to the southeast. The Duvall landfill operated in a gravel pit 3000 feet north of the property from the 1940s until 1981. Hart-Crowser's review of Department of Ecology reports suggested little evidence of contamination or groundwater infiltration into the Ring Hill property.

During the 1980s and 1990s, Port Blakely Tree Farms proposed to subdivide the Ring Hill property for development. Initial proposals for 182 single family homes were reduced to a proposal for 46 lots between 0.75 and 2.72 acres in size. A Final Environmental Impact Statement (EIS) was completed for the project in 1994 (King County DDES, 1994).

Acquisition

The 1994 King County Comprehensive Plan produced interest in conserving rural forestlands outside of the established Forest Production District (FPD). The Rural Forest District was designated as the area in which to achieve low densities through incentives aimed at conserving forestland. The west wall of the Snoqualmie River Valley, including Ring Hill, was designated as a part of the Rural Forest District.

The 1995 Arts and Natural Resources Initiative provided funding for programs to preserve rural forest and agriculture lands and practices in King County. These funds were used to develop long-term strategies, to establish incentives for forest stewardship, and to acquire property. Ring Hill was identified in the 1996 King County Council Ordinance 10000 as the highest priority forest purchase for bond funds (King County Council, 1996). Ring Hill was a high priority because Port Blakely had received permits, and development of the property was imminent.

King County purchased Ring Hill Forest in two phases for a total of \$3.5 million; in 1997 the county purchased part of the site with \$2.4 million from the Arts and Natural Resources Bond, and the Trust for Public Lands (TPL) purchased the remainder for \$1.1 million. Real Estate Excise Tax (REET) funding was used in 1998 to purchase the outstanding property from TPL. The Arts and Natural Resources funding is dedicated in part to preserving sustainable forestry practices in King County; managing Ring Hill Forest for long-term timber production is in accordance with both funding sources.

Access

There are no driveable access roads into Ring Hill Forest, but there are three locations where the forest abuts county roads that would allow development of management roads. The first is an old logging grade, which joins 232nd Ave NE just north of NE 159th St. and leads into Ring Hill Forest through parcel #1526069005 (Figure 2). This will be the most easily developed road access. There are several old logging spurs and skid trails winding their way throughout the property from this point.

The second potential road access is in the southwest corner of the property from the end of NE 147th St. where a seldom-used path joins up with an old logging grade. It will take careful engineering to fit a road between a King County drainage installation and forested wetlands. West Snoqualmie Valley Road parallels the east of the property and may support road access that could provide for harvest of approximately 18 to 25 acres in an area between streams 3 and 4 (Figure 3). Private homes and lots along 232nd Ave NE limit further access on the west of the property. Private property and steep slopes to the north, south and east also limit access.

Easements

The following easements are recorded on the property by First American Title Insurance Company:

- 1928. Puget Sound Traction, Light, and Power Company power line easement 35 ft north of southern boundary of property.

- 1928. Robert Main County Road Right of way easement granting public access on road in the southern quarter of the property.
- 1991. King County Drainage and Road Easement in the southern quarter of property, which allows Port Blakely to remove drainage facilities and construct a road under certain conditions.
- 1989. Road access and utilities along south-western access road between Port Blakely and Axelson party. [Note: the easement parcel “was conveyed to King County for Public Road by quitclaim deed in 1991.”
- 1991. Easement for cut and fill along street margin of NE 147th Place – referred to in the preceding deed with King County.

Parcels

Ring Hill Forest consists of seventeen parcels (Figure 2).

Table 1. Parcel numbers and acreage.

1526069001 (Acres: 20.17)	1526069057 (Acres: 20.32)
1526069002 (Acres: 20.00)	1526069120 (Acres: 20.01)
1526069003 (Acres: 20.00)	1526069121 (Acres: 20.01)
1526069004 (Acres: 20.02)	1526069122 (Acres: 20.04)
1526069005 (Acres: 8.85)	1526069123 (Acres: 20.03)
1526069014 (Acres: 20.02)	1526069124 (Acres: 20.04)
1526069015 (Acres: 20.44)	1526069125 (Acres: 21.58)
1526069016 (Acres: 20.32)	1526069126 (Acres: 20.73)
1526069047 (Acres: 9.11)	

Zoning and Surrounding Land Uses

The Ring Hill vicinity is designated as rural in the King County Comprehensive Plan and zoned RA-10 and RA-5. Prior to current zoning many lots less than one acre were created. The Snoqualmie Agriculture Production District supports 35-acre lots immediately to the east and is characterized by low-density residences, farms, and pastures. Properties in the area support a mixture of suburban, rural residential, agricultural, and forestry uses.

The site is several miles north and east of Redmond and Woodinville, just beyond the county urban growth boundary. Expansion of the eastern fringe of suburban development has brought many new residents to the area over the past decades. The Snoqualmie River Valley divides the Redmond and Woodinville fringe from the SR 203 Duvall and Carnation corridor, which also is experiencing growth. There are several subdivisions and master planned

communities near the site, including Redmond Ridge and Lake of the Woods East. Subdivisions and growth have increased population and traffic pressures in this vicinity.

Ring Hill Forest is an important public land holding as part of a buffer between rural residential development and the agricultural Snoqualmie River Valley. The site supports a number of sensitive areas including steep slopes, streams and wetlands. Public ownership and forest stewardship of the site are in accordance with the King County Comprehensive Plan designation of this area as rural with an emphasis on forestry uses.

Natural Resource Analysis

Landscape Context

King County encompasses 2,135 square miles between Puget Sound and the crest of the Cascade Range. Ring Hill Forest is located on the western valley wall above the Snoqualmie River Valley within the Puget Sound Eco-region, the flat, low valley of Puget Sound formed by the weight and scouring of glaciers during the last ice ages. The terrain of the Puget Lowland is made up of a series of rolling plateaus cut by steep-sided valleys. The drift plains slope gently west and northwest from the Cascade Range foothills (approx. 800 ft. elevation) to bluffs overlooking Puget Sound; they are built of unconsolidated sediment deposited during glacial periods.

Several large valleys cross the lowlands; the Snoqualmie valley runs roughly north-south in King County and is mostly in-filled by drift from the most recent glaciation. Many small streams flow into the Snoqualmie, carving innumerable ravines in the edges of the plateaus. The surface landforms and materials in the lowlands are geologically young and are not likely to be in equilibrium with respect to geomorphic processes. Ring Hill Forest slopes within the uplands are generally under 15 %, but a significant portion of the forest has slopes in excess of 40%.

Weather in the Puget Sound Eco-region is moderated by Pacific Ocean currents, semi-permanent high and low pressure cells, and orographic effect. At Ring Hill Forest, average annual temperature is 50.5° F with an average range from 38.3° in January to 63.9° in August – very representative of averages for the whole region. Average annual rainfall at Ring Hill is 46 to 50 inches. The elevation ranges from about 550 feet in the uplands to about 75 feet adjacent to West Snoqualmie Valley Road.

The vegetation zone is western hemlock, which is a wet low-to-mid-elevation forest area covering much of western Washington. This zone would typically support a climax forest characterized by western hemlock with western red cedar and Douglas fir. Sub-dominant species include grand fir, Sitka spruce, western white pine and lodgepole pine, with hardwood species (red alder, bigleaf maple, black cottonwood, Oregon ash and vine maple) in riparian, disturbed and open areas. Prior to European settlement, forests blanketed the entire Puget Sound Eco-region and climbed the forested foothills into the Cascade Mountain Range.

Settlement, agriculture, and rapid residential development over the last 30 years have significantly altered landcover and forest connectivity. Ring Hill Forest is bounded to the north by Woodinville-Duvall Road and residential lots; to the west by many roads, residences and developments; to the south by larger lot ownerships eventually constrained by NE Novelty Hill Road; and to the east by West Snoqualmie Valley Road and agricultural fields.

While many of the ownerships still have forest cover, surrounding roads, heavy traffic, human activity and built environments have caused Ring Hill Forest to be isolated from larger forested landscapes. This semi-isolated forested landscape is primarily second and third growth (having reforested after one or two harvests).

The Snoqualmie River provides important transport and rearing habitat for coho, chum, pink and Chinook salmon. Tributaries to the Snoqualmie provide important spawning and rearing habitat. Tuck Creek, which passes by the very northeast corner of Ring Hill Forest, is used by coho and chum salmon. The northern-most tributary evaluated in the 1994 EIS flows under West Snoqualmie Valley Road through an 18-inch culvert into a ditch and then into Tuck Creek, which then flows into the Snoqualmie River (King County DDES, 1994). The other tributaries flow under West Snoqualmie Valley Road into drainage ditches and then into the Snoqualmie River. Only the northern-most tributary was noted in the 1994 EIS as having potential salmonid habitat.

Forest Health

The land that is now Ring Hill Forest was originally logged in approximately 1911. Based on observation of old growth stumps, the site was harvested down to and across streams. There is evidence of fire (charring of old growth stumps) on at least a portion of the site. Following the initial harvest, the site reforested naturally. The resulting forest was composed of Douglas fir, western hemlock, western red cedar, red alder, bigleaf maple and black cottonwood.

Between 1962 and 1965 the site was harvested again, this time leaving many trees standing. From the condition of the residual trees and current forest cover that re-seeded from them, it appears only trees of high value and volume were harvested, leaving undersized, deformed and/or diseased coniferous trees and deciduous trees standing. This has resulted in predominantly mixed coniferous/deciduous stands with the greatest volumes comprised of mistletoe infected hemlock and bigleaf maple. Tree age varies from 40 to 85+ years with the predominant age class of 40 years. Understory species include vine maple, salmonberry, red huckleberry, trailing blackberry, swordfern, Oregon grape and salal. A relatively thick duff layer is present in most areas, indicating a developing, healthy nutrient cycle.

Dwarf Mistletoe

The most significant health issue within Ring Hill Forest is dwarf mistletoe (*Arceuthobium tsugense*) infecting the western hemlock. Dwarf mistletoe grows in tree bark and wood, absorbing the water and nutrients of the host tree that otherwise are used for growth. The parasite induces a localized swelling of bark and wood, often stimulating nearby buds and branches to grow excessively, resulting in abnormal clumps of branches called “witches’ brooms.” Throughout the forest, most of the hemlock is moderately to severely infested.

The effects of dwarf mistletoe include reduced growth rates and decreased strength and quality of infected wood. When infection rate is severe, small trees can be killed, and growth of severely infected living trees can be reduced by 40%. Growth losses caused by dwarf mistletoes become clearly evident after 50% or more of tree branches become infected with mistletoe plants, generally when trees are 15 to 20 years of age or older. Very large stem swellings caused by hemlock dwarf mistletoe drastically affect wood quality. Severely infected trees are also more susceptible to other damaging agents (British Columbia Ministry of Forests, 1995).

Partial harvesting in stands infested with dwarf mistletoe can greatly increase its impact because latent infections are activated by increased light in tree crowns. Scattered infected overstory trees produce a barrage of dwarf mistletoe seed that can rapidly infect new seedlings. Single tree or group selection systems will likely result in intensified spread and damage by dwarf mistletoe. Both pre-commercial and commercial thinning increase the light available in stands and can increase the activity of dwarf mistletoe.

