SECTION 4. PROPERTY DESCRIPTIONS & MANAGEMENT RECOMMENDATIONS

Please see the Draft Lake Whatcom Forest Management Plan main document prepared for public comment for additional context. Below are detailed assessments and recommendations for county-owned properties in the plan.

Lake Whatcom Park

Overview

Site Description

Lake Whatcom Park is a large, 4,660-acre property owned by Whatcom County on the east side of Lake Whatcom. The park is accessed via the North Shore Road where two trailheads (upper and lower) provide public recreational access. The upper trailhead provides gated access to Wickersham Truck Trail which leads into the upper watershed. The lower trailhead provides gated access to the Hertz Trail which provides access along the east shore of Lake Whatcom. The property extends from the eastern shore of Lake Whatcom up western-facing slopes to the upper ridgelines of Stuart Mountain. To the north and east it borders forestland primarily owned by the Washington Department of Natural Resources (DNR). To the south it borders forestland in the Blue Canyon Preserve owned by the City of Bellingham. The community of Sunnyside sits near the park's entrance.

Property Information

This forest is located in Sections 02, 03, 04, 05, 09, 10, 15, and 16 of Township 37N, Range 04E, and Sections 26, 27, 28, 32, 33, 34, and 35 of Township 38N, Range 04E of the US Public Land Survey System and includes 34 parcels listed at the end of this section. Property corners and boundaries are not regularly marked.

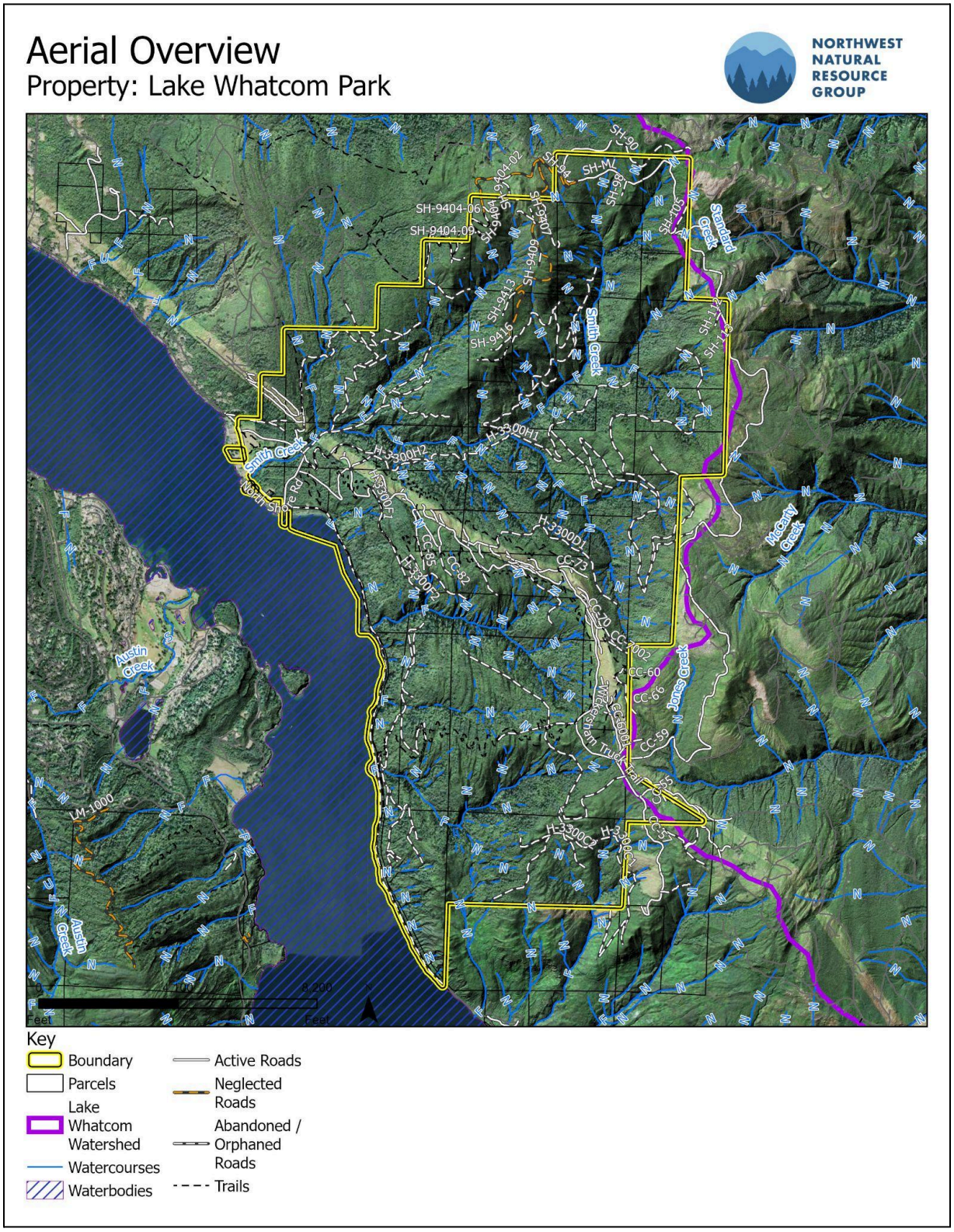
Management History

Most of the forestland at Lake Whatcom Park was originally logged by early settlers during the late 19th and early 20th century, and large timber companies would eventually come to own most of the land in the watershed. A railroad operated by the Bellingham Bay and Eastern Railway (later part of the Northern Pacific Railroad) once transported coal and logs along the east shore of Lake Whatcom in the late 1800s. Logging started lower on the mountain and in easy-to-access locations, before progressing upslope onto steeper and less accessible terrain. Much of the area was logged out by the 1940s, but logging continued in the Smith Creek basin through the early 1960s. In time most of the original old growth was removed, though in some locations, the forest appears to have originated in wildfires

preceding the logging era and has never been logged. For a time, post-logging broadcast burning was commonly employed to reduce logging slash, and many older hand-cut stumps bear the mark of these fires. At higher elevations, the stands are younger, frequently cut with power saws, and fire marks are infrequent. While many timberlands remained in private hands throughout the 20th century, some timber companies stopped paying property taxes after cutting the lucrative timber, and the properties were foreclosed upon by Whatcom County, which in turn transferred them in trust to the State of Washington Department of Natural Resources (DNR).

The second growth forests on Lake Whatcom Park began to be harvested again in the early 1990s and were replanted with conventional Douglas-fir plantations. In 1998 the County acquired five parcels at the end of the North Shore Road and formed the original North Lake Whatcom Park. Growing concern about forest management activities in the Lake Whatcom watershed spurred the creation of the 2004 Lake Whatcom Landscape Plan, which was created to guide forest management activities on state-owned forestlands in the watershed. In 2012 the County began the process of reconveying these lands back to county ownership, taking over title in early 2014. Not all of these reconveyed parcels had been under continuous, decades-long DNR management, as many parcels were previously owned by the Trillium Corporation and its predecessor, industrial timberland owner Georgia Pacific, prior to a large land swap in 1994 that consolidated DNR holdings into contiguous blocks around Lake Whatcom. Today this property is known as Lake Whatcom Park and managed by the Whatcom County Parks and Recreation Department.

Property Overview Map



Assessment

Topoclimate

The park is situated on the western-facing slopes of Stuart Mountain at elevations ranging from 200 to 2,800 feet. The property is characterized by steep terrain that descends toward the shores of Lake Whatcom, with numerous drainages feeding into Smith Creek and its tributaries. As part of the last foothills before the larger Cascade Mountains, the area receives higher rainfall than locations west of the lake due to orographic lift. When moist air from the lowlands is forced upward by the rising terrain, it cools and condenses, producing increased precipitation. Upper slopes are cooler and can receive snowfall in winter, while lower elevations near the lake experience milder temperatures year-round. During the winter, storm fronts moving inland from the Pacific collide with the ridges of Lake Whatcom Park, leading to intense winter storms that can deliver large volumes of precipitation in short time spans.

Vegetation Zone

According to vegetation zone maps for North America, the following Ecological Systems were likely present prior to Euro-American settlement. More information on these maps and full descriptions of each system can be found in the discussion of Vegetation Zones in Section 2 of this document.

- North Pacific Hypermaritime Western Red-cedar-Western Hemlock Forest
- North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest
- North Pacific Mesic Western Hemlock-Silver Fir Forest
- North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest

Soils

Data from the USDA Natural Resource Conservation Service (NRCS) Soil Surveys were used to identify the major soil types that underlay this forest, which are described in more detail in the discussion of Soil Productivity in Section 2. Information about specific soil units likely present at this property, including depth, drainage, productivity, and relevant management concerns are listed in the table below. The location of these soil units can be found in the accompanied map packet for this property.

Forest Soil Units Summary Table

Soil Unit	Productivity		Management Concerns					Acres (Pct)
	Site Class	Max Growth	Drought Stress Hazard	Wind Throw Hazard	Mass Wasting Hazard	Logging Rutting Hazard	Logging Compact Hazard	
Andic Xerochrepts-Rock Outcrop Complex Ashy Loam 60-90% Slopes Mod. Deep (24in) Well Drained	DF-3	143 ft3/ac/yr	High	High	Severe	High	High	2,150 (46%)
Andic Xerochrepts-Rock Outcrop Complex Ashy Loam 60-90% Slopes Very Shallow (0in) Well Drained	DF-4	114 ft3/ac/yr	Mod.	Low	Severe	High	High	657 (14%)
Andic Xerochrepts Ashy Loam on 60-90% Slopes; Mod. Deep (27in); Well Drained	DF-3	143 ft3/ac/yr	High	High	Severe	High	High	303 (7%)
Chuckanut Series Gravelly Medial Loam 30-65% Slopes Deep (56in) Well Drained	DF-2	186 ft3/ac/yr	Mod. High	Low	Severe	High	Mod.	256 (5%)
Nati Series Ashy Loam 30-60% Slopes Mod. Deep (38in) Well Drained	DF-3	129 ft3/ac/yr	Mod. High	High	Severe	High	High	251 (5%)
Chuckanut Series Gravelly Medial Loam 15-30% Slopes Deep (56in) Well Drained	DF-2	186 ft3/ac/yr	Mod. High	Low	Severe	High	Mod.	249 (5%)
Getchell Series Decomposed Plant Material 15-30% Slopes Mod. Deep (39in) Moderately Well Drained	WH-4	200 ft3/ac/yr	Low.	High	Severe	High	Mod.	196 (4%)

Soil Unit	Productivity		Management Concerns					Acres (Pct)
	Site Class	Max Growth	Drought Stress Hazard	Wind Throw Hazard	Mass Wasting Hazard	Logging Rutting Hazard	Logging Compact Hazard	
Typic Cryorthods Loam 60-90% Slopes Well Drained	WH-4	157 ft3/ac/yr	Low.	Low	Severe	High	High	192 (4%)
Revel Series Loam 30-60% Slopes Mod. Deep (35in) Well Drained	DF-4	114 ft3/ac/yr	Mod. High	High	Severe	High	High	98 (2%)
Kline Series Very Gravelly Loamy Sand 2-8% Slopes Moderately Well Drained	DF-3	143 ft3/ac/yr	High	Low	Moderate	Mod.	Mod.	72 (2%)

Slope Stability

As previously described in Section 2, this plan utilizes remotely mapped topographic data as well as hazard zones and historic landslides identified by the DNR to gauge the likelihood that unstable slopes will be found within a proposed management area. The presence of a mapped hazard zone or historic landslide does not preclude management, but indicates that further investigation is required.

Steep slopes are present across Lake Whatcom Park, but are most prominent along the banks of Smith Creek and the unnamed southern major streams and their tributaries. Almost all of the stream channels across the property are potential hazard zones as well as the steep slopes directly above many of the channels. These include the steep gorges of the major streams which likely have rule-identified inner gorges as well as potentially other unstable landforms. The headwaters of several of the tributaries of Smith Creek and the unnamed southern creeks contain likely rule-identified convergent headwalls. There is also a large hazard zone that stretches across the slopes directly above the shore of Lake Whatcom on the south side of the property.

Many historic landslides have been mapped across Lake Whatcom Park, particularly in the drainage systems of the major streams. Alluvial fans at the mouth of Smith Creek and other unnamed streams indicate the long history of slope instability in this watershed. As described in Section 2, widespread logging and road building across Lake Whatcom Park's steep slopes triggered numerous slope failures during the 20th century, including events in 1917, 1949, 1971, and 1983. During the 1983 event, extensive rainfall initiated numerous small landslides along the Smith Creek drainage, which swept down the creek and exploded onto the alluvial fan, destroying homes and pushing houses into the lake. This event also wiped out access to much of the road system that used to provide access into the Smith Creek

drainage. In response the County built berms along the mouth of Smith Creek to protect homes and mitigate any future potential debris flows and has undertaken annual monitoring of Smith Creek.

During this assessment, small recent landslide activity was observed on steep headwalls and inner stream gorges. In addition, some minor soil instability was observed at the site of the 2023 Blue Canyon Fire at the southern end of Lake Whatcom Park.

Hydrology

The property lies primarily within the Lake Whatcom hydrologic basin, with water generally flowing west into Lake Whatcom. A few small areas along the eastern ridgeline drain east into the Acme basin. Both basins are part of the Nooksack Water Resource Inventory Area (WRIA). On the north side of the property, streams and tributaries flow through steep terrain into Smith Creek. Most of Smith Creek, including its north, main, and south forks are classified as fish-bearing by the DNR's hydrography database. Smaller tributaries are non-fish-bearing due to steep cliffs that block fish passage. On the south side of the property, three unnamed stream systems drain west toward Lake Whatcom. The northernmost and southernmost are identified as fish-bearing, while the middle stream is identified as non-fish-bearing.

A handful of forested wetlands can be found across the property, but no waterbodies are present. The folding pattern of the Chuckanut formation, which shaped the geology of Lake Whatcom Park influences the hydrology by creating wet sites between the small ridges that were created by this folding. As a result, more forested wetlands are likely present but not currently delineated.

Roads and Access

The primary access point to the property is through a gated road at the Chanterelle Trailhead, located off the North Shore Road. This road is known variously as the Wickersham Truck Trail, Cub Creek Mainline, or H-3300 road. This road proceeds uphill gaining the first ridgeline rising above Lake Whatcom and running parallel to the powerline transmission corridor. At a highpoint on the ridgeline, the road passes through another county-owned gate and hits an intersection with forks going to the south and north. The southern fork continues downhill to the town of Acme. The northern fork passes through private timberlands before gaining the southern ridgeline of Stewart Mountain. This fork is known in some records as the Sultan Hill Mainline (SH-ML) and runs north, passing above the headwaters of Smith Creek before entering the Olsen Creek State Forest road system and other industrial timberlands. These roads eventually lead back down to a gate on Y Road. The Bonneville Power Administration maintains an access agreement on the Wickersham Truck Trail to service the transmission power lines. And the DNR, and possibly other timber companies, have easements on the Truck Trail as well as the Sultan Hill Mainline to access nearby forestlands. Both of these mainline roads are in good condition, with recent maintenance focusing on brush management and limited ditch shaping.

Additional access includes the Class-A Hertz Trail which is gated but drivable for around two miles. This trail runs along the lakeshore of Lake Whatcom on an old railroad grade. The trail crosses several

unnamed creeks and includes two footbridges to cross fish-bearing streams with vehicle traffic crossing through a nearby ford. Along the northern boundary of the park, the SH-94 and SH-9404 roads provide access down high ridgelines in the upper drainage of Smith Creek. In the park's south the CC-57 road provides a short access to the City of Bellingham's Blue Canyon Preserve and the H-3300F road provides access to the Chanterelle Trail overlook.

Small spur roads once ran off these main access routes at several locations but have either been formally abandoned or, in cases of roads dating before 1975, orphaned. Notable orphaned roads include the H-3300E spur which leaves the Wickersham Truck Trail after 0.75 miles and has been repurposed into the current Chanterelle Trail. Further up, the H-3300D route is a potentially abandoned railroad grade which provided access north of the powerlines along the south fork of Smith Creek. The H-3300C1 and C2 orphan roads were likely also a railroad line that enabled the historic logging of the south and west-facing slopes of the Park leading down to Lake Whatcom. Along the shores of Lake Whatcom, the Hertz Trail now runs in an abandoned railroad grade. At the current location of the Chanterelle Connector Trail, an orphaned grade runs uphill bypassing the lakeshore cliffs and providing access for historical logging along the lower slopes. During the 1983 storm and debris torrent, over 10 miles of road system that once provided access to the lower slopes of the Smith Creek drainage was destroyed and abandoned. Today, access into this basin is only from the upper ridgelines.

Forest roads were assessed to determine their status and suitability for management activities as well as to identify any potential maintenance or design issues. Notable findings of this assessment are summarized below.

Neglected and/or Improperly Abandoned Roads. Several roads were identified that, having not been officially abandoned, are theoretically "active" but maintenance has been neglected for many years. At Lake Whatcom Park this includes the SH-94 and SH-9404 roads which were active at the time of reconveyance. These roads currently are overgrown, but have culverts still in place as well as paved asphalt segments. No other improperly abandoned roads were identified. The Sultan Hill mainline was blocked by a fallen tree during the assessment but is in otherwise good condition.

Existing Orphan Roads. This assessment did not identify any major concern with existing orphan roads that warrant a management recommendation. As discussed in Section 2, the RMAP process undertaken by the DNR at Lake Whatcom Park prior to reconveyance included a thorough investigation of these orphaned road systems. Spot checks of these roads concurred with the DNR findings that these orphaned roads currently pose a limited risk.

Fish Passage Issues. One potential fish passage issue was identified on a culvert on the current Hertz Trail. This stream is currently identified as fish-bearing in the DNR's hydrography database, but it is likely so for only a very short distance, and further investigation is required to confirm the stream's fish-bearing status. The culvert in this location is right on the lakeshore and has currently rusted out, failing to contain the stream flow. The 30-inch diameter culvert is likely undersized for its basin and lacks natural streambed material which poses a potential barrier to fish passage if the stream is determined to be fish-bearing.

Drainage Control Issues on Active Roads. Several active roads were identified as suffering from deferred maintenance of their drainage control structures, primarily road grades, ditches, and cross-draining culverts. In some situations, this has caused water to enter the roadway resulting in minor channelization on the road surface. These issues were most pronounced on the Wickersham Truck Trail and include:

- **Inoperable Cross-Draining Culverts.** Over time culvert inlets can become obstructed by large woody debris or buried under sediment if not properly maintained. Steel culverts are also prone to rusting and culvert outfalls may cause erosion if energy dissipation devices, such as rock armoring or downflumes are not properly installed and maintained. Of the 81 drainage culverts surveyed, 4 were partially plugged, 2 were majorly plugged, and one had collapsed internally.
- **Obstructed Ditches.** Ditches become obstructed or otherwise inoperable for many reasons, including sloughing hillsides, large debris, and unsanctioned recreational use. Obstructed ditches force water onto the roadway, where it bypasses well designed cross-draining culverts and uncontrollably exits the roadway, causing erosion and/or delivering sediment into nearby streams. Over 7 observations of obstructed ditches were identified.
- **Improperly Maintained Road Grades**. When water does enter the road a properly maintained road grade ensures the water is shed quickly and does not continue down the road system, leading to channelization, erosion, and potential slope instability issues. Over 5 observations of water on the roadway were identified.

Culvert Condition. Culvert diameter, material, and condition were noted during this assessment and the bankfull width measured for stream crossings. As described earlier, though culverts inlets were partially obstructed as a result of deferred maintenance, the culverts themselves were generally in good condition. With the exception of two locations where the Chanterelle Trail crossed the Wickersham Truck Trial ditch, all crossdrains were 18 inches or larger as required by state regulations. Of the 14 stream-crossing culverts identified during this assessment, 7 had diameters less than the bankfull width of the stream they carried. While this does imply they are functionally undersized, additional analysis is required to determine if these culverts are appropriately sized to meet current WA DNR requirements. As previously discussed in Section 2, the majority of culverts at Lake Whatcom Park are galvanized steel, which has a serviceable life from 20-40 years. Many of these culverts date from the RMAP process from the early 2000s and are likely around 20 years old, though some may be considerably older. During this assessment the majority of steel culverts surveyed were in good condition. Still, culvert failures are predicted to increase in the future as steel culverts reach the end of their serviceable life.

Health and Resiliency

Invasive species pressure was low across the forests of Lake Whatcom Park. Himalayan blackberry was observed in limited locations along road edges and near the Chanterelle Trailhead. In general, blackberry at this property is not nearly as prevalent as elsewhere in the watershed. English holly was also found in the understory of many stands.

Overstocking is the most important forest health problem facing the forests at Lake Whatcom Park where many stands are overstocked and/or growing at unsustainable densities. This includes naturally regenerated stands that are in the Stem Exclusion stage of development as well as previously-established plantations that have experienced extensive infilling by natural regenerating hemlock and alder, thus increasing their densities to unsustainable levels. In many cases, stocking exceeds 400 trees per acre, and relative densities of 60 or even higher are fairly common. At these densities, competition-induced mortality is rampant, stands are increasingly unstable, and dead material is accumulating as potential wildfire fuel.

In addition, localized pockets of laminated root-rot and hemlock dwarf mistletoe were observed sporadically across the forest, but are operating within normal levels.

The upper slopes of Lake Whatcom Park include stands dominated primarily by drought-intolerant western hemlock but also silver fir. Stands growing on sites with low moisture potential, such as top of ridgelines and south-facing aspects, are at particular risk of drought stress, which is expected to increase under future hotter and drier climates.

Wildlife Habitat

A review of the Washington State Department of Fish and Wildlife Priority Species Database identified Townsend's big-eared bat, myotis bat, and gray wolf as having been documented somewhere within the 23,000-acre township containing Lake Whatcom Park. Additionally, the fish-bearing streams are identified as habitat for cutthroat trout, and there is potential habitat for marbled murrelet in a southern section along the shore of Lake Whatcom.

The property supports a variety of wildlife habitats due to its mix of forest ages and structures. Small pockets of old-growth forest contain large trees and complex canopy layers that provide diverse habitat features for many species. Much of the forest on the upper slopes is in the Stem Exclusion phase which offers more limited habitat value because of their dense, uniform structure. However, some forest stands are beginning to transition into more structurally complex stages, with larger trees and developing understories that support greater biodiversity. Additionally, the numerous stream channels across Lake Whatcom Park and their associated riparian zones offer valuable wildlife habitat, with increased species diversity, structural complexity, and reliable water sources. The lower sections of the streams offer important habitat for fish species that are found in Lake Whatcom.

Wildfire Susceptibility

The risk of wildfire ignition is generally moderate at Lake Whatcom Park. Most of the surrounding properties are not residential, and there is limited public access to much of the property, particularly on the north side of the park. However, the recreational trails in the central and southern parts of the property increases the risk of wildfire ignition in these areas. Notably, at least two small ignitions have occurred along the Hertz Trail over the last decade. Fortunately, these fires remained small and were extinguished before they could spread further. The developed road network in the central zone and

along the upper ridgeline ensures a rapid response to fires in these areas. However, much of the property has limited road access, particularly in the large Smith Creek drainage system on the north side and on the lower slopes of the south side of the property. Firefighting capabilities are limited in these remote areas.

As discussed in Section 2, overstocked, mixed-conifer stands and Douglas-fir plantations in Stem Exclusion are more susceptible to high-severity fire as they have high levels of fine woody debris, lack larger trees that are more resistant to fire, and have low canopies and many potential ladder fuels. Older mixed conifer forests in the Mature-I and Mature-II stages of development have lower densities, taller crowns, and reduced fuel loads which reduce their susceptibility to high-severity fire. Mixed conifer and hardwood forests are also less susceptible to fire because hardwood species have large water-laden leaves and lower content of resin and pitch that makes them less likely to burn in a fire, and their low-density crowns can reduce the chance of a crown fire spreading. These stand types are further identified below, but approximately one quarter of the forestland at Lake Whatcom Park consists of overstocked stands in Stem Exclusion which are susceptible to high-severity fire.

The recent Blue Canyon Fire in 2023 is a recent example of potential wildfire activity in the watershed. The fire was ignited in late-August by lightning and burned 30-40 acres in steep terrain on the southern slopes of Lake Whatcom Park near the end of the Hertz Trail. The firefighting response was rapid, involving helicopter water drops every five minutes and ground crews making short hikes to engage the fire from nearby road access points. This fire was notable for burning in an older, naturally-regenerated forest that had a high-level of species and age diversity prior to the fire. This forest is generally around 100 years old but contains a large component of much older Douglas-fir trees that are over 400 years old and have survived prior fire events. While the fire primarily operated as a surface-fire, prevalent ladder fuels did enable the fire to occasionally enter the canopy, scorching and killing some trees. Given the lower densities of this stand these crown fire events were not sustained and fire severity was low to moderate across much of the fire. While many smaller diameter trees died in this blaze, most of the medium to large-sized trees are still alive two years later and ground-cover has re-established in many areas.

Carbon Storage

The property's forests are largely conifer-dominated, providing strong long-term carbon storage potential. Remnant patches of old-growth forest demonstrate the landscape's high capacity for carbon storage, featuring large, long-lived conifers alongside younger, fast-growing trees that are actively sequestering carbon. However, many previously logged areas are in a stem exclusion phase, where dense competition has slowed tree growth and carbon accumulation. Thinning these areas to reduce competition and promote dominant tree growth would enhance carbon storage over time. On upper slopes, stands dominated by western hemlock may face reduced long-term carbon potential if warming and drying conditions lead to slower growth or higher mortality. Lower on the slopes near Smith Creek and its tributaries, red alder is more common, which offers relatively low carbon storage potential due to its short lifespan.

Cultural Resources

The Lake Whatcom watershed is a landscape rich with cultural significance for Indigenous peoples—particularly the Lummi Nation and the Nooksack and Swinomish Tribes—who have maintained deep spiritual, cultural, and subsistence connections to the landscape. Although a review of the Washington State Department of Archaeology and Historic Preservation Wisaard online database did not identify any known historical sites on this property and none were encountered while developing this plan, this property has a long history of human use and artifacts may be present. Please see the previous discussion about cultural use practices in the Lake Whatcom Watershed for a more detailed assessment of best management practices moving forward.

Recreation

Non-motorized recreational use is common in portions of the Lake Whatcom Park forestlands. At the park entrance, the Chanterelle Trailhead includes two parking lots and bathroom facilities. The Chanterelle Trail ascends up a ridgeline in the central zone of the park utilizing old road beds in some locations and generally paralleling the Wickersham Truck Trail. A downhill mountain bike trail descends from the upper ridgeline back to the Chanterelle Trailhead. The Hertz Trail runs from the Chanterelle Trailhead south along the shore of Lake Whatcom following the old railroad grade that once existed here. Halfway along this trail is the start of the Chanterelle Connector Trail which ascends up a southern ridgeline before connecting with the Chanterelle Trail near the top of the ridgeline. The public also frequently hikes and bikes along undeveloped forest roads in the upper ridgelines of the park but there are no developed recreational trails in the larger Smith Creek basin on the north side of the property or on the far south side of the property. The public also uses the orphaned road system directly north of the North Shore Road bridge over Smith Creek to access adjacent roads and trails in the DNR owned Olsen Creek State Forest. Unsanctioned recreational trails were identified along the upper ridgelines nearby to the Wickersham Truck Trail and powerline easement in the central portion of the property.

Recommendations

Roads and Access

This plan recommends the following actions be taken to improve the maintenance and function of the existing road system at Lake Whatcom Park:

- **Neglected and/or Improperly Abandoned Roads.** Restoring access on the SH-94 and 9404 roads will provide critical access to the majority of young plantations at Lake Whatcom Park. These stands are in need of thinning interventions over several decades, and maintaining access on these road spurs will be critical to enacting the recommendations outlined in this plan. If management recommendations are not followed, these neglected roads should be formally decommissioned to ensure no long-term hydrological effects.

- **Drainage Control Issues on Active Roads.** The Wickersham Truck Trail needs ditch cleanouts, culvert clearing, and regrading across numerous sections to ensure proper drainage. After this has been done, implement a maintenance plan for ditches, culverts, and road grades to ensure all active roads maintain a high standard of function. See the best management practices identified in Section 2.
- **Culvert Condition.** Replace failed culverts. Upgrade undersized cross-draining culverts and evaluated stream-crossing culverts to confirm they are sized appropriately for their respective basins. Future culvert installation, particularly of cross-draining culverts, should prioritize modern, longer lasting HDPE plastic culverts.
- **Fish Passage & Current Failures.** Evaluate and rectify the ongoing stream-crossing culvert failure identified on the Hertz Trail, which is also a potential barrier to fish passage. This culvert should be replaced, potentially with a footbridge to maintain recreational access.

Without road access, heavy equipment cannot be used in forest management activities, and thinning recommendations must be implemented as non-commercial cut and drop. This greatly increases the cost of forest management and likely reduces the amount of the landscape that can be actively managed to reach its desired future condition. Given the challenges of properly maintaining roads on steep terrain, the decision to build new roads requires careful planning and should follow the guidelines identified in Section 2. Specific recommendations for creating or restoring temporary spur roads to facilitate forest management activities are given by FMU below.

Health and Resiliency

Though continued treatment and monitoring of Himalayan blackberry would be a prudent decision to prevent its spread, it does not present a significant management concern at this property. In a few localized areas blackberry is impacting future forest development and specific recommendations are given at the management unit level below.

Recommendations for addressing observed overstocking are given at the management unit level below.

Wildfire Susceptibility

Shaded fuel breaks are recommended within 100 feet of public roads and existing structures which are designed to keep fires on the ground and slow their spread until firefighting resources can arrive. For additional details on implementation, see the description of a shaded fuel break given in the discussion of Wildfire Susceptibility in Section 2 of this document.

Forest Types

Summarized below are the general forest types present at Lake Whatcom Park and their management recommendations.

Forest Types Summary Table

Forest Type	Acres	Proportion
Conifer Plantation - Small DBH	84	2%
Conifer Plantation - Large DBH	306	7%
Mixed Conifer - Stem Exclusion	481	10%
Mixed Conifer - Stem Exclusion/Mature-I	411	9%
Mixed Conifer - Mature-I	539	12%
Mixed Conifer - Mature-I/II	326	7%
Mixed Conifer - Mature-II	284	6%
Mixed Conifer - Late Seral	17	0%
Mixed Hardwood - Young	0	0%
Mixed Hardwood - Mature	0	0%
Mixed Hardwood - Old	0	0%
Mixed Conifer and Hardwood	2,008	43%
Unforested	15	0%
Non-Forest	189	4%
Total	**4,660**	**100%**

Mixed Conifer Stands

Mixed conifer stands are very common at Lake Whatcom Park, representing about 44% of the property. These stands regenerated naturally following clearcut harvests between 60 to 125 years ago. After clearcutting, the forest was left to regenerate naturally, and in most cases, no intervening management has occurred. Based on observed fire scars and a lack of logging evidence, it is estimated that there are stands in Smith Creek and in the south side of the property along the lake shore that regenerated following a wildfire and were never logged. At the time of logging, these forests likely had smaller trees that regenerated following an earlier fire, and were likely not cut due to their smaller size and lower value compared to the trees in the surrounding forests. Within these areas, clusters of trees over 400 years or older were observed during the assessment that survived these fires.

Today, these stands are primarily dominated by a mixture of conifers, primarily Douglas-fir and western hemlock, though western redcedar and pacific silver fir are also present. Douglas-fir is more common at lower elevations, while hemlock is more common at higher elevations. A majority of the mixed conifer stands at Lake Whatcom Park are in Stem Exclusion or Mature-I stage of development, where density remains relatively high to very high. There are some early Mature-II stands that have begun to develop as well as some older fire origin stands that exhibit later seral characteristics, but these are a minority.

As previously described in Section 3, the management of mixed conifer stands is best delineated by stand development stage, and recommendations follow the general discussion earlier in this document. For stands in Stem Exclusion, this plan recommends variable density commercial thinning, with priority varying from moderate (level 3) to high (level 1) depending on stocking. Given their generally high priority, when commercial access is not possible, non-commercial thinning should be utilized in the most overstocked stands. This plan recommends variable density thinning in Mature-I stands, but assigns these stands priority varying from low (level 4) to moderate (level 3) depending on stocking. Finally, this plan generally does not recommend management in Mature-II or older stands at Lake Whatcom Park.

Plantations

Around 9% of Lake Whatcom Park forestland are Douglas-fir plantations. These stands are typically third generation forests, having been established after clearcut harvests of the naturally regenerated second growth forests over the last 15 to 40 years. These plantations were established at high densities of primarily Douglas-fir but in many cases have experienced significant infilling by western hemlock. Subsequent pre-commercial thinning operations have not occurred in these plantations since reconveyance, and many of these stands are currently growing at extremely high levels of stocking.

A more complete description and assessment of plantation silviculture and recommendations for these stands is provided in Section 3 of this document. Broadly, all plantations at Lake Whatcom Park require management interventions to accelerate the transition of these stands towards forests with more complex stand structures, thereby improving resiliency, reducing fire risk, increasing hydrological maturity, and providing additional wildlife habitat. As previously described in Section 3, pre-commercial thinning is recommended in overstocked, small diameter stands and variable density commercial thinning in overstocked, large-diameter stands. Given high-levels of homogeneity and the likelihood that multiple entries are needed to restore forest function, thinning plantations is one of the highest priority management recommendations made in this plan. Broadly, access to these stands is good and thinning can be primarily commercial. Additional details are provided in each management unit below.

Mixed Conifer and Hardwoods

Mixed conifer and hardwood stands are very common at Lake Whatcom Park, representing about 43% of the property. These stands regenerated all across the property following clearcut harvests between 60 to 125 years ago. Unlike other conifer-dominated stands, these stands either initiated with a large component of hardwoods or have grown at lower densities, allowing new hardwood species to establish in subsequent years. In either case, these stands now include a wide range of species growing in multiple canopy positions.

As previously described in Section 3, the management of these stands can follow either more mixed-conifer recommendations or mixed-hardwood recommendations depending on the proportion of species present, but in well-mixed stands typically focuses on forest health issues. At Lake Whatcom Park, since these stands are generally in good health, exhibiting high diversity, and growing at sustainable densities, large-scale management is not recommended in most cases.

Management Units

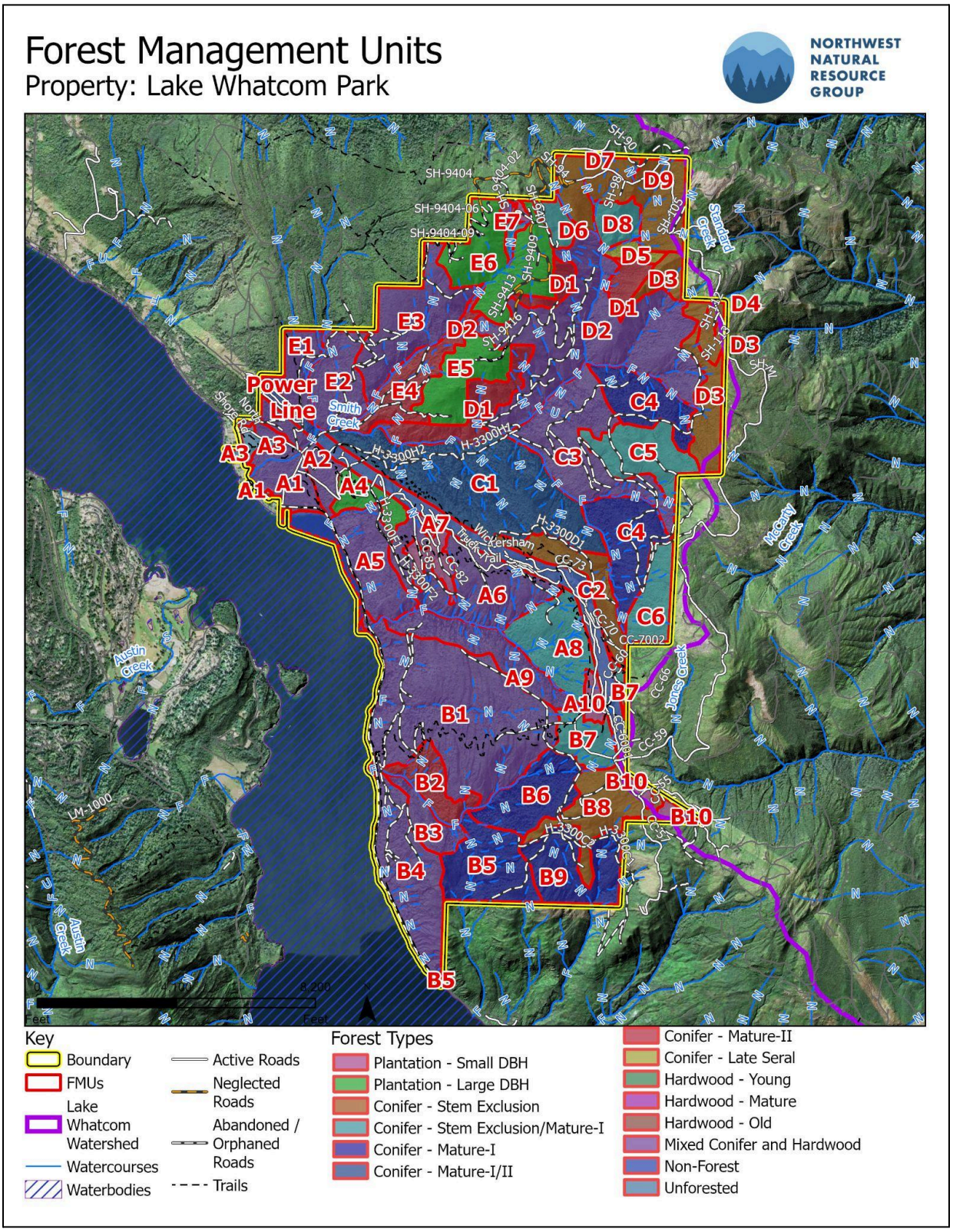
Forest cover was delineated into the forest management units (FMUs) using both remotely sensed data, historic inventory units, and field inventory data. The forestland within these management units share similar forest characteristics and management recommendations. For each FMU, this plan describes the geophysical attributes and forest conditions and assesses the unit against the plans management objectives using the previously described framework by forest type. Recommendations are then given by FMU, typically referencing general recommendations by forest type, but more information is given as needed. Finally, a schedule of management activities by year and FMU is given at the end of this section.

