

NEWBERRY HILL HERITAGE PARK FOREST STEWARDSHIP PLAN

MANAGING NHHP'S FOREST ECOSYSTEMS
FOR HEALTH AND DIVERSITY



FOREST STEWARDSHIP PLAN

MANAGING NHHP'S FOREST ECOSYSTEMS FOR HEALTH AND
DIVERSITY

KITSAP COUNTY PARKS AND RECREATION

Jim Dunwiddie, Director
1195 NW Fairgrounds Rd, Bremerton, WA 98311
360-337-5350
www.kitsapgov.com/parks/

Approximately 1200 acres bordered on the north by
Newberry Hill Road and the west by Seabeck Highway to a
point south approximately equal to the intersection of
Seabeck Highway and Holly road..

Prepared by: Frank Stricklin, Arno Bergstrom, and Tom Coleman
January 2013



FORESTRY STEWARDSHIP PLAN

CONTENTS

CONTENTS	3
ACKNOWLEDGEMENTS	4
DESCRIPTION OF NATURAL RESOURCES STEWARDSHIP OBJECTIVES	6
Vision	6
Goals	6
Objectives	7
GENERAL PROPERTY DESCRIPTION	8
Acquisition History, Funding Sources, and Deed Restrictions	8
Vegetation	9
Ecological Classification	9
Trees	10
Hazard Trees	10
Shrubs	10
RESOURCE DESCRIPTION AND RECOMMENDATIONS	11
RESOURCE CATEGORY I: FOREST HEALTH	12
RESOURCE CATEGORY II: FOREST TREE INVENTORY	13
RESOURCE CATEGORY III: SOILS	14
RESOURCE CATEGORY IV: WATER QUALITY, RIPARIAN, AND WETLAND AREAS	14
RESOURCE CATEGORY V: FISH AND WILDLIFE HABITAT	15
RESOURCE CATEGORY VI: THREATENED AND ENDANGERED SPECIES	17
RESOURCE CATEGORY VII: HISTORIC AND CULTURAL RESOURCES	18
RESOURCE CATEGORY VIII: AESTHETICS AND RECREATION	19
	3

RESOURCE CATEGORY IX: SPECIAL FOREST PRODUCTS	20
STEWARDSHIP TIMELINE	20
FIRE RISK REDUCTION STRATEGIES FOR NHHP	20
SUMMARY CHECKLIST AND SIGNATURE PAGES:	23
APPENDICES	24
Appendix 1: Mapping Units	24
Appendix 2: Percentage of Trees Per ACRE (Conifers)	27
Appendix 3: Percentage of Trees Per ACRE (Hardwoods)	28
Appendix 4: Replacement Trees	29
Appendix 5: Trees Per Acre and Volume	30
Appendix 6: Age Distribution	31
Appendix 7: Forest Stand Conditions/Prescriptions	33
Appendix 8: Total Volume	59
Appendix 10: RMAP Culvert Inventory and Road Maintenance Plan	63
Appendix 10: Soil Types	70
Appendix 11: Trail Map	73
Appendix 12: Timeline for Variable Density Thinning (VDT)	74

ACKNOWLEDGEMENTS

Kitsap County Staff

Jim Dunwiddie, Director of Parks and Recreation

Dori Leckner, Parks Superintendent

Lori Raymaker, Stewardship Coordinator

Volunteers

Arno Bergstrom

Frank Stricklin

Tom Coleman

Karina Ellis

Dylan Vaughn

Camden Kolb

Ron Cleveland

Bill Wasson

Ann Avery

Chris Butler-Minor

Kathy Howard

DESCRIPTION OF NATURAL RESOURCES STEWARDSHIP OBJECTIVES

VISION

Newberry Hill Heritage Park has a complex forest structure, supporting a diverse population of animals, high productivity for plants, and a replenishment of the water cycle.

The Forest Stewardship Plan for Newberry Hill Heritage Park emphasizes ecosystem management, a process that considers the environment a complex system functioning as a whole, not as a collection of parts. It also recognizes the environmental and social values of people. This ecosystem management approach will rely heavily on partnerships with park stewards, as well as private, tribal, local, state, and federal government stakeholders. The ecosystem approach will:

- Work *with* nature: Work with native plant species that have evolved and adapted to our climate and are competitive and resistant to disease and insects.
- Provide forest wildlife habitat: Structurally diverse forests provide the best habitat for the greatest number of wildlife species
- Diversify species: Forests of mixed native tree species improve habitat, aesthetics, and the value of both timber and non-timber assets and better support diverse wildlife populations.
- Recognize the true value of forest ecosystems: The stewardship of the park's forests must not have a short-term view, but rather work as a dynamic and adaptive process that will benefit the county for centuries to come.
- Protect Water as a vital resource: Healthy, vibrant forest ecosystems are the best and least cost option for maintaining high water quality and for the management of surface and storm water runoff.

GOALS

A successfully implemented forest stewardship plan for Newberry Hill Heritage Park will meet four basic goals, which are closely related and not mutually exclusive. A successful program:

- Enhances natural forest ecosystem complexity and health
- Protects and enhances soil, water quality, and fish and wildlife habitat
- Is biologically, socially and economically self-sustaining
- Provides safe, reasonable and appropriate public access to county forestlands

Through this forest stewardship plan, Kitsap County will realize the full range of benefits and values of the Newberry Hill Heritage Park in a manner consistent with the county's

overarching goal of a growing community where natural resources and systems are sustained for the benefit of current and future generations.

OBJECTIVES

The goal of the NHHP forestry management plan is to improve the ecological diversity of the park. Timber stands, many of which were planted by the state Department of Natural Resources as commercial forests, currently lack the wildlife and vegetation diversity of a naturally grown forest in Western Washington. Many ecosystems in the park contain niches that are vacant because of early forest management practices, which lead to the creation of a monoculture by removing competing species. Park stewards hope to increase wildlife habitat by rectifying some of these past practices.

This can best be accomplished by:

- thinning stands that are overcrowded
- diversifying tree species
- planting selective species to fill biological niches

Inasmuch as the county plans to log only 200 acres commercially each year, NHHP would benefit from as much of the commercial and pre-commercial thinning as possible since it contains several stands nearing the end of their prime growth (50-70 years), beyond which tree health, girth, and longevity will suffer if the trees are not released.

Park stewards, in collaboration with the Forestry Stewardship Advisory Council and the Kitsap County Parks and Recreation Natural Resources Division will establish priorities for areas to be treated every five years or sooner if found necessary.

(See Appendix 8 for a current list of priorities)

In addition, the group will submit and maintain RMAP and other required permits and paperwork to state authorities as needed and with the guidance of the Kitsap County Natural Resources Division.

(See Appendix 9 for RMAP and culvert information)

GENERAL PROPERTY DESCRIPTION

NHHP is considered a “heritage” park, meaning at least 70% of it must be preserved in its natural state.

Newberry Hill Heritage Park (NHHP) is approximately 1200 acres of Kitsap County owned mixed conifer forests located within two separate watersheds. While the park itself is very primitive, it is located only a short distance from the retail hub of Silverdale. Klahowya Secondary, a public school serving grades 7-12, sits in the middle of the park and is connected via an easement to Newberry Hill Road. The property was logged as early as the 1870’s. It was later used by the Department of Natural Resources as School Forest land.

A stewardship group oversees and maintains the park and has been instrumental in the creation of this forestry management plan with the assistance of Arno Bergstrom, Director of the Kitsap County WSU Extension Agency. The NHHP Forestry Stewardship Plan will outline the group’s attempt to increase wildlife diversity, monitor forest health, and hasten trees’ progress to old growth status.

The stewardship group will collaborate with the Forestry Stewardship Committee and the Kitsap County Parks and Recreation Natural Resources Division to prioritize and assess all timberwork in the park.

ACQUISITION HISTORY, FUNDING SOURCES, AND DEED RESTRICTIONS

Newberry Hill Heritage Park came into existence as the result of long range strategic planning by Kitsap County government. This effort was accomplished by collaborating with several public agencies to protect the Chico Creek Watershed headwaters. Planners hoped the wetlands within the newly formed park would help protect an unnamed tributary to Wildcat Creek, provide late summer flow for salmonids, provide a wildlife corridor, ensure aquifer recharge, flood reduction, and allow low impact recreational use in this important watershed. The careful planning paid off.

Kitsap County purchased 623 acres of the Port Blakely Tree Farm for the Central Kitsap Greenway project in 2004. This purchase was funded by a grant from the Washington Wildlife and Recreation office for protection of urban wildlife. Funding was approximately \$750,000. (See Kitsap County Project 04-1457A.)

In 2004, Kitsap County acquired 247 acres adjacent to Newberry Hill Road. This piece was the first acquisition in a series of trades that would eventually become Newberry Hill Heritage Park. In 2009, Kitsap County traded 520 acres of the Port Blakely Tree Farm purchase to DNR for 520 acres strategically important to the preservation of the Chico Creek Watershed. 303 Acres of the 520, were set aside as an Urban Wildlife Conservation area.

Within these 303 acres is a Category 1 Washington State Natural Heritage Wetland. The exchange parcels abut DNR-managed Green Mountain State Forest in the southern end of what became the Newberry Hill Heritage Park.

In 2011 the final 315 acre parcel was re-conveyed to Kitsap County for use as a park. This land had been held in trust for Kitsap County by DNR and managed for timber production to generate revenue that in part benefited schools. Local residents have used the land for recreational pursuits for decades. Finally, in 2012, the state returned the last parcels of the property to the county, and the park was established.

VEGETATION

The parks forest has been impacted by man’s presence in many ways. Most evident is the lack of habitat diversity caused by commercial timber production. About 40% of the park’s land was managed by Washington State DNR for commercial timber production, and was replanted with Douglas fir after each harvest. Between harvests, competing species were suppressed or eliminated to increase lumber yields. These practices produced even aged plantations of Douglas fir.

Natural processes have impacted the park as well. Beaver, high winds and disease pockets have created openings in the forest that promote natural crown differentiation. Soils in the park were formed by repeated glaciations. Some soils are more productive than others creating larger trees than trees of the same age in less productive soil.

There are 23 groups of trees that are similar in age, specie composition, and/or vigor within the park, which have been mapped and separated into stands. Walking through the forest, these changes in forest structure are most obvious where soils change or manmade and natural disturbances have occurred. NHHP is a mosaic of stands, and each of these different stands has been mapped, documented, inventoried and given an ecological classification. Ecological classifications were determined by the successional stage and type of the dominant vegetation present.

ECOLOGICAL CLASSIFICATION

A	Old Growth	Defined as trees 200 years and older. Mix of shade tolerant understory trees and shrubs, decadent trees, snags, logs on the forest floor and canopy stratification
B	Simple	Trees of uniform age, spacing, height and lacking canopy and species diversity. Plantations and disturbed sites
C	Complex	Trees of different height, age, specie and spacing. Canopy stratification to some extent, some mature trees (70-200 years old)
D	Meadow	Existing open areas artificially maintained as an ecotone for raptors and bats (limited to 1-2 acres)

E	Hardwood Patch	Pure stands of hardwood trees Naturally occurring Red Alder stands, and small areas (1 to 2 acres) where conifer seedlings are removed to maintain a single species of hardwood to benefit wildlife
F	Wetland	TYPE A An area of 1/4 th acre or more covered by open water seven consecutive days between April 1 and October 1 st TYPE B An open area of 1/4 th acre or more that is vegetated with water tolerant plants and or shrubs. NHHP has 5 Type A wetlands and more than 20 type B wetlands
G	Forested Wetland	A forested area with an interspersed, seasonal high water table; subject to annual flooding with brief to long durations
H	Riparian	Those areas that interface land to streams. There are two riparian zones in NHHP, Little Anderson Creek and an unnamed tributary of Wildcat Creek.

TREES

The dominant forest conifer is Douglas fir (*Pseudotsuga menziesii*). Other tree species found include: Western hemlock (*Tsuga heterophylla*), Western white pine (*Pinus monticola*), shore pine (*Pinus contorta*), Western red cedar (*Thuja plicata*), grand fir (*Abies grandis*), red alder (*Alnus rubra*) bigleaf maple (*Acer nacrpyllum*) black cottonwood (*Populus balamifera*) paper birch (*Betula papyrifera*), bitter cherry (*Prunus emarginata*), and Pacific madrone (*Arbutus menziesii*).

Several hardwood species found in the park are important sources of mast (berries) for resident and migrating birds. They also contribute leaf litter to the forest that is essential to macro-invertebrates, which in turn form a food web that supports anadromous fish.

HAZARD TREES

There are hazards associated with standing dead timber, wind thrown trees that are leaning against other trees, and snags and branches precariously perched and ready to fall with a slight breeze. These hazards require attention when people or property is at risk of injury or damage by falling debris. Our logs on the forest floor and most of our standing dead trees are important wildlife habitats and a vital part of the ecosystem. Consideration of this must be included in all risk mitigation decisions.

SHRUBS

Salal (*Gaultheria shallon*) dominates well drained slopes where canopy densities allow adequate light to reach the forest floor, and evergreen huckleberry (*Vaccinium obatum*) can be found below the coniferous canopy along edges and openings throughout the park. Both these shrubs are important sources of soft mast (berries) for birds, as well as a commercial forest product for the floral industry. Other shrubs include: red huckleberry (*Vaccinium parvifolium*), Pacific rhododendron (*R. macropyllum*), kinnikinnick (*Arctostaphylos uva-ursi*), Western trumpet honeysuckle (*Lonicera ciliosa*), red elderberry (*Sambucus racemosa*), common snowberry (*Symphoricarpos albus*), and oceanspray (*Holodiscus discolor*), Indian plum (*Oemleria cerasiformis*), black hawthorn (*Crataegus douglasii*) Pacific ninebark (*Physocarpus capitatus*), baldhip rose (*Rosa gymnocarpa*), and Nootka rose (*Rosa nutkana*).

Shrubs of the rubus family are numerous and an important source of soft mast for birds. Salmonberry (*Rubus spectabilis*) is abundant near wetlands. Also present: black raspberry (*Rubus leucodermis*), thimbleberry (*Rubus parviflorus*), trailing blackberry (*Rubus ursinus*), hardhack (*Spiraea douglasii*), red flowering currant (*Ribes sanguineum*), Hooker's willow (*Salix hookeriana*), Pacific willow (*Salix lucida*), Scouler's willow (*Salix scouleriana*), Sitka willow (*Salix sitchensis*), Cascara (*Rhamnus purshiana*), dull Oregon-grape (*Mahonia nervosa*), and tall Oregon-grape (*Mahonia aquifolium*).