Fully-stocked stands have lower rates of spread and intensification of dwarf mistletoes. Dense stands suppress seed production of dwarf mistletoes, and shade out lower branches that are often the most heavily infected. With age, existing infections usually lose their aerial shoots, and become inactive. However, a disturbance that increases available sunlight often reactivates these infections to produce new shoots. Intermediate cuts in stands infested with dwarf mistletoe should be undertaken with caution. This type of disturbance can greatly exacerbate the spread and damage caused by dwarf mistletoe.

The dwarf mistletoe affecting western hemlock also affects noble fir and Pacific silver fir as its primary host trees. Grand fir and mountain hemlock are occasional hosts. Douglas fir, Sitka spruce and western white pine are rare hosts. The Douglas fir on site does not appear to be affected by dwarf mistletoe. Western red cedar is not susceptible.

Insect Damage

Insect activity and damage to trees appears to be at a fairly normal level. The good mixture of deciduous and coniferous trees and diversity of species within most of the stands will help ensure that insect activity remains within the normal range. One concern in the future will be the attractiveness and susceptibility of stressed mistletoe infested hemlock to wood-boring insects. This could lead to increased incidence of woodborers and potentially higher mortality of infected hemlock.

Noxious Weeds

Invasive plant species are present within the forest, but appear to be at fairly low levels and primarily occur on the perimeter where adjacent to disturbed or developed sites. Holly, ivy, herb robert, and tansy ragwort are among the non-native vegetation noted at the site during a 2002 site visit. All of these species occur at low frequency, but early control would help stem their future spread. Tansy ragwort is listed as a Class B Noxious Weed by King County; control is required. The only area of tansy ragwort infestation noted was around the stormwater pond at the southwest corner of the property, at the end of 147th Ave NE. Ivy is found in the very northwest of the property where it has completely overwhelmed the tree canopies in a small area.

Fire and Animal Damage

Species diversity, age class distribution, stocking levels and aspect contribute to a relatively low hazard from fire or animal damage in most stands. Fire hazard could increase if mistletoe infected hemlock begins to suffer increasing mortality. When considering the risk of wildfire spread, it is important to remember that the Puget Sound Basin has a historically very low frequency of forest fire occurrence with very high fire intensity. The urbanizing rural interface presents the greatest risk of ignition sources.

Timber Trespass

A significant threat to the health of Ring Hill Forest is encroachment from adjacent residential development. At least two patches of timber totaling up to six acres in size were recently topped or felled along the western edge of the forest and directly behind residences (ostensibly to create views). They are now shrub/evergreen blackberry patches. In addition, a couple of acres appear to have been heavily disturbed when grading was undertaken for adjacent development. Homeowner activities (fireworks, outdoor burning, etc.) also increase the risk of fire ignition. Disturbed sites can become seed sources for invasive plant species.

One acre of timber trespass was resolved in a monetary settlement that allowed replanting with mixed species conifer. Re-planting occurred in the 2003 planting season.

Water Quality, Riparian and Wetland Areas

Streams

There are four streams on the site that flow east across the floodplain to Tuck Creek and the Snoqualmie River (Figure 3).

Tuck Creek:

The northeast corner of the property lies in the Tuck Creek Sub-basin. The sub-basin drains 16 acres at the very northeast edge of the site. Tuck Creek originates less than one mile upstream of Ring Hill Forest and flows along the Woodinville-Duvall Road for about 200 feet along the very northeast of the forest as it drains to the Snoqualmie River. Tuck Creek is the largest tributary in the area and supports use by coho and chum salmon. The slope toward Tuck Creek is approx. 60% and has a mixed stand of high quality Douglas fir, cedar and hemlock that provide shade. This area will not be harvested.

Stream 1:

Streams 1, 2 and 3 drain 166 acres of the project site, and support a total drainage sub-basin of 591 acres. Stream 1 drains the southern half of the collective sub-basin.

Stream 1's headwaters originate to the southwest of the site; contributing sources appear to include Radar Lake/Lake O'Brien to the south of the site and two wetland complexes documented in the Environmental Impact Statement for Ring Hill Estates (King County Department of Development and Environmental Services (DDES), 1994). The stream is ephemeral, and would be classified as a Class 3 Stream by King County and a Class 5 stream by WADNR. The stream flows through a steep, narrow, well-vegetated ravine through the southern portion of the site. It passes under West Snoqualmie Road through an 18 inch pipe and then through drainage ditches to the Snoqualmie River.

Streams 2 and 3:

Streams 2 and 3 both originate west of the Ring Hill property. They each flow through narrow, well-vegetated ravines in their upper portions and converge near the center of the Ring Hill property. The narrow channel flattens and opens up through the central and eastern portions of the site, supporting small braided channels within a moderately steep-sided valley below the point of confluence. Stream 2's channel is one to three feet wide and supports year round flow. It is classified as Class 2 by King County and Class 3 by WDNR. Stream 3 is intermittent, Class 3, and supports occasional off-channel wetlands. After their confluence, the joined stream flows through a newly installed, fish-passable, boxed, bottomless arch under West Snoqualmie Valley Road, then through ditches to the Snoqualmie River.

Streams 1, 2 and 3 do not provide any spawning habitat, but may provide limited rearing habitat for coho. No fish were observed during site visits, though cutthroat trout may inhabit some streams.

Stream 4:

Stream 4 drains approximately 131 acres in the north and northwest portion of the site; total sub-basin size is 464 acres. Stream 4 is the only stream documented on the site by the Catalog of Washington Streams and Salmon Utilization (#07-0270) (Williams et al. 1975). This is a Class 2 stream under King County's classification system due to its perennial flow, and a Class 3 stream under the WDNr classification system. The stream's headwaters are in the northwest corner of the project site. The stream flows through a steep narrow ravine for most of its length.

The EIS (King County DDES, 1994) included a comprehensive United States Forest Service (USFS) Level 3 stream survey of this stream. This study documented a riparian floodplain 10 to 100 feet wide through the site. The stream channel appears fairly stable and varies in width from 1.5 feet to 15 feet with average water depths of 2 to 7 inches. Stream gradient reached 37% through parts of the site with stream banks varying in steepness from 12% to 85%. This stream flows through a 24-inch culvert under West Snoqualmie Valley Road, then via drainage ditches in the floodplain to Tuck Creek approximately 2000 feet before its convergence with the Snoqualmie River.

The habitat assessment indicates that spawning and rearing habitat is generally poor, though there are a few reaches noted as fair. The poor quality is due to the compactness of the gravel, the embedded nature of the substrate, and poor pool-to-riffle ratio. In addition there is a 30-foot long culvert under West Snoqualmie Road that creates a fish barrier for both juvenile and adult resident and anadromous fish due to the depth of the scour pool and vertical distance to the outlet of the pipe. Most of the reaches contain one or more falls of one to three feet in height that may be impassable to juvenile fish. Upper reaches had impassable cascades along with falls. There are two other culverts present in this tributary; one of 36 inches appears passable by both juvenile and adult resident and anadromous fish. The final culvert is 12 inches, impassable and located right on the forest boundary.

Wetlands

The wetland inventory in the EIS identified four wetlands on the site, totaling 3.7 acres (Figure 3) (King County DDES, 1994). The steep eastern slopes support numerous seeps, but these were not mapped as part of the study.

Two wetlands are located in the southwest portion of the site near 232nd Ave NE. The other two wetlands are located in the northwest portion of the site, also near 232nd Ave NE. All four wetlands were given a King County Sensitive Areas Ordinance rating of Class 2 based on the forest cover component. They are forested wetlands as classified by WADNR. These forested

wetlands have canopy coverage of 79% with 36% mid-story coverage and 63% shrub coverage (King County DDES, 1994).

The southern wetlands (A and B on Figure 3) are approximately 1.0 and 2.5 acres in size, classified as palustrine scrub-shrub and forested sites. These wetlands are associated with the southernmost Stream #1 and may contribute headwater flow to the stream. Wetlands A and B had many patches of standing water when surveyed during June and July of 1992. Overstory at these two wetlands included western red cedar and alder, with salmonberry, lady fern and skunk cabbage composing the understory.

The northern wetlands (C and D on Figure 3) are both approximately 0.1 acres in size. Wetland D is associated with a widened portion of Stream #3's channel, and supports red alder in the overstory and salmonberry, vine maple, elderberry and skunk cabbage in the understory. The other wetland is isolated from Stream #3, surrounding a shallow drainage swale. Black cottonwood and cascara overstory and salmonberry, devil's club, vine maple and skunk cabbage understory characterize this wetland.

Fish and Wildlife Habitat

While Ring Hill Forest comprises second and third growth trees, it contains a good diversity of vegetative species and is developing more complex structure. There are four small, Class 2 forested wetlands and significant riparian vegetation along the tributaries. The forest provides habitat for a wildlife community consisting of generalist species typical of patches of this limited size. There are no distinct wildlife migration corridors, and connectivity to other forested habitat is severely limited by roads and development. Patch size and isolation make it unlikely that Ring Hill Forest will ever serve as priority habitat as defined by Washington Department of Fish and Wildlife.

Fish

The Snoqualmie River provides habitat for coho, chum, pink, and Chinook salmon (Williams et al. 1975). Chinook are listed as threatened and coho as candidate species under the Endangered Species Act. Tuck Creek, lying immediately north of the site, is known to support coho salmon (Williams et al. 1975).

Shapiro and Associates identified Stream 4 as the most likely stream on the site to support salmonids and cutthroat trout (Shapiro and Associates, 1990). The stream survey completed for the 1994 EIS indicated poor spawning and rearing habitat in most of the stream and found no evidence of salmonid presence, but there is potential rearing habitat. Of three culverts on Stream 4, two are impassable: the culvert at West Snoqualmie Valley Road (two-foot drop from culvert to pool below), and the culvert at the upstream extent of the site. Steep gradients,

impassable cascades, and falls throughout the stream's course may present natural barriers to juvenile salmonid access within the stream corridor itself.

Wildlife

Four primary habitat types have been identified within Ring Hill Forest: mixed deciduous/conifer forest, which comprises the largest portion; conifer forest occurring primarily in patches too small to be indicated on vegetation stratification maps; wetland comprising 3.7 acres; and shrub/cleared area comprising up to eight acres (King County DDES, 1994).

Although Ring Hill Forest is second and third growth, the habitats on the site have fairly diverse structure, species and spatial distribution resulting from the logging history and natural regeneration that followed. The average trees-per-acre ranges from 93 to 171 with variable spacing. All stands are dominated by trees in the 8 to 14-inch DBH size class. Most stands have between 2 to 5+ trees per acre in the 24 to 32+ inch DBH size class. Understory species in the mixed deciduous/conifer stands include vine maple, salmonberry, cascara, devil's club, red huckleberry, swordfern, deer fern, Oregon grape, salal, and trailing blackberry. In the small patches of dense hemlock and cedar understory, vegetation is very sparse. The wetlands are forested with some patches of standing water. Large snags and downed woody debris are limited in extent, but smaller snags and woody debris are increasing, mostly through the contribution of hemlock succumbing to mistletoe.