Because this property is so large, it is also delineated into sub-areas based on stream basins and shared access routes. The letter at the beginning of the FMU label represents the area or “series” to which it belongs. Series A FMUs are located near the Chanterelle Trailhead and extend up the ridgeline accessed by the Wickersham Truck Trail. Series B FMUs occur on the west facing slopes and drainages south from the A series. These FMUs can be accessed via the Hertz Trail on the bottom and the upper reaches by the Wickersham Truck Trail. Series C FMUs occur on the south fork of Smith Creek, series D FMUs on the main fork of Smith Creek, and series E FMUs on the north fork of Smith Creek. An overview of these units is available in the table and maps below.

Summary of Forest Management Units

FMU	Acres	Forest Type	Management
A1	76	Mixed Conifer and Hardwood	Invasive Species Management
A2	54	Mixed Conifer and Hardwood	None
A3	15	Unforested	Invasive Species & Planting
A4	43	Conifer Plantation - Large DBH	Thinning
A5	105	Mixed Conifer and Hardwood	None
A6	179	Mixed Conifer and Hardwood	Thinning
A7	38	Conifer Plantation - Small DBH	Thinning
A8	114	Mixed Conifer - Stem Exclusion/Mature-I	Thinning
A9	101	Mixed Conifer and Hardwood	None
A10	18	Conifer Plantation - Small DBH	Thinning
B1	426	Mixed Conifer and Hardwood	None
B2	59	Mixed Conifer - Mature-II	None
B3	44	Mixed Conifer and Hardwood	None
B4	158	Mixed Conifer and Hardwood	None
B5	121	Mixed Conifer - Mature-I	None
B6	103	Mixed Conifer - Mature-I	None
B7	64	Mixed Conifer - Stem Exclusion/Mature-I	Thinning
B8	102	Mixed Conifer - Stem Exclusion	Thinning
B9	117	Mixed Conifer - Mature-I	None
B10	18	Conifer Plantation - Small DBH	Thinning
C1	326	Mixed Conifer - Mature-I/II	None
C2	80	Mixed Conifer - Stem Exclusion	Thinning
C3	186	Mixed Conifer and Hardwood	None
C4	198	Mixed Conifer - Mature-I	None
C5	97	Mixed Conifer - Stem Exclusion/Mature-I	Thinning
C6	64	Mixed Conifer - Stem Exclusion/Mature-I	Thinning
D1	135	Mixed Conifer - Mature-II	None
D2	378	Mixed Conifer and Hardwood	None
D3	107	Mixed Conifer - Stem Exclusion	Thinning
D4	21	Mixed Conifer - Stem Exclusion	Thinning
D5	17	Mixed Conifer - Late Seral	None
D6	35	Mixed Conifer - Stem Exclusion/Mature-I	Thinning
D7	61	Mixed Conifer - Stem Exclusion	Thinning
D8	37	Mixed Conifer - Stem Exclusion/Mature-I	Thinning

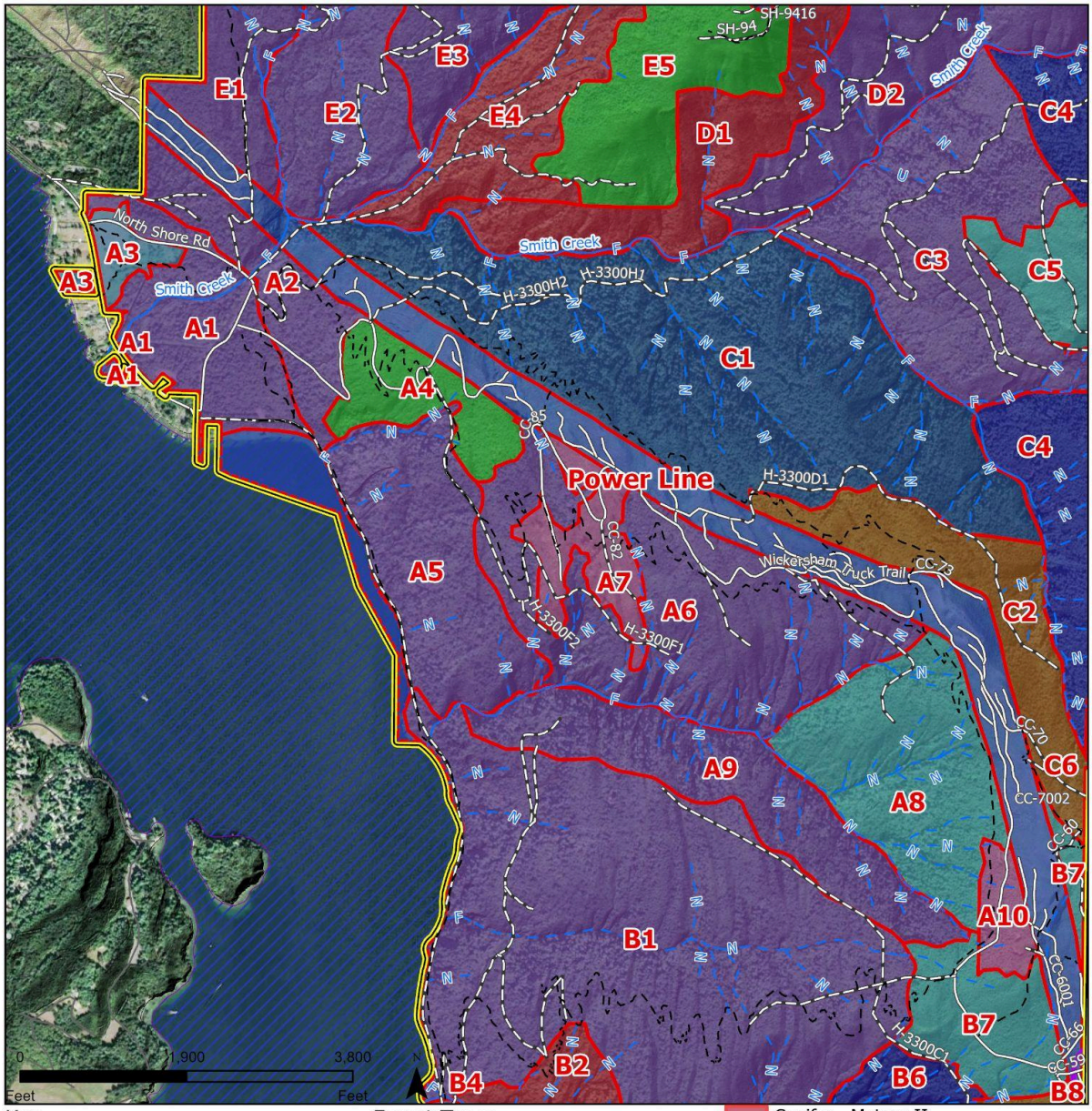
FMU	Acres	Forest Type	Management
D9	110	Mixed Conifer - Stem Exclusion	Thinning
E1	55	Mixed Conifer and Hardwood	Monitor Invasive Species
E2	91	Mixed Conifer and Hardwood	Invasive Species Management
E3	155	Mixed Conifer and Hardwood	None
E4	90	Mixed Conifer - Mature-II	None
E5	94	Conifer Plantation - Large DBH	Thinning
E6	169	Conifer Plantation - Large DBH	Thinning
E7	10	Conifer Plantation - Small DBH	Thinning
Power Line	160	Unforested	Not Applicable
Total	**4,660**		


Forest Management Units
Property: Lake Whatcom Park
NORTHWEST NATURAL RESOURCE GROUP
Power Line
Smith Creek
Austin Creek
Standard Creek
McCarthy Creek
Jones Creek
Wickersham Trail
SH-9404
SH-9404-06
SH-9404-09
LM-1000
H-3300H1
H-3300H2
H-3300D1
H-3300C2
CC-7002
Key
Boundary
FMUs
Lake Whatcom Watershed
Watercourses
Waterbodies
Active Roads
Neglected Roads
Abandoned / Orphaned Roads
Trails
Forest Types
Plantation - Small DBH
Plantation - Large DBH
Conifer - Stem Exclusion
Conifer - Stem Exclusion/Mature-I
Conifer - Mature-I
Conifer - Mature-I/II
Conifer - Mature-II
Conifer - Late Seral
Hardwood - Young
Hardwood - Mature
Hardwood - Old
Mixed Conifer and Hardwood
Non-Forest
Unforested

Forest Management Units

Property: Lake Whatcom Park - Group A

NORTHWEST NATURAL RESOURCE GROUP



Key

- Boundary
- FMUs
- Lake Whatcom Watershed
- Watercourses
- Waterbodies
- Active Roads
- Neglected Roads
- Abandoned / Orphaned Roads
- Trails

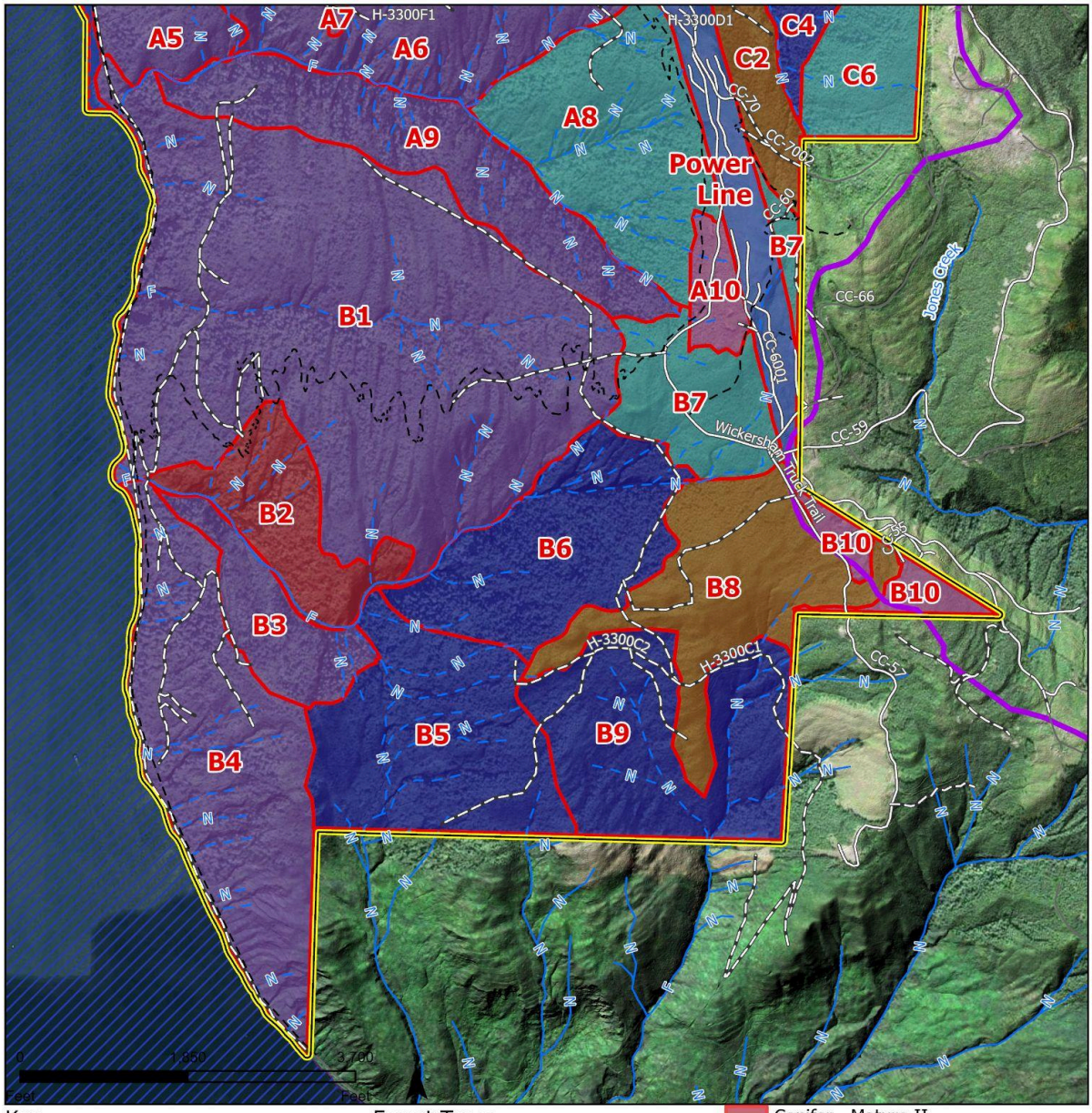
Forest Types

- Plantation - Small DBH
- Plantation - Large DBH
- Conifer - Stem Exclusion
- Conifer - Stem Exclusion/Mature-I
- Conifer - Mature-I
- Conifer - Mature-I/II
- Conifer - Mature-II
- Conifer - Late Seral
- Hardwood - Young
- Hardwood - Mature
- Hardwood - Old
- Mixed Conifer and Hardwood
- Non-Forest
- Unforested

Forest Management Units

Property: Lake Whatcom Park - Group B

NORTHWEST NATURAL RESOURCE GROUP



Key

- Boundary
- FMUs
- Lake Whatcom Watershed
- Watercourses
- Waterbodies
- Active Roads
- Neglected Roads
- Abandoned / Orphaned Roads
- Trails

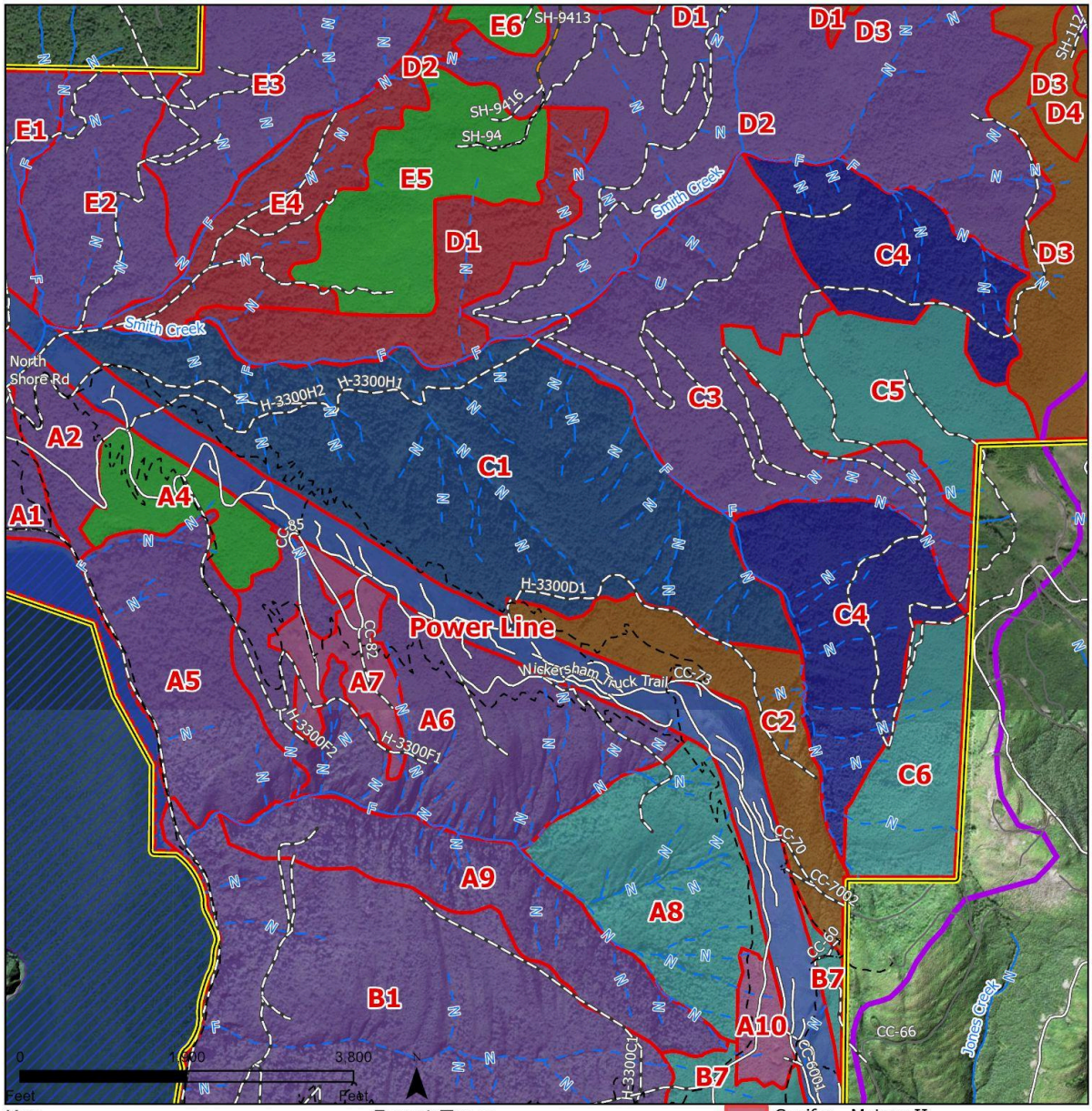
Forest Types

- Plantation - Small DBH
- Plantation - Large DBH
- Conifer - Stem Exclusion
- Conifer - Stem Exclusion/Mature-I
- Conifer - Mature-I
- Conifer - Mature-I/II
- Conifer - Mature-II
- Conifer - Late Seral
- Hardwood - Young
- Hardwood - Mature
- Hardwood - Old
- Mixed Conifer and Hardwood
- Non-Forest
- Unforested

Forest Management Units

Property: Lake Whatcom Park - Group C

NORTHWEST NATURAL RESOURCE GROUP



Key

- Boundary
- FMUs
- Lake Whatcom Watershed
- Watercourses
- Waterbodies
- Active Roads
- Neglected Roads
- Abandoned / Orphaned Roads
- Trails

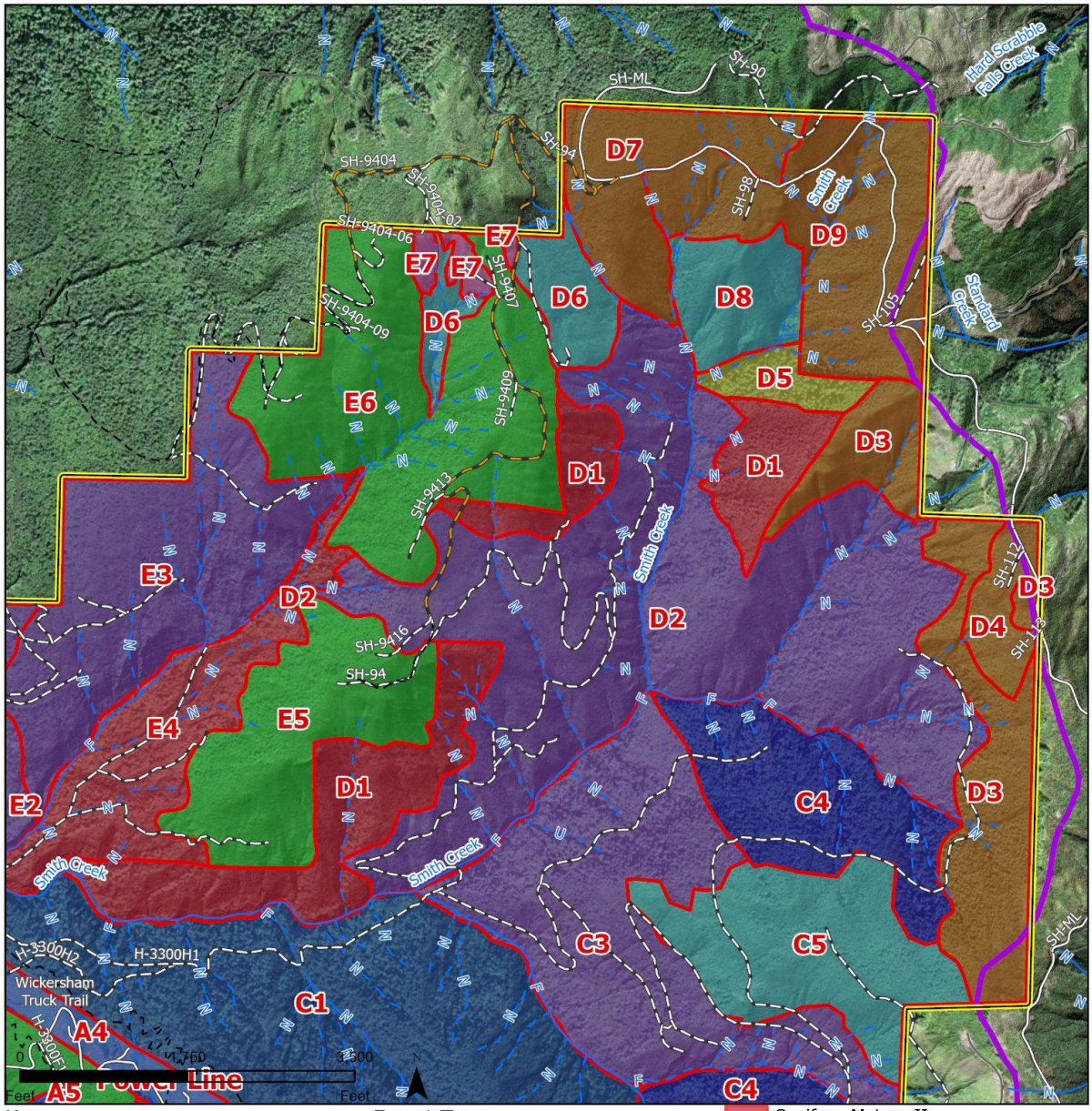
Forest Types

- Plantation - Small DBH
- Plantation - Large DBH
- Conifer - Stem Exclusion
- Conifer - Stem Exclusion/Mature-I
- Conifer - Mature-I
- Conifer - Mature-I/II
- Conifer - Mature-II
- Conifer - Late Seral
- Hardwood - Young
- Hardwood - Mature
- Hardwood - Old
- Mixed Conifer and Hardwood
- Non-Forest
- Unforested

Forest Management Units

Property: Lake Whatcom Park - Group D

NORTHWEST NATURAL RESOURCE GROUP



Key

- Boundary
- FMUs
- Lake Whatcom Watershed
- Watercourses
- Waterbodies
- Active Roads
- Neglected Roads
- Abandoned / Orphaned Roads
- Trails

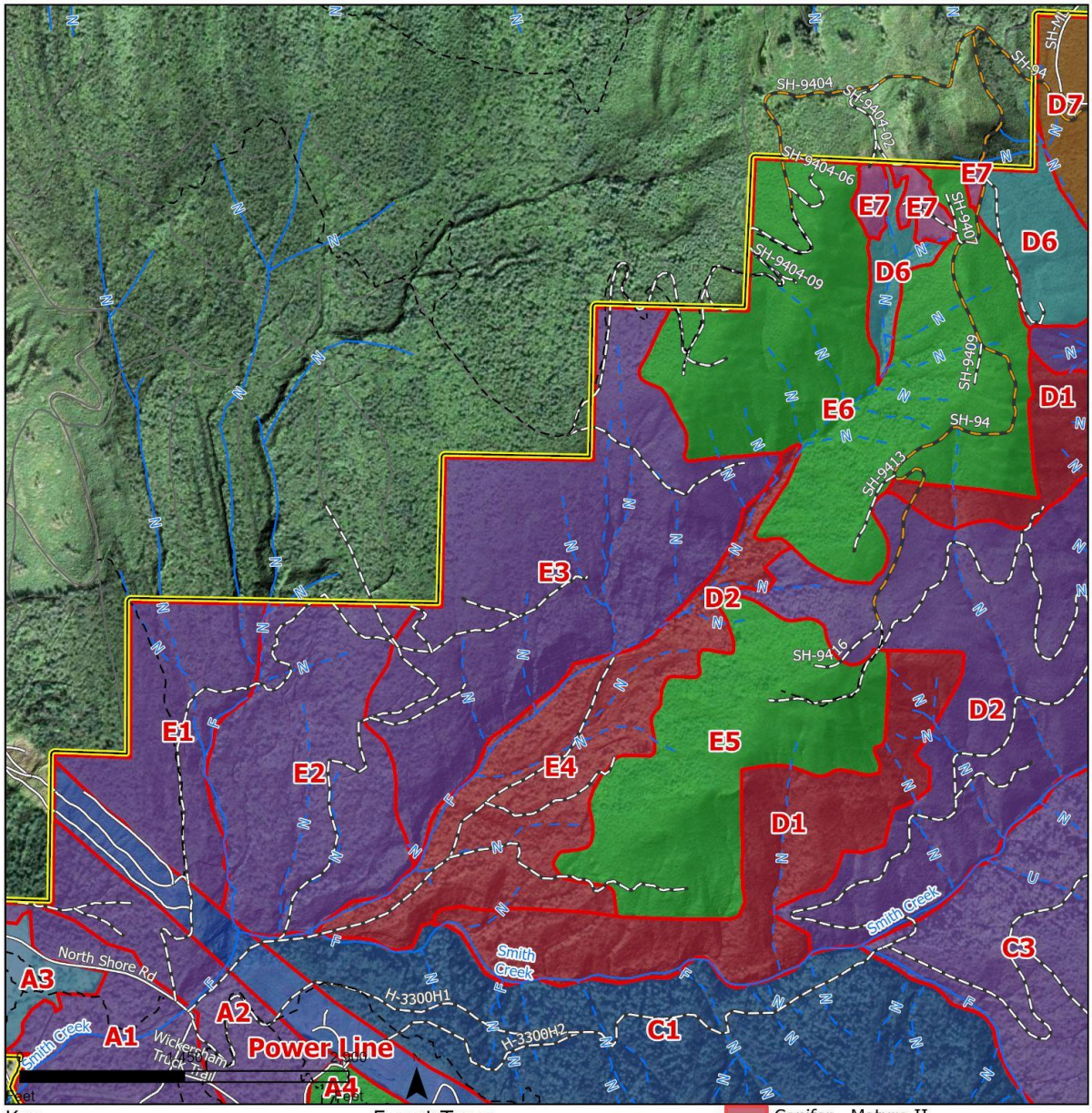
Forest Types

- Plantation - Small DBH
- Plantation - Large DBH
- Conifer - Stem Exclusion
- Conifer - Stem Exclusion/Mature-I
- Conifer - Mature-I
- Conifer - Mature-I/II
- Conifer - Mature-II
- Conifer - Late Seral
- Hardwood - Young
- Hardwood - Mature
- Hardwood - Old
- Mixed Conifer and Hardwood
- Non-Forest
- Unforested

Forest Management Units

Property: Lake Whatcom Park - Group E

NORTHWEST NATURAL RESOURCE GROUP



Key

- Boundary
- FMUs
- Lake Whatcom Watershed
- Watercourses
- Waterbodies
- Active Roads
- Neglected Roads
- Abandoned / Orphaned Roads
- Trails

Forest Types

- Plantation - Small DBH
- Plantation - Large DBH
- Conifer - Stem Exclusion
- Conifer - Stem Exclusion/Mature-I
- Conifer - Mature-I
- Conifer - Mature-I/II
- Conifer - Mature-II
- Conifer - Late Seral
- Hardwood - Young
- Hardwood - Mature
- Hardwood - Old
- Mixed Conifer and Hardwood
- Non-Forest
- Unforested

FMU A1 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	RC	77	95	173	56	8	16	36	86
	Minor	BM	18	25	31		8	14	24	96
		DF	25	67	107		12	25	36	160
		WH	11	13	14		10	12	14	80
	All	All	144	224	356		8	17	36	103
Midstory	Major	RC	20	10	19	6	2	9	14	60
		WH	26	11	20		2	8	14	48
	All	All	50	24	45		2	9	18	55
Total	All	All	194	248	400	62	2	15	36	91

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the west side of the property near the shoreline of Lake Whatcom and the Chanterelle Trailhead. It is the floodplain or Smith Creek which flows through the center of the unit. It contains mostly flat terrain and has a soil productivity rating of site class III. It was likely logged in the early 1900s and also experienced a flooding event in 1983. Total stocking is approximately 194 TPA. The overstory contains approximately 144 TPA and is primarily composed of western redcedar, with small components of bigleaf maple, Douglas-fir and western hemlock. Overstory western redcedar average 16 inches DBH and 86 ft tall. The midstory contains approximately 50 TPA and is primarily composed of western hemlock and western redcedar. Midstory redcedar average 9 inches DBH and 60 ft tall, and hemlock average 8 inches DBH and 48 ft tall. Per the earlier discussion of mixed conifer and hardwood forests, no large-scale management activities are recommended in this forest. However, large infestations of invasive species, particularly Himalayan blackberry, cutleaf blackberry, and English ivy, are present near the road and edges of this stand, and treatment and restoration of these areas is recommended. This unit is accessible from the North Shore Road.

FMU A2 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	50	93	131	60	10	18	36	118
		RC	58	110	165		10	19	36	124
	Minor	BM	24	44	47		10	15	28	125
	All	All	145	274	371		10	18	36	124

Midstory	Major	RC	62	34	56	9	4	9	14	58
		WH	21	7	15		4	8	12	60
	All	All	83	41	70		4	9	14	59
Total	All	All	228	315	442	69	4	15	36	100

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the lower slopes of the west side of the property near the Chanterelle Trailhead. Smith Creek runs through the center of the unit with moderate west-facing slopes on either side. The soil productivity rating ranges from site class II to III. The unit likely regenerated naturally following a clearcut harvest in the early 1900s. Total stocking is approximately 228 TPA. The overstory contains approximately 145 TPA and is primarily composed of western redcedar and Douglas-fir, with a small component of bigleaf maple. Overstory Douglas-fir average 18 inches DBH and 118 ft tall, and redcedar average 19 inches DBH and 124 ft tall. The midstory contains approximately 83 TPA and is primarily composed of western hemlock and western redcedar. Midstory redcedar average 9 inches DBH and 58 ft tall, and hemlock average 8 inches DBH and 60 ft tall. Per the earlier discussion of mixed conifer and hardwood forests with no forest health concerns, no management activities are recommended. The north side of the unit is accessible from North Shore Road, and the south side of the unit is accessible from Wickersham Truck Trail.

FMU A3 - Unforested

This FMU is an unforested field on the west side of the property near the shoreline of Lake Whatcom. It has a soil productivity rating of site class II. The exact history of this field is unknown, but it's possible that grass colonized the site following a disturbance and prevented the regeneration of trees, or that it was intentionally converted to a field. In addition, infestations of invasive species, particularly Himalayan blackberry, cutleaf blackberry, and English ivy, are present near the road and edges of this unit, and treatment and restoration of these areas is recommended. To regain forest cover at this site, this plan recommends planting trees across the unit at 250 to 300 TPA. This unit is easily accessible from the North Shore Road.

FMU A4 - Conifer Plantation - Large DBH

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	BM	64	29	15	60	2	4	6	40
		DF	252	181	309		6	11	18	62
	All	All	315	210	324		2	10	18	58
Midstory	Major	BM	5	0	1	0	2	4	6	10
Total	All	All	320	210	325	60	2	10	18	57

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the lower slopes of the west side of the property. It has moderate to steep west-facing slopes and a soil productivity rating of site class III. It was clearcut around 1993 and replanted with Douglas-fir. Total stocking is approximately 320 TPA. The overstory contains approximately 315 TPA and is primarily composed of bigleaf maple and Douglas-fir. Overstory Douglas-fir average 11 inches DBH and 62 ft tall, and maple average 4 inches DBH and 40 ft tall. The midstory contains approximately 5 TPA and is primarily composed of bigleaf maple that average 4 inches DBH and 10 ft tall. The unit is currently overstocked with low species and structural diversity common to plantations.

Per the earlier discussion of overstocked, large-diameter plantations, a two-part sequence of variable density thinning is recommended, and potential underplanting once density has been sufficiently reduced. Much of the terrain should enable ground-based logging operations aside from steeper terrain on the southwest and southeast side of the unit which will require cable yarding or tethering. This unit is accessible from the Wickersham Truck Trail, and most of the stand is within 800 ft of the road.

FMU A5 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	88	149	242	56	12	19	36	127
	Minor	BM	20	43	50		12	18	24	160
	All	All	114	206	304		12	18	36	134
Midstory	Major	RC	33	11	31	9	4	10	14	56
		WH	33	11	31		4	10	14	56
	All	All	73	27	67		4	9	14	54
Total	All	All	187	233	370	65	4	15	36	103

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the west side of the property along the shoreline of Lake Whatcom. It has moderate to steep west-facing slopes and a soil productivity rating of site class III. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1917. Total stocking is approximately 187 TPA. The overstory contains approximately 114 TPA and is primarily composed of Douglas-fir, with a small component of bigleaf maple. Overstory Douglas-fir average 19 inches DBH and 127 ft tall. The midstory contains approximately 73 TPA and is primarily composed of western hemlock and western redcedar that both average 10 inches DBH and 56 ft tall. Per the earlier discussion of mixed conifer and hardwood forests with no forest health concerns, no

management activities are recommended. There is no current road access to this stand as the previous orphaned road spur, H-3300F, has been converted to a hiking trail.

FMU A6 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	105	155	224	60	10	16	28	120
		RA	40	52	73		10	14	20	115
	Minor	RC	13	13	18		10	12	18	110
	All	All	164	232	326		10	15	28	119
Midstory	Major	RC	24	8	13	5	2	7	12	38
		WH	39	14	19		2	6	12	39
	Minor	DF	10	4	5		4	6	8	40
	All	All	74	26	37		2	6	12	39
Total	All	All	238	258	363	64	2	12	28	94

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the middle slopes of the west side of the property on southwest-facing terrain. The upper zone has moderate slopes and the lower zone has steep slopes. The unit has a soil productivity rating of site class III. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1935. Total stocking is approximately 238 TPA. The overstory contains approximately 164 TPA and is primarily composed of red alder and Douglas-fir, with a small component of western redcedar. Overstory Douglas-fir average 16 inches DBH and 120 ft tall, and alder average 14 inches DBH and 115 ft tall. The midstory contains approximately 74 TPA and is primarily composed of western hemlock and western redcedar, with a small component of Douglas-fir. Midstory western redcedar average 7 inches DBH and 38 ft tall, and hemlock average 6 inches DBH and 39 ft tall.

This is a mixed conifer and hardwood stand that is moderately overstocked, particularly in areas that are dominant to Douglas-fir. In conifer-dominated portions, the forest appears to be in late Stem Exclusion or early Mature I stages of development. A commercial thinning in the accessible portions of this stand is recommended to address the conifer overstocking. The upper part of the stand is accessible from the Wickersham Truck Trail and contains moderate slopes that should enable ground-based logging operations. The lower slopes on the south side are very steep and are part of a hazard zone, so thinning will likely need to be non-commercial or avoided entirely in this zone.