Absent from this list are the bryophytes, non-flowering plants, such as mosses and lichens. These are an important part of the forest biomass, but little is known about their contributions to the ecosystem. Epiphytic mosses and lichens can total 2.6 metric tons per hectare in old growth Douglas fir forests¹.

RESOURCE DESCRIPTION AND RECOMMENDATIONS

The Newberry Hill Heritage Park is managed by a stewardship group whose mission is to implement the guidelines below, which were derived from a series of public planning meetings in 2009-10:

GUIDING PRINCIPLES

- Celebrate the natural beauty and protect the ecological health of plant/wildlife communities and watershed headwaters
- Offer safe, inviting, and clear access points and way-finding throughout the park
- Maximize the park's educational potential for students and the larger community in safe and engaging ways
- Connect to nearby regional trail systems
- Offer a variety of non-motorized recreational uses appropriate to the ecological characteristics of the land and within the County's ability to build and maintain them
- Contribute to the park's role as a good neighbor to surrounding communities

In its efforts to protect the natural beauty, wildlife diversity, and overall health of the park, volunteers have conducted forest ecosystem analyses using the latest accepted forms of scientific measurement. Sample sections of forest stands are subjected to standardized plot analyses, measuring such datum as tree height, diameter, and condition. Also, trees are counted by species, and replacement trees are noted. These studies have raised serious concerns about the health of the forest.

Because the land was formerly maintained by the Department of Natural Resources, typical use involved an intensely commercial style logging and replacement regimen.

Stands would be densely planted, sometimes thinned, then clear-cut. The resulting stands of timber are far less conducive to wildlife habitat and forest health than old growth stands, which take thousands of years to form in a natural, undisturbed environment. Such logging practices result in uniform height stands dominated by a single species, typically Douglas fir.

Close planting and sometimes irregular thinning schedules often result in trees that are too near one another, encouraging diseases and increasing fire risk. Trees compete for nutrients and sunlight, and thus an entire stand of trees grows at a less than optimal rate and in a potentially unhealthy environment.

In addition, wildlife diversity is greatly diminished because of the uniform habitat. Animals, plants, reptiles, and insects, as well as microscopic organisms, adapt to specific ecosystems and are absent in such a monoculture.

The goal of this forestry stewardship plan is to attempt to create an environment at NHHP more nearly like that of a late seral stage, old growth forest. Multiple canopy heights will be established. Meadows and partially open areas will be created. Various species of evergreens and hardwood will be under-planted throughout the twenty-three identified stands in the park.

In all its endeavors, this plan's authors will refer to and reflect the Integrated Forestry Stewardship Policy guidelines set down by the Kitsap County Board of Directors.

RESOURCE CATEGORY I: FOREST HEALTH

- a) Existing resource condition: As indicated, managed logging in the park has greatly diminished overall habitat and species diversity. In addition, laminated root rot, pine blister rust, bark beetle infestations, Armillaria root rot, and heart rot can be found in many areas of the park. Some invasive species, notably Scotch broom and holly, infect much of the park. A small section of Japanese knotweed has been identified and quarantined on the Wildlife Trail, a main thoroughfare in the southern end of the park.
- b) Resources protection measures: Plot analyses have identified areas that need prophylactic care and/or diseased tree removal.
- c) Stewardship practice recommendations: Measurement and identification of root rot pockets is ongoing. Park stewards, with the help of the Kitsap County Noxious Weeds Department, are eradicating invasive species. Refer to Appendix 7: Forest Stand Conditions/Prescriptions for detailed information about the health of individual mapping units in the park.

RESOURCE CATEGORY II: FOREST TREE INVENTORY

- a) Existing resource condition: Every section of the park has been sampled by plot analyses. Certainly, some species that were not noted may occur in small numbers as volunteers due bird or wind distribution. Refer to Appendix 8: Total Volume for a complete tree inventory.
- b) Resources protection measures: Replanting will occur in areas where it is deemed appropriate. For instance, in a root rot pocket, after diseased trees are removed, resistant species would be planted. If a meadow is desired, little replanting of trees would occur.
- c) Stewardship practice recommendations: Limited pre-commercial and commercial thinning will be required in various areas of the park due to the nature of a Douglas fir plantation. While some thinning will be needed in isolated trouble spots, most stands are fairly uniform and can be treated as four common types.

COMPLEX CANOPY PRESCRIPTIONS

The first, complex canopy stands, should need little to no attention because they already possess the desired attributes of a healthy forest, i.e. diversified canopy heights, varied density, and a multi-age mix of various species.

SIMPLE CANOPY PRESCRIPTIONS

Single canopy stands, on the other hand, will need treatment. Thinning from below and for variable density will be our main goals in these stands. Areas such as this where trees are 50-70 years old would be a prime candidate for commercial thinning.

OLD GROWTH PRESCRIPTIONS

A third type of forest contains old growth, legacy trees. Our goal will be to assess the surrounding timber and decide how best to protect these senior trees. For instance, if a root rot pocket is located nearby, it would be a priority to remove diseased trees in a safe perimeter then plant resistant species between it and the old growth.

PRE-COMMERCIAL PRESCRIPTIONS

Finally, areas of trees too young to be of commercial value will need their initial or second thinning. In many cases, the DNR overplanted areas to account for mortality with the assumption that they would thin the stand in 8-10 years. However, funding, personnel, and land ownership issues have disrupted this cycle. These areas will require pre-commercial thinning.

PRESCRIPTION DATA

Each of these forest types can be found in the 23 discrete stands of timber in the park, which are referred to as mapping units. Mapping units are distinguished from each other by age of planting/harvest, soil type, growing conditions, and other silvicultural factors. See Appendix 1: Mapping Units for a detailed information about these discrete stands.

- d) Each mapping unit was extensively cruised to establish specific stand prescriptions. The data based on these field studies can be found in Appendix 7.

RESOURCE CATEGORY III: SOILS

- a) Existing resource condition: Soils vary greatly throughout the park. Refer to Appendix 10: Soil Types for specific stand maps and information.
- b) Resources protection measures: Minimal forest floor impact and soil compaction during thinning are high priorities of park stewards. Horse logging, minimal impact skidders, and/or other low-impact devices should be used to remove fallen trees.
- c) Stewardship practice recommendations: Stewards recognize that some damage to the forest floor and surrounding trees is inevitable. But all care will be taken to minimize these occurrences.

RESOURCE CATEGORY IV: WATER QUALITY, RIPARIAN, AND WETLAND AREAS

- a) Existing resource condition: Much of the park is comprised of wet areas, some permanent and some seasonal.

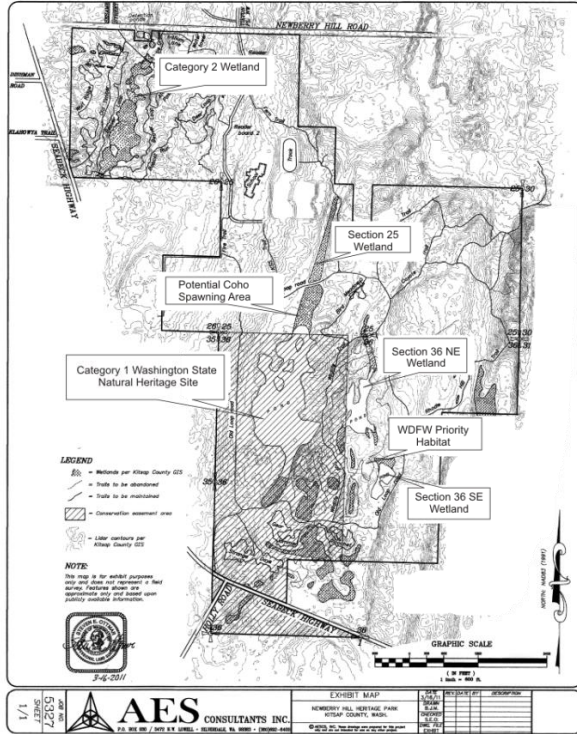
STREAMS

NHHP is situated within WRIA-15, and stores rainwater for two major Kitsap County watersheds. A 12 acre beaver pond at the northern end of the park forms the headwaters of the most westerly branch of Little Anderson Creek, which joins the mainstem north of the park and flows to Hood Canal. In the southern end of the park, two north/south oriented lowland valleys contribute water to the Chico Watershed, and drain to Dyes Inlet. Without sufficient elevation for a snowpack, Kitsap County streams are fed by rainwater that has been stored in shallow aquifers during the wet season. Beaver dams on the drainage form pools that feed an unnamed stream that joins Wildcat Creek. Both streams contain anadromous fish.

WETLANDS

There are many wetlands throughout the park. Most are small, with 90% persistent emerged woody plants and macrophytes. They remain wet year round. There are 23 of these

Major Wetland Locations



small wetlands, and they are rated Category IV under Washington DOE guidelines, and are rated Type B under forest practices law of Washington State.

There are five larger wetlands categorized as Type A under forest practices law, and the largest of these is rated Category 1 and has been designated as a Natural Heritage Site by DNR. A second wetland with a Category 1 rating is composed of a mature western red cedar stand that is annually flooded from October through May. The remaining three are currently being rated but should score high in habitat functions under DOE guidelines.

b) Resources protection measures: Buffers required by the State of Washington’s Forest Practices Act and the Kitsap County Critical Areas Ordinance are exceeded by 100% in

this plan.

c) Stewardship practice recommendations: The Forest Practices Act restricts activity in the inner-zone, places near streams and wetlands that would be sensitive to disturbance. Stewards feel that, while adequate, these measures should be more stringently applied in a sensitive area like the park’s setting. For example, there will be no log extraction within the inner zone.

RESOURCE CATEGORY V: FISH AND WILDLIFE HABITAT

a) Existing resource condition: Several areas within the park are considered priority habitats by the Washington State Department of Fish and Wildlife.

BIRDS FOUND IN NHHP²

Wood Duck	Mallard	Bufflehead	Ring Neck	Canada Goose
Hooded Merganser	Rufous Hummingbird	Pileated Woodpecker	Red-breasted Sapsucker	Band-tailed Pigeon
Hutton's Vireo	Bald Eagle	Steller's Jay	American Crow	Common Raven
Black-capped Chickadee	Red-breasted Nuthatch	Brown Creeper	Bewick's Wren	
Winter Wren		American Robin	Vaired Thrush	Golden-crowned Kinglet
Cedar Waxwing		Spotted Towhee	Dark-eyed Junco	
Pine Siskin	Northern Flicker	Cooper's Hawk	Tree Swallow	Yellow-rumped Warbler

The following birds are expected to be present based on observed habitats

Sharp-shinned Hawk	Great-horned Owl	Barred Owl	Downy Woodpecker
Hairy Woodpecker	Pacific-slope Flycatcher	Cassin's Vireo	Warbling Vireo
Red-eyed Vireo	Swainson's Thrush	Orange-crowned Warbler	Yellow Warbler
Townsend's Warbler	MacGillivray's Warbler	Wilson's Warbler	Western Tanager
Fox Sparrow	Black-headed Grosbeak	Purple Finch	

This is a conservative list. There will undoubtedly be more as different habitats are explored.

MAMMALS

Carnivora	Artiodactyla	Rodentia	Lagomorpha	Soricomorpha
Coyote (Canis latrans)	Black Tailed Deer	Mountain Beaver (Aplodonia rufa)	Eastern Cottontail (Sylvilagus foridanus)	Townsend's Mole (Scapanus townsendii)
Red Fox	Black Bear	Douglas	Snowshoe Hare	Pacific Mole

²Courtesy Kitsap Audubon, Vic and Idie Ulsh

(Vulpes vulpes)	(Ursus americanus)	Squirrel (Tamiasciurus douglasii)	(Lepus americanus)	(Scapanus orarius)
Cougar (Puma concolor)	Beaver (Castor Canadensis)	Northern Flying Squirrel (Glaucomys sabrinus)	Bobcat (Lynx Rufus)	Shrew Mole (Neurotrichus gibbsii)

This is a conservative list. In addition, several species of common rodents inhabit the park.

AMPHIBIANS

Red Legged Frog (Rana aurora)	Long Toed Salamander (Ambystoma macrodactylum)
Pacific Treefrog (Hyla regilla)	Rough Skinned Newt (<u>Taricha</u> granulosa)
Pacific Salamander	Northwestern Salamander (Ambystoma gracile)

- b) Resources protection measures: These priority habitats will be undisturbed. Extended buffers will completely remove these areas from log extraction operations.
- c) Stewardship practice recommendations: The science behind the state’s and county’s protection of sensitive areas is adequate in most locations; however, we have the luxury of exceeding minimum requirements in the park. Stewards believe it is better to err on the side of caution when sensitive fish and wildlife habitat is at risk.

RESOURCE CATEGORY VI: THREATENED AND ENDANGERED SPECIES

- a) Existing resource condition: No endangered species have been noted in the park at this time. However, there are small areas that have been designated by the state as potential marbled murrelet habitat. Coho salmon, a threatened species, exist in the southern end of the park.
- b) Resources protection measures: Viable, healthy salmon habitat within the park is under-utilized due to blocking or perched culverts.
- c) Stewardship practice recommendations: Stewards have developed a plan to replace and repair some of these culverts. Others will require extensive resources and inter-agency cooperation.

RESOURCE CATEGORY VII: HISTORIC AND CULTURAL RESOURCES

- a) Existing resource condition: The first humans to enjoy the beauty and natural resources of the Newberry Hill Heritage Park were Native Americans, who arrived sometime between 10-15, 000 years ago. While no evidence of Native American habitation has been found, it can be assumed that the Twana and Suquamish tribes used the area for fishing and hunting. It is also likely that a trail led to Silverdale, facilitating trade between Hood Canal and Puget Sound tribes.

Certainly the watersheds would have been crucial to salmonid rearing thousands of years ago. Salmon have been located by WDFW in the wetlands across Seabeck Highway, but inadequate culverts and other obstructions currently block access to the park's beaver ponds, which are part of the headwaters of Little Anderson, Big Beef, and Chico Creeks. Ancient Twana and Suquamish tribal members would have certainly enjoyed the abundance of fish that used to migrate to these streams.