The 1994 EIS referred to the King County Wildlife Habitat Profile valuation of the property (on a 1 to 4 scale, with 4 as the highest value to wildlife) (King County Park, Planning and Resource Department, 1987). Second growth lowland mixed deciduous/conifer forest is given a 4 rating; second growth lowland coniferous forests in the northeast portion of the site and in patches are rated as 3. The cleared and shrubby areas have a lower habitat value. Ring Hill Forest, while somewhat isolated from larger forested landscapes by roads, development and agriculture, provides high quality habitat features for a diverse assemblage of amphibians, reptiles, birds and mammals normally found in smaller habitats (Appendix A).

The EIS inventoried 25 bird species, three reptiles and amphibians, and six mammals (Appendix A); a number of other species would be expected to use the site but were not directly identified. Neighboring landowners report having seen cougar on the site. There is an osprey nest located in the northeast sector of the site, where nesting has occurred for several years.

There was no direct evidence of wildlife migration corridors found on the site in the 1994 study. However, the 1994 King County Comprehensive Plan identified a wildlife habitat corridor across the property from the northeast to the southwest of the site.

Threatened and Endangered Species

In the 1994 EIS, consultation with the Washington State Natural Heritage Data System and the United States Fish and Wildlife Service (USFWS) indicated that no federally-listed threatened or endangered species were known to inhabit the site. Streams on the site are relatively small, have high gradients, flow through dairy farm ditches to their confluence with the Snoqualmie River, and may have impassable culverts at West Snoqualmie Valley Road. This reasonably precludes most use by anadromous salmonids such as threatened chinook, threatened bull trout, or candidate coho salmon. Osprey nests are afforded protection by the federal Migratory Bird Treaty Act, but neither the state or federal government lists the species as sensitive.

Timber and Wood Products

Timber harvest first occurred on Ring Hill Forest around 1911, and the site was logged again between 1962 and 1965. These forestry operations produced a relatively young forest stand today with scattered residual trees, particularly in the steeper drainages. Most of the property supports mixed coniferous and deciduous stands, with a small amount of coniferous forest in the northeast. Variation in topography and logging history contribute to mixed stand age and composition throughout the site. In general, stocking levels and timber volumes are low. Alderwood soil series is predominant with a site class of III (100-year site index 151 and 50-year site index 108), the middle range for productivity. This site class normally would yield 16 to 21+ MBF per acre at 40 years of age; however Ring Hill Forest is currently averaging volumes of 10.9 MBF per acre. Low stocking levels and the presence of hemlock dwarf mistletoe contribute to lower than expected annual volume accrual.

Ring Hill Forest is along the edge of the Snoqualmie River Valley wall and is divided by four streams. Accordingly, much of the site comprises riparian, wetland or unstable slope buffers, or operability constraints. WADNR's resource mapping designates half of Ring Hill Forest as having medium to high slope instability potential (Washington State Department of Natural Resources). Any forestry activities in those areas will require additional geotechnical review. Approximately 95 acres of riparian and unstable slopes and buffers and 6 acres of forested wetlands and buffers will be left unmanaged, with an additional 39+ acres of potentially unstable slopes subject to additional review. From 32% to 43% of the 320-acre forest will not be harvested.

International Forestry Consultants performed a timber cruise of the entire Ring Hill Forest for Port Blakely Tree Farms in July of 1996 (International Forestry Consultants, 1996) (Appendix B). Stand boundaries in the 1996 timber cruise took into account the proposed development of the site. As a result, timber type boundaries based on significant differences in identifiable

species, crown cover and age class were further divided into development or open space categories in the cruise report. Timber types were delineated and contained within development or open space areas and were designated as “D” for development, and “O” for open space. Ring Hill Forest is now a managed working forest and is not subject to development. For ease in discussing the various stands in this plan, they are re-designated stands #1 through #11 (Figure 4). Appendix B contains information about each stand and the cruise data provided by International Forestry Consultants, Inc.

Volumes per acre are significantly lower for the operable areas as compared to the riparian and other buffer areas. This probably results from those operable areas being harvested between 1962 and 1965 and subsequently becoming infected from diseased hemlock that was considered non-merchantable and left standing. Currently Ring Hill Forest is not realizing the growth potential possible if the site were fully stocked and healthy. Net timber volumes across proposed development areas averaged around 9 thousand board feet (MBF) per acre in the International Forestry Consultants, Inc., cruise report in 1996. The stand was 33 years old at time of the cruise, which indicates a net mean annual increment (MAI) of approximately 273 board feet per acre.

Soils and Slopes

There are five soil types on this site (Natural Resource Conservation Service, 1973): Alderwood, Everett-Alderwood, Alderwood-Kitsap, Shalcar and Indianola (Figure 5). The western half is mainly Alderwood series; the eastern half (25-70% slopes) is Alderwood-Kitsap soil. Hart-Crowser (1997) documents the underlying geology as Lawton Clay at low elevations, Esperance Sand/advance outwash deposits at higher elevations in the property's center, and Vashon Till on most of the west side plateau.

The soil types of Ring Hill Forest are very compatible with timber growth and management. Predominant site class is III (100-year Douglas Fir site index 151 and 50-year Douglas Fir site index 108), the middle range for productivity (Washington State Forest Practice Act, 2001). The soils tend to be dry in the summer and have perched water tables in the winter. They also tend to easily support competing or invasive vegetation when disturbed. Steeper slopes have surface erosion concerns and can have moderate to severe erosion and slippage hazard if the soils are disturbed.

Slopes (Figure 6) adjacent to the streams are 60% to 100% in some areas and there are visible signs of slope creep and shallow slumping, probably caused by the downward migration of stream channels as they carve through glacially deposited materials. Washington Department of Natural Resources designates up to half of Ring Hill Forest as having potential for medium to high slope instability. Any harvest on those slopes will require additional review, and potentially need geotechnical expertise and reporting.

Roads

While the site has an extensive network of old logging grades and skid trails, they were all constructed from 1962 through 1965, prior to Washington State Department of Natural Resources Forest Practice Act, and are considered orphan roads. Orphan roads must be identified under Forest and Fish Rules, but no other actions are required. The old grades are well vegetated and pose no discernable risk to any resources.

Agro-forestry/Special Forest Products

The shrub and ground vegetation components present on Ring Hill Forest are not of sufficient quality or quantity for the floral industry at this time. The tree species, ages and crown condition are not suitable for the evergreens industry.

Cultural Resources

First Nation peoples frequented forested hillsides above major drainages such as the Snoqualmie River. The hillsides were used for hunting, gathering and tool making, among other pursuits. However, there are currently no identified cultural, historical or archeological resources on or adjacent to Ring Hill Forest.

Aesthetics and Recreation

Ring Hill Forest provides an important buffer to the agricultural valley from the developing plateau to the west. It also presents a pleasing regional view of forested slopes to people recreating along the Snoqualmie Valley.

The forest itself sees surprisingly little recreational use considering the development surrounding it. There appears to be very infrequent use of the old logging grades for hiking, horseback riding or mountain biking. However, neighboring landowners have commented that there used to be more use of the trails before they became overgrown, and they have expressed a desire for limited trail development along the western edge of the property.

Management Recommendations

Landscape Considerations

Management decisions will consider activities in the surrounding area. Adjacent and surrounding landowners will be encouraged to participate in stewardship activities.

Riparian, wetland and unstable slope buffers will provide for continued forage, migration and hiding cover throughout the portions of the forest managed for timber. Reforestation and silvicultural management will stress species diversity and structural complexity.

Forest Health Considerations

A forest stand that has a diversity of tree, shrub and forb species maintained at an optimal and variable spacing and distribution based on stand age will be more productive, vigorous and resilient. Reforestation should consider planting diverse tree species at a spacing of 13 by 13 feet or 250 seedlings per acre. This will allow a longer time before stands move into the stem exclusion phase. Stands should be monitored for signs of reduced vigor due to crowding of canopies. For those portions of the forest on the flatter plateau, stands may be able to sustain until they are of sufficient size for commercial thinning. For those portions of the forest on steeper slopes, pre-commercial thinning of trees to a variable spacing ranging from 15 by 14 feet to 19 by 19 feet resulting in 120 to 200 trees per acre would result in a well stocked stand that also allows light to the forest floor in areas to allow understory growth. Optimum spacing of trees will ensure continued forest vigor and resilience.

Control Dwarf Mistletoe

Harvesting all or most of the mistletoe infected western hemlock would be the most effective way to improve health and vigor at Ring Hill Forest. When designing harvests to improve forest health, the strategy should be to prefer Douglas fir, western red cedar, cottonwood, alder and maple (in that order of preference) in selection of wildlife leave trees. If western hemlock is the only species available as a leave tree, choosing standing dead over living trees is preferred, as the mistletoe requires a living host.

If hemlock is within the outer 100-foot perimeter of riparian, wetland and slope stability buffers, care should be taken to plant and manage for mistletoe resistant western red cedar, Douglas fir, western white pine and Sitka spruce. Red alder can also be allowed as a component of the regenerated stand; however Ring Hill Forest is not a good alder site and is not appropriate for pure alder stand management.

Monitor Insect Damage

All stands at Ring Hill Forest should be observed for signs of increased insect activity during routine annual or biennial inspections.

Control Noxious Weeds

Tansy ragwort and ivy should be pulled and/or cut (in the case of well-established aerial ivy vines) when resources allow. Any stand management contracts should call for cutting any holly within the contract area. King County Noxious Weed staff should be notified of the areas of intensive tansy ragwort, ivy and herb Robert infestations. Adjacent landowners should be encouraged to eliminate noxious weeds on their property in order to reduce incursion into the forest. County staff should survey for noxious weeds during annual forest inspections.

Reduce Risk from Fire or Animal Damage

The most important preventative measures for both fire and animal damage will be management activities that promote forest health such as reducing the tree cover affected by dwarf mistletoe, assuring optimal stocking levels for all age classes, and maintaining a broad diversity of vegetative species. Outreach to surrounding neighborhoods regarding “firewise” community planning would help elevate awareness and improve stewardship on private properties surrounding the forest.

Prevent Trespass

Staff should survey for any additional trespass activity during annual forest inspections. Active outreach and education about the values and dynamics of managed forest resource lands and forest health should be targeted to the community.

Ecological considerations

Riparian and Wetland Areas

All wetlands and streams will be buffered as required by WDNR Forest Practice Rules and according to best available science. Streams will be buffered according to presumed habitat. Some of the stream reaches in Ring Hill Forest will have buffers largely augmented by slope

stability buffers. The combined result will be wide wildlife travel corridors, increased accumulation of large woody debris, and additional shade. In addition, harvest system requirements will be designed to avoid or minimize disturbance to ground vegetation and duff layers on all slopes, which will help prevent erosion.

Fish

As described in the analysis section, the streams of Ring Hill Forest provide generally poor fish habitat. There are steep gradients and impassable cascades in the upper reaches of the streams, making fish use improbable. However, in an effort to be conservative, any streams over two feet wide bank-full width will be buffered as though they were fish bearing. The wide buffers are augmented in many areas by slope stability buffers. This will assure large woody debris recruitment, shade and hydrologic cover.

Wildlife

Management of Ring Hill Forest will result in improved forest health and resilience of the forest. Wide riparian, wetland and slope stability buffers will remain unmanaged, providing areas of hiding and breeding cover for the species that frequent Ring Hill. Harvest activities will improve forage for some species, and wildlife retention trees will be both aggregated and dispersed to provide for a wide variety of species.