FMU A7 - Conifer Plantation - Small DBH

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	408	58	94	32	2	4	6	20
		RA	189	27	44		2	4	6	20
	Minor	CH	117	16	27		2	4	6	20
	All	All	714	101	164		2	4	6	20
Total	All	All	714	101	164	32	2	4	6	20

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the middle slopes of the west side of the property. It has mostly moderate west-facing slopes and a soil productivity rating that ranges from site class II to III. It was clearcut around 2009 and replanted with Douglas-fir. No management has occurred in the intervening years and extensive infilling by red alder and other hardwoods has greatly increased stocking. Total stocking is approximately 714 TPA. The overstory is primarily composed of red alder and Douglas-fir, with a small component of bitter cherry. Overstory Douglas-fir average 4 inches DBH and 20 ft tall, and red alder average 4 inches DBH and 20 ft tall. No midstory is currently present in this stand. This plantation is overstocked and currently in the Stem Exclusion phase of development.

Per the earlier discussion of overstocked small-diameter plantations, an initial pre-commercial thinning is recommended, followed by a two-part sequence of variable density thinnings in the future, and potential underplanting once density has been sufficiently reduced. The unit is accessible from the Wickersham Truck Trail and the active H-3300E spur that provides access to the Chanterelle Trail Overlook. In addition, 1,000 ft of the abandoned spur known as CC-82 should be temporarily restored to provide better access into this unit in the coming years.

FMU A8 - Mixed Conifer - Stem Exclusion / Mature-I

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	116	179	275	65	10	17	28	138
		WH	46	70	87		8	15	24	135
	Minor	RC	27	36	46		8	14	18	129
	All	All	189	284	408		8	16	28	136
Midstory	Major	RC	33	7	13	4	2	6	10	26
		WH	38	8	15		2	6	10	30
	All	All	75	17	30		2	6	10	30

Total	All	All	264	301	438	69	2	13	28	106

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on middle slopes in the central area of the property. It has southwest-facing slopes that are generally moderate at the upper elevations and steep at the lower elevations. The soil productivity rating ranges from site class III to IV. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1945-1952. Total stocking is approximately 280 TPA. The overstory contains approximately 140 TPA and is primarily composed of Douglas-fir, with small components of bigleaf maple, red alder, western redcedar and western hemlock. Overstory Douglas-fir average 18 inches DBH and 140 ft tall. The midstory contains approximately 140 TPA and is primarily composed of western hemlock and western redcedar that average 6 inches DBH and 60 ft tall. This is a moderately overstocked mixed conifer stand in the late stages of Stem Exclusion and early Mature-I stage of development with a cohort of trees developing in the understory and midstory.

Per the earlier discussion of this forest type at these stocking levels, a variable density thinning is recommended. The upper part of this unit is currently accessible from the Wickersham Truck Trail, though short, temporary spurs may need to be extended past the powerline easement to provide operational access to this unit. Hazard zones are present in this unit that appear to identify convergent headwalls and inner gorges along streams. These will need to be avoided during operations and further assessment is needed. Ground-based logging operations may be possible near the road, but much of this unit will likely require cable-yarding for commercial operations due to the steep slopes.

FMU A9 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	70	100	180	49	12	18	28	140
	Minor	BM	14	20	24		10	14	20	140
		RA	14	20	24		10	14	20	140
		RC	21	30	36		10	14	20	140
		WH	21	30	36		10	14	20	140
	All	All	140	200	300		10	16	28	140
Midstory	Major	RC	70	20	31	8	2	6	10	60
		WH	70	20	31		2	6	10	60
	All	All	140	40	62		2	6	10	60
Total	All	All	280	240	362	56	2	11	28	100

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the central area of the property and contains steep north-facing slopes above a stream channel. The soil productivity rating is site class III. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1938. Total stocking is approximately 280 TPA. The overstory contains approximately 140 TPA and is primarily composed of Douglas-fir, with small components of bigleaf maple, red alder, western redcedar and western hemlock. Overstory Douglas-fir average 18 inches DBH and 140 ft tall. The midstory contains approximately 140 TPA and is primarily composed of western hemlock and western redcedar. Midstory redcedar and hemlock both average 6 inches DBH and 60 ft tall. This is a mixed conifer and hardwood stand with no health concerns, and most of the unit is in an identified hazard zone. Per the earlier discussion of this forest type, no management activities are recommended. There is no current road access to this stand.

FMU A10 - Conifer Plantation - Small DBH

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	302	102	279	52	4	9	14	51
	Minor	RC	53	18	12		2	4	6	44
		WH	53	18	12		2	4	6	44
	All	All	408	138	304		2	8	14	49
Midstory	Major	CH	4	2	2	1	4	6	8	20
		DF	4	2	2		4	6	8	20
		RA	4	2	2		4	6	8	20
	All	All	12	6	5		4	6	8	20
Total	All	All	420	144	309	53	2	8	14	49

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located near the top of the ridgeline in the east-central area of the property next to the powerlines. It has mostly steep west-facing slopes and a soil productivity rating of site class IV. It was clearcut in the early 2000s and replanted with Douglas-fir. NO management has occurred in the following years. Total stocking is approximately 420 TPA. The overstory contains approximately 408 TPA and is primarily composed of Douglas-fir, with small components of western redcedar and western hemlock. Overstory Douglas-fir average 9 inches DBH and 51 ft tall. The midstory contains approximately 12 TPA and is primarily composed of red alder, bitter cherry and Douglas-fir. All three midstory species average 6 inches DBH and 20 ft tall. This plantation is overstocked and currently in the Stem Exclusion phase of development.

Per the earlier discussion of overstocked small-diameter plantations, an initial pre-commercial thinning is recommended, followed by a two-part sequence of variable density thinnings in the future, and potential underplanting once density has been sufficiently reduced. This unit is accessible from the

Wickersham Truck Trail and from the top via the CC-60 road currently being used to access the powerline easement. The steep terrain will likely require cable-yarding for commercial operations. Minor hazard zones are present that appear to identify inner gorges along streams and may require additional assessment, but these can be easily avoided during thinning operations.

FMU B1 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	77	139	270	68	8	22	32	125
		RA	29	49	60		8	16	28	114
	Minor	RC	13	31	31		8	17	32	108
		WH	10	17	16		8	13	20	81
	All	All	135	248	389		8	19	32	116
Midstory	Major	RC	17	6	7	5	2	6	10	45
		WH	65	28	32		2	6	12	46
	All	All	84	35	41		2	6	12	46
Total	All	All	219	283	429	71	2	14	32	89

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the southern part of the property and stretches from the shores of Lake Whatcom on the west side to the upper slopes on the east side. It contains a series of west-facing terraces that alternate with moderate and steep slopes. A steep stream channel runs through the center of the unit, and the soil productivity rating ranges from site class II to III. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1933-1956. Total stocking is approximately 219 TPA. The overstory contains approximately 135 TPA and is primarily composed of red alder and Douglas-fir, with small components of western redcedar and western hemlock. Overstory Douglas-fir average 22 inches DBH and 125 ft tall, and alder average 16 inches DBH and 114 ft tall. The midstory contains approximately 84 TPA and is primarily composed of western hemlock and western redcedar. Midstory redcedar average 6 inches DBH and 45 ft tall, and hemlock average 6 inches DBH and 46 ft tall. This is a mixed conifer and hardwood stand with no health concerns. Per the earlier discussion of this forest type, no management activities are recommended. There is no current road access to this stand.

FMU B2 - Mixed Conifer - Mature-II

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT

Overstory	Major	DF	70	120	213	58	12	20	36	180
		RC	70	120	149		8	16	36	180
	All	All	140	240	362		8	18	36	180
Midstory	Major	RC	50	20	35	9	4	8	12	60
		WH	50	20	35		4	8	12	60
	All	All	100	40	70		4	8	12	60
Total	All	All	240	280	432	67	4	14	36	130

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the southwest part of the property on steep southwest-facing slopes. The soil productivity rating is site class III. There is limited evidence of logging in this unit and based on historic inventory data, it is estimated that the unit regenerated naturally following a wildfire around 1896. While most trees are over 100 years old, a small cohort of Douglas-fir and western redcedar survived the fire and are even older. Total stocking is approximately 240 TPA. The overstory contains approximately 140 TPA and is primarily composed of western redcedar and Douglas-fir. Overstory Douglas-fir average 20 inches DBH and 180 ft tall, and redcedar average 16 inches DBH and 180 ft tall. The midstory contains approximately 100 TPA and is primarily composed of western hemlock and western redcedar that both average 8 inches DBH and 60 ft tall. This unit is a mixed conifer forest in the later Mature-II stage of development, with established midstory and understory cohorts. Per the earlier discussion of conifer forests in this stage, no management activities are recommended. There is no current road access to this unit.

FMU B3 - Mixed Conifer and Hardwood

This FMU is located in the southwest corner of the property near the shoreline of Lake Whatcom. It has mostly steep north-facing slopes and a soil productivity rating of site class III. Based on historic inventory data, it is estimated that the unit regenerated naturally following multiple landslides around 1940-1970. There is currently no road or trail access to this stand. This unit was not visited during the assessment due to challenging access. Based on remote sensing, this unit has similar forest conditions to nearby unit A9, where no management is recommended. In addition, this unit is on very steep slopes that include hazard zones and historic landslide activity. For these reasons, no management is recommended in this unit.

FMU B4 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	31	69	167	52	16	28	Over 48	153

		RA	49	28	34		4	8	12	100
	Minor	BM	16	35	37		10	17	32	140
		RC	20	45	47		10	17	32	140
	All	All	124	200	313		4	16	Over 48	127
Midstory	Major	RC	31	20	30	5	4	9	16	60
		WH	15	4	8		4	7	12	60
	All	All	46	25	38		4	9	16	60
Total	All	All	170	225	350	57	4	14	Over 48	109

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is in the southwest corner of the property along the shoreline of Lake Whatcom. It has steep west-facing slopes and a soil productivity rating of site class III. There is limited evidence of logging in this unit and based on historic inventory data, it is estimated that the unit regenerated naturally following a wildfire around 1908-1910. While most trees are over 100 years old, a small cohort of Douglas-fir survived the fire and are even older, with one fallen tree counted to be over 400 years old. This cohort measured four to five feet in diameter with extremely thick and fire-scarred bark as well as large diameter epicormic branches and reiterated tops.

Total stocking is approximately 170 TPA. The overstory contains approximately 124 TPA and is primarily composed of red alder and Douglas-fir, with small components of bigleaf maple and western redcedar. In the overstory, post-fire Douglas-fir average 28 inches DBH and 153 ft tall, and alder average 8 inches DBH and 100 ft tall. The midstory contains approximately 46 TPA and is primarily composed of western hemlock and western redcedar. Midstory redcedar average 9 inches DBH and 60 ft tall, and hemlock average 7 inches DBH and 60 ft tall. This is a mixed conifer and hardwood stand with no health concerns.

The 2023 Blue Canyon Fire burned 30-40 acres in the southern tip of this unit. While many smaller diameter trees died in this blaze, most of the medium to large-sized trees are still alive two years later and ground-cover has re-established in many areas. Per the earlier discussion of this forest type, no management activities are recommended and the recently burned areas are expected to continue developing naturally. There is no current road access to this stand but the Hertz Trail passes through the lower sections of this unit.

FMU B5 - Mixed Conifer - Mature-I

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	60	168	245	54	16	24	32	120

	Minor	RC	15	42	26		10	14	24	120
		WH	15	42	26		10	14	24	120
	All	All	100	280	322		10	20	32	120
Midstory	Major	RC	30	3	7	2	2	4	8	20
		WH	30	3	7		2	4	8	20
	All	All	60	5	14		2	4	8	20
Total	All	All	160	285	336	56	2	14	32	82

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the south side of the property. The terrain is mostly steep west-facing slopes but there is a flatter plateau on the west side. The soil productivity rating is site class III on the steep slopes and site class II on the plateau. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1940-1951. Total stocking is approximately 160 TPA. The overstory contains approximately 100 TPA and is primarily composed of Douglas-fir, with small components of western redcedar and western hemlock. Overstory Douglas-fir average 24 inches DBH and 120 ft tall. The midstory contains approximately 60 TPA and is primarily composed of western hemlock and western redcedar. Midstory redcedar average 4 inches DBH and 20 ft tall, and hemlock average 4 inches DBH and 20 ft tall. This stand is in the Mature-I stage of development with a cohort of trees developing in the understory and midstory. The stand is not overstocked, and the overstory density is already below the initial target density for this forest type. Given these factors, no management is recommended. There is no current road access to this stand.

FMU B6 - Mixed Conifer - Mature-I

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	80	151	276	61	12	22	32	137
		WH	52	90	112		8	16	28	132
	All	All	136	250	393		8	19	32	134
Midstory	Major	RC	16	12	11	5	4	8	12	40
		WH	52	24	32		2	7	12	40
	All	All	68	36	43		2	7	12	40
Total	All	All	204	286	436	66	2	15	32	103

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the southern area of the property on the middle to upper slopes. It contains mostly steep northwest-facing slopes and has a soil productivity rating of site class III. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around

1945-1951. Total stocking is approximately 204 TPA. The overstory contains approximately 136 TPA and is primarily composed of western hemlock and Douglas-fir. Overstory Douglas-fir average 22 inches DBH and 137 ft tall, and hemlock average 16 inches DBH and 132 ft tall. The midstory contains approximately 68 TPA and is primarily composed of western hemlock and western redcedar. Midstory redcedar average 8 inches DBH and 40 ft tall, and hemlock average 7 inches DBH and 40 ft tall. This stand is in the Mature-I stage of development with a cohort of trees developing in the understory and midstory. The stand is not overstocked and the overstory density is already below the initial target density for this forest type. Given these factors, no management is recommended. There is no current road access to this stand.

FMU B7 - Mixed Conifer - Stem Exclusion / Mature-I

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	WH	237	219	343	75	8	13	18	104
	Minor	DF	85	86	181		10	16	24	118
		RC	19	16	26		10	12	14	120
		SF	14	14	19		8	12	16	80
	All	All	356	336	569		8	13	24	107
Midstory	Major	WH	70	10	20	3	2	5	8	16
	Minor	RC	14	1	3		2	4	6	11
	All	All	88	12	24		2	4	8	15
Total	All	All	444	348	593	78	2	12	24	89

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the southwest area of the property near the upper ridgeline. The stand contains moderate slopes on the upper portion surrounded by steep west- and southwest-facing slopes. The soil productivity rating is site class IV. Based on historic inventory data and aerial imagery, it is estimated that the unit regenerated naturally following clearcut harvesting between the 1930s and 1950s. There is some evidence portions of this unit uphill of the road have been pre-commercially thinned in the past, potentially as part of the nearby harvest of unit A10 in the early 2000s. Total stocking is approximately 444 TPA. The overstory contains approximately 356 TPA and is primarily composed of western hemlock, with small components of Douglas-fir, western redcedar and Pacific silver fir. Overstory western hemlock average 13 inches DBH and 104 ft tall. The midstory contains approximately 88 TPA and is primarily composed of western hemlock, with a small component of western redcedar. Midstory western hemlock average 5 inches DBH and 16 ft tall. Though this unit has a varied history, it is currently overstocked and in the late Stem Exclusion and early Mature-I phases of development.

Per the earlier discussion of overstocked mixed conifer forests in this phase, a sequence of variable density thinnings is recommended. Given the current high density of this stand, two thinnings will be

required to hit the initial density target. This unit can be accessed from the Wickersham Truck Trail. The moderate upper slopes should enable ground-based commercial thinning activities, while the steeper lower slopes may require cable-yarding for commercial operations. Hazard zones are present that appear to identify inner gorges along streams and may require additional assessment, but these can be avoided during thinning operations.

FMU B8 - Mixed Conifer - Stem Exclusion

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	WH	270	233	378	80	6	12	20	115
	Minor	DF	64	59	125		10	15	24	117
		SF	72	66	136		10	15	24	117
	All	All	406	358	639		6	13	24	116
Total	All	All	406	358	639	80	6	13	24	116

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the southwest area of the property near the upper ridgeline. The stand contains an upper plateau surrounded by mostly moderate south- and west-facing slopes. The soil productivity rating is site class IV. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1942-1949. Total stocking is approximately 406 TPA. The overstory is primarily composed of western hemlock, with small components of Douglas-fir and pacific silver fir. Overstory western hemlock average 12 inches DBH and 115 ft tall. No midstory is currently present in this stand. This stand is overstocked and in the Stem Exclusion phase of development.

Per the earlier discussion of overstocked mixed conifer forests in this phase, a sequence of variable density thinnings is recommended. Given the current high density of this stand, two thinnings will be required to hit the initial density target. This unit can be accessed from the Wickersham Truck Trail. Ground-based commercial thinning should be possible on the flatter upper plateau with cable-yarding used on the steeper edges of the unit.

FMU B9 - Mixed Conifer - Mature-I

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	90	190	319	75	12	22	32	120
		WH	72	152	153		8	16	24	120
	Minor	RC	18	38	31		8	14	24	120

	All	All	180	380	503		8	19	32	120
Midstory	Major	WH	100	20	44	5	2	6	8	40
Total	All	All	280	400	547	80	2	14	32	91

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is in the southeast corner of the property and contains mostly moderate to steep south-facing slopes that curve around two stream channels. The soil productivity rating ranges from site class II to IV. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1936-1949. Total stocking is approximately 280 TPA. The overstory contains approximately 180 TPA and is primarily composed of western hemlock and Douglas-fir, with a small component of western redcedar. Overstory Douglas-fir average 22 inches DBH and 120 ft tall, and hemlock average 16 inches DBH and 120 ft tall. The midstory contains approximately 100 TPA and is primarily composed of western hemlock that average 6 inches DBH and 40 ft tall. This stand is in the Mature-I stage of development with a cohort of trees developing in the understory and midstory. Given the current overstory diversity and presence of regeneration, per the earlier discussion of overstocked mixed conifer forests in this phase, no management is recommended. There is no current road access to this stand.

FMU B10 - Conifer Plantation - Small DBH

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	194	80	157	44	4	9	14	40
		RA	135	26	52		2	5	8	40
	Minor	CH	36	10	8		2	4	8	40
		RC	18	5	4		2	4	6	40
		SF	18	5	4		2	4	6	40
		WH	62	23	32		2	6	12	40
	All	All	464	148	258		2	7	14	40
Midstory	Major	DF	16	1	4	2	2	4	6	10
		RC	16	1	4		2	4	6	10
		WH	16	1	4		2	4	6	10
	All	All	48	4	11		2	4	6	10
Total	All	All	512	152	269	45	2	6	14	37

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the southeast side of the property. It has mostly mild northwest-facing slopes and a soil productivity rating of site class IV. This unit was clearcut in 2006 and replanted with Douglas-fir, but natural regeneration of red alder and other minor species also occurred. Total stocking is approximately 512 TPA. The overstory contains approximately 464 TPA and is primarily composed of Douglas-fir and red

alder, with small components of bitter cherry, western redcedar, pacific silver fir and western hemlock. Overstory Douglas-fir average 9 inches DBH and 40 ft tall, and alder average 5 inches DBH and 40 ft tall. The midstory contains approximately 48 TPA and is primarily composed of Douglas-fir, western redcedar and western hemlock, which all average 4 inches DBH and 10 ft tall. This stand is at the end of the Canopy Closure phase of development and current stocking densities are not sustainable long term. Per the earlier discussion of overstocked small-diameter plantations, an initial pre-commercial thinning is recommended, followed by a two-part sequence of variable density thinnings in the future, and potential underplanting once density has been sufficiently reduced. Underplanting may not be necessary, however, due to the current minor presence of several other species. The unit is accessible from the Wickersham Truck Trail and CC-57 spur, though short, temporary spurs may need to be extended past the powerline easement to provide operational access to this unit. The moderate terrain should enable ground-based commercial operations.

FMU C1 - Mixed Conifer - Mature-I/II

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	47	88	137	45	10	19	32	152
	Minor	RC	19	38	87		10	25	42	135
		WH	18	30	31		8	14	20	144
	All	All	99	181	282		8	19	42	143
Midstory	Major	RC	22	12	13	5	2	7	14	51
		WH	32	14	19		2	7	20	40
	All	All	58	27	37		2	7	20	47
Total	All	All	157	208	320	50	2	15	42	108

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the central part of the property on steep north-facing slopes above Smith Creek. The soil productivity rating is site class III. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut and high-grade harvesting around 1918-1942. Some large older cedar that likely originated before this time range were observed on the lower slopes near large cut stumps, suggesting that parts of the stand were high-grade harvested rather than clearcut. Total stocking is approximately 157 TPA. The overstory contains approximately 99 TPA and is primarily composed of Douglas-fir, with small components of western redcedar and western hemlock. Overstory Douglas-fir average 19 inches DBH and 152 ft tall. The midstory contains approximately 58 TPA and is primarily composed of western hemlock and western redcedar. Midstory redcedar average 7 inches DBH and 51 ft tall, and hemlock average 7 inches DBH and 40 ft tall. The high-grade harvest that likely occurred in parts of this mixed conifer stand make it difficult to identify an exact phase of development, but most of it is likely in the late Mature-I and early Mature-II phase. Per the earlier discussion of stands in these stages

of development, and given the healthy stocking density and presence of regeneration, no management activities are recommended for this unit. There is no current road access to this stand, but the Wickersham Truck Trail runs through part of the adjacent powerlines.

FMU C2 - Mixed Conifer - Stem Exclusion

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	128	146	194	54	8	13	24	123
		WH	153	158	182		6	11	18	126
	All	All	281	304	376		6	12	24	125
Midstory	Major	WH	32	13	19	3	4	7	10	40
	All	All	39	20	24		4	7	10	40
Total	All	All	320	324	400	58	4	11	24	114

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the upper slopes of the central part of the property and runs adjacent to the powerline easement. It contains moderate to steep north-east facing slopes leading down to the south fork of Smith Creek. It has a soil productivity rating that ranges from site class III to IV. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1936-1946. Total stocking is approximately 320 TPA. The overstory contains approximately 281 TPA and is primarily composed of western hemlock and Douglas-fir. Overstory Douglas-fir average 13 inches DBH and 123 ft tall, and hemlock average 11 inches DBH and 126 ft tall. The midstory contains approximately 39 TPA and is primarily composed of western hemlock that average 7 inches DBH and 40 ft tall. This stand is overstocked and in the Stem Exclusion phase of development.

Per the earlier discussion of overstocked mixed conifer forests in this phase, a sequence of variable density thinnings is recommended. This stand is accessible from active powerline easement roads, including the CC-70. Ground-based logging may be feasible on the mild terrain on the north side, but the steep slopes elsewhere in the unit may require cable-yarding for commercial operations. Hazard zones are present that appear to identify inner gorges along streams that flow on the lower slopes of this unit. These may require additional assessment, but can be avoided during thinning operations.

FMU C3 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	37	69	149	41	12	24	44	152

		RA	21	30	31		8	13	20	127
		WH	28	42	62		10	16	22	132
	All	All	89	144	254		8	19	44	139
Midstory	Major	RC	25	14	21	7	6	9	22	61
		WH	33	17	24		6	8	12	61
	Minor	DF	11	8	8		6	8	12	63
	All	All	69	40	53		6	8	22	61
Total	All	All	158	184	306	47	6	14	44	105

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is in the central area of the property and is part of the Smith Creek drainage. Smith Creek and one of its tributaries flows along the northern and southern boundaries of the unit. The terrain consists of mostly steep northwest- and southwest-facing slopes and the soil productivity rating is site class III. This site likely has variable harvest and disturbance history. It is estimated that a fire swept through parts of this stand in the late 1800s, burning some trees and leaving some pockets of remnant old trees. In the 1940s and 1950s, parts of this unit were logged near the road that was built, likely removing some of the easily accessible large trees that survived the fire. Other areas were not logged likely due to having mostly small low-value trees at the time that regenerated after the fire. These areas that were not logged contained some pockets of the old trees that survived the original fire.

Total stocking is approximately 158 TPA. The overstory contains approximately 89 TPA and is primarily composed of western hemlock, red alder and Douglas-fir. Overstory Douglas-fir average 24 inches DBH and 152 ft tall, hemlock average 16 inches DBH and 132 ft tall, and alder average 13 inches DBH and 127 ft tall. The midstory contains approximately 69 TPA and is primarily composed of western hemlock and western redcedar, with a small component of Douglas-fir. Midstory redcedar average 9 inches DBH and 61 ft tall, and hemlock average 8 inches DBH and 61 ft tall. The complex disturbance history of this stand has resulted in a mixed forest with multiple cohorts of trees. Per the earlier discussion of mixed conifer and hardwood stands with no health concerns, no management activities are recommended for this unit. There is no current road access to this stand since the 1983 storm event destroyed the road system that used to provide access.

FMU C4 - Mixed Conifer - Mature-I

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	WH	162	198	416	53	8	18	22	120
	Minor	SF	18	22	31		8	14	20	120
	All	All	180	220	447		8	18	22	120
Total	All	All	180	220	447	53	8	18	22	120

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU consists of two separate areas on the east side of the property that are part of the Smith Creek drainage. The northern area consists of steep north-facing terrain, and the southern area consists of steep west–facing terrain. The soil productivity rating ranges from site class III on the lower slopes to site class IV on the upper slopes. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1950. While some adjacent stands were only partially harvested during these times, historical aerial imagery from 1951 shows that the two areas that make up this unit were likely clearcut harvested.

Total stocking is approximately 180 TPA. The overstory is primarily composed of western hemlock, with a small component of pacific silver fir. Overstory western hemlock average 18 inches DBH and 120 ft tall. No midstory is currently present in this stand. This stand is in the early Mature-1 phase of development, with regeneration occurring in the understory. The current stocking is near the initial target density for mixed conifer stands in this phase. The unit is mostly north and northwest facing slopes where more abundant soil moisture is suitable for drought-intolerant western hemlock and silver fir. Per the earlier discussion of mixed conifer forests in the Mature-I stage with healthy stocking levels, no management activities are recommended. There is no current road access to this stand.

FMU C5 - Mixed Conifer - Stem Exclusion/Mature-I

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	69	55	108	50	8	13	24	95
		WH	262	208	280		6	10	24	99
	All	All	332	264	389		6	11	24	98
Midstory	Major	RC	14	7	8	3	4	7	12	53
		WH	42	13	15		2	5	10	48
	All	All	56	20	24		2	6	12	50
Total	All	All	388	284	412	53	2	10	24	91

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the upper slopes of the east side of the property. It consists of an upper plateau in the center surrounded by moderate to steep terrain the slopes to the north, west, and south. The soil productivity rating is site class IV. Based on historic inventory data and aerial imagery, it is estimated that parts of this unit regenerated naturally following a wildfire in the late 1800s and parts regenerated naturally following harvest activities in the 1920s-1940s. Despite the variable disturbance history, the unit has been delineated based on the presence of overstocked forests with slow-growth rates throughout.

Total stocking is approximately 388 TPA. The overstory contains approximately 332 TPA and is primarily composed of western hemlock and Douglas-fir. Overstory Douglas-fir average 13 inches DBH and 95 ft tall, and hemlock average 10 inches DBH and 99 ft tall. The midstory contains approximately 56 TPA and is primarily composed of western hemlock and western redcedar. Midstory redcedar average 7 inches DBH and 53 ft tall, and hemlock average 5 inches DBH and 48 ft tall. This stand is overstocked and mostly in the Stem Exclusion phase of development, but some areas with slightly lower stocking have started to enter the Mature-I phase. The unit is mostly ridgeline and southwest facing slopes and western hemlock is likely poorly suited to future growing conditions. Per the earlier discussion of overstocked mixed conifer forests in this phase, a sequence of variable density thinnings is recommended. Due to the lack of road access, the thinning will need to be non-commercial unless 0.5 miles of new road is constructed.

FMU C6 - Mixed Conifer - Stem Exclusion/Mature-I

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	WH	236	161	220	41	4	9	28	85
	Minor	DF	14	38	66		16	27	34	140
	All	All	255	218	318		4	11	38	89
Midstory	Major	WH	144	18	33	5	2	4	6	40
	All	All	154	21	40		2	4	12	41
Total	All	All	409	239	358	46	2	8	38	71

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the upper slopes of the east side of the property. It contains mostly moderate west-facing slopes and has a soil productivity rating of site class IV. Based on historic inventory data, it is estimated that most of this unit regenerated naturally following clearcut harvesting around 1950. Based on field observations and historical aerial imagery, it appears that some portions of this stand were left during this harvest, and today contain slightly older trees than the areas that were harvested. It is possible that a wildfire swept through parts of this stand in the late 1800s, so the trees that regenerated post-fire were small and low-value when the harvest occurred, and therefore retained.

Total stocking is approximately 409 TPA. The overstory contains approximately 255 TPA and is primarily composed of western hemlock, with a small component of Douglas-fir. Overstory western hemlock average 9 inches DBH and 85 ft tall. The midstory contains approximately 154 TPA and is primarily composed of western hemlock that average 4 inches DBH and 40 ft tall. The forest in this stand is overstocked and a mix of areas in the Stem Exclusion phase and areas in the Mature-I phase of development. While the unit's northwest facing slopes are suitable for drought-intolerant western hemlock, the overstory is over 90% hemlock and lacks diversity. Per the earlier discussion of overstocked mixed conifer forests in this phase, a sequence of variable density thinnings is recommended. There is no

current road access to this stand, but the SH-2000 road runs near the eastern border of the stand. The thinning will likely be non-commercial unless a new road is constructed into the stand.

FMU D1 - Mixed Conifer - Mature-II

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF - Cohort 1	62	166	237	69	10	23	42	169
		WH	35	90	102		10	19	30	164
	Minor	DF - Cohort 2	8	24.5	73		32	40	> 48	180
	All	All	116	312	441		10	22	> 48	169
Midstory	Major	RC	40	22	39	12	4	10	16	64
		WH	64	28	55		4	9	16	63
	All	All	104	50	94		4	9	16	63
Total	All	All	220	362	534	81	4	16	> 48	119

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This stand consists of three separate areas on the north side of the property that are part of the Smith Creek drainage. Two areas are on the north side of Smith Creek and contain steep south- and east-facing slopes, while the third area is on the south side of Smith Creek and contains steep northwest-facing slopes. There is limited evidence of logging in this unit and based on historic inventory data, it is estimated that the unit regenerated naturally following a wildfire around 1880. While most trees are over 125 years old, a small cohort of Douglas-fir survived the fire and are even older, possibly several hundred years old. This cohort measured three to five feet in diameter with extremely thick bark as well as large-diameter epicormic branches.

Total stocking is approximately 220 TPA. The overstory contains approximately 116 TPA and is primarily composed of western hemlock and Douglas-fir. Overstory Douglas-fir average 23 inches DBH and 169 ft tall, and hemlock average 19 inches DBH and 164 ft tall. The midstory contains approximately 104 TPA and is primarily composed of western hemlock and western redcedar. Midstory redcedar average 10 inches DBH and 64 ft tall, and hemlock average 9 inches DBH and 63 ft tall. This mixed conifer forest is in the Mature-II phase of development with healthy stocking levels and midstory and understory cohorts of trees. Per the earlier discussion of mixed conifer forests in this phase, no management activities are recommended. Parts of this unit can be accessed via the SH-94 road, but access is otherwise limited.

FMU D2 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy	Cohort	Species	TPA	BAA	SDI	RD	Min	Avg	Max	Avg

Position	Type						DBH	DBH	DBH	HT
Overstory	Major	RA	66	100	139	55	10	16	24	122
	Minor	DF	26	59	88		10	21	32	130
		RC	19	44	54		10	19	32	118
		WH	21	49	60		10	19	32	123
	All	All	132	252	341		10	18	32	123
Midstory	Major	WH	92	32	56	7	4	7	12	44
Total	All	All	224	284	397	62	4	14	32	91

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This is a large FMU spread out across the lower and middle slopes of the Smith Creek drainage on the north side of the property. It contains mostly steep terrain on both sides of Smith Creek and one of its major tributaries. Based on historic inventory data, it is estimated that most of this unit regenerated naturally following clearcut harvesting around 1950-1953. Total stocking is approximately 224 TPA. The overstory contains approximately 132 TPA and is primarily composed of red alder, with small components of Douglas-fir, western redcedar and western hemlock. Overstory red alder average 16 inches DBH and 122 ft tall. The midstory contains approximately 92 TPA and is primarily composed of western hemlock that average 7 inches DBH and 44 ft tall. This stand regenerated as a mixed forest following the harvest. This unit will undergo a transition as the alder declines, but there is no concern about the future forest cover of the unit due to the presence of long-lived overstory conifer species and current regeneration in the understory. Therefore, there are no management recommendations for this mixed conifer and hardwood unit. Parts of this unit can be accessed via the SH-94 road, but access is otherwise limited since the 1983 storm event destroyed the road system that used to provide access.

FMU D3 - Mixed Conifer - Stem Exclusion

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	WH	248	180	267	45	6	10	22	91
	Minor	DF	50	37	62		6	11	22	97
		RC	22	17	22		8	10	14	87
	All	All	324	239	355		6	11	22	92
Midstory	Major	RC	45	18	25	7	4	7	10	55
		WH	61	21	30		4	6	10	47
	All	All	106	39	56		4	7	10	50
Total	All	All	430	278	410	52	4	10	22	82

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This unit consists of two separate areas on the upper slopes along the eastern boundary of the property. It has moderate to steep west- and south-facing slopes and a soil productivity rating that ranges from site class III to IV. Based on historic inventory data, it is estimated that the area regenerated following a clearcut harvest around 1950. Total stocking is approximately 430 TPA. The overstory contains approximately 324 TPA and is primarily composed of western hemlock, with small components of Douglas-fir and western redcedar. Overstory western hemlock average 10 inches DBH and 91 ft tall. The midstory contains approximately 106 TPA and is primarily composed of western hemlock and western redcedar. Midstory redcedar average 7 inches DBH and 55 ft tall, and hemlock average 6 inches DBH and 47 ft tall. Even though there is a slightly different disturbance history, both areas are overstocked mixed conifer forests in the Stem Exclusion phase of development.

Per the earlier discussion of overstocked mixed conifer forests in this phase, a sequence of variable density thinnings is recommended. This stand is generally accessible from the Sultan Hill Mainline road, though short temporary spurs would need to be built or restored to provide access. Aside from the plateau on the southern side, the unit contains mostly steep slopes that will likely require cable-yarding for commercial operations. Hazard zones are present that appear to identify inner gorges along streams and a convergent headwall and will require additional assessment.

FMU D4 - Mixed Conifer - Stem Exclusion

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	88	64	88	31	8	10	12	80
		WH	132	96	132		8	10	12	80
	All	All	220	160	220		8	10	12	80
Midstory	Major	DF	160	60	70	21	4	6	8	60
		WH	160	60	70		4	6	8	60
	All	All	320	120	141		4	6	8	60
Total	All	All	540	280	361	51	4	8	12	68

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the upper slopes along the eastern boundary of the property. It contains mostly steep west-facing slopes and has a soil productivity rating of site class IV. Based on historic inventory data, it is estimated that the stand was planted with Douglas-fir following a clearcut harvest around 1991 and filled in naturally with western hemlock. Total stocking is approximately 540 TPA. The overstory contains approximately 220 TPA and is primarily composed of western hemlock and Douglas-fir. Overstory Douglas-fir average 10 inches DBH and 80 ft tall, and hemlock average 10 inches DBH and 80 ft tall. The midstory contains approximately 320 TPA and is primarily composed of western hemlock and Douglas-fir. Midstory Douglas-fir and hemlock both average 6 inches DBH and 60 ft tall. This stand is

overstocked and in the Stem Exclusion phase of development. Per the earlier discussion of overstocked mixed conifer forests in this phase, a sequence of variable density thinnings is recommended. This stand is accessible from the Sultan Hill mainline road and the short, abandoned SH-112 spur road. The upper part of the stand contains mild slopes that may enable ground-based commercial operations, but much of the stand will likely require cable-yarding. A couple hazard zones are present that will need further assessment before operations.

FMU D5 - Mixed Conifer - Late Seral

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	10	60	124	36	42	48	> 48	180
		RC	10	60	100		38	42	> 48	180
	All	All	20	120	224		38	45	> 48	180
Midstory	Major	RC	16	32	49	15	16	20	24	120
		WH	24	48	73		16	20	24	100
	All	All	40	80	122		16	20	24	108
Total	All	All	60	200	346	50	16	28	> 48	132

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the northeast side of the property and is part of the Smith Creek drainage. It has steep northwest facing slopes and a soil productivity rating that ranges from site class III to IV. This stand was not harvested and contains remnant old-growth Douglas-fir and western redcedar in the overstory and complex midstory and understory cohorts. This stand has experienced natural disturbances over the years, including a windstorm and likely a wildfire that swept through this area in the late 1800s. These disturbances have reduced the density of the original overstory cohort.