The next group of humans to use the park was early pioneers in the 1850's in Kitsap County, taking advantage of homesteading acts to create farms. The only evidence in the park that may point to early settlers are the collapsed and rotting remains of a tiny shack near the south end of the Wildlife Trail. Its use and history remain unknown.

Loggers arrived next, with the earliest evidence of axes and two-man saws occurring somewhere near the 1870's. With one of the largest mills in the nation in nearby Seabeck, it would have been relatively easy to market the huge, old-growth timber.

According to longtime resident, Keith Asbury, fire ravaged this area in the 1880's. Charcoal inside axe-cut springboard notches supports this claim, and evidence of fire can be found throughout the park near the surface of the forest floor. Because of the DNR's practice of slash burning and smaller, naturally occurring fires, it is difficult to date all of the fires that have occurred in the park.

Hunters, trappers, and local outdoors enthusiasts took advantage of the logging roads and yarding areas to access the park. Residents in the area relate using the park for various purposes for multiple generations of their families.

- b) Resources protection measures: No evidence of sensitive historical or cultural use has been found in the park.
- c) Stewardship practice recommendations: Stewards have found metal debris and disturbed land harkening back to the early days of logging in the park. If the debris is innocuous, it is usually left in place as a reminder to visitors of the working forest that once echoed to the sounds of misery whips and double-bit axes.

RESOURCE CATEGORY VIII: AESTHETICS AND RECREATION

- a) Existing resource condition: Besides being a sanctuary for wildlife, a valuable aquifer regenerator, and a protected place to grow late seral stage forests, NHHP provides various opportunities for citizens to enjoy the park. It fills the county's need to provide a more rural setting than some of the smaller, urban parks.

PUBLIC USE

The playfields on the site belong to the county but are maintained and primarily used by Klahowya Secondary School. These are available to the general public when not in use by the school. While the park is closed to motorized vehicles, many people ride horses, hike, and mountain bike there. The park is also used by geocachers, mushroom hunters, and long-distance runners. Klahowya Secondary School's sports teams use the trails for conditioning, and cross-county meets are held there. In addition, KSS students utilize the park as an outdoor classroom, conducting ecosystem experiments and studying logging history first hand.

ACCESS

Access to the park is currently somewhat limited because of parking. When school is in session, users must park on the side of the road, but the KSS parking lot is available after 2:30 on weekdays and all day on the weekends.

A gated entrance in the south controls access to the main DNR logging road (*Old Loop*) that circles the lower park, and two kiosks mark trailheads (*Flying Eagle* and *IMBA*) in the north end. Three small trails also enter the park, one off of Seabeck Highway (*Old Timber*) and two from Newberry Hill Road (*Beaver Loop* and *Little Creek*). Residents of the Whisper Ridge housing development may enter the park from a private trail on the east side of the park. A parking lot is currently being planned behind Fire Station 56 on Seabeck Highway.

TRAILS

Approximately fifteen miles of trails give access to park users. Most are multi-use trails, but some are limited to foot traffic or prohibit horses. Three trails (*Strange Days*, *Gear Jammer*, and *Ricochet*) in the south end are primarily used by mountain bikers. Trails within the south wetland area, a Recreation and Conservation Office easement site, are limited to foot traffic only except for *Wildlife Trail*, a legacy skid road that runs down the center of the two main wetlands there.

An approved trail plan was filed by the NHHP Stewardship Group in 2010 and is available on the group's website at www.friendsofnhnp.com.

See Appendix 11: Trail Map for location of trails in the park.

- b) Resources protection measures
- c) Stewardship practice recommendations

RESOURCE CATEGORY IX: SPECIAL FOREST PRODUCTS

- a) Existing resource condition: Other than wood for timber or pulp, brush picking of salal, huckleberry, and boughs provide a source of revenue. Kitsap County maintains a contract with a brush picking company, which is renewed annually. Citizens also pick mushrooms in the park.
- b) Resources protection measures: Activities of illegal, non-permitted brush pickers have occasionally caused problems in the park. Non-approved trails made to access prime brush are an example of this. Also, mushroom pickers have cause off-trail soil compaction in some areas of the park.
- c) Stewardship practice recommendations: One of the best safeguards against illegal brush picking is the maintenance of an active contract with a legitimate brush company. After all, legitimate pickers only make money if the resource their company has paid for is not abused, which often happens in the case of illegal picking. Stewards contacted the Kitsap Mycological Society in 2012 and expressed their concern about off-trail use, and the club promised to pass this information on to its members.

STEWARDSHIP TIMELINE

In the short-term, stewards expect to conduct more plot summaries of areas requiring pre-commercial or commercial thinning. While large-scale logging on state and federal land focuses on generating revenue, park stewards are more interested in a varied and healthy habitat for trees and the wildlife that depend on them. As each mapping unit's needs are addressed, this priority will guide ongoing, "feet-on-the-ground" surveys of areas to be thinned.

A longer-term goal is to treat all of the park over a 15-30 year period. Some areas are in urgent need of intervention now while others need only to be left alone. These long-term priorities are reflected in Appendix 12: Timeline for Variable Density Thinning (VDT).

FIRE RISK REDUCTION STRATEGIES FOR NHHP

The objective of fire risk mitigation in the park is to reduce the potential for a crown fire. There is no way we can alter the weather or topography of the park. This leaves us with control and distribution of fire fuels as our only viable option for reducing the intensity of a fire. If successful, this strategy would not prevent fire, which is a natural part of the environment, but reduce a fire's intensity by limiting it to a ground fire or surface fire. Reducing the potential for a fire to occur and

creating a defensible space are other options that are compatible with long range goals and objectives for this park.

Ground fires: least damaging and limited to duff with no visible flames (smoldering)

Surface fires: produce a flame front and can be destructive

Crown fires: most destructive with flames spreading from tree crown to tree crown

Recognition of the role of fire in maintaining natural ecosystems³

Historical records show that wildfires have been a part of the natural environment for many centuries before the arrival of Europeans. A single fire that occurred on the Olympic Peninsula circa 1700, burned from near the Elwha southerly to the Hood Canal as far as Belfair. Wildfires create new forests and contribute to the diversity of plants and habitats.

INTEGRATING FIRE MANAGEMENT WITH ECOSYSTEM MANAGEMENT

In addition to increasing plant and habitat diversity, employing variable density thinning (thinning from below) reduces the potential for a crown fire by increasing the spacing between trees. Thinning from below creates larger, more vigorous, and fire resistant trees and raises the base of tree crowns, thus reducing ladder fuels.

“THE COMMON DENOMINATOR IS FUEL⁴”

Efforts should be made to:

- Reduce surface fuels.
- Increase the height to the base of tree crowns.
- Increase spacing between tree crowns.
- Keep larger trees of more fire-resistant species.
- Promote more fire-resistant forests at the landscape level by reducing fuels both vertically and horizontally.

Following these principles accomplishes three goals:

1. Reduces the intensity of a fire, making it easier for firefighters to suppress.
2. Increases the odds that the forest will survive a fire. Small trees, shrubs, and other understory vegetation may be injured or killed, but larger trees in the stand will only be scorched, and soil damage also will be reduced.
3. Reduces the extent of restoration activities needed, such as replanting or erosion control measures.”

NHHP FIRE CONTROL GOALS

1. Access.

³ Fire Management for the 21st Century, James K Agee. Creating a Forestry for the 21st Century Kohm/Franklin

⁴ PNW 618 A Pacific Northwest Extension Publication

Oregon State University, University of Idaho, Washington State University

Maintain Old Loop as access for firefighting personnel and equipment
Maintain water/gas/sewer right of way for access to existing fire hydrants

2. Fuel reduction zones

Reduce fuel loading along trails by chipping or scattering

3. Shaded Fuel Breaks

Take advantage of topography and enhance moist areas by removing dead wood and ladder fuels while leaving groundcover to increase moisture retention reducing the potential for a fire.

4. Mineral soil firebreaks

Maintain a minimum of 30 foot crown separation across existing roads, (See RMAPS supplement) reduce fuels (noxious weeds and dead wood) reduce fuel load within 60 feet of firebreak and maintain as mineral soil firebreaks.

SUMMARY CHECKLIST AND SIGNATURE PAGES:

APPENDICES

APPENDIX 1: MAPPING UNITS

NHHP Mapping Units Section 1 (North)



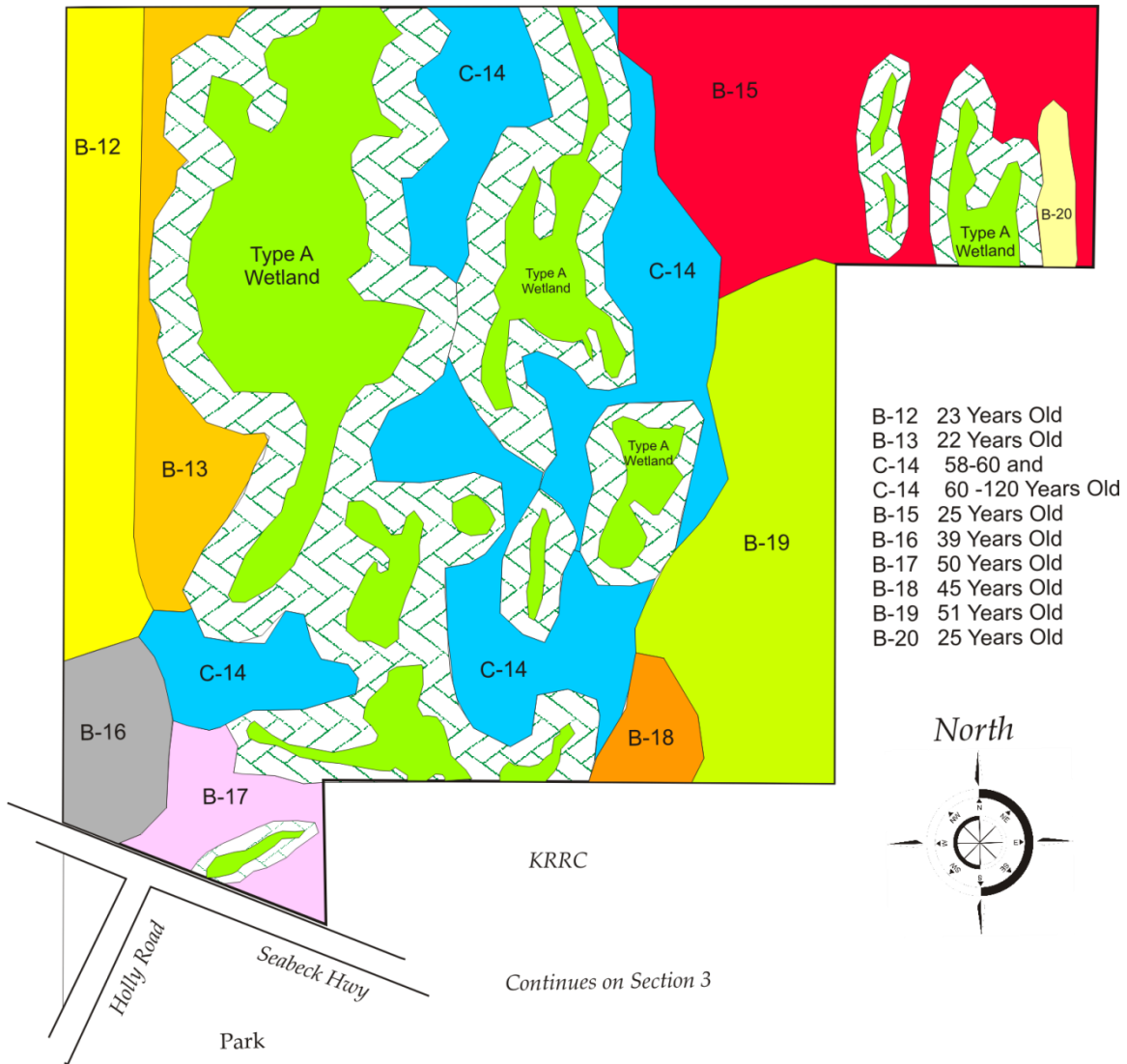
- B-1 28 Years Old
- C-2A 90 Years Old
- B-2B 75 Years Old
- B-3A 38 Years Old
- B-3B 40 Years Old
- C-4 74 Years Old
- B-5 39 Years Old
- B-6 25 Years Old
- B-7 30 Years Old
- B-8 81 Years Old
- B-9 29 Years Old
- B-10 25 Years Old
- B-11 44 Years Old
- B-15 25 Years Old

Continues on Section 2 (Central)

NHHP Mapping Units Section 2 (Central)