There is currently a shortage of large snags and woody debris. The proposed timber management strategy recommends leaving large, dominant healthy trees. With the dwarf mistletoe infestation in the hemlock and the low stocking of the forest, the harvest strategy will be to retain the largest and most vigorous trees and replace the parasite-stressed hemlock with stands that should be more capable of large growth to provide the large structural wildlife trees of the future.

The osprey nest is well protected in an area that will not be harvested. As this area has some of the healthiest and most structurally diverse forest components, it will be left intact.

Threatened and Endangered Species

The management strategy for the forest will improve the structure and diversity of the forest over time, making it potentially more attractive to species that require large structure (eagles in particular). In addition, the continued maintenance of a healthy forest helps provide the water, nutrients and potential rearing habitat that are required by salmonids.

Timber and Wood Products

When evaluating harvest alternatives and impacts, the extensive hemlock mistletoe infestation must be taken into consideration. Any mature hemlock retained following a harvest prescription has the likelihood of re-infesting any hemlock component of the regeneration stand.

Harvest units should be cruised prior to the sale of timber. Changes in volume per acre can be compared to the 1996 cruise data to determine periodic annual increment, which, when compared with mean annual increment, will better define current site productivity and inform decisions regarding harvest timing.

The unit projections below do not include costs associated with sales planning, layout, compliance and maintenance over time. It is recommended that costs be carefully tracked and monitored to allow for improving efficiency and effectiveness.

Harvests will be designed to maximize improvement to forest productivity and forest health, and to provide revenue to the Natural Resource Lands program while protecting habitat and maintaining hydrologic function. Timing between harvests should average 7 to 10 years for maintenance of hydrologic function, tree root-strength integrity, and hiding cover. Timing should also be planned to accommodate markets. Harvest units should be prepared in advance and sold to capitalize on strong markets as feasible. All harvests will meet current Forest Practice Rules and will be informed by best available science.

Because all harvestable stands are of similar age, volume and species composition, harvest units should be decided based on road access, topography, and buffered resource constraints. Management recommendations will be discussed based on harvest planning units. Five harvest units are recommended (Figure 7). Design, size and logging constraints of individual units will cause variations in projected harvest unit acreage. All units should be cruised prior to sale.

Harvest planning will be similar for all units. Streams will be buffered based on habitat potential, which presumes fish presence. Roads will be designed and built according to Washington Department of Natural Resources Forest Practice Rules and under the Forest Practice Board Manual Guidelines. Additional slope stability analysis will occur where necessary, and unstable slopes will be buffered. As discussed in the forest health section, wildlife and leave tree selection will favor Douglas fir, western red cedar, cottonwood, alder and maple, in that order. Leave trees will primarily be aggregated in the riparian and unstable slope buffers and in swales, with some distributed through harvest areas.

On the plateau, slopes under 30 to 35 percent can be ground-based harvested with low-ground-pressure, tracked machinery. For slopes in excess of 30 to 35 percent, high-lead cable yarding systems will be required. Harvest contracts should specify adequate suspension of logs ($\frac{1}{2}$ to $\frac{3}{4}$ length suspended) to minimize or prevent disturbance to duff and ground vegetation. Yarding should be away from, rather than across, streams, draws or swales as practicable. Harvest should be limited to periods of dry, favorable site conditions. Operations should be suspended during any period of saturated soils or other unfavorable operating conditions. Timing of operations should be limited to 7 AM through 5 PM Monday through Friday to minimize noise disturbance to neighbors. Consideration will need to be given to the use of 232nd Ave NE by logging trucks, as the road is fairly narrow with residential development along it. Proper safety precautions will be required.

Stand rotation ages (length between harvests) may change over time as available science, communities and markets change. Given the resource science, markets and community balance in 2004, rotation age should be targeted for between 65 to 80 years. New markets, such as carbon sequestration, could change rotation age targets significantly.

Timber prices and management costs vary significantly over time. For harvest and management activities planned beyond 2006, projections will be discussed in terms of acreage and board foot volume.

Consideration should be given to the evolving special forest products industry into the future, and any opportunities should be explored for alternate sources of sustainable products and revenue. Carbon sequestration could be of special interest if markets start to evolve.

Reforestation and silvicultural strategies for all harvest areas

As mentioned above, planting diverse mistletoe-resistant tree species, bare-root Douglas fir, western red cedar plugs and western white pine, at a spacing of 13 by 13 feet or 250 seedlings per acre will allow a longer time before stands move into the stem exclusion phase. Stands should be monitored for signs of reduced vigor due to crowding of canopies, and for over-topping of conifer by shrub and hardwood species. Between four and seven years following stand establishment, it may be necessary to implement hand methods (slashing) of competing vegetation control.

For those portions of the forest on the flatter plateau, stands may be able to sustain until they are of sufficient size for commercial thinning. These stands should be evaluated for commercial thinning around 25 years following stand establishment.

For those portions of the forest on steeper slopes, pre-commercial thinning of trees to a variable spacing, ranging from 15 by 14 feet to 19 by 19 feet resulting in 120 to 200 trees per

acre, would result in a well stocked stand that also allows light to the forest floor in areas to allow understory growth. Pre-commercial thinning will become desirable at between 12 and 15 years following stand establishment.

Roads

Any harvest activities planned in the future will require a combination of complete reconstruction and new construction of harvest roads meeting the current forest practice standards. Up to 100 stations (10,000 feet) of road construction would be required across Ring Hill Forest to fully implement the proposed forest management (Figure 7).

Proposed road construction will occur primarily on Alderwood soil complexes. These soils support roads well, requiring low to moderate ballast. All phases will require road surfacing (gravel) that will have to be acquired off site. The closest gravel sources are in the Monroe and Duvall areas. In areas of wetter soils, use of geotextile will help prevent pumping of surfacing into the subgrade and will minimize rutting and puddling on the roads.

Orphan roads (roads built prior to the Forest Practice Act of 1974) must be identified and any risk to natural resources noted. No other action is required. The old logging grades (orphan roads) that exist within the Ring Hill Forest have re-vegetated and pose no risk to resources. Until such time as they may be rebuilt for management activities, they do not require any maintenance.

Unit #1

Harvest of Unit #1 should be scheduled between 2005 and 2010. The unit is 50 to 55 acres (depending on slope stability limitations), including the southern portion of Stand #2 and operable portions of the southern part of Stand #5. It is bounded on the south side by creeks #2 and #3 (Figure3), to the north by the lowest point in a broad swale, to the west by the property line and to the east by the limitations of steep unstable slopes. Stands #2 and #5 are primarily comprised of 40 year old hemlock, maple, alder, cedar and Douglas fir, and average 11.6 MBF per acre net (MAI adjusted 2005 volume). Log sorts are primarily domestic 3 and 4-saw. Unit #1 will net between 580 and 638 MBF (MAI adjusted to 2005). If the average value per MBF is \$350, an approximate value would be \$203,000 to \$223,300 gross.

The harvest will involve 6,250 feet (62.5 stations) of road construction. Much of the road will be located coincident with orphaned road grade. Approximately 2,500 feet of the road will be temporary and removed following the harvest. The remainder of the road can be placed in an inactive status. Road costs will be about \$50,000. Logging costs will be approximately

\$120/MBF or \$69,600 to \$76,560. Reforestation costs will be approximately \$250 per acre, or \$12,500 to \$13,750.

With the given range of roading, logging and reforestation costs, Unit #1 should net from \$70,900 to \$83,050. Consideration should be given to utilizing proceeds from the harvest of Unit #1 to take advantage of the efficiency of combining reforestation for the remaining 5 acres of trespassed land by adding Stand #11 to the Unit #1 reforestation contract. This would be a \$1250 stand improvement expense.

Unit # 2

Harvest of Unit #2 should be scheduled for 2012 to 2020 (7 to 10 years following completion of Unit #1). The unit is 25 to 28 acres (depending on slope stability limitations), including portions of Stands #1, #4 and #6. It is bounded on the south by the property line, to the west by wetlands A and B, to the north by stream #1, and to the east by unstable slope limitations. Unit #2 contains approximately three acres of Stand #4, a small swath of residual older hemlock, cedar and Douglas fir. Wetland buffer will retain about 1 acre, leaving 2 acres available for harvest. Unit #2 includes 18 acres of Stand #1, predominantly hemlock, with some cedar, alder and Douglas fir. The remaining 5 to 8 acres of the unit is in Stand #6, located on steeper slopes comprising maple, hemlock, alder and cedar.

Stand #4 has residual larger trees, which yield higher log grades of 1, 2 and 3-saw predominantly. Stand #1 log grades are distributed through domestic saw log grades 2, 3, and 4 and utility. Stand #6 log grades are largely domestic 2 and 3-saw with some 4-saw and utility.

Unit #2 will be accessed from NE 147th and will require approximately 2,200 feet (22 stations) of new road construction. All but the first 250 feet of road will be temporary use.

Unit #3

Harvest of Unit #3 should be scheduled for harvest between 2019 and 2030. The total volume is 246 MBF (Mean Annual Increment adjusted to 2022). The unit is 15 acres within Stand #6, bounded by the property line on the east, stream #4 on the north, unstable slopes on the west and stream #3 on the south. Stand #6 consists of maple, hemlock, alder and cedar. This portion of Stand #6 has moderate to medium slope instability concern, and the soils tend to be wetter. Stand #6 will have up to half the volume in domestic 1 and 2-saw in maple, hemlock and alder, and 3 and 4-saw and utility in all species.

Unit #3 can be accessed from West Snoqualmie Valley Road and will require approximately 1,100 feet (11 stations) of road construction, much of that reconstruction of an orphan road. The soils tend to be wetter on this lower slope. Road construction and all ground-based operation should be limited to July through mid-September and be discontinued during any wet weather patterns. Though the road will be temporary, ballast rock will probably be necessary. Following harvest, the road should be removed and made inaccessible by a deep water-bar to prevent it from becoming an attractive nuisance.

Unit #3 should be harvested with a low-ground-pressure, tracked operation. The contract should specify using tops and limbs to cushion operating paths.

Unit #4

Harvest of Unit #4 should be scheduled between 2026 and 2040 (7 to 10 years following completion on Unit #3). Total volume is 777 to 858 MBF (MAI adjusted to 2030). The unit is 48 to 55 acres (depending on forest practice slope stability limitations) including portions of Stand #1, Stand #6 and perhaps a small part of Stand #7. It is bounded to the west by the property line, to the north by streams #2 and #3, to the east by West Snoqualmie Valley Road (or unstable slope limitations) and to the south by stream #1. Unit #4 includes 18 acres of stand #1, predominantly hemlock, with some cedar, alder and Douglas fir. The unit has 30 to 33 acres in stand #6, located on steeper slopes with maple, hemlock, alder and cedar. Stand #7 has residual older hemlock, cedar and spruce. This stand is on difficult ground but potentially 2 or 3 acres can be harvested with Unit #4.

Unit #4 will be accessed from 147th and the road constructed for Unit #2. The harvest will require 2,000 feet (20 stations) of road construction. The road should be removed or inactivated following harvest.