Total stocking is approximately 60 TPA. The overstory contains approximately 20 TPA and is primarily composed of Douglas-fir and western redcedar. Overstory Douglas-fir average 48 inches DBH and 180 ft tall, and redcedar average 42 inches DBH and 180 ft tall. The midstory contains approximately 40 TPA and is primarily composed of western hemlock and western redcedar. Midstory redcedar average 20 inches DBH and 120 ft tall, and hemlock average 20 inches DBH and 100 ft tall. Regeneration of redcedar, hemlock, and Pacific silver fir is occurring at a density of greater than 50 TPA. This is a late seral stand, which is rare in the Lake Whatcom watershed. Per the earlier discussion of old mixed conifer forests, no management activities are recommended. There is no current road access to this stand.

FMU D6 - Mixed Conifer - Stem Exclusion/Mature-I

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	136	118	253	88	8	15	24	95
		WH	254	222	398		8	13	24	110
	All	All	390	340	651		8	14	24	104
Midstory	Major	WH	65	16	22	4	2	5	12	40
	Minor	RC	15	6	10		4	8	12	40
	All	All	80	22	32		2	6	12	40
Total	All	All	470	362	683	92	2	12	24	94

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU consists of two separate areas on the north side of the property. The west-most area consists of mostly southwest-facing slopes, and the east-most area consists of mostly moderate southeast-facing slopes. The soil productivity rating is site class IV. Based on historic inventory data, it is estimated that the stand regenerated naturally following a clearcut harvest around 1962-1963. Total stocking is approximately 470 TPA. The overstory contains approximately 390 TPA and is primarily composed of western hemlock and Douglas-fir. Overstory Douglas-fir average 15 inches DBH and 95 ft tall, and hemlock average 13 inches DBH and 110 ft tall. The midstory contains approximately 80 TPA and is primarily composed of western hemlock, with a small component of western redcedar. Midstory hemlock average 5 inches DBH and 40 ft tall.

No management is recommended in the western area of this unit as it is a riparian zone and unstable convergent headwall that was not logged during recent DNR activities in 2011. In the eastern area, a sequence of variable density thinnings is recommended, per the earlier discussion of overstocked mixed conifer forests in this phase of development. The eastern stand is accessible from the SH-94 road and operations would benefit from restoring 0.25 miles of abandoned road bed to provide access deeper into the stand. The eastern unit contains mild slopes which should enable ground-based commercial operations. A historic landslide may be present in the southern half of the eastern unit which will require further assessment.

FMU D7 - Mixed Conifer - Stem Exclusion

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	130	121	143	44	6	11	18	64
		WH	151	118	124		4	9	18	74

	Minor	RC	23	26	36		8	13	18	80
	All	All	304	265	304		4	10	18	70
Midstory	Major	WH	123	60	28	4	2	4	6	36
	Minor	RC	23	5	5		2	4	6	25
	All	All	148	68	34		2	4	6	35
Total	All	All	452	333	338	47	2	8	18	58

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the north side of the property, near the headwaters of Smith Creek. It contains an upper plateau with mild slopes and a section with steep south-facing slopes. The soil productivity rating is site class IV. Based on historic inventory data, it is estimated that the stand was replanted following a clearcut harvest around 1962-1967. It was likely planted with Douglas-fir but other conifer species have also naturally regenerated. Total stocking is approximately 452 TPA. The overstory contains approximately 304 TPA and is primarily composed of western hemlock and Douglas-fir, with a small component of western redcedar. Overstory Douglas-fir average 11 inches DBH and 64 ft tall, and hemlock average 9 inches DBH and 74 ft tall. The midstory contains approximately 148 TPA and is primarily composed of western hemlock, with a small component of western redcedar. Midstory western hemlock average 4 inches DBH and 36 ft tall. This stand is overstocked and in the Stem Exclusion phase of development. Per the earlier discussion of overstocked mixed conifer forests in this phase, a sequence of variable density thinnings is recommended. This stand is accessible from the Sultan Hill Mainline road. The mild terrain on the upper plateau should enable ground-based commercial thinning, but the lower steep slopes will likely require cable-yarding techniques. Hazard zones are present along the edges of this stand that appear to identify inner gorges along streams, but these can be avoided during thinning operations.

FMU D8 - Mixed Conifer - Stem Exclusion/Mature-I

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	104	171	285	83	8	19	28	140
		WH	149	190	268		8	14	22	112
	All	All	270	380	576		8	16	28	122
Midstory	Major	RC	55	20	24	6	4	6	10	40
		WH	55	20	24		4	6	10	40
	All	All	110	40	48		4	6	10	40
Total	All	All	380	420	624	89	4	13	28	98

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the north side of the property, near the headwaters of Smith Creek. It has steep south-facing slopes and a soil productivity rating that ranges from site class III to IV. Based on historic inventory data, it is estimated that the stand regenerated naturally following a wildfire around 1900. Total stocking is approximately 380 TPA. The overstory contains approximately 270 TPA and is primarily composed of western hemlock and Douglas-fir. Overstory Douglas-fir average 19 inches DBH and 140 ft tall, and hemlock average 14 inches DBH and 112 ft tall. The midstory contains approximately 110 TPA and is primarily composed of western hemlock and western redcedar that both average 6 inches DBH and 40 ft tall. This forest is overstocked and largely in the Stem Exclusion phase of development with some lower-density areas beginning to enter the Mature-I phase.

Per the earlier discussion of overstocked mixed conifer forests in this phase, a sequence of variable density thinnings is recommended. Restoring 800ft of the abandoned SH-98 spur will be necessary to reach this stand. Commercial thinning may be possible using cable-yarding techniques, but will likely need to avoid several steep inner gorge systems so the total treatable area will be lower.

FMU D9 - Mixed Conifer - Stem Exclusion

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	WH	314	181	220	48	4	8	12	77
	Minor	DF	62	39	43		4	8	10	78
		RA	38	20	27		6	8	10	80
		RC	80	39	77		6	10	16	77
	All	All	495	279	367		4	8	16	78
Midstory	Major	WH	180	8	45		2	4	8	42
	Minor	RC	18	2	8		4	6	8	60
	All	All	197	11	53		2	4	8	43
Total	All	All	692	290	420	55	2	7	16	68

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the northeast corner of the property and is part of the headwaters for Smith Creek. It contains moderate to steep slopes on both sides of Smith Creek and one of its tributaries, so slope direction varies but generally curves around the streams that flow to the southwest. The soil productivity rating is site class IV. Based on historic inventory data, it is estimated that the stand naturally regenerated following a clearcut harvest around 1984-1985. Douglas-fir was likely replanted following the harvest, but survival was low and the stand naturally regenerated with mostly western hemlock. Total stocking is approximately 692 TPA. The overstory contains approximately 495 TPA and is primarily composed of western hemlock, with small components of Douglas-fir, red alder and western redcedar. Overstory western hemlock average 8 inches DBH and 77 ft tall. The midstory contains approximately

197 TPA and is primarily composed of western hemlock, with a small component of western redcedar. Midstory hemlock average 4 inches DBH and 42 ft tall. This stand is overstocked and in the Stem Exclusion phase of development. Per the earlier discussion of overstocked mixed conifer forests in this phase, a sequence of variable density thinnings is recommended. This stand is very accessible from the Sultan Hill Mainline road. Most of the steep terrain will likely require cable-yarding for commercial operations. Hazard zones are present that appear to identify inner gorges along streams and may require additional assessment, but these can be avoided during thinning operations.

FMU E1 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	35	83	120	54	12	21	32	134
		RA	23	54	53		12	17	24	129
		RC	35	83	120		12	21	32	134
	Minor	WH	15	35	38		10	18	24	135
	All	All	112	264	341		10	20	32	133
Midstory	Major	RC	36	20	29	7	4	9	14	60
		WH	36	20	29		4	9	14	60
	All	All	72	40	58		4	9	14	60
Total	All	All	184	304	399	61	4	16	32	104

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the northwest corner on the lower slopes of the property. It has mostly south-facing slopes and a soil productivity rating of site class II. Based on historic inventory data, it is estimated that the stand naturally regenerated following a clearcut harvest around 1920-1924. Total stocking is approximately 184 TPA. The overstory contains approximately 112 TPA and is primarily composed of red alder, Douglas-fir and western redcedar, with a small component of western hemlock. Overstory Douglas-fir and redcedar both average 21 inches DBH and 134 ft tall, and alder average 17 inches DBH and 129 ft tall. The midstory contains approximately 72 TPA and is primarily composed of western hemlock and western redcedar that both average 9 inches DBH and 60 ft tall. This is a mixed conifer and hardwood forest with red alder that is beginning to decline.

Per the earlier discussion of mixed conifer and hardwood forests with healthy stocking, no large-scale management activities are recommended in this forest, but it is recommended to monitor the presence of invasive species. Gaps will form in the canopy of this stand as the red alder declines which creates the possibility of Himalayan blackberry infestation due its presence in nearby stands. Monitoring will ensure any potential infestations are caught early and treated before they become a major forest health

concern. The lower portion of this stand is currently accessible from a powerline access road and an orphaned road system continues up into the stand which is now being used as a hiking and biking trail.

FMU E2 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	26	70	108	39	16	24	32	120
	Minor	BM	13	34	37		8	19	28	120
		RA	13	34	37		8	19	28	120
		RC	11	29	29		8	18	24	120
		WH	11	29	29		8	18	24	120
	All	All	76	196	240		8	20	32	120
Midstory	Major	RA	8	3	4	4	2	6	10	60
		RC	14	9	12		2	9	16	60
		WH	14	9	12		2	9	16	60
	All	All	36	20	27		2	8	16	60
Total	All	All	112	216	267	42	2	16	32	101

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the northwest corner on the lower slopes of the property. It has mostly south-facing slopes and a soil productivity rating of site class II. Based on historic inventory data, it is estimated that the stand naturally regenerated following a clearcut harvest around 1941. Total stocking is approximately 112 TPA. The overstory contains approximately 76 TPA and is primarily composed of Douglas-fir, with small components of bigleaf maple, red alder, western redcedar and western hemlock. Overstory Douglas-fir average 24 inches DBH and 120 ft tall. The midstory contains approximately 36 TPA and is primarily composed of western hemlock, red alder and western redcedar. Midstory redcedar and hemlock average 9 inches DBH and 60 ft tall, and alder average 6 inches DBH and 60 ft tall.

This mixed conifer and hardwood forest has low stocking, likely as a result of red alder die-off in the overstory. Some of the canopy gaps have been colonized by invasive Himalayan blackberry, which is preventing the regeneration of trees in the understory. Invasive species removal and planting are recommended in affected areas of this stand to ensure long-term forest cover. There is no current road access to this stand.

FMU E3 - Mixed Conifer and Hardwood

This FMU is located on the north side of the property. It has moderate to steep south-facing slopes and a soil productivity rating that ranges from site class II to IV. Based on historic inventory data, it is estimated

that the unit regenerated naturally following clearcut harvesting around 1915. There is currently no road or trail access to this stand. This unit was not visited during the assessment due to challenging access. Based on remote sensing, this unit has similar forest conditions to nearby unit E1, where no largescale management is recommended. In addition, parts of this unit include hazard zones and historic landslide activity. For these reasons, no management is recommended in this unit.

FMU E4 - Mixed Conifer - Mature-II

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	29	89	117	71	12	24	32	140
		RC	53	163	243		12	26	36	140
	Minor	BM	12	37	31		12	18	30	140
		WH	19	60	71		12	22	32	140
	All	All	120	372	480		12	24	36	140
Midstory	Major	RC	46	16	32	8	4	8	12	47
		WH	46	16	32		4	8	12	47
	All	All	92	32	64		4	8	12	47
Total	All	All	212	404	545	80	4	17	36	100

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the northwest part of the property on mostly moderate northwest-facing slopes. The soil productivity rating is site class III. Based on historic inventory data, it is estimated that the stand naturally regenerated following a clearcut harvest around 1923. Total stocking is approximately 212 TPA. The overstory contains approximately 120 TPA and is primarily composed of Douglas-fir and western redcedar, with small components of bigleaf maple and western hemlock. Overstory Douglas-fir average 24 inches DBH and 140 ft tall, and redcedar average 26 inches DBH and 140 ft tall. The midstory contains approximately 92 TPA and is primarily composed of western hemlock and western redcedar that both average 8 inches DBH and 47 ft tall. This unit is a mixed conifer forest in the Mature-II stage of development, with established midstory and understory cohorts. Per the earlier discussion of conifer forests in this stage, no management activities are recommended. There is no current road access to this unit.

FMU E5 - Conifer Plantation - Large DBH

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT

Overstory	Major	DF	283	173	329	63	6	11	16	75
	All	All	298	179	333		2	11	16	73
Total	All	All	298	179	333	63	2	11	16	73

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is in the northwest area of the property. It has steep west- and south-facing slopes that curve around a ridgeline. The soil productivity rating is site class III. The unit was clearcut around 1990 and replanted with Douglas-fir. Total stocking is approximately 298 TPA. The overstory is primarily composed of Douglas-fir that average 11 inches DBH and 75 ft tall. No midstory is currently present in this stand. The unit is currently overstocked with low species and structural diversity common to plantations.

Per the earlier discussion of overstocked, large-diameter plantations, a two-part sequence of variable density thinning is recommended starting in 5-10 years, and potential underplanting once density has been sufficiently reduced. The stand is currently accessible from the neglected SH-94 road and management activity in this unit is a good chance to meet maintenance obligations on this road system. The steep terrain will likely require cable-yarding for commercial operations but the southern half of the unit is likely inaccessible to cable-thinning operations and will need to be non-commercially thinned. A large hazard zone extends across the steep northwest slopes, and further assessment is necessary before operations begin in this area.

FMU E6 - Conifer Plantation - Large DBH

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	376	206	412	79	4	10	16	67
	Minor	WH	48	10	11		2	4	8	60
	All	All	424	216	423		2	10	16	66
Total	All	All	424	216	423	79	2	10	16	66

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is on the north side of the property. It contains mostly steep west- and southeast-facing terrain on either side of the north fork of Smith Creek. The soil productivity rating is mostly site class IV, with a small area on the south side having a rating of site class III. The unit was clearcut around 1990 and replanted with Douglas-fir. Total stocking is approximately 424 TPA. The overstory is primarily composed of Douglas-fir, with a small component of western hemlock. Overstory Douglas-fir average 10 inches DBH and 67 ft tall. No midstory is currently present in this stand. The unit is currently overstocked with low species and structural diversity common to plantations.

Per the earlier discussion of overstocked, large-diameter plantations, a two-part sequence of variable density thinning is recommended starting in 5-10 years, and potential underplanting once density has been sufficiently reduced. There are pockets of this stand that are highly overstocked with hemlock and may be pre-commercially thinned at this time as well. The east side of the stand is currently accessible from the SH-94 and SH-9404 roads. Several short, abandoned spurs as well as 0.5 miles of the partially abandoned SH-9404 road should be restored to provide additional access. The SH-94 road is currently active but neglected and management activity in this unit is a good chance to meet maintenance obligations on this road system. A large hazard zone extends across much of the east side of this stand on the steep northwest-facing slopes. Further assessment is necessary before operations, and non-commercial thinning may be necessary in this zone.

FMU E7 - Conifer Plantation - Small DBH

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	360	100	252	48	4	8	12	40
Total	All	All	360	100	252	48	4	8	12	40

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU consists of three small separate areas on the north side of the property. It has mostly steep south-facing slopes and a soil productivity rating of site class IV. The unit was clearcut around 2011 and replanted with Douglas-fir. Total stocking is approximately 360 TPA. The overstory is primarily composed of Douglas-fir. Overstory Douglas-fir average 8 inches DBH and 40 ft tall. No midstory is currently present in this stand.

Per the earlier discussion of overstocked small-diameter plantations, an initial pre-commercial thinning is recommended, followed by a two-part sequence of variable density thinnings in the future, and potential underplanting once density has been sufficiently reduced. This road is accessible via the neglected SH-94 and SH-9404 road system and management activity in this unit is a good chance to meet maintenance obligations on this road system.

Management Activity Schedule

Timeline	Activity	Priority	FMU	Prescription
2025 to 2030	Thinning (PCT)	1	A10, A7, B10, E7	Pre-commercially thin to a target density of 250 to 300 TPA.
	Thinning (CT / NCT)	1	B7, B8, D6, D9	Thin to an interim target density of 250 to 300 TPA.
			A4, E5, E6	Thin to an initial target density of 140 to 170 TPA.
		2	C2, C5, C6, D3, D4, D7, D8	Thin to an initial target density of 140 to 170 TPA.
		3	A8	Thin to an initial target density of 140 to 170 TPA.
		3 or 4	A6	Thin to an initial target density of 140 to 170 TPA.
	Planting	1	A3	Plant with 250-300 TPA of a mix of species suitable to site conditions.
		3	E2	Plant in gaps after invasive species removal with 150-250 TPA of a mix of species suitable to the site conditions.
	Invasive Species	3	A1, A3, E2	Remove invasive species.
			E1	Monitor for invasive species and remove if they pose a forest health risk.
2035 to 2040	Thinning (CT / NCT)	1	A7, B10	Thin to an initial target density of 140 to 170 TPA within 10-15 years after the last thinning entry.
		2	B7, B8, D6, D9	Thin to an initial target density of 140 to 170 TPA within 10-15 years after the last thinning entry.
			A4	Thin to a final target density of 80 to 110 TPA within 10-15 years after the last thinning entry.
	Planting	3	A4	Underplant after thinning with 150 TPA shade-tolerant conifers suitable to site conditions or wait 5-10 years and assess natural regeneration, planting if necessary.
2040 to	Thinning (CT /	1	A10, E7	Thin to an initial target density of 140 to 170 TPA

Timeline	Activity	Priority	FMU	Prescription
2045	NCT)			within 15-20 years after the last thinning entry.
		2	E5	Thin to a final target density of 80 to 110 TPA within 10-15 years after the last thinning entry.
		3	C2, C5, C6, D3, D4, D7, D8	Evaluate the stand for a second thinning and, if necessary, thin to a final target density 80 to 110 TPA within 15-20 years after the last thinning entry.
	Planting	3	E5	Underplant after thinning with 150 TPA shade-tolerant conifers suitable to site conditions or wait 5-10 years and assess natural regeneration, planting if necessary.
2045 to 2050	Thinning (CT / NCT)	2	A7, B10, E6	Thin to a final target density of 80 to 110 TPA within 10-15 years after the last thinning entry.
	Planting	3	A7, B10, E6	Underplant after thinning with 150 TPA shade-tolerant conifers suitable to site conditions or wait 5-10 years and assess natural regeneration, planting if necessary.
2050 to 2055	Thinning (CT / NCT)	3	B7, B8, D6, D9	Evaluate the stand for a second thinning and, if necessary, thin to a final target density 80 to 110 TPA within 15-20 years after the last thinning entry.
	Planting	3	B7, B8, D9	Monitor the stand for natural regeneration, and, if necessary, underplant with 150 TPA of shade-tolerant conifers suitable to site conditions.
2055 to 2060	Thinning (CT / NCT)	2	A10, E7	Thin to a final target density of 80 to 110 TPA within 15-20 years after the last thinning entry.
	Planting	3	A10, E7	Underplant after thinning with 150 TPA shade-tolerant conifers suitable to site conditions or wait 5-10 years and assess natural regeneration, planting if necessary.

Notes: PCT - Pre-commercial Thinning, CT - Commercial Thinning, NCT - Non-commercial Thinning. Priority Levels: 1 - High, 2 - Moderately High, 3 - Moderate, 4 - Low. Additional thinning and planting considerations are identified in Section 1 of this document as well as in the FMU-specific section above.

Parcel Table

Owner	Parcel ID	Year Acquired	Previous Owner
County	3704020662650000	2014	DNR
County	3704020662650001	2014	DNR
County	3704030640540000	2014	DNR
County	3704033210540000	2014	DNR
County	3704034634540000	2014	DNR
County	3704034660660000	2014	DNR
County	3704044640570000	2014	DNR
County	3704044653060000	2014	DNR
County	3704044654320000	2014	DNR
County	3704093710660000	2014	DNR
County	3704094613010000	2014	DNR
County	3704104573270000	2014	DNR
County	3704104680540000	2014	DNR
County	3704110920480000	2014	DNR
County	3704154613240000	2014	DNR
County	3704164663240000	2014	DNR
County	3704164980630000	2014	DNR
County	3804260630680000	2014	DNR
County	3804260662650000	2014	DNR
County	3804271471500000	2014	DNR
County	3804274081490000	2014	DNR
County	3804274083300000	2014	DNR
County	3804284610660000	2014	DNR

Owner	Parcel ID	Year Acquired	Previous Owner
County	3804325171800000	2014	DNR
County	3804332663250000	2014	DNR
County	3804334080700000	2014	DNR
County	3804342013650000	2014	DNR
County	3804343281980000	2014	DNR
County	3804344143370000	2014	DNR
County	3804351330650000	2014	DNR
County	3804351333950000	2014	DNR
County	3804351341980000	2014	DNR
County	3704040704100000	1998	Trillium
County	3704055105250000	Unknown	Unknown
County	3704093252550000	1998	Trillium
County	3804325100750000	Unknown	Unknown
County	3804331910670000	Unknown	Unknown

Lookout Mountain Forest Preserve

Overview

Site Description

Lookout Mountain Forest Preserve (afterward identified as Lookout Mountain) is a large, 4,554-acre, property on the southwest side of Lake Whatcom. It is mostly owned by Whatcom County, except for two parcels on the northeast side near the Lookout Mountain Forest Preserve Trailhead which are jointly owned by the County and the City of Bellingham. The preserve stretches from Lake Whatcom Boulevard near the shoreline of Lake Whatcom up eastern slopes to the ridgeline containing Lookout Mountain and down southern slopes to Cain Lake. It borders the community of Sudden Valley to the north and Glenhaven to the south.

Property Information

This forest is located in Sections 01, 02, 11, 12, 13 and 24 of Township 37N, Range 03E, and Sections 06, 07, 17, 18, 19, 20, 29, 30, and 31 of Township 37N, Range 04E of the US Public Land Survey System and includes the parcels listed at the end of this section. Property corners and boundaries are not regularly marked.

Management History

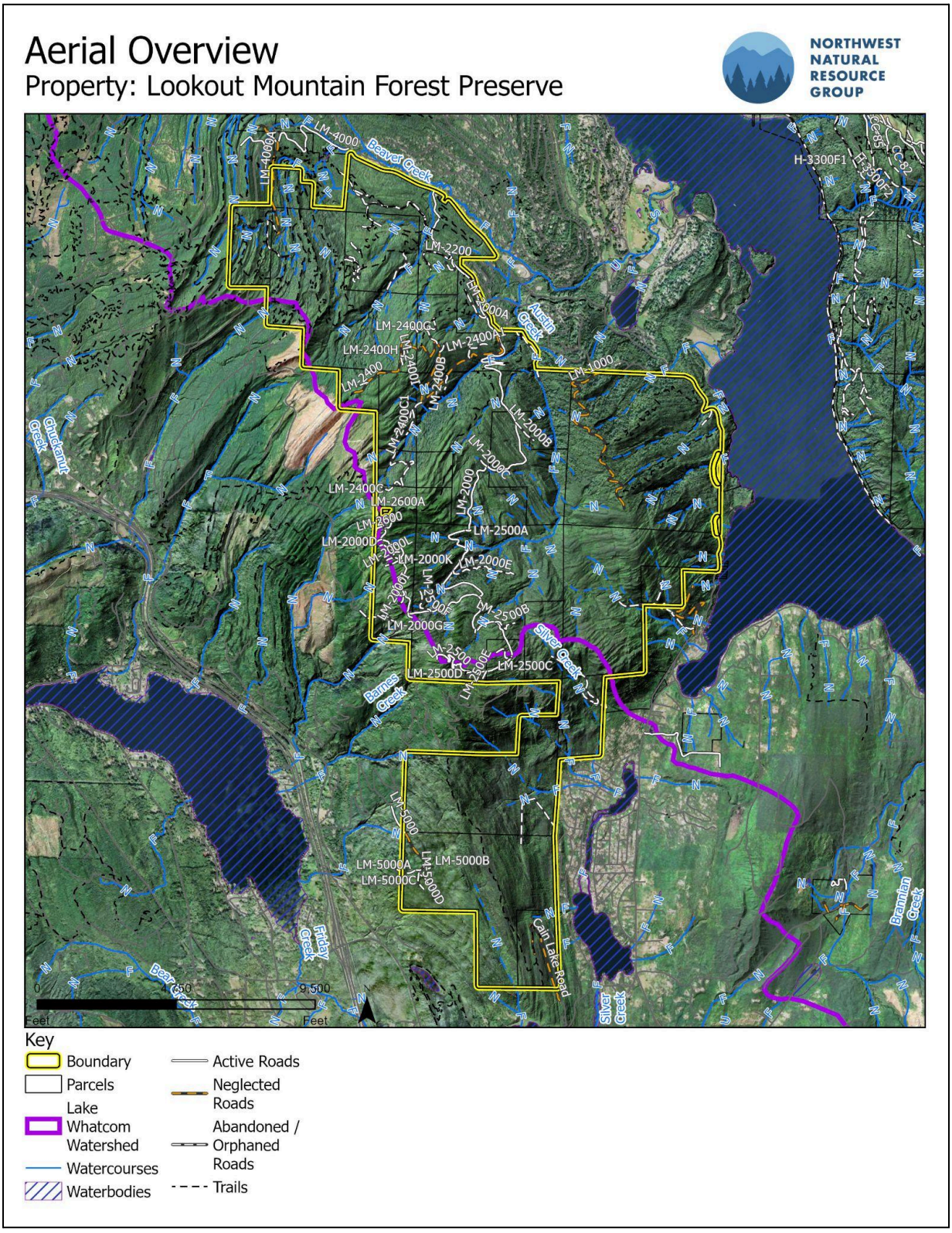
The forestland at Lookout Mountain was originally logged by early settlers during the late 19th and early 20th century, and large timber companies would eventually come to own most of the land in the watershed. Logging likely started lower on the mountain and in easy-to-access locations, before progressing upslope onto steeper and less accessible terrain. For a time, post-logging broadcast burning was commonly employed to reduce logging slash, and many older hand-cut stumps bear the mark of these fires. At higher elevations, the stands are younger, frequently cut with power saws, and fire marks are infrequent. Logging continued at Lookout Mountain through the early 1950s. In time, the last old growth stands were harvested and these forests were left to regenerate naturally. While many timberlands remained in private hands throughout the 20th century, some timber companies stopped paying property taxes after cutting the lucrative timber, and the properties were foreclosed upon by Whatcom County, which in turn transferred them in trust to the State of Washington Department of Natural Resources (DNR).

The second growth forests on Lookout Mountain began to be harvested again in the early 1990s and were replanted with conventional Douglas-fir plantations. Growing concern about forest management activities in the Lake Whatcom watershed spurred the creation of the 2004 Lake Whatcom Landscape Plan, which was created to guide forest management activities on state-owned forestlands in the watershed. In 2012 the County began the process of reconveying these lands back to county ownership,

taking over title in early 2014 to all of the parcels included in the Lookout Mountain Reconveyance property.

Not all of these parcels had been under continuous, decades-long DNR management, as many parcels were previously owned by the Trillium Corporation and its predecessor, industrial timberland owner Georgia Pacific, prior to a large land swap in 1994 that consolidated DNR holdings into contiguous blocks around Lake Whatcom. Today, these forestlands are managed by the Whatcom County Parks and Recreation Department. In addition, the two jointly-owned parcels on the northeast side near the Lookout Mountain Forest Preserve Trailhead were not part of the 2014 reconveyance. These parcels were previously owned by a local family which logged their property sporadically over the decades prior to the properties being purchased by the City and County in 2002.

Property Overview Map



Assessment

Topoclimate

The property spans a large elevation range, from the summit of Lookout Mountain at 2,700 feet down to near the shores of Lake Whatcom. Predominantly east-facing, the site receives slightly less precipitation than the windward west slopes of Lookout Mountain. The terrain descends from the summit but briefly rises again to a secondary ridgeline, the location of Repeater Road, before continuing downward toward the lake. This elevation gradient creates distinct microclimates. The upper elevations are cooler and can receive occasional snowfall in winter, while the lower slopes benefit from the lake's moderating influence, resulting in milder temperatures. During the winter, storm fronts moving inland from the Pacific collide with the ridges of Lookout Mountain, leading to intense winter storms that can deliver large volumes of precipitation in short time spans.

Vegetation Zone

According to vegetation zone maps for North America, the following Ecological Systems were likely present prior to Euro-American settlement. More information on these maps and full descriptions of each system can be found in the discussion of Vegetation Zones in Section 2 of this document.

- North Pacific Hypermaritime Western Red-cedar-Western Hemlock Forest
- North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest
- North Pacific Mesic Western Hemlock-Silver Fir Forest
- North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest

Soils

Data from the USDA Natural Resource Conservation Service (NRCS) Soil Surveys were used to identify the major soil types that underlay this forest, which are described in more detail in the discussion of Soil Productivity in Section 2. Information about specific soil units likely present at this property, including depth, drainage, productivity, and relevant management concerns are listed in the table below. The location of these soil units can be found in the accompanied map packet for this property.

Forest Soil Units Summary Table

Soil Unit	Productivity		Management Concerns					Acres (Pct)
	Site Class	Max Growth	Drought Stress Hazard	Wind Throw Hazard	Mass Wasting Hazard	Logging Rutting Hazard	Logging Compact Hazard	
Andic Xerochrepts-Rock outcrop Complex Ashy Loam on 60-90% Slopes Mod. Deep (24in) Well Drained	DF-3	143 ft3/ac/yr	High	High	High	High	High	1,092 (24%)
Revel-Welcome-Rock outcrop Complex Ashy Loam on 30-60% Slopes Mod. Deep (37in) Well Drained	DF-3 / DF-4	126 ft3/ac/yr	Mod. High	High	High	High	High	911 (20%)
Chuckanut Series Gravelly Medial Loam on 30-65% Slopes Deep (56in) Well Drained	DF-2	186 ft3/ac/yr	Mod. High	Low	High	High	Mod.	679 (15%)
Nati Series Ashy Loam on 15-30% Slopes Mod. Deep (31in) Well Drained	DF-2 / DF-3	172 ft3/ac/yr	Mod. High	Medium	High	High	High	664 (15%)
Nati Series Ashy Loam on 30-60% Slopes Mod. Deep (38in) Well Drained	DF-3	129 ft3/ac/yr	Mod. High	High	High	High	High	296 (7%)
Revel Series Loam on 5-30% Slopes Mod. Deep (39in) Well Drained	DF-4	114 ft3/ac/yr	Mod. High	High	High	High	High	295 (6%)
Nati Series Ashy Loam on 5-15% Slopes Mod. Deep (37in) Well Drained	DF-2 / DF-3	172 ft3/ac/yr	Mod. High	Medium	High	High	High	292 (6%)
Revel Series Loam on 30-60% Slopes Mod. Deep (35in) Well Drained	DF-4	114 ft3/ac/yr	Mod. High	High	High	High	High	117 (3%)

Soil Unit	Productivity		Management Concerns					Acres (Pct)
	Site Class	Max Growth	Drought Stress Hazard	Wind Throw Hazard	Mass Wasting Hazard	Logging Rutting Hazard	Logging Compact Hazard	
Chuckanut Series Gravelly Medial Loam on 5-15% Slopes Deep (56in) Well Drained	DF-2	186 ft3/ac/yr	Mod. High	Low	Mod.	High	Mod.	99 (2%)
Chuckanut Series Gravelly Medial Loam on 15-30% Slopes Deep (56in) Well Drained	DF-2	186 ft3/ac/yr	Mod. High	Low	High	High	Mod.	93 (2%)

Slope Stability

As previously described in Section 2, this plan utilizes remotely mapped topographic data as well as hazard zones and historic landslides identified by the DNR to gauge the likelihood that unstable slopes will be found within a proposed management area. The presence of a mapped hazard zone or historic landslide does not preclude management, but indicates that further investigation is required.

Steep slopes are present across Lookout Mountain, but are most prominent along the banks of Austin Creek, on the eastern facing slopes off Repeater Ridge, and on the southwest and southeast facing slopes along the southern ridgeline leading down from Lookout Mountain. Hazard zones are present across Lookout Mountain, including the steep gorges of Austin Creek which include rule-identified inner gorges as well as potentially other unstable landforms. The headwaters of the northern fork of Austin Creek as well as other unnamed drainages contain likely rule-identified convergent headwalls. The southeast facing upper slopes leading down from Lookout Mountain are also a potential hazard zone as are the steep stream channels flowing east off Repeater Ridge. A large, historic landslide was mapped in the middle of Lookout Mountain, but this landslide is considered prehistoric and no active sliding was observed during field investigations. Other historic landslides are thought to have occurred on the southeast facing slopes of Silver Creek as well as the upper headwaters of Beaver Creek and along Repeater Ridge. During field investigations, a small landslide was observed originating from the road on Repeater Ridge.

Hydrology and Water Quality

The majority of this property falls within the Lake Whatcom watershed. The most prominent stream system, Austin Creek, originates in several tributaries along Lookout Mountain's eastern slopes and flows east and northeast into Lake Whatcom. Additional streams from the Repeater Road ridge flow directly east into the lake. The streams on the northernmost part of the property flow north into Beaver Creek

which eventually merges with Austin Creek before flowing into the lake. The southern portion of the property lies within the Friday Creek basin. Water drains primarily to the southeast into Silver Creek and tributaries which eventually flow into Friday Creek. This basin is part of the Lower Skagit-Samish Water Resource Inventory Area (WRIA), while the rest of the Lookout Mountain property is part of the Nooksack WRIA.

The majority of the streams are identified as non-fish-bearing in the DNR's hydrography database. The terrain quickly climbs from the shore of Lake Whatcom, creating cliffs that act as natural barriers to fish passage. Austin Creek is identified as a fish-bearing stream by DNR until about 1.5 miles upstream from the lower property boundary. Additionally, the west fork of Austin Creek is fish-bearing for about 0.25 miles upstream from its confluence with the main fork until a cliff blocks fish passage; the south fork of Silver Creek is identified as fish-bearing for about 500 feet within the property boundary; and the south fork of Beaver Creek is identified as fish-bearing for about 0.5 miles from the lower property boundary near the Lookout Mountain Forest Preserve Trailhead.

A handful of forested wetlands can be found across the property, but no waterbodies are present. The folding pattern of the Chuckanut formation, which shaped the geology of Lookout Mountain, influences the hydrology by creating wet sites between the small ridges that were created by this folding. As a result, more forested wetlands are likely present but not currently delineated.

Roads and Access

The primary access point to the property is through a gate at the Lookout Mountain Forest Preserve Trailhead, located off Lake Louise Road. From there the "mainline" (LM-2000) road proceeds uphill, traversing tributaries of Austin Creek along the eastern slopes of Lookout Mountain. Eventually the road forks, with the northern fork terminating at two communication towers at the northern peak on Lookout Mountain and the southern fork (LM-2500) continuing up a series of sharp switchbacks to a communication tower at the southern peak on the ridgeline. The communication tower leases at the top of Lookout Mountain require the County to maintain the road in drivable condition. Current maintenance has focused on brush management and some ditch shaping, but many of the ditch segments along this roadway are in need of restoration.

Additional roads include the LM-2400 which branches off the mainline around one mile from the trailhead, providing access up the northern fork of Austin Creek. The LM-1000, also known as Repeater Ridge Road, provides access up Repeater Ridge. In the north, a spur of the LM-4000 road provides access into the northwest corner of the property. In the south, the Cain Lake Road provides access to the southeast corner and a private forest road in the Barnes Creek drainage provides access to the southwest corner.

Small spur roads once ran off these main roads at several locations but have either been formally abandoned or, in cases of roads dating before 1975, orphaned. Notable orphaned roads include the LM-2400C which branches off the LM-2400 road after 0.8 miles and runs parallel to the northern fork of Austin Creek for another half mile and the LM-2000E, which branches off the LM-2000 road after 3.7

miles, cutting across Austin Creek and holds a steady contour east for approximately 1.5 miles. Smaller orphaned roads can be found at miles 1.0, 2.2, 3.7, and 4.5 of the LM-2000 road as well as miles 0.4 and 0.7 of the LM-2600 road and are identified in a map at the end of this section. Previously, at least three roads led off the LM-2000 road and provided access for logging operations on the two jointly-owned parcels near the trailhead, but these road beds have been converted to recreational trail use.

Forest roads were assessed to determine their status and suitability for management activities as well as to identify any potential maintenance or design issues. Notable findings of this assessment are summarized below.