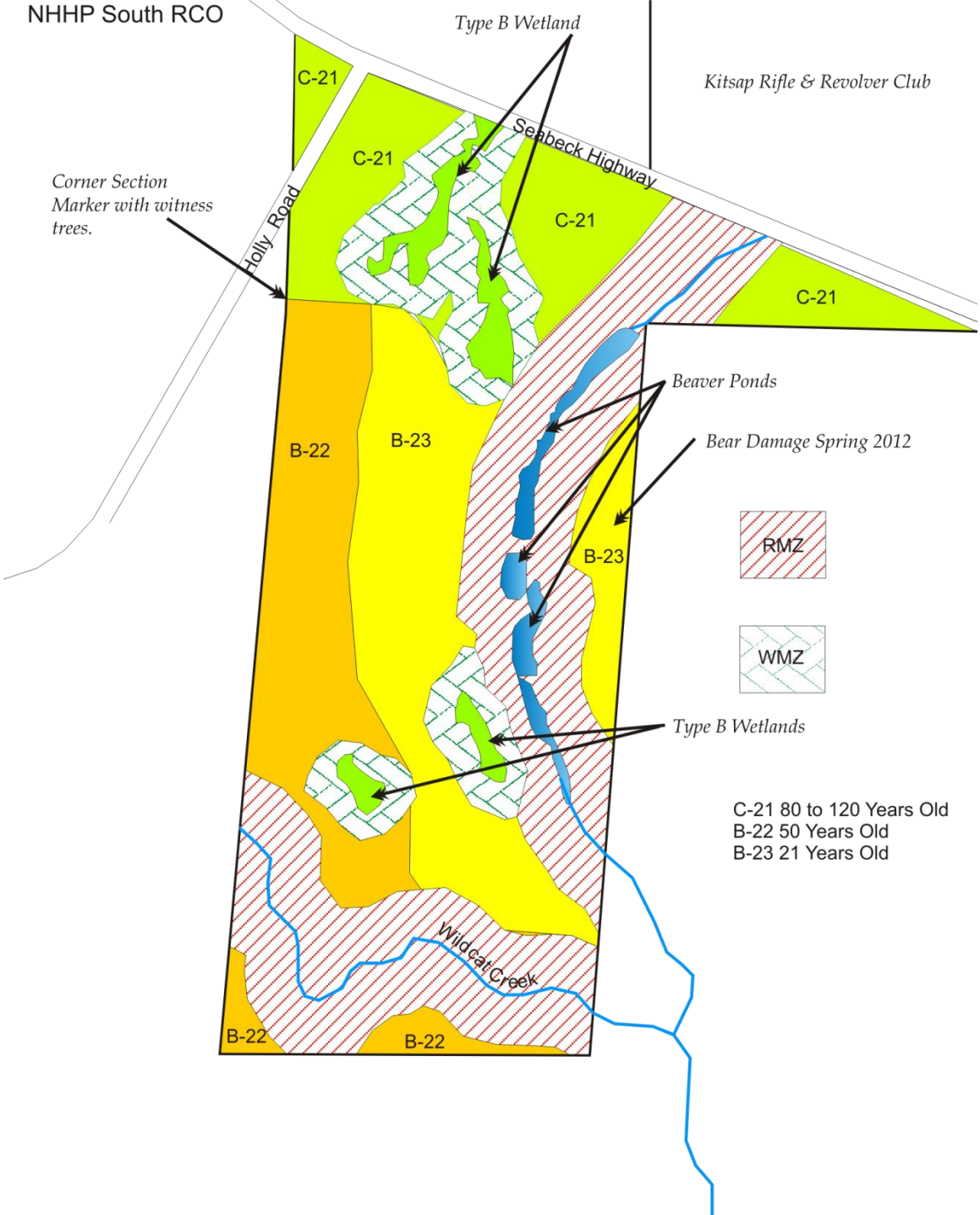


WMZ Type A Buffer = 200'
Type B Buffer = 100'



NHHP Mapping Units Section 3 (South)

NHHP South RCO



APPENDIX 2: PERCENTAGE OF TREES PER ACRE (CONIFERS)

Mapping Unit	Average TPA	% Douglas Fir	% Western Hemlock	% Red Cedar	% White Pine	% Shore Pine
1	318.12	79.69%	0.36%	2.48%	6.00%	0.00%
2A	212.00	44.34%	18.87%	33.96%	0.94%	0.00%
2B	286.96	66.18%	14.24%	11.21%	1.39%	0.00%
3A	210.65	88.00%	5.63%	3.06%	0.00%	0.00%
3B	212.83	97.61%	2.39%	0.00%	0.00%	0.00%
4	258.00	44.96%	21.71%	30.23%	1.55%	0.00%
5	162.44	86.11%	2.78%	8.33%	0.00%	0.00%
6	256.76	62.50%	6.25%	0.00%	18.75%	6.25%
7	300.00	95.00%	0.00%	0.00%	5.00%	0.00%
8	284.00	91.00%	3.00%	4.00%	2.00%	0.00%
9	233.33	72.86%	4.29%	7.14%	15.71%	0.00%
10	217.27	76.40%	9.77%	0.00%	6.86%	5.35%
11	199.51	94.36%	4.96%	0.00%	0.68%	0.00%
12	391.37	55.00%	45.00%	0.00%	0.00%	0.00%
13	764.18	90.00%	0.00%	0.00%	5.00%	5.00%
14	187.00	41.69%	20.32%	34.24%	0.53%	0.00%
15	235.20	97.75%	0.00%	0.00%	2.25%	0.00%
16	215.00	95.08%	0.00%	0.00%	4.92%	0.00%
17	208.47	52.07%	5.87%	6.58%	35.48%	0.00%
18	158.15	100.00%	0.00%	0.00%	0.00%	0.00%
19	277.78	54.00%	17.60%	22.00%	5.60%	0.00%
20						
21	190.83	35.78%	23.58%	30.13%	4.80%	0.00%
22	255.00	70.59%	5.88%	17.65%	0.98%	0.00%
23	598.81	90.77%	0.00%	2.55%	6.68%	0.00%
Average %		74.24%	8.85%	8.90%	5.21%	0.69%
% Conifer	97.90%					

APPENDIX 3: PERCENTAGE OF TREES PER ACRE (HARDWOODS)

Mapping Unit	Average TPA	% Red Alder	% Big Leaf Maple	% Aspen	% Willow
1	318.12	7.94%	3.53%	0.00%	0.00%
2A	212.00	1.89%	0.00%	0.00%	0.00%
2B	286.96	5.58%	1.39%	0.00%	0.00%
3A	210.65	3.31%	0.00%	0.00%	0.00%
3B	212.83	0.00%	0.00%	0.00%	0.00%
4	258.00	0.00%	1.55%	0.00%	0.00%
5	162.44	2.78%	0.00%	0.00%	0.00%
6	256.76	0.00%	0.00%	0.00%	6.25%
7	300.00	0.00%	0.00%	0.00%	0.00%
8	284.00	0.00%	0.00%	0.00%	0.00%
9	233.33	0.00%	0.00%	0.00%	0.00%
10	217.27	0.00%	0.00%	1.62%	0.00%
11	199.51	0.00%	0.00%	0.00%	0.00%
12	391.37	0.00%	0.00%	0.00%	0.00%
13	764.18	0.00%	0.00%	0.00%	0.00%
14	187.00	3.21%	0.00%	0.00%	0.00%
15	235.20	0.00%	0.00%	0.00%	0.00%
16	215.00	0.00%	0.00%	0.00%	0.00%
17	208.47	0.00%	0.00%	0.00%	0.00%
18	158.15	0.00%	0.00%	0.00%	0.00%
19	277.78	0.80%	0.00%	0.00%	0.00%
20					
21	190.83	5.70%	0.00%	0.00%	0.00%
22	255.00	4.90%	0.00%	0.00%	0.00%
23	598.81	0.00%	0.00%	0.00%	0.00%
Average %		1.50%	0.27%	0.07%	0.26%
% Hardwood		2.10%			

APPENDIX 4: REPLACEMENT TREES

Mapping Unit	Total Acres Covered	Red Cedar/Acre	Western Hemlock/Acre	White Pine/Acre	Big Leaf Maple/Acre	Red Alder/Acre	Total RTPA
1	1.12	46.54	45.65	151.26	13.43	0	256.87
2A	0.60	125.00	5.00	0	0	0	130.00
2B	1.15	81.74	26.09	0	0	0	107.83
3A	0.40	55.17	17.55	0	0	0	72.72
3B	0.27	25.82	29.51	0	0	0	55.33
4	0.50	68.00	6.00	0	0	0	74.00
5	0.44	54.73	120.87	52.45	0	0	228.05
6	0.10	0	135.84	62.70	0	0	198.54
7	0.11	0	75.12	56.34	0	0	131.46
8	0.40	22.50	5.00	0	0	0	27.50
9	0.30	6.67	23.33	40.00	0	0	70.00
10	0.38	0	21.15	21.15	0	0	42.29
11	0.85	29.40	217.54	16.46	0	0	263.40
12	0.10	0	123.84	412.80	0	0	536.64
13	0.07	0	101.01	173.16	0	0	274.17
14	1.00	43.00	12.00	1.00	0	0	56.00
15	0.25	3.95	126.53	134.44	0	0	264.93
16	0.30	6.67	66.67	50.00	0	0	123.33
17	0.28	7.14	21.41	92.77	0	0	34.00
18	0.26	108.65	34.92	31.04	0	0	174.62
19	1.00	44.00	18.00	3.00	0	0	65.00
20					0		
21	1.20	63.33	45.00	10.83	0	12.50	131.67
22	0.80	37.50	8.75	11.25	0	7.50	65.00
23	0.28	36.01	7.20	43.21	0	54.01	140.42

RTPA = Replacement Trees per Acre

APPENDIX 5: TREES PER ACRE AND VOLUME

Mapping Unit	% D Fir	Age	TPA	RTPA	Volume (MBF)/Acre	Total Volume (MBF) of
1	64.70 %	28	318.12	256.87	9.54	505.62
2A	44.34 %	90	212	130.00	70.38	3167.1
2B	72.73 %	75	286.96	107.8261	77.25	3476.35
3A	78.51 %	38	210.65	72.72	25.28	202.24
3B	95.34 %	40	212.83	55.33	21.28	319.20
4	44.96 %	74	258	74.00	47.4	379.2
5	79.28 %	39	190.56	228.05	17.15	583.10
6	39.06 %	25	256.76	198.54	7.70	115.50
7	100.00 %	30	300.00	131.46	30.00	960.00
8	69.01 %	81	284.00	27.50	27.82	500.76
9	72.86 %	29	233.33	70.00	17.10	820.8
10	59.08 %	32	217.27	42.29	12.60	529.20
11	87.38 %	44	199.51	263.40	17.96	2316.84
12	30.25 %	23	391.37	536.64	11.74	258.28
13	81.00 %	22	764.18	274.17	22.93	779.62
14	41.71 %	58-67/120	187.00	56.00	50.08	6009.6
15	94.41 %	25	235.20	264.93	14.11	1199.35
16	96.51 %	39	215.00	123.33	24.00	360
17		20				
18	100.00 %	45	158.15	174.62	23.72	260.92
19	54.00 %	51	277.78	65.00	39.42	2246.94
20		50				
21	35.81 %	125/80	190.83	131.67	49.79	1543.49
22	70.59 %	50	255.00	65.00	31.91	2552.8
23		21				

APPENDIX 6: AGE DISTRIBUTION

Mapping Unit #	Acres	Ages	Description	Pre - scri ption
1	53	28	Simple	PCT
2A	27	90	Complex	
2B	55	75	Simple	
3A	8	38	Simple	
3B	15	40	Simple	
4	8	74	Complex	
5	33	39	Simple	
6	15	25	Simple	PCT
7	32	30	Simple	
8	18	81	Simple	
9	48	29	Simple	
10	42	25	Simple	
11	129	44	Simple	
12	22	23	Simple	
13	34	22	Simple	
14	120	58-67/120	Complex	
15	85	25	Simple	
16	15	39	Simple	
17	12	20	Simple	
18	11	45	Simple	
19	57	51	Simple	
20	5	25	Simple	
21	30	125/80	Complex 10/Simple 20	
22	50	50	Simple	
23	15	21	Simple	PCT
	939			

Simple = Single Canopy PCT = Pre-commercial Thinning

Complex = Multiple Canopy

AGE DISTRIBUTION RANGES



Age Range	Acres
31 -70 (Simple)	318
71 + (Simple)	93
70+ (Complex)	165
Wetland/Stream/ <u>Riparian</u>	<u>261</u>
	837

APPENDIX 7: FOREST STAND CONDITIONS/PRESCRIPTIONS

Mapping Unit	Species	Age	Acres	Trees/Acre
1	Douglas Fir	28	53	300+

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Tree Species	Replacement Trees / Acres
150+	84/106/123*	9.5	WH/RC/BM	250

*west to north strip (20 acres) is Kapowsin gravelly loam SI 123

CONDITION

This 53 acre unit has a simple/single canopy and was planted with Douglas fir seedlings in 1986 following a clear-cut harvest in 1985. Douglas fir makes up 80 percent of the unit followed by: 2.3 percent Western hemlock; 5.3 percent Western white pine; 3.8 percent red alder; 3.8 percent big leaf maple. Much of this unit is extremely overstocked with an additional 100 + dead trees per acre. Unit was never pre-commercially thinned. This unit has very high fire hazard potential and generally poor wildlife habitat.

PRESCRIPTION

Pre-commercial thinning is recommended to reduce competition and fire hazard followed by Variable Density Thinning (VDT) with in 10-15 years to promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species.
Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
2A*	D. Fir/R. Cedar	90/300+	27	200+

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Tree Species	Replacement Trees / Acres
140	111 Alderwood	70	RC/WH	130

*this stand has two DF canopies, one 90 years & one 300+ years

CONDITION

Complex Canopy made up of an old growth Douglas fir canopy with a mature Douglas fir/Western red cedar second canopy. A third understory canopy made up of 130 trees per acre, Western red cedar (96%) and Western hemlock (4%), is developing. Douglas fir makes up 70 percent of the standing tree volume followed by Western red cedar at 18 percent and Western Hemlock at 12 percent. Due to the dense canopy, understory vegetation is sparse. Holes in the canopy are occurring where Western white pine have die from blister rust, thus reinvigorating understory/ground cover vegetation. Some evidence of Douglas fir root rot has also created canopy opening. Some of the largest, 7 ft diameter, and oldest old growth Douglas fir, 300-400 years old, occur in this ecotype.

PRESCRIPTION

Establish permanent plots to monitor ecotype condition and change over time. Hazard tree assessments and management are needed along trails that traverse this unit. No commercial thinning is warranted for the foreseeable future. This unit represents the potential or future condition for most of Newberry Hill Heritage Park!
Monitor successional vegetation change and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
2B	D Fir/RC/WH	76	55	400

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
200	111 Alderwood	77	RC/WH	107

CONDITION

This 55 acre unit has a simple canopy with occasional, scattered old growth Douglas fir legacy trees with a standing volume of 77 MBF and a total unit volume of 4.2 million board feet. The 75 year old Douglas fir component makes up 89 percent of the unit with an equal amount Western red cedar and Western hemlock comprising 8 percent, followed by nearly amount of Western white pine, red alder and big leaf maple make up the balance. There are numerous root rot areas that are have been naturally reforested with Western red cedar, red alder and small numbers of Western white pine. Data collected show that there are 107 shade tolerant replacement trees per acre across the unit. This unit lacks complexity with vast areas with heavy shade condition due to high number of trees per acre. Heavily stocked mixed conifer stands have high percentage of intermediate and co-dominant trees, mostly Western hemlock, but some Douglas fir.