Unit #5

Unit #5 should be scheduled for harvest between 2033 and 2050 (7 to 10 years following harvest of Unit #4). Total volume is 1,035 to 1,155 MBF (MAI adjusted to 2035). The unit is 50 to 56 acres including 45 acres of stand #2, 5 acres of stand #3 and up to 6 acres of stand #5. It is bounded on the north by stream #4, on the south by Stream #3, and on the west by property lines. Both stands #2 and #5 consist primarily of hemlock, maple, alder, cedar and Douglas fir. Stand #3 is uniquely stocked with good quality Douglas fir.

Unit #5 will be accessed from 232nd and will require additional construction of 2,700 feet of road (27 stations). The road should be removed or inactivated following harvest.

Cultural Resources

During field operations, careful observations should be made for any potential artifacts such as manufactured rock flakes or chips. If any such artifacts are observed, King County Water and Land Resources management, affected tribes, the Office of Historical and Archeological Preservation and Washington Department of Natural Resources will be consulted.

Aesthetics and Recreation

When implemented, active forest management activities should be signed, and access made available to facilitate outreach regarding sustainable forestry and its opportunities. Use of forest roads as trails will become an available option as management progresses.

When harvests occur, the groupings of leave trees and riparian, wetland and slope buffers will help create varied and natural-looking views.

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Williams, R.W., R.M. Laramie, and J.J. Ames. 1975. A Catalog of Washington Streams and Salmon Utilization, Volume 1, Puget Sound. Washington Department of Fisheries, Olympia, WA.

Appendix A

(from Shapiro and Associates. 1992)

Table 1. Plant species observed in each habitat type on Ring Hill Forest during June and July, 1992.

Common Name	Scientific Name	Mixed Forest	Wetland
Trees			
Red alder	<i>Alnus rubra</i>	*	*
Black cottonwood	<i>Populus trichocarpa</i>	*	*
Big-leaf maple	<i>Acer macrophyllum</i>	*	*
Douglas fir	<i>Pseudotsuga menziesii</i>	*	*
Western hemlock	<i>Tsuga heterophylla</i>	*	*
Western red cedar	<i>Thuja plicata</i>	*	*
Shrubs and small trees			
Vine maple	<i>Acer circinatum</i>	*	*
Indian plum	<i>Oemleria cerasiformis</i>	*	*
devil's club	<i>Oplopanax horridum</i>	*	*
cascara	<i>Rhamnus purshiana</i>	*	
salmonberry	<i>Rubus spectabilis</i>	*	*
red elderberry	<i>Sambucus racemosa</i>	*	*
shining Oregon grape	<i>Berberis nervosa</i>	*	
red huckleberry	<i>Vaccinium parvifolium</i>	*	*
salal	<i>Gaultheria shallon</i>	*	
evergreen blackberry	<i>Rubus laciniatus</i>	*	
trailing blackberry	<i>Rubus ursinus</i>	*	
willow	<i>Salix sp.</i>	*	*
Grasses and forbs			
lady-fern	<i>Athyrium filix femina</i>	*	*
Pacific bleeding heart	<i>Dicentra formosa</i>	*	*
bedstraw	<i>Galium aparine</i>	*	*
twinflower	<i>Linnaea borealis</i>	*	*
false lily-of-the-valley	<i>Maianthemum dilatatum</i>	*	*
foam flower	<i>Tiarella sp.</i>		*
miners lettuce	<i>Montia</i>	*	
twisted stalk	<i>Streptopus</i>		*
deer fern	<i>Blechnum</i>	*	*
horsetail	<i>Equisetum sp</i>		*
sword fern	<i>Polystichum munitum</i>	*	*

bracken fern	<i>Pteridium aquilinum</i>	*	*
trillium	<i>Trillium ovatum</i>	*	
stinging nettle	<i>Urtica dioica</i>	*	*
slough sedge	<i>Carex obnupta</i>		*
sedge	<i>Carex sp</i>		*
skunk cabbage	<i>Lysichitum americanum</i>		*
speedwell	<i>Veronica sp.</i>	*	
pig-a-back	<i>tolmiea monziesii</i>		*

Table 2: Bird species abundance during surveys at Ring Hill Forest during June and July, 1992.*

Species	Wetland	Mixed Forest
American robin	5	12
black-capped chickadee	4	14
brown creeper	0	2
barn swallow	5	1
black-throated gray warbler	0	9
bushtit	1	0
crow	1	3
golden-crowned kinglet	0	2
MacGillivray's warbler	1	1
orange-crowned warbler	3	1
Oregon junco	1	3
olive-sided flycatcher	1	0
purple finch	1	1
red-breasted nuthatch	1	0
red-breasted sapsucker	1	0
red-eyed vireo	1	3
ruffed grouse	4	0
rufous-sided towhee	2	1
song sparrow	5	2
Steller's jay	4	1
Swainson's thrush	3	14
unknown	0	2
unknown woodpecker	0	2
violet-green swallow	3	0
western flycatcher	4	9
winter wren	5	17
Total dedections	56	100
Total species	21	20

* Numbers represent observations from 3 stations in mixed forest habitat and 1 station in wetland habitat

Table 3. Mammals observed on Ring Hill Forest during June and July, 1992.

Common Name	Scientific name
Mountain beaver #	Aplodontia rufa
Douglas tree squirrel	Tamiasciurus douglasii
Rabbit	Sylvilagus floridanus
Coyote*	Canis latrans
Black bear*	Ursus americanus
Black-tailed deer*	Odocoileus hemionus columbianus

burrows observed

* scat and tracks observed

Table 4. Amphibians and reptiles observed on Ring Hill Forest during June and July, 1992.

Common Name	Scientific name	Number
Red-legged frog	Rana aurora	2
Northwestern salamander	Ambystoma gracile	1
Garter snake	Thamnophis sp.	3

Appendix B

Table 1: Stand descriptions (based on 1996 Timber Cruise Report by International Forestry Consultants, Inc.)

Plan Stand #	Acres	Cruise Stand #	Harvestable?	Stand Description	Gross Vol. MBF	Net Vol. MBF
#1	26	D-1 and D-4	Yes	Low volume; averaging 5.9 MBF/acre net; mixed species w/dominant hemlock, cedar, and alder. 40 yrs old. Scattered 70+ yr. hemlock and cedar in overstory. D-4, a small swale area, is included w/ D-1 in the acreage and volume calculation.	213	154
#2	84	D-2	Yes	Low volume, averaging 9.1 MBF/acre net, mixed species w/dominant hemlock, alder, cedar, and Douglas fir. 40 yrs old. Hemlock dominant w/ cedar and alder as main overstory species. While volume is low this stand contains some of the higher value timber.	863	768
#3	5	D-3	Yes	5 acres predominantly stocked with good quality Douglas fir. Net volume of 13.2 MBF per acre is slightly higher than the overall average. Some of the highest value per acre is within this stand and stand #4.	85	66
#4	4	O-1	Yes – 2 acres	4 acres of residual hemlock and cedar with an average of 17 MBF/acre net. Some of the larger trees with higher grades are in this stand making it among the highest value.	86	68
#5	39	O-2	May be a small portion	Essentially the western bank, including the draw, of the main stem of the stream at the northeast corner of the forest. Timber volumes are moderate with hemlock, maple and cedar dominant. Slopes range up to 100%. A very small portion of this stand may be harvestable depending on geotechnical review.	393	368
#6	101	O-3	Partial on	Stand is located in a broad creek valley with an average of 9.2 MBF/acre net. Maple dominates mixed with hemlock, alder and cedar. Valley slopes are up to 65%. The lower end of the valley has saturated areas (which show up on WADNR and King County maps as an unclassified stream – no stream channel exists per 1994 EIS and field verification in 2003).	1,005	929
#7	5	O-4	May be a small portion	5 acres of residual hemlock, cedar and spruce located along saturated soils of mixed topography south of the confluence of streams 2 and 3. Due to the saturated soils, adjacency to riparian area and the wildlife beneficial species composition of this small stand, it should not be considered harvested. 17.6 MBF/ac. net.	90	88
#8	32	O-5	No	Good quality Douglas fir and hemlock averaging 12 MBF/acre net, and located along the east bank of the northeast stream (stream 4). This stand should be considered unharvestable, as it is within the riparian buffer zone and/or on unstable slopes.	504	385
#9	11	O-6	No	An 11 acre patch of high quality Douglas fir with hemlock and alder and an average volume of 30 MBF/acre net. This stand is located on the northeast slope of a ridge overlooking Woodinville-Duvall Highway. There is no road access to the forest from this side and the slopes are unstable. This stand should be considered unharvestable.	433	327
#10	8	O-7	NA – non-merchantable	8 acres of non-merchantable timber, predominantly alder, approximately 15 years old which appears to have naturally reforested following a grading disturbance.	0	0
#11	8	X	NA - non-merchantable	Two pockets of clearing created by topping and felling of trees behind residences, ostensibly for creation of view corridors.	0	0

Table 2: Ring Hill Forest Timber Inventory (from 1996 Timber Cruise Report by International Forestry Consultants, Inc.)