Neglected and/or Improperly Abandoned Roads. Several roads were identified that, having not been officially abandoned, are theoretically "active" but maintenance has been neglected for many years. At Lookout Mountain, this includes the LM-2400, LM-1000, and a long spur off the LM-4000 road, and Cain Lake Road. No other improperly abandoned roads were identified.

Existing Orphan Roads. This assessment did not identify any major concern with existing orphan roads that warrant a management recommendation. As discussed in Section 2, the RMAP process undertaken by the DNR at Lookout Mountain Forest Preserve prior to reconveyance included a thorough investigation of these orphaned road systems. Spot checks of these roads concurred with the DNR findings that these orphaned roads currently pose a limited risk.

Fish Passage Issues. The current Rufus Creek Trail repurposes a defunct forest road and uses an existing culvert to pass over a fish-bearing stream. This culvert is currently failing to contain the stream flow and lacks natural streambed material posing a potential barrier to fish passage.

Drainage Control Issues on Active Roads. Several active roads were identified as suffering from deferred maintenance of their drainage control structures, primarily road grades, ditches, and cross-draining culverts. In some situations, this has caused water to enter the roadway resulting in minor channelization on the road surface. These issues were most pronounced on the Lookout Mountain "mainline" and include:

- **Inoperable Cross-Draining Culverts.** Over time culvert inlets can become obstructed by large woody debris or buried under sediment if not properly maintained. Steel culverts are also prone to rusting and culvert outfalls may cause erosion if energy dissipation devices, such as rock armoring or downflumes are not properly installed and maintained. Of the 89 drainage culverts surveyed, 17 were partially plugged, 2 had energy dissipation issues, and 1 was completely failed. In addition, one ditchout structure was compromised by sloughing hillside and unsanctioned recreational use.
- **Obstructed Ditches.** Ditches become obstructed or otherwise inoperable for many reasons, including sloughing hillsides, large debris, and unsanctioned recreational use. Obstructed ditches force water onto the roadway, where it bypasses well designed cross-draining culverts and uncontrollably exits the roadway, causing erosion and/or delivering sediment into nearby streams. Over 28 observations of obstructed ditches were identified.

- **Improperly Maintained Road Grades**. When water does enter the road a properly maintained road grade ensures the water is shed quickly. The steep slopes at Lookout Mountain's mainline have restricted the road width and left insufficient room to maintain a continuous ditch. As a result, past road engineers created a delicate drainage control system that utilizes the road's surface and a sharply insloping grade to transport water around intermittent interruptions in the ditch system. In these systems, maintaining property road grading is necessary to ensure that water exits the road system as designed and does not continue down the road system, leading to channelization, erosion, and potential slope instability issues. Over 10 observations of water on the roadway were identified.

Culvert Condition. Culvert diameter, material, and condition were noted during this assessment and the bankfull width measured for stream crossings. As described earlier, though culverts inlets were partially obstructed as a result of deferred maintenance, the culverts themselves were generally in good condition. Though two crossdrains were flagged as undersized according to Forest Practices Act requirements, the majority of culverts were 18 inches or larger as required by state regulations. Of the 26 stream-crossing culverts identified during this assessment, 17 had diameters less than the bankfull width of the stream they carried. While this does imply they are functionally undersized, additional analysis is required to determine if these culverts are appropriately sized to meet current WA DNR requirements. As previously discussed in Section 2, the majority of culverts at Lookout Mountain are galvanized steel, which has a serviceable life from 20-40 years. Many of these culverts date from the RMAP process from the early 2000s and are likely around 20 years old, though some may be considerably older. During this assessment the majority of steel culverts surveyed were in good condition and only two steel culverts were identified as having rusted out and an additional two showed signs of ongoing corrosion. Still, culvert failures are predicted to increase in the future as steel culverts reach the end of their serviceable life.

Road Failures. Several historic road failures and one active failure were identified during this assessment which are important guides to the types of future issues that this road system may experience.

- In 2018, a large storm saturated the roadway and surrounding soils, causing uncontrolled water on the roadway and extensive erosion at the intersection of the LM-2000 and LM-2400 road at Lookout Mountain Forest Preserve, closing the LM-2400 road to vehicle traffic ever since. Repairs of the failed section, including upgraded drainage control systems, are currently underway with construction projected to finish in early 2026.
- Another recent failure also occurred on the LM-2000 road where the northern fork of Austin Creek passes under the road in a large 6ft culvert. During a storm in 2021, this culvert became plugged and the creek overtopped the road, eroding some of the road bed but leaving the culvert in place. Notably, the current culvert is considered appropriately sized to pass the volume of water calculated to occur during the 100-year flood event, but was unable to pass the large woody debris transported by this flood. Though repairs have been made, this failure indicates that this water crossing needs to be upgraded to handle future storm events and the County is planning to undertake this upgrade in 2026.

- During this assessment an acute issue was identified with another water crossing at the Lookout Mountain Forest Preserve. This crossing is on the current Rufus Creek Trail where a defunct forest road has been repurposed as a biking and hiking trail. The trail crosses over an existing road culvert on a fish-bearing stream that has rusted out, failing to contain the stream and causing erosion of the overlying road surface. Though this location is on very flat topography it has the potential to deliver sediment into the local watershed in the future.

Health and Resiliency

Invasive species pressure was remarkably low across the forests of Lookout Mountain. Himalayan blackberry was observed in limited locations along road edges but is not nearly as prevalent as elsewhere in the watershed. English holly was also found in the understory of many stands but is not affecting forest development.

Overstocking is the most important forest health problem facing the forests at Lookout Mountain where many stands are overstocked and/or growing at unsustainable densities. This includes naturally regenerated stands that are in the Stem Exclusion stage of development as well as previously-established plantations that have experienced extensive infilling by natural regenerating hemlock and alder, thus increasing their densities to unsustainable levels. In some cases, stocking exceeds 600 trees per acre and relative densities of 75 or even higher are fairly common. At these densities, competition-induced mortality is rampant, stands are increasingly unstable, and dead material is accumulating as potential wildfire fuel.

In addition, localized pockets of laminated root-rot were observed sporadically across the forest but are operating within normal levels. Most notably, at Lookout Mountain, several large patches of hemlock dwarf mistletoe were sporadically observed across the FMUs on the upper mountain, with large patches in FMUs B4 and B6. While mistletoe infestations reduce growth and can limit commercial timber value, they have the benefit of creating dense branching brooms similar to epicormic branching that occurs later in stand development. Mistletoe infestations spread slowly from tree to tree and can be stopped by unvegetated barriers and the absence of suitable host species.

Finally, insect activity was observed sporadically in the oldest mixed-conifer forests at Lookout Mountain. Small to large (1-acre) pockets of dead and dying large-diameter Douglas-fir were observed with frass suggesting the outbreak is likely the result of Douglas-fir beetle which prefers larger diameter trees.

The upper slopes of Lookout Mountain include stands dominated primarily by drought-intolerant western hemlock but also silver fir. Stands growing on sites with low moisture potential, such as top of ridgelines and south-facing aspects, are at particular risk of drought stress, which is expected to increase under future hotter and drier climates.

Wildlife Habitat

A review of the Washington State Department of Fish and Wildlife Priority Species Database identified Townsend's big-eared bat, little brown bat, and myotis bat as having been documented somewhere within the 23,000-acre township containing Lookout Mountain Reconveyance. The base of Austin Creek is also habitat for cutthroat trout. The property is identified as a large biodiversity area and corridor that spans Lookout Mountain and is a priority area for terrestrial habitat.

Much of the forest on the property is in the Stem Exclusion stage, characterized by dense stands of tall, thin trees. However, some forest stands are beginning to transition into more structurally complex stages, with larger trees and developing understories that support greater biodiversity. Additionally, the numerous stream channels across Lookout Mountain and their associated riparian zones offer valuable wildlife habitat, with increased species diversity, structural complexity, and reliable water sources. The lower sections of the streams offer important habitat for fish species that are found in Lake Whatcom.

Wildfire Susceptibility

The risk of wildfire ignition is high at Lookout Mountain. The close proximity of residential development in Sudden Valley, Glenhaven, and other locations increases the risk of wildfire ignition and though recreational use is entirely non-motorized and day-use, the extensive recreational use of this property introduces additional ignition risks. While ignitions are likely, the developed road network both on this property and adjacent forestlands as well as extensive trail access ensures a rapid firefighting response, and, as long as strong winds aren't blowing, can likely be contained with the help of local topography.

As discussed in Section 2, overstocked, mixed-conifer stands and Douglas-fir plantations in Stem Exclusion are more susceptible to high-severity fire as they have high levels of fine woody debris, lack larger trees that are more resistant to fire, and have low canopies and many potential ladder fuels. Older mixed conifer forests in the Mature-I and Mature-II stages of development have lower densities, taller crowns, and reduced fuel loads which reduce their susceptibility to high-severity fire. Mixed conifer and hardwood forests are also less susceptible to fire because hardwood species have large water-laden leaves and lower content of resin and pitch that makes them less likely to burn in a fire, and their low-density crowns can reduce the chance of a crown fire spreading. These stand types are further identified below, but approximately one third of the forestland at Lookout Mountain consists of overstocked stands in Stem Exclusion which are susceptible to high-severity fire. These stands are common across most of the upper slopes of the mountain. Most notably, overstocked plantations can be found along the property's northern boundary in relatively close proximity to residential development.

Carbon Storage

The conifer dominance on most of the property provides excellent long-term carbon storage potential due to the long lifespan of the trees, but many stands are currently overstocked and in the Stem Exclusion phase, limiting growth and reducing carbon sequestration rates. As the upper mountain is

primarily dominated by western hemlock, there is some concern about the long-term suitability of this species, and carbon storage may be reduced if growth slows or mortality increases under future drier and warmer conditions. Thinning suppressed trees would result in a short-term reduction in stored carbon but would enhance growth of the remaining trees, accelerating sequestration and improving long-term carbon storage capacity.

Cultural Resources

The Lake Whatcom watershed is a landscape rich with cultural significance for Indigenous peoples—particularly the Lummi Nation and the Nooksack and Swinomish Tribes—who have maintained deep spiritual, cultural, and subsistence connections to the landscape. Although a review of the Washington State Department of Archaeology and Historic Preservation Wisaard online database did not identify any known historical sites on this property and none were encountered while developing this plan, this property has a long history of human use and artifacts may be present. Please see the previous discussion about cultural use practices in the Lake Whatcom watershed for a more detailed assessment of best management practices moving forward.

Recreation

The property experiences high levels of non-motorized recreational use, particularly by mountain bikers, hikers, and runners, on both sanctioned and unsanctioned trails spread throughout the forestland. The primary access point to the property is the Lookout Mountain Preserve Trailhead, located off Lake Louise Road, but access points are also possible from Cain Lake and the LM-1000 road, frequently known as Repeater Road, near Sudden Valley. The LM-2000 road is the mainline carrying uphill hikers and bikers, seeking to access the northern and southern peaks of Lookout Mountain. The currently non-drivable LM-2400 spur provides recreational access to portions of Lookout Mountain directly adjacent to the Galbraith Tree farm, and many trails connect with this more extensive trail system. Repeater Road provides uphill access to the ridge running along the eastern edge of the property.

All sanctioned trails are located near the Lookout Mountain Preserve Trailhead in the northeast area which receive high levels of recreational use. There are also an enormous number of unsanctioned bike trails on this property, seemingly able to facilitate the descent of mountain bikes down almost every ridgeline. Notable trail systems descend from the northern communication towers down the ridgeline running NE towards Sudden Valley, down ridgelines to the NW leading into Galbraith Mountain as well as down the southern ridgeline towards the town of Alger and Cain Lake. An extensive downhill trail system is accessible from the top of Repeater Road where trails descend the northeastern, eastern, and southeastern ridgeline spurs toward South Lake Whatcom Boulevard.

As previously mentioned, unsanctioned trail building and use can often create unintentional erosion hazards that reduce water quality. Most of the trails observed during this assessment were constructed along ridgelines and not causing sediment delivery. Occasionally, when a trail attempted to find a way off the ridgeline and back onto main roads, it would enter terrain prone to erosion. Notable examples of

trail-induced erosion are found at the second switchback turn after crossing the northern fork of Austin Creek where an unsanctioned bike trail has been re-routed several times to avoid ongoing slope instability.

Recommendations

Roads and Access

This plan recommends the following actions be taken to improve the maintenance and function of the existing road system at Lookout Mountain:

- **Neglected and/or Improperly Abandoned Roads.** Restoring access on the LM-2400 and Cain Lake Roads will provide critical access to the majority of young plantations at Lookout Mountain. These stands are in need of thinning interventions over several decades, and maintaining access on this road spur will be critical to enacting the recommendations outlined in this plan. Once repairs are completed on the LM-2400 road, both of these road grades are in good condition and can be easily restored to active condition. This plan also recommends restoring access on the LM-1000 road and the long spur off LM-4000 road in order to enact the management recommendations outlined in this plan, but this access only needs to be maintained for the next decade or less, after which these roads can be formally decommissioned. If management recommendations are not followed, these neglected roads should be formally decommissioned to ensure no long-term hydrological effects.
- **Drainage Control Issues on Active Roads.** The Lookout Mountain mainline needs ditch cleanouts, culvert clearing, and regrading across numerous sections to ensure proper drainage. After this has been done, implement a maintenance plan for ditches, culverts, and road grades to ensure all active roads maintain a high standard of function. See the best management practices identified in Section 2.
- **Culvert Condition.** Replace failed culverts and rectify energy dissipation issues by placing additional rock or using down flumes to carry water safely downhill. Upgrade undersized cross-draining culverts and evaluated stream-crossing culverts to confirm they are sized appropriately for their respective basins. Future culvert installation, particularly of cross-draining culverts, should prioritize modern, longer lasting HDPE plastic culverts.
- **Fish Passage & Current Failures.** Evaluate and rectify the ongoing stream-crossing culvert failure identified on the Rufus Creek Trail which is also a potential barrier to fish passage. This culvert should be replaced, potentially with a footbridge to maintain hiking and biking access.

Without road access, heavy equipment cannot be used in forest management activities, and thinning recommendations must be implemented as non-commercial cut and drop. This greatly increases the cost of forest management and likely reduces the amount of the landscape that can be actively managed to reach its desired future condition. Given the challenges of properly maintaining roads on steep terrain, the decision to build new roads requires careful planning and should follow the guidelines identified in

Section 2. Specific recommendations for creating temporary spur roads to facilitate forest management activities are given by FMU below.

Health and Resiliency

Though continued treatment and monitoring of Himalayan blackberry would be a prudent decision to prevent its spread, it does not currently present a significant management concern at this property.

Recommendations for addressing observed overstocking are given at the management unit level below.

The currently observed levels of dwarf mistletoe at Lookout Mountain, specifically in the B-series FMUs on the upper mountain, warrant periodic monitoring given the high proportion of suitable host species (western hemlock and silver fir), but this infestation is not of major concern given current management objectives.

The observed level of insect activity is not excessively impacting the forest's growth and development. Newly created overstory gaps are already being colonized by vigorously growing new seedlings, highlighting how natural disturbance processes can increase stand complexity.

Wildfire Susceptibility

Shaded fuel breaks are recommended within 100 feet of public roads and existing structures, which are designed to keep fires on the ground and slow their spread until firefighting resources can arrive. For additional details on implementation, see the description of a shaded fuel break given in the discussion of Wildfire Susceptibility in Section 2 of this document.

Forest Types

Summarized below are the general forest types present at Lookout Mountain and their management recommendations.

Forest Types Summary Table

Forest Type	Acres	Proportion
Conifer Plantation - Small DBH	92	2%
Conifer Plantation - Large DBH	298	7%
Mixed Conifer - Stem Exclusion	775	17%
Mixed Conifer - Stem Exclusion/Mature-I	258	6%
Mixed Conifer - Mature-I	371	8%
Mixed Conifer - Mature-I/II	112	2%
Mixed Conifer - Mature-II	1,259	28%
Mixed Conifer - Late Seral	0	0%

Forest Type	Acres	Proportion
Mixed Hardwood - Young	43	1%
Mixed Hardwood - Mature	0	0%
Mixed Hardwood - Old	105	2%
Mixed Conifer and Hardwood	1,241	27%
Unforested	0	0%
Non-Forest	0	0%
Total	**4,554**	**100%**

Mixed Conifer Stands

Mixed conifer stands are very common at Lookout Mountain, representing about 61% of the property. These stands regenerated following clearcut harvests between 75 to 125 years ago. After clearcutting, the forest was left to regenerate naturally, and in most cases, no intervening management has occurred. Today, these stands are primarily dominated by a mixture of conifers, primarily Douglas-fir and western hemlock, though western redcedar and pacific silver fir are also present. Douglas-fir is more common at lower elevations, while hemlock is more common at higher elevations. A majority of the mixed conifer stands at Lookout Mountain are in Stem Exclusion or Mature-I stage of development, where density remains relatively high to very high. There are some early Mature-II stands that have begun to develop as well as some older fire origin stands that exhibit later seral characteristics, but these are a minority.

As previously described in Section 3, the management of mixed conifer stands is best delineated by stand development stage, and recommendations follow the general discussion earlier in this document. For stands in Stem Exclusion, this plan recommends variable density commercial thinning, with priority varying from moderate (level 3) to high (level 1) depending on stocking. Given their generally high priority, when commercial access is not possible, non-commercial thinning should be utilized in the most overstocked stands. This plan recommends variable density thinning in Mature-I stands, but assigns these stands priority varying from low (level 4) to moderate (level 3) depending on stocking. Finally, this plan generally does not recommend management in Mature-II stands at Lookout Mountain.

Plantations

Around 9% of Lookout Mountain forestland are Douglas-fir plantations. These stands are typically third generation forests, having been established after clearcut harvests of the naturally regenerated second growth forests over the last 15 to 40 years. These plantations were established at high densities of primarily Douglas-fir but in many cases have experienced significant infilling by western hemlock and red alder. Subsequent pre-commercial thinning operations have not occurred since reconveyance, and many of these stands are currently growing at extremely high levels of stocking.

A more complete description and assessment of plantation silviculture and recommendations for these stands is provided earlier in this document. Broadly, all plantations at Lookout Mountain require management interventions to accelerate the transition of these stands towards forests with more

complex stand structures, thereby improving resiliency, reducing fire risk, increasing hydrological maturity, and providing additional wildlife habitat. As previously described in Section 3, this plan recommends pre-commercial thinning in overstocked, small diameter stands and variable density commercial thinning in overstocked, large-diameter stands. Given high-levels of homogeneity and the likelihood that multiple entries are needed to restore forest function, thinning plantations is one of the highest priority management recommendations made in this plan. Broadly, access to these stands is good and thinning can be primarily commercial. Additional details are provided in each management unit below.

Mixed Hardwoods

Stands of pure mixed hardwoods are uncommon at Lookout Mountain, occurring on only approximately 3% of the property. These stands are primarily composed of red alder and bigleaf maple. As previously described in Section 3, the management of these stands is most concerned with ensuring a smooth seral transition towards more conifer-dominated forests. Recommendations follow the general discussion earlier in this document, delineated by stand development stage. For young stands, this plan recommends pre-commercial thinning and underplanting. For mature stands, this plan recommends commercial thinning and underplanting. For older stands, this plan recommends solely underplanting. Planting should be 150 TPA of shade-tolerant conifers under the existing canopy and up to 250 TPA into more open canopy gaps.

Mixed Conifer and Hardwoods

Mixed conifer and hardwood stands are common at Lookout Mountain, representing about 27% of the property. These stands regenerated all across the property following clearcut harvests between 75 to 125 years ago. Unlike other conifer-dominated stands, these stands either initiated with a large component of hardwoods or have grown at lower densities, allowing new hardwood species to establish in subsequent years. In either case, these stands now include a wide range of species growing in multiple canopy positions.

As previously described in Section 3, the management of these stands can follow either more mixed-conifer recommendations or mixed-hardwood recommendations depending on the proportion of species present, but in well-mixed stands typically focuses on forest health issues. At Lookout Mountain, because these stands are generally in good health, exhibiting high diversity, and growing at sustainable densities, this plan does not recommend management in most cases.

Management Units

Forest cover was delineated into the forest management units (FMUs) using both remotely sensed data, historic inventory units, and field inventory data. The forestland within these management units share similar forest characteristics and management recommendations. For each FMU, this plan describes the geophysical attributes and forest conditions and assesses the unit against the plans management objectives using the previously described framework by forest type. Recommendations are then given by

FMU, typically referencing general recommendations by forest type, but more information is given as needed. Finally, a schedule of management activities by year and FMU is given at the end of this section.

Because this property is so large, it is also delineated into sub-areas based on the principal routes used to access different portions of the property. The letter at the beginning of the FMU label represents the area or "series" to which it belongs. Series A FMUs are reached by the LM-2400 road, series B FMUs by the LM-2000 road, series D FMUs by the Repeater Road, and series E FMUs by the southern ridgeline. Series C FMUs include the middle of the property, while series F FMUs are located in the northwest corner. An overview of these units is available in the table and maps below.

Summary of Forest Management Units

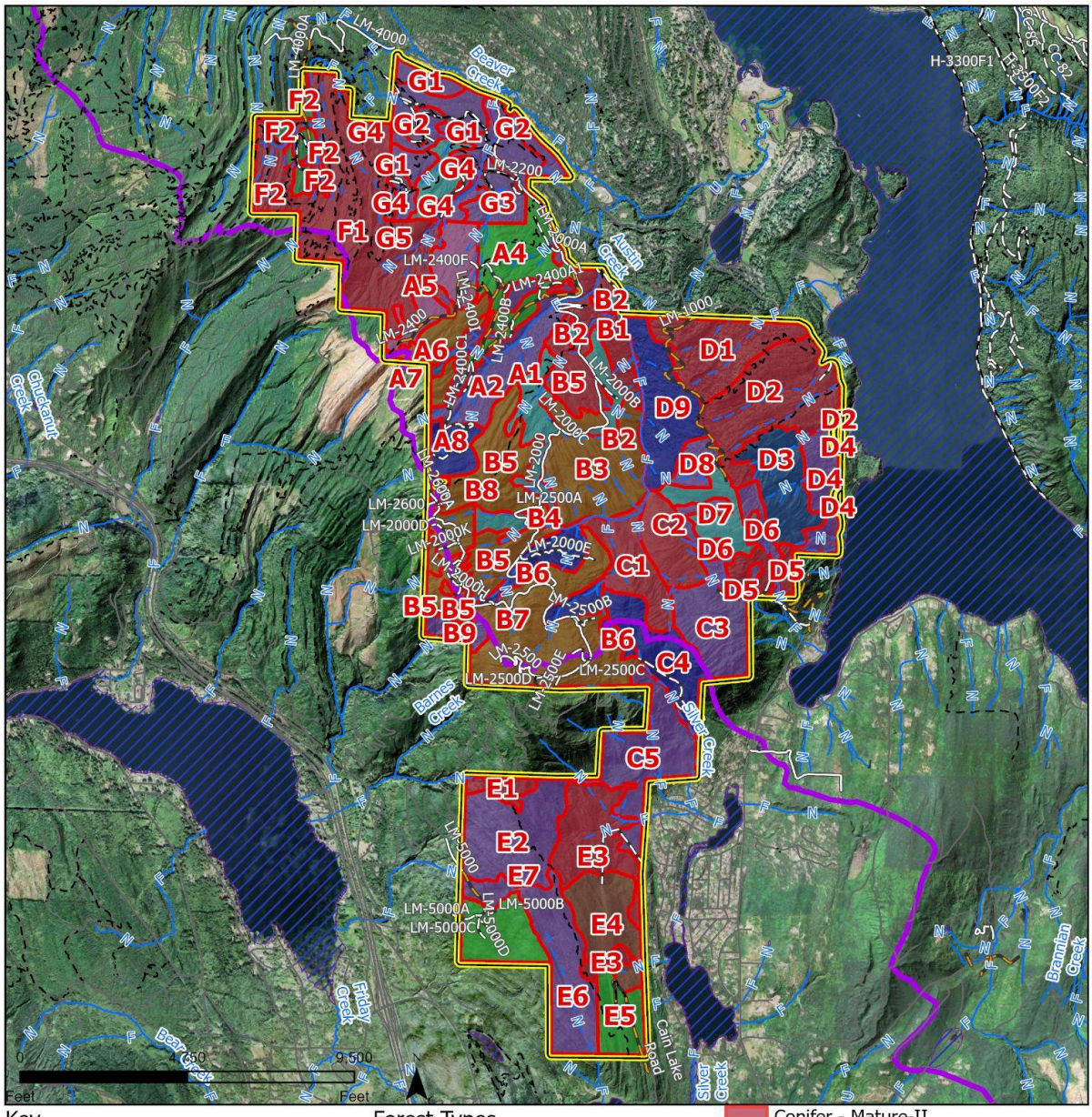
FMU	Acres	Forest Type	Management
A1	112	Mixed Conifer and Hardwood	None
A2	47	Conifer Plantation - Large DBH	Thinning
A3	44	Mixed Conifer and Hardwood	None
A4	102	Conifer Plantation - Large DBH	Thinning
A5	92	Conifer Plantation - Small DBH	Thinning
A6	61	Mixed Conifer - Stem Exclusion	Thinning
A7	6	Mixed Conifer - Mature-I/II	None
A8	44	Mixed Conifer - Mature-I	Thinning
B1	138	Mixed Conifer - Mature-II	None
B2	46	Mixed Conifer - Stem Exclusion / Mature-I	Thinning
B3	158	Mixed Conifer - Stem Exclusion	Thinning
B4	97	Mixed Conifer - Stem Exclusion / Mature-I	Thinning
B5	222	Mixed Conifer - Stem Exclusion	Thinning
B6	91	Mixed Conifer - Mature-I	Thinning
B7	260	Mixed Conifer - Stem Exclusion	Thinning
B8	74	Mixed Conifer - Stem Exclusion	Thinning
B9	24	Mixed Conifer and Hardwood	None
C1	92	Mixed Conifer - Mature-II	None
C2	71	Mixed Conifer - Mature-II	None
C3	101	Mixed Conifer and Hardwood	None
C4	104	Mixed Conifer - Mature-I	None
C5	144	Mixed Conifer and Hardwood	None
D1	132	Mixed Conifer - Mature-II	None
D2	201	Mixed Conifer - Mature-II	None
D3	106	Mixed Conifer - Mature-I/II	None
D4	68	Mixed Conifer and Hardwood	None
D5	39	Mixed Conifer - Mature-II	None

FMU	Acres	Forest Type	Management
D6	80	Mixed Conifer and Hardwood	None
D7	70	Mixed Conifer - Stem Exclusion / Mature-I	Thinning
D8	33	Mixed Conifer and Hardwood	None
D9	132	Mixed Conifer - Mature-I	Thinning
E1	25	Mixed Conifer - Mature-II	None
E2	158	Mixed Conifer and Hardwood	None
E3	135	Mixed Conifer - Mature-II	None
E4	105	Mixed Hardwood - Old	Monitor & Planting
E5	65	Conifer Plantation - Large DBH	Thinning
E6	159	Mixed Conifer and Hardwood	None
E7	84	Conifer Plantation - Large DBH	Thinning
F1	426	Mixed Conifer - Mature-II	None
F2	43	Mixed Hardwood - Young	Thinning
G1	128	Mixed Conifer and Hardwood	None
G2	102	Mixed Conifer and Hardwood	None
G3	48	Mixed Conifer and Hardwood	None
G4	40	Mixed Conifer and Hardwood	Thinning
G5	45	Mixed Conifer - Stem Exclusion / Mature-I	Thinning
Total	**4,554**		

Forest Management Units

Property: Lookout Mountain Forest Preserve

NORTHWEST NATURAL RESOURCE GROUP



Key

- Boundary
- FMUs
- Lake Whatcom Watershed
- Watercourses
- Waterbodies
- Active Roads
- Neglected Roads
- Abandoned / Orphaned Roads
- Trails

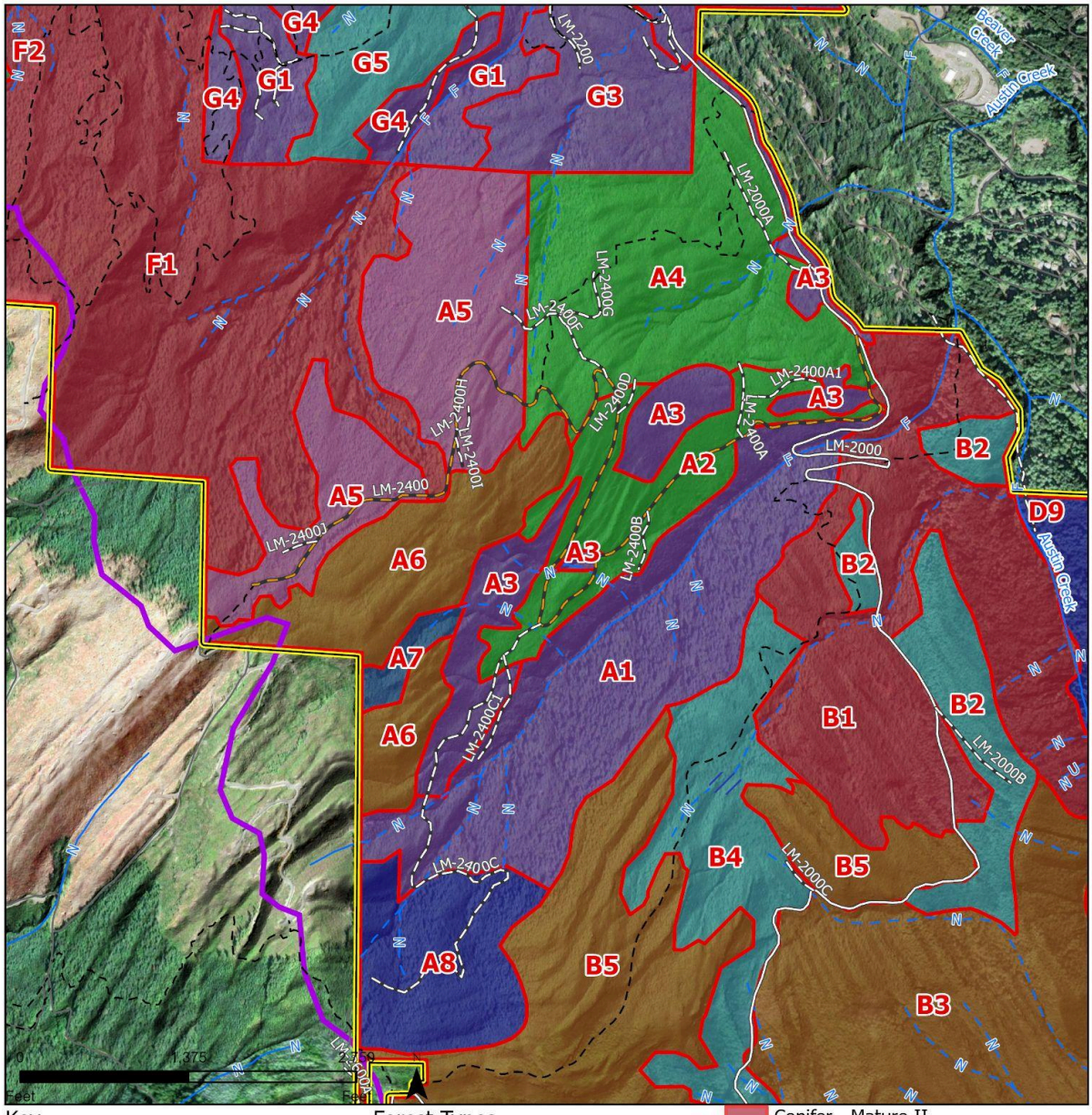
Forest Types

- Plantation - Small DBH
- Plantation - Large DBH
- Conifer - Stem Exclusion
- Conifer - Stem Exclusion/Mature-I
- Conifer - Mature-I
- Conifer - Mature-I/II
- Conifer - Mature-II
- Conifer - Late Seral
- Hardwood - Young
- Hardwood - Mature
- Hardwood - Old
- Mixed Conifer and Hardwood
- Non-Forest
- Unforested

Forest Management Units

Property: Lookout Mountain Forest Preserve - Group A

NORTHWEST NATURAL RESOURCE GROUP



Key

- Boundary
- FMUs
- Lake Whatcom Watershed
- Watercourses
- Waterbodies
- Active Roads
- Neglected Roads
- Abandoned / Orphaned Roads
- Trails

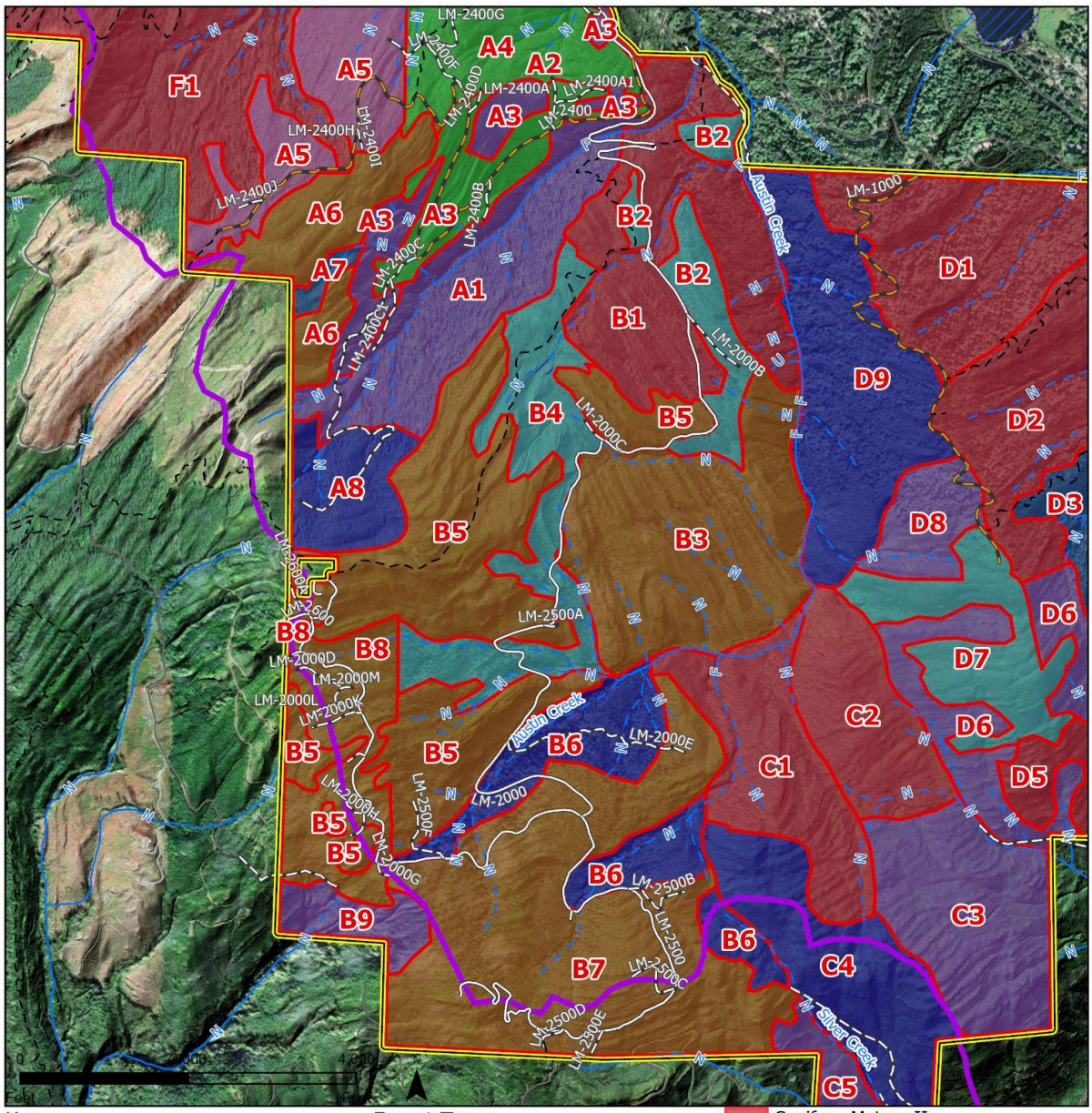
Forest Types

- Plantation - Small DBH
- Plantation - Large DBH
- Conifer - Stem Exclusion
- Conifer - Stem Exclusion/Mature-I
- Conifer - Mature-I
- Conifer - Mature-I/II
- Conifer - Mature-II
- Conifer - Late Seral
- Hardwood - Young
- Hardwood - Mature
- Hardwood - Old
- Mixed Conifer and Hardwood
- Non-Forest
- Unforested