PRESCRIPTION

Variable Density Thinning (VDT) would promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species. Good candidate for horse thinning operation. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
3A	Douglas Fir	38	8	210

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Tree Species	Replacement Trees / Acres
100	111 Alderwood	25	RC/WH	70

CONDITION

Simple Canopy - This 8 acre unit was planted with Douglas fir seedlings in 1976 following a clear-cut harvest in 1975. Douglas fir makes up 97.5 percent of the unit followed by 2.5 percent Western hemlock; 5.3 percent. Average tree diameter is 13.85 inches and the standing volume is 25 MBF per acre. This unit was pre-commercially thinned approximately 20 years ago. Unit has a closed, single canopy with a moderately stocked forest understory. Understory plants include fern and sparse amounts of salal and evergreen huckleberry. There is an average of 72 shade tolerant replacement trees per acre, composed of 55 Western red cedar and 17 Western hemlock per acre. This unit is a long strip that front Newberry Hill Road and is very visible to the public.

Prescription

Variable Density Thinning (VDT) would promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species. Some under planting of shade tolerant trees is recommended to bring the number of replacement trees to at least 100 per acre. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
3B	Douglas fir	40	15	212

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100	111 Alderwood*	21	RC/WH	55

*north 10 % is Alderwood with balance being 106 Shelton

CONDITION

This unit is a plantation with a single/simple canopy that is 97.5 percent Douglas fir. It was pre-commercially thinned 20+ years ago and has a 2.5 percent Western hemlock component. With 200+ trees per acre there is crown closure limiting the establishment of shade tolerant replacement trees. Understory vegetation is low to medium density providing very little wildlife mast. There are several small (less than 14 acre) root rot centers that have opened up the canopy allowing light to regenerate some understory brush species.

PRESCRIPTION

Variable Density Thinning (VDI) would promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species. Some under planting of shade tolerant trees is recommended to bring the number of replacement trees to at least 100 per acre. Clear root rot areas and plant hardwoods as needed. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
4*	DF/W Hemlock	74	8	250

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100	111 Alderwood	47	RC/WH	74

*This small has a few (>5) legacy Douglas fir dating from 1730.

CONDITION

This a unique and somewhat complex 8 acre forest ecotype near the entrance to Klahowya Secondary School and bordering Newberry Hill Rd. Last harvested in mid 1930's this unit was naturally re-seeded resulting in unique second growth forest. Remnants of the original old growth Douglas fir forest remain as both standing and blow down. This unit is also a small drainage feeding Little Anderson Creek. Douglas fir comprises 45 percent of the stand with Western red cedar having 30 percent, Western hemlock at 22 percent, followed by Western white pine and big leaf maple having equal part of the remaining 3 percent. There are 74 shade tolerant replacement trees per acre in the understory. Recent storms have resulted in significant blow down in the wetter soils resulting in jacks straw trees across the drainage. One complete old growth Douglas fir specimen, having fallen 50+ years ago due to saturated soils, is located in this unit. One tree inventoried was a 280 year old Douglas fir measuring 24 inches in diameter.

PRESCRIPTION

Establish permanent plot to monitor ecotype condition and change over time. No commercial thinning is warranted. This unit represents the potential or future condition of Newberry Hill Heritage Park!
Control noxious and invasive plant species. Monitor changes in vegetation and wildlife usage.

Mapping Unit	Species	Age	Acres	Trees/Acre
5	Douglas Fir	39	33	190

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100	111 Alderwood	17	WH/RC/WP	228

CONDITION

This unit is a plantation with a single/simple canopy that is 92 percent Douglas fir. It was pre-commercially thinned 20 years ago and has a 5 percent Western red cedar, and equally split, 3 percent component, of Western hemlock and red alder. With 190 trees per acre there is crown closure limiting the establishment of viable shade tolerant replacement trees. Understory vegetation is low to medium density providing very little wildlife mast. There are several small (less than 1/4 acre) root rot centers that have opened up the canopy allowing light to regenerate some understory brush species.

PRESCRIPTION

Variable Density Thinning (VDT) would promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species. Some under planting of shade tolerant trees is recommended to bring the number of replacement trees to at least 100 per acre. Clearing root rot areas of infected Douglas fir and planting red alder is recommended. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
6	Douglas Fir	25	15	256

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100	111 Alderwood	7	WH/WP	200

CONDITION

This unit is a young plantation with a single/simple canopy that is 64 percent Douglas fir. It was not pre-commercially thinned has a 17 percent Western white pine, a three equal, 6+ percent components, of shore pine, Western hemlock and willow. With 256 trees per acre there is crown closure limiting the establishment of viable shade tolerant replacement trees. Understory vegetation is low to medium density providing very little wildlife mast. There are several small (less than 1/4 acre) root rot centers that have opened up the canopy allowing light to regenerate some understory brush species.

PRESCRIPTION

Pre-commercial thinning is recommended to reduce competition and fire hazard followed by Variable Density Thinning (VDT) with in 20 years to promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species.
Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
7	Douglas fir	30	32	300

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
150	84/106 Shelton	30	WH/WP	130

84 is Shelton extremely gravelly sandy loam; balance is 106 Shelton

CONDITION

Last harvested in 1981, this unit is a plantation with a single/simple canopy that is 95 percent Douglas fir. It was pre-commercially thinned 10-15 years ago and has a 5 percent Western white pine component. At 300 trees per acre there is crown closure limiting the establishment of viable shade tolerant replacement trees. Understory vegetation is low to medium density providing very little wildlife mast. Shade tolerant trees that could form a second canopy are in good supply and include 57 percent Western hemlock and 43 percent Western white pine seedlings and saplings. Ground and understory plants are low in number due to heavy canopy shade. Wildlife benefits have steadily declined since crown closure occurred 15-20 years ago.

PRESCRIPTION

Variable Density Thinning (VDT) would promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species.
Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
8	Douglas Fir	81	18	220

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	106 Shelton	43	RC/WH	27

CONDITION

This 18 acre unit has a simple canopy, with a handful of old growth Douglas fir legacy tree, has a standing volume of 59 MBF and a total unit volume of 1.07 million board feet. The 81 year old Douglas fir component makes up 91 percent of the unit with nearly equal amount Western hemlock, Western red cedar and Western hemlock composing up the balance. Established after harvest in the late 1920's, this forest has extremely heavy old Evergreen huckleberry brush that standing 6+ feet high. Data collected show that there are only 27 shade tolerant replacement trees per acre across the unit. This unit lacks complexity with vast areas with heavy shade condition due to high number of trees per acre. Natural-thinning has occurred as is evident with many dead and down small diameters Douglas fir tree found. Live crown ratios for dominate Douglas fir range from 30-50 percent.

PRESCRIPTION

Variable Density Thinning (VDT) would promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species. Good candidate for horse thinning operation. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
9	Douglas Fir	33	48	240

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	106 Shelton	17	WH/WP/WH	70

CONDITION

Harvested in 1978, this unit is a plantation with a single/simple canopy that is 73 percent Douglas fir. It was pre-commercially thinned 15 years ago and has a 16 percent Western white pine component. At 240 trees per acre there is crown closure limiting the establishment of viable shade tolerant replacement trees. Understory vegetation is low to medium density providing very little wildlife mast. Shade tolerant trees that could form a second canopy are in good supply and include 40 percent Western white pine and 23 percent Western hemlock seedlings and saplings. Ground and understory plants are relatively low in number due to heavy canopy shade. Wildlife benefits have steadily declined since crown closure occurred after pre-commercial thinning.

PRESCRIPTION

At the current stand density of 240, the Douglas fir trees Western white pines are still growing quite well. Variable Density Thinning (VDT) in 5 to 10 years would promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
10	Douglas Fir	25	42	201

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
90	112 Grove	12	WP/WH/RC	42

CONDITION

Harvested in 1986, this unit is a plantation with a single/simple canopy that is 77 percent Douglas fir. It was pre-commercially thinned 10 years ago and has a 10 percent Western white pine component. At 201 trees per acre there is some crown closure that is limiting the establishment of viable shade tolerant replacement trees. Understory vegetation is low to medium density providing very little wildlife mast. Shade tolerant trees that could form a second canopy are in low supply. Of the 42 replacement trees per acre, 50 percent Western white pine and 50 percent Western hemlock seedlings and saplings. Ground and understory plants have a medium density due to canopy shade. Wildlife benefits continue to decline since crown closure occurred after pre-commercial thinning.

PRESCRIPTION

At the current stand density of 201, the Douglas fir trees Western white pines are still growing quite well. Variable Density Thinning (VDT) in 5 to 10 years would promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species. Under planting native shade tolerant trees is recommended after thinning. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
11	Douglas Fir	44	129	163

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
80	111 Alderwood	18	WH/RC/WP	260

CONDITION

This unit is a plantation with a single/simple canopy that is 93 percent Douglas fir. It was pre-commercially thinned 20 years ago and has a 7 percent Western hemlock component. With 163 trees per acre and an average tree diameter of 9.68 inches, there has been ample sun light for the natural propagation shade tolerant replacement trees. Understory vegetation is low to medium density due to the high density of replacement trees. Therefore this unit is providing limited wildlife mast. There are several small (less than 1/4 acre) root rot centers that have opened up the canopy allowing light to regenerate some understory brush species.

PRESCRIPTION

Variable Density Thinning (VDT) would promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species. Some under planting of shade tolerant trees is recommended to bring the number of replacement trees to at least 100 per acre. Clearing root rot areas of infected Douglas fir and planting red alder is recommended. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
12	Douglas Fir	23	22	390

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
130+	106/126*	11.7	WP/WH	500

*north end is 106 Shelton; south end is 126 Ragnar fine sandy loam

CONDITION

Harvested in 1988, this unit is a plantation with a single/simple canopy that now is 55 percent Douglas fir. It was not pre-commercially thinned and has a 45 percent Western white pine component. At 390 trees per acre there is crown closure that is limiting the establishment of viable shade tolerant replacement trees. Understory vegetation is low to medium density providing very little wildlife mast. Shade tolerant trees that could form a second canopy are in extremely high supply. Of the 500 replacement trees per acre, 76 percent Western white pine and 23 percent Western hemlock seedlings and saplings. Ground and understory plants have a very low density due to canopy shade. Wildlife benefits continue to decline with tree height growth and canopy closure. Stem exclusion will occur within the next 5 years. Site quality for southern portion of this unit is exceptionally good.

Prescription

At the current stand density of 390, the Douglas fir trees Western white pines are crowded and growing more slowly. Pre-commercial thinning is recommended to reduce the trees per acre to at least 100 stems per acre followed by Variable Density Thinning (VDT) with in 20 years will promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species. With careful pre-commercial thinning and VDT, under planting native shade tolerant trees may not be necessary. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
13	Douglas Fir	21	34	700+

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	112 Grove	23	WP/WH	274

CONDITION

Harvested in 1990, this unit is a plantation with a single/simple canopy that now is 90 percent Douglas fir. This unit was not pre-commercially thinned and has an equal amount of Western white pine and shore pine making up the remaining 10 percent. With 280 trees per acre there is crown closure that is limiting the establishment of viable shade tolerant replacement trees. Understory vegetation is low to medium density providing very little wildlife mast. Shade tolerant trees that could form a second canopy are in extremely high supply. Of the 274 replacement trees per acre, 63 percent Western white pine and 37 percent Western hemlock seedlings and saplings. Ground and understory plants have a very low density due to canopy shade. Wildlife benefits continue to decline with tree height growth and canopy closure. Stem exclusion will occur within the next 5 years.

PRESCRIPTION

At the current stand density of 700 trees per acre, the Douglas fir trees Western white pines are crowded and growing more slowly. Pre-commercial thinning is recommended to reduce the trees per acre by at least 250 stems per acre followed by Variable Density Thinning (VDT) with in 20 years to promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species. With careful pre-commercial thinning and VDT, under planting native shade tolerant trees may not be necessary. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

This unit is within the wetland setbacks; therefore all treatments will be non-commercial

Mapping Unit	Species	Age	Acres	Trees/Acre
14	DF/W Hemlock	67/120	120	380

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
150+	112 Grove	47	RC/WH/WP	56

CONDITION

This unit has the most complex canopy made up of a mature (120 year old) Douglas fir canopy with a second, (67 year old) Douglas fir second canopy. Western red cedar dominates this unit with the species ranging in age from Sapling to potentially 200 years. Western red cedar makes up 42 percent of the standing tree volume followed by Douglas fir at 37 percent and Western Hemlock at 16 percent. Due to the dense canopy, understory vegetation is sparse. Holes in the canopy are occurring where Western white pine have die from blister rust, thus reinvigorating understory/ground cover vegetation. Some evidence of Douglas fir root rot has also created canopy opening. Some of the largest diameter Western red cedar trees occur in this ecotype. A limited, yet third understory canopy made up of 56 trees per acre, Western red cedar (76%) and Western hemlock (23%), is developing as more light reaches through the forest canopy.

PRESCRIPTION

This unit is within the wetland setbacks; therefore all treatments will be non-commercial. Monitor successional vegetation change and wildlife usage. Control noxious and invasive plant species.
Hazard tree assessments and management are needed along trails that traverse this unit.

Mapping Unit	Species	Age	Acres	Trees/Acre
15	Douglas Fir	25	85	235

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	111 Alderwood	14	WP/WH/RC	264

CONDITION

Harvested in 1986, this unit is a plantation with a single/simple canopy that is 97 percent Douglas fir. The unit was pre-commercially thinned 8- 10 years ago and has a 3 percent Western white pine component. At 235 trees per acre there is crown closure that starting to limit the establishment of viable shade tolerant replacement trees. Understory vegetation is low to medium density providing very little wildlife mast. Shade tolerant trees that could form a second canopy are in good supply. Of the 264 replacement trees per acre, 50 percent Western white pine and 47 percent are Western hemlock seedlings and saplings. Ground and understory plants have a medium density due to canopy shade. Wildlife benefits continue to declined since crown closure occurred after pre-commercial thinning. There are several small (less than 14 acre) root rot centers that have opened up the canopy allowing light to regenerate some understory brush species.