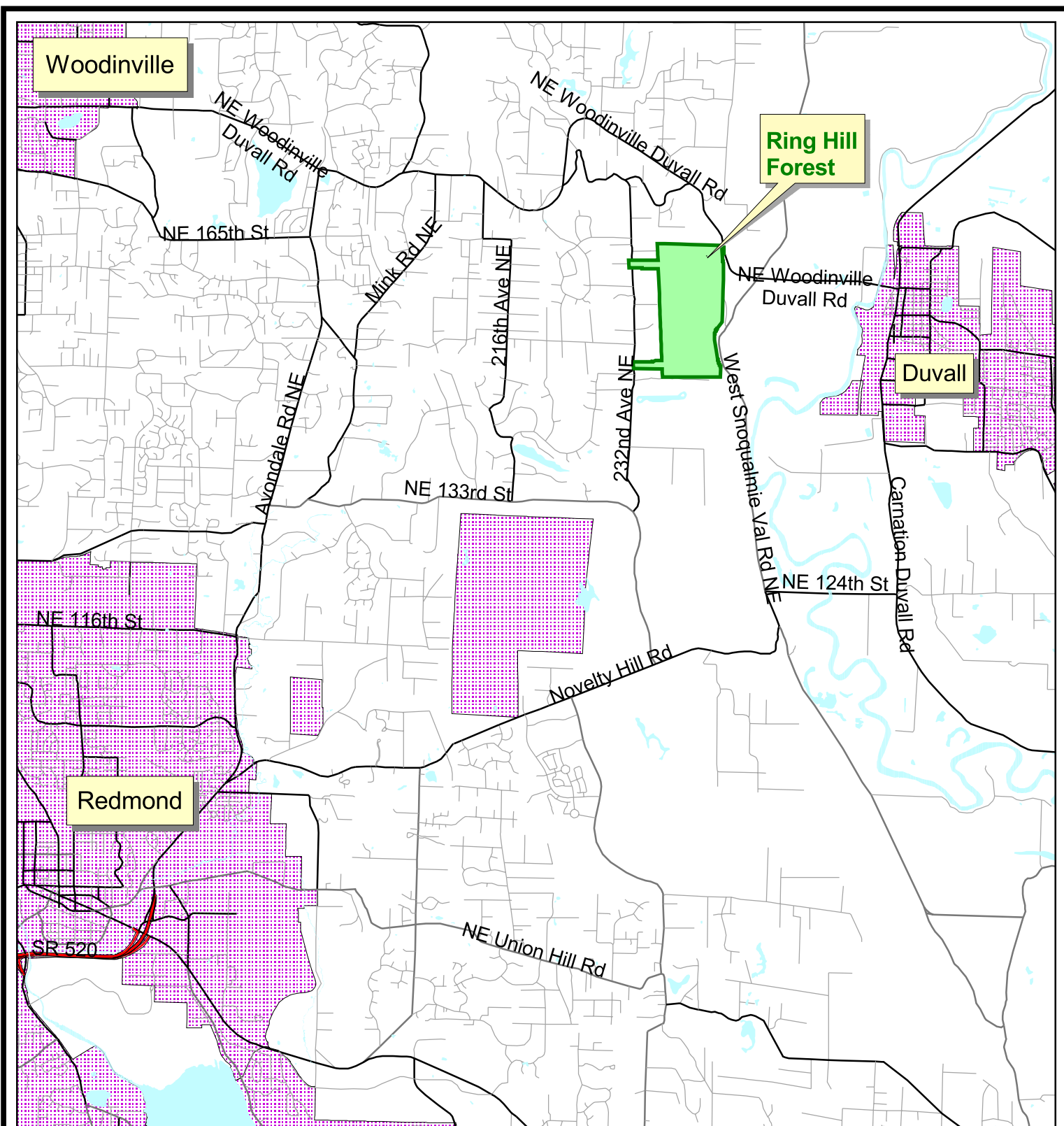
Stand	Acres	Species	Volume	Grade distribution (MBF)												pulp	SEE%
			Net MBF	Peel	J-o.g.	J-s.g.	C-x	Lo-C	K-x	J-spx	ld	2d	3d	4d			
Development 1 (Incl D4)	26	Doug.-fir	16			4	3		3				4	2			
		Hemlock	67				2		22			7	8	15	12		
		Cedar	26										22	2	1		
		Alder	21										3	9	9		
		Maple	15										4	4	7		
		Cottonwood	7								6			1			
		Hem dead	4									3	1				
		Subtotal	154														19
Development 2	84	Doug.-fir	60			4	13	3	7	5		1	19	8			
		Hemlock	426				22	13	88	4			140	154	5		
		Cedar	63										50	13			
		Alder	76											50	25		
		Maple	100								8	26	8	10	49		
		Cottonwood	42									25		3	14		
		Subtotal	768														7.
Development 3	5	Doug.-fir	53			25			13	5		2	6	2			
		Hemlock	3						1					3			
		Cedar	2										1				
		Alder	7									1	2	2	2		
		Subtotal	66														22
Total Development	115	Doug.-fir	130			33	16	3	23	10		4	29	12			
		Hemlock	496				24	13	112	4		7	148	171	17		
		Cedar	91										74	16	1		
		Alder	104									1	5	61	37		
		Maple	115								8	26	12	14	56		
		Cottonwood	49								6	25		4	14		
		Hem dead	4									3	1				
		Total	988														7
Open 1	4	Doug.-fir	9			5		1	1				1	1			
		Hemlock	47		3	8	5	13			3	7	6	2			
		Cedar	12									8	4				
		Subtotal	68														26

Stand	Acres	Species	Volume Net MBF	Grade distribution (MBF)												SEE%
				Peel	J-o.g.	J-s.g.	C-x	Lo-C	K-x	J-spx	ld	2d	3d	4d	pulp	
Open 2	39	Doug.-fir	32			5	5		11	3		2	2	4		10
		Hemlock	169						48	9			59	49	5	
		Cedar	42										27	9	6	
		Alder	33										26		7	
		Maple	56									10	3	10	33	
		Cottonwood	31	11								11		2	7	
		Cherry	5										4	1		
		Subtotal	368													
Open 3	101	Doug.-fir	58			35		13					6	5		8
		Hemlock	220			54		4	80	10		6	22	44		
		Cedar	123										108	14		
		Alder	160									11	26	72	51	
		Maple	342								143	57	46	16	81	
		Cottonwood	25								21	5				
		Subtotal	929													
Open 4	5	Doug.-fir	6									3	2	1		18
		Hemlock	51			16	10	7	5	2		3	5	2	1	
		Cedar	13										12		1	
		Spruce	12			8	3					1				
		Maple	6								2	2			2	
		Subtotal	88													
Open 5	32	Doug.-fir	157			62	18	2	27	9		5	15	9	9	13
		Hemlock	119			5	14	3	25	19		2	15	36	2	
		Cedar	55									4	37	7	7	
		Spruce	3										2			
		Alder	18											15	3	
		Maple	30									9	11	5	5	
		Cottonwood	3									3				
		Subtotal	385													

Stand	Acres	Species	Volume Net MBF	Grade distribution (MBF)												SEE%
				Peel	J-o.g.	J-s.g.	C-x	Lo-C	K-x	J-spx	ld	2d	3d	4d	pulp	
Open 6	11	Doug.-fir	250		5	107	55	24	5	11		8	21	6	9	5
		Hemlock	29			6			16					5	2	
		Cedar	30									13	17			
		Alder	12										3	6	3	
		Maple	6									4			2	
		Sub Total	327													
Open 7	8	No Volume														
Open Total	200	Doug.-fir	512		5	215	78	40	43	23		17	48	25	18	7
		Hemlock	635			83	32	19	188	41		14	106	141	11	
		Cedar	274									17	209	35	13	
		Spruce	15			8	3					1	2			
		Alder	223									11	55	94	63	
		Maple	441								144	83	60	30	123	
		Cottonwood	59	11							21	19		2	7	
		Cherry	5										4	1		
		Total	2,164													
Non-forest	8															
Total	323	Doug.-fir	642		5	249	94	42	66	33		21	77	37	18	4
		Hemlock	1131			83	57	32	299	45		22	254	312	28	
		Cedar	365									17	283	50		
		Spruce	15			8	3					1	2			
		Alder	328									12	61	155		
		Maple	556								152	109	72	44		
		Cottonwood	108								26	44		6		
		Cherry	9									3	5	1		
		Total	3153													

Table 3: Ring Hill Timber Inventory - Combined Statistics All Types

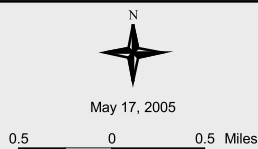
	Type	Vol/Ac	SEE	%	SD	# Plots	Acres
01		21,505	5,780	27	12,924	5	4
02		10,084	1,053	10	7,371	49	39
03		9,951	797	8	5,579	49	101
04		18,054	3,270	18	10,341	10	5
05		15,756	2,101	13	12,951	38	32
06		39,384	1,983	5	6,869	12	11
D1		8,201	1,545	19	8,028	27	26
D2		10,278	727	7	6,543	81	84
D3		17,163	3,643	22	9,638	7	5
Total						278	307
Average (Plot-weighted)		11,969	494	4	8,243		
Average (Acre-weighted)		11,969	460	4	7,676		
Development Areas Only							
D1		8,201	1,545	19	8,028	27	26
D2		10,278	727	7	6,543	81	84
D3		17, 163	3,643	22	9,638	7	5
Total						115	115
Average (Plot-weighted)		10,108	666	7	7137		
Average (Acre-weighted)		10,108	659	7	7063		
Open Space Areas Only							
01		21,505	5,780	27	12,924	5	4
02		10,084	1,053	10	7,371	49	39
03		9,951	797	8	5,579	49	101
04		18,054	3,270	18	10,341	10	5
05		15,756	2,101	13	12,951	38	32
06		39,384	1,983	5	6,869	12	11
Total						163	192
Average (Plot-weighted)		13,084	700	5	8,942		
Average (Acre-weighted)		13,084	628	5	8,021		



Ring Hill Forest

Figure 1 : Vicinity Map

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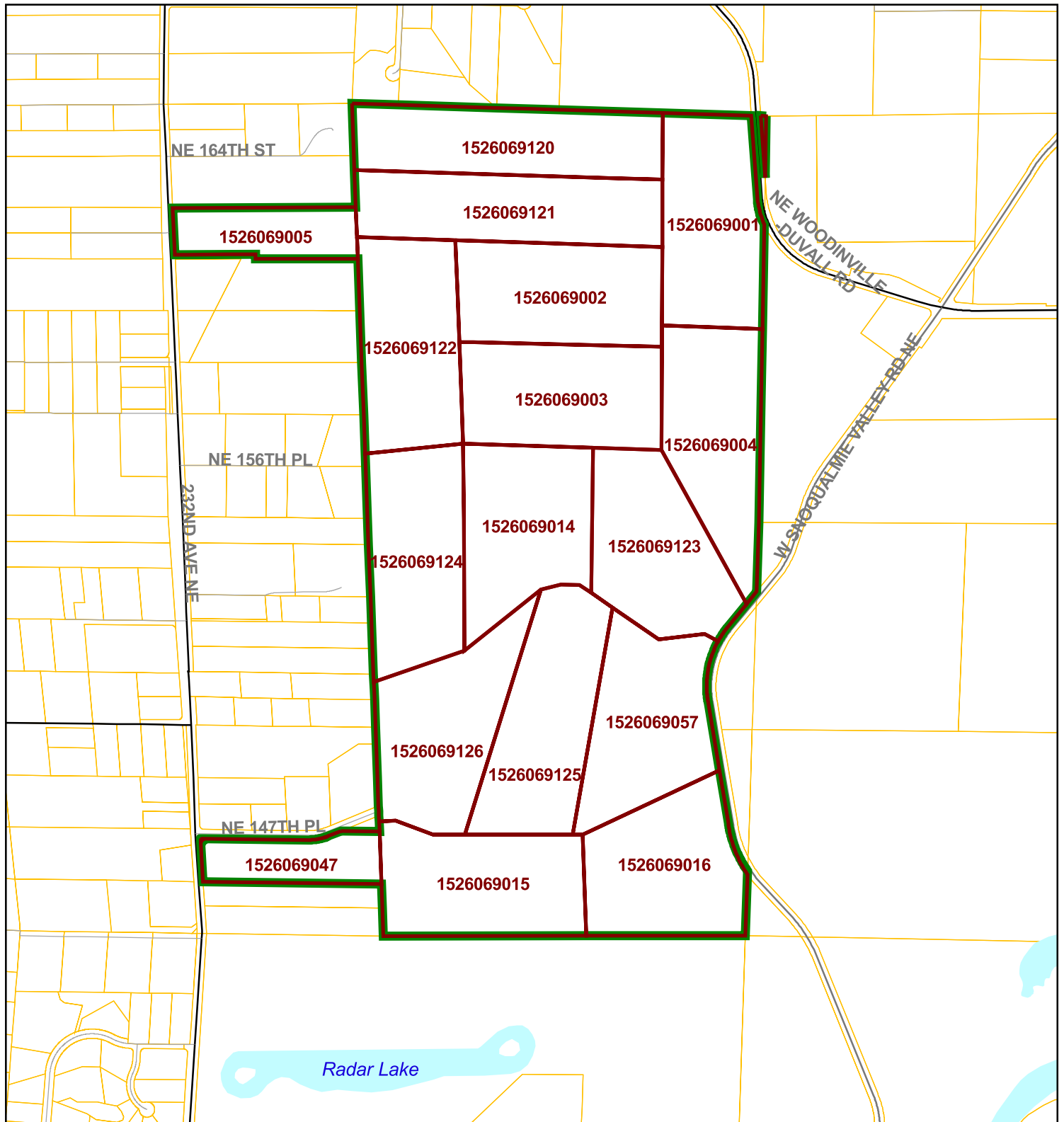
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- Ring Hill Forest
- Rivers and Lakes
- Incorporated Areas