Forest Management Units

Property: Lookout Mountain Forest Preserve - Group B

NORTHWEST NATURAL RESOURCE GROUP



Key

- Boundary
- FMUs
- Lake Whatcom Watershed
- Watercourses
- Waterbodies
- Active Roads
- Neglected Roads
- Abandoned / Orphaned Roads
- Trails

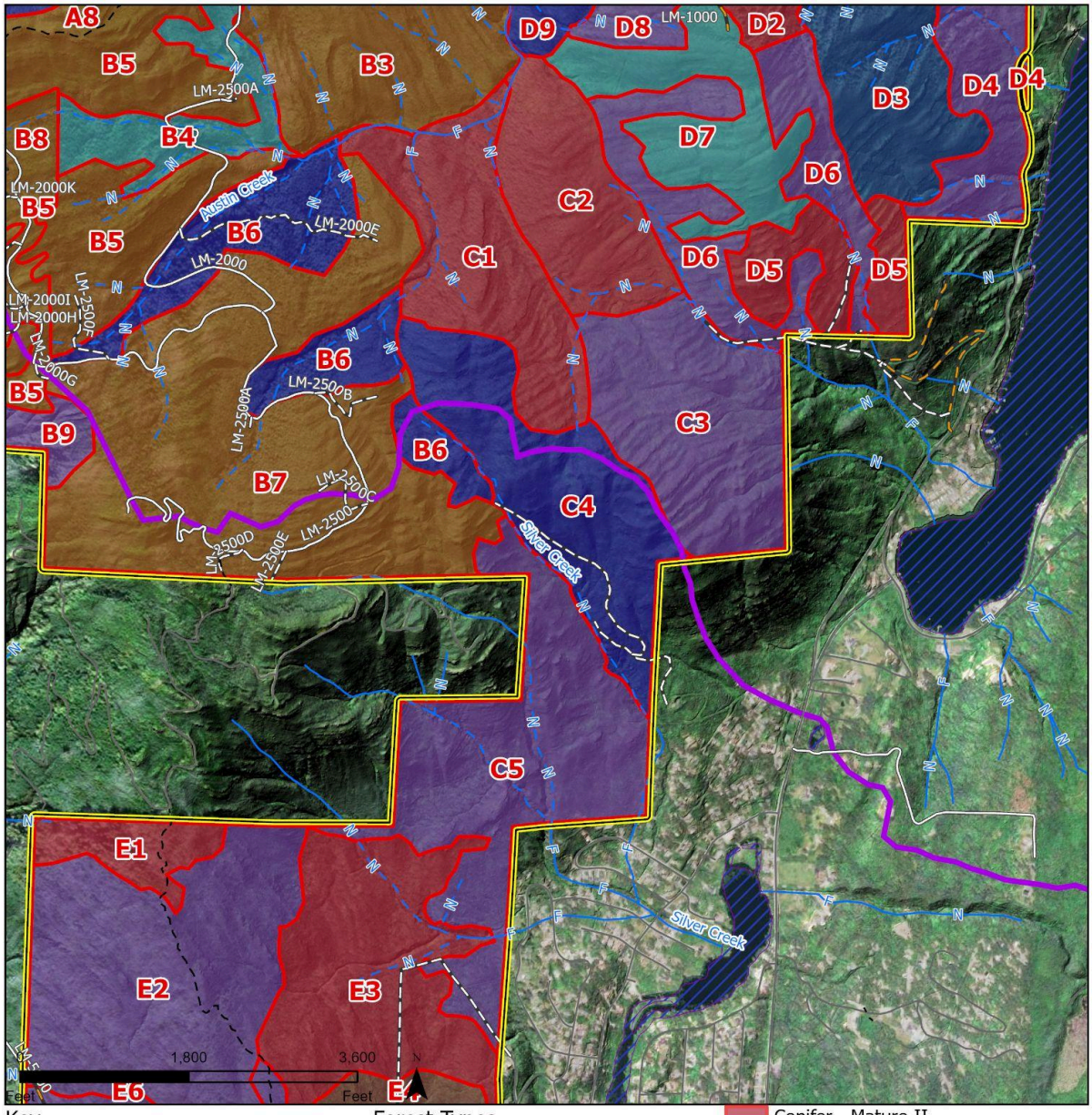
Forest Types

- Plantation - Small DBH
- Plantation - Large DBH
- Conifer - Stem Exclusion
- Conifer - Stem Exclusion/Mature-I
- Conifer - Mature-I
- Conifer - Mature-I/II
- Conifer - Mature-II
- Conifer - Late Seral
- Hardwood - Young
- Hardwood - Mature
- Hardwood - Old
- Mixed Conifer and Hardwood
- Non-Forest
- Unforested

Forest Management Units

Property: Lookout Mountain Forest Preserve - Group C

NORTHWEST NATURAL RESOURCE GROUP



Key

- Boundary
- FMUs
- Lake Whatcom Watershed
- Watercourses
- Waterbodies
- Active Roads
- Neglected Roads
- Abandoned / Orphaned Roads
- Trails

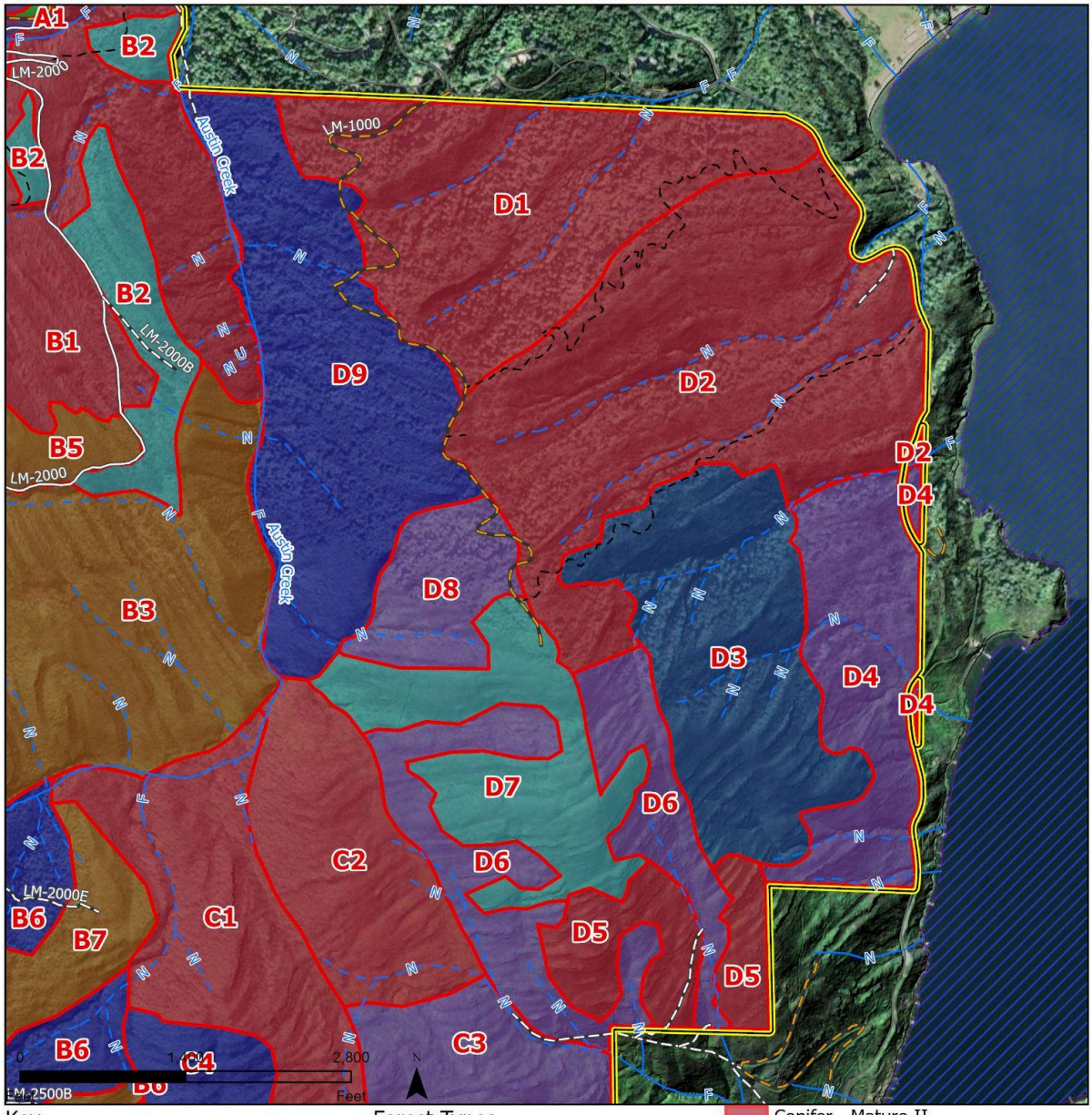
Forest Types

- Plantation - Small DBH
- Plantation - Large DBH
- Conifer - Stem Exclusion
- Conifer - Stem Exclusion/Mature-I
- Conifer - Mature-I
- Conifer - Mature-I/II
- Conifer - Mature-II
- Conifer - Late Seral
- Hardwood - Young
- Hardwood - Mature
- Hardwood - Old
- Mixed Conifer and Hardwood
- Non-Forest
- Unforested

Forest Management Units

Property: Lookout Mountain Forest Preserve - Group D

NORTHWEST NATURAL RESOURCE GROUP



Key

- Boundary
- FMUs
- Lake Whatcom Watershed
- Watercourses
- Waterbodies
- Active Roads
- Neglected Roads
- Abandoned / Orphaned Roads
- Trails

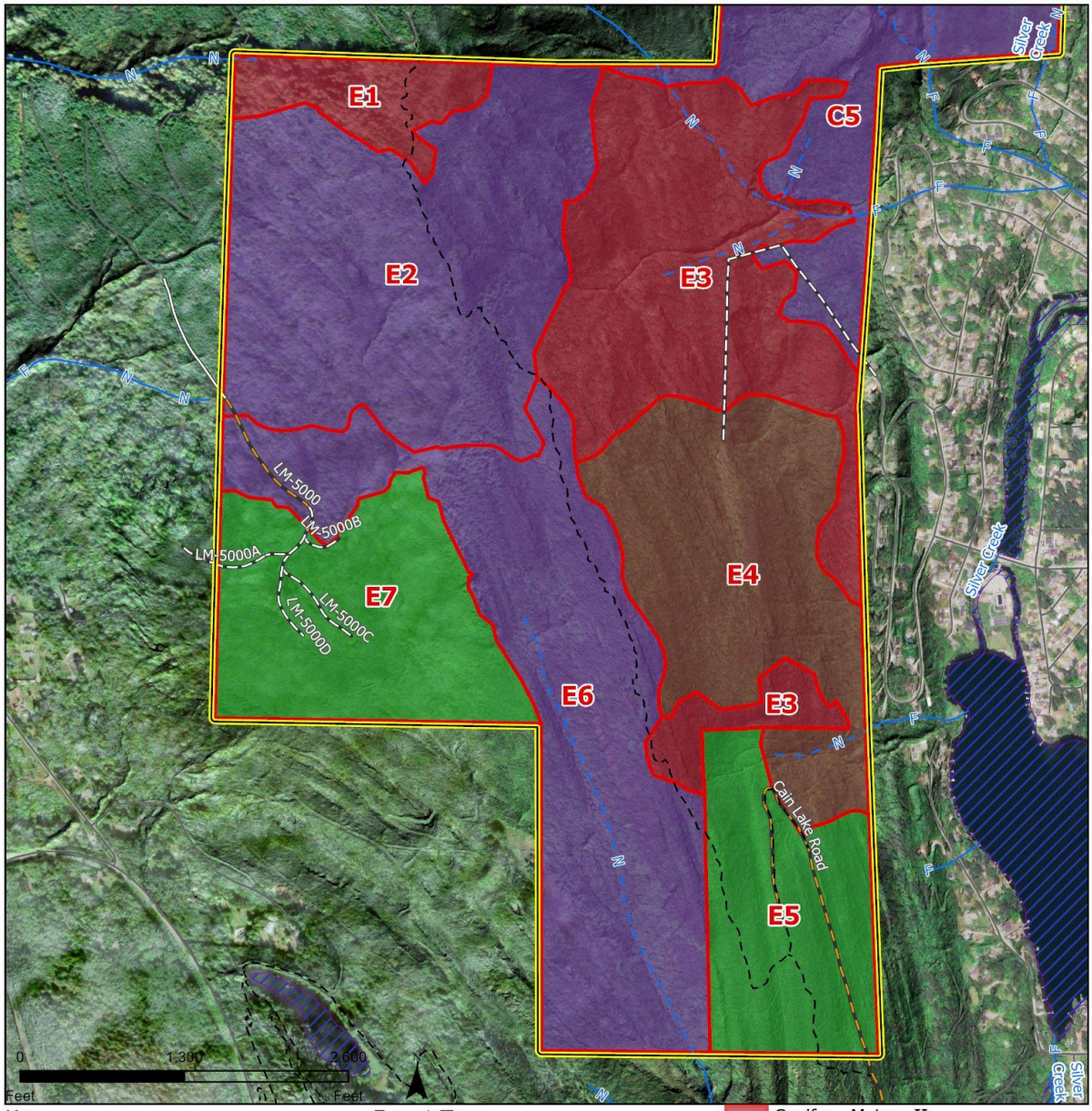
Forest Types

- Plantation - Small DBH
- Plantation - Large DBH
- Conifer - Stem Exclusion
- Conifer - Stem Exclusion/Mature-I
- Conifer - Mature-I
- Conifer - Mature-I/II
- Conifer - Mature-II
- Conifer - Late Seral
- Hardwood - Young
- Hardwood - Mature
- Hardwood - Old
- Mixed Conifer and Hardwood
- Non-Forest
- Unforested

Forest Management Units

Property: Lookout Mountain Forest Preserve - Group E

NORTHWEST NATURAL RESOURCE GROUP



Key

- Boundary
- FMUs
- Lake Whatcom Watershed
- Watercourses
- Waterbodies
- Active Roads
- Neglected Roads
- Abandoned / Orphaned Roads
- Trails

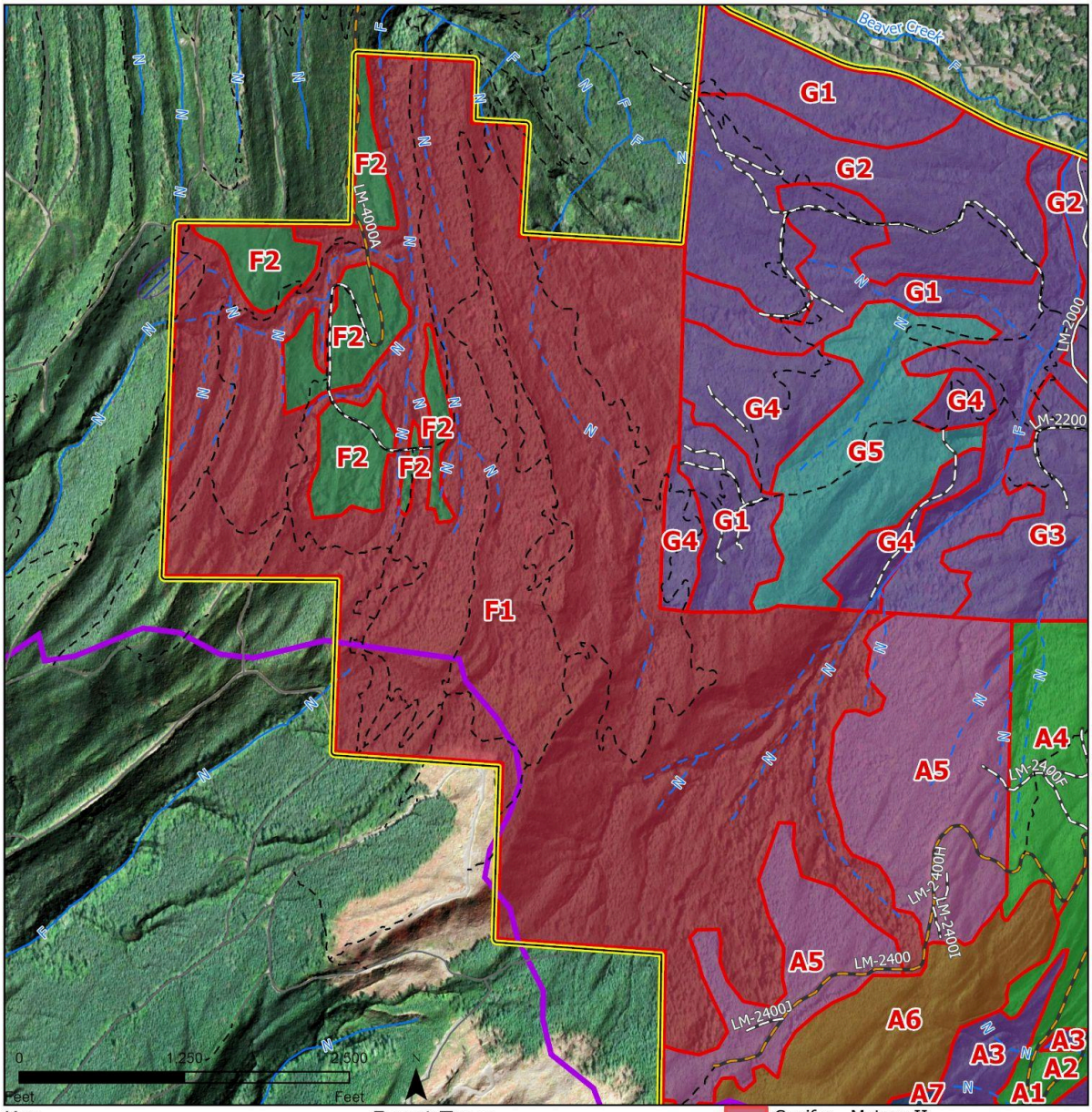
Forest Types

- Plantation - Small DBH
- Plantation - Large DBH
- Conifer - Stem Exclusion
- Conifer - Stem Exclusion/Mature-I
- Conifer - Mature-I
- Conifer - Mature-I/II
- Conifer - Mature-II
- Conifer - Late Seral
- Hardwood - Young
- Hardwood - Mature
- Hardwood - Old
- Mixed Conifer and Hardwood
- Non-Forest
- Unforested

Forest Management Units

Property: Lookout Mountain Forest Preserve - Group F

NORTHWEST NATURAL RESOURCE GROUP



Key

- Boundary
- FMUs
- Lake Whatcom Watershed
- Watercourses
- Waterbodies
- Active Roads
- Neglected Roads
- Abandoned / Orphaned Roads
- Trails

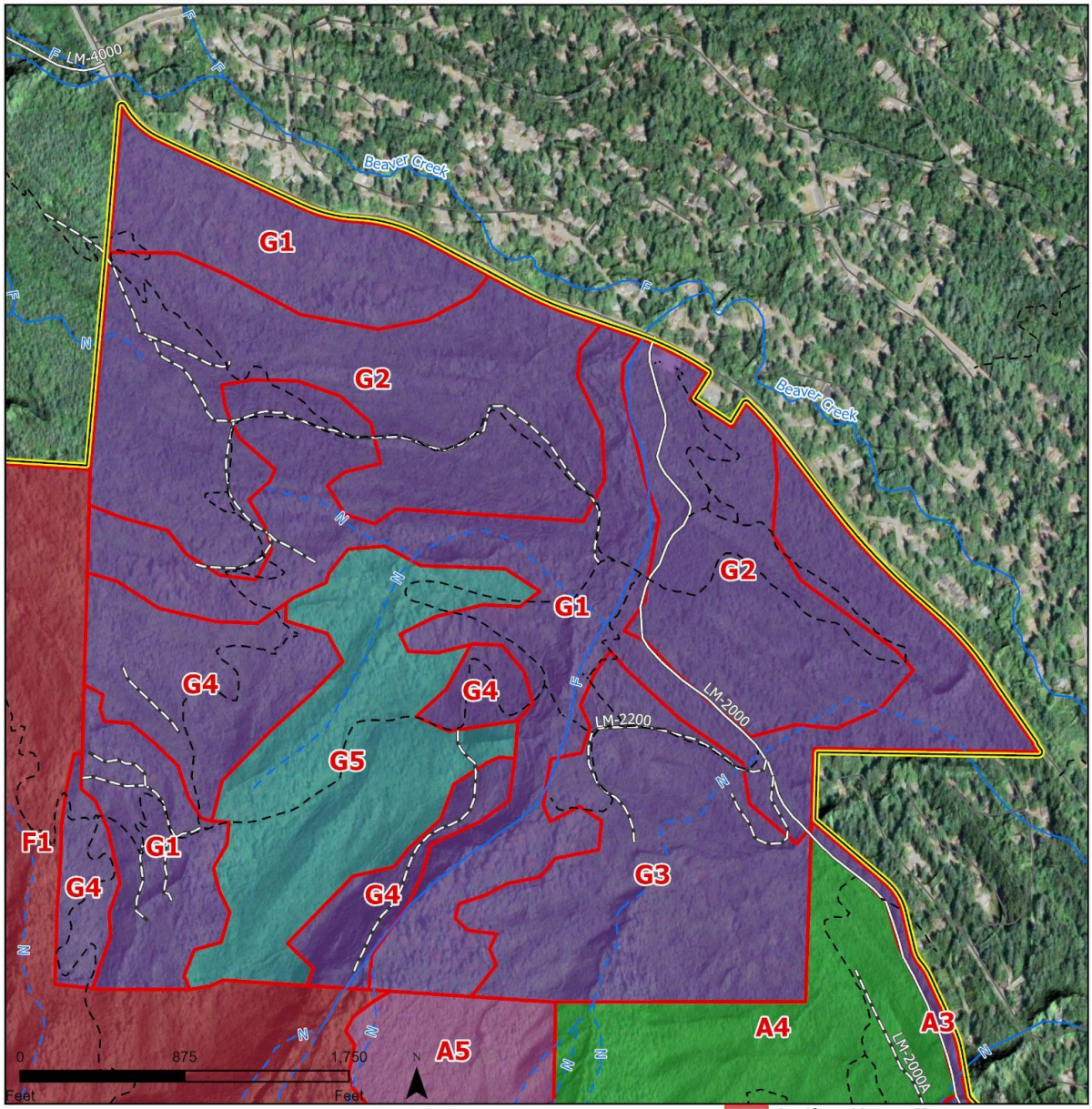
Forest Types

- Plantation - Small DBH
- Plantation - Large DBH
- Conifer - Stem Exclusion
- Conifer - Stem Exclusion/Mature-I
- Conifer - Mature-I
- Conifer - Mature-I/II
- Conifer - Mature-II
- Conifer - Late Seral
- Hardwood - Young
- Hardwood - Mature
- Hardwood - Old
- Mixed Conifer and Hardwood
- Non-Forest
- Unforested

Forest Management Units

Property: Lookout Mountain Forest Preserve - Group G

NORTHWEST NATURAL RESOURCE GROUP



Key

- Boundary
- FMUs
- Lake Whatcom Watershed
- Watercourses
- Waterbodies
- Active Roads
- Neglected Roads
- Abandoned / Orphaned Roads
- Trails

Forest Types

- Plantation - Small DBH
- Plantation - Large DBH
- Conifer - Stem Exclusion
- Conifer - Stem Exclusion/Mature-I
- Conifer - Mature-I
- Conifer - Mature-I/II
- Conifer - Mature-II
- Conifer - Late Seral
- Hardwood - Young
- Hardwood - Mature
- Hardwood - Old
- Mixed Conifer and Hardwood
- Non-Forest
- Unforested

FMU A1 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	82	133	277	60	12	21	32	133
		WH	26	41	37		8	13	20	129
	Minor	RA	18	24	42		8	17	22	109
	All	All	126	198	356		8	19	32	129
Midstory	Major	DF	9	3	6	3	6	8	12	80
		WH	12	6	10		6	9	14	69
	All	All	25	13	20		6	9	14	69
Total	All	All	151	211	375	63	6	17	32	119

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU follows the drainage of the northern fork of Austin Creek, located in the north-central zone of the property. It mostly contains steep north-facing slopes with a soil productivity rating of site-class III and was last logged in the 1950s. Today, total stocking is approximately 151 TPA. The overstory contains approximately 126 TPA and is primarily composed of western hemlock and Douglas-fir, with a small component of red alder. Overstory Douglas-fir average 21 inches DBH and 133 ft tall, and western hemlock average 13 inches DBH and 129 ft tall. The midstory contains approximately 25 TPA and is primarily composed of western hemlock and Douglas-fir. Midstory Douglas-fir average 8 inches DBH and 80 ft tall, and western hemlock average 9 inches DBH and 69 ft tall. The stand is in good health, and per the earlier discussion of mixed conifer and hardwood forests, no management is needed.

FMU A2 - Conifer Plantation - Large DBH

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	317	281	452	87	8	12	18	92
Total	All	All	317	281	452	87	8	12	18	92

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the north-central part of the property off the LM-2400 road on moderate southeast facing slopes near the northern fork of Austin Creek. It is more productive than much of the property, rated as site-class II. It was clearcut around 30 years ago and replanted with Douglas-fir. Total stocking is approximately 317 TPA of Douglas-fir that average 12 inches DBH and 92 ft tall. No midstory is currently present in this stand. It does not appear this stand was previously thinned, and the stand is currently overstocked with low species and structural diversity common to plantations. Per the earlier

discussion of overstocked, large-diameter plantations, a two-part sequence of variable density thinning is recommended, and potential underplanting once density has been sufficiently reduced. The entire stand is within 500 feet of the LM-2400 road, and ground-based logging operations should be straightforward.

FMU A3 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	56	119	170	59	12	20	28	120
		RA	66	104	139		8	16	28	97
		WH	33	47	31		4	9	18	75
	All	All	155	270	340		4	16	28	101
Midstory	Major	DF	47	28	23	10	4	6	12	57
		WH	73	37	47		2	7	14	50
	All	All	125	66	70		2	7	14	51
Total	All	All	280	336	411	68	2	12	28	79

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the north-central area of the property off the LM-2400 road and consists of four separate areas on moderate to steep east-facing slopes. These are the remnants of the second growth forest that naturally regenerated around 1940, before a clearcut harvest in the early 1990s created the nearby plantations. Total stocking is approximately 280 TPA. The overstory contains approximately 155 TPA and is primarily composed of Douglas-fir, western hemlock, and red alder. Overstory Douglas-fir average 20 inches DBH and 120 ft tall, hemlock average 9 inches DBH and 75 ft tall, and alder average 16 inches DBH and 97 ft tall. The midstory contains approximately 125 TPA and is primarily composed of Douglas-fir and western hemlock. Midstory Douglas-fir average 6 inches DBH and 57 ft tall, and hemlock average 7 inches DBH and 50 ft tall. The stand is a mixture of development stages - primarily Mature-I in conifer dominated pockets, but in some areas, the pioneer cohort of red alder is dying off. As the alder declines, density should continue to drop, but there are sufficient conifers growing in the midstory and understory to replace the alder. No management activities are recommended for this unit, as it supports a healthy, diverse forest with no current concerns.

FMU A4 - Conifer Plantation - Large DBH

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	255	181	340	68	8	12	20	87

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
	Minor	RA	16	11	8		2	7	12	85
		WH	45	24	21		2	6	16	67
	All	All	337	229	380		2	10	20	84
Midstory	Major	WH	10	2	2	1	2	4	6	26
	All	All	16	3	4		2	4	6	28
Total	All	All	353	232	383	68	2	10	20	82

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the north-central area of the property near the lower section of the LM-2000 road. It has moderate to steep northwest-facing slopes and a soil productivity rating that is primarily site classes II and III. This unit was clearcut around 1991 and replanted with Douglas-fir. Red alder and western hemlock naturally regenerated in minor amounts as well. Total stocking is approximately 353 TPA. The overstory contains approximately 337 TPA and is primarily composed of Douglas-fir, with small components of red alder and western hemlock. Overstory Douglas-fir average 12 inches DBH and 87 ft tall. The midstory contains approximately 16 TPA and is primarily composed of western hemlock that average 4 inches DBH and 26 ft tall. It does not appear this stand was previously thinned, and the stand is currently overstocked with low species and structural diversity common to plantations. Per the earlier discussion of overstocked, large-diameter plantations, a two-part sequence of variable density thinning is recommended, and potential underplanting once density has been sufficiently reduced.

The lower portions of this stand can be accessed by the LM-2000 road and decommissioned spurs off the LM-2400 road provide access to the upper southwestern corner of the stand. For commercial thinning activities, these roads will need to be restored which would require the installation of new culverts. Except for some ground-based logging on flat ground at the top of the unit, logging will be mainly cable-yarding, and as a result portions of this stand are unreachable from current landings and some thinning will need to be non-commercial. A few small hazard zones run through the unit. Further assessment of these hazard zones will be necessary, but they appear to identify inner gorges along streams which can be strategically avoided during operations.

FMU A5 - Conifer Plantation - Small DBH

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	297	115	246	49	4	9	14	57
		WH	141	49	39		2	4	14	59
	Minor	RA	18	8	18		6	10	16	80
	All	All	464	175	305		2	7	16	58

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Midstory	Major	WH	18	2	4	0	2	4	6	20
Total	All	All	482	177	309	50	2	7	16	57

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is in the north-central area of the property. It consists of two adjacent stands separated by a stream channel and contains moderate to steep northwest-facing slopes. The soil productivity rating varies but is primarily site-class II at lower elevations and site-class IV at the top of the ridgeline. The forest was clearcut around 2000 and replanted with Douglas-fir, but has seen substantial natural regeneration of hemlock. Total stocking is approximately 482 TPA. The overstory contains approximately 464 TPA and is primarily composed of Douglas-fir and western hemlock, with a small component of red alder. Overstory Douglas-fir average 9 inches DBH and 57 ft tall, and hemlock average 4 inches DBH and 59 ft tall. The midstory contains approximately 18 TPA and is primarily composed of western hemlock that average 4 inches DBH and 20 ft tall. This plantation is overstocked, does not appear to have been previously thinned, and is currently in the Stem Exclusion phase of development.

Per the earlier discussion of overstocked small-diameter plantations, an initial pre-commercial thinning is recommended, followed by a two-part sequence of variable density thinnings in the future, and potential underplanting once density has been sufficiently reduced. This stand can be partially accessed off the LM-2400 road and LM-2400F spur, which should provide adequate access for non-commercial thinning operations. The steep terrain will largely require cable-yarding for commercial operations, and at least 20 acres on the northern and western portions of the FMU are unlikely to be accessible for commercial harvesting without restoring a half mile of old road bed. Non-commercial thinning should be utilized in these areas if access cannot be identified. A small hazard zone runs through the northern portion of the unit. Further assessment of this hazard zone will be necessary, but it appears to identify inner gorges along streams which can be strategically avoided during operations.

FMU A6 - Mixed Conifer - Stem Exclusion

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	167	171	287	84	6	14	32	106
		WH	214	158	236		6	11	20	101
	Minor	RC	45	38	41		4	9	16	100
	All	All	432	376	573		4	12	32	103
Midstory	Major	RC	34	6	8	2	2	4	8	27
		WH	34	6	8		2	4	8	27
	All	All	67	11	15		2	4	8	27

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Total	All	All	499	387	589	86	2	11	32	93

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the north-central part of the property on a wide ridgeline and consists of two separate stands. The larger northern area has mostly moderate northeast-facing slopes, and the southern area has mostly steep northeast-facing slopes. The soil productivity rate is site-class IV, and the dry upper ridgeline position likely reduces productivity even further. Historic inventory data identified this stand as originating in 1908. No stumps were observed, and charred snags suggest this may be a naturally regenerated fire-origin stand that has experienced extremely slow growth on top of the dry ridgeline. Total stocking is approximately 499 TPA. The overstory contains approximately 432 TPA and is primarily composed of Douglas-fir and western hemlock, with a small component of western redcedar. Overstory Douglas-fir average 14 inches DBH and 106 ft tall, and hemlock average 11 inches DBH and 101 ft tall. The midstory contains approximately 67 TPA and is primarily composed of western redcedar and western hemlock. Midstory redcedar average 4 inches DBH and 27 ft tall, and hemlock average 4 inches DBH and 27 ft tall.

This unit is overstocked and, though potentially near 120 years old, is still in the Stem Exclusion phase of development. Per the earlier discussion of overstocked mixed-conifer stands in Stem Exclusion, a sequence of variable density thinnings is recommended. Given the high initial density of this stand, two thinnings will be required to hit the initial density target. Most of the unit can be accessed off the LM-2400 road, and relatively flat slopes should enable ground-based commercial thinning activities. The southern stand is likely inaccessible to commercial thinning, and non-commercial thinning entries should be used to reduce densities.

FMU A7 - Mixed Conifer - Mature-I/II

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	84	216	438	93	18	28	36	160
	Minor	RC	28	72	72		12	18	24	160
		WH	28	72	72		12	18	24	160
	All	All	140	360	582		12	24	36	160
Midstory	Major	RC	30	10	21	5	4	8	12	80
		WH	30	10	21		4	8	12	80
	All	All	60	20	42		4	8	12	80
Total	All	All	200	380	624	98	4	19	36	136

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This is a small FMU located in the north-central area of the property, separating the two stands of FMU A6. The soil productivity rate is site-class IV, but the unit is situated in a shallow, northeast-facing stream channel where the availability of water has allowed this stand, which likely originated the same time as FMU A6, to grow much faster and achieve more advanced stages of stand development. Total stocking is approximately 200 TPA. The overstory contains approximately 140 TPA and is primarily composed of Douglas-fir, with a small component of western redcedar and western hemlock. Overstory Douglas-fir average 28 inches DBH and 160 ft tall. The midstory contains approximately 60 TPA and is primarily composed of western redcedar and western hemlock. Midstory western redcedar average 8 inches DBH and 80 ft tall. Midstory western hemlock average 8 inches DBH and 80 ft tall. The forest here is more developed and structurally diverse than nearby units and is likely in the late Mature-I and early Mature-II phase of development. Per the earlier discussion of stands in these stages of development, and given the advanced regeneration currently present, no management activities are recommended for this unit.

FMU A8 - Mixed Conifer - Mature-I

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	50	77	154	60	12	20	30	136
		WH	166	239	305		8	15	24	135
	All	All	216	316	459		8	16	30	135
Midstory	Major	RC	8	4	4	1	4	6	10	60
		WH	8	4	4		4	6	10	60
	All	All	16	8	7		4	6	10	60
Total	All	All	232	324	466	60	4	15	30	130

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located near the north peak of Lookout Mountain on steep east- and north-facing slopes that contain the headwaters of the northern fork of Austin Creek. The soil productivity rate is site-class IV, but the north-facing site has decent soil moisture capacity, though productivity notably declines higher on the slope where less water is available. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1926. Total stocking is approximately 232 TPA. The overstory contains approximately 216 TPA and is primarily composed of western hemlock with some Douglas-fir. Overstory Douglas-fir average 20 inches DBH and 136 ft tall, and hemlock average 15 inches DBH and 135 ft tall. The midstory contains approximately 16 TPA and is primarily composed of western redcedar and western hemlock. Midstory redcedar and hemlock both average 6 inches DBH and 60 ft tall. Western hemlock regeneration is strong throughout the unit, suggesting this stand has emerged from Stem Exclusion and entered the Mature-I phase of development. Stocking remains high, and the stand contains a large component of western hemlock. However, the north-facing site likely provides decent growing conditions for this drought-intolerant species.

Per the earlier discussion of Mature-I stands, this unit could be lightly thinned, but priority is low. Given the advanced regeneration, no second entry is necessary. Access is possible to the top of this stand off the LM-2000 road, but access is no longer possible to the lower slopes without rebuilding one mile of the LM-2400C road, including a stream crossing. In addition, a hazard zone has been identified across the eastern half of this FMU, potentially because of rule-identified inner gorges and convergent headwalls at the headwaters of the creek system. If access is limited to the top, then the steep terrain and bench topography likely limits logging feasibility to around 10-acres. This makes the stand a good candidate to include with thinning operations on adjacent, highly-overstocked stands on the upper mountain, but it generally remains a lower priority.

FMU B1 - Mixed Conifer - Mature-II

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	90	226	335	66	12	23	36	154
	All	All	106	265	371		8	22	36	154
Midstory	Major	RC	45	29	35	8	2	8	18	59
		WH	27	12	18		2	8	16	59
	All	All	81	44	60		2	8	18	61
Total	All	All	187	309	431	73	2	16	36	114

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the north-central zone of the property near the base of Lookout Mountain. It is near the start of the LM-2000 road, and Austin Creek flows along the eastern boundary. It contains a series of northeast-facing terraces that alternate with plateaus and short steep slopes. The soil productivity rate is a mixture of site class III and IV. The lower part of the unit contains continuous steep slopes over 70% above Austin Creek. Total stocking is approximately 187 TPA. The overstory contains approximately 106 TPA and is primarily composed of Douglas-fir that average 23 inches DBH and 154 ft tall. The midstory contains approximately 81 TPA and is primarily composed of western redcedar and western hemlock. Midstory western redcedar average 8 inches DBH and 59 ft tall, and western hemlock average 8 inches DBH and 59 ft tall. More developed than nearby stands, the forest in this unit is likely in the Mature-II stage of development, with larger diameter trees, canopy gaps, and structural diversity. A small to medium sized outbreak of Douglas-fir beetle is operating within normal levels in this stand, accelerating the creation of canopy gaps and recruiting a new cohort of trees into the canopy. No management activities are recommended.

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	192	245	418	90	8	16	30	114
	Minor	RC	24	34	38		6	13	24	114
		WH	46	54	77		6	14	24	107
	All	All	263	333	532		6	15	30	113
Midstory	Major	RC	33	8	12	3	2	5	8	53
		WH	33	8	12		2	5	8	53
	All	All	66	15	24		2	5	8	53
Total	All	All	329	348	556	92	2	13	30	101

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the north-central zone of the property on the lower to mid-slopes of Lookout Mountain. It contains a series of northeast-facing terraces that alternate with plateaus and short steep slopes. The soil productivity rate is site-class IV. The unit contains three stands separated by older forest types that don't require management. Total stocking is approximately 322 TPA. The overstory contains approximately 283 TPA and is primarily composed of Douglas-fir and western hemlock, with a small component of western redcedar. Overstory Douglas-fir average 16 inches DBH and 112 ft tall, and western hemlock average 11 inches DBH and 104 ft tall. The midstory contains approximately 39 TPA and is primarily composed of suppressed western redcedar and western hemlock. Midstory western redcedar average 5 inches DBH and 54 ft tall, and western hemlock average 5 inches DBH and 54 ft tall. This unit varies between late Stem Exclusion and early Mature-I stages of development and is currently overstocked.

Per the earlier discussion of overstocked mixed-conifer stands, a sequence of variable density thinnings is recommended to reduce density and accelerate the development of late-seral characteristics in this stand. The majority of this unit can be accessed by the LM-2000 road with the exception of the most northern stand in this unit. Accessing the northern stand requires yarding about 300ft through an older stand type, which will increase logging complexity and cost. Additionally, though the road runs adjacent to the central stand, identifying a landing may be difficult and require some yarding through adjacent stands or tethering of logging equipment. All stands are sufficiently flat for ground-based logging.

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	100	117	191	65	8	15	28	110
		WH	100	138	186		6	15	24	119
	Minor	RC	41	44	73		6	14	36	105
	All	All	244	304	455		6	15	36	113
Midstory	Major	RC	26	11	14	3	4	7	14	45
		WH	20	5	10		4	6	14	40
	All	All	46	16	24		4	7	14	43
Total	All	All	290	320	479	68	4	13	36	102

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the central zone of the property on the mid slopes of Lookout Mountain adjacent to the LM-2000 road. Austin Creek flows along the south and east boundaries. It contains a series of northeast-facing terraces that alternate with plateaus and short steep slopes. The soil productivity rating is a mixture of site class II and IV. The eastern part of the unit contains continuous steep slopes over 70% above Austin Creek. Total stocking is approximately 290 TPA. The overstory contains approximately 244 TPA and is primarily composed of Douglas-fir and western hemlock, with a small component of western redcedar. Overstory Douglas-fir average 15 inches DBH and 110 ft tall, and overstory western hemlock average 15 inches DBH and 119 ft tall. The midstory contains approximately 46 TPA and is primarily composed of suppressed western redcedar and western hemlock. Midstory western redcedar average 7 inches DBH and 45 ft tall, and midstory western hemlock average 6 inches DBH and 40 ft tall. This stand is best characterized in the Stem Exclusion stage of stand development. Per the earlier discussion of overstocked mixed-conifer stands in Stem Exclusion, a sequence of variable density thinnings is recommended.

This unit was delineated separately from similar forest stands due to potential slope stability challenges requiring additional review before management recommendations can be implemented. Most of the unit falls within a hazard zone due to historic landslide activity and steep, potentially inner-gorge slopes leading down to Austin Creek. The historic landslide designation seems overly cautious given the local topography, but harvesting in this unit will require further investigation and may be impossible or severely restricted. Most of the stand can be accessed from the LM-2000 road, but a few short temporary spur roads may need to be built to facilitate equipment access, including utilizing the LM-2000A spur that was previously decommissioned. Harvesting, if possible, can be accomplished with a combination of ground and cable-yarding, but long yarding distances will likely increase costs.

FMU B4 - Mixed Conifer - Stem Exclusion/Mature-I

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	73	131	209	63	12	19	32	141
		WH	111	185	215		10	15	24	142
	Minor	RC	11	21	25		10	16	24	143
	All	All	195	337	449		10	17	32	142
Midstory	Major	RC	10	4	6	1	2	7	12	51
		WH	4	1	2		2	6	10	40
	All	All	15	5	8		2	7	12	48
Total	All	All	210	342	457	64	2	16	32	135

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the central zone of the property and stretches across the mid slopes of Lookout Mountain adjacent to the LM-2000 road. It contains a mix of moderate to steep northeast- and east-facing slopes. The soil productivity rate is site-class IV, but this unit has been delineated separately from nearby stands as it has lower stocking, larger trees, and is generally more accessible.

Total stocking is approximately 210 TPA. The overstory contains approximately 195 TPA and is primarily composed of Douglas-fir and western hemlock, with a small component of western redcedar. Overstory Douglas-fir average 19 inches DBH and 141 ft tall, and hemlock average 15 inches DBH and 142 ft tall. The midstory contains approximately 15 TPA and is primarily composed of western hemlock and western redcedar. Midstory redcedar average 7 inches DBH and 51 ft tall, and hemlock average 6 inches DBH and 40 ft tall. This unit ranges between late Stem Exclusion and early Mature-I stages of development. It remains overstocked, which is restricting growth and development of the forest.

Per the earlier discussion of overstocked mixed-conifer stands, a sequence of variable density thinnings is recommended. Access is off the LM-2000 road and harvest operations will likely be a mix of ground-based equipment and cable-yarding. The northern portion of this unit is not likely accessible without building 400 ft of temporary road. The central portion of this unit has good road access but includes several hazard zones which will require additional review. The southern portion of this unit has good access and can be easily cable-yarded.

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	87	78	151	64	8	14	24	103
		WH	234	184	316		6	12	22	100
	All	All	328	270	478		6	13	24	101
Midstory	Major	RC	29	17	12	2	2	6	10	53
		WH	17	8	6		2	5	8	47
	All	All	46	25	17		2	5	10	51
Total	All	All	374	295	495	66	2	12	24	94

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the central zone of the property and contains several areas on the mid to upper slopes of Lookout Mountain. It mostly contains a mix of moderate to steep northeast- to east-facing slopes, but there are some steep southwest-facing slopes near the western property boundary. Total stocking is approximately 374 TPA. The overstory contains approximately 328 TPA and is primarily composed of Douglas-fir and western hemlock. Overstory Douglas-fir average 14 inches DBH and 103 ft tall, and hemlock average 12 inches DBH and 100 ft tall. The midstory contains approximately 46 TPA and is primarily composed of western hemlock and western redcedar. Midstory redcedar average 6 inches DBH and 53 ft tall, and hemlock average 5 inches DBH and 47 ft tall. This FMU is in the Stem Exclusion phase.

Per the earlier discussion of overstocked mixed-conifer stands in Stem Exclusion, a sequence of variable density thinnings is recommended. Given the high initial density of this stand and its exposed ridgeline positions, two thinnings should be used to hit the initial density target. The stand is generally free from hazard zones, except for some small areas of overlap on its eastern and southeastern border. These areas are likely rule-identified inner-gorges which can be avoided during future operations. Small stands on the unit's southwest boundary may have been left by past DNR harvests because of concerns around slope stability and will require further review. The stand is partially accessible off the LM-2000 road. Logging operations would be primarily cable-yarding and, given the topography, will likely be a complex layout of multiple small areas that can be easily accessed by equipment operating from the LM-2000 road. Much of the northern most portion of the stand is likely inaccessible to logging operations.

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	73	89	185	57	10	18	24	142
		WH	137	161	235		8	14	20	138
	All	All	210	250	421		8	15	24	139
Total	All	All	210	250	421	57	8	15	24	139

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the central zone of the property on the mid slopes of Lookout Mountain. The upper section of Austin Creek flows along the northern boundary. It consists of three separate areas with moderate and steep northeast-facing slopes. It has a soil productivity rating of site class IV. Total stocking is approximately 210 TPA. The overstory is primarily composed of Douglas-fir and western hemlock. Overstory Douglas-fir average 18 inches DBH and 142 ft tall, and western hemlock average 14 inches DBH and 138 ft tall. No midstory is currently present. This unit is in the Mature-I stage of development, with a well-established cohort of western hemlock in the understory.

Per the earlier discussion on mixed conifer stands in this stage, a variable density thinning is recommended in accessible stands, but is a lower priority to thin than the adjacent stands in Stem Exclusion. Parts of this stand are accessible from the LM-2000 road and can be commercially thinned. Commercial harvesting can be accomplished using a combination of ground and cable-yarding techniques as terrain dictates. The northern stand in this unit includes hazard zones leading down to Austin Creek and will require further assessment. In addition, access to this northern stand is only possible from the northern part of the unit unless the decommissioned LM-2000E road is restored, which would require a stream crossing of Austin Creek. As a result, only a small portion of this unit near the LM-2000 road is likely a good candidate for thinning. Restoring 600 ft of an abandoned spur road (LM-2500B) would provide reasonable cable-yarding access to the middle stand and is a good candidate for thinning. Finally, the southern stand in this unit is inaccessible without new road building and is not a good candidate for thinning.

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	RC	61	58	102	54	8	13	32	85
		WH	172	187	230		6	12	20	106
	Minor	DF	30	35	65		10	16	20	114
		SF	32	28	32		6	10	20	80
	All	All	296	307	428		6	12	32	100
Midstory	Major	RC	15	10	7	1	4	6	8	40
		WH	6	1	1		2	4	8	60
	All	All	21	11	8		2	5	8	46
Total	All	All	317	318	436	55	2	12	32	96

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the upper slopes of Lookout Mountain near the southern peak. It contains mostly moderate northeast-facing slopes with some terraces that alternate with plateaus and short steep slopes. There is a small area with steep southwest-facing slopes off of Lookout Mountain's southern peak. The unit has a soil productivity rating of site class IV. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1942-1950. Total stocking is approximately 317 TPA. The overstory contains approximately 296 TPA and is primarily composed of western hemlock and western redcedar, with small components of Douglas-fir and pacific silver fir. The silver fir is generally limited to the upper elevations of this unit. Overstory western redcedar average 13 inches DBH and 85 ft tall, and hemlock average 12 inches DBH and 106 ft tall. The midstory contains approximately 21 TPA and is primarily composed of western hemlock and western redcedar. Midstory western redcedar average 6 inches DBH and 40 ft tall, and western hemlock average 4 inches DBH and 60 ft tall. This stand is overstocked in the Stem Exclusion stage of development.

Per the earlier discussion on mixed conifer stands in Stem Exclusion, a sequence of variable density thinnings is recommended. This thinning should occur within the next 5 years, but stocking is slightly lower than in other stands owing to its later origination, and therefore this stand could wait up to 10 years if required. Parts of this stand are accessible from the LM-2000 road, which runs through the middle of the stand to the top of the southern peak. Accessible areas can be commercially thinned, while inaccessible areas will need to be non-commercially thinned unless new roads are constructed. Commercial harvesting can be accomplished using a combination of ground and cable-yarding techniques. Currently, logging trucks with normal length logs would be unable to navigate several hairpin turns on the way to the communication tower, so either very short logs need to be manufactured or non-commercial thinning used across these upper slopes.

FMU B8 - Mixed Conifer - Stem Exclusion

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	WH	554	110	256	48	2	6	12	50
	Minor	DF	40	6	28		6	8	12	40
		RA	118	39	60		4	7	10	60
		RC	80	13	18		2	4	8	40
	All	All	792	168	362		2	6	12	50
Total	All	All	792	168	362	48	2	6	12	50

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located along the upper ridgeline of Lookout Mountain near the northern peak. It contains some mellow slopes in the middle and steeper slopes along the edges, particularly in the southwest corner. The soil productivity rating of the unit is site class IV on the east side and site class III on the west side. After clearcutting in 1990, the stand was likely replanted with Douglas-fir and potentially other species, but has experienced high-levels of natural regenerating hemlock and alder. Total stocking is approximately 792 TPA. The overstory is primarily composed of western hemlock, with a small component of Douglas-fir, red alder, and western redcedar. Overstory western hemlock average 6 inches DBH and 50 ft tall. No midstory is currently present in this stand. The stand is in the Stem Exclusion stage of development. Per the earlier discussion of overstocked small-diameter plantations, an initial pre-commercial thinning is recommended, followed by a two-part sequence of variable density thinnings in the future, and potential underplanting once density has been sufficiently reduced. The unit is accessible from the maintained LM-2000 road, and several spurs can be easily brought back into service to access most parts of this unit.

FMU B9 - Mixed Conifer and Hardwood

This FMU is located on the western slopes of the southern peak of Lookout Mountain. It is on steep south- and southeast-facing slopes which form the headwaters of Barnes Creek, which drains west into Lake Samish. It has a soil productivity rating of site class III. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1950. This unit was not visited during the assessment due to challenging access. Based on remote sensing, this unit has characteristics similar to nearby unit E2, where no management is recommended. In addition, this unit is on steep and likely unstable slopes, most of which forms a convergent headwall. For these reasons, no management is recommended in this unit.

FMU C1 - Mixed Conifer - Mature-II

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	120	240	377	73	12	20	26	160
Midstory	Major	RC	28	26	28	8	6	10	20	83
		WH	36	22	36		6	10	14	100
	All	All	64	48	64		6	10	20	92
Total	All	All	184	288	441	78	6	17	26	137

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the central part of the property on the mid-slopes of Lookout Mountain. It contains moderate to steep slopes that face north and east and that drain into Austin Creek at the base of the unit. The soil productivity rating is site class III on the north side and site class IV on the south side. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1934. Total stocking is approximately 184 TPA. The overstory contains approximately 120 TPA and is primarily composed of Douglas-fir. Overstory Douglas-fir average 20 inches DBH and 160 ft tall. The midstory contains approximately 64 TPA and is primarily composed of western redcedar and western hemlock. Midstory western redcedar average 10 inches DBH and 83 ft tall, and western hemlock average 10 inches DBH and 100 ft tall. This forest is in the Mature-II stage of development. Per the earlier discussion of conifer forests in this stage, no management activities are recommended. There is no current road access to this unit.

FMU C2 - Mixed Conifer - Mature-II

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	24	84	125	53	22	28	40	180
		RC	38	48	136		14	22	26	120
	Minor	RA	13	16	27		12	16	22	120
		WH	13	16	33		14	18	20	120
	All	All	88	164	321		12	22	40	136
Midstory	Major	RC	89	94	111	17	6	11	18	104
	All	All	96	104	123		6	12	18	105
Total	All	All	184	268	445	67	6	17	40	120

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the central part of the property on the mid-slopes of Lookout Mountain. It contains a central plateau with moderate slopes to the north and south. Austin Creek runs along the north side of the unit. The soil productivity rating is site class II. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1934. Total stocking is approximately 184 TPA. The overstory contains approximately 88 TPA and is primarily composed of Douglas-fir and western redcedar, with a small component of red alder. Overstory Douglas-fir average 28 inches DBH and 180 ft tall, and western redcedar average 22 inches DBH and 120 ft tall. The midstory contains approximately 96 TPA and is primarily composed of western redcedar that average 11 inches DBH and 104 ft tall. This forest is in the Mature-II stage of development. Per the previous discussion on mixed conifer forests in this stage, no management activities are recommended. There is no current road access to this unit.

FMU C3 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	RC	96	80	129	28	8	12	22	120
	Minor	RA	24	20	62		14	18	22	120
	All	All	120	100	190		8	13	22	120
Midstory	Major	RC	20	10	14	4	6	8	10	60
		WH	20	10	14		6	8	10	60
	All	All	40	20	28		6	8	10	60
Total	All	All	160	120	218	31	6	12	22	105

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the south-central zone of the property on the lower slopes of Lookout Mountain. It contains east-facing slopes that are moderate at the higher elevations and increase in steepness at the lower elevations. The soil productivity rating is site class III on the east side and site class IV on the west side. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1934. Total stocking is approximately 160 TPA. The overstory contains approximately 120 TPA and is primarily composed of western redcedar, with a small component of red alder and occasional Douglas-fir. Overstory western redcedar average 12 inches DBH and 120 ft tall. The midstory contains approximately 40 TPA and is primarily composed of western redcedar and western hemlock. Midstory western redcedar and hemlock both average 8 inches DBH and 60 ft tall. This stand used to be more dominant to red alder, which has experienced significant mortality due to its short lifespan. Western redcedar and other conifers are growing to replace the red alder, so the forest is on a healthy trajectory as it undergoes a successional shift. Per the earlier discussion of mixed conifer and hardwood forests, no management activities are recommended. This unit has no current road access.

FMU C4 - Mixed Conifer - Mature-I

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	60	133	154	66	10	18	32	160
		RC	60	133	154		10	18	32	160
		WH	60	133	154		10	18	32	160
	All	All	180	400	462		10	18	32	160
Midstory	Major	RC	20	4	9	2	4	6	8	60
		WH	20	4	9		4	6	8	60
	All	All	40	8	18		4	6	8	60
Total	All	All	220	408	480	69	4	16	32	142

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the south-central part of the property, with Silver Creek flowing along the southern boundary. The terrain includes mostly south-facing slopes that are moderate at the upper elevations and steeper at the lower elevations. The soil productivity rating is site class III on the south side and site class IV on the north side. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1934-1945. Total stocking is approximately 220 TPA. The overstory contains approximately 180 TPA and is primarily composed of Douglas-fir, western redcedar, and western hemlock. Overstory Douglas-fir average 18 inches DBH and 160 ft tall, redcedar average 18 inches DBH and 160 ft tall, and hemlock average 18 inches DBH and 160 ft tall. The midstory contains approximately 40 TPA and is primarily composed of western redcedar and western hemlock. Midstory redcedar and hemlock both average 6 inches DBH and 60 ft tall. This unit is in the Mature-I stage of development with some regeneration occurring and a limited midstory in places. The stand is not currently accessible for commercial thinning, and any new road construction would be several miles long. Though a little overstocked, the overstory density is very close to the initial target density for mixed conifer stands in this stage of development. Given these factors, no management is recommended.

FMU C5 - Mixed Conifer and Hardwood

This FMU is located on southeastern slopes leading down from Lookout Mountain's southern peak towards the community of Glenhaven. An unnamed creek runs through the middle of the unit towards Cain Lake and the soil productivity rating ranges from site class II to III. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1940. There is currently no road or trail access to this stand. Though an old road bed once likely led out of the town of Glenhaven near the current water tower, current legal access is unclear. This unit was not visited during the assessment due to challenging access. Based on remote sensing, this unit has similar forest

conditions to nearby unit E6, where no management is recommended. In addition, this unit is on very steep slopes that include hazard zones and historic landslide activity. For these reasons, no management is recommended in this unit.

FMU D1 - Mixed Conifer - Mature-II

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	46	102	340	85	18	35	48	195
	Minor	RC	17	49	97		16	30	48	186
		WH	17	49	97		16	30	48	186
	All	All	84	208	554		16	32	48	191
Midstory	Major	RC	34	26	70	18	8	16	24	96
		WH	34	26	70		8	16	24	96
	All	All	68	52	140		8	16	24	96
Total	All	All	152	260	694	102	8	25	48	149

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located along the eastern boundary of the property, with northeast-facing slopes descending from the north side of Repeater Road to Lake Whatcom Boulevard. It has a soil productivity rating of site class III. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1931. Total stocking is approximately 152 TPA. The overstory contains approximately 84 TPA and is primarily composed of Douglas-fir, with a small component of western redcedar. Overstory Douglas-fir average 35 inches DBH and 195 ft tall. The midstory contains approximately 68 TPA and is primarily composed of western redcedar and western hemlock. Midstory redcedar and hemlock both average 16 inches DBH and 96 ft tall. The forest in this unit is in the Mature-II stage of development. Per the earlier discussion of conifer forests in this stage, no management activities are recommended. The lower part of this unit is accessible from Lake Whatcom Boulevard, and the upper part is accessible from Repeater Ridge Road.

FMU D2 - Mixed Conifer - Mature-II

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	61	122	244	60	16	24	36	152
	Minor	BM	19	38	78		16	24	30	120
	All	All	96	192	354		8	22	36	142
Midstory	Major	RC	44	46	60	11	4	12	20	55
		WH	30	18	21		4	8	12	60
	All	All	74	64	81		4	10	20	57
Total	All	All	170	256	435	69	4	17	36	105

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located along the eastern boundary of the property, with east-facing slopes descending from Repeater Road to Lake Whatcom Boulevard. It has a soil productivity rating of site class III. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1930-1941. Total stocking is approximately 170 TPA. The overstory contains approximately 96 TPA and is primarily composed of Douglas-fir, with a small component of bigleaf maple. Overstory Douglas-fir average 24 inches DBH and 152 ft tall. The midstory contains approximately 74 TPA and is primarily composed of western redcedar and western hemlock. Midstory western redcedar average 12 inches DBH and 55 ft tall, and hemlock average 8 inches DBH and 60 ft tall. The forest in this unit is at the beginning of the Mature-II stage of development. Per the earlier discussion of conifer forests in this stage, no management activities are recommended. The lower part of this unit is accessible from Lake Whatcom Boulevard, and the upper part is accessible from Repeater Ridge Road.

FMU D3 - Mixed Conifer - Mature-I/II

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	98	236	451	89	12	26	40	163
	Minor	WH	11	24	34		10	20	30	163
	All	All	112	267	494		10	25	40	164
Midstory	Major	DF	17	7	19	9	4	10	16	60
		RC	19	11	17		4	9	16	73
		WH	29	15	31		4	10	16	68
	All	All	65	33	66		4	10	16	67
Total	All	All	177	300	560	98	4	19	40	128

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density,

DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the lower slopes of Lookout Mountain near the eastern boundary of the property and has a soil productivity rating of site class III. Based on historic inventory data, it is estimated that the unit regenerated naturally sometime around 1900, possibly from wildfire, as no stumps were observed. A handful of very large, old-growth trees were found growing in the steep ravines leading down to Lake Whatcom, where they likely survived the last disturbance. Total stocking is approximately 177 TPA. The overstory contains approximately 112 TPA and is primarily composed of Douglas-fir, with a small component of western hemlock. Overstory Douglas-fir average 26 inches DBH and 163 ft tall. The midstory contains approximately 65 TPA and is primarily composed of Douglas-fir, western redcedar, and western hemlock. Midstory Douglas-fir average 10 inches DBH and 60 ft tall, redcedar average 9 inches DBH and 73 ft tall, and hemlock average 10 inches DBH and 68 ft tall. This unit is generally in the Mature-II stage of development, but varies with some areas high on the ridgeline where growth has progressed slowly only beginning to exhibit early Mature-I conditions. Per the earlier discussion of conifer stands in this stage, no management activities are recommended. There is no current road access to this stand.

FMU D4 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	BM	61	108	216	55	12	22	36	120
	Minor	DF	13	26	73		24	29	40	180
	All	All	90	170	361		12	24	42	129
Midstory	Major	RC	70	80	155	22	8	16	26	89
Total	All	All	160	250	517	76	8	20	42	111

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located along the eastern boundary of the property that is adjacent to Lake Whatcom Boulevard. It contains east-facing slopes that are steep on the south side and more moderate on the north side. It has a soil productivity rating of site class III. Based on historic inventory data, it is estimated that the oldest trees in this unit regenerated naturally around 1817 following a wildfire, making it one of the oldest stands in the watershed. Many of the trees are likely younger, having originated later than the original Douglas-fir overstory and the stand broadly appears to possess well developed Mature-II and other later-seral characteristics. Total stocking is approximately 160 TPA. The overstory contains approximately 90 TPA and is primarily composed of bigleaf maple, with a small component of Douglas-fir. Overstory bigleaf maple average 22 inches DBH and 120 ft tall. The midstory contains approximately 70 TPA and is primarily composed of western redcedar that average 16 inches DBH and 89 ft tall. Per the earlier discussion of mixed conifer and hardwood stands with no health concerns, no management activities are recommended. This unit is accessible from Lake Whatcom Boulevard.

FMU D5 - Mixed Conifer - Mature-II

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	60	280	388	75	24	32	40	160
Midstory	Major	RC	80	96	137	20	10	14	22	100
	Minor	WH	20	24	14		6	8	12	80
	All	All	100	120	151		6	13	22	96
Total	All	All	160	400	539	92	6	20	48	120

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the central zone of the property on steep southeast facing slopes near the boundary of the South Lake Whatcom Preserve. It has a soil productivity rating of site class III. It contains two separate areas divided by a stream channel. Historic inventory data suggests an origination date around 1933, but this appears unlikely as no cut stumps were identified and the stand condition is more similar to the older neighboring stands in unit D3 and D4, suggesting a likely fire origin sometime in the last 120 - 200 years. Total stocking is approximately 160 TPA. The overstory contains approximately 60 TPA and is primarily composed of Douglas-fir that average 32 inches DBH and 160 ft tall. The midstory contains approximately 100 TPA and is primarily composed of western redcedar, with a small component of western hemlock. Midstory western redcedar average 14 inches DBH and 100 ft tall. This conifer forest is in the Mature-II stage of development. Per the earlier discussions of forests in this stage, no management activities are recommended.

FMU D6 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	RA	91	141	237	59	12	18	32	94
		WH	47	74	116		10	18	28	84
	All	All	146	230	371		10	18	32	91
Midstory	Major	DF	20	12	14	7	4	8	16	60
		WH	46	27	36		4	9	16	49
	All	All	69	41	53		4	8	16	52
Total	All	All	215	271	424	66	4	15	32	79

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the central zone of the property, near the southern end of the Repeater Road ridge. It contains two separate areas, one with moderate west-facing slopes and the other with steep

east- and southeast-facing slopes. The unit is split between soil productivity ratings of III on the lower slopes and IV on the upper slopes. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1933-1943. Total stocking is approximately 215 TPA. The overstory contains approximately 146 TPA and is primarily composed of western hemlock and red alder. Overstory western hemlock average 18 inches DBH and 84 ft tall, and red alder average 18 inches DBH and 94 ft tall. The midstory contains approximately 69 TPA and is primarily composed of Douglas-fir and western hemlock. Midstory Douglas-fir average 8 inches DBH and 60 ft tall, and hemlock average 9 inches DBH and 49 ft tall. This mixed forest is on a healthy trajectory as it undergoes a successional shift with a midstory and understory component of conifers growing to replace the declining red alder. Per the earlier discussion of healthy mixed conifer and hardwood stands, no management activities are recommended.

FMU D7 - Mixed Conifer - Stem Exclusion/Mature-I

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	141	269	429	84	12	20	32	120
		WH	41	74	55		8	12	18	120
	All	All	190	360	495		8	18	32	120
Midstory	Major	RC	15	5	7	2	4	6	10	60
		WH	25	7	11		4	6	10	60
	All	All	40	12	18		4	6	10	60
Total	All	All	230	372	512	86	4	16	32	110

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the central part of the property, near the southern end of Repeater Road. It contains mostly moderate west-facing slopes with a soil productivity rating of site class IV. Based on historic inventory data it is estimated that the unit regenerated naturally following clearcut harvesting around 1943. Total stocking is approximately 230 TPA. The overstory contains approximately 190 TPA and is primarily composed of Douglas-fir and western hemlock. Overstory Douglas-fir average 20 inches DBH and 120 ft tall, and hemlock average 12 inches DBH and 120 ft tall. The midstory contains approximately 40 TPA and is primarily composed of western redcedar and western hemlock. Midstory western redcedar and hemlock both average 6 inches DBH and 60 ft tall. There is a small area with young red alder at an old landing near the end of Repeater Road.

This is an overstocked mixed conifer forest that is leaving the Stem Exclusion stage and entering the Mature-I stage of development. Per the earlier discussion of mixed conifer forests in these stages, a variable density thinning is recommended. The north side of the unit is accessible from Repeater Road and is suitable for commercial thinning using cable yarding methods. Accessing the south side of the unit will require building about one quarter mile of temporary road along the ridgeline. If this is not feasible,

then given current density and stand development, this southern unit can be left to develop by its own processes.

FMU D8 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	32	48	113	56	12	22	32	140
		RC	32	48	113		12	22	32	140
		WH	32	48	113		12	22	32	140
	Minor	RA	24	36	32		10	12	16	140
	All	All	120	180	372		10	20	32	140
Midstory	Major	RC	30	20	21	5	4	8	12	40
		WH	30	20	21		4	8	12	40
	All	All	60	40	42		4	8	12	40
Total	All	All	180	220	414	61	4	16	32	107

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the central part of the property on the west side of Repeater Road. It contains mostly moderate west-facing slopes with a soil productivity rating of site class IV. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1943. Total stocking is approximately 180 TPA. The overstory contains approximately 120 TPA and is primarily composed of Douglas-fir, western redcedar, and western hemlock, with a small component of red alder. Overstory Douglas-fir average 22 inches DBH and 140 ft tall, redcedar average 22 inches DBH and 140 ft tall, and hemlock average 22 inches DBH and 140 ft tall. The midstory contains approximately 60 TPA and is primarily composed of western redcedar and western hemlock. Midstory redcedar average 8 inches DBH and 40 ft tall, and hemlock average 8 inches DBH and 40 ft tall. Per the earlier discussion of mixed conifer and hardwood forests with no health concerns, no management activities are recommended. The unit is accessible from Repeater Ridge Road.

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	165	342	501	96	12	20	32	144
Midstory	Major	DF	18	9	18	6	6	10	14	69
		WH	39	16	23		4	7	14	38
	All	All	57	25	41		4	8	14	48
Total	All	All	222	367	542	101	4	17	32	120

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located in the central part of the property, with steep west-facing slopes descending down from Repeater Road to Austin Creek. It has a soil productivity rating of site class III. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1930. Total stocking is approximately 222 TPA. The overstory contains approximately 165 TPA and is primarily composed of Douglas-fir that average 20 inches DBH and 144 ft tall. The midstory contains approximately 57 TPA and is primarily composed of Douglas-fir and western hemlock. Midstory Douglas-fir average 10 inches DBH and 69 ft tall, and hemlock average 7 inches DBH and 38 ft tall. This stand is in the Mature-I stage of development. Competition remains high, and overstory species composition remains entirely Douglas-fir.

Per the earlier discussion of this forest type, a variable density commercial thinning is recommended to increase species diversity and reduce competition. There is good access from Repeater Road to the top of the stand. The steep slopes will require cable yarding methods, but operations should be straight forward. The lower half of the FMU adjacent to Austin Creek is within a known hazard zone, which requires additional assessment but is likely a rule-identified inner gorge and will be excluded from thinning operations.

FMU E1 - Mixed Conifer - Mature-II

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	WH	53	101	149	48	14	18	48	123
	Minor	DF1	12	34	81		14	31	48	135
		DF2	13	38	33		14	18	22	120
	All	All	91	207	345		14	22	48	126
Midstory	Major	WH	57	44	53	7	6	9	14	75
	All	All	62	48	57		6	10	14	75
Total	All	All	153	255	402	55	6	17	48	105

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located near the ridgeline in the southern zone of the property. It mostly contains steep west-facing slopes but does include a small east-facing section on the other side of the ridgeline. The soil productivity rating of the unit is site class III. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1879. Total stocking is approximately 153 TPA. The overstory contains approximately 91 TPA and is primarily composed of western hemlock. There is a small component of Douglas-fir that is growing in two distinct cohorts, with the larger one consisting of older legacy trees. Overstory western hemlock average 18 inches DBH and 123 ft tall. The midstory contains approximately 62 TPA and is primarily composed of western hemlock that average 9 inches DBH and 75 ft tall. Per the earlier discussion, this stand is in the Mature-II stage of development, and no management is recommended. There is no current road access to this stand, but a trail along the ridgeline can provide limited access.

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	BM	28	44	54	38	8	15	28	136
		DF	24	42	87		10	22	32	143
		RA	30	42	73		8	17	24	69
	All	All	94	148	228		8	17	32	118
Midstory	Major	BM	23	13	23	9	6	10	14	60
		RC	23	13	23		6	10	14	60
		WH	23	13	23		6	10	14	60
	All	All	70	40	70		6	10	14	60
Total	All	All	164	188	298	48	6	14	32	93

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located along the ridgeline in the southern zone of the property. It contains steep east-facing and southwest-facing slopes with a soil productivity rating of site-class III. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1937-1942. Total stocking is approximately 164 TPA. The overstory contains approximately 94 TPA and is primarily composed of Douglas-fir, red alder, and bigleaf maple. Overstory Douglas-fir average 22 inches DBH and 143 ft tall, maple average 15 inches DBH and 136 ft tall, and alder average 17 inches DBH and 69 ft tall. The midstory contains approximately 70 TPA and is primarily composed of maple, redcedar, and hemlock. Midstory redcedar average 10 inches DBH and 60 ft tall, hemlock average 10 inches DBH and 60 ft tall, and maple average 10 inches DBH and 60 ft tall. This unit is undergoing a transition as the alder declines, but long-lived overstory and midstory Douglas-fir, bigleaf maple, and other conifers, as well as new regeneration, ensures this transition will almost certainly be successful. As a result, no management is needed. Much of the unit is inaccessible by road. The eastern portion of the unit can be accessed by a privately-owned road in the Barnes Creek drainage, but the exact access arrangement is currently unclear.

FMU E3 - Mixed Conifer - Mature-II

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	58	133	300	58	14	28	36	179
	Minor	RC	11	32	19		12	14	18	160
	All	All	74	180	333		12	25	36	175
Midstory	Major	BM	16	10	20	7	6	11	14	74
		RC	16	10	20		6	11	14	74
		WH	10	7	8		6	9	14	71
	All	All	46	32	52		6	11	14	72
Total	All	All	120	212	385	65	6	20	36	136

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the east-facing slopes of the southern zone of the property. It contains mostly steep slopes with some flatter terraces near the base and has a soil productivity rating of site class III around the edges and site class II in the middle. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1938. Total stocking is approximately 120 TPA. The overstory contains approximately 74 TPA and is primarily composed of Douglas-fir, with a small component of western redcedar. Overstory Douglas-fir average 28 inches DBH and 179 ft tall. The midstory contains approximately 46 TPA and is primarily composed of bigleaf maple, western redcedar, and western hemlock. Midstory redcedar average 11 inches DBH and 74 ft tall, hemlock average 9 inches DBH and 71 ft tall, and maple average 11 inches DBH and 74 ft tall. Understory hemlock is growing at a density of 50 TPA. This forest is in the Mature-II stage of development with no health concerns. Per the earlier discussion of mixed conifer forests in this stage, no management activities are recommended. There is no current road access to this stand.

FMU E4 - Mixed Hardwood - Old

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	BM	40	70	85	29	10	16	20	100
		RA	40	70	85		10	16	20	100
	All	All	80	140	170		10	16	20	100
Midstory	Major	BM	10	10	7	2	4	8	10	60
		WH	10	10	7		4	8	10	60
	All	All	20	20	14		4	8	10	60
Total	All	All	100	160	184	30	4	14	20	92

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the steep east-facing slopes of the southern zone of the property and has a soil productivity rating of site class III. Based on historic inventory data, it is estimated that the unit regenerated naturally following clearcut harvesting around 1938. Total stocking is approximately 100 TPA. The overstory contains approximately 80 TPA and is primarily composed of bigleaf maple and red alder. Overstory bigleaf maple average 16 inches DBH and 100 ft tall, and red alder average 16 inches DBH and 100 ft tall. A limited midstory contains approximately 20 TPA and is primarily composed of bigleaf maple and western hemlock. Midstory hemlock average 8 inches DBH and 60 ft tall, and maple average 8 inches DBH and 60 ft tall. Mortality of the old alder is occurring, creating canopy gaps where some hemlock and maple have established. Regeneration of western hemlock and maple is occurring in some areas, but a thick understory shrub layer poses some concerns about future regeneration at this site. This unit should be monitored over the next 10 years to ensure there is sufficient regeneration as mortality of the alder continues. If regeneration does not continue to occur, then planting should follow recommendations outlined for older mixed hardwood stands. The southern part of the unit is accessible from the neglected Cain Lake road, and a hiking trail along the ridgeline could provide access to future ground crews.

FMU E5 - Conifer Plantation - Large DBH

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	248	252	377	78	8	13	18	100
	Minor	BM	16	14	16		4	10	16	100
		RA	16	14	16		4	10	16	100
	All	All	280	280	409		4	13	18	100
Total	All	All	280	280	409	78	4	13	18	100

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located at the southern end of the property. It contains moderate north-facing slopes and steep east-facing slopes. The west side of the unit has a soil productivity rating of site class III, and the east side has a rating of site class II. This unit was clearcut around 40 years ago and replanted with Douglas-fir. Total stocking is approximately 320 TPA. The overstory is primarily composed of Douglas-fir, with a small component of bigleaf maple and red alder. Overstory Douglas-fir average 12 inches DBH and 100 ft tall. No midstory is currently present. Per the earlier discussion on overstocked, large-diameter plantations, a series of variable density commercial thinnings is recommended, and potential underplanting once density has been sufficiently reduced. Access is possible to this stand by bringing one mile of the currently neglected Cain Lake road back into service. Given road access, harvest operations would be a combination of ground and cable-yarding but should be relatively simple to lay out and execute as there are limited riparian features or known geologic hazards to navigate.

FMU E6 - Mixed Conifer and Hardwood

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	BM	26	53	63	60	12	17	34	128
		DF	55	148	217		12	23	Over 48	152
	All	All	100	259	355		12	22	Over 48	143
Midstory	Major	BM	24	14	22	9	4	9	16	62
		RC	24	14	22		4	10	16	62
	All	All	64	39	62		4	10	16	66
Total	All	All	164	298	418	69	4	17	Over 48	113

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density,

DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located at the southern end of the property. It contains a series of southwest-facing terraces that alternate with plateaus and short steep slopes. The unit has a soil productivity rating of site class III. Based on historic inventory data, it is estimated that most of the unit regenerated naturally following clearcut harvesting around 1930. There are some large legacy Douglas-fir in the stand that are older. Total stocking is approximately 164 TPA. The overstory contains approximately 100 TPA and is primarily composed of Douglas-fir and bigleaf maple. Overstory Douglas-fir average 23 inches DBH and 152 ft tall, and bigleaf maple average 17 inches DBH and 128 ft tall. The midstory contains approximately 64 TPA and is primarily composed of bigleaf maple and western redcedar. Midstory redcedar average 10 inches DBH and 62 ft tall, and maple average 9 inches DBH and 62 ft tall. This is a mixed conifer and hardwood forest with no health concerns. Per the earlier discussion of this type of forest, no management activities are recommended for this unit. There is access to the northwest part of the unit from a privately-owned road in the Barnes Creek drainage, but the exact access arrangement is currently unclear.

FMU E7 - Conifer Plantation - Large DBH

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	272	123	257	62	6	10	14	60
		RA	143	52	68		2	6	10	60
	All	All	415	175	325		2	8	14	60
Total	All	All	415	175	325	62	2	8	14	60

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located at the southern end of the property and includes moderate to steep slopes, most of which face southwest. The unit has a soil productivity rating of site class III. It was clearcut around 2000 and replanted with Douglas-fir. Red alder has also naturally regenerated across the stand. Total stocking is approximately 415 TPA. Overstory Douglas-fir average 10 inches DBH and 60 ft tall, and red alder average 6 inches DBH and 60 ft tall. No midstory is currently present in this stand. This stand was not previously thinned and is currently overstocked and in the Stem Exclusion stage of development.

Per the earlier discussion of this type of forest, a sequence of commercial thinnings is recommended, and potential underplanting once density has been sufficiently reduced. Thinning should begin in 5-10 years, once the trees have grown in diameter, and two entries will be required to safely reduce density to the initial target. This stand was previously logged using a privately-owned road in the Barnes Creek drainage, but the exact access arrangement is currently unclear. Securing a road-use agreement on this road will be necessary for future management operations. Harvest operations should be relatively simple, employing primarily ground-based logging systems, though some cable-yarding may be necessary to navigate two prominent cliff-bands.

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	58	157	193	47	14	21	44	191
	Minor	RC	11	25	31		12	20	36	180
		WH	17	41	56		12	21	36	203
	All	All	88	228	285		10	21	44	191
Midstory	Major	RC	32	26	33	10	4	10	14	88
		WH	22	17	19		4	9	16	88
	Minor	DF	13	12	14		4	10	14	96
	All	All	71	58	69		4	10	16	89
Total	All	All	159	286	354	57	4	16	44	146

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This is a large FMU on the northern end of the property. The center of the unit contains a ridgeline that runs north-south with moderate slopes on either side. The southern part of the unit contains several stream drainages with moderate to steep northeast-facing slopes. The northwest corner of the unit contains a series of north-facing drainages. The majority of the unit has a soil productivity rating of site class III. A portion of the west side has a site class IV rating, and a portion on the east side has a site class II rating. Based on historic inventory data, it is estimated that the unit regenerated naturally following a series of clearcut harvests from 1906-1933. Total stocking is approximately 159 TPA. The overstory contains approximately 88 TPA and is primarily composed of Douglas-fir, with small components of western redcedar and western hemlock. Overstory Douglas-fir average 21 inches DBH and 191 ft tall. The midstory contains approximately 71 TPA and is primarily composed of western hemlock and western redcedar, with a small component of Douglas-fir. Midstory western redcedar average 10 inches DBH and 88 ft tall, and hemlock average 9 inches DBH and 88 ft tall. This unit is in the Mature-II stage of development. Per the earlier discussion of forests in this stage, no management is recommended. Part of the unit is accessible from the north on a spur off the LM-4000 road as well as through numerous hiking and biking trails connecting to adjacent properties.

FMU F2 - Mixed Hardwood - Young

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	RA	738	54	170	39	2	4	6	40
	Minor	BM	41	3	18		4	6	8	40
		DF	41	3	18		4	6	8	40
	All	All	820	60	206		2	4	8	40
Total	All	All	820	60	206	39	2	4	8	40

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on moderate north-facing slopes on the northern end of the property. It consists of several narrow fingers between retained riparian zones The unit has a soil productivity rating of site class III. The unit was last clearcut in 2009 and likely replanted in Douglas fir. No management of the plantation has occurred in subsequent years, and the unit has become dominated by naturally regenerated red alder. Total stocking is approximately 820 TPA. The overstory is primarily composed of red alder, with a small component of bigleaf maple and Douglas-fir. Overstory red alder average 4 inches DBH and 40 ft tall. No midstory is currently present, but western redcedar is regenerating at a density of greater than 50 TPA.

This young stand is stocked at unsustainable densities, and future red alder growth will likely overtop and outcompete other species. Given the current redcedar regeneration, it is likely that by reducing density conifers can be recruited into this stand. Therefore, it is recommended to pre-commercially thin this stand, removing alder and releasing maple and Douglas-fir, after which the stand should be monitored for successful conifer establishment. This unit is accessible from the north via a spur off the LM-4000 road.

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	BM	25	46	74	53	8	20	36	126
		DF	27	49	126		8	26	42	127
		WH	29	52	97		8	21	36	126
	Minor	RC	18	36	55		10	20	36	130
	All	All	104	193	361		4	21	42	127
Midstory	Major	BM	21	15	9	4	2	6	12	57
		WH	25	19	16		2	7	16	50
	Minor	RC	11	6	6		2	7	16	55
	All	All	57	40	31		2	7	16	54
Total	All	All	161	233	392	57	2	16	42	101

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the northeast side of the property near the Lookout Mountain Forest Preserve Trailhead. It contains second-growth forest that naturally regenerated following an initial clearcut in the early 1900s, but has not been harvested again due to being in riparian zones and steep areas. It has moderate to steep northwest facing slopes and a soil productivity rating of site class II. Total stocking is approximately 161 TPA. The overstory contains approximately 104 TPA and is primarily composed of western hemlock, bigleaf maple and Douglas-fir, with a small component of western redcedar. Overstory Douglas-fir average 26 inches DBH and 127 ft tall, hemlock average 21 inches DBH and 126 ft tall, and maple average 20 inches DBH and 126 ft tall. The midstory contains approximately 57 TPA and is primarily composed of western hemlock and bigleaf maple, with a small component of western redcedar. Midstory hemlock average 7 inches DBH and 50 ft tall, and maple average 6 inches DBH and 57 ft tall. This mixed conifer forest has no health concerns and is primarily in riparian zones and very steep terrain. For these reasons, no management is recommended. The lower section of this stand is accessible from the LM-2000 road, but most of it is not currently accessible by road as the old roads have been turned into trails.

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	RA	158	87	119	46	4	8	24	63
		WH	92	72	73		4	8	36	27
	Minor	CW	21	23	22		4	10	24	46
		RC	21	40	70		8	21	42	84
	All	All	304	234	307		4	9	42	53
Midstory	Major	BM	20	6	5	2	2	4	8	28
		WH	32	8	9		2	4	12	34
	All	All	67	16	18		2	4	12	31
Total	All	All	371	250	325	49	2	8	42	49

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the northeast side of the property near the Lookout Mountain Forest Preserve Trailhead. It has mostly moderate northeast-facing slopes and a soil productivity rating of site class II. It is estimated that the unit was high-grade harvested around 1980-1990 which removed most of the high-value Douglas-fir, leaving behind second-growth maple, redcedar, and hemlock. After this harvest, early-seral hardwoods, such as red alder and cottonwood, as well as young hemlock have filled in open canopy gaps throughout the unit. Total stocking is approximately 371 TPA. The overstory contains approximately 304 TPA and is primarily composed of western hemlock and red alder, with small components of black cottonwood and western redcedar. Overstory western hemlock average 8 inches DBH and 27 ft tall, and alder average 8 inches DBH and 63 ft tall. The midstory contains approximately 67 TPA and is primarily composed of western hemlock and bigleaf maple. Midstory hemlock average 4 inches DBH and 34 ft tall, and maple average 4 inches DBH and 28 ft tall. Regeneration is occurring in lower density pockets. As this stand continues to grow, competition will increase and mortality will begin to occur in higher-density pockets of younger red alder and western hemlock, but the retained second-growth cohort will not be affected by this competition, and long-term density will drop as red alder and cottonwood die off from old age. As a result, though management could accelerate these transitions, it is not recommended at this time. This unit is accessible from the LM-2000 road and an old road-grade converted into the Rufus Creek Trail.

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	BM	49	30	43	39	4	9	20	85
		RA	80	63	81		4	10	16	97
		RC	43	49	90		4	16	24	107
	Minor	CW	10	6	12		4	11	20	88
		WH	21	23	21		4	10	16	103
	All	All	211	176	254		4	11	24	96
Midstory	Major	RC	24	4	7	2	2	4	10	24
		WH	24	4	7		2	4	10	24
	All	All	49	8	14		2	4	10	24
Total	All	All	260	184	267	41	2	10	24	82

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the northeast side of the property near the Lookout Mountain Forest Preserve Trailhead. It has moderate to steep northeast-facing slopes and a soil productivity rating of site class II. It is estimated that this unit was mostly clearcut harvested around 1990, though second growth cedar and hemlock were retained in some areas. It is unknown if this unit was replanted after harvest. If it was, there was likely high mortality of the planted conifers as the stand is now a mix of species, primarily hardwoods, that most likely naturally regenerated. Total stocking is approximately 260 TPA. The overstory contains approximately 211 TPA and is primarily composed of bigleaf maple, western redcedar and red alder, with small components of black cottonwood and western hemlock. Overstory redcedar average 16 inches DBH and 107 ft tall, maple average 9 inches DBH and 85 ft tall, and alder average 10 inches DBH and 97 ft tall. The midstory contains approximately 49 TPA and is primarily composed of western hemlock and western redcedar that both average 4 inches DBH and 24 ft tall. Though heavy to hardwood, this unit's conifer overstory and midstory should ensure long-term forest cover. Per the earlier discussion of this type of forest, no management activities are recommended for this unit. This unit is partially accessible from the LM-2000 Road, but was historically accessed via the now decommissioned LM-2200 road which has been turned into a hiking trail.

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	90	40	90	60	6	10	16	80
		RA	166	109	166		4	10	14	65
		WH	90	40	90		6	10	16	80
	All	All	353	194	353		2	10	18	72
Midstory	Major	RC	10	4	2	1	2	4	8	40
		WH	20	4	4		2	4	8	40
	All	All	30	8	7		2	4	8	40
Total	All	All	383	202	360	60	2	10	18	70

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU consists of four separate areas located on the northeast side of the property near the Lookout Mountain Forest Preserve Trailhead. It has moderate to steep mostly northeast-facing slopes and a soil productivity rating of site class II. It is estimated that it was mostly clearcut harvested around 1990. A Douglas-fir plantation was potentially started at that time, but has mostly failed except for in the northwestern corner of this unit. Otherwise, red alder and western hemlock have naturally regenerated across the remainder of the unit. Total stocking is approximately 383 TPA. The overstory contains approximately 353 TPA and is primarily composed of western hemlock, Douglas-fir and red alder. Overstory Douglas-fir and hemlock average 10 inches DBH and 80 ft tall, and alder average 10 inches DBH and 65 ft tall. The midstory contains approximately 30 TPA and is primarily composed of western hemlock and western redcedar that both average 4 inches DBH and 40 ft tall. Given the recent disturbance history and high-levels of competition, this plan recommends pre-commercial thinning of high-density conifer and red alder pockets to reduce competition, shift species composition and accelerate the stands development. There is no current road access to this unit, as the previous road up this hillside has been converted to a hiking trail.

FMU G5 - Mixed Conifer - Stem Exclusion / Mature-I

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	DF	60	65	129	47	8	16	32	103
		WH	66	73	126		8	15	32	105
	Minor	BM	24	35	40		4	13	24	120
	All	All	158	182	324		4	15	32	107
Midstory	Major	BM	9	2	4	2	4	6	8	60
		WH	24	12	12		4	6	12	60
	All	All	38	15	19		4	6	12	60
Total	All	All	196	197	343	49	4	14	32	98

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

This FMU is located on the northeast side of the property near the Lookout Mountain Forest Preserve Trailhead. It has mostly moderate northeast-facing slopes and a soil productivity rating of site class II. It is estimated that this unit was mostly clearcut harvested around 1970-1980. Douglas-fir were likely planted after the harvest, but infilling by western hemlock has come to dominate most of the unit. Total stocking is approximately 196 TPA. The overstory contains approximately 158 TPA and is primarily composed of western hemlock and Douglas-fir, with a small component of bigleaf maple. Overstory Douglas-fir average 16 inches DBH and 103 ft tall. Overstory western hemlock average 15 inches DBH and 105 ft tall. The midstory contains approximately 38 TPA and is primarily composed of western hemlock and bigleaf maple. Midstory western hemlock average 6 inches DBH and 60 ft tall. Midstory bigleaf maple average 6 inches DBH and 60 ft tall. The highest density portions of this unit are dominated by western hemlock in the Stem Exclusion stage while natural regeneration is occurring in lower-density areas entering the early Mature-I stage of development. Per the earlier discussion of mixed conifer forests in these stages and given that current overstory density is within the first thinning target, a variable density thinning is recommended in 5 to 10 years. There is no current road access to this unit, as the previous road up this hillside has been converted to a hiking trail. Restoring this road will be necessary for commercial thinning otherwise this unit will need to be non-commercially thinned.

Management Activity Schedule

Timeline	Activity	Priority	FMU	Prescription
2025 to 2030	Thinning (PCT)	1	A5, B8	Pre-commercially thin to a target density of 250 to 300 TPA.
		2	F2	Pre-commercially thin to a target density of 150 to 200 TPA, removing alder and retaining maple and Douglas-fir.
			G4	Pre-commercially thin to a target density of 200 to 250 TPA, preferentially removing alder and hemlock while retaining Douglas-fir.
	Thinning (CT / NCT)	1	A6	Thin to an interim target density of 250 to 300 TPA.
			A2, E5	Thin to an initial target density of 140 to 170 TPA.
		2	B3, B5, B7, B2, B4, D7	Thin to an initial target density of 140 to 170 TPA.
		3	A8, B6	Thin to an initial target density of 140 to 170 TPA.
		4	D9	Thin to a final target density of 80 to 110 TPA.
2030 to 2035	Thinning (CT / NCT)	1	E7	Thin to an interim target density of 250 to 300 TPA.
		3	G5	Thin to a final target density of 80 to 110 TPA.
	Planting	1	E4	Monitor the stand for natural regeneration, and, if necessary, underplant with 150-250 TPA of shade-tolerant conifers suitable to site conditions.

Timeline	Activity	Priority	FMU	Prescription
		2	F2	Monitor the stand for natural regeneration, and, if necessary, underplant with 150 TPA of shade-tolerant conifers suitable to site conditions.
2035 to 2040	Thinning (CT / NCT)	1	A5	Thin to an initial target density of 140 to 170 TPA within 10-15 years after the last thinning entry.
		2	A6	Thin to an initial target density of 140 to 170 TPA within 10-15 years after the last thinning entry.
			A2, E5	Thin to a final target density of 80 to 110 TPA within 10-15 years after the last thinning entry.
		3	B3, B2	Evaluate the stand for a second thinning and, if necessary, thin to a final target density 80 to 110 TPA within 10-15 years after the last thinning entry.
	Planting	3	A2, E5	Underplant after thinning with 150 TPA shade-tolerant conifers suitable to site conditions or wait 5-10 years and assess natural regeneration, planting if necessary.
2040 to 2045	Thinning (CT / NCT)	1	E7	Thin to an initial target density of 140 to 170 TPA within 10-15 years after the last thinning entry.
		2	B8	Thin to an initial target density of 140 to 170 TPA within 15-20 years after the last thinning entry.
		3	B5, B7, B4	Evaluate the stand for a second thinning and, if necessary, thin to a final target density 80 to 110 TPA within 15-20 years after the last thinning entry.
		4	B6	Evaluate the stand for a second thinning and, if necessary, thin to a final target density 80 to 110 TPA within 15-20 years after the last thinning entry.
2045 to 2050	Thinning (CT / NCT)	2	A5	Thin to a final target density of 80 to 110 TPA within 10-15 years after the last thinning entry.

Timeline	Activity	Priority	FMU	Prescription
	Planting	3	A5	Underplant after thinning with 150 TPA shade-tolerant conifers suitable to site conditions or wait 5-10 years and assess natural regeneration, planting if necessary.
2050 to 2055	Thinning (CT / NCT)	2	E7	Thin to a final target density of 80 to 110 TPA within 10-15 years after the last thinning entry.
		3	A6	Evaluate the stand for a second thinning and, if necessary, thin to a final target density 80 to 110 TPA within 15-20 years after the last thinning entry.
	Planting	3	E7	Underplant after thinning with 150 TPA shade-tolerant conifers suitable to site conditions or wait 5-10 years and assess natural regeneration, planting if necessary.
			A6	Monitor the stand for natural regeneration, and, if necessary, underplant with 150 TPA of shade-tolerant conifers suitable to site conditions.
2055 to 2060	Thinning (CT / NCT)	3	B8	Evaluate the stand for a second thinning and, if necessary, thin to a final target density 80 to 110 TPA within 15-20 years after the last thinning entry.
Notes: PCT - Pre-commercial Thinning, CT - Commercial Thinning, NCT - Non-commercial Thinning. Priority Levels: 1 - High, 2 - Moderately High, 3 - Moderate, 4 - Low. Additional thinning and planting considerations are identified in Section 1 of this document as well as in the FMU-specific section above.				

Parcel Table

Owner	Parcel ID	Year Acquired	Previous Owner
County	3703010600550000	2014	DNR
County	3703114613960000	2014	DNR
County	3703121983300000	2014	DNR
County	3703123344670000	2002	Private

Owner	Parcel ID	Year Acquired	Previous Owner
City	3703123344670001	2002	Private
County	3703133294690000	2014	DNR
County	3703134662020000	2014	DNR
County	3703134663080000	2014	DNR
County	3703244633290000	2014	DNR
County	3704070681860000	2014	DNR
County	3704070804500000	2002	Private
City	3704070804500001	2002	Private
County	3704071851880000	2014	DNR
County	3704170650560000	Unknown	Unknown
County	3704180721810000	2014	DNR
County	3704183300630000	2014	DNR
County	3704184650600000	2014	DNR
County	3704191950520000	2014	DNR
County	3704193340530000	2014	DNR
County	3704194670570000	2014	DNR
County	3704202071830000	2014	DNR
County	3704203663670000	2014	DNR
County	3704290823780000	2014	DNR
County	3704304570580000	2014	DNR
County	3704313360620000	2014	DNR
County	3704314760680000	2014	DNR

South Lake Whatcom Park

Overview

Site Description

South Lake Whatcom Park is a 75-acre property owned by Whatcom County. It is located along South Bay Drive and the southeast shore of Lake Whatcom.

Property Information

This forest is located in Section 27, Township 37N, Range 04E of the US Public Land Survey System and includes two parcels that are listed in the table at the end of this section.

Management History

South Lake Whatcom Park consists of two parcels owned by Whatcom County. The exact history of the site is unknown, but the widespread presence of red alder suggests that a major disturbance occurred on the property 60-80 years ago. While obvious cut stumps are absent on much of the property, some are visible which suggests that the property was likely clearcut in the mid-1900s, like many of the forests around Lake Whatcom.

Property Overview Map

Assessment

Topoclimate

The site is mostly flat with gentle slopes draining north toward Lake Whatcom. Its position along the lake's south shore brings moderating effects from lake breezes, resulting in slightly higher humidity and smaller temperature fluctuations compared to surrounding higher elevations.

Vegetation Zone

According to vegetation zone maps for North America, the following Ecological Systems were likely present prior to Euro-American settlement. More information on these maps and full descriptions of each system can be found in the discussion of Vegetation Zones in Section 2 of this document.

- North Pacific Lowland Riparian Forest and Shrubland
- North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest

Soils

Data from the USDA Natural Resource Conservation Service (NRCS) Soil Surveys were used to identify the major soil types that underlay this forest, which are described in more detail in the discussion of Soil Productivity in Section 2. Information about specific soil units likely present at this property, including depth, drainage, productivity, and relevant management concerns are listed in the table below. The location of these soil units can be found in the accompanied map packet for this property.

Forest Soil Units Summary Table

Soil Unit	Productivity		Management Concerns					Acres (Pct)
	Site Class	Max Growth	Drought Stress Hazard	Wind Throw Hazard	Mass Wasting Hazard	Logging Rutting Hazard	Logging Compact Hazard	
Wickersham Series Channery Ashy Silt Loam on 0-8% Slopes Mod. Deep (21in) Well Drained	DF-2	186 ft3/ac/yr	Low.	Low	Low	High	Mod.	57 (76%)
Sehome Series Medial Loam on 8-15% Slopes Mod. Deep (26in) Moderately Well Drained	DF-2	186 ft3/ac/yr	Mod. High	Medium	High	High	Mod.	5 (7%)

Soil Unit	Productivity		Management Concerns					Acres (Pct)
	Site Class	Max Growth	Drought Stress Hazard	Wind Throw Hazard	Mass Wasting Hazard	Logging Rutting Hazard	Logging Compact Hazard	
Barneston Series Very Gravelly Ashy Loam on 0-8% Slopes Somewhat Excessively Drained	DF-3	157 ft3/ac/yr	High	Low	Low	Low	Mod.	4 (5%)
Sehome Series Medial Loam on 2-8% Slopes Mod. Deep (26in) Moderately Well Drained	DF-2	186 ft3/ac/yr	Mod. High	Medium	Mod.	High	Mod.	4 (5%)
Shalcar-Fishtrap Undifferentiated group Muck on 0-2% Slopes Very Poorly Drained	RA-4	86 ft3/ac/yr	Low.	High	Low	High	High	3 (4%)
Squalicum Series Gravelly Ashy Loam on 5-15% Slopes Deep (44in) Moderately Well Drained	DF-2	186 ft3/ac/yr	Mod.	Low	Mod.	Mod.	High	2 (3%)

Slope Stability

As previously described in Section 2, this plan utilizes remotely mapped topographic data as well as hazard zones and historic landslides identified by the State of Washington Department of Natural Resources (DNR) to gauge the likelihood that unstable slopes will be found within a proposed management area. The presence of a mapped hazard zone or historic landslide does not preclude management, but indicates that further investigation is required.

The site is mostly flat and does not contain any slopes greater than 40%. There are no known landslides or hazard zones identified in the park.

Hydrology

The park is directly adjacent to the south shore of the lake. There are a few streams that flow north through the park into Lake Whatcom. Two of them on the east side are identified as fish-bearing by the DNR's hydrography database. Most of the northeast corner of the park is a forested wetland.

Roads and Access

The park is accessible from South Bay Drive and there are several pull-offs along this road that can be used to access public trails in the park, particularly on the northeast side. There is also a dirt road that runs along the western border of the park. Otherwise, no roads are present within the property boundaries.

Health and Resiliency

An additional health concern is a moderate infestation of English holly in the conifer dominated stand in the northwest side of the park. Many small sprouts of the invasive species are popping up and could easily spread if not contained. There is also an open field in the southwest corner of the park that is heavily infested with Himalayan blackberry around the edges.

Most of the park consists of old red alder, some of which is dying off. The aging alder is susceptible to blowdown during wind events. Very little regeneration is present in the red alder stands, likely due to the thick shrub layer that is growing. There is some concern about the future forest cover of this site if regeneration does not occur as the red alder continues to die off.

Wildlife Habitat

A review of the Washington State Department of Fish and Wildlife Priority Species Database identified Townsend's big-eared bat and myotis bat as having been documented somewhere within the 23,000-acre township containing South Lake Whatcom Park. The wetland in the northeast corner of the preserve is identified as a priority area for aquatic habitat. There are also streams within the preserve that are identified as habitat for kokanee salmon and cutthroat trout.

In general, the park is lacking wildlife habitat features. There is low habitat diversity since the park is primarily red alder forest. Some areas have downed logs and snags due to the alder starting to die, but these habitat features are lacking in most of the park. As the red alder continues to die, additional dead wood will be added to the forest in the form of snags and downed wood. The snags may not stay standing long, however, as red alder often falls over quickly once dead. While habitat features are generally lacking, the shrub layer in the forest provides food sources for many wildlife species.

Wildfire Susceptibility

The park is close to a major public road and residential areas and also has high recreation use, which increases the risk of fire ignition. The proximity to a major road, however, allows for a rapid response to fire. The strong hardwood component across much of the forest makes it more resistant to fire, and while some younger stands are present, there is little buildup of fine woody debris. However, the thick shrub layer throughout parts of the forest can act as fuel sources if they become dead or drought-stressed.

Carbon Storage

Most of the park has low carbon storage potential due to being dominant to short-lived red alder, aside from the northwest corner of the park that is composed primarily of western red cedar. The site contains wet soil that is suitable for the redcedar, so it should hold the site for a long time which gives it higher carbon storage potential. Establishing more conifers in the red alder stands and reforesting the open field in the southwest corner of the park will increase the carbon storage potential of the site.

Cultural Resources

The Lake Whatcom watershed is a landscape rich with cultural significance for Indigenous peoples—particularly the Lummi Nation and the Nooksack and Swinomish Tribes—who have maintained deep spiritual, cultural, and subsistence connections to the landscape. Though a review of the Washington State Department of Archaeology and Historic Preservation Wisaard online database did not identify any known historical sites on this property and none were encountered while developing this plan, this property has a long history of human use and artifacts may be present. Please see the previous discussion about cultural use practices in the Lake Whatcom Watershed for a more detailed assessment of best management practices moving forward.

Recreation

The park provides public access to the south shore of Lake Whatcom and gets particularly heavy use in the summer by people accessing the lake for swimming and other water recreational activities. Access is dispersed across several short trails leading down from the road.

Recommendations

Roads and Access

There are no existing roads within the preserve, and no new road construction is recommended.

Health and Resiliency

Recommendations for addressing observed invasive species and declining alder are given at the management unit level below.

Wildfire Susceptibility

Shaded fuel breaks are recommended within 100 feet of public roads and existing structures which are designed to keep fires on the ground and slow their spread until firefighting resources can arrive. For additional details on implementation, see the description of a shaded fuel break given in the discussion of Wildfire Susceptibility in Section 2 of this document.

Forest Types

All recommendations for this property follow the previous discussion of forest-types in section 3 and are discussed by management unit below.

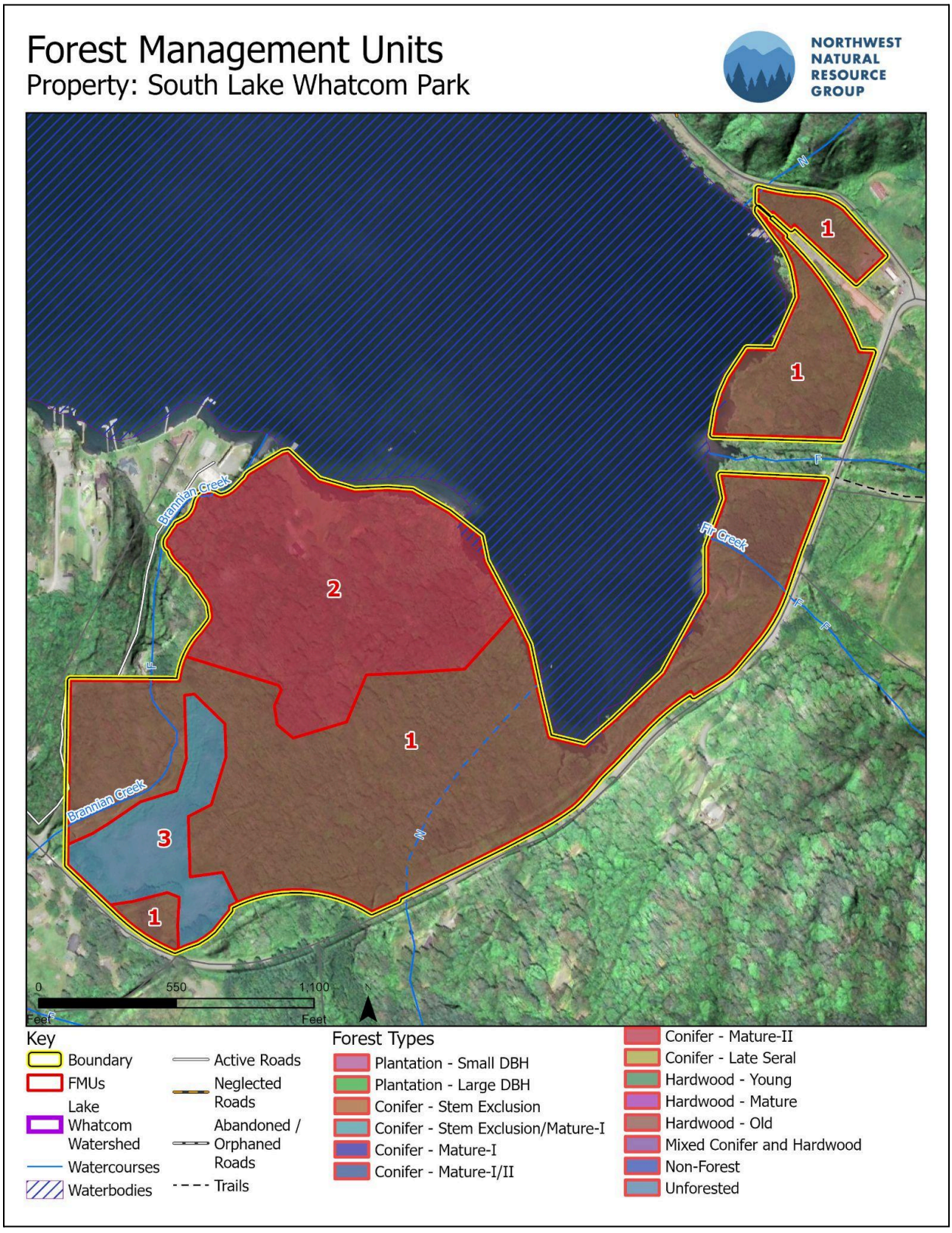
Management Units

Forest cover was delineated into the forest management units (FMUs) using both remotely sensed data, historic inventory units, and field inventory data. The forestland within these management units share similar forest characteristics and management recommendations. For each FMU, this plan describes the geophysical attributes and forest conditions and assesses the unit against the plans management objectives using the previously described framework by forest type. Recommendations are then given by FMU, typically referencing general recommendations by forest type, but more information is given as needed. Finally, a schedule of management activities by year and FMU is given at the end of this section.

Summary of Forest Management Units

FMU	Acres	Forest Type	Management
1	48	Mixed Hardwood - Old	Planting
2	22	Mixed Conifer - Mature-II	Invasive Species Management
3	6	Unforested	Invasive Species Management and Planting
Total	**75**		

Map of Forest Management Units



FMU 1 - Mixed Hardwood - Old

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	RA	88	117	269	53	12	20	24	117
	All	All	90	120	276		12	20	32	117
Total	All	All	90	120	276	53	12	20	32	117

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

FMU 1 represents the majority of the park, aside from a couple areas on the west side. It has a soil productivity rating of site class II. It was likely clearcut 60–80 years ago and has since naturally regenerated with red alder. In some areas, particularly on the northeast side, alder is beginning to die off with few conifers growing to replace it, resulting in low stocking. The middle of the stand is also composed of older alder that has not yet experienced major mortality, but with a dense salmonberry shrub layer and little regeneration, it is expected to follow a similar trajectory of becoming a low stocked forest. Total stocking across the stand is approximately 90 TPA. The overstory red alder average 20 inches DBH and 117 ft tall. Per the earlier discussion of old hardwood stands without regeneration, underplanting of conifers is recommended to ensure long-term forest development of the site.

FMU 2 - Mixed Conifer - Mature-II

Stand Composition Summary

Canopy Position	Cohort Type	Species	TPA	BAA	SDI	RD	Min DBH	Avg DBH	Max DBH	Avg HT
Overstory	Major	RC	160	360	567	79	14	22	38	140
Midstory	Major	WH	20	20	20	2	8	10	12	60
Total	All	All	180	380	587	81	8	21	38	131

Note: TPA - Trees Per Acre, BAA - Basal Area (sq ft) Per Acre, SDI - Reineke Stand Density Index (i.e. equivalent 10in trees), RD - Relative Density, DBH - Diameter at Breast Height (in), HT - Height (ft). See appendix for species codes.

FMU 2 is on the northwest side of the property and has a soil productivity rating of site class II. It was likely harvested 80-120 years ago, but has naturally regenerated with different species than FMU 1. Total stocking is approximately 180 TPA. The overstory contains approximately 160 TPA and is primarily composed of western red cedar that average 22 inches DBH and 140 ft tall. The midstory contains approximately 20 TPA of western hemlock that average 10 inches DBH and 60 ft tall. The wet site conditions can likely continue to support the redcedar and western hemlock growing here. The stand is entering the mature II phase of development with a midstory cohort and regeneration of redcedar and hemlock. Large clumps of English holly sprouts are growing in the understory of this unit, which will likely continue to spread if not managed due to the ability for the invasive species to thrive under closed

canopies. It is recommended to remove the holly in this unit while the plants are still small and before the infestation becomes more severe.

FMU 3 - Unforested

FMU 3 is an unforested field in the southwest corner of the property with a soil productivity rating of site class II. The exact history of this field is unknown, but it's possible that grass and shrubs colonized the site following a disturbance and prevented the regeneration of trees. Himalayan blackberry is abundant around the edges of the field and could easily spread into the field due to the lack of tree cover. It is recommended to remove the invasive blackberry and plant trees across the site to convert the field into a forest.

Management Activity Schedule

Timeline	Activity	Priority	FMU	Prescription
2025 to 2030	Invasive Species	1	3	Remove invasive species.
		3	2	Remove invasive species.
	Planting	1	1	Underplant with 150-250 TPA of shade-tolerant conifers suitable to site conditions.
			3	After invasive species removal, plant a mix of species at 250-300 TPA.
Notes: Priority Levels: 1 - High, 2 - Moderately High, 3 - Moderate, 4 - Low. Additional thinning and planting considerations are identified in Section 1 of this document as well as in the FMU-specific section above.				

Parcel Table

Owner	Parcel ID	Year Acquired	Previous Owner
County	3704230400200000	Unknown	Unknown
County	3704273703800000	Unknown	Unknown