PRESCRIPTION

Variable Density Thinning (VDT) in 10 years would promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species. Clearing root rot areas of infected Douglas fir and planting red alder is recommended. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
16	Douglas Fir	39	15	230

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	126 Ragnar	24	WH/WP/RC	123

CONDITION

This unit is a plantation with a single/simple canopy that is 95 percent Douglas fir. It was pre-commercially thinned 20 years ago and has a 5 percent Western white pine component. With 230 trees per acre there is crown closure limiting the establishment of viable shade tolerant replacement trees. Understory vegetation is low density providing very little wildlife mast. Of the 123 replacement trees per acre, 54 percent are Western hemlock, 40 percent are Western white pine and 6 percent are Western red cedar seedlings and saplings. Ground and understory plants have a medium density due to canopy shade. Wildlife benefits continue to decline since crown closure occurred after pre-commercial thinning. Site quality is exceptionally high and is reflected in the average diameter of tree 12 inches for this unit

PRESCRIPTION

Variable Density Thinning (VDT) would promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species. Some under planting of shade tolerant trees is recommended to maintain a adequate number of replacement trees per acre. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
17	Douglas Fir	21	12	280

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
50	112 Grove	7	WP/WH/RC	106

CONDITION

Harvested in 1990, this unit is a poorly stocked (50%) plantation with a single/simple canopy that now is 59 percent Douglas fir. This unit was not pre-commercially thinned and has 31 percent Western white pine and 10 percent Western hemlock. Invasive species comprise most to the open spaces. Where there is understory vegetation it is low to medium density providing very little wildlife mast. Shade tolerant trees that could form a second canopy are limited to areas where there is no competition from invasive plants. Of the 106 replacement trees per acre, 76 percent are Western white pine, 18 percent Western hemlock and 6 percent are Western red cedar seedlings and saplings. Where there is a canopy, ground and understory plants have a very low density due to canopy shade. Wildlife benefits continue to decline with tree height growth and canopy closure. Stem exclusion will occur within the next 5 years. Approximately 2 acres of this unit is a wetland boarding Seabeck Hwy.

PRESCRIPTION

Invasive species need to be controlled and native plants including tree, shrubs and grasses need to be established at a high enough density to restore this unit to a natural state. Where appropriate, pre-commercial thinning is recommended to reduce the trees per acre by at least 80 stems per acre followed by Variable Density Thinning (VDT) with in 20 years to promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species. With careful pre-commercial thinning, VDT, invasive species control, under planting native shade tolerant trees maybe minimal. This unit is within the wetland setbacks; therefore all treatments will be non-commercial. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
18	Douglas Fir	45	11	158

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100	112 Grove	24	RC/WH/WP	175

CONDITION

This unit is a plantation with a single/simple canopy that is 100 percent Douglas fir. It was pre-commercially thinned 25 years ago. With 158 trees per acre and an average tree diameter of 14 inches, there has been ample sun light for the natural propagation shade tolerant replacement trees. Understory vegetation is low to medium density due to the high density of replacement trees. Therefore this unit is providing limited wildlife mast. There are several small (less than 1/4 acre) root rot centers that have opened up the canopy allowing light to regenerate some understory brush species.

PRESCRIPTION

Variable Density Thinning (VDT) would promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species. Some under planting of shade tolerant trees may be required to preserve the number of replacement trees to at least 100 per acre. Monitor for root rot areas if areas become infected, harvest diseased Douglas fir and planting red alder. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
19	Douglas Fir	51	57	250

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	111 Alderwood	44	RC/WH/WP	65

CONDITION

This unit was harvested in 1962 and planted with 2 year old Douglas fir seedlings the following year. It is a plantation with a single/simple canopy that is 54 percent Douglas fir and naturally regenerated species consisting of 22 percent Western red cedar, 18 percent Western hemlock, 5 percent Western white pine and 1 percent red alder. With 250 trees per acre and an average tree diameter of 14 inches, there has been ample sun light for the natural propagation shade tolerant replacement trees. Understory vegetation medium density due to the canopy closure. This unit is providing moderate wildlife mast. There are a few small (less than 1/4 acre) root rot centers that have opened up the canopy allowing light to regenerate some understory brush species. Sloping terrain is less than 30 percent.

PRESCRIPTION

Variable Density Thinning (VDT) would promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and help establish a second canopy by releasing shade tolerant replacement trees. Some under planting of shade tolerant trees may be required to preserve the number of replacement trees to at least 100 per acre. Monitor for root rot areas if areas become infected, harvest diseased Douglas fir and planting red alder. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
20	Douglas Fir	25	5	250

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100+	111 Alderwood	9	RC/WH/WP	50

CONDITION

Harvested in 1986, this unit is a plantation with a single/simple canopy that is 90 percent Douglas fir. It was pre-commercially thinned 10 years ago and has a 10 percent combination of Western white pine, Western red cedar and Western hemlock. With a stocking rate of 250 trees per acre, crown closure is limiting the establishment of viable shade tolerant replacement trees. Understory vegetation is low to medium density providing very little wildlife mast. Shade tolerant trees that could form a second canopy are in low supply. Of the 50 replacement trees per acre, 50 percent Western white pine and 50 percent Western hemlock seedlings and saplings. Ground and understory plants have a medium density due to canopy shade. Wildlife benefits continue to decline since crown closure occurred after pre-commercial thinning.

Prescription

Variable Density Thinning (VDI) in 10 years would promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species.
Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
21	DF/RC/WH/WP	125/80	30	350

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
150	111/126*	49	RC/WH/WP	131

*111 Alderwood/126 Poulsbo Ragnar

CONDITION

This unit has the most complex canopy made up of a mature (125 year old) Douglas fir canopy with a second, (67 year old) Douglas fir second canopy. Western red cedar is a significant component in this unit with ages from sapling to specimens upwards of 200 years old. Douglas fir makes up 49 percent of the standing tree volume followed by Western red cedar at 27 percent, Western Hemlock at 18 percent, Western white pine 4 percent and red alder at 2 percent. Due to the dense canopy, understory vegetation is sparse. Holes in the canopy are occurring where Western white pine have die from blister rust, thus reinvigorating understory/ground cover vegetation. Red alder are also in decline and creating canopy openings. Some evidence of Douglas fir root rot has also created canopy opening. Some of the largest diameter Western red cedar trees in the park occur in this ecotype.

A limited, third understory canopy made up of 131 trees per acre, Western red cedar (48%) and Western hemlock (34%), Western white pine (8%) is developing as more light reaches the forest floor.

PRESCRIPTION

This unit has several wetland setbacks; therefore treatments in or near the wetland buffer will be non-commercial. A 10+ acre portion of this unit has a single/simple canopy would benefit from variable density thinning (VDT). This would promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species.

Hazard tree assessments and management are needed when trails are developed traversing this unit Monitor successional vegetation change and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
22	DF/WH/RC	61	50	260

% Stocking	Site Index Soil Type	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
120	112 Grove/126*	32	RC/WP/WH	65

*126 Ragnar sandy loam on western boundary along with 84 Shelton extreme

CONDITION

This unit was harvested in 1952 and planted with 2 year old Douglas fir seedlings the following year. It is a plantation with a single/simple canopy with 63 percent Douglas fir and naturally regenerated species consisting of 22 percent Western red cedar, 3 percent Western hemlock, 2 percent Western white pine and 10 percent red alder. With 260 trees per acre and an average tree diameter of 13 inches, there has not been ample sun light for the natural propagation shade tolerant replacement trees. Understory vegetation is low to medium density due to the canopy closure. This unit is providing moderate wildlife mast. There are a few small (less than 1/4 acre) root rot centers that have opened up the canopy allowing light to regenerate some understory brush species. Sloping terrain is less than 20 percent.

PRESCRIPTION

Variable Density Thinning (VDI) would promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and help establish a second canopy by releasing shade tolerant replacement trees. Some under planting of shade tolerant trees may be required to increase the number of replacement trees to at least 100 per acre. Monitor for root rot areas if areas become infected, harvest diseased Douglas fir and planting red alder. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species.

Mapping Unit	Species	Age	Acres	Trees/Acre
23	DF/WP	21	15	300

% Stocking	Site Index	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100	111 Alderwood	6	WP	80

CONDITION

Harvested in 1990, this unit is a plantation with a single/simple canopy that now is 90 percent Douglas fir. This unit was not pre-commercially thinned and has an equal amount of Western white pine and shore pine making up the remaining 10 percent. With 280 trees per acre there is crown closure that is limiting the establishment of viable shade tolerant replacement trees. Understory vegetation is low to medium density providing very little wildlife mast. Shade tolerant trees that could form a second canopy are in limited supply. Of the 80 replacement trees per acre, 80 percent Western white pine and 20 percent Western hemlock seedlings and saplings. Ground and understory plants have a very low density due to canopy shade. Wildlife benefits continue to decline with tree height growth and canopy closure. Stem exclusion will occur within the next 5 years. Observed significant bear damage primarily to Douglas fir trees; damage is estimated to have occurred on 15 percent of the fir trees.

PRESCRIPTION

At the current stand density of 300 trees per acre, the Douglas fir trees Western white pines are crowded and diameter growth is slowing. Pre-commercial thinning is recommended to reduce the trees per acre by at least 200 stems per acre followed by Variable Density Thinning (VDT) with in 15-20 years to promote increased vigor for largest diameter residual trees and promote increase complexity through the release of understory vegetation and shade tolerant tree species. With careful pre-commercial thinning and VDT, under planting native shade tolerant trees may not be necessary. Monitor pre and post thinning vegetation and wildlife usage. Control noxious and invasive plant species. Some portions of this unit are within the riparian/wetlands setbacks; all treatments in the setback areas will be non-commercial.

Mapping Unit	Species	Age	Acres	Trees/Acre
Wetland/Riparian	Willow/Alder/Conifers	Various	200-260	100-200

% Stocking	Site Index	Volume MBF Per Acre	Replacement Trees	Replacement Trees / Acres
100	N/A	N/A		

CONDITION

Wetland and riparian areas exist throughout the park. Timber harvesting operation as recent as the mid 1990's didn't provide for wetland and riparian protection. Clear cutting was basically allowed to occur right down to the waters edge as long as sediment wasn't discharged. As a result, there are limited amounts of prime wildlife habitat trees in the riparian area and wetlands buffers of the park. Large wood debris (LWD) for habitat and recruitment trees for future LWD are also in short supply. Typing/categorization of wetlands and streams hasn't be completed to determine the proper status. Active beaver colonies have been mapped in at least three areas of the park; adjacent to Ecotype 1 &2, Ecotype 14, and Ecotype 22.

Prescription

Restore wetland and riparian areas as needed by planting conifers and hardwood tree species that will provide prime habitat and LWD.
 Continue to categorized wetlands and streams to assure the proper protection of these critical water and wildlife habitat resources.
 Monitor vegetation and wildlife usage.
 Control noxious and invasive plant species

APPENDIX 8: TOTAL VOLUME

Map	Unit	Doug.	Doug.	West.	West.	White	Shore	Red	Big	Aspen/	Upland
Unit	Acres	Fir Age	Fir	Hem.	Red Cedar	Pine	Pine	Alder	Maple	Willow	Tot. Vol
1	53	28	407,833	51	11,832	27,000	-	39,287	19,618	-	505,620
2A	27	90	1,332,720	176,580	343,980	29,160	-	17,820	-	-	1,900,260
2B	55	75	3,812,217	170,739	196,087	24,391	-	19,609	25,826	-	4,248,870
3A	8	38	175,281	13,489	6,735	-	-	6,735	-	-	202,240
3B	15	40	311,259	7,981	-	-	-	-	-	-	319,240
4	8	74	243,200	53,120	67,520	8,800	-	-	6,560	-	379,200
5	33	39	534,479	9,738	29,156	-	-	9,738	-	-	583,110
6	15	25	73,483	7,221	-	20,393	7,221	-	-	7,221	115,540
7	32	30	912,000	-	-	48,000	-	-	-	-	960,000
8	18	81	976,800	39,600	48,600	5,400	-	-	-	-	1,070,400
9	48	29	664,000	17,600	46,400	92,800	-	-	-	-	820,800
10	42	25	404,370	51,711	-	36,309	27,840	-	-	9,262	529,280
11	129	39	2,185,670	114,889	-	15,890	-	-	-	-	2,316,310
12	22	23	142,065	116,235	-	-	-	-	-	-	258,300
13	34	22	701,514	-	-	38,973	38,973	-	-	-	779,460
14	120	67/120	2,127,429	939,428	2,413,714	30,857	-	161,143	-	-	5,672,571
15	85	25	1,172,521	-	-	26,989	-	-	-	-	1,199,510
16	15	39	354,000	-	-	6,000	-	-	-	-	360,000
17	12	23	42,177	4,755	5,330	28,739	-	-	-	-	81,000
18	11	45	260,920	-	-	-	-	-	-	-	260,950
19	57	51	1,709,367	156,433	264,100	109,567	-	7,600	-	-	2,247,067
20	5	25	45,000	-	-	-	-	-	-	-	45,000
21	30	125/80	736,000	271,250	407,000	56,250	-	23,250	-	-	1,493,750
22	50	50	1,011,875	38,125	358,750	26,250	-	160,625	-	-	1,595,625
23	15	21	81,126	-	2,538	6,336	-	-	-	-	90,000

Total	20,417,306	2,188,945	4,201,740	638,103	74,034	445,806	52,004	16,484	28,034,103
Upland Acres	939								
								28 million board feet - Current Condition	
	D32 - K32 =	28,034,423					29,855	board feet per acre	
		minus	28,034,103					65 million board feet - Future Condition	
	Difference in bd ft =	320							

Appendix 9: Thinning Priorities

Recommendation	Year	Groups involved
Priority One		
Fire fuel load reduction in N250 East of Old Timber	2013	NHHP Stewards, BSA,
VDT Stands 20-40 years old	2013	Contractor
PCT 30 acres east of KCFR Station 56	2013	Contractor, NHHP Stewards
Replace culverts 16,17,18 and 19 with arched culvert to restore stream function and facilitate Coho passage.	2013-2018	Suquamish Tribe, WDFW, NHHP Stewards, Kitsap SSWM
Increase size of culvert #3 to 24" to prevent scour and overtopping during rain on snow events.	2013	WNEK Engineering, NHHP Stewards, Kitsap SSWM, Asbury Topsoil
Install 24" culvert West of KSS south terminus.	2013	WNEK Engineering, NHHP Stewards

Recommendation	Year	Groups involved
Priority Two		
Develop parking lot design	2013	NHHP Stewards, Kitsap Backcountry Horsemen, KC Search and Rescue
VDT Stands 40+ years old	2013-2018	Contractors
PCT		
Invasive/Noxious weed control		NHHP Stewards, Volunteers, Kitsap County Noxious Weed Program
Wildlife viewing platforms		NHHP Stewards
Replace culverts		
Install rain garden upstream of Culvert #3 to increase infiltration and reduce runoff.	2014	
Under plant conifers		

Compile monitoring results and update plan		
Enhance riparian habitat in south 120 acres along thalweg of unnamed tributary to Wildcat Creek	2013-2014	NHHP Stewards, KSS Environmental students, Church groups, BSA

APPENDIX 10: RMAP CULVERT INVENTORY AND ROAD MAINTENANCE PLAN

Is it a trail or is it a road? Is it a park or is it a forest? In order to log in the park, these decisions must be made. All forest landowners are responsible for properly constructing and maintaining roads to protect fish habitat and water quality.