King County Streets

- Freeway
- Arterial Roads
- Local Roads

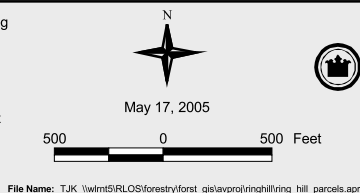
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Ring Hill Forest

Figure 2 : Parcels

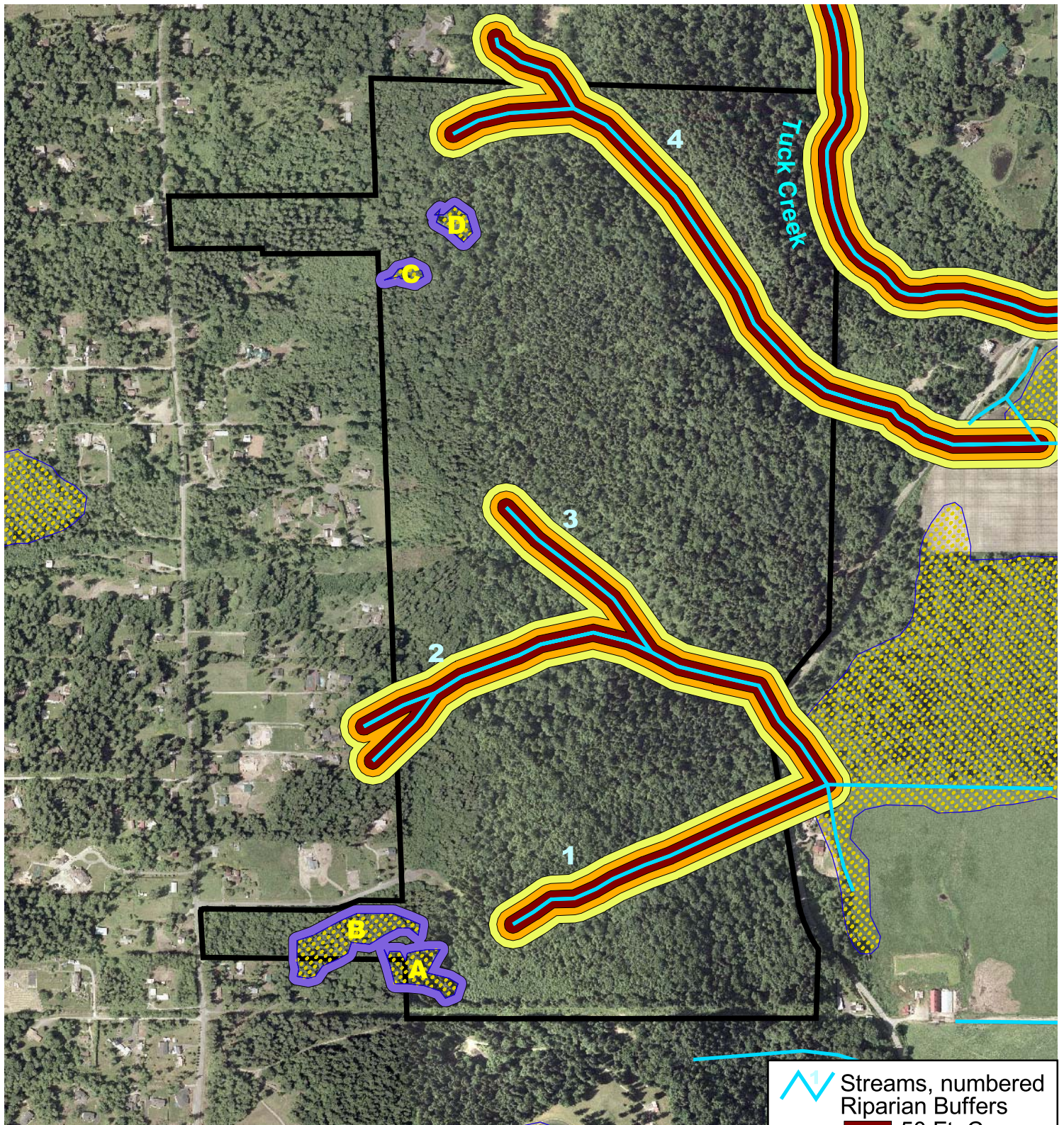
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Legend

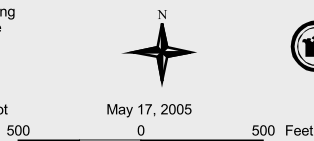
- Ring Hill Parcels
- Ring Hill Forest Boundary
- Parcel Boundaries
- Water Bodies



Ring Hill Forest

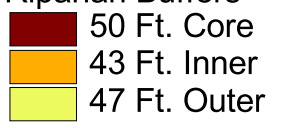
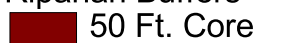




Figure 3 : Streams and Wetlands

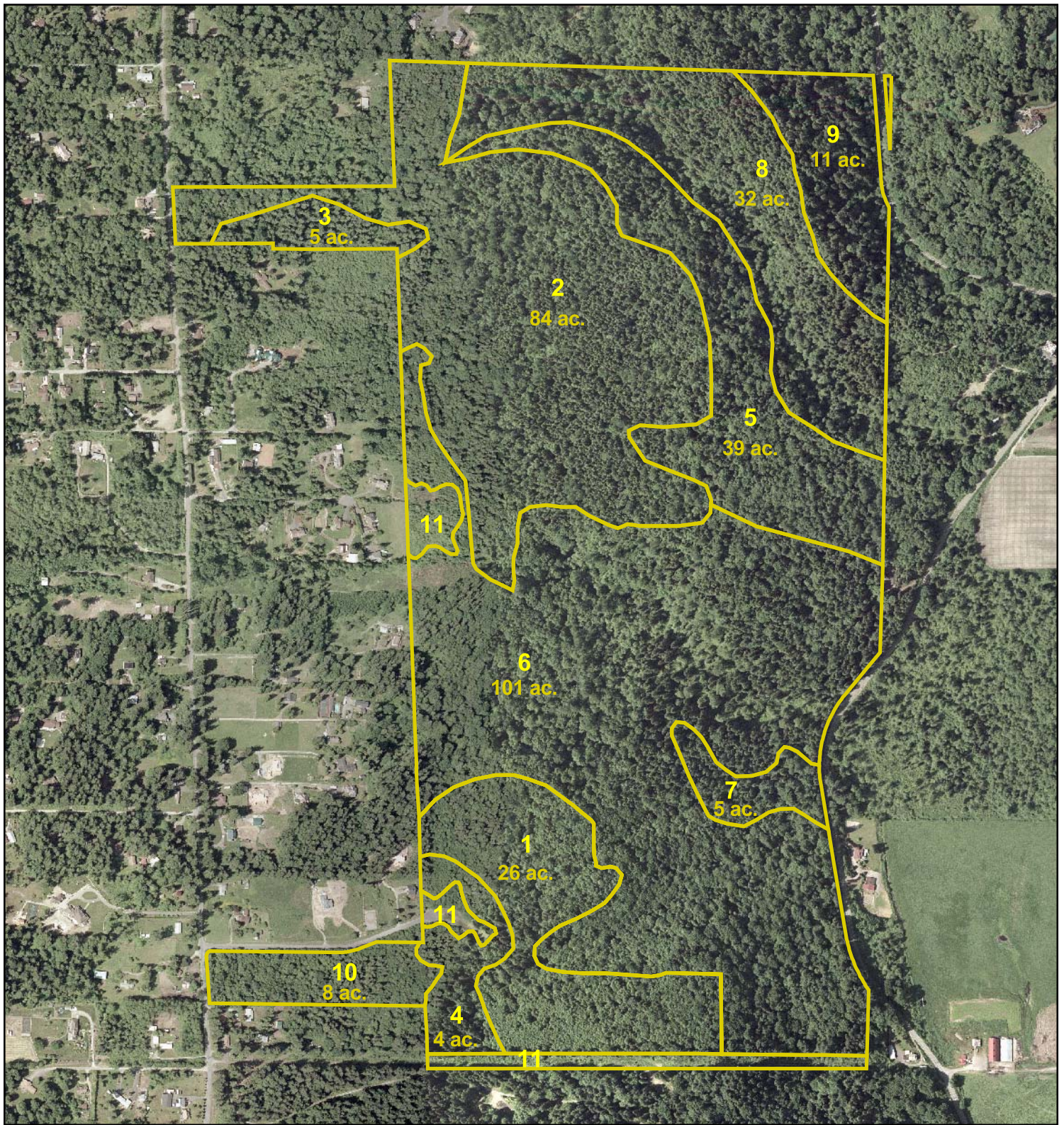
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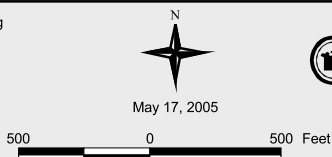
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-  Riparian Buffers
 -  50 Ft. Core
 -  43 Ft. Inner
 -  47 Ft. Outer
-  Forested Wetlands, numbered
-  Wetland Buffers
-  Ring Hill Forest Boundary
- Date of Photography: Summer 2002



