



# North Tualatin Mountains Nature Park

## Comprehensive Plan Amendment Request

Submitted by:

**METRO**

September 2017 submission







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## Exhibits

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| Exhibit 1  | Multnomah County Tax Assessor's Maps: Sections |
| Exhibit 2  | Metro North Tualatin Mountain Master Plan      |
| Exhibit 3  | Site Conservation Plan                         |
| Exhibit 4  | Geotechnical Report                            |
| Exhibit 5  | Traffic Impact Report                          |
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| Exhibit 8  | Zoning Map                                     |
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**Section I: Application Summary**

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**Proposal:** Metro seeks to amend Multnomah County's Comprehensive Plan to include the text of the Metro's Master Plan for the North Tualatin Mountains Natural Area.

**Site Location:** North Tualatin Mountains, located northwest of Forest Park and southeast of NW Cornelius Pass Road; comprised of the Burlington Creek Forest, Ennis Creek Forest, McCarthy Creek Forest, and North Abbey Creek Forest

**Subject Parcels:** *Burlington Creek Forest*  
2N1W20BC-01400, 2N1W20BC-01200, 2N1W19-00500, 2N1W19AA-00500, 2N1W20BD-01300, 2N1W20B-00700, 2N1W19-00200, 2N1W20BD-03600, 2N1W20B-00500, 2N1W20BD-00800, 2N1W20BD-01700, 2N1W20BB-03900, 2N1W20BB-01400, 2N1W20BD-00900, 2N1W19AA-00200, 2N1W20BD-02400, 2N1W20C-00500, 2N1W20BD-03700, 2N1W20BC-01000, 2N1W20C-00400, 2N1W20C-00100, 2N1W20C-00200, 2N1W20B-00600, 2N1W19AA-00100, 2N1W20BB-04000, 2N1W19AA-00800, 2N1W20BD-02700, 2N1W20B-00200, 2N1W20C-00600, 2N1W19-00300, 2N1W20BC-01600, 2N1W19AA-00400, 2N1W20-00400, 2N1W20C-00700, 2N1W19AA-00600, 2N1W20B-00100, 2N1W20BD-02100, 2N1W19AA-00300, 2N1W20B-00400, 2N1W20BD-02500, 2N1W20BD-03200, 2N1W19AA-00700, 2N1W20BC-00800, 2N1W20BB-01500, 2N1W20C-00300, 2N1W20B-00300, 2N1W20BC-00900, 2N1W19D-00800, 2N1W20BC-01700, 2N1W20BC-01800, 2N1W20BC-00600, 2N1W20-00300, 2N1W20BC-01300

*Ennis Creek Forest*  
2N1W28C-00500, 2N1W28CA-01701, 2N1W32A-00600, 2N1W32A-00500, 2N1W33B-00700, 2N1W28CA-01500, 2N1W28C-01000, 2N1W28CD-01000, 2N1W28C-00600, 2N1W28DC-01900, 2N1W32A-00400, 2N1W33B-00600, 2N1W33B-00500, 2N1W28C-00500, 2N1W33B-00100, 2N1W28DC-01800, 2N1W33A-00500, 2N1W28CD-00400, 2N1W28DC-02000, 2N1W33B-00200, 2N1W32A-00100, 2N1W33C-00300

*McCarthy Creek Forest*  
2N1W32B-00600, 2N1W32B-00900, 2N1W32C-00100, 2N1W32C-00200, 2N1W310-01200, 2N1W31D-00100, 2N1W31D-00200, 2N1W31D-00300

*North Abbey Creek*  
1N1W05C -00100, 1N1W05C-00400, 1N1W05C-00500, 1N1W08B -00100, 1N1W05C -00300, 1N1W05C -00500, 1N1W05B-00900, 1NIW05C-00200, 1NIW06D-00400

**Permit Approval:** Comprehensive Plan Amendment (text)

**Application Type:** Type IV

**Comprehensive Plan**

**Map Designation:** West Hills Rural – Resource Land



**Zoning:** CFU 1; CFU 2; EFU

**Property Owner  
and Applicant:** Metro  
600 NE Grand Avenue  
Portland, Oregon 97232

**Applicant's  
Representatives:** Gary Shepherd (primary contact)  
[gary.shepherd@oregonmetro.gov](mailto:gary.shepherd@oregonmetro.gov)  
Office of Metro Attorney  
600 NE Grand Avenue  
Portland, OR 97232

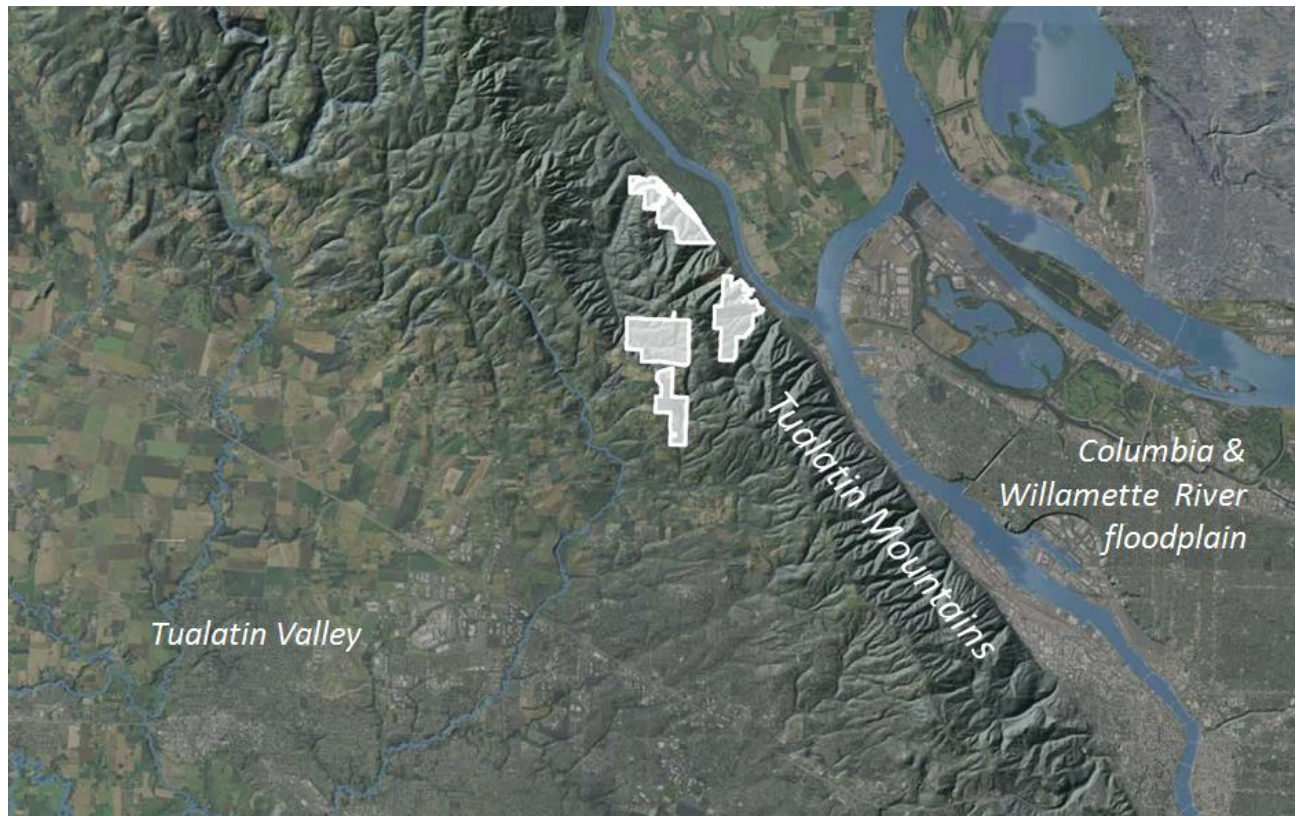
Karen Vitkay  
Metro Parks and Nature  
Parks Planner

|                      |  |  |
|----------------------|--|--|
| <b>Project Team:</b> | <i>Planning and Legal</i><br>Metro                                 | <i>Site Conservation/Mitigation Planning</i><br>Metro                  |
|                      | <i>Civil Engineering/Surveying</i><br>AKS Engineering and Forestry | <i>Biological/Habitat</i><br>Siskiyou BioSurvey<br>Metro               |
|                      | <i>Geotechnical Engineering</i><br>Carlson Geotechnical            | <i>Traffic Engineering</i><br>KPFF<br>Nemariam Engineers & Assoc., LLC |
|                      | <i>Trail Specialist</i><br>Sentieros Consulting                    |  |



The Tualatin Mountains extend into the greater Portland area along the Columbia River, dividing the lowlands of the Willamette and Columbia rivers from the Tualatin Valley. Burlington Creek Forest, McCarthy Creek Forest, Ennis Creek Forest, and North Abbey Creek Forest are four discontinuous sites owned by Metro, totaling 1,300 acres, which form the North Tualatin Mountains. They are located northwest of Forest Park and southeast of NW Cornelius Pass Road. Collectively, the sites that make up the North Tualatin Mountains preserve large blocks of upland forest, streams and habitat connectivity between Forest Park, Washington County and the Coast Range.

**Figure 1 Site Vicinity Map**



Three of the four North Tualatin Mountain sites are located within the Skyline Ridge neighborhood. The fourth site, North Abbey Creek Forest, is in the Forest Park neighborhood. The sites are surrounded by a mixture of land uses, including residential, agricultural, commercial forestry, and mining.

Surrounding land uses of note include the following:

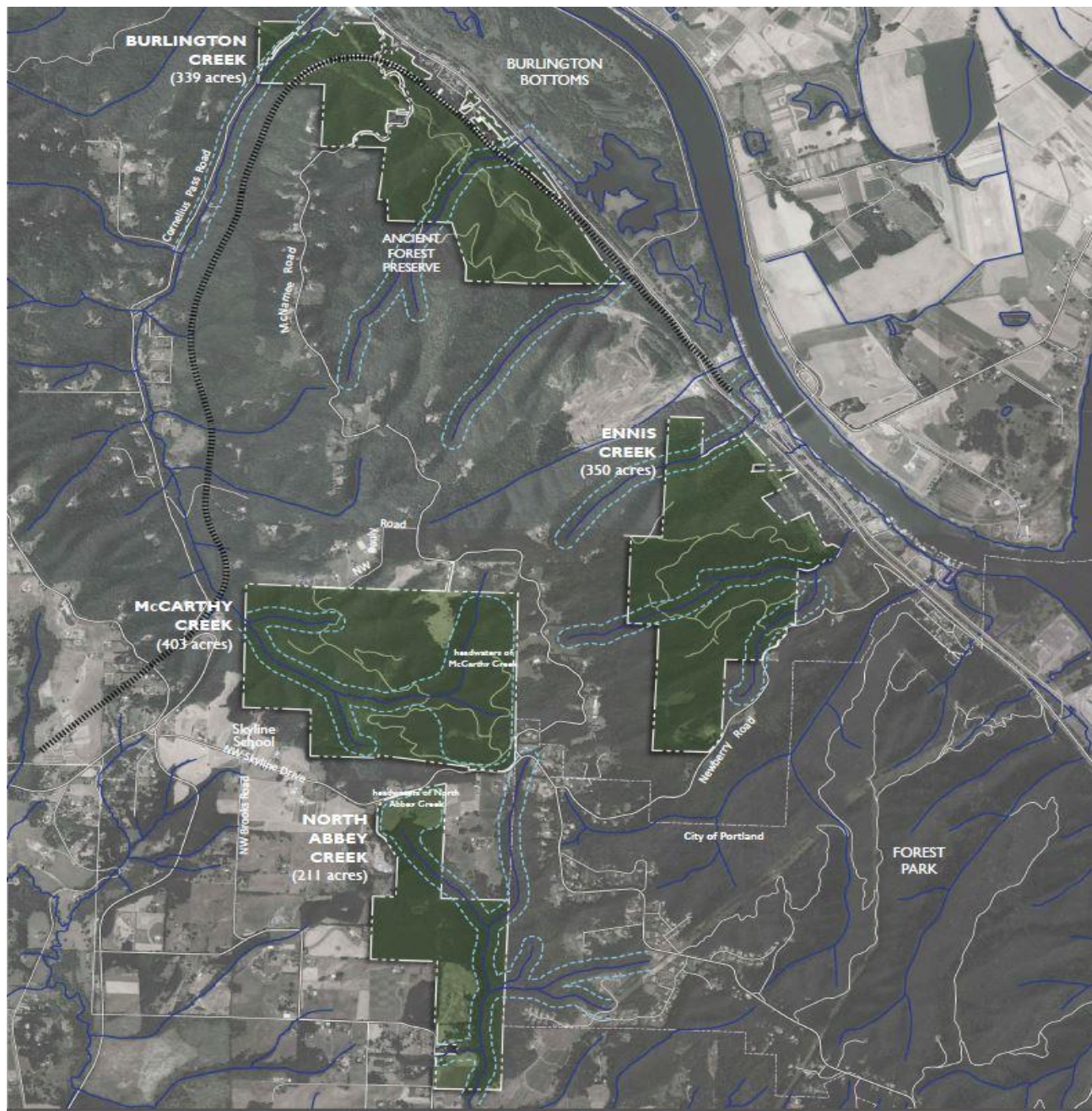
- **Quarry:** An operational quarry, located along U.S. Highway 30 between Burlington Creek Forest and Ennis Creek Forest. There is a trail easement held by the Forest Park Conservancy on the property to establish a trail connection between Ennis Creek and Burlington Creek forests.



- *Rural Residential:* Residential areas composed primarily of rural residential parcels, on small (up to five acres), medium (five to 20 acres), and large lots (more than 20 acres). Many of the large residential parcels adjacent to Burlington Creek Forest have conservation easements.
- *Ancient Forest Preserve:* The Ancient Forest, owned and managed by the Forest Park Conservancy, protects nearly forty (40) acres of old growth forest adjacent to the Burlington Creek Forest site. The conservancy welcomes visitors to the Ancient Forest and has recently extended the trail system.
- *Burlington Bottoms:* The roughly 400-acre Burlington Bottoms wetlands, owned by Bonneville Power Administration (BPA) and managed by Oregon Department of Fish and Wildlife (ODFW), lie northeast of Burlington Creek Forest.
- *Forest Park:* The City of Portland's Forest Park lies south, across Newberry Road from Ennis Creek Forest.
- *Skyline Elementary School:* Skyline School is located on Skyline Road, southwest of McCarthy Creek Forest.



**Figure 2 Site Map** (after this map was produced, Metro acquired additional property in Burlington Creek Forest that is not depicted on the map – holdings now exceed 350 acres)



### Section III: Procedural/Application Introduction

The subject property is resource land, generally zoned and managed for forestry use, and therefore governed by Goal 4. In a separate but related application, Metro is requesting land use approval to construct visitor access improvements and trails in Burlington Creek Forest. Most of what Metro is



proposing (restoration and land management activities, access roads, and recreational trails) is outright permitted under Goal 4.<sup>1</sup>

However, County staff is of the opinion that because applicant is also proposing a parking lot and related amenities, the proposed use rises above the uses permitted outright by Goal 4, and now becomes a public “local park” use regulated by OAR 660-034-0035 and 0040. A “local park” is defined by state law, in part, as a public area intended for outdoor recreational use that is owned and managed by a regional government and that is designated as a public park in the applicable comprehensive plan.

From the definition of “local park,” out of caution and a desire to avoid a potential procedural error, County staff recommends that any use regulated and approved under OAR 660-035-0035/0040 must first be contemplated in the County’s Comprehensive Plan. As such, the County directs that in order to permit development of the proposed parking lot, trailhead, restroom, etc. at Burlington Creek Forest, that Metro must first request that its North Tualatin Mountain Master Plan be included in the County’s Comprehensive Plan. Metro’s Master Plan contemplates land management activities and uses that are permitted by Goal 4 or otherwise expressly permitted by OAR 660-034-0035/0040.

Please Note: Approving the Comprehensive Plan amendment does not constitute specific approval of access improvements, such as the parking lot at Burlington, contemplated in the Master Plan. In order to construct the visitor access improvements at Burlington, Metro must apply for and obtain use and design review approval. That effort also requires Metro to demonstrate compliance with any overlay criteria, including SEC and Hillside protections.

As such, in conjunction with the subject plan amendment request, Metro has submitted a use request seeking permission to develop recreational access improvements at Burlington Creek Forest.

Metro respectfully requests that its North Tualatin Mountain Master Plan be incorporated into the Multnomah County Comprehensive Plan.

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<sup>1</sup> The starting point for determining permissible uses and facilities on forestry resource land is Goal 4. One primary objective of Goal 4 is “to provide for recreational opportunities” on forest lands. As such, Goal 4 provides that recreational opportunities, and necessarily their accessory/support elements, that are appropriate in a forest environment are allowed on forest lands and do not require exception approval.

If a use is not permitted by Goal 4, state law OAR 660-034-0035/0040, provides two alternative avenues to permit recreational development on resource land under the category of a state or local park and which do not require an exception to Goal 4. For less intensive facility development, such as parking areas and uses with similar impacts, the uses are allowed through a traditional development application (for example: design review). For more intensive facility development, such as a tennis court, pool, or music venue, a park provider can pursue a master planning process, rather than the exception process.

Uses expressly permitted in local parks by OAR 660-034-0035/0040 include day use areas, recreational trails (for walking, hiking, biking, and horses), staging areas, and support facilities such as parking areas, restrooms, signs, etc.



## Section IV: North Tualatin Mountains Access Master Plan Introduction

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Metro Parks and Nature protects water quality, fish and wildlife habitat and creates opportunities to enjoy nature close to home through a connected system of parks, trails and natural areas. Recreation opportunities provide physical, mental, and spiritual benefits as well as economic benefits for the County's residents.

In 2013, voters approved a five-year levy to help care for regional parks and natural areas. As a result, Metro is restoring habitat, and expanding opportunities to experience and learn about nature throughout Multnomah County. Roughly half of all levy funds go toward land restoration and management, including controlling invasive plants, planting native species, and improving habitat for fish and wildlife. The remainder of the levy pays for park maintenance and improvements, volunteer programs, conservation education, community grants and natural area improvements for visitors. The 2013 levy specifically identified sites in the North Tualatin Mountains as opportunities to provide public access to nature.

Pursuant to Metro's 2007 Target Area Refinement Plan, Metro acquired property in the North Tualatin Mountains in order to: Keep important wildlife and riparian corridors intact; protect upland habitat and headwater areas important to preserving the region's water quality; and provide trail connections between the region's largest urban park and public lands in the Oregon Coast Range. Burlington Creek Forest was slated to become housing prior to its acquisition.

**The North Tualatin Mountains Access Master Plan ("Master Plan")** is designed to provide a long-term vision and implementation strategy to guide land management and public use of the North Tualatin Mountains. See Exhibit 2. The plan was developed by land and property managers, landscape architects, scientists, planners, naturalists, project stakeholders, and community participants.

Metro employs a science-based approach to site management and conservation. During the master planning process, Metro scientists provided baseline information about current conditions, conservation targets and habitat restoration goals, guided by conservation biology, site knowledge, and research. External experts also evaluated possible impacts of potential access opportunities. Metro scientists then worked with Metro's planning team to develop access opportunities that are compatible with habitat, wildlife, and water quality goals for the natural area. The process objective was to identify suitable locations and activities for recreation while seeking to stabilize and restore diversity and the ecological health of the site. That objective is achieved in this case.

The final product and public improvements contemplated are the result of over two years of significant public outreach effort, including community meetings, public open houses, surveys, and outreach. The project stakeholders were Laurel Erhardt, Skyline Ridge Neighbors; Brad Graff, Skyline Ridge Neighbors; Jerry Grossnickle, Forest Park Neighborhood Association; Andy Jansky, Northwest Trail Alliance; Shawn Looney, West Multnomah Soil and Water Conservation District; Renee Myers, Forest Park Conservancy; Travis Neumeyer, Trackers Earth; Jinnet Powell, Skyline School; Emily Roth, Portland Parks & Recreation; Jim Thayer, Oregon Recreation Trails Advisory Committee; Roger Warren, Oregon Department of Forestry; and, Susan Watt, Skyline Ridge Neighbors. Metro received hundreds of comments, ranging from wanting to keep all four sites completely closed to public access, to wanting extensive trails and other improvements across all four sites.

The plan establishes project goals and objectives, outlines site resources and conditions, and summarizes the planning process. Employing principles of landscape ecology and landscape-level



design strategies, the plan identifies access locations and approximate trail locations. It also presents a general plan for development of trailheads and strategies for implementing future development.

The plan's goals include: Keeping important wildlife and riparian corridors intact, protecting upland habitat and headwaters areas important to preserving the region's water quality, providing recreational access and diverse recreational opportunities where appropriate, and contemplating a trail connection between the region's largest urban park and public lands in the Oregon Coast Range.

The Master Plan represents a balance, with the top priority being to protect water quality and preserve core habitat areas thirty acres or larger, including upland forests and streams that wildlife depend on as habitat connections. Thereafter, access is envisioned in a way that ensures healthy habitats and meaningful experiences in nature. To do so, the plan:

- Protects and enhances natural and scenic resources by protecting large blocks of forest and core habitat.
- Integrates landscape-level analysis and community desires into decision-making.
- Identifies and accesses the best location for day use and trail heads.
- Utilizes existing road and trails and locates new trails where habitat is already fragmented while minimizing new fragmentation.
- Employs sustainable trail construction techniques.
- Provides safe ingress and egress and internal movement of vehicles and pedestrians.
- Is designed consistent with the surrounding landscape and uses and in a scale and character that the community supports.
- Requires continued monitoring of water quality and habitat impacts and the flexibility to make adjustments if needed.

Metro envisions visitor improvements at two of the four sites: Initially at Burlington Creek Forest and subsequently, and minimally, at McCarthy Creek Forest. The location and extent of envisioned improvements were dictated by site conditions, including existing roads, trails and sensitive areas, as well as site limitations, including fairly steep topography and forested hillsides, which are typical of the surrounding landscape. Ennis Creek Forest and North Abbey Creek Forest will remain natural areas, with the exception of the future Pacific Greenway Trail envisioned through Ennis Creek Forest.

All four sites are significantly altered and damaged by prior land management activities. Site stabilization and restoration work at all four sites has already begun in earnest. Activities include invasive weed control, forest thinning, planting native plants and trees, erosion control, road maintenance (including decommissioning), and stream improvements. The land management activities also reduce long-term fuel and wildfire risk and make the forest more resistant to disease. Metro has working partnerships with West Multnomah Soil and Water Conservation District, City of Portland, Forest Park Conservancy, Trout Mountain Forestry and Portland Audubon to support this and future work.



Metro's restoration work and long-term management strategy includes identifying and reducing fire risks where possible. An Incident Action Plan is developed for each site that includes information to assist Metro and cooperating agencies responding to a fire on Metro property. Incident Action Plans will be developed for both Burlington and McCarthy prior to implementing formal public access. Metro follows the Oregon Department of Forestry Industrial Fire Precaution Levels and restrictions, and may close areas in very high fire conditions, may prevent certain activities, and will work with local fire prevention and suppression agencies.