We have inherited roads in the park that were constructed by DNR for logging operations when this land was held in trust for Kitsap county schools. In order to keep these roads, which are now our trails, we must comply with state law. The Forest and Fish law is part of the Forest Practices Regulations of Washington State. The intent of the law is reduction of silt pollution and runoff into streams and rivers. Road prisms are hard on streams when forgotten culverts become plugged, wash out roadbeds, and deposit tons of silt in streams.

We want to keep the existing road prisms in the park (Old Loop Road and Old Timber for example) to use as: family friendly trails, access for people with disabilities, running trails for cross country track, football, wrestling and soccer teams and access routes for maintenance equipment, salvage logging, and ingress /egress during emergencies. In order to do this we must comply with the RMAPs law by July 1st 2016.



NHHP CULVERT INVENTORY

NHHP ID#	Trail Name	Location		Dia.	Type	BFW
1	Holly Rd Entrance	N47°36.726	W122°45.368	14"	Galv	<1 ft Ephem
2	Old Loop Road	N47°36.959	W122°45.307	20"	PVC	RI Wetland
3	Old Loop Road	N47°37.120	W122°45.303	16"	Galv	3 ft Intermittent
4	Old Loop Road	N47°37.198	W122°45.305	16"	PVC	<1 ft Intermittent
5	Old Loop Road	N47°37.425	W122°44.965	16"	Galv	RI Wetland
6	Old Loop Road	N47°37.401	W122°44.680	16"	Galv	<1 ft Ephem
7	Old Loop Road	N47°37.257	W122°44.707	16"	Galv	<1 ft Ephem
8	Old Loop Road	N47°37.157	W122°44.663	16"	Galv	1 ft Ephem
9	Old Loop Road	N47°37.099	W122°44.635	16"	Galv	1 ft Ephem
10	Old Loop Road	N47°37.006	W122°44.580	16"	Galv	1 ft Ephem

11	Old Loop Road	N47°36.924	W122°44.591	16"	Galv	1 ft Ephem
12	Old Loop Road	N47°36.717	W122°44.741			
13	Old Loop Road	N47°36.738	W122°44.954	16"	Galv	3ft Intermittent
14	Old Loop Road	N47°36.784	W122°45.125	16"	Galv	RIW
15	Old Loop Road	N47°36.777	W122°45.144	16"	Galv	1 ft Ephem
16	Old Loop Road	N47°36.776	W122°45.148	16"	Galv	Perched Relief
17	Old Loop Road	N47°36.769	W122°45.168	18"	Galv	Cat 1 wetland Thalweg
18	Old Loop Road	N47°36.770	W122°45.169	24"	Galv	Cat 1 wetland Main Thalweg
19	Deer Fern	N47°37.512	W122°44.898	16"	Galv	<1ft Ephem
20	Deer Fern	N47°37.577	W122°44.900	16"	Galv	<1ft Ephem
21	Deer Fern	N47°37.679	W122°44.905	16"	Galv	Wetland
22	Rhodie Hill	N47°37.455	W122°44.245	18"	Galv	2ft Ephem
23	Old Timber	N47°38.003	W122°45.884	12"	Poly	Wetland
24	Old Timber	N47°37.933	W122°45.886	12"	Poly	Wetland
25	Maintenance Yard	N47°36.710	W122°44.730	16"	Galv	None*

Construction of a ditch/berm to prevent access to gun range rerouted water to culvert #12

Bankfull width(BFW) measured at outfall of culverts.

Culverts rated *Ephemeral* have flow during heavy rains.

Culverts designated *Intermittent* have flow approximately six months of each year.

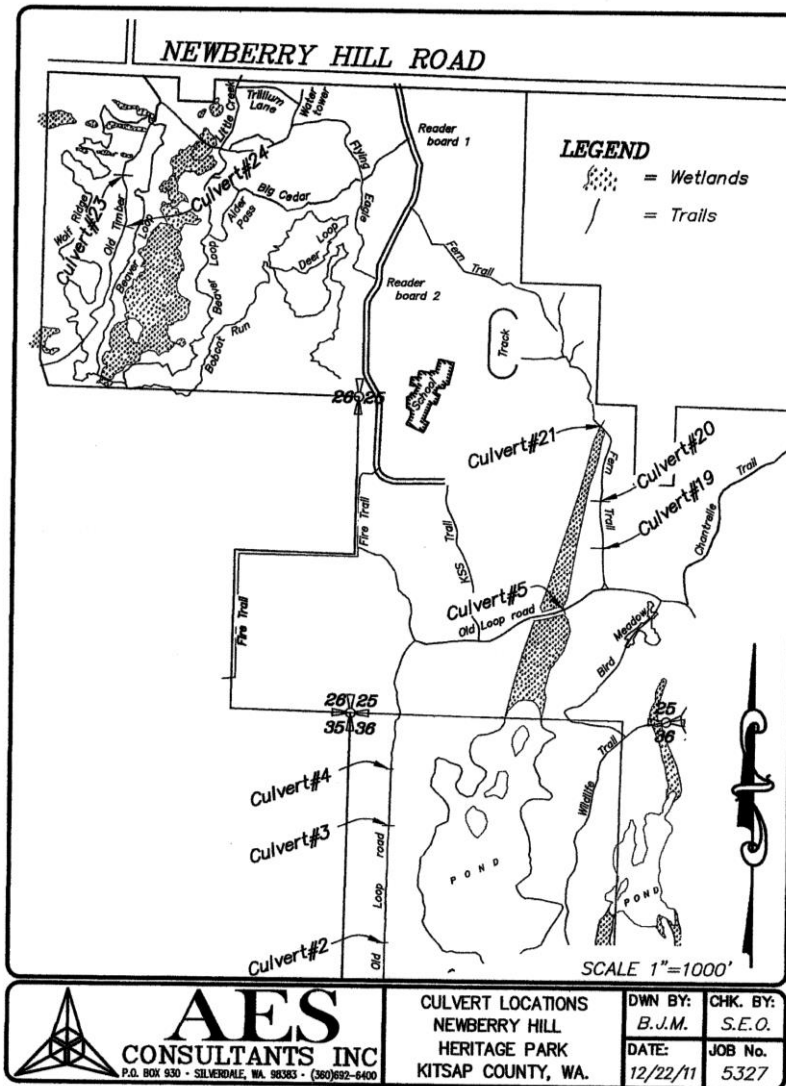
Culverts with *RIW* designation are those where wetland water levels are augmented by road impoundment.

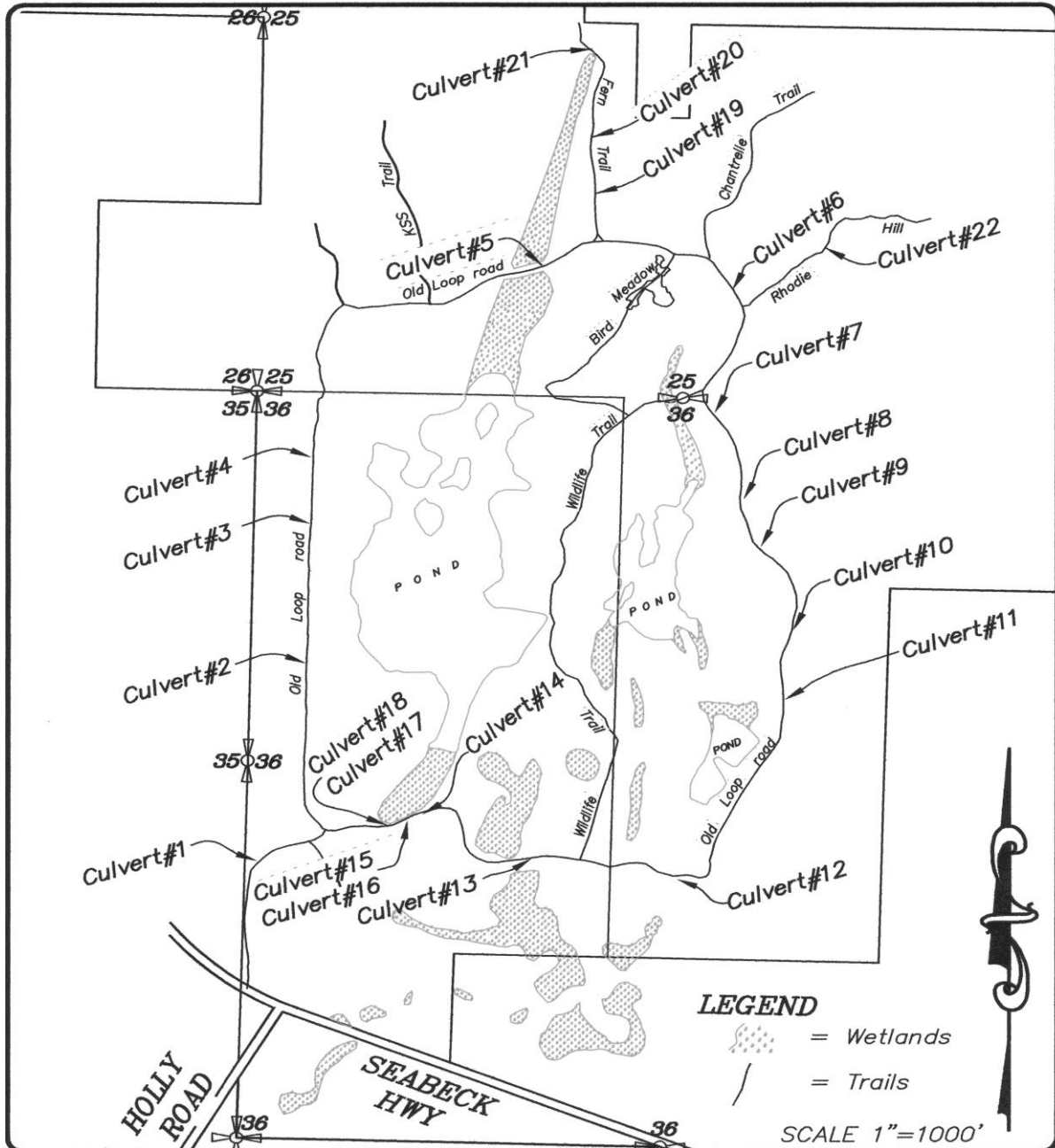
BEAVER FLOODING

We recognize the beaver as a stakeholder and vital part of the park's ecosystem. During the winter of 2011, a small headcut was formed across the Old Loop Road due to culvert #5 being plugged by beaver, and water topping the road prism. During August when the wetland is dry, the culvert will be unplugged and a Flexible Leveler will be installed as an experiment to prevent flooding and subsequent erosion, while keeping water below the road prism during heavy rainfall. This device, based on Clemson University research, will not change the current or traditional water level of the wetland but will hopefully prevent beaver from plugging the culvert and is considered effective 90% of the time.

At the north end of the park, at the headwaters of Little Anderson Creek, beaver have flooded Beaver Loop Trail by damming the downstream shoulder of the old logging road. The trail is under water for more than six months of each year. They are also building a dam downstream that could permanently flood the trail, if built high enough. There are plans in place for a bridge that would allow us to close the existing trail, bypass the flooded trail, and leave this area for the beaver to enjoy.

Special thanks to Steve Ottmar of AES Consultants for his help with culvert mapping.






AES
CONSULTANTS INC
P.O. BOX 930 • SILVERDALE, WA. 98383 • (360)692-6400

CULVERT LOCATIONS
NEWBERRY HILL
HERITAGE PARK
KITSAP COUNTY, WA.

DWN BY:	CHK. BY:
B.J.M.	S.E.O.
DATE:	JOB No.
7/22/11	5327

ROAD MAINTENANCE PLAN

There are 4.4 miles of roads within the park that will be maintained. Motorized recreational vehicles are not allowed in the park. The only motorized traffic on the park roads will be authorized maintenance vehicles (tractors, graders etc.), contractor vehicles (brush pickers, salvage logging, for example) and emergency vehicles. Where possible, runoff will be quickly returned to the forest floor as sheet flow by emphasizing out-sloping.

1. An inventory of all park culverts will be maintained.
2. GPS coordinates will be noted for each culvert.
3. Culvert location monuments/markers will be placed at each culvert crossing.
4. Culvert monuments/markers will be tall enough to be visible from the road prism.
5. Each culvert monument/marker will be inscribed with a unique NHHP ID #.
6. Culvert inspection will occur each August/September to prepare for winter rains.
7. Ditches along Old Loop Road, Rhodie Hill, Deer Fern and Old Timber shall be free from obstructions to water flow.
8. Moss, duff and grasses in ditches should remain undisturbed: for added water energy distribution, water absorption and head cut reduction.
9. Roads shall be crowned or out sloped and water directed to the forest floor. See WAC 222-24
10. Where beaver activity is present, frequent checks must be made to prevent washouts.
11. Beaver are currently (Spring 2011) active at the south end of the park at Culverts 5, 14, 17, and 18 on Old Loop Road, and #21 on Deer Fern. At the north end of the park, beaver are active at the headwaters of Little Anderson Creek.

CULVERTS TO BE REPLACED

Culverts that block fish passage must be removed/ replaced with bridges or arched culverts by July 1st, 2016. The goal is to ensure stream crossings allow fish passage for all life stages of fish. Culverts block juvenile fish by creating a strong laminar flow that prevents upstream migration of Coho and Steelhead smolt. Culverts block returning adult salmon when they are perched higher than the fish can jump.

Replacement culverts must be a minimum of 18" in diameter. Many culverts have deteriorated to the point they will need replacement . All but a few have been in use for more than 50 years.