Ring Hill Forest

Figure 4 : Timber Stands

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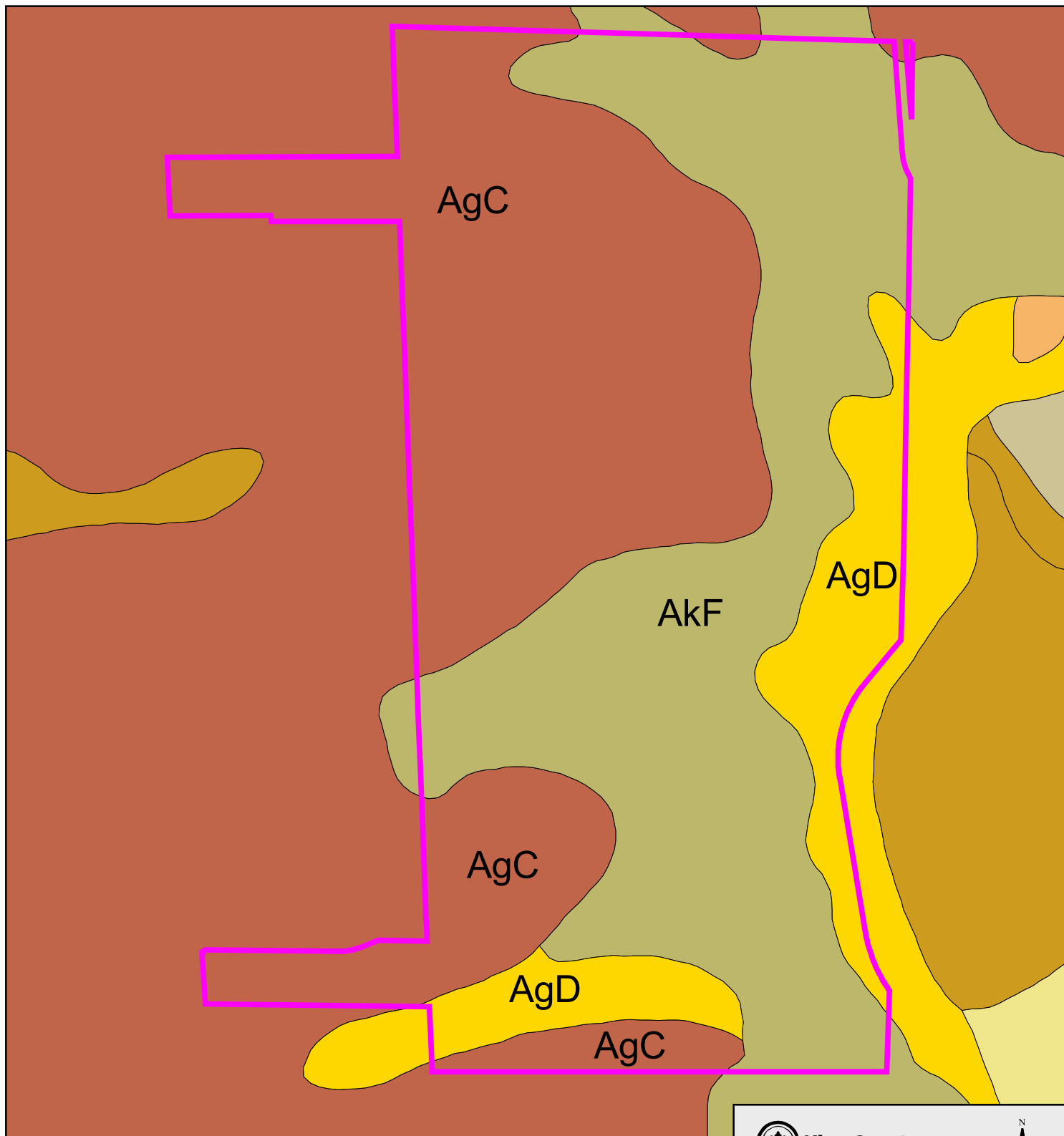


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File Name: T:\K \wlm\5r\os\Forestry\Forst_GIS\avproj\ringhill\ring_hill_stands.apr

- Timber Stand Boundaries
- 5 Timber Stand Number

Date of Photography:
Summer 2002






Ring Hill Forest

Figure 5 : Soil Types

 Ring Hill Forest Boundary

Soil Types

-  AgC ALDERWOOD GRAVELLY SANDY LOAM, 6 TO 15 PERCENT SLOPES
-  AgD ALDERWOOD GRAVELLY SANDY LOAM, 15 TO 30 PERCENT SLOPES
-  AkF ALDERWOOD AND KITSAP SOILS, 30 TO 70 PERCENT SLOPES

500 0 500 Feet



King County

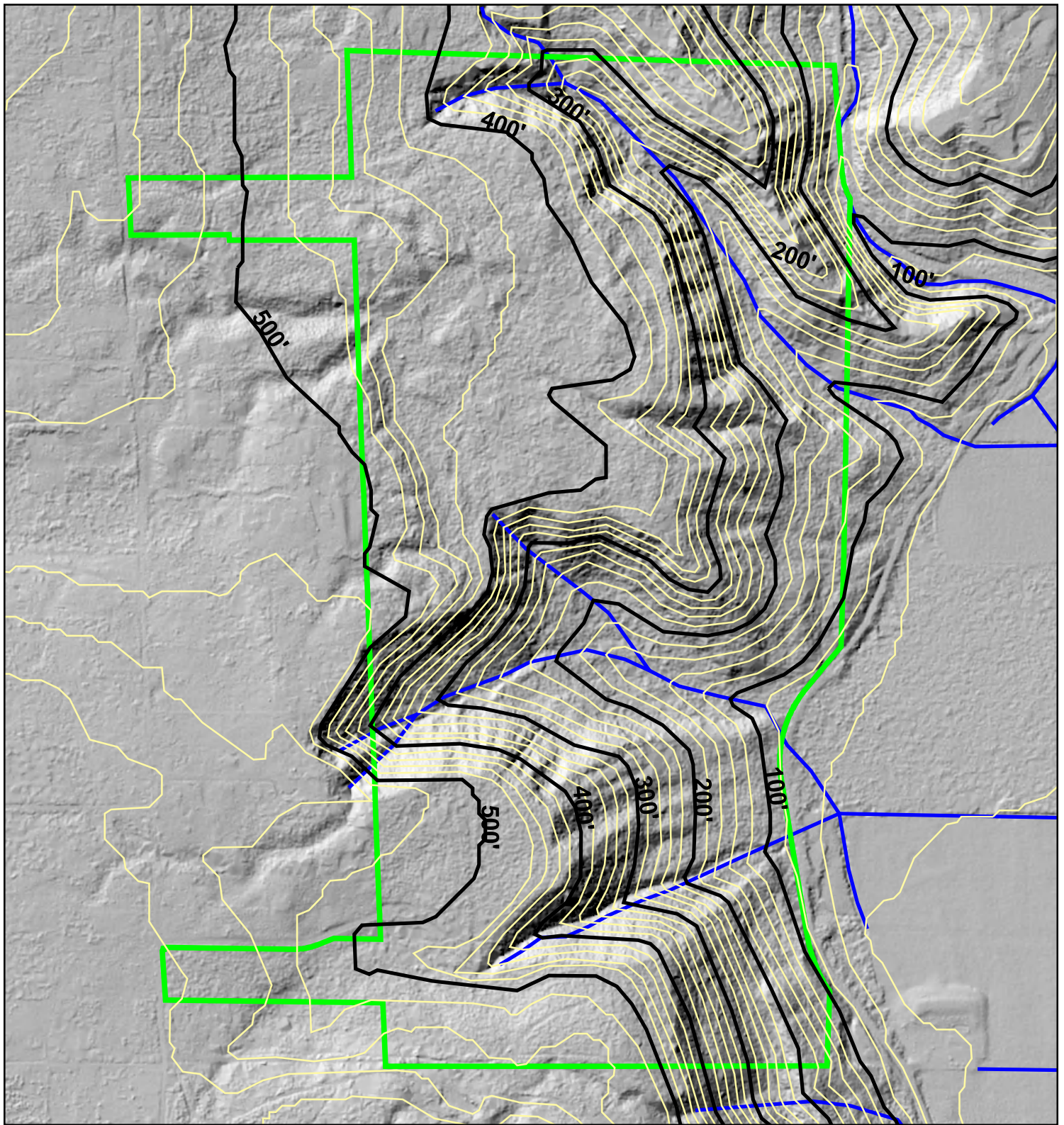
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May 13, 2005

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Ring Hill Forest

Figure 6 : Topography

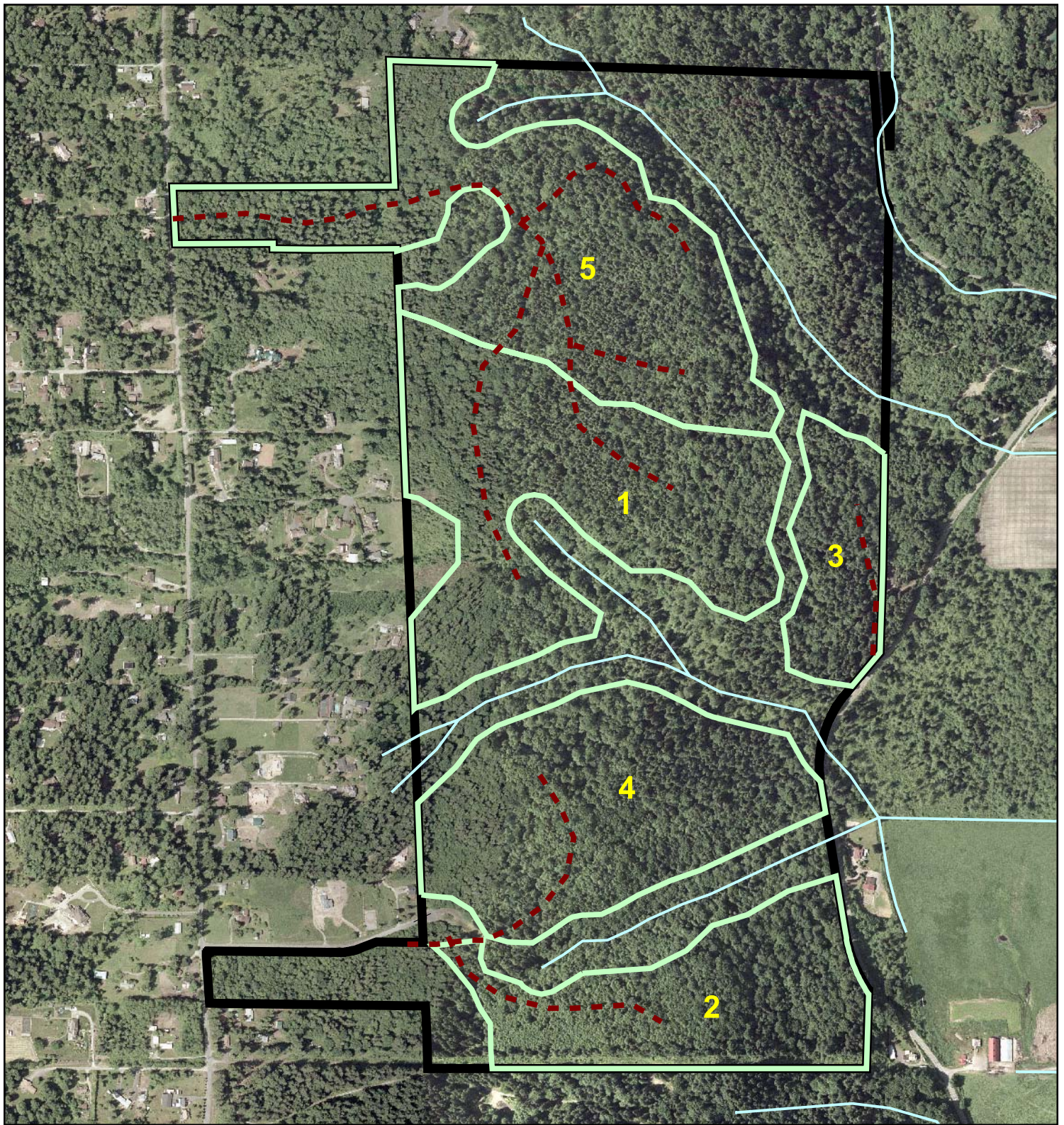
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-  100 ft Contour lines
-  20 ft Contour Lines
-  Ring Hill Forest Boundary
-  Streams

File Name: TJK \wlmr\src\Forestry\Forest_GIS\avpro\ringhill\ring_hill_topo.apr



Ring Hill Forest

Figure 7: Potential Harvest Units

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File Name: T:\K \wlm5\roa\Forestry\Forst_GIS\avproj\ringhill\ring_hill_harvest.apr

-  Streams
-  Proposed Harvest Roads
-  Potential Harvest Units
-  Ring Hill Forest Boundary

Date of Photography:
Summer 2002