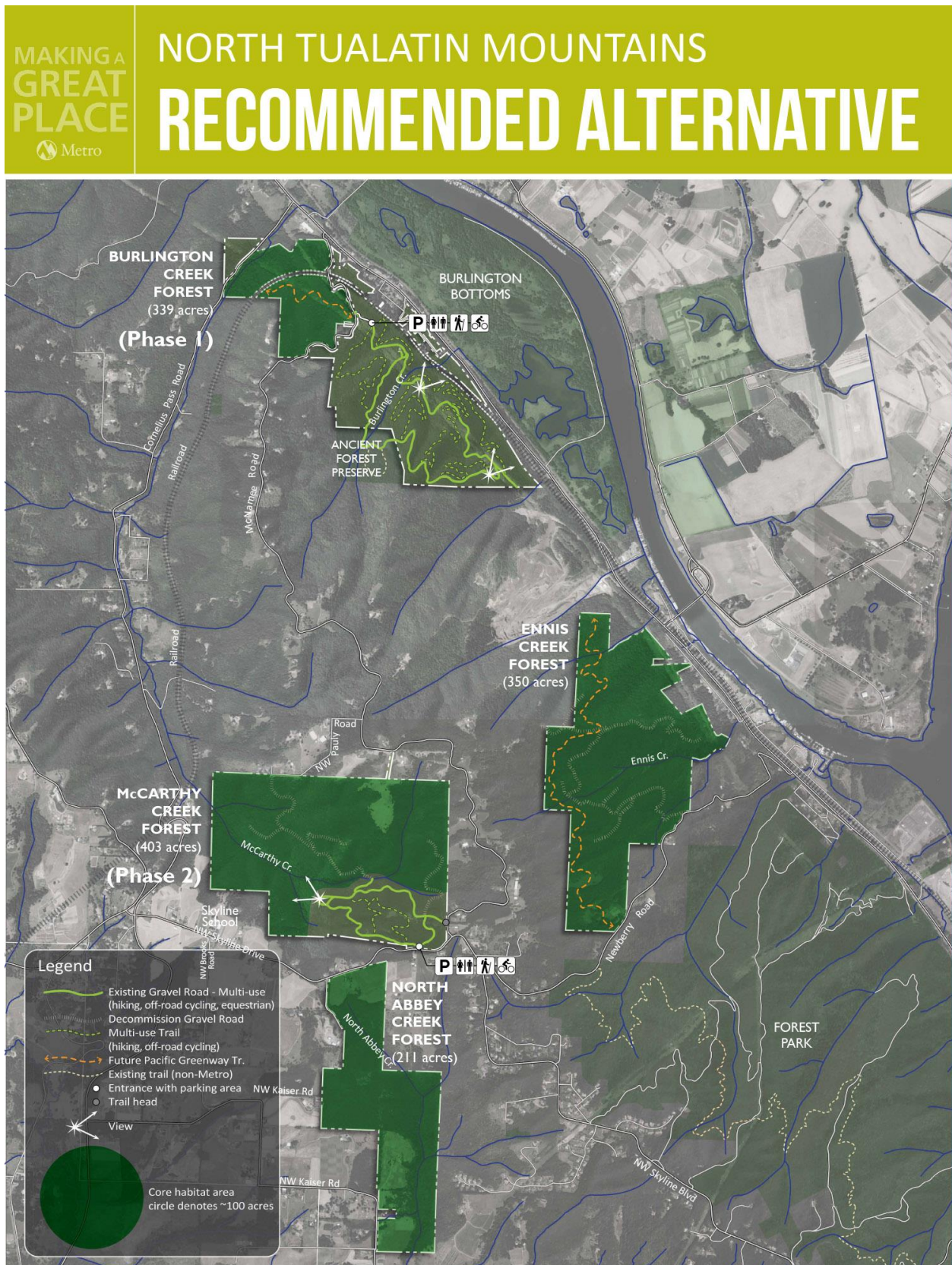
Site rehabilitation and management is pursuant to a Site Conservation/Restoration Plan, produced by Metro, which continues restoration aims to protect and enhance the North Tualatin Mountain's natural and scenic resources and to create a place for wildlife to thrive. *See Exhibit 3.* Metro is committed to engaging in sustainable forestry practices, including restoring old-growth habitat, increasing the biodiversity of forests through selective harvesting, management and plantings, preserving connectivity, supporting wildlife, and protecting clean water. Unneeded roads will be decommissioned.

In planning for access, five potential entry locations (at least one at each of the four forests) were evaluated to understand the feasibility of providing safe ingress and egress. While the five locations were all determined to be feasible, the location, site conditions, conservations goals, and the varying degree of improvements needed to provide safe and sufficient access dictated which access opportunities were most appropriate. Other specific considerations given were trail construction feasibility, stakeholder and community input, and the access objective - providing opportunities for meaningful experiences of nature. Knowing that people experience and connect with nature in many different ways, Metro sought to provide welcoming entries; provide a system of trails that serve appropriate multiple uses and trail users of differing abilities; provide access to viewpoints and key natural features; promote visitor safety; and reduce and mitigate potential impacts on the surrounding community; among others.

The two plus year process resulted in the preferred alternative represented in the Master Plan.



Figure 3 Master Plan Recommendation





Implementing the Master Plan will nurture healthy forests and streams and create healthy habitat for a variety of native and sensitive animals, while providing meaningful experiences in nature for area and County residents.

The North Tualatin Mountains is just the type of place voters of Multnomah County and throughout the region had in mind when they invested in protecting natural resources and acquiring land for future parks and visitor access.

#### **THE FOUR SITES - CURRENT ACCESS, USES, CHARACTER and VISION:**

The North Tualatin Mountains provide a variety of views and forest experiences. In areas that have been cleared for timber harvest, utilities or home sites, views across the Tualatin Valley, Sauvie Island and the Cascade mountains offer a broad perspective of how the sites fit into the region's geography. The North Tualatin Mountains Natural Area protects significant sections of four streams and associated riparian forest habitat. The sites also protect headwater areas of McCarthy, Ennis and North Abbey creeks.

Two of the sites, Burlington Creek Forest and Ennis Creek Forest, are located on the east-facing slopes of the mountain ridge and are similar in character to Forest Park, with fairly steep topography and forested hillsides. McCarthy Creek Forest and North Abbey Creek Forest are west of the main ridgeline and are more open, with areas of more gentle topography.

In recent history, these lands have been managed primarily for commercial timber harvest and limited agriculture. Much of the area was logged in the early 1990s. Hundreds of acres are dominated by single species, densely planted young stands of Douglas fir. Little to no snags and downed wood are present. Metro is currently managing the forest to reduce the number of conifers per acre, to promote healthy trees, preserve hardwoods and native shrubs, and increase diversity. Open areas exist in places that were cleared for pasture, agriculture, homes sites, planned development, and utility corridors.

Metro's Site Conservation Plan, Exhibit 3, identifies desired future conditions for riparian and upland forests, upland early successional shrub, and oak savanna for all four sites. The desired conditions will promote native trees and shrubs; provide habitat for migrating and nesting bird, mammals and amphibians; and protect water quality and riparian habitat while promoting cooler temperatures.



**Conservation Targets**

- RIPIARIAN FOREST
- UPLAND FOREST
- UPLAND EARLY SUCCESSION SHRUB
- OAK SAVANNA
- WETLAND SHRUB

**BURLINGTON CREEK**  
(339 acres)

**BURLINGTON BOTTOMS**

**ANCIENT FOREST PRESERVE**

**ENNIS CREEK**  
(350 acres)

**McCARTHY CREEK**  
(403 acres)

**NORTH ABBEY CREEK**  
(211 acres)

**CITY OF PORTLAND**

**FOREST PARK**

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sign are commonly observed at North Abbey, McCarthy and Ennis, and less frequently at Burlington.

Amphibians, including northern red-legged frogs, are present at McCarthy Creek, Burlington Creek, and Ennis Creek Forests. Red-legged frogs are considered a conservation strategy species by ODFW.

Although outside the project area, Coho salmon and steelhead utilize lower McCarthy Creek and lower North Abbey Creek for spawning, and other native fish are likely present. Water quality in the upper watershed (Metro's property) directly influences water quality in the lower watershed.

### **Burlington Creek Forest**

Burlington Creek Forest is comprised of numerous parcels zoned Commercial Forest Use 1 (CFU-1) covering approximately 350 acres. The area surrounding Burlington Creek Forest contains a mixture of land uses including residential, timber harvest, gravel extraction, ancient forest preserve, and wetland.

Of the four sites, Burlington Creek Forest has the most current use by people. People, including neighbors, walk and ride bikes and horses on existing logging roads and trails and access the site primarily via NW McNamee Road. Visitors also access the adjacent Ancient Forest Preserve. The site is recovering from extensive logging over its steep ridges and valleys.

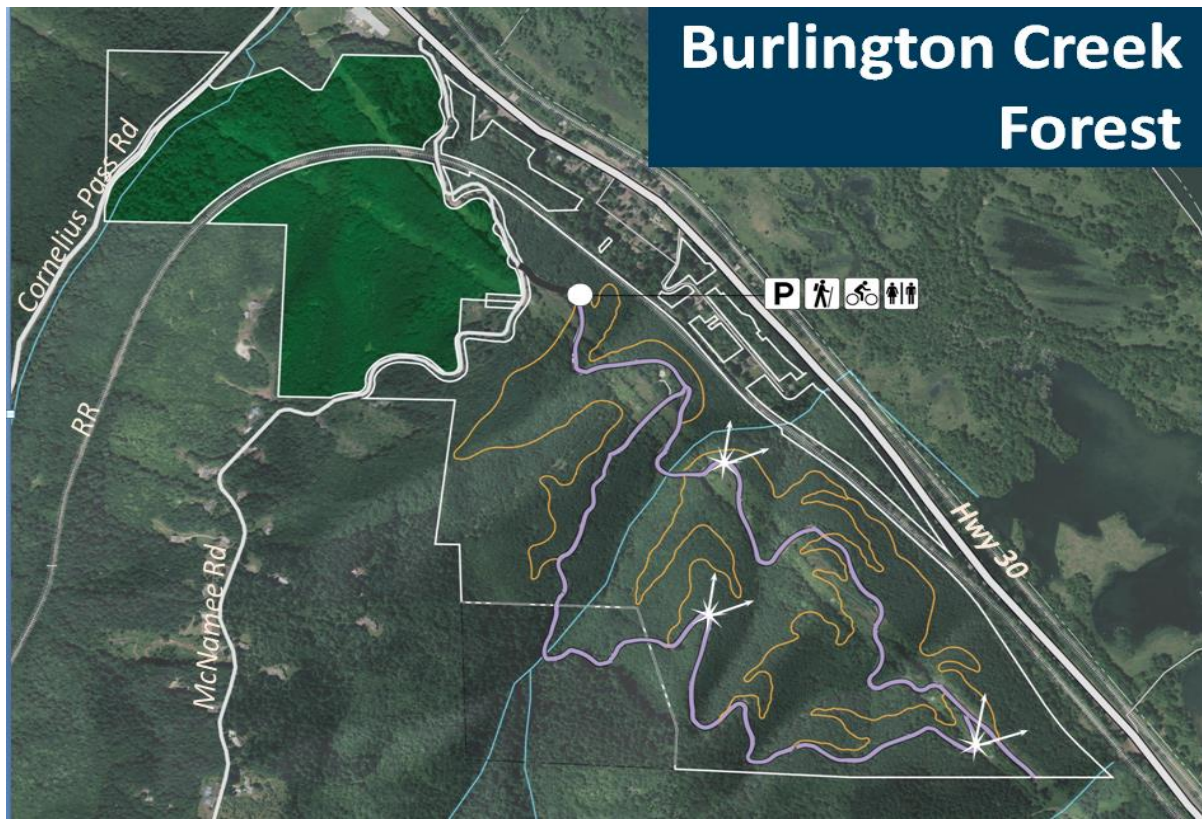
McNamee Road, Cornelius Pass Road and the railroad all cross through the Burlington Creek Forest. Additional infrastructure includes PGE and BPA power line corridors running the length of the site, logging roads, and a Burlington Water District water tank that serves the neighborhood below. Connectivity between Burlington Creek Forest and Burlington Bottoms Wetlands and Multnomah Channel located east of the forest is impeded by US Highway 30, local roads, residential development, and the railroad line.

Burlington Creek and several unnamed tributaries flow eastward through steep valleys to the base of the ridge.

Planned improvements include parking, a trailhead, and shared use trails designed specifically for hiking and off-road cycling. Visitors will be able to continue walking, riding bikes and horses on the existing logging roads, in addition to new multi-use trails proposed.



**Figure 5 Burlington Creek Forest Site and Plan Overview**



Burlington Creek represents Phase 1 of the planned improvements. The Master Plan recommends a variety of recreational activities and amenities to encourage greater use and enjoyment by a diverse community. Objectives include: Providing a system of trails that serve appropriate and multiple uses and abilities, including hiking, off-road cycling, and wildlife viewing; providing scenic viewpoints; providing safe non-motorized and vehicle access to the area; providing necessary site amenities and infrastructure to serve visitors; providing a family-friendly environment with opportunities for people of all ages and abilities to enjoy the site; and following “sustainable trails” guidelines for all trail development. Visitors to Burlington Creek Forest will access the site from an existing gravel-surfaced access road off of NW McNamee Road.

Although the site is isolated from neighbors given its sheer size and uses promoted in the interior of the forest, to minimize impacts to the surrounding neighborhoods from site development and public use, Metro objectives include: Providing controlled access and on-site parking scaled to the site’s capacity, assuring the privacy of neighbors by controlling access, and providing setbacks and buffers.

All rules and regulations at the nature park will be consistent with Metro’s Title 10, which outlines regulations “governing the use of Metro owned and operated regional parks and greenspaces facilities by members of the public in order to provide protection of wildlife, plants, and property, and to protect the safety and enjoyment of visiting these facilities.”

For public security and safety, hours of operation and regulatory signs will be installed at the access point. Regulatory signs will include public use restrictions, such as no fires, camping, hunting, or



motorized vehicles, and other uses outlined in Metro's Title 10. Vehicle access will be controlled with automatic gates to prevent after hours use. Gates will be locked daily at park closure times. Boundary markers will be installed along the perimeter of the natural area to clearly delineate the public/private edge. Daily maintenance of the park will include toilet cleaning, litter pick-up and general monitoring. Routine seasonal maintenance of the natural area features, including trails, overlooks, and mowing, will also occur. Metro Park Rangers, land managers, nature educators and scientists will ensure successful operation, maintenance, and continued use of the site.

Site rehabilitation and management will be pursuant to a Site Conservation/Restoration Plan, produced by Metro, which continues restoration aimed to protect and enhance the forest's natural and scenic resources and to create a place for wildlife to thrive. *See Exhibit 3.*

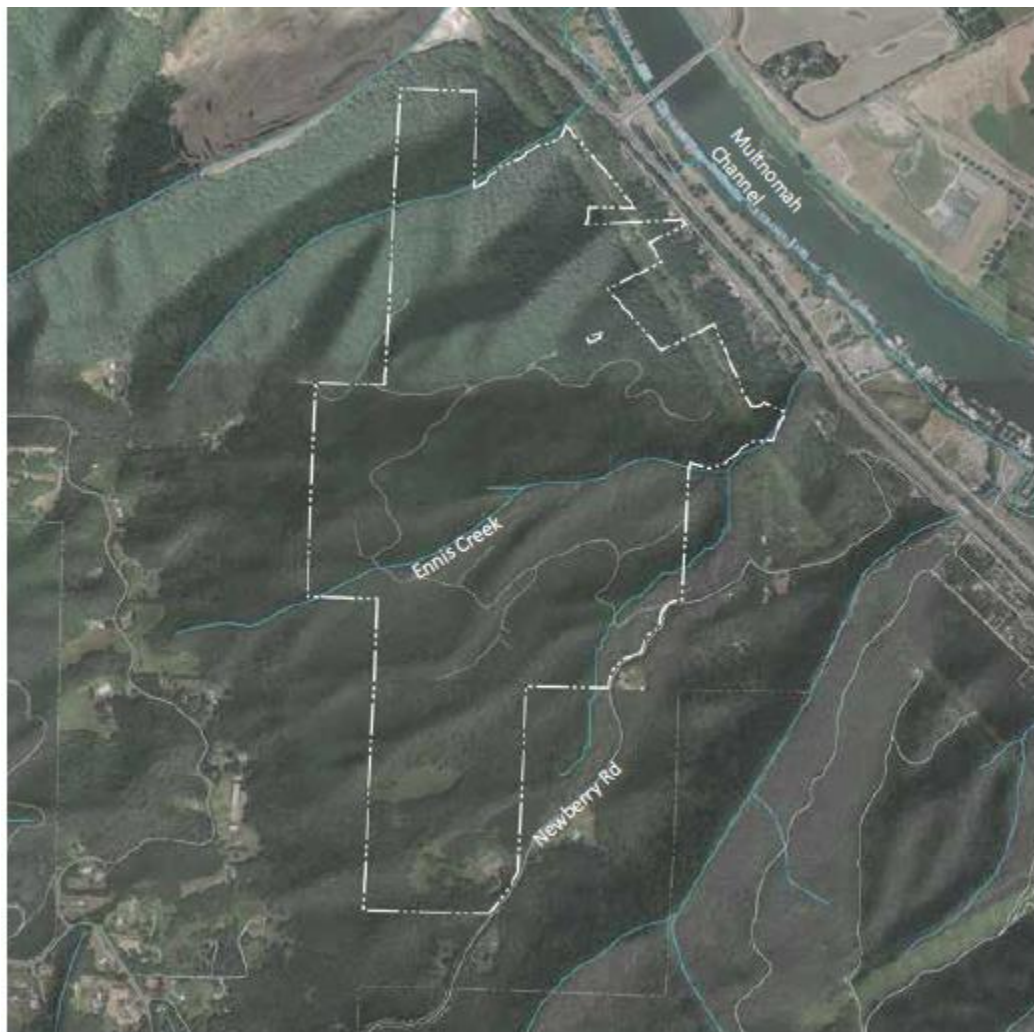


## **Ennis Creek Forest**

Ennis Creek Forest comprises of approximately 350 acres. The north half is similar in character to Burlington Creek Forest, composed of young conifer and hardwood forest. The site is separated from Burlington Creek by an operational quarry. On the southern portion of the site, the north and south forks of Ennis Creek flow through a more gentle topography and the forest is older and more diverse with wetter soils.

Ennis Creek and several unnamed tributaries occupy the southern half of the forest and flow eastward to the base of the ridge. At Ennis Creek, the Multnomah Channel flows along the base of the ridge.

**Figure 6 Ennis Creek Forest Site Overview**



Except for including a potential north south trail connector (which is envisioned by state and regional trail planners as a section of trail eventually leading to the Oregon Coast) no formal access improvements are proposed. Metro's focus at Ennis is on restoring and improving natural resources, forest health, habitat, and water quality associated with the site.



## **McCarthy Creek Forest**

McCarthy Creek Forest, a former tree farm, is approximately 402 acres. It is located west of McNamee Road and below the Skyline ridge. A meadow in the northern section of the site offers spectacular views and is frequented by a local elk herd. Metro's holding protects over five miles of McCarthy Creek and its tributaries, and approximately one-third of the entire McCarthy Creek watershed. A network of logging roads, many of which are degraded, traverses the site. Plans call for decommissioning roads north of the southern loop road. Notably, there is a 20-acre patch of mature forest (60 to 80 years old) in the northwest corner of the natural area.

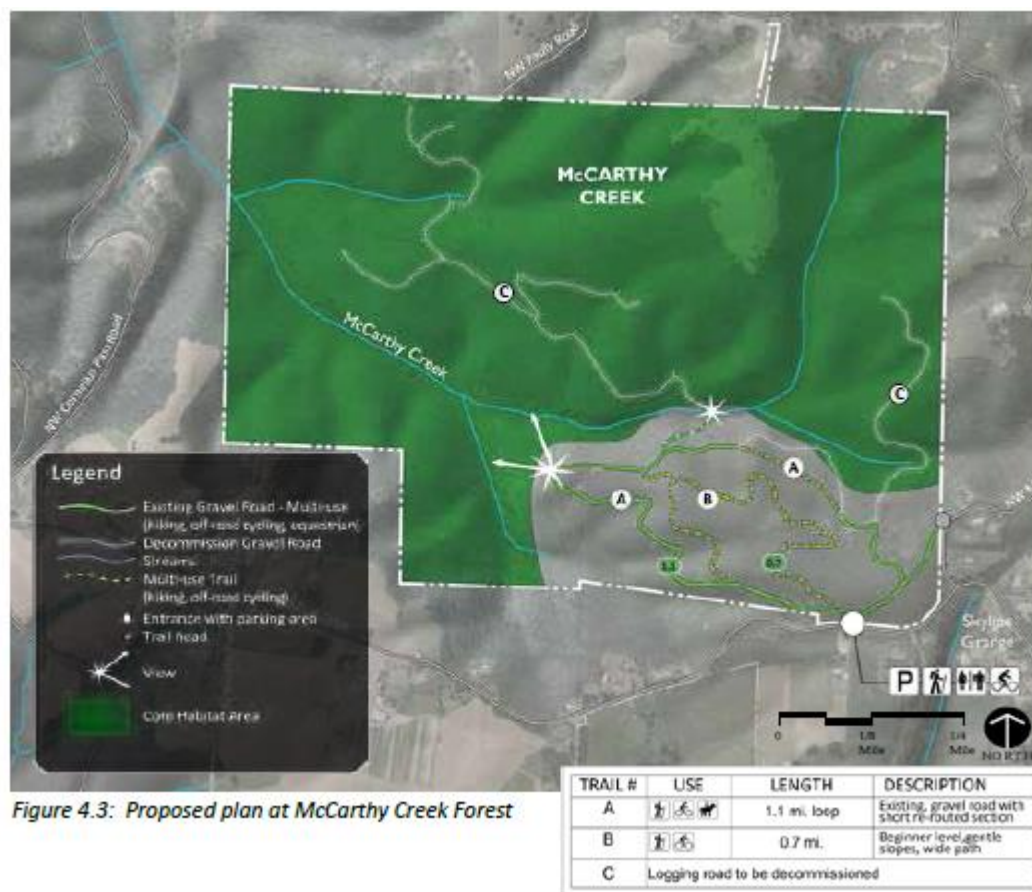
Hikers and equestrians currently walk or ride the loop road in the south half of the site. The site is accessed by neighbors. Schools and youth organizations also visit the site for field trips.

**Figure 7 McCarthy Creek Forest Site Overview**





**Figure 8 McCarthy Creek Master Plan Overview**



Metro is recommending official public access and minimal visitor improvements at McCarthy Creek Forest. The recommendations call for continued use of small section of former logging roads and new trails in the SE section of the forest. Other existing roads will be decommissioned. Planned improvements include a parking lot, trailhead, interpretative and way finding signs, picnic tables and shared use trails. An existing one mile loop road will continue to be enjoyed by hikers, cyclists, and equestrians. Roughly one mile of new trail is recommended.

Visitor experience will focus on expansive views into the stream valley below. Core habitat along the north and west parts of the sites will be preserved.

The early preferred alternative recommended including a trail through the northern portion of McCarthy that would have offered access to stunning vistas of the Tualatin Valley and Coast Range. However, to address neighbor concerns about elk that frequent the meadow, the trail section is not included in the Master Plan.

Except for the minimal improvements planned, Metro's focus is on restoring and improving natural resources, forest health, habitat, and water quality associated with the site.

Planned improvements at McCarthy Creek Forest are not proposed to be constructed or permitted through a land use application at this time. They are identified as a future project phase, which provides an opportunity to apply lessons learned during the first phase of the project implementation at Burlington Creek Forest.



### **North Abbey Creek Forest**

Burlington, Ennis, and McCarthy Creek forests are all located on the northwest side of Skyline Ridge, and within the Columbia River Watershed. North Abbey Creek Forest, located southwest of Skyline Ridge, is the only site in the Tualatin River watershed. Metro's holding, approximately 211 acres, protects the headwaters of North Abbey Creek, which flows the length of the site through a steep canyon. The forest is more diverse, including big leaf maple, Douglas fir and a developed understory. Large open areas are frequented by the local elk herd and provide opportunities to developed shrub-dominated pollinator and migratory bird habitat.

Current public uses are primarily restoration focused or educational in nature. Additionally, residents from the neighborhood access the east side of the property via existing informal trails that connect to neighborhood association land. No formal access improvements are proposed. Metro's focus is on restoring and improving natural resources, forest health, habitat, and water quality associated with the site.

**Figure 9 North Abbey Creek Forest Site Overview**





## **Section V: Applicable Criteria**

Below are the applicable review criteria from the Multnomah County's Code, Comprehensive Plan and state law.

### **Multnomah County Code:**

MCC Section 37.0705 Type IV Quasi-Judicial Plan and Zone Change Approval Criteria

### **Multnomah County Comprehensive Plan:**

Goals, Policies, and Strategies

### **State law:**

Statewide Planning Goals  
OAR 660-034-0035/0040

## **Section VI: Compliance with Applicable Review Criteria**

Below are the applicable criteria in *italics*, followed by **findings** demonstrating compliance and supported by substantial evidence.

### ***MCC § 37.0705 TYPE IV QUASI-JUDICIAL PLAN AND ZONE CHANGE APPROVAL CRITERIA.***

*(A) Quasi-judicial Plan Revision. The burden of proof is upon the person initiating a quasi-judicial plan revision. That burden shall be to persuade that the following standards are met.*

**Finding:** Metro has met its burden of proof by demonstrating with findings, supported by substantial evidence, that the following standards are met.

*(1) The plan revision is consistent with the standards of ORS 197.732 if a goal exception is required, including any OAR's adopted pursuant to these statutes;*

**Finding:** No goal exception is required or sought. As such, ORS 197.732 is not applicable. This standard is met or otherwise not applicable.

*(2) The proposal conforms to the intent of relevant policies in the comprehensive plan or that the plan policies do not apply. In the case of a land use plan map amendment for a commercial, industrial, or public designation, evidence must also be presented that the plan does not provide adequate areas in appropriate locations for the proposed use; and*

**Finding:** Metro demonstrates compliance with the relevant and applicable policies in the comprehensive plan by findings supported by substantial evidence. Metro is not requesting a plan map amendment, and as such, the second portion of the above standard is not applicable.

*(3) The uses allowed by the proposed changes will:*

*(a) Not destabilize the land use pattern in the vicinity;*

**Finding:** To avoid repetition, applicant respectfully directs the reviewer to sections 3 and 4 above (pages 6-20). The information and exhibits referenced therein demonstrate that the master planned restoration and limited recreational improvements are consistent with area land uses and will not destabilize the area's land use pattern. In short, 1,300 acres of natural areas will be



enhanced and protected in perpetuity as part of this application, thereby contributing to and stabilizing the area's rural community identity.

*(b) Not conflict with existing or planned uses on adjacent lands; and*

**Finding:** To avoid repletion, applicant respectfully directs the reviewer to sections 3 and 4 above (pages 6-20). The information and exhibits referenced therein demonstrate that the master planned restoration and limited recreational improvements do not conflict with existing or planned uses on adjacent land.

Metro also provide the following additional information in response to the standard.

Burlington Creek Forest: For purposes of this standard, the analysis area are those lands adjacent to the Burlington Creek Forest Natural Area. Metro's Burlington Creek Forest site is located on the east-facing slopes of the mountain ridge and is similar in character to Forest Park, with forested hillside and fairly steep topography typical of the area.

The area adjacent to Burlington Creek Forest contains a mixture of land uses including residential, timber harvest, gravel extraction, and ancient forest preserve.

Surrounding land uses of note include the following:

- *Quarry:* An operational quarry, located along U.S. Highway 30 southeast of Burlington Creek Forest.
- *Rural Residential:* Residential areas composed primarily of rural residential parcels. Many parcels 20 acres or greater in size are located along NW McNamee, west of the forest. Small residential parcels are located adjacent to Hwy 30, below the forest.
- *Ancient Forest Preserve:* The Ancient Forest, owned and managed by the Forest Park Conservancy, protects nearly 40 acres of old growth forest adjacent to the southwest corner Burlington Creek Forest site. The conservancy welcomes visitors to the Ancient Forest and has recently extended the trail system.

The residential uses adjacent to Hwy 30 are typically solely residential in nature. The railroad line is located west of the homesites, with Burlington Creek Forest, uphill from the rail line.

The residential uses on both sides of NW McNamee in the immediate vicinity of subject property and further south have forest lands associated with them. The closest homesite along NW McNamee is ¼ of a mile away from the proposed access improvements, and several hundred feet higher in elevation, with mature trees located in between.

There are no commercial farming activities occurring on lands adjacent to the property.

The timber/forestry related activities that may occur on the properties adjacent to McNamee and the subject property, if the owners were to engage in harvesting activities, include: Timber harvesting, reforestation (tree stocking after harvest), slash treatments (including burning), chemical application (fertilizers and pesticides), and road construction and maintenance. The forestry operations are located a substantial distance from the proposed access improvements.

The subject property is currently used for recreational purposes. People walk and ride bikes and horses on existing logging roads and trails, and access the site primarily via the existing access road



from NW McNamee Road. Activities occurring on site currently do not impede any forestry operations occurring in the general vicinity. Metro is proposing visitor access improvements to promote the safe and directed use of the site, rather than the unregulated and undirected recreational use currently occurring, thereby reducing potential conflicts

Although the site is isolated from neighbors given its sheer size and uses promoted in the interior of the forest, to minimize impacts to the surrounding neighborhoods from site development and public use, Metro objectives include: Providing controlled access and on-site parking scaled to the site's capacity, assuring the privacy of neighbors by controlling access, and providing setbacks and buffers.

There are no level of service issues. The assigned functional classifications reflect the roadways' intended purpose, the anticipated speed and volume, and the adjacent land uses. The primary roads upon which the adjacent properties rely on for local access will continue to carry volumes of traffic that the roads are designed to accommodate.

Given the distance of potential resource related activities from the subject property, as well as the location of the use activities made within the forest, together with topographical protections, the potential for conflicts is minimal to none. This standard is met.

Ennis Creek Forest: For purposes of this standard, the analysis area are those lands adjacent to the Ennis Creek Forest Natural Area. Metro's Ennis Creek Forest site is located on the east-facing slopes of the mountain ridge.

The area surrounding Ennis Creek Forest contains a mixture of land uses including residential, timber harvest, and gravel extraction. However, given its location on the eastern slope with the railroad lines and State Hwy 30 to the east, the property is rather isolated from surrounding uses. Additional infrastructure include power line corridors running the length of the eastern portion of the site and logging roads.

Surrounding land uses of note include the following:

- *Quarry:* An operational quarry, located along U.S. Highway 30 north of Ennis Creek Forest.
- *Rural Residential:* Residential areas composed primarily of rural residential parcels are located west and south of the forest (adjacent to Newberry and McNamee Roads) and also adjacent to Hwy 30, below the forest.

The residential uses adjacent to Hwy 30 are typically solely residential in nature. The residential uses on both sides of NW McNamee and Newberry Roads in the immediate vicinity of subject property have forest lands associated with them. The homesites along McNamee are a substantial distance from Ennis Creek Forest, with substantial forest between them and the site. The homesites along Newberry Road are closer to the forest site, with mature trees located in between.

There are no commercial farming activities occurring on lands adjacent to the property.

The timber/forestry related activities that may occur on the adjacent properties, if the owners were to engage in harvesting activities, include: Timber harvesting, reforestation (tree stocking after harvest), slash treatments (including burning), chemical application (fertilizers and pesticides), and road construction and maintenance.



The subject property is currently used for recreational purposes and resource management. Activities occurring on site currently do not impede or conflict with any forestry operations or rural residential uses occurring in the general vicinity. Except for a potential regional trails connecting with the Oregon Coast Trail, the forest will be managed for forest health, ensuring significant buffers between the Metro property/uses and adjacent uses. The potential for conflicts is minimal to none. This standard is met.

McCarthy Creek Forest: For purposes of this standard, the analysis area are those lands adjacent to the McCarty Creek Forest Natural Area. Metro's McCarthy Creek Forest site is located in the headwaters of McCarthy Creek.

The area surrounding McCarthy Creek Forest contains a mixture of land uses including residential, timber harvest, and farming. McNamee Road is east of the site and Skyline Boulevard is to the south.

Surrounding land uses of note include the following:

- *Rural Residential:* Residential areas composed primarily of rural residential parcels are located along McNamee, west of the forest, and also adjacent to Skyline, below the forest.
- *Skyline Elementary School:* The school is located north of Skyline Boulevard and southwest of the forest.
- *Tualatin Valley Fire and Rescue:* The station is located north of Skyline Boulevard and southwest of the forest.

The residential uses along McNamee in the immediate vicinity of the subject site have forest lands associated with them. The residential uses along Skyline in the immediate vicinity of the site have forest uses and some farm uses associated with them.

The farm uses occurring on lands adjacent to the property (north of Skyline) are currently done in close proximity to the elementary school. The elementary school represents an intensive use that coexists with the rural residential and resource uses in the vicinity. There are a few properties that appear to be in hay production. Farming activities involve adequate control of weeds, insects, and disease as necessary and is often achieved by spraying pesticides and fungicides. For those pasture or hayfields that are actively managed in the area, fertilizer is generally applied once or twice in the spring with tractor and spreader. Herbicide spray is broadcast on the ground with tractor boom, and blackberries are generally sprayed with a wand using Crossbow or Garlon. Hay fields are cut and baled usually twice in the summer. Crops are harvested with combines. Mechanical equipment uses public roadways to manage farms and haul product to market.

The timber/forestry related activities that may occur on the properties adjacent to McNamee and the subject property, if the owners were to engage in harvesting activities, include: Timber harvesting, reforestation (tree stocking after harvest), slash treatments (including burning), chemical application (fertilizers and pesticides), and road construction and maintenance. The forestry operations are located a substantial distance from the proposed access improvements.

Proposing and confining the planned limited access improvements to the southeast interior of the forest isolates the use from area rural residences and away from NW Skyline uses, and thereby minimizes any impacts, if any.



The subject property is currently used for recreational purposes. People walk and ride bikes and horses on existing logging roads and trails, and access the site primarily via the existing access road from NW McNamee Road. Activities occurring on site currently do not impede any forestry or farming operations occurring in the general vicinity. Metro is proposing visitor access improvements to promote the safe and directed use of the site, rather than the unregulated and undirected recreational use currently occurring, intending to reduce the potential for conflicts.

Although the site is isolated from neighbors given its sheer size and uses promoted in the interior of the forest, to minimize impacts to the surrounding neighborhoods from site development and public use, Metro objectives include: Providing controlled access and on-site parking scaled to the site's capacity, assuring the privacy of neighbors by controlling access, and providing setbacks and buffers.

There are no level of service issues. The assigned functional classifications reflect the roadways' intended purpose, the anticipated speed and volume, and the adjacent land uses. The primary roads upon which the adjacent properties rely on for local access will continue to carry volumes of traffic that the roads are designed to accommodate.

Except for a planned small parking area and the few existing logging roads and trails that will continue to support recreational uses in the SE corner of the McCarthy Creek Forest, the remainder of the site will be managed for forest health, ensuring significant buffers between the Metro property/uses and adjacent uses.

Given the distance of potential resource related activities from the subject property, as well as the location of the use activities made within the forest, together with topographical protections, the potential for conflicts is minimal to none. This standard is met.

North Abbey Creek Forest: For purposes of this standard, the analysis area are those lands adjacent to the North Abbey Creek Forest Natural Area. Metro's North Abbey Creek Forest site is located south of Skyline Boulevard.

The area surrounding North Abbey Creek Forest contains a mixture of land uses including residential, timber harvest, and farm uses.

Surrounding land uses of note include the following:

- *Rural Residential:* Residential areas composed primarily of large rural residential parcels are located west, south and east of the forest.
- *Multnomah County Road Maintenance Facility.* Located immediately west of the forest.

The land east/southeast of the site and in the immediate vicinity is a rural subdivision, including land owned by a homeowners association. The land is used for and supports residential purposes.

The land west and northeast of the site have farm uses associated with them. The properties appear to be in hay production. Farming activities involve adequate control of weeds, insects, and disease as necessary and is often achieved by spraying pesticides and fungicides. For those pasture or hayfields that are actively managed in the area, fertilizer is generally applied once or twice in the spring with tractor and spreader. Herbicide spray is broadcast on the ground with tractor boom, and blackberries are generally sprayed with a wand using Crossbow or Garlon. Hay fields are cut and baled usually twice in the summer. Crops are harvested with combines. Mechanical equipment uses public roadways to manage farms and haul product to market.



The timber/forestry related activities that may occur on the properties adjacent to McNamee and the subject property, if the owners were to engage in harvesting activities, include: Timber harvesting, reforestation (tree stocking after harvest), slash treatments (including burning), chemical application (fertilizers and pesticides), and road construction and maintenance. The forestry operations are located a substantial distance from the proposed access improvements.

The site is managed for forest health. Activities occurring on site currently do not impede or conflict with any forestry or farm operations or rural residential uses occurring in the general vicinity. There is no potential for conflicts with surrounding uses. This standard is met.

*(c) That necessary public services are or will be available to serve allowed uses.*

**Finding:** Public services associated with the planned access improvements include police and fire services. In conjunction with the Burlington Creek Forest Access Development application, submitted in conjunction with this plan amendment application, Metro submitted service provider forms and comments from police and fire service providers indicating that the area and planned park are or can be served.

Other customary public services associated with development, such as water, storm, and sewer, are not necessary to serve the planned recreational and resource management activities represented in the Master Plan. The subject Master Plan does not plan for uses that require support from public services. All potential service needs are planned for on-site accommodation. For example, if water is desired, a well can be installed. All stormwater generated by an access improvement will be controlled on site.

With respect to agency coordination surrounding emergency and fire service provisions, the Master Plan represents that an Incident Action Plan is developed for each site that includes information to assist Metro and cooperating agencies responding to a fire on Metro property. Incident Action Plans will be developed for both Burlington and McCarthy prior to implementing formal public access. Metro follows the Oregon Department of Forestry Industrial Fire Precaution Levels and restrictions, and may close areas in very high fire conditions, may prevent certain activities, and will work with local fire prevention and suppression agencies.

*(4) Proof of change in a neighborhood or community or mistake in the planning or zoning for the property under consideration are additional relevant factors to be considered under this subsection.*

**Finding:** Metro is not asserting that a proof of change in neighborhood or community or mistake in planning as a relevant factor. This standard is not applicable.

#### *MULTNOMAH COUNTY COMPREHENSIVE PLAN POLICIES*

**Finding:** The County's Comprehensive Plan is intended to guide future growth and development in unincorporated Multnomah County. The County's plan was recently amended in 2016; the first overhaul since it was adopted in 1977. It includes numerous topics, mirroring Statewide Planning Goals, and provides goals, policies, and strategies to guide decision making. Goals are broad statements of intended outcomes. They provide a foundation and general direction for policies. A policy is a commitment to a general course of action designed to guide decisions. By adopting a land use policy, the County obliges itself to render decisions consistent with that policy. A strategy is a specific course of action for implementing a particular policy.



The findings below demonstrate that the proposed Comprehensive Plan text amendment is consistent with the applicable goals, policies, and strategies of the Comprehensive Plan, or that they are otherwise not applicable.

The North Tualatin Mountain Master Plan upholds County values by preserving and protecting wildlife and its habitat; streams and other natural resources; scenic views; and the forest. The Master Plan promotes County and Metro objectives of inclusion, diversity and equity. The Master Plan also supports County and Metro sustainability and climate change resilience efforts and attempts to maintain and promote a quality of life that benefits and serves those both inside and outside the rural area by supporting both resource and recreational values.

### **Chapter 1 Citizen Involvement**

**Goal:** *To promote equitable participation by all members of the community in the development and implementation of the Comprehensive Plan by ensuring access to information and transparency of decision-making, and providing multiple and meaningful opportunities to become involved.*

**Finding:** Compliance with the County's administrative procedures, including notice and public hearings, which have been acknowledged as consistent with state law, will ensure this decision-making process is consistent with Citizen Involvement goals and policies. This application is being processed through Type IV administrative procedure.

In developing the Comprehensive Plan, which was largely driven by citizen advisory committees, each rural area was permitted to craft a vision statement. The subject property is within the West Hills subarea.

*The West Hills Vision statement is as follows:*

*The vision for the West Hills planning area is to retain its cherished rural character, natural features, scenic views, forestry and agricultural productivity, to enhance resource protections, and to reduce and manage cumulative impacts of traffic, recreation, and development in order to preserve the distinctive character of the West Hills for future generations.*

The West Hills subarea section further provides:

*"Public lands: Metro owns over 1,000 acres near the northern end of Forest Park which benefits wildlife connectivity and public access. These Metro properties are part of a large and extensive network of protected natural and recreational areas in the West Hills that extend into the city of Portland's jurisdiction, including Forest Park conservancy's Ancient Forest Preserve, over 5,000 acres in Portland's Forest Park and the Audubon Society of Portland's 150-acre Nature Sanctuary, Washington Park, and the Hoyt Arboretum."*

Metro owns over 1,300 acres in the West Hills planning area. The four forest sites are integral to achieving the goals and objectives represented in the vision statement. Metro properties, as represented in the North Tualatin Mountains Master Plan, are critical to the area retaining scenic views, forest health, and natural resource and habitat protections. The Master Plan favors conservation and promoting habitat and water quality, while permitting limited recreation in areas that can be safely and efficiently served.

The Master Plan was developed through a lengthy and involved public process that included stakeholders and community members representing the West Hills. To avoid repetition, applicant directs the reviewer to sections 3 and 4 above that describe the master planning process, desired



outcomes, and the preferred alternatives that will result in the rural character, natural features, scenic view, resource production, and resource protections envisioned by the County's Comprehensive Plan, together with limited and important public access to scenic views and recreation intended to foster a sense of place.

If Metro is permitted to implement the Master Plan, it will improve the forest health and greenery of over 1,300 acres, promote wildlife and habitat, and provide additional recreational opportunities for multiple user types and abilities.

The West Hills sense of place repeatedly mentions diverse wildlife and plant life, good air quality, healthy headwater streams, good water quality, habitat, and valuable ecosystems. Metro's holdings, which include the headwaters of four major streams and tributaries, are integral in that vision.

### ***Equity***

***Goal:*** To support access to all people and to ensure that planning policies and programs are inclusive.

***Policy 1.1*** Acknowledge the needs of low-income and minority populations in future investments and programs, including an equity analysis consistent with required federal, state, and local requirements.

***Policy 1.2*** Consider and seek to achieve social and racial equity in evaluating and making planning decisions.

**Finding:** An investment in Metro's nature parks ensures a public benefit informed by principles of diversity, equity and inclusion. This important work includes providing parks and natural areas welcoming to all people so future park visitors reflect our region's growing diversity.

Metro's commitment to the principles of diversity, equity and inclusion inform the selection of this project site and future plans for community education. The project Stakeholder Advisory Committee affirmed the importance of Burlington Creek Forest's proximity and accessibility from the diverse neighborhoods of inner North and Northeast Portland, located just across the St. Johns Bridge and Oregon Highway 30, which leads to the trailhead.

Since 2014, Metro has partnered with the non-profit Self Enhancement Inc. (SEI) to connect hundreds of at-risk youth of color with nature programming at North Tualatin Mountains' North Abbey Creek and McCarthy Creek sites. During the park planning process, SEI youth were exposed to nature education and conducted a joint planting party with the Northwest Trail Alliance.

Unfortunately, Burlington Creek Forest, in its current state, is not feasible for programming with youth as young as middle school age due to the lack of infrastructure such as formal parking, restrooms, shelter and wayfinding. Until such features are in place, SEI program opportunities will be limited to short-duration visits focused on high school students. Outreach to and partnerships with marginalized communities for nature education and engagement will expand once trail construction is completed.

Metro's Youth Ecology Corps (YEC) program provides diverse and marginalized youth a pathway towards meaningful work in conservation through leadership development and deepening their connections with nature. The YEC is a partnership between Metro and Project Youth Employability Support Services (Project YESS) to provide youths aged 16 to 21 in Multnomah County with paid work opportunities in habitat restoration, conservation education and workforce



development. The YEC is designed to serve low-income, at-risk, disconnected youths. Since project inception in 2014, 35 youth have participated in Metro's YEC program with 60% of the participants identifying as persons of color.

Crew members do important work in Metro's parks and natural areas to improve water quality, restore native plant communities, create wildlife habitat and enable public access to nature by building site improvements such as trails. Conservation education includes collecting data for science projects and having fun outdoors, all while exploring some of Oregon's most beautiful places. Crew members gain valuable skills learning how to get a job and gain real experience, potentially opening doors towards careers in the outdoors.

YEC crews have worked with Metro Natural Resource Specialists at the North Tualatin Mountains. Site restoration work already completed by the YEC crew includes removal of invasive plants and monitoring of native plant species.

While Metro intends to use a professional contractor to build the proposed trails at Burlington, finding opportunities for disadvantaged youth to work with professionals is a priority.

Trail building at Burlington Creek Forest is an ideal candidate for a YEC project. Working alongside professional contractors helps YEC youth develop skills and build relationships that could lead to future employment opportunities.

*Policy 1.3 Provide meaningful citizen engagement opportunities for communities of color in planning, decision-making, and evaluation.*

*Policy 1.4 Use the County Equity and Empowerment Lens when developing policy, implementing codes, and capital projects.*

**Finding:** Policy 1.3 and 1.4 are not applicable. They represent procedural directions to the County to engage communities of color in planning and decision-making and to use the county equity and empowerment lens. Metro is making a concerted effort to involve underserved community members in our planning, decision-making and evaluation processes. Outreach to community based organizations, engagement in place, targeted surveys, grants and partnerships have helped Metro better understand and respond to the needs of communities of color. Internal bias awareness, COBID procurement and race based equity trainings are advancing how all Metro staff can contribute to achieving racial equity in our system of parks and nature.

*Policy 1.5 Implement the goals, objectives, policies, and guideline elements contained in the Management Plan for the Columbia River Gorge National Scenic Area and attendant maps (including any future amendments) for that portion of the County designated by Congress as the Columbia River Gorge National Scenic Area.*

**Finding:** Policy 1.5 is not applicable. It pertains to the Columbia River Gorge National Scenic Area.

## **Chapter 2 Land Use**

**Goal:** *To implement an efficient land use planning process and policy framework as a basis for all decisions and actions related to use of land that is consistent with state law and community goals and priorities, addresses or mitigates potential conflicts between different land uses, and is implemented in a fair, equitable and reasonable manner.*



**Finding:** The subject plan amendment application is being processed in accordance with Multnomah County codes that have been acknowledged as consistent with state law. By applying the code standard and following the administrative procedures, the land use planning process will ensure potential conflicts between different land uses will be discussed, adverse impacts mitigated, and a fair and equitable process. This goal is met.

*Policy 2.1 Coordinate with Metro in its role to establish and maintain an Urban Growth Boundary in accord with the following.*

**Finding:** This policy is not applicable. The application does not involve UGB coordination.

*Policy 2.2 Transfer land use jurisdiction to Multnomah County cities for the unincorporated lands within the Urban Growth Boundary in accordance with approved urban planning area agreements between the County and the cities.*

**Finding:** This policy is not applicable. The subject property is outside the UGB and regulated by the County.

*Policy 2.3 Support higher densities and mixed land uses within the Urban Growth Boundary.*

**Finding:** This policy is not applicable. The subject property is outside the UGB.

*Policy 2.4 Establish and maintain rural reserves in coordination with urban reserves adopted by Metro and in accord with the following principles.*

**Finding:** This policy is not applicable. The application does not involve rural reserve and urban reserve coordination.

### ***Rural Residential Areas***

*Policy 2.5 Designate limited areas for rural residential development based upon the following criteria:*

*Policy 2.6 Protect farmland and forest land from encroachment by residential and other non-farm or non-forest uses that locate in the RR zone.*

*Policy 2.7 Ensure that new, replacement, or expanding uses in the RR zone minimize impacts to farm and forest land by requiring recordation of a covenant that recognizes the rights of adjacent farm and forestry practices.*

*Policy 2.8 New non-agricultural businesses should be limited in scale and type to serve the needs of the local rural area.*

**Finding:** Policy's 2.5, 2.6, 2.7 and 2.8 are not applicable. They all pertain to Rural Residential Areas and involve designating areas for rural residential development and protecting resource uses from encroachment by residential uses. The subject application involves resource land zoned CFU and EFU.

### ***Rural Center Location and Siting***

*Policy 2.9 Establish and maintain Rural Centers which are intended primarily for commercial and community services needed by the residents of the rural areas of the County, and to provide some tourist services.*



*Policy 2.10 Rural Centers are or may be established on the basis of existing center development, on local area needs, on an evaluation of probable impacts on adjacent natural resource areas, on the demand for land to serve the primary purposes in a compact pattern, and on the capacity and condition of existing support services.*

*Policy 2.11 Expansion of a Rural Center (RC) to adjacent land shall be based upon findings that:*

*Policy 2.12 The County shall determine the suitability of uses within a Rural Center by:*

**Finding:** Policies 2.9, 2.10, 2.11 and 2.12 are not applicable. They all pertain to Rural Centers and involve designating areas for rural center development and protecting resource uses from encroachment by center uses. The subject application involves resource land zoned CFU and EFU.

### ***Residential Uses in Rural Centers***

*Policy 2.13 Continue to reinforce the rural nature of designated rural communities through the zoning code by limiting residential development to one dwelling unit per Lot of Record.*

*Policy 2.14 Require new residential parcels in the Rural Center zone to be at least one acre in size in order to not increase residential density and to ensure that the carrying capacity of public services and the environment is not exceeded.*

*Policy 2.15 Accommodate permitted growth and development within designated rural communities while preserving their rural function and appearance.*

**Finding:** Policies 2.13, 2.14, and 2.15 are not applicable. They all pertain to Residential Uses in Rural Centers. The subject application involves resource land zoned CFU and EFU.

### ***Commercial Uses in Rural Centers***

*Policy 2.16 Ensure that new commercial and industrial uses within rural centers are small scale and low impact in nature as defined by County code so that these uses will not adversely impact agriculture or forestry uses and will reinforce the rural nature of the community, while also providing economic and employment opportunities by allowing for the maximum use of floor area for existing lawfully established buildings and parking areas to the extent allowed by State law.*

*Commercial uses shall serve the rural community and surrounding area but industrial uses need not serve the rural community and surrounding area.*

*Policy 2.17 Improve the availability and accessibility of consumer goods and services for rural areas by supporting the location and scaling of commercial development in rural centers to meet the needs of the surrounding community and reinforce community identity.*

*Policy 2.18 Encourage land use development patterns which support the efficient use of existing rural centers.*

*Policy 2.19 Locate commercial activities in rural centers which are planned and developed as a unit related in location, size, and type of shops to the trade area to be serviced and to create aesthetically attractive community focal points.*

*Policy 2.20 Provide for tourist commercial uses in clusters at highway interchanges or in areas with special tourist attractions.*



*Policy 2.21 Provide for home occupations and small business in rural centers to assist in developing new business opportunities and to increase convenience to rural residents.*

*Policy 2.22 Minimize adverse impacts of commercial, office, and industrial development on adjacent development, including residential uses, through site location and design standards.*

*Policy 2.23 Reduce crime through design and site location based on the principles of defensible space.*

*Policy 2.24 Support commercial, office, and industrial development siting and expansion at sites of a size which can accommodate the present and future uses and is of a shape which allows for a site layout in a manner which maximizes user convenience and energy conservation.*

*Policy 2.25 Promote compatible development and minimize adverse impacts of site development on adjacent properties and the surrounding community through the application of design review standards.*

**Finding:** Policies 2.16, 2.17, 2.18, 2.19, 2.20, 2.21, 2.22, 2.23, 2.24, and 2.25 are not applicable. They all pertain to Commercial Uses in Rural Centers. The subject application involves resource land zoned CFU and EFU.

*Policy 2.26 Locate office services in rural centers where they can best serve households and businesses within rural centers and the surrounding rural community by providing jobs and services close to where people live.*

*Policy 2.27 Provide siting and expansion opportunities to office uses meeting their locational and development requirements.*

*Policy 2.28 Support the location of office, commercial, and industrial activities on existing transportation systems with volume capacities and modal mixes available and appropriate to serve present and future scales of operation.*

**Finding:** Policies 2.26, 2.27, and 2.28 are not applicable. They all pertain to Office Uses in Rural Centers. The subject application involves resource land zoned CFU and EFU.

### ***Industrial Uses in Rural Centers***

*Policy 2.29 Protect the stability and functional aspects of industrial uses by protecting them from incompatible uses.*

*Policy 2.30 Promote economic diversification and growth in rural centers by allowing appropriate industrial uses meeting locational and site requirements appropriate to the rural character of the center and surrounding area.*

*Policy 2.31 Encourage the siting and expansion of industrial uses in rural centers to meet the needs for jobs by rural residents.*

*Policy 2.32 Ensure that impacts to EFU and CFU zoned land from new or expanding uses in adjacent RC zones are minimized by requiring “right to farm” measures to be implemented in those areas. These measures can be in the form of maintaining a larger setback between the new development and the zone boundary, and/or requiring recordation of a covenant that recognizes the rights of adjacent farm and forest managers to farm their land and practice forest management.*



*Policy 2.33 Implement regulations to ensure that new or expanded commercial and industrial development will not exceed the capacity of water supply and waste disposal services available to the site, or if such services are not available to the site, the capacity of the site itself to provide water and manage wastewater, including sewage.*

*Policy 2.34 Implement regulations to ensure that new or expanded commercial and industrial uses will not result in public health hazards or adverse environmental impacts.*

*Policy 2.35 Ensure that new and expanded commercial or industrial uses are subject to design review in order to ensure compatibility with the community character.*

**Finding:** Policies 2.29, 2.30, 2.31, 2.32, 2.33, 2.34, and 2.35 are not applicable. They all pertain to Industrial Uses in Rural Centers. The subject application involves resource land zoned CFU and EFU.

### ***Home Occupations***

*Policy 2.36 Allow for home occupations wherever dwellings are permitted in order to assist in developing new business opportunities and to increase convenience to residents, while considering and minimizing impacts on adjacent land uses.*

**Finding:** Policy 2.36 is not applicable. It pertains to home occupations.

### ***Community Identity and Design***

*Policy 2.37 Create, maintain or enhance rural community identity by:*

- 1. Identifying and reinforcing community boundaries;*
- 2. Identifying important natural landscape features;*
- 3. Requiring identified important natural landscape features be preserved as part of the development process.*

**Finding:** The focus of this and the following community identity policies is a feeling people have about their community. That effort requires identifying and reinforcing community boundaries, identifying important landscape features, and preserving important features of the community. The policies are focused on influencing the design of properties and buildings in relation to each other and to minimize conflicts with land uses in the same area. 1,300 acres of natural areas will be enhanced and protected in perpetuity as part of this application contributing to the rural community identity of the area.

*Policy 2.38 Implement design standards regulating commercial and industrial development which reflect and enhance the rural character of rural centers. Design standards shall be oriented to rural areas and may differ from those applied in urban areas of the County. Where appropriate, design standards should include flexibility associated with landscaping, parking, or other site and design requirements.*

*Policy 2.39 Maintain a design review process which:*

**Finding:** Policies 2.38 and 2.39 are directed at the County to adopt and implement certain design standards in the County code. They are not applicable in this application for a text amendment.

### ***Permitting, Code Enforcement and Other Procedural Issues***



*Policy 2.40 Ensure that the County's development permitting procedures and requirements are consistent with state planning requirements, while also being fair and equitable to community members and minimizing the time and expense required to obtain needed permits.*

*Strategy 2.40-1: Periodically review and refine permitting requirements, as needed, in consultation with affected community members and staff, to simplify requirements, and reduce related time and expense for applicants while continuing to ensure consistency with State and County mandates. Potential refinements shall be based on recurring issues identified by community members or county representatives.*

*Policy 2.41 Enforce compliance with the County Comprehensive Plan and Zoning Code in a fair and consistent manner in all cases of verifiable code violations.*

**Finding:** Policies 2.40 and 2.41 are directed at the County to ensure a timely, orderly, and fair permitting and enforcement system. They are not applicable to this application.

### ***Grading and Fill***

*Policy 2.42 Establish standards for qualifying topsoil fill as a routine agricultural management practice exempt from County review requirements.*

*Policy 2.43 Establish limits for fill that does not qualify as an agricultural management practice and is subject to County review requirements.*

*Policy 2.44 Establish clearly defined exemptions to the Grading and Erosion Control permit requirements.*

**Finding:** Policies 2.42, 2.43, and 2.44 pertain to agricultural management practices, including grading and fill. Applicant is not proposing fill as part of an agricultural management practice. These policies are not applicable.

### ***Community Facilities***

*Policy 2.45 Support the siting and development of community facilities and services appropriate to the needs of rural areas while avoiding adverse impacts on farm and forest practices, wildlife, and natural and environmental resources including views of important natural landscape features.*

*Policy 2.46 Encourage land use development which supports the efficient use of existing and planned community facilities.*

*Policy 2.47 Support community facilities siting and development at sites of a size which can accommodate the present and future uses and is of a shape which allows for a site layout in a manner which maximizes user convenience and energy conservation.*

**Finding:** Policies 2.45, 2.46, and 2.47 are not applicable. These policies pertain to local community facilities that are intended to serve the immediate/adjacent rural residents and rural communities, such as schools, parks, fire stations and cemeteries. Applicant is not proposing a local/neighborhood park intended to serve only the West Hills neighborhood. The subject property is resource land zoned CFU in which forestry and recreational uses are permitted and recognized as appropriate throughout the County and State of Oregon. The property will serve the West Hills neighborhood as well as other County residents.



## **Other Policies**

*Policy 2.48 The lawful use of any building, structure or land at the time of the enactment or amendment of any zoning ordinance or regulation may be continued, altered, restored or replaced in accordance with Oregon Revised Statutes 215.130 and 215.135.*

**Finding:** This policy is not applicable. Applicant is not proposing to continue a non-conforming use.

*Policy 2.49 An alteration (including additions) or replacement of a nonconforming use or structure shall not create a greater adverse impact on the neighborhood, including but not limited to, noise, dust, lighting, traffic, odor, water use, sewage disposal impacts, and safety.*

**Finding:** This policy is not applicable. Applicant is not proposing to continue a non-conforming use.

*Policy 2.50 As part of land use permit approval, impose conditions of approval that mitigate off-site effects of the approved use when necessary to:*

- 1. Protect the public from the potentially deleterious effects of the proposed use; or*
- 2. Fulfill the need for public service demands created by the proposed use.*

**Finding:** This policy is a procedural standard that confirms the ability of the County to impose conditions of development approval.

*Policy 2.51 Creation and open space are an important part of the character and economic base of Multnomah County. These areas also provide opportunities for recreational use, as well as many environmental benefits, such as wildlife habitat, riparian areas, clean air, stormwater filtration, and carbon sequestration.*

**Finding:** Provided for above and in further detail in the Master Plan, Metro's North Tualatin Mountains Natural Area represents every condition and opportunity that the County's Comprehensive Plan and Policy 2.51 promote. The land is currently managed and master planned to conserve and rehabilitate the forest resources, avoid sensitive natural resources and hazards, and provide for limited recreational activities in appropriate and scientifically supported locations. Access and trail development are entirely contained on Metro property and will not conflict with forest production and resource uses on adjacent lands. The policy is being promoted.

## **Chapter 3 Farm Land**

### ***Agricultural/EFU Zones***

**Goal:** *To conserve agricultural land in exclusive farm use and mixed use agricultural zones and maximize its retention for productive, sustainable farm use.*

*Policy 3.1 Prohibit creation of new lots or parcels, except as authorized by code, which detracts from agricultural practices and from protection of open space and rural community values.*

**Finding:** Applicant is not proposing to create a new lot on EFU land. This policy is not applicable.

*Policy 3.2 Re-designating land from Agricultural land use to another land use classification should be in accord with the standards set forth by the Statewide Planning Goals, OARs, and in this Plan.*



**Finding:** Applicant is not proposing to re-designate land from agricultural use to another use classification. This policy is not applicable.

*Policy 3.3     Require lot and parcel aggregation standards to reduce parcelization, maintain larger lot and parcel sizes in farm and forest zones, and help minimize impacts of non-farm and forest uses on surrounding farm and forest production. In order to minimize confusion over the development potential of a property, a condition of approval for land use and development permits shall require deed restrictions be recorded that identify the properties that constitute a lot of record along with the development restrictions that go with the lot of record.*

**Finding:** This policy is a directive to the County in adopting land use standards. It is not applicable.

*Policy 3.4     Ensure that transportation policies and policies related to the regulation of activities and events in agricultural zones minimize the difficulties conflicting uses impose on farming practices.*

*Policy 3.5     Develop and adopt a unified permitting process for review of mass gatherings and other gatherings. Establish more restrictive permitting thresholds for the number of visitors and the frequency or duration of events than the maximums authorized by state law.*

**Finding:** Applicant is not requesting a mass gathering permit. This policy is not applicable.

*Policy 3.6     Designate and maintain as exclusive agricultural land, areas which are:*

**Finding:** Only a small portion of the subject property, located in the southwestern portion of North Abbey Creek Forest, is zoned EFU and in farm use. The remaining portion of the site is zoned CFU. The subject Master Plan does not propose any non-farm uses for the EFU land. Metro is not proposing any use of the farmland that conflicts with any policy identified in the “general policies for agricultural zones” or policies specific to the “EFU Zones.” No uses are proposed for North Abbey Creek that will conflict with or interfere with farm uses occurring south and west of the site. This goal and policies are satisfied or otherwise not applicable.

## **Chapter 4    Forest Land**

### ***CFU Zones***

**Goal:** *To conserve forest lands in forest zones for timber production, while practicing sound management of natural resources and hazards, providing for recreational activities where appropriate, and minimizing conflicts between forest production and non-forest production uses and activities.*

**Finding:** Except for the small portion of EFU land in North Abbey Creek Forest, the subject Master Plan property is zoned CFU 1 and CFU 2.

The County’s Comprehensive Plan provides:

“Forest lands for timber production, natural habitat, recreation and open space are an important part of the character and economic base of Multnomah County. . . . These areas also provide opportunities for recreational use, as well as many environmental benefits, such as wildlife habitat, riparian areas, clean air, stormwater filtration, and carbon sequestration.”

**Finding:** As provided for above and in further detail in the Master Plan, Metro’s North Tualatin Mountains Natural Area represents every condition and opportunity that the County’s



Comprehensive Plan promotes. The land is currently managed and master planned to conserve and rehabilitate the forest resources, avoid sensitive natural resources and hazards, and provide for limited recreational activities in appropriate and scientifically supported locations. Access and trail development are entirely contained on Metro property and will not conflict with forest production on adjacent forestry lands. This goal is being promoted.

*Policy 4.1 Designate and maintain as commercial forest land, areas which are:*

1. *Predominantly in Forest Cubic Foot Site Class I, II, and III for Douglas Fir as classified by the U.S. Soil Conservation Service;*
2. *Suitable for commercial forest use and small woodlot management;*
3. *Potential reforestation areas, but not, at the present, used for commercial forestry;*
4. *Not impacted by urban services; and*
5. *Cohesive forest areas with large parcels; or*
6. *Other areas which are:*
  - a. *Necessary for watershed protection or are subject to landslides, erosion or slumping;*
  - b. *Wildlife and fishery habitat areas, potential recreation areas, or of scenic significance.*

**Finding:** Consistent with Policy 4.1, the land is appropriately designated and maintained as forest land. As demonstrated in the Master Plan, the land is managed for forestry practices, as regulated by the State Forest Practices Act. Additionally, the land is being reforested, includes cohesive areas with large parcels, is necessary and planned for watershed protection, and includes improving wildlife and fishery habitat, includes scenic views, and portions of it represent the potential for recreation areas. This policy is met.

*Policy 4.2 Maximize retention of forest land by maintaining Commercial Forest Use designated areas with forestry as the primary allowed use.*

**Finding:** The subject plan amendment request and Master Plan maximized retention of forest land by planning for and actively engaging in forestry practices. The CFU designation is maintained. This policy is met.

*Policy 4.3 Require that applications for new development comply with Lot of Record standards described in the CFU zoning code.*

**Finding:** The subject plan amendment application is not an application for new development. However, Metro's companion application, which seeks land use approval for new visitor access improvements at Burlington Creek Forest, is an application for new development and in which applicant has demonstrated compliance with Lot of Record standards. This policy is not applicable or otherwise met.

*Policy 4.4 Allow forest management with related and compatible uses and restrict incompatible uses from the commercial forest land area, recognizing that the intent is to preserve the best forest lands from inappropriate and incompatible development.*

**Finding:** As detailed above and further described in the Master Plan, Metro's Master Plan represents a plan that promotes forest management with limited permitted and compatible recreational uses in select and appropriate locations on the property.



*Policy 4.5 Redesignating land from Commercial Forest Land Use to another land use classification should be in accord with the standards set forth by the LCDC Goals, OAR's, and in this Plan.*

**Finding:** Applicant is not proposing to redesignate land from forestry use to another use classification. This policy is not applicable.

*Policy 4.6 If current statewide planning regulations of Commercial Forest Use lands are changed, Multnomah County should not allow new subdivision lots of less than 80 acres in the CFU district in order to preserve forest practices and natural resources such as wildlife habitat, streams, and scenic views, to the extent allowed by law.*

**Finding:** Applicant is not proposing a land division. This policy is not applicable.

*Policy 4.7 Do not support zone changes that remove productive forest land from the protections of Goal 4 of the Oregon Statewide Planning Program.*

**Finding:** Applicant is not requesting a zone change. This policy is not applicable.

## **Chapter 5 Natural Resources**

**Goal:** *To protect and restore rivers, streams, wetlands, wildlife habitat and other natural resources; maintain and enhance air, water, and land quality; conserve scenic areas and open spaces; and maintain natural resources' contribution to the rural character of the County.*

**Finding:** As the Comprehensive Plan recognizes, balancing recreational uses with resource management and the protection of natural resources is a main objective in any planning effort, including that represented in Metro's Master Plan. That balancing effort, although one which favors resource protection, water quality, and habitat improvements over recreation, is represented in Metro's Master Plan.

### ***General Policies and Strategies***

*Policy 5.1 Identify and protect natural resources in order to promote a healthy environment and natural landscape that contributes to Multnomah County's livability.*

Metro Parks and Nature protects water quality, fish and wildlife habitat and creates opportunities to enjoy nature close to home through a connected system of parks, trails and natural areas. Connecting with nature provides physical, mental, spiritual and economic benefits for the County's residents.

Metro acquired property in the North Tualatin Mountains in order to: Keep important wildlife and riparian corridors intact; protect upland habitat and headwater areas important to preserving the region's water quality; and provide trail connections between the region's largest urban park and public lands in the Oregon Coast Range. Burlington Creek Forest was slated to become housing prior to its acquisition.

The Master Plan is designed to provide a long-term vision and implementation strategy to guide land management and public use of the North Tualatin Mountains. The plan was developed by land and property managers, landscape architects, scientists, planners, naturalists, project stakeholders, and community participants.

Metro employs a science-based approach to site management and conservation. During the master planning process, Metro scientists provided baseline information about current conditions,



conservation targets and habitat restoration goals, guided by conservation biology, site knowledge, and research. External experts also evaluated possible impacts of potential access opportunities. Metro scientists then worked with Metro's planning team to develop access opportunities that are compatible with habitat, wildlife, and water quality goals for the natural area. The process objective was to identify suitable locations and activities for recreation while seeking to stabilize and restore diversity and the ecological health of the site. That objective is achieved in this case.

*Policy 5.2 Protect natural areas from incompatible development and specifically limit those uses which would significantly damage the natural area values of the site.*

**Finding:** The Master Plan is designed to provide a long-term vision and implementation strategy to guide land management and public use of the North Tualatin Mountains. The plan was developed by land and property managers, landscape architects, scientists, planners, naturalists, project stakeholders, and community participants.

Metro employs a science-based approach to site management and conservation. During the master planning process, Metro scientists provided baseline information about current conditions, conservation targets and habitat restoration goals, guided by conservation biology, site knowledge, and research. External experts also evaluated possible impacts of potential access opportunities. Metro scientists then worked with Metro's planning team to develop access opportunities that are compatible with habitat, wildlife, and water quality goals for the natural area. The process objective was to identify suitable locations and activities for recreation while seeking to stabilize and restore diversity and the ecological health of the site. That objective is achieved in this case.

The final product and public improvements contemplated are the result of over two years of significant public outreach effort, including community meetings, public open houses, surveys, and outreach. See Exhibit 2. The project stakeholders were Laurel Erhardt, Skyline Ridge Neighbors; Brad Graff, Skyline Ridge Neighbors; Jerry Grossnickle, Forest Park Neighborhood Association; Andy Jansky, Northwest Trail Alliance; Shawn Looney, West Multnomah Soil and Water Conservation District; Renee Myers, Forest Park Conservancy; Travis Neumeyer, Trackers Earth; Jinnet Powell, Skyline School; Emily Roth, Portland Parks & Recreation; Jim Thayer, Oregon Recreation Trails Advisory Committee; Roger Warren, Oregon Department of Forestry; and, Susan Watt, Skyline Ridge Neighbors. Metro received hundreds of comments, ranging from wanting to keep all four sites completely closed to public access, to wanting extensive trails and other improvements across all four sites.

The plan establishes project goals and objectives, outlines site resources and conditions, and summarizes the planning process. Employing principles of landscape ecology and landscape-level design strategies, the plan identifies access locations and approximate trail locations. It also presents a general plan for development of trailheads and strategies for implementing future development.

The plan's goals include: Keeping important wildlife and riparian corridors intact, protecting upland habitat and headwaters areas important to preserving the region's water quality, providing recreational access and diverse recreational opportunities where appropriate, and contemplating a trail connection between the region's largest urban park and public lands in the Oregon Coast Range.

The Master Plan represents a balance, with the top priority to protect water quality and preserve core habitat areas 30 acres or larger, including upland forests and streams that wildlife depend on



for habitat connections. Thereafter, access is envisioned in a way that ensures healthy habitats and meaningful experiences in nature. This policy is satisfied.

*Strategy 5.2-2: Incorporate headwaters management strategies into County planning activities with the understanding of the importance of headwaters and their critical ecosystem role.*

**Finding:** Metro understands the role of headwaters and the importance of headwaters management in promoting healthy ecosystems. The Master Plan represents those understandings and proposed management techniques. This policy is supported.

*Policy 5.3 Encourage voluntary conservation efforts such as conservation easements and community-based restoration projects that complement Multnomah County's Goal 5 (Natural and Cultural Resources) and Goal 15 (Willamette River Greenway) regulatory programs.*

**Finding:** Metro has working partnerships with West Multnomah Soil and Water Conservation District, City of Portland, Forest Park Conservancy, Trout Mountain Forestry and Portland Audubon, among other groups to support the restoration and recreational uses envisioned in the Master Plan. The North Tualatin Mountains have already benefitted from a community planting event conducted by Self Enhancement Inc. and the Northwest Trail Alliance. This policy is supported.

*Policy 5.4 Review Goal 5 inventories and programs periodically in order to consider any new data and, if necessary, initiate amendments to the inventories and protection programs.*

**Finding:** This is a directive to the County to review Goal 5 inventories and amend as necessary. The policy is not applicable.

### ***Water Quality and Erosion Control***

*Policy 5.5 Protect the County's water quality by adopting standards to protect the water quality resources from the impacts of development.*

**Finding:** In implementing the North Tualatin Mountains Master Plan, Metro intends on protecting significant sections of four streams and associated riparian forest habitat. The sites also protect headwater areas of McCarthy, Ennis, and North Abbey creeks.

Burlington Creek, Ennis Creek and several unnamed streams flow eastward through steep valleys to the base of the ridge. At Ennis Creek, the Multnomah Channel flows along the base of the ridge. The roughly 400-acre J.R. Palensky Wildlife Mitigation Area (Burlington Bottoms), owned by the Bonneville Power Administration (BPA) and managed by Oregon Department of Fish and Wildlife (ODFW), lies at the base of Burlington Creek Forest.

Ennis Creek and its many unnamed tributaries occupy the southern half of the Ennis Creek Forest site. The southern half of Ennis Creek Forest is less steep, and field observations indicate that the area appears to have wetter soils and, potentially, a higher likelihood of forested wetlands.

McCarthy Creek drains a 400-acre area bounded by Skyline on the south and McNamee on the east. With over five miles of main stem and tributaries, the natural area protects about a third of the watershed of McCarthy Creek. Existing roads, developed for logging, are in various conditions including a north – south running road that crosses many small drainages and has experienced road slumps and culvert failures. Current plans call for culvert repairs and decommissioning roads north of the loop road.



North Abbey Creek Forest is the only one of the four sites located in the Tualatin River Watershed. The northern part of the site protects headwaters of North Abbey Creek, which flows through a steep ravine along the length of the eastern site boundary.

Large conifers and down wood have been removed from many of the North Tualatin riparian areas, resulting in incised (eroded) stream channels and slumping stream banks. Old logging roads are a significant source of sediment in North Tualatin Mountain's streams. Sediment harms water quality and degrades amphibian and fish habitat. Water quality is also threatened by the many culverts found on-site; old and under-sized, they block wildlife movement and increase the risk of culvert failure and stream sedimentation. Specific Metro activities to protect and improve water quality are discussed in Chapter 3 of the Master Plan.

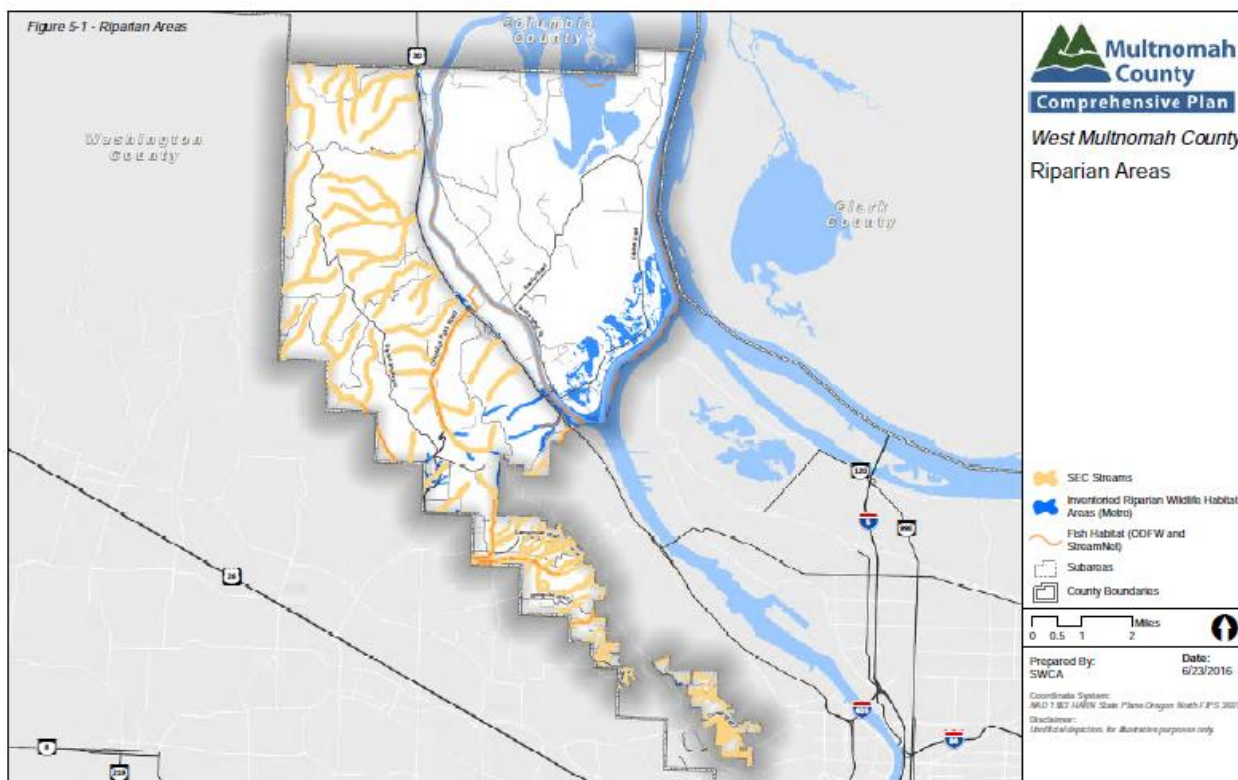
*Policy 5.6 Protect vegetated riparian corridors in order to maintain their water quality functions including the following:*

- 1. Providing shade to maintain or reduce stream temperatures to meet state water quality standards;*
- 2. Supporting wildlife in the stream corridors;*
- 3. Minimizing erosion, nutrient, and pollutant loading into water;*
- 4. Maintaining natural hydrology; and*
- 5. Stabilizing slopes to prevent landslides that contribute to sedimentation of water.*

**Finding:** The subject properties include stream and tributaries identified in County SEC overlays (water, wildlife, hillside, and scenic), including very important headwater holdings. The property was purchased by Metro and Master Planned because it represents a significant natural area that was in large part mismanaged or under threat of uses that are incompatible with the natural resource potential for the property.



**Figure 10 Riparian Areas**



Metro’s Master Plan understands the importance these stream and tributaries play in protecting water quality, ecological function, and wildlife and fishery habitat. As described above, the Master Plan represents a science/conservation based approach to land management. Only those areas deemed appropriate and supportive of recreational uses have been planned for such. Trail development will occur only on existing roads or otherwise where trails are appropriate. Applicant, and its team of scientists and geotechnical engineers have studied the site and alternative trail layouts. The preferred alternatives for trail development represent the best balance between restoring and promoting natural conditions and permitting limited recreational access. Elsewhere, the large forest tracts and headwater holdings are being managed for water quality and erosion control.

Historically, the North Tualatin Mountains were dominated by upland forest, described as mosaic mixed conifer forest with mostly deciduous understory. The natural area may have included Douglas fir, western hemlock, red cedar, grand fir, bigleaf maple, yew, dogwood, white oak, red alder. Historic burns were recorded at the southern half of Burlington and the southern half of North Abbey.

In recent history these lands have been managed primarily for commercial timber harvest and agriculture. Much of the area was logged in the early 1990s. Today, the North Tualatin Mountains natural areas have hundreds of acres of former commercial tree farms dominated by young stands of Douglas fir. As a result, the sites are characterized by upland forest with densely planted Douglas fir trees that are about 20 to 30 years old. Standing dead trees (snags) and downed wood have been removed by previous property owners through clearcut harvesting or other land uses. In implementing the Master Plan and companion Site Conservation Plan, Metro is managing the



forests to reduce the number of conifers per acre, to keep trees healthy, preserve hardwoods and native shrubs, and increase downed dead wood. Several patches of older forest (60 to 80 years old) remain at the southern end of Ennis Creek Forest, and along McCarthy and North Abbey Creeks.

The Site Conservation Plan identifies desired future conditions for riparian and upland forests, upland early successional shrub, and oak savanna. Riparian forests protect water quality and provide important habitat near the headwaters of Burlington, Ennis, and McCarthy Creeks, which flow into the Multnomah Channel, and North Abbey Creek, a tributary of the Tualatin River. Tributary creeks and confluence areas provide clean and cold water, nutrients and refuge areas for important fish species.

Large conifers and downed wood have been removed from many of the North Tualatin Mountains riparian areas, resulting in incised (eroded) stream channels and slumping stream banks. Growing big conifers quickly and adding large wood into streams helps improve stream conditions and water quality. Metro is actively working on stream restoration at North Abbey Creek to help curb stream erosion. This policy is met.

*Policy 5.7 Allow changes to existing development when the overall natural resource value of the property is improved by those changes and water quality will be improved.*

**Finding:** The Master Plan and companion Site Conservation Plan are intended to change existing conditions of the property and vastly improve its overall natural resource value, including water quality. This policy is met.

*Policy 5.8 Support efforts by the Soil and Water Conservation Districts to conduct a public information and assistance program for watershed property owners in management practices that enhance the water quality of streams.*

**Finding:** The Multnomah County Soil and Water Conservation District is a Metro partner and assisting to achieve the objectives outlined in the Master Plan. This policy is supported.

*Policy 5.10 Encourage use of voluntary measures to decrease the negative impacts of agricultural practices upon water quality in area streams.*

**Finding:** Education and land stewardship, including teaching techniques to improve ecological function and improve water quality in area streams is an important part of Metro's mission. Currently, the sites are studied and used for natural resource educational purposes, and will continue to be so. The hope is to lead by example. This policy is supported.

*Policy 5.11 Protect water quality of streams by controlling runoff that flows into them.*

*Strategy 5.11-1: Use hillside development and erosion control standards to control the effects of nonpoint runoff into streams from sources such as roadways, parking areas, and other impervious areas.*

**Finding:** During the access planning process, Metro scientists provided baseline information about current conditions, conservation targets and habitat restoration goals, which in large part were driven by the desire and need to protect and improve water quality of streams. That effort and the desired outcomes are reflected in the Master Plan.



Site transformation starts with a short-term strategy to mitigate degrading conditions and establish an improving trend in ecological function. Examples of stabilization actions include controlling erosion, forest thinning, reforestation, weed abatement, and mitigating stream incision.

To date, vegetation management and site stabilization activities in the North Tualatin Mountains include thinning to improve forest health, which also reduces long-term fuel and fire risk; culvert maintenance to reduce sedimentation; and invasive species management. At all four sites, tree thinning is planned and/or underway, which will help to restore a more complex forest structure, provide a more diverse habitat, and make forests more resilient to disease and wildfire. At Burlington, Ennis, McCarthy and North Abbey creeks, Metro is developing key wildlife habitat features like snags and down dead wood. As stated above, stream restoration is underway at North Abbey Creek.

As an additional example, old logging roads are a significant source of sediment in streams, which harms water quality and degrades fish habitat. Repairing or decommissioning and revegetating old roads reduces the risk of soil erosion and sediment in streams. Many culverts in the North Tualatin Mountains are old and under-sized, blocking wildlife movement and increasing the risk of failure and the amount of sediment into streams, resulting in decreased water quality. Removing or replacing culverts improves water quality and provides better wildlife connectivity. Pursuant to this Master Plan, Metro will decommission unneeded roads and remove or replace undersized and failing culverts. In short, implementing the Master Plan will result in additional work specifically focused on water quality.

With respect to planned recreational access improvements, geotechnical and hydrological reports directed and support Metro's planned visitor access improvements. Those reports, coupled with on-site conditions, dictated where it was and where it was not appropriate to develop infrastructure and trail improvements.

The Master Plan requires and results in new public access in a way that maintains the site's core ecological function by:

- Protecting large blocks of forest and core habitat areas.
- Integrating landscape-level analysis and regional thinking into decision-making about providing access and locating access features.
- Locating new trails where habitat is already fragmented and minimize new fragmentation.
- Providing appropriate setbacks from streams, wetlands, and seasonally wet and sensitive areas.
- Minimizing stream crossings where other routes are possible and using bridges and boardwalks, instead of culverts, where appropriate.
- Avoiding constructing new trails in areas of high natural resource value or high erodibility.
- Using best practices for sustainable trail construction such as cross-slope, rolling grades, and drainage dips to move water off-trail and avoid erosion; and
- Monitoring for water quality and habitat impacts.

*Policy 5.12 Limit visible and measurable erosion from development in substantial compliance with the water quality standards of Title 3 of the Metro Urban Growth Management Functional Plan.*



**Finding:** Erosion is regulated in accordance with standards adopted by Multnomah County and implemented by the County.

*Policy 5.14 Stormwater drainage for new development and redevelopment shall prioritize water quality and natural stream hydrology in order to manage stormwater runoff in accordance with the following:*

- 1. The run-off from the site shall not adversely affect the water quality in adjacent streams, ponds, or lakes, or alter the drainage on adjoining lands, or cause damage to adjacent property or wildlife habitat.*
- 2. Stormwater infiltration and discharge standards shall be designed to protect watershed health by requiring onsite detention and/or infiltration in order to mimic pre-development hydraulic conditions so that post-development runoff rates and volumes do not exceed pre-development conditions.*
- 3. Apply Low Impact Development Approaches (LIDA) in order to conserve existing resources, minimize disturbance, minimize soil compaction, minimize imperviousness, and direct runoff from impervious areas onto pervious areas.*
- 4. Protect and maintain natural stream hydrology (or flow), with an emphasis on reducing hydromodification impacts such as stream incision and widening.*

**Finding:** During the access planning process, Metro scientists provide baseline information about current conditions, conservation targets and habitat restoration goals, which in large part were driven by the desire and need to protect and improve water quality of streams. That effort and the desired outcomes are reflected in the Master Plan.

Site transformation starts with a short-term strategy to mitigate degrading conditions and establish an improving trend in ecological function. Examples of stabilization actions include controlling erosion, forest thinning, reforestation, weed abatement, and mitigating stream incision.

To date, vegetation management and site stabilization activities in the North Tualatin Mountains include thinning to improve forest health, which also reduces long-term fuel and fire risk; culvert maintenance to reduce sedimentation; and invasive species management. At all four sites, tree thinning is planned and/or underway, which will help to restore a more complex forest structure, provide more diverse habitat, and make forests more resilient to disease and wildfire. At Burlington, Ennis, McCarthy and North Abbey creeks, Metro is developing key wildlife habitat features like snags and downed dead wood. As stated above, stream restoration is underway at North Abbey Creek.

As an additional example, old logging roads are a significant source of sediment in streams, which harms water quality and degrades fish habitat. Repairing or decommissioning and revegetating old roads reduces the risk of soil erosion and sediment in streams. Many culverts in the North Tualatin Mountains are old and under-sized, blocking wildlife movement and increasing the risk of failure and the amount of sediment into streams, resulting in decreased water quality. Removing or replacing culverts improves water quality and provides better wildlife connectivity. Pursuant to this Master Plan, Metro will decommission unneeded roads and remove or replace undersized and failing culverts. In short, implementing the Master Plan will result in additional work specifically focused on water quality.



With respect to planned recreational access improvements, geotechnical and hydrological reports directed and support Metro's planned visitor access improvements. Those reports, coupled with on-site conditions, dictated where it was and where it was not appropriate to develop infrastructure and trail improvements.

The Master Plan requires and results in new public access in a way that maintains the site's core ecological function by:

- Protecting large blocks of forest and core habitat areas.
- Integrating landscape-level analysis and regional thinking into decision-making about providing access and locating access features.
- Locating new trails where habitat is already fragmented and minimize new fragmentation.
- Providing appropriate setbacks from streams, wetlands, and seasonally wet and sensitive areas.
- Minimizing stream crossings where other routes are possible and using bridges and boardwalks, instead of culverts, where appropriate.
- Avoiding constructing new trails in areas of high natural resource value or high erodibility.
- Using best practices for sustainable trail construction such as cross-slope, rolling grades, and drainage dips to move water off-trail and avoid erosion; and
- Monitoring for water quality and habitat impacts.

### ***Willamette River Greenway***

*Policy 5.15 Protect, conserve, enhance, and maintain the natural, scenic, historical, agricultural, economic, and recreational qualities of lands along the Willamette River.*

**Finding:** The property is not within the Willamette River Greenway. This policy is not applicable.

### ***Wild and Scenic Waterways***

*Policy 5.16 Protect all state or federal designated scenic waterways from incompatible development and prevent the establishment of conflicting uses within scenic waterways.*

**Finding:** The property is not within a Wild and Scenic Waterway. This policy is not applicable.

### ***Wetlands and Riparian Areas***

*Policy 5.18 Designate as areas of Significant Environmental Concern, those water areas and adjacent riparian areas, streams, wetlands, and watersheds that warrant designation as a protected Goal 5 resource or have special public value in terms of the following:*

*Policy 5.19 Periodically review and consider any new data to update, adjust, and more accurately show riparian corridor centerlines.*

**Finding:** This is a directive to the County. The subject property already includes riparian areas that are designated areas of SEC and Goal 5 resources. These policies are met.



*Policy 5.20 Promote creation of cooperative property owner organizations for the protection of individual streams and their watersheds.*

*Strategy 5.20-1: Encourage these and other organizations, including Soil and Water Conservation Districts, to provide technical assistance and information regarding financial resources to people about best management practices necessary to protect streams and adjoining riparian habitat.*

*Policy 5.21 Provide incentives through the Zoning Code for new development to be compatible with, and enhance, significant streams and adjoining riparian habitat.*

*Policy 5.22 Support and promote enforcement of existing stream protection standards in the Forest Practices Act.*

*Policy 5.23 Promote cooperation with owners throughout the entire watershed, regardless of jurisdictional lines.*

*Strategy 5.23-1: Work cooperatively with the local Soil and Water Conservation Districts and other interested parties in efforts to promote watershed health throughout the entire watershed.*

**Finding:** These policies direct the County to promote riparian and watershed conservation efforts. Metro acquired property in the North Tualatin Mountains in order to: Keep important wildlife and riparian corridors intact; protect upland habitat and headwater areas important to preserving the region's water quality; and provide trail connections between the region's largest urban park and public lands in the Oregon Coast Range. Burlington Creek Forest was slated to become housing prior to its acquisition.

The Master Plan is designed to provide a long-term vision and implementation strategy to guide land management and public use of the North Tualatin Mountains. The plan was developed by land and property managers, landscape architects, scientists, planners, naturalists, project stakeholders, and community participants.

Metro employs a science-based approach to site management and conservation. During the master planning process, Metro scientists provided baseline information about current conditions, conservation targets and habitat restoration goals, guided by conservation biology, site knowledge, and research. External experts also evaluated possible impacts of potential access opportunities. Metro scientists then worked with Metro's planning team to develop access opportunities that are compatible with habitat, wildlife, and water quality goals for the natural area. The process objective was to identify suitable locations and activities for recreation while seeking to stabilize and restore diversity and the ecological health of the site. That objective is achieved in this case.

Supporting the Master Plan will promote these policies.

### ***Riparian Areas***

*Policy 5.24 Balance protection of significant streams with flexibility of use by property owners.*

**Finding:** The Master Plan represents a balance, with the top priority to protect water quality and preserve core habitat areas 30 acres or larger, including upland forests and streams that wildlife depend on for habitat connections. Thereafter, access is envisioned in a way that ensures healthy habitats and meaningful experiences in nature. To do so, the plan:



- Protects and enhances natural and scenic resources by protecting large blocks of forest and core habitat.
- Integrates landscape-level analysis and community desires into decision-making.
- Identifies and accesses the best location for day use and trail heads.
- Utilizes existing road and trails and locates new trails where habitat is already fragmented while minimizing new fragmentation.
- Employs sustainable trail construction techniques.
- Provides safe ingress and egress and internal movement of vehicles and pedestrians.
- Is designed consistent with the surrounding landscape and uses and in a scale and character that the community supports.
- Requires continuing monitoring of water quality and habitat impacts and the flexibility to make adjustment if needed.

Metro envisions visitor improvements at two of the four sites: initially at Burlington Creek Forest and subsequently, and minimally, at McCarthy Creek Forest. The location and extent of envisioned improvements were dictated by site conditions, including existing roads, trails and sensitive areas, as well as site limitations, including fairly steep topography and forested hillsides, which are typical of the surrounding landscape. Ennis Creek Forest and North Abbey Creek Forest will remain natural areas, with the exception of the future Pacific Greenway Trail envisioned through Ennis Creek Forest.

All four sites are significantly altered and damaged by prior land management activities. Site stabilization and restoration work at all four sites has already begun in earnest. Activities include invasive weed control, thinning, planting native plants and trees, erosion control, culvert repair, road maintenance (including decommissioning), and stream improvements. The land management activities also reduce long-term fuel and wildfire risk and make the forest more resistant to disease. Metro has working partnerships with West Multnomah Soil and Water Conservation District, City of Portland, Forest Park Conservancy, Trout Mountain Forestry and Portland Audubon to support this and future work.

Metro's restoration work and long-term management strategy includes identifying and reducing fire risks where possible. An Incident Action Plan is developed for each site that includes information to assist Metro and cooperating agencies responding to a fire on Metro property. Incident Action Plans will be developed for both Burlington and McCarthy prior to implementing formal public access. Metro follows the Oregon Department of Forestry Industrial Fire Precaution Levels and restrictions, and may close areas in very high fire conditions, may prevent certain activities, and will work with local fire prevention and suppression agencies.

Site rehabilitation and management is pursuant to a Site Conservation/Restoration Plan, produced by Metro, which continues restoration aims to protect and enhance the North Tualatin Mountain's natural and scenic resources and to create a place for wildlife to thrive. *See Exhibit 3.* Metro is committed to engaging in sustainable forestry practices, including restoring old-growth habitat, increasing the biodiversity of forests through selective harvesting, management and plantings, preserving connectivity, supporting wildlife, and protecting clean water. Unneeded roads will be decommissioned.



In planning for access, five potential entry locations (at least one at each of the four forests) were evaluated to understand the feasibility of providing safe ingress and egress. While the five locations were all determined to be feasible, the location, site conditions, conservation goals, and the varying degree of improvements needed to provide safe and sufficient access dictated which access opportunities were most appropriate. Other specific considerations given were trail construction feasibility, stakeholder and community input, and the access objective - providing opportunities for meaningful experiences of nature. Knowing that people experience and connect with nature in many different ways, Metro sought to provide welcoming entries; provide a system of trails that serve appropriate multiple uses and trail users of differing abilities; provide access to viewpoints and key natural features; promote visitor safety; and reduce and mitigate potential impacts on the surrounding community; among others.

The two plus year process resulted in the preferred alternative represented in the Master Plan.

### ***Fish and Wildlife Habitat***

*Policy 5.26 Designate as areas of Significant Environmental Concern, those habitat areas that warrant designation as a protected Goal 5 resource or have special public value in terms of the following:*

**Finding:** This is a directive to the County. The subject property already includes habitat that are designated areas of SEC. This policy is met.

*Policy 5.27 Protect significant native fish and wildlife habitat and wildlife corridors and specifically limit conflicting uses within these habitats and sensitive big game winter habitat areas.*

**Finding:** Historically, the North Tualatin Mountains were dominated by upland forest, described as a mosaic mixed conifer forest with mostly deciduous understory. The natural area may have included Douglas fir, western hemlock, red cedar, grand fir, bigleaf maple, yew, dogwood, white oak, and red alder. Historic burns were recorded at the southern half of Burlington and the southern half of North Abbey.

In recent history these lands have been managed primarily for commercial timber harvest and agriculture. Much of the area was logged in the early 1990s. Today, the North Tualatin Mountains natural areas have hundreds of acres of former commercial tree farms dominated by young stands of Douglas fir. As a result, the sites are characterized by upland forest with densely planted Douglas fir trees that are about 20 to 30 years old. Standing dead trees (snags) and downed wood have been removed by previous property owners through clearcut harvesting or other land uses. Metro is actively managing the forests to reduce the number of conifers per acre, to keep trees healthy, preserve hardwoods and native shrubs, and increase downed dead wood. Several patches of older forest (60 to 80 years old) remain at the southern end of Ennis Creek Forest, and along McCarthy and North Abbey Creeks.

Open areas exist in places that had been cleared for pasture, agriculture or home sites. In addition, power line corridors runs generally north-south the length of Burlington Creek and Ennis Creek Forest sites.

The open areas provide opportunities for shrub dominated plant communities which provide important feeding and breeding habitat for neotropical migrant birds as well as other wildlife. Metro has maintained some existing open areas by controlling tree encroachment.



The Site Conservation Plan identifies desired future conditions for riparian and upland forests, upland early successional shrub, and oak savanna.

**Upland Forest:** Upland forests are composed primarily of native trees and shrubs such as Douglas fir, big-leaf maple, Oregon grape, salal and sword fern. The upland forest is especially important to migrating and nesting songbirds, woodpeckers, mammals such as Douglas squirrel and deer, and as seasonal habitat for salamanders, frogs and turtles. Urbanization has fragmented and reduced the amount of upland forest.

**Riparian Forests:** Riparian forests protect water quality and provide important habitat near the headwaters of Burlington, Ennis, and McCarthy Creeks, which flow into the Multnomah Channel, and North Abbey Creek, a tributary of the Tualatin River. Tributary creeks and confluence areas provide clean and cold water, nutrients and refuge areas for important fish species.

**Upland Early Successional Shrub:** Shrub dominated communities provide food and cover for neotropical migrant songbirds and create habitat for a variety of pollinator species. Small scale agricultural sites, recently logged areas, and utility clearings are opportunities to manage for early successional upland forest shrubs.

**Oak Savanna:** Oak savanna and oak woodlands harbor many unique plant and animal species. Once common, such habitats are now rare in our region.

In general, Metro manages for habitat conditions rather than targeting individual species. Exceptions are made when the needs of a high-priority species are not addressed via habitat-level approaches. Partners and community members have expressed particular interest or concern about several species known or thought to occur on-site. Following is a brief summary of key species considerations and how they have informed this plan.

No sensitive big game habitat is present. Elk are found throughout areas in and around the North Tualatin Mountains. The North Tualatin Mountains herd is part of the Willamette Unit, which is an ODFW “de-emphasis area.” Because of this, ODFW allows a longer hunting season and has more liberal tag regulations, including not tracking bull to cow ratios. Although the elk are born and raised around humans, and are relatively acclimated to some human activity, trail development at Burlington and McCarthy may change their movement patterns. That said, according to ODFW, available forage, especially grass, is one of the biggest issues limiting Elk in the North Tualatin Mountains; fragmented habitat has a lesser impact.

According to observations of the North Tualatin Mountains as a whole, elk frequent several meadows in the area and migrate between these sites and into Forest Park. Given that these elk move within a relatively large area, frequently cross busy roads, and use backyards and farm fields, an increase in human use of a small portion of the North Tualatin Mountains sites is not likely to cause significant effects on the elk population.

Elk are charismatic and great to see along the Tualatin Mountains Ridge. Through this planning process, participating community members have expressed how important this herd of elk is to people who live in the area. For this reason, the Master Plan was amended to minimize disturbances to local elk movement.

*Policy 5.28 Establish a Wildlife Advisory Committee to advise the County about matters under its jurisdiction and control that may affect wildlife.*

*Policy 5.29 Develop and implement a bird-friendly building policy for new buildings.*



*Policy 5.30 Encourage and promote bird-friendly building practices.*

*Policy 5.31 Protect significant forested wildlife habitat areas through large-lot zoning and educational programs.*

*Policy 5.32 Provide incentives through the zoning code for new development to be compatible with and to enhance wildlife habitat.*

**Finding:** Policies 5.28, 5.29, 5.30, and 5.31 all direct the County to take certain actions. They are not applicable.

*Policy 5.33 Balance protection of wildlife habitat with flexibility of use by property owners.*

**Finding:** As the Comprehensive Plan recognizes, balancing recreational uses with resource management and the protection of natural resources is a main objective in any planning effort, including that represented in Metro's Master Plan.

Metro properties, as represented in the North Tualatin Mountains Master Plan, are critical to the area retaining scenic views, forest health, and natural resource and habitat protections. The Master Plan favors conservation and promoting habitat and water quality, while permitting limited recreation in areas that can safely and efficiently be served.

The Master Plan was developed through a lengthy and involved public process that included stakeholders and community members representing the West Hills. If Metro is permitted to implement the Master Plan, it will improve the forest health of over 1,300 acres, promote wildlife and riparian habitat and function, and provide additional recreational opportunities for multiple users and abilities.

*Policy 5.34 Work with State and local agencies, Soil and Water Conservation Districts, and other public and private conservation groups to protect high value habitat such as, but not limited to, oak woodlands, bottomland cottonwood/ash forests, and old growth forests.*

**Finding:** Metro has working partnerships with West Multnomah Soil and Water Conservation District, City of Portland, Forest Park Conservancy, Trout Mountain Forestry and Portland Audubon, among other groups to support the restoration and recreational uses envisioned in the Master Plan. With the County's support of Metro's Master Plan, this policy can be met.

*Policy 5.35 Work with and coordinate with the Oregon Department of Fish and Wildlife (ODFW), local Soil and Water Conservation Districts, and other agencies or organizations authorized by the State to administer the Wildlife Habitat tax deferral programs for lands that are eligible by administrative rule or statute.*

*Policy 5.36 Explore amendments to the Significant Environmental Concern overlay for wildlife habitat (SEC-h) to limit the size and building footprint of houses in order to minimize harm to wildlife habitat in significant habitat areas.*

**Finding:** Policies 5.35 and 5.36 direct the County to take certain actions concerning taxes and code amendments. They are not applicable.

*Policy 5.37 Encourage educational programs regarding the maintenance and restoration of wildlife habitat, including programs addressing:*

1. *Maintenance and restoration of wildlife corridors.*



2. *Restoration and enhancement of wetlands, riparian areas, and grasslands.*
3. *Planting of native vegetation hedgerows.*
4. *Conserving Oregon white oak habitat and bottomland cottonwood/ash forests.*
5. *Use of wildlife-friendly fencing.*

**Finding:** Education and land stewardship, including teaching techniques to improve conservation values, ecological function and improve water quality in area streams, are an important part of Metro's mission. Currently, the sites are studied and used for natural resource educational purposes, and will continue to be so.

Since 2014, Metro has partnered with the non-profit Self Enhancement Inc. (SEI) to connect hundreds of at-risk youth of color with nature programming at North Tualatin Mountains' North Abbey Creek and McCarthy Creek sites. During the park planning process, SEI youth were exposed to nature education and conducted a joint planting party with the Northwest Trail Alliance. Unfortunately Burlington Creek Forest, in its current state, is not feasible for programming with youth as young as middle school age due to the lack of infrastructure such as formal parking, restrooms, shelter and wayfinding. Until such features are in place, SEI program opportunities will be limited to short-duration visits focused on high school students. Outreach to and partnerships with marginalized communities for nature education and engagement will expand once trail construction is completed.

Metro's Youth Ecology Corps (YEC) program provides diverse and marginalized youth a pathway towards meaningful work in conservation through leadership development and deepening their connections with nature. The YEC is a partnership between Metro and Project Youth Employability Support Services (Project YESS) to provide youths aged 16 to 21 in Multnomah County with paid work opportunities in habitat restoration, conservation education and workforce development. The YEC is designed to serve low-income, at-risk, disconnected youths. Since project inception in 2014, thirty-five youth have participated in Metro's YEC program with 60% of the participants identifying as persons of color.

Crew members do important work in Metro's parks and natural areas to improve water quality, restore native plant communities, create wildlife habitat and enable public access to nature by building site improvements such as trails. Conservation education includes collecting data for science projects and having fun outdoors, all while exploring some of Oregon's most beautiful places. Crew members gain valuable skills learning how to get a job and gain real experience, potentially opening doors towards careers in the outdoors.

YEC crews have worked with Metro Natural Resource Specialists at the North Tualatin Mountains. Site restoration work already completed by the YEC crew includes removal of invasive plants and monitoring of native plant species.

While Metro intends to use a professional contractor to build the proposed trails at Burlington, finding opportunities for disadvantaged youth to work with professionals is a priority. Trail building at Burlington Creek Forest is an ideal candidate for a YEC project. Working alongside professional contractors helps YEC youth develop skills and build relationships that could lead to future employment opportunities.

The hope is to lead by example. With the County's support of Metro's Master Plan, this policy can be met.



## **Scenic Views and Sites**

*Policy 5.38 Conserve scenic resources and protect their aesthetic appearance for the enjoyment of future generations.*

*Policy 5.39 Balance protection of scenic views with flexibility of use by property owners.*

**Finding:** Although the Burlington Creek Forest is within the SEC-scenic view overlay, the access road, vault toilet, and related amenities are planned and topographically screened. As such, they will not be visible in the range's view shed, up from the river. The restoration and reforestation activities to be implemented through the Master Plan will promote greenery and support the view shed, as compared to clearcuts and potential housing and residential development that threatened before Metro's acquisition.

Also, access improvements will provide and encourage access to scenic vistas, allowing County citizens to enjoy its land and sense of place. This policy is met.

## **Tree Protection**

*Policy 5.40 In order to minimize the detrimental environmental impacts and habitat fragmentation of extensive tree removal around structures, development, landscaping, and yard areas, amend the Significant Environmental Concern overlay zones to require replanting of trees, in areas where tree removal has occurred, consistent with County fire-safety standards and legitimate farm uses.*

**Finding:** Policy 5.40 directs the County to take certain actions concerning code amendments. It is not applicable.

## **Air Quality, Noise, and Lighting Impacts**

*Policy 5.41 Cooperate in the development and implementation of regional efforts to maintain and improve air and water quality and reduce noise impacts.*

**Finding:** Policy 5.41 directs the County to cooperate in regional efforts to maintain and improve air and water quality. By supporting Metro's Master Plan, the County will be supporting a substantial effort to protect and improve significant watershed and promote both air and water quality throughout 1,300 acres of the North Tualatin Mountains.

*Policy 5.42 If a land use proposal is a noise-sensitive use and is located in a noise-impacted area, or if the proposed use is a noise generator, the development must meet the following:*

- 1. Building placement on the site must be in an area having minimal noise level disruptions to reduce impacts from surrounding noise generators if the use is a noise-sensitive use, or to minimize impacts on surrounding uses if the use is a noise generator.*
- 2. Building insulation or other construction techniques must be used to lower interior noise levels in noise-impacted areas.*

**Finding:** No noise sensitive use or noise impacted area is involved in this application. This policy is not applicable. Much of what is proposed in the Master Plan are forestry practices. Any future development will be limited. Noise impacts may occur briefly during constructing parking facilities at Burlington and potentially further in the future at McCarthy. However, the proposed facilities are in the interior of large acreage wooded properties which shield the surrounding area from any noise that may emanate from the site.



*Policy 5.43 Require outdoor lighting to be low intensity and designed in a manner that minimizes the amount of light pollution.*

**Finding:** Light fixtures may be included in the trailhead development plans. Any lighting will be dark skies compliant. Compliance with policy will be ensured through the land development process.

### ***Wilderness Areas***

*Policy 5.44 Recognize the value of wilderness among the many resources derived from public lands.*

**Finding:** Although the property has the potential for and will be managed for wilderness/old growth like attributes, the wilderness classification is a federal classification. Like wilderness throughout the state, the appropriate balance between habitat preservation and recreational use is achievable and represented in the Master Plan.

### ***Mineral and Energy Resources***

*Policy 5.45 Protect sites required for generation of energy.*

*Policy 5.46 Protect and ensure appropriate use of mineral and aggregate resources of the County and minimize conflicts between surface mining activities and surrounding land uses.*

**Finding:** The subject property is not necessary for energy resources. However, a gravel mining operation does exist north of Ennis Creek. Ennis Creek is master planned for forestry uses and restoration activities which have no impact on the operation.

## **Chapter 6 Historic and Cultural Resources**

**Goal:** *To protect cultural resources and conserve and restore historic resources.*

*Policy 6.1 Recognize significant historic resources and apply appropriate historic preservation measures to all designated historic sites.*

**Finding:** The subject property is not a significant historic resource or designated historic site. This policy does not apply or is otherwise met.

*Policy 6.2 Protect cultural areas and archaeological resources and prevent conflicting uses from disrupting the educational and scientific value of known sites.*

*Strategy 6.2-1: Maintain information on file regarding the location of known archaeological sites, to the extent permissible by law. Although not made available to the general public, this information will be used to ensure the sites are not degraded through incompatible land use actions.*

*Strategy 6.2-2: Coordinate with the State Historic Preservation Office regarding the identification and recognition of significant archaeological resources.*

*Strategy 6.2-3: Encourage landowners to notify state authorities upon discovering artifacts or other evidence of past cultures on their property.*

*Policy 6.3 Coordinate with Native American tribes and the Oregon State Historic Preservation Office (SHPO) to adopt a program to inventory, recover, and protect archaeological and cultural*



*resources and prevent conflicting uses from disrupting the scientific value of known sites. Adopt a process that includes timely notice to tribes and SHPO of applications that could impact cultural resource sites, and develop standards to evaluate comments received from the tribes and SHPO.*

*Policy 6.4     Require reporting of the discovery of Native American artifacts and other cultural resources to SHPO and the Native American tribes.*

*Policy 6.5     Where development is proposed on areas of cultural significance, require evaluation of alternative sites or designs that reduce or eliminate impacts to the resource.*

**Finding:** There are no known cultural areas or archaeologically significant findings on the subject property. The landscape is largely disturbed by land management and forestry practices.

However, in furtherance of this policy and Metro's respect of native American cultural, Metro intends on requiring all development activities to abide by an inadvertent discovery plan which requires contractors to follow protocols and take specific action in response to any discovery or potential discovery of cultural or archaeological resources or human remains. Included is notification to SHPO and tribes. This policy is met.

## **Chapter 7   Natural Hazards**

**Goal:** *To reduce impacts to people, property, structures, and natural resources from natural hazards such as erosion, flooding, landslides, earthquakes and wildfires.*

### ***Areas Susceptible to Landslide***

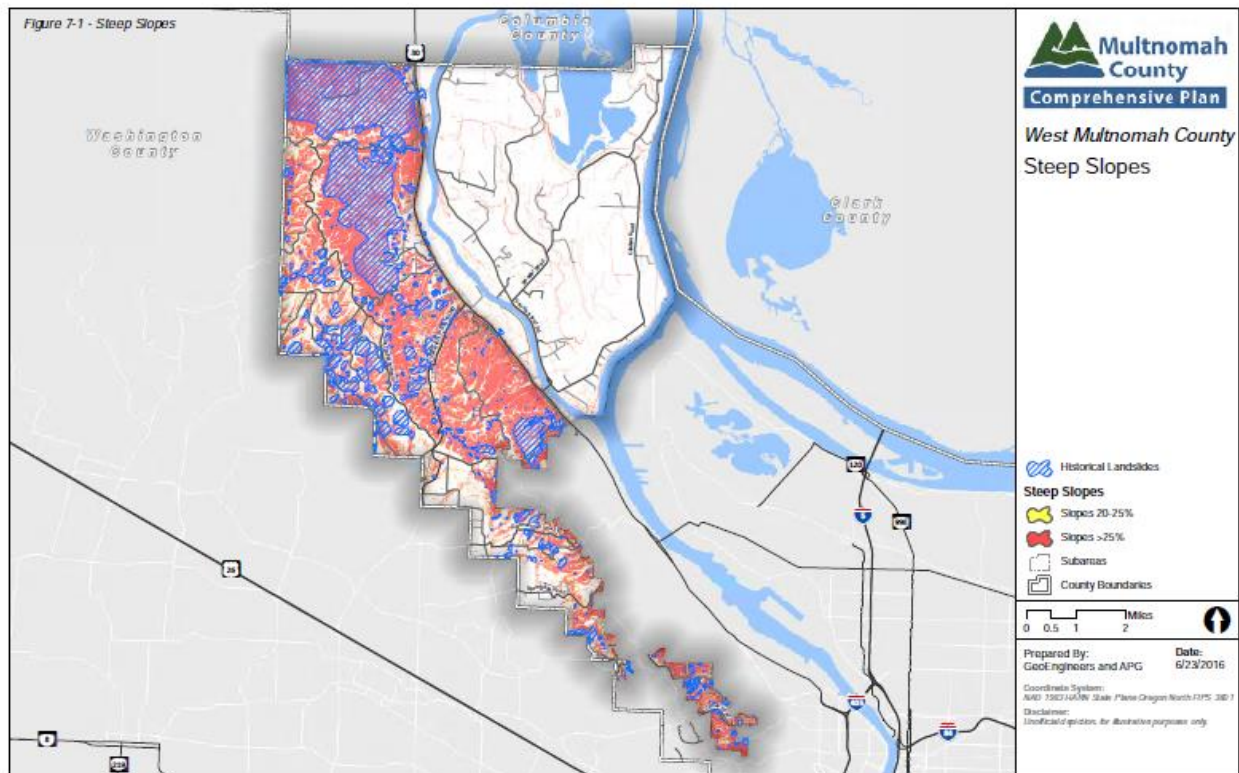
*Policy 7.1     Direct development and landform alterations away from areas with development limitations related to potential hazards associated with steep slopes (over 25%) and other areas shown to be potentially susceptible to landslides or their impacts based on available County and state data associated with these hazards. Allow for exceptions based upon a showing that design and construction techniques can prevent or mitigate public harm or associated public cost and prevent or mitigate adverse effects to nearby properties.*

*Policy 7.2     Protect lands having slopes greater than 25% and lesser slopes shown to be potentially susceptible to landslides from inappropriate development or slope alteration. Consider possible adverse effects on nearby homes and public and private infrastructure.*

**Finding:** The subject four forests include areas of steep slopes and some evidence of historical slumping, however, most of the historical landslide activity is documented north of Cornelius Pass Road.



**Figure 11 Steep Slopes Map**



Landslide risks are minimized through application of the County's Hillside Development (HD) overlay zone and code provisions. The HD zone includes a number of requirements related to the assessment and documentation of risk and restrictions on development where slopes exceed 25%. Where slopes exceed 25%, property owners are required to obtain a report and recommendations from a geotechnical professional, documenting the risks associated with potential landslides and measures that can be taken to mitigate those risks. Metro has undertaken that effort with respect to its planned Burlington Creek Forest visitor improvements. See Exhibit 4. All future parking lot and trail construction activities will require a Grading and Erosion Control permit and satisfaction of all applicable standards intended to minimize risks and potential damage associated with steeper slopes. The recommendations of the Geotechnical Engineer will be followed. The Geotechnical Engineer concluded that the areas proposed for parking and trail improvements are topographically suitable for the proposed uses. These policies are and will be met.

### **Earthquake Hazards**

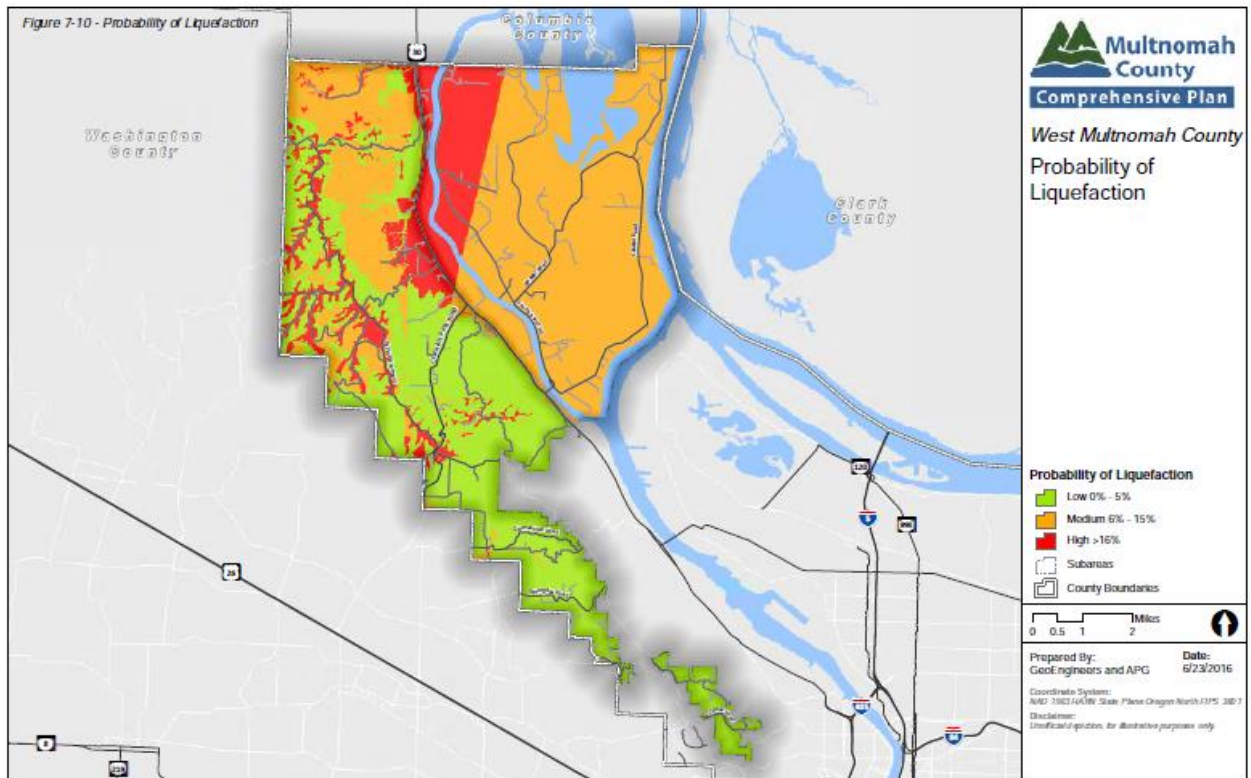
*Policy 7.3 Direct development away from areas with hazards associated with potential liquefaction resulting from major earthquakes.*

*Policy 7.4 Protect against seismic hazards to structures and ground areas susceptible to earthquake damage.*

**Finding:** Although the entire regional area is at risk from an earthquake, the subject properties are at a low risk of liquefaction. Additionally, only limited ground level uses are contemplated in the Master Plan. These policies are met.



**Figure 12 Liquefaction Map**



## ***Flooding***

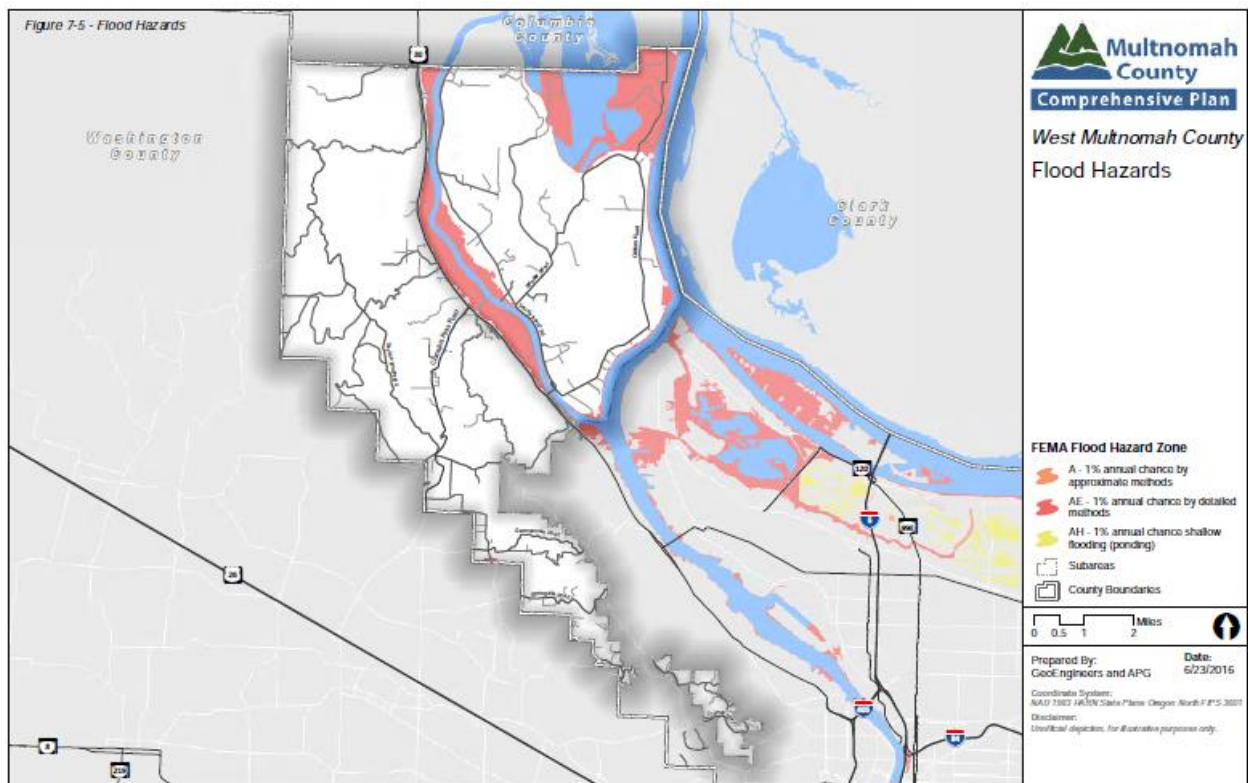
*Policy 7.5 Regulate flood management areas in order to reduce the risk of flooding, prevent or reduce the risk to human life and property, and maintain functions and values of floodplains such as allowing for the storage and conveyance of stream flows through existing and natural flood conveyance systems.*

*Policy 7.6 Reduce potential hazards related to flooding and channel migration through the following strategies:*

**Finding:** The subject property and application do not include flood hazard property. These policies are not applicable.



**Figure 13 Flood Hazards Map**



## Wildfire Risks

**Policy 7.7** Require development in areas prone to wildfire risks to meet fire safety and mitigation standards.

*Strategy 7.7-1: Use current mapping data related to wildfire risk in determining the location of fire prone areas, supplemented by onsite assessments, if needed.*

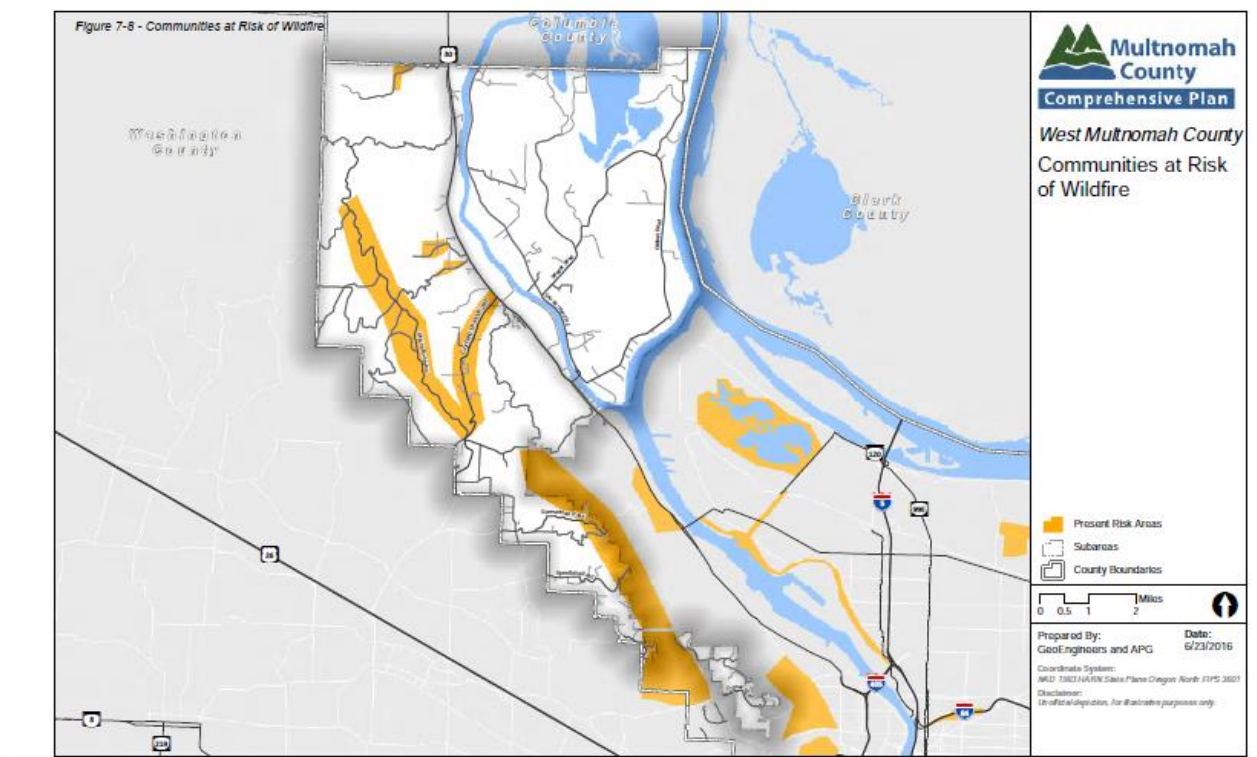
*Strategy 7.7-2: To reduce wildfire risk and associated impacts while protecting wildlife habitat, expand requirements to areas identified as prone to wildfires but not currently subject to regulations after revising standards to better ensure wildlife habitat compatibility. Weigh and balance wildlife habitat needs with effective wildfire risk reduction.*

*Strategy 7.7-3: Ensure that agencies responsible for fire protection are provided an opportunity to comment on development applications prior to approval of the application.*

**Finding:** Most of the property which is the subject of the Master Plan is outside of the area identified on the communities at risk of wildfire map. However, the West Hills community would be impacted by any wildfire on public or private land within the mountain range.



**Figure 14 Communities at Risk of Wildfire**



As such, Metro's restoration work and long-term management strategy include identifying and reducing fire risks where possible. Forest management actions include promoting old-growth conditions, significant thinning and removing fuels, all of which mitigate fire risks. Also, an Incident Action Plan is developed for each site that includes information to assist Metro and cooperating agencies responding to a fire on Metro property. Incident Action Plans will be developed for both Burlington and McCarthy prior to implementing formal public access. Metro follows the Oregon Department of Forestry Industrial Fire Precaution Levels and restrictions, and may close areas in very high fire conditions, may prevent certain activities, and will work with local fire prevention and suppression agencies.

If development is proposed as contemplated in the Master Plan, applicant will be required to demonstrate compliance with fire setbacks and other mitigation standards. The only building planned is a concrete, non-flammable vault toilet. At the time of the development proposal, additional participation from affected firefighting agencies will be solicited and obtained. This policy is met.



## **Chapter 8 Parks and Recreation**

**Goal:** *To help meet the recreational needs of Multnomah County rural residents and visitors to its rural areas through support of, and coordination with local, regional, state, and federal agencies that manage recreation facilities and sites within the County.*

**Policy 8.1** *Support efforts of the Intertwine Alliance, Metro, and other organizations in establishing a coordinated approach to create and maintain a strong, interconnected regional network of parks, trails, and natural areas.*

**Policy 8.2** *Encourage the development of recreation opportunities by public agencies and private entities consistent with wildlife habitat and wildlife corridor protection.*

**Policy 8.3** *Coordinate with other agencies in strategically siting new public recreational facilities to take advantage of existing infrastructure that allow for multi-modal access opportunities and shared parking. An example would be joint use of park and school facilities by locating them adjacent, or close, to each other.*

**Policy 8.4** *Ensure that the residents of areas outside of the urban growth boundary are represented on parks and open space issues.*

**Policy 8.5** *Consider the impacts of proposed recreation facilities on nearby private properties and require applicants to avoid and minimize significant adverse impacts to nearby properties.*

**Finding:** Multnomah County does not own or manage any parks or recreational facilities. The County relies on a variety of other private organizations, local, regional, state, and federal agencies, including Metro, to provide for a wide range of natural areas, parks, and recreational activities to serve County residents.

Metro is a regional government agency serving Multnomah County residents and the greater Portland area. Metro, as a parks service provider, has its roots in Multnomah County and the County's park system. In 1995, Metro assumed ownership and operation of a number of park and recreational facilities previously owned and operated by the County, including Oxbow Regional Park, Blue Lake Regional Park, Glendoveer Golf Course and Fitness Trail, Howell Territorial Park, Gleason Memorial Boat Ramp, Broughton Beach, Chinook Marine Facility, historic cemeteries, and a number of other facilities. Metro also owns and manages a number of natural areas and nature preserves in Multnomah County which are managed to protect water quality, promote fish and wildlife habitat, and provide access to nature. Metro's facilities provide a diverse range of outdoor recreational opportunities and experiences, including boating, hiking, bicycling, horseback riding, bird watching, and general scenic and recreational access.

Today, Metro Parks and Nature protects water quality, fish and wildlife habitat and creates opportunities to enjoy nature close to home through a connected system of parks, trails and natural areas. Connecting with nature provides physical, mental, spiritual, and economic benefits for the County's residents.

In 2013, voters approved a five-year levy to help care for regional parks and natural areas. As a result, Metro is restoring habitat, and expanding opportunities to experience and learn about nature throughout Multnomah County. Roughly half of all levy funds go toward land restoration and management, including controlling invasive plants, planting native species, and improving habitat for fish and wildlife. The remainder of the levy pays for park maintenance and improvements, volunteer programs, conservation education, community grants and natural area



improvements for visitors. The 2013 levy specifically identified sites in the North Tualatin Mountains as opportunities to provide access to nature.

Metro acquired property in the North Tualatin Mountains in order to: Keep important wildlife and riparian corridors intact; protect upland habitat and headwater areas important to preserving the region's water quality; and provide trail connections between the region's largest urban park and public lands in the Oregon Coast Range. Burlington Creek Forest was slated to become housing prior to its acquisition.

The Master Plan is designed to provide a long-term vision and implementation strategy to guide land management and public use of the North Tualatin Mountains. *See Exhibit 2.* The plan was developed by land and property managers, landscape architects, scientists, planners, naturalists, project stakeholders, and community participants.

Metro employs a science-based approach to site management and conservation. During the master planning process, Metro scientists provided baseline information about current conditions, conservation targets and habitat restoration goals, guided by conservation biology, site knowledge, and research. External experts also evaluated possible impacts of potential access opportunities. Metro scientists then worked with Metro's planning team to develop access opportunities that are compatible with habitat, wildlife, and water quality goals for the natural area. The process objective was to identify suitable locations and activities for recreation while seeking to stabilize and restore diversity and the ecological health of the site. That objective is achieved in this case.

The final product and public improvements contemplated are the result of over two years of significant public outreach effort, including community meetings, public open houses, surveys, and outreach. The project stakeholders were Laurel Erhardt, Skyline Ridge Neighbors; Brad Graff, Skyline Ridge Neighbors; Jerry Grossnickle, Forest Park Neighborhood Association; Andy Jansky, Northwest Trail Alliance; Shawn Looney, West Multnomah Soil and Water Conservation District; Renee Myers, Forest Park Conservancy; Travis Neumeyer, Trackers Earth; Jinnet Powell, Skyline School; Emily Roth, Portland Parks & Recreation; Jim Thayer, Oregon Recreation Trails Advisory Committee; Roger Warren, Oregon Department of Forestry; and, Susan Watt, Skyline Ridge Neighbors. Metro received hundreds of comments, ranging from wanting to keep all four sites completely closed to public access, to wanting extensive trails and other improvements across all four sites.

The plan establishes project goals and objectives, outlines site resources and conditions, and summarizes the planning process. Employing principles of landscape ecology and landscape-level design strategies, the plan identifies access locations and approximate trail locations. It also presents a general plan for development of trailheads and strategies for implementing future development.

The Master Plan represents a balance, with the top priority to protect water quality and preserve core habitat areas 30 acres or larger, including upland forests and streams that wildlife depend on for connections between Forest Park and the Coast Range. Thereafter, access is envisioned in a way that ensures healthy habitats and meaningful experiences in nature. To do so, the plan:

- Protects and enhances natural and scenic resources by protecting large blocks of forest and core habitat;
- Integrates landscape-level analysis and community desires into decision-making;
- Identifies and accesses the best location for day use and trail heads;



- Utilizes existing road and trails and locates new trails where habitat is already fragmented while minimizing new fragmentation;
- Employs sustainable trail construction techniques;
- Provides safe ingress and egress and internal movement of vehicles and pedestrians;
- Is designed consistent with the surrounding landscape and uses and in a scale and character that the community supports; and
- Requires continuing monitoring of water quality and habitat impacts and the flexibility to make adjustments if needed.

Metro envisions visitor improvements at two of the four sites: initially at Burlington Creek Forest and subsequently, and minimally, at McCarthy Creek Forest. The location and extent of envisioned improvements were dictated by site conditions, including existing roads, trails and sensitive areas, as well as site limitations, including fairly steep topography and forested hillsides, which are typical of the surrounding landscape. Ennis Creek Forest and North Abbey Creek Forest will remain natural areas, with the exception of the future Pacific Greenway Trail envisioned through Ennis Creek Forest.

All four sites are significantly altered and damaged by prior land management activities. Site stabilization and restoration work at all four sites have already begun in earnest. Activities include invasive weed control, thinning, planting native plants and trees, erosion control, road maintenance (including decommissioning), and stream improvements. The land management activities also reduce long-term fuel and wildfire risk and make the forest more resistant to disease. Metro has working partnerships with West Multnomah Soil and Water Conservation District, City of Portland, Forest Park Conservancy, Trout Mountain Forestry and Portland Audubon to support this and future work.

Metro's restoration work and long-term management strategy includes identifying and reducing fire risks where possible. An Incident Action Plan is developed for each site that includes information to assist Metro and cooperating agencies responding to a fire on Metro property. Incident Action Plans will be developed for both Burlington and McCarthy prior to implementing formal public access. Metro follows the Oregon Department of Forestry Industrial Fire Precaution Levels and restrictions, and may close areas in very high fire conditions, may prevent certain activities, and will work with local fire prevention and suppression agencies.

Site rehabilitation and management is pursuant to a Site Conservation/Restoration Plan, produced by Metro, which continues restoration aims to protect and enhance the North Tualatin Mountain's natural and scenic resources and to create a place for wildlife to thrive. *See Exhibit 3.* Metro is committed to engaging in sustainable forestry practices, including restoring old-growth habitat, increasing the biodiversity of forests through selective harvesting, management and plantings, preserving connectivity, supporting wildlife, and protecting clean water. Unneeded roads will be decommissioned.

In planning for access, five potential entry locations (at least one at each of the four forests) were evaluated to understand the feasibility of providing safe ingress and egress. While the five locations were all determined to be feasible, the location, site conditions, conservations goals, and the varying degree of improvements needed to provide safe and sufficient access dictated which access opportunities were most appropriate. Other specific considerations given were trail construction feasibility, stakeholder and community input, and the access objective, providing opportunities for



meaningful experiences of nature. Knowing that people experience and connect with nature in many different ways, Metro sought to provide welcoming entries; provide a system of trails that serve appropriate multiple uses and trail users of differing abilities; provide access to viewpoints and key natural features; promote visitor safety; and reduce and mitigate potential impacts on the surrounding community; among others.

The two plus year process resulted in the preferred alternative represented in the Master Plan.

Additionally, during the pre-application conference, concerns were raised that the amount of parking represented in the Master Plan for the planned visitor access improvements at Burlington Creek Forest (15 spaces) were not sufficient. In response to those concerns, Metro has redesigned the parking lot planned for Burlington to include 25 spaces. As demonstrated by the Traffic Impact report, that number of spaces is ample to accommodate anticipated usage. *See Exhibit 5.*

Implementing the Master Plan will nurture healthy forests and streams and create healthy habitat for a variety of native and sensitive animals, while providing meaningful experiences in nature for area and County residents.

The North Tualatin Mountains is just the type of place voters of Multnomah County had in mind when they invested in protecting natural resources and acquiring land for future parks and visitor access.

By supporting Metro's Master Plan, the County will be promoting policies 8.1, 8.2, 8.3, 8.4, and 8.5.

*Policy 8.6     Require areas for bicycle parking facilities in development proposals where appropriate.*

**Finding:** The Master Plan contemplates providing bicycle parking facilities at the planned access locations. This policy is met.

#### *West Hills Policies and Strategies*

*Policy 8.7     Support the natural systems and recreational values of Forest Park and adjacent areas in concert with the City of Portland, Metro, and other agencies.*

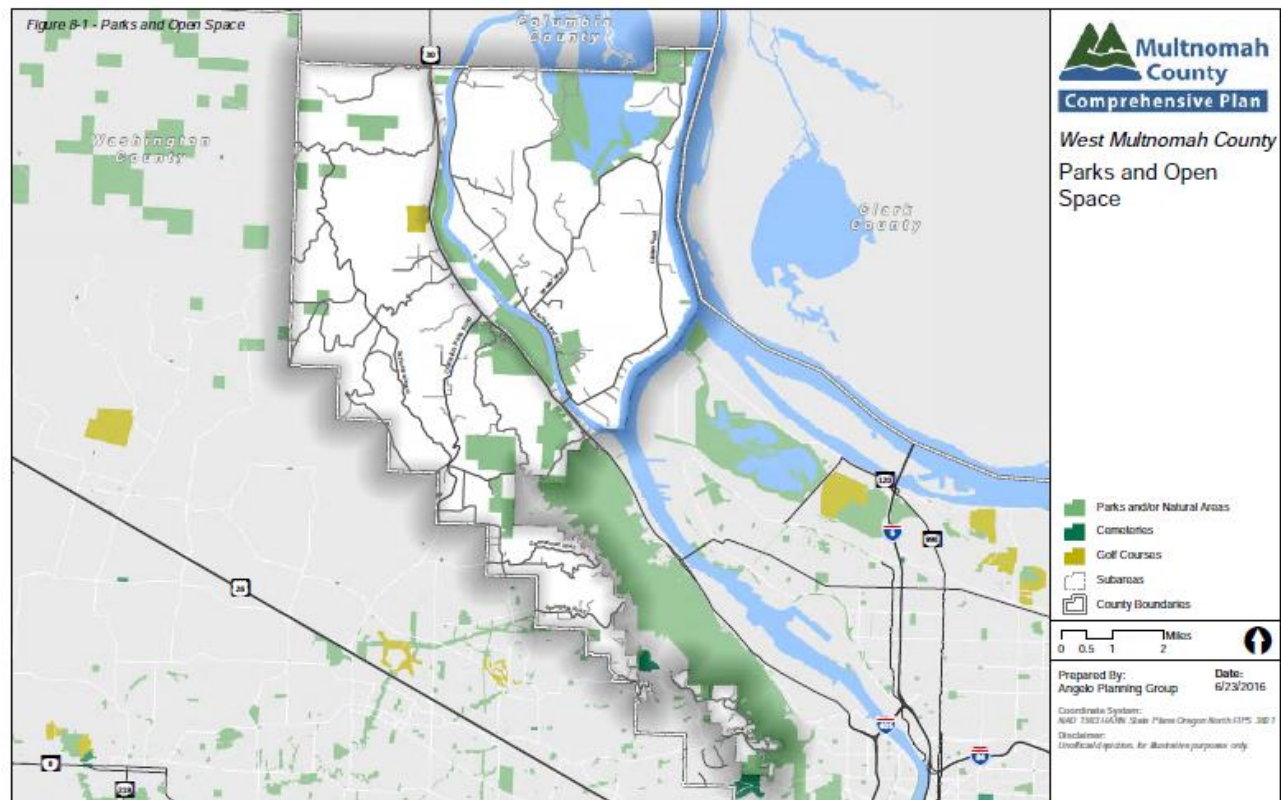
*Policy 8.8     Support only those recreational activities within the West Hills area that are consistent with, and do not cause significant negative impacts on, natural and environmental resources that are identified in Goal 5.*

**Finding:** Metro Parks and Nature protects water quality, fish and wildlife habitat and creates opportunities to enjoy nature close to home through a connected system of parks, trails and natural areas. Connecting with nature provides physical, mental, and spiritual benefits for the County's residents.

Metro acquired property in the North Tualatin Mountains in order to: Keep important wildlife and riparian corridors intact; protect upland habitat and headwater areas important to preserving the region's water quality; and provide trail connections between the region's largest urban park and public lands in the Oregon Coast Range. Burlington Creek Forest was slated to become housing prior to its acquisition.



**Figure 15 Parks and Open Space Map**



The Master Plan is designed to provide a long-term vision and implementation strategy to guide land management and public use of the North Tualatin Mountains. See Exhibit 2. The plan was developed by land and property managers, landscape architects, scientists, planners, naturalists, project stakeholders, and community participants.

Metro employs a science-based approach to site management and conservation. During the master planning process, Metro scientists provided baseline information about current conditions, conservation targets and habitat restoration goals, guided by conservation biology, site knowledge, and research. External experts also evaluated possible impacts of potential access opportunities. Metro scientists then worked with Metro's planning team to develop access opportunities that are compatible with habitat, wildlife, and water quality goals for the natural area. The process objective was to identify suitable locations and activities for recreation while seeking to stabilize and restore diversity and the ecological health of the site. That objective is achieved in this case.

The final product and public improvements contemplated are the result of over two years of significant public outreach effort, including community meetings, public open houses, surveys, and outreach. The project stakeholders were Laurel Erhardt, Skyline Ridge Neighbors; Brad Graff, Skyline Ridge Neighbors; Jerry Grossnickle, Forest Park Neighborhood Association; Andy Jansky, Northwest Trail Alliance; Shawn Looney, West Multnomah Soil and Water Conservation District; Renee Myers, Forest Park Conservancy; Travis Neumeyer, Trackers Earth; Jinnet Powell, Skyline School; Emily Roth, Portland Parks & Recreation; Jim Thayer, Oregon Recreation Trails Advisory Committee; Roger Warren, Oregon Department of Forestry; and, Susan Watt, Skyline Ridge Neighbors. Metro received hundreds of comments, ranging from wanting to keep all four sites



completely closed to public access, to wanting extensive trails and other improvements across all four sites.

The plan establishes project goals and objectives, outlines site resources and conditions, and summarizes the planning process. Employing principles of landscape ecology and landscape-level design strategies, the plan identifies access locations and approximate trail locations. It also presents a general plan for development of trailheads and strategies for implementing future development.

The Master Plan represents a balance, with the top priority to protect water quality and preserve core habitat areas 30 acres or larger, including upland forests and streams that wildlife depend on for connections between Forest Park and the Coast Range. Thereafter, access is envisioned in a way that ensures healthy habitats and meaningful experiences in nature. To do so, the plan:

- Protects and enhances natural and scenic resources by protecting large blocks of forest and core habitat;
- Integrates landscape-level analysis and community desires into decision-making;
- Identifies and accesses the best location for day use and trail heads;
- Utilizes existing road and trails and locates new trails where habitat is already fragmented while minimizing new fragmentation;
- Employs sustainable trail construction techniques;
- Provides safe ingress and egress and internal movement of vehicles and pedestrians;
- Is designed consistent with the surrounding landscape and uses and in a scale and character that the community supports; and
- Requires continuing monitoring of water quality and habitat impacts and the flexibility to make adjustments if needed.

Metro envisions visitor improvements at two of the four sites: initially at Burlington Creek Forest and subsequently, and minimally, at McCarthy Creek Forest. The location and extent of envisioned improvements was dictated by site conditions, including existing roads, trails and sensitive areas, as well as site limitations, including fairly steep topography and forested hillsides, which are typical of the surrounding landscape. Ennis Creek Forest and North Abbey Creek Forest will remain natural areas, with the exception of the future Pacific Greenway Trail envisioned through Ennis Creek Forest.

All four sites are significantly altered and damaged by prior land management activities. Site stabilization and restoration work at all four sites has already begun in earnest. Activities include invasive weed control, thinning, planting native plants and trees, erosion control, road maintenance (including decommissioning), and stream improvements. The land management activities also reduce long-term fuel and wildfire risk and make the forest more resistant to disease. Metro has working partnerships with West Multnomah Soil and Water Conservation District, City of Portland, Forest Park Conservancy, Trout Mountain Forestry and Portland Audubon to support this and future work.

Metro's restoration work and long-term management strategy includes identifying and reducing fire risks where possible. An Incident Action Plan is developed for each site that includes information to assist Metro and cooperating agencies responding to a fire on Metro property.



Incident Action Plans will be developed for both Burlington and McCarthy prior to implementing formal public access. Metro follows the Oregon Department of Forestry Industrial Fire Precaution Levels and restrictions, and may close areas in very high fire conditions, may prevent certain activities, and will work with local fire prevention and suppression agencies.

Site rehabilitation and management is pursuant to a Site Conservation/Restoration Plan, produced by Metro, which continues restoration aims to protect and enhance the North Tualatin Mountain's natural and scenic resources and to create a place for wildlife to thrive. *See Exhibit 3.* Metro is committed to engaging in sustainable forestry practices, including restoring old-growth habitat, increasing the biodiversity of forests through selective harvesting, management and plantings, preserving connectivity, supporting wildlife, and protecting clean water. Unneeded roads will be decommissioned.

In planning for access, five potential entry locations (at least one at each of the four forests) were evaluated to understand the feasibility of providing safe ingress and egress. While the five locations were all determined to be feasible, the location, site conditions, conservations goals, and the varying degree of improvements needed to provide safe and sufficient access dictated which access opportunities were most appropriate. Other specific considerations given were trail construction feasibility, stakeholder and community input, and the access objective, providing opportunities for meaningful experiences of nature. Knowing that people experience and connect with nature in many different ways, Metro sought to provide welcoming entries; provide a system of trails that serve appropriate multiple uses and trail users of differing abilities; provide access to viewpoints and key natural features; promote visitor safety; and reduce and mitigate potential impacts on the surrounding community; among others.

The two-plus year process resulted in the preferred alternative represented in the Master Plan.

Implementing the Master Plan will nurture healthy forests and streams and create healthy habitat for a variety of native and sensitive animals, while providing meaningful experiences in nature for area and County residents.

The North Tualatin Mountains is just the type of place voters of Multnomah County had in mind when they invested in protecting natural resources and acquiring land for future parks and visitor access.

As stated in the comprehensive plan, a variety of local, state, and regional plans and policies are relevant to planning for parks and recreation in Multnomah County.

At page 8-7, the Comprehensive Plan provides: "Individual park or recreation facility plans, such as those for Oxbow Park, Columbia River Gorge facilities, Howell Territorial Park and others guide activities at those sites." As such, the County's Comprehensive Plan specifically contemplates park facility plans.

This application is an effort to include the park and recreation facility Master Plan for the North Tualatin Mountains within the County's Comprehensive Plan to guide activities at those sites.

By supporting Metro's Master Plan, the County will be promoting policies 8.7 and 8.8.

## **Chapter 9 Rural Economy**

***Goal:*** *To support the rural economy of the County, including farm and forest production, as well as commercial, industrial, office, and retail activities; to do so consistent with available infrastructure*



*and resources, in compatibility with other land uses, and in compliance with state and local goals and laws.*

**Finding:** This chapter is intended to help the County plan for and support economic activity and development. While this chapter is not directly applicable in considering the subject text amendment, the recreational amenities that are represented in the master plan will bring visitors to this area of Multnomah County and support the rural economy through service and retail industry purchases and very likely by supporting local farms stands and other farm uses. Forest Park is already a significant draw for recreational tourism in Multnomah County. Recreational opportunities at the North Tualatin Mountains will build on that success.

### **Chapter 10 Housing**

**Goal:** *To support housing opportunities for rural County residents (including lawfully authorized marinas and moorages and floating residential units), while meeting health and safety concerns, minimizing environmental and resource land impacts, and complying with state land use requirements.*

**Finding:** This chapter is not applicable. Applicant's Master Plan does not propose housing or affect the County's housing policy.

### **Chapter 11 Public facilities**

**Goal:** *To coordinate and collaborate with service providers and affected agencies to ensure an appropriate level of public services to rural areas of the County, consistent with their rural character.*

### **General Policies and Strategies**

**Policy 11.1** *Taking the following factors into consideration, to plan and ensure a timely and efficient arrangement of public facilities and services to serve as a framework for appropriate levels of development of land within the County's jurisdiction.*

- 1. The health, safety, and general welfare of County residents.*
- 2. The level of services required, based upon the needs and uses permitted in urban, rural, and natural resource areas.*
- 3. Environmental, social, and economic impacts.*

**Policy 11.2** *Develop and implement public services and facilities plans and capital improvements programs that will result in the following:*

- 1. Coordination of land use planning and provision of appropriate types and levels of public facilities.*
- 2. Coordination of a full range of public facilities and services among all agencies responsible for providing them.*
- 3. Provision of adequate facilities and services for existing uses.*
- 4. Protection of natural resource and rural areas.*

**Policy 11.3** *Support the siting and development of public facilities and services appropriate to the needs of rural areas while avoiding adverse impacts on farm and forest practices, wildlife, and natural and environmental resources including views of important natural landscape features.*

**Policy 11.4** *Reduce Multnomah County's long-term public works costs by eliminating marginal facilities and extending the life of others through timely maintenance and functional upgrading.*



*Policy 11.5 Set and schedule capital improvements project expenditures based on an evaluation which includes the consideration of the following:*

- 1. Public health, safety, and general welfare.*
- 2. County liabilities, assets, and resources.*
- 3. Existing service system maintenance and update costs.*
- 4. Minimization of costs due to coordination of scheduled public works projects.*
- 5. Private and public resources availability for financing and maintaining service system improvements.*
- 6. Conformance with the Comprehensive Plan.*
- 7. Time required to provide service and reliability of service.*
- 8. Equity in meeting the needs of low-income and minority populations.*

*Policy 11.6 Use capital improvements programming and budgeting to achieve levels of public facilities and services appropriate to rural areas.*

*Policy 11.7 Coordinate plans for public services and facilities with plans for designation of urban boundaries, urbanizable land within the UGB, rural uses outside the UGB, and for the transition of rural to urban uses within UGB expansion areas.*

*Policy 11.8 Identify needs and priorities for public works capital improvements in conjunction with the Comprehensive Plan.*

*Policy 11.9 To achieve desired types and levels of public facilities and services, consider existing and new, creative methods and devices such as, but not limited to, the following:*

- 1. Tax incentives and disincentives*
- 2. Public and private grants*
- 3. Land use controls and ordinances*
- 4. Multiple use and joint development practices*
- 5. Fee and less-than-fee acquisition techniques*
- 6. User fees*
- 7. Public/private partnerships*

*Policy 11.10 Except as otherwise provided by law, new electrical substations and water system storage tanks or reservoirs intended to solely serve uses within the urban growth boundary shall not be located outside the urban growth boundary unless it can be demonstrated that there is no practical alternative site within the urban growth boundary that can reasonably accommodate the use.*

*Policy 11.11 For development that will be served by a power utility company, the utility company must be willing and able to provide the power needs of the development.*

**Finding:** As stated in the Comprehensive Plan, the policies in this chapter require coordination with service providers, minimizing and mitigating impacts on public facilities. Those objectives are ensured through the land use development process, which in Multnomah County requires service provider coordination and use proposals to go through conditional and design review for specified uses. Those code standards also require minimization and mitigation of impacts on uses in the zone. The chapter is intended to implement the requirements of Goal 11, which requires long-range planning for public facilities (specifically sewer, water, and drainage facilities) needed to support intensive development, and prohibits certain public facilities in that area intended on serving urban uses from locating on rural/resource land. In short, this chapter seeks to prevent the urbanization of rural/resource lands.



In rural Multnomah County, this chapter and Goal 11 have limited application, as public facilities are not needed to support proposed uses as most (such as sewer/septic, water/well, and drainage/sheet flow) are accommodated on individual properties.

The subject Master Plan does not plan for uses that require support from public facilities. All potential services needs are planned for on-site accommodation. For example, if water is desired, a well can be installed.

With respect to agency coordination surrounding emergency and fire service provisions, the Master Plan represents that an Incident Action Plan is developed for each site that includes information to assist Metro and cooperating agencies responding to a fire on Metro property. Incident Action Plans will be developed for both Burlington and McCarthy prior to implementing formal public access. Metro follows the Oregon Department of Forestry Industrial Fire Precaution Levels and restrictions, and may close areas in very high fire conditions, may prevent certain activities, and will work with local fire prevention and suppression agencies.

### ***Water Supply and Wastewater Treatment Systems***

*Policy 11.12 A water supply system for new development shall be by either of the following methods:*

- 1. Connection to a public water system having adequate capacity to serve the development and all other system customers.*
- 2. A private water system that produces safe drinking water with sufficient volume and pressure to meet applicable Building Code and Fire Protection Code.*

*Policy 11.13 Wastewater disposal for new development shall be by any of the following methods:*

- 1. Connection to a public sewer system having adequate capacity to serve the development and all other system customers.*
- 2. A private system that meets Oregon Department of Environmental Quality regulations.*

**Finding:** No public water supply or public waste water disposal (sewer) is needed to implement and support the restoration and recreational objectives of the Master Plan. This policy is not applicable or otherwise met.

### ***Energy Facilities***

*Policy 11.14 Work with utility and communications companies that own transmission, distribution and communication lines to bury the lines to provide more secure power and communications service during emergency situations and improve scenic qualities.*

*Policy 11.15 Ensure that public service providers and utility providers have the capability to serve proposed new development by inviting their review and comment on development applications that may impact them.*

*Strategy 11.15-1: Circulate development proposals to affected service and utility providers (i.e. County Sheriff's Office, School Districts, Water Districts, Fire Districts, etc.).*

**Finding:** No electrical or natural gas service is needed to implement and support the restoration and recreational objectives of the Master Plan. This policy is not applicable or otherwise met.

### ***Solid Waste Management***



*Policy 11.16 Implement a solid waste and recycling management program that complies with State law, the Regional Solid Waste Management Plan, and the County's intergovernmental agreement with Metro.*

**Finding:** This policy is a directive to the County and is not applicable.

### ***Police, Fire, and Emergency Response Facilities***

*Policy 11.17 As appropriate, include school districts, police and fire protection, and emergency response service providers in the land use process by requiring review of land use applications from these agencies regarding the agency's ability to provide the acceptable level of service with respect to the land use proposal.*

**Finding:** This policy requires coordination with service providers. The policy is implemented through the land use development process, which in Multnomah County, requires service provider coordination and use proposals to go through conditional and design review for specified uses. County code ensures this policy will be met when a land use development application is presented to the County for review.

## **Chapter 12 Transportation**

The Multnomah County Transportation System Plan serves as the Transportation Element of the Comprehensive Plan. Figure 17, below, depicts County road jurisdiction.

The County's TSP implements Statewide Planning Goal 12 and related administrative rules.

The objective is to promote efficient, safe, and diverse transportation systems to serve the needs of County residents.

The subject comprehensive plan amendment does not "significantly affect" a transportation facility as described in 660-012-0060(1).<sup>2</sup> The uses considered by the plan amendment will not result in types or levels of land uses that would result in levels of travel or access inconsistent with the functional classification of a transportation facility, nor would they violate roadway performance standards.

As demonstrated by the traffic analysis report prepared by Nemariam Engineers & Associates, LLC, which specifically addresses the County TSP and Multnomah County Road Rules, the limited recreational uses proposed will have a minimal impact on the transportation facilities serving the

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<sup>2</sup> OAR 660-012-0060(1) provides:

"A plan or land use regulation amendment significantly affects a transportation facility if it would:

(a) Changes the functional classification of an existing or planned transportation facility;

(b) Changes standards implementing a functional classification system;

(c) Result in ...

(A) Types or levels of travel or access that are inconsistent with the functional classification of an existing or planned transportation facility;

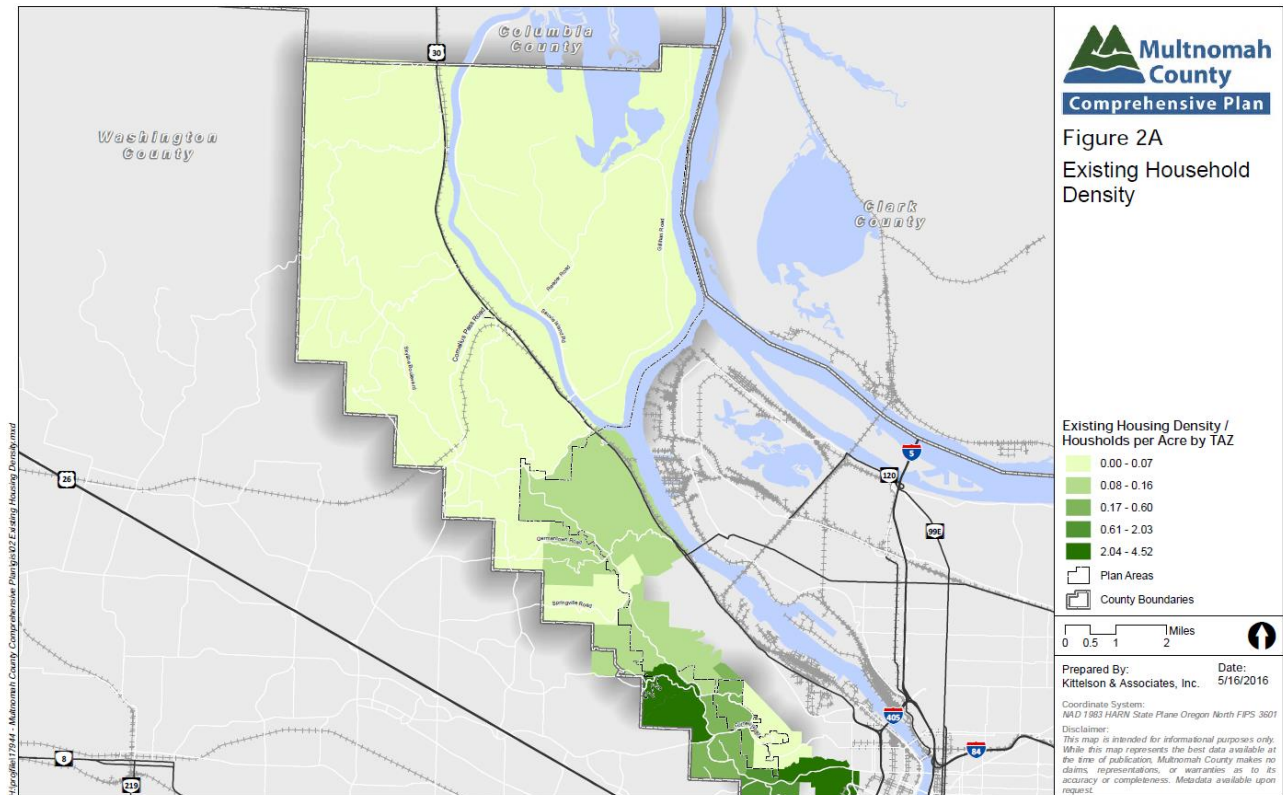
(B) Degrade the performance of an existing or planned transportation facility such that it would not meet the performance standards identified in the TSP or comprehensive plan; or

(C) Degrade the performance of an existing or planned transportation facility that is otherwise projected to not meet the performance standards identified in the TSP or comprehensive plan."



property. The report demonstrates that recreational uses are more often associated with non-peak hours and weekends. The report demonstrates that with site distance improvements, anticipated visitors will safely and efficiently access the site and use the existing road system with other users. *See Exhibit 5.* The subject West Hills Neighborhood represents the lowest housing densities per acre in the County, resulting in fewer trips and demands on the road system during peak times.

**Figure 16 Housing Densities Map**

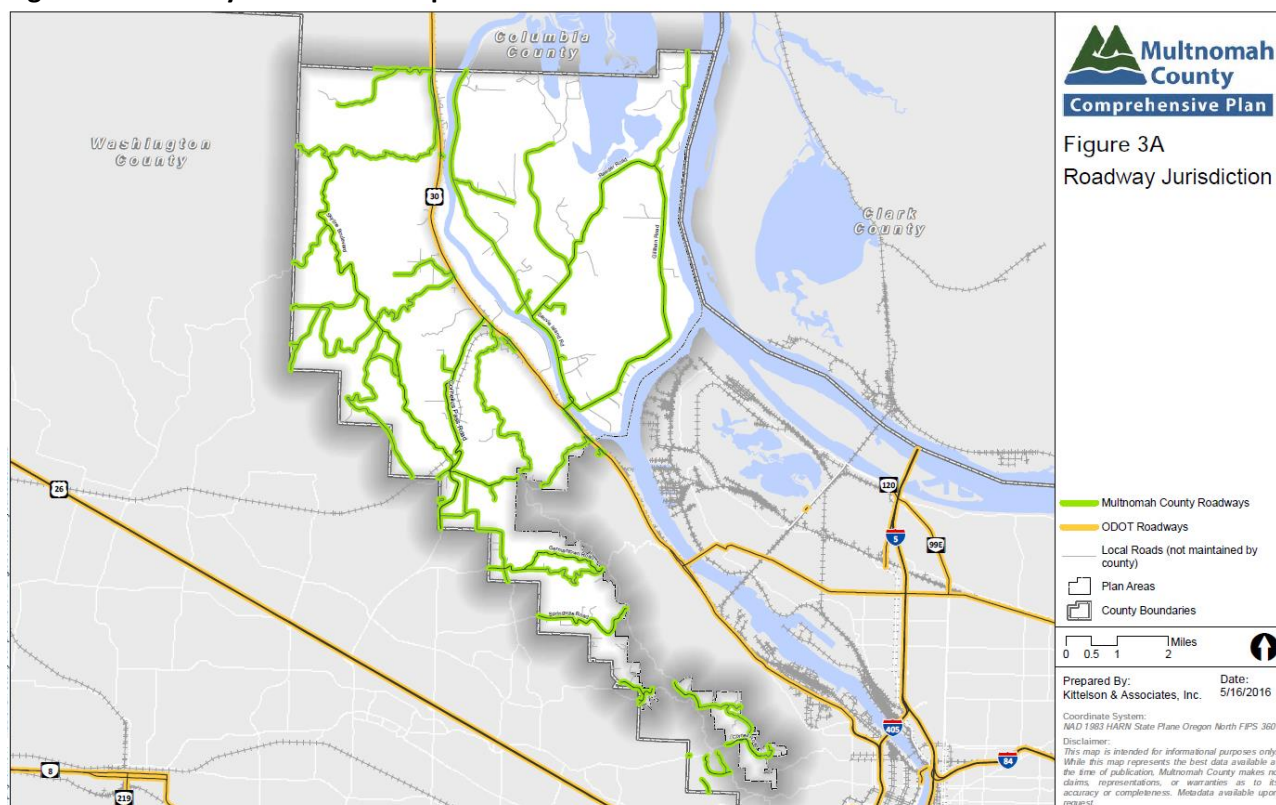


This is confirmed by the County's daily traffic map that shows the County roads serving the properties experience lower levels of traffic. *See Exhibit 17.*

The properties are and can be adequately served by County roads which provide access to State Highway 30 and throughout the West Hills. *See Exhibit 14.*



**Figure 17 Roadway Jurisdiction Map**



Compliance with the TPR is thus demonstrated.

### ***Statewide Planning Goals***

**Finding:** The findings below demonstrate the application is consistent with Statewide Planning Goals. The following Goals may apply to this request.

#### ***Goal 1 – Citizen Involvement:***

*To develop a citizen involvement program that insures the opportunity for citizens to be involved in all phases of the planning process.*

**Finding:** Goal 1 requires opportunities for citizen involvement in all phases of the planning process. Goal 1 is satisfied by compliance with the County’s administrative procedures which have been acknowledged as consistent with state law.

#### ***Goal 2 – Part I:***

*To establish a land use planning process and policy framework as a basis for all decision and actions related to use of land and to assure an adequate factual base for such decisions and actions.*

**Finding:** Goal 2, Part I requires land use actions to be consistent with acknowledged Comprehensive Plans. Consistency with the applicable provisions of the Multnomah County Comprehensive Plan is demonstrated above. Goal 2, Part I also requires coordination with affected governments and agencies, and for a decision to have an adequate factual basis. Compliance with the County’s administrative procedures and state laws will ensure coordination and that this



decision-making process is consistent with this Goal. The factual basis supporting this decision and demonstration of compliance with all applicable criteria consists of this narrative statement and all exhibits. This application is consistent with Goal 2.

Goal 2 – Part II, Exceptions:

**Finding:** Goal 2, Part II defines an exception process whereby an applicant can be relieved from the strict application of an otherwise applicable Statewide Planning Goal. Applicant is not requesting an exception to a statewide goal. This section of the Goal is not applicable.

Goal 3 – Agricultural Lands:

*To preserve and maintain agricultural lands.*

**Finding:** Goal 3 seeks to preserve and maintain agricultural lands. Goal 3 defines “agricultural land” in western Oregon as land that is predominately Class I, II, III and IV soils. Only a small portion of the subject property, located in the southwestern portion of North Abbey Creek Forest, is zoned EFU and in farm use. The remaining portion of the site is zoned CFU. The subject Master Plan does not propose any non-farm uses for the EFU land. Metro is not proposing any use of the farmland that conflicts with any policy identified in the “general policies for agricultural zones” or policies specific to the “EFU Zones.” No uses are proposed for North Abbey Creek that will conflict with or interfere with farm uses occurring south and west of the site. This goal is satisfied or otherwise not applicable.

Goal 4 – Forest Lands:

*To conserve forest lands by maintaining the forest land base and to protect the state's forest economy by making possible economically efficient forest practices that assure the continuous growing and harvesting of forest tree species as the leading use on forest land consistent with sound management of soil, air, water, fish and wildlife resources and to provide for recreational opportunities and agriculture.*

**Finding:** Goal 4 seeks to preserve and maintain forest lands. The four forests, except a small portion of EFU land in North Abbey Creek, are entirely comprised of CFU land.

The goal requires counties to inventory forest lands and adopt policies and ordinances that will conserve forest lands for forest uses.

The Goal provides that uses allowed on forestry land include forest operations, conservation, resources restoration, and recreational opportunities appropriate in a forest environment. The Master Plan plans for each of those allowed use. All uses proposed in the Master Plan are consistent with and encouraged by Goal 4.

By supporting this Master Plan, the County will be adopting a policy that will conserve forest lands for forest uses, and thus comply with Goal 4.

Goal 4 encourages plans that consider the carrying capacity of the air, land and water resources of the planning area. As demonstrated throughout this narrative and in the Master Plan, Metro’s master plan does just that. Goal 4 is satisfied.

Goal 5 – Natural Resources, Scenic and Historic Areas, and Open Spaces:

*To protect natural resources and conserve scenic and historic areas and open spaces.*



**Finding:** Metro Parks and Nature protects water quality, fish and wildlife habitat and creates opportunities to enjoy nature close to home through a connected system of parks, trails and natural areas. Connecting with nature provides physical, mental, and spiritual benefits for the County's residents.

Metro acquired property in the North Tualatin Mountains in order to: Keep important wildlife and riparian corridors intact; protect upland habitat and headwater areas important to preserving the region's water quality; and provide trail connections between the region's largest urban park and public lands in the Oregon Coast Range. Burlington Creek Forest was slated to become housing prior to its acquisition.

The Master Plan is designed to provide a long-term vision and implementation strategy to guide land management and public use of the North Tualatin Mountains. The plan was developed by land and property managers, landscape architects, scientists, planners, naturalists, project stakeholders, and community participants.

Metro employs a science-based approach to site management and conservation. During the master planning process, Metro scientists provided baseline information about current conditions, conservation targets and habitat restoration goals, guided by conservation biology, site knowledge, and research. External experts also evaluated possible impacts of potential access opportunities. Metro scientists then worked with Metro's planning team to develop access opportunities that are compatible with habitat, wildlife, and water quality goals for the natural area. The process objective was to identify suitable locations and activities for recreation while seeking to stabilize and restore diversity and the ecological health of the site. That objective is achieved in this case.

*Goal 6 – Air, Water and Land Resources:*

*To maintain and improve the quality of the air, water and land resources of the state.*

**Finding:** Goal 6 addresses the quality of air, water, and land resources. The Goal requires development to comply with applicable state or federal environmental quality rules governing wastes and discharges.

The Goal is generally concerned with controlling urban and rural residential development.

In the context of a plan amendment, an applicant complies with Goal 6 by explaining why it believes that the uses authorized by the zone will be able to satisfy applicable state and federal environmental standards. The State of Oregon Department of Environmental Quality restricts and limits pollution, in conjunction with EPA oversight. Compliance with state and federal laws will ensure resources are protected according to law. Those laws would apply to any future development and ensure compliance with Goal 6.

*Goal 