Currently, anadromous fish are present in the southern end of the park, and the potential exists for them to utilize the parks wetland habitat. There are chum, sea run cutthroat, steelhead and coho in the watershed outside the park boundaries. The presence of coho has been documented by WDFW south of the park, blocked by a culvert on Seabeck Highway. The large category 1 wetland is prime rearing habitat for juvenile coho, and potential spawning habitat is available north of the wetland.

There are several culverts (#15, 16, 17 and 18) that are candidates for possible replacement with an arched culvert or bridge. Flow through these culverts is typed "F"

(Fish Bearing) by DNR, and flows into the Chico Creek System. Replacing these culverts with a bridge or arched culvert should restore natural stream processes improving Salmonid habitat.

CONDITIONS AT TIME OF INITIAL INVENTORY JUNE 2011

ID #	Notes	Action Req.	Cleared	Replaced
1	Crushed on North side, partly blocked		July 2011	
2	Water flow 6 months, stable			
3	Overwhelmed in past. Large flow during heavy rains.			
4	Good shape			
5	100% blocked by beaver activity, bottom rotted out.		August 2011	Prioritize
6	Collapsing , bottom rotted out			
7	Good shape, crosses road at 45° angle			
8	50% blocked silt and gravel	Clear	December 2011	
9	60% blocked, drains from upslope via ditch along Old Loop Road	Clear		
10	20% blocked at outfall end			
11	Good shape			
12	Good shape			
13	10% blocked		August 2011	
14	Rotted bottom			
15	Crushed on south side of road and bottom rotted out			
16	This culvert is a perched relief culvert designed to prevent road washout if beaver plug all other culverts in this area. Good shape			
17	Completely plugged by beaver. Bottom rotted out	Replace with bridge or arched culvert		
18	Completely plugged by beaver and cleared often by WDFW volunteer. HPA on file with parks. Bottom rotted out	Replace with bridge or arched culvert		
19	Good Shape			
20	Good Shape		August 2011	
21	20% Blocked		August 2011	
22	Partially crushed on east end			

23	New Poly pipe at puncheon		July 2011	July 2010
24	New Poly pipe at puncheon			June 2011
25	Clear			

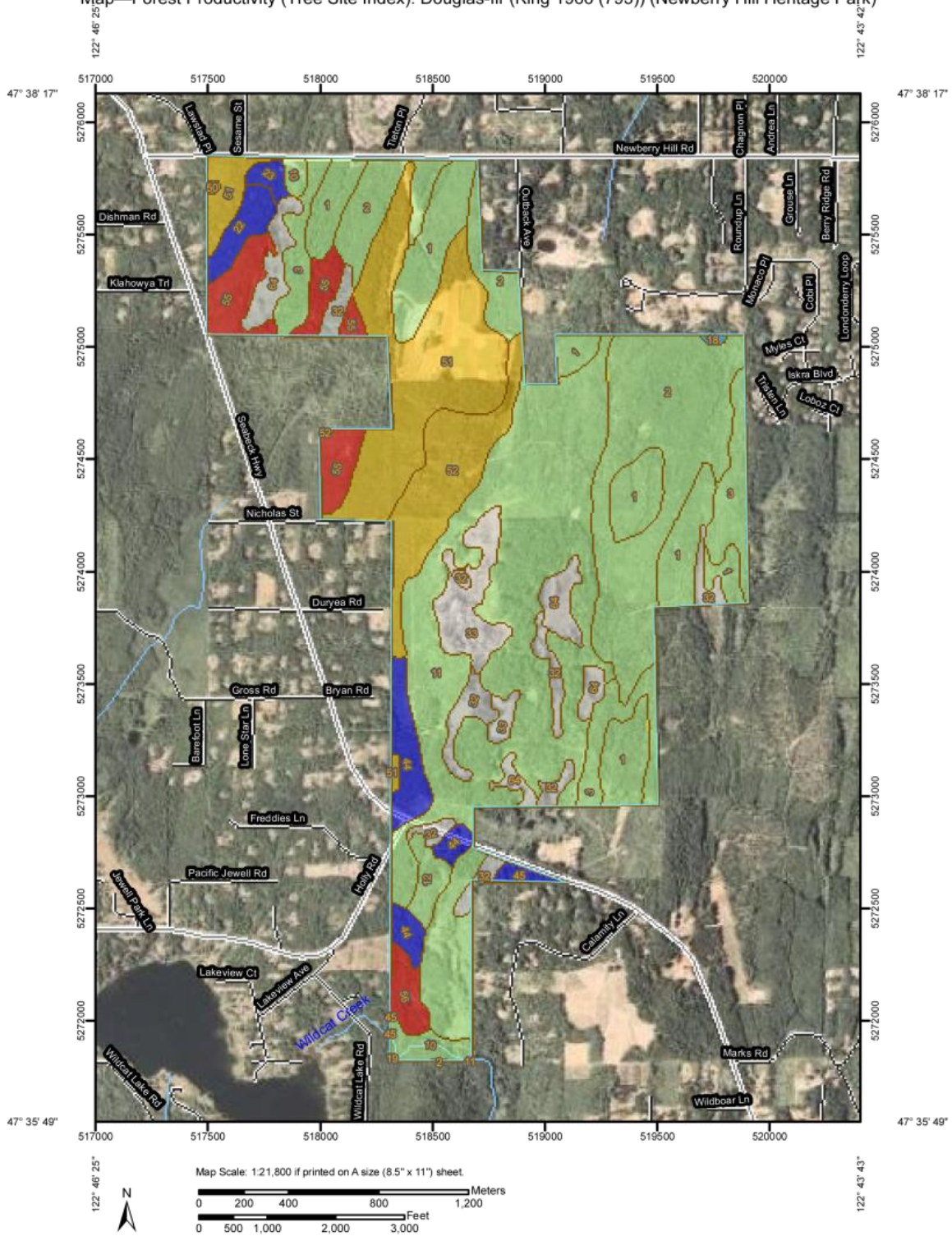
The culvert below on the west fork of Little Anderson Creek currently blocks fish from entering the northwest section of the park. A major improvement will be necessary if salmonids ever to return to this area of NHHP. Note the culvert is more than six feet above the streambed.

Spring 2009



APPENDIX 10: SOIL TYPES

Custom Soil Resource Report
 Map—Forest Productivity (Tree Site Index): Douglas-fir (King 1966 (795)) (Newberry Hill Heritage Park)




The following key describes the soil types illustrated on the previous page:

More soil data is available through the Natural Resources Division upon request.

Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)


 Area of Interest (AOI)

Soils

 Soil Map Units

Soil Ratings

 ≤ 84

 > 84 AND ≤ 106

 > 106 AND ≤ 112

 > 112 AND ≤ 115


 > 115 AND ≤ 126

 Not rated or not available


Political Features

 Cities

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

MAP INFORMATION

Map Scale: 1:21,800 if printed on A size (8.5" x 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: UTM Zone 10N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Kitsap County Area, Washington
Survey Area Data: Version 7, Jul 2, 2012

Date(s) aerial images were photographed: 7/21/2006

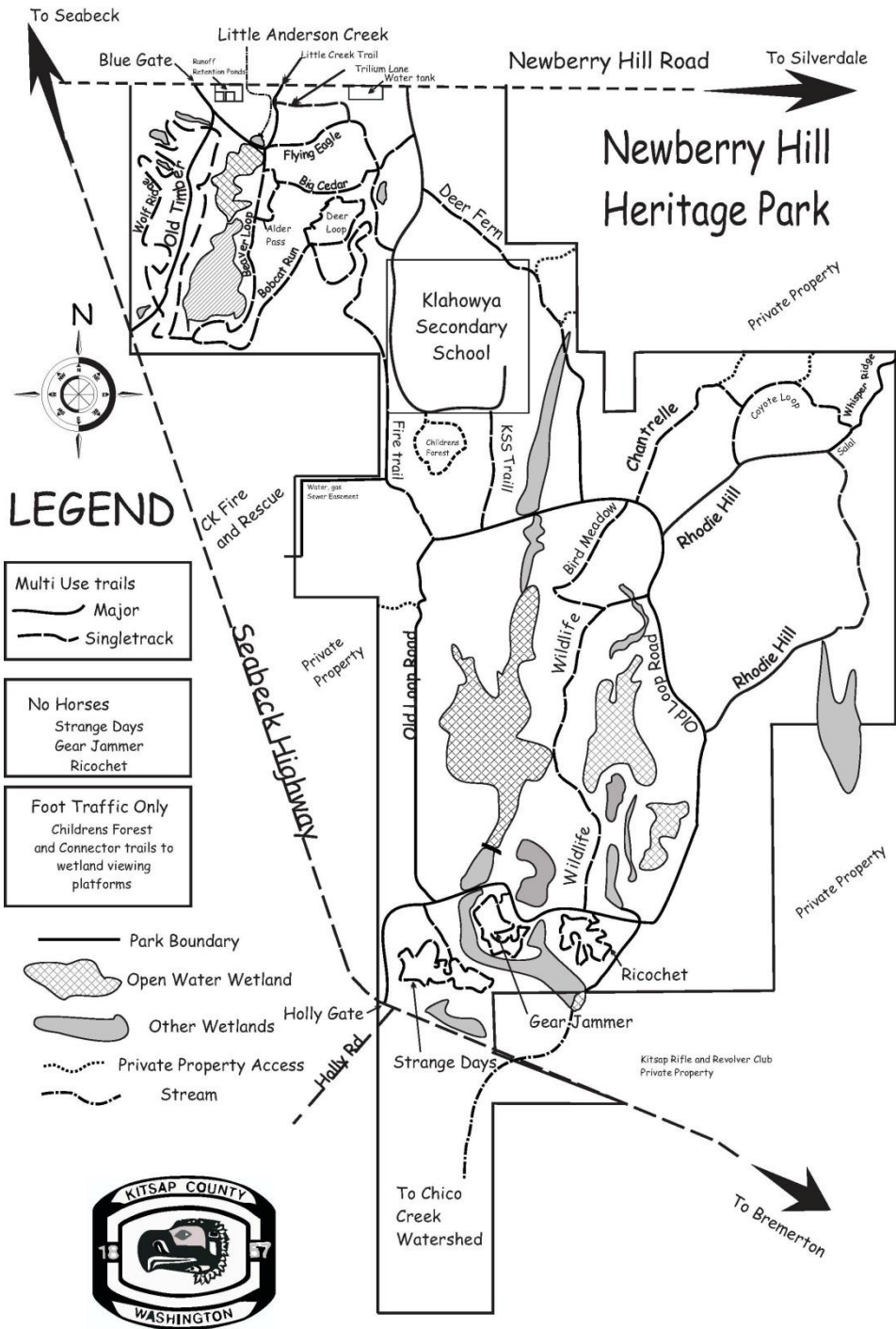
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Custom Soil Resource Report

Table—Forest Productivity (Tree Site Index): Douglas-fir (King 1966 (795)) (Newberry Hill Heritage Park)

Forest Productivity (Tree Site Index): Douglas-fir (King 1966 (795))— Summary by Map Unit — Kitsap County Area, Washington (WA635)				
Map unit symbol	Map unit name	Rating (feet)	Acres in AOI	Percent of AOI
1	Alderwood very gravelly sandy loam, 0 to 6 percent slopes	111	123.2	11.1%
2	Alderwood very gravelly sandy loam, 6 to 15 percent slopes	111	184.2	16.5%
3	Alderwood very gravelly sandy loam, 15 to 30 percent slopes	111	65.2	5.8%
10	Dystric Xerorthents, 45 to 70 percent slopes	110	14.6	1.3%
11	Grove very gravelly sandy loam, 0 to 3 percent slopes	112	299.5	26.9%
12	Grove very gravelly sandy loam, 3 to 15 percent slopes	112	10.7	1.0%
18	Indianola loamy sand, 0 to 6 percent slopes	115	1.0	0.1%
19	Indianola loamy sand, 6 to 15 percent slopes	115	0.2	0.0%
22	Kapowsin gravelly loam, 0 to 6 percent slopes	123	14.2	1.3%
23	Kapowsin gravelly loam, 6 to 15 percent slopes	123	5.4	0.5%
32	McKenna gravelly loam		40.9	3.7%
33	Mukilteo peat		34.4	3.1%
44	Ragnar fine sandy loam, 0 to 6 percent slopes	126	31.9	2.9%
45	Ragnar fine sandy loam, 6 to 15 percent slopes	126	4.0	0.4%
50	Shalcar muck		0.7	0.1%
51	Shelton very gravelly sandy loam, 0 to 6 percent slopes	106	133.8	12.0%
52	Shelton very gravelly sandy loam, 6 to 15 percent slopes	106	58.1	5.2%
55	Shelton extremely gravelly sandy loam, 0 to 6 percent slopes	84	46.2	4.2%
56	Shelton extremely gravelly sandy loam, 6 to 15 percent slopes	84	11.5	1.0%
64	Water		34.4	3.1%
Totals for Area of Interest			1,114.1	100.0%

APPENDIX 11: TRAIL MAP



Map is downloadable at www.friendsofnhnp.com

APPENDIX 12: TIMELINE FOR VARIABLE DENSITY THINNING (VDT)

Variable Density Thinning will be applied to all but two mapping units in the park. Approximately 70 acres per year will be thinned on approximately 70 percent of the park uplands, which is 59 percent of the park acreage. Extended riparian and wetland management areas have been established creating no-harvest zones designed to protect water and wildlife resources. The table below provides a 10-year timeline with projected harvest volumes in mean board feet (MBF) and revenues. The four largest mapping units will be thinned in two or three segments over multiple years.

VDT Harvest –Volume per Mapping Unit (MBF)

Mapping Unit	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
B-8	362									
B-16	125									
B-1		163								
B-19		352	394							
B-2B		538		565		445				
B-6			48							
B-15										603
B-20			18							
B-23			35							
B-17				31						
B-11				360			407			
B-2B			537			593				
B-7					401					
C-21					278					
B-18							114			
C-14									632	
B-22								168		
B-9							10			
B-5								275		
B-3B									206	
B-12									157	
B-3A										103
B-10										246
B-13								202		
C-2A	-	-	-	-	-	-	-	-	-	-
C-4	-	-	-	-	-	-	-	-	-	-
Volume per Year	487	1,052	1,032	955	679	1,038	531	645	995	953
Net Revenue per Year	\$80K	151K	156K	158K	105K	207K	65K	110K	126K	164K

Ten Year Volume = 8,400,000 Ten Year Net Revenue= \$1,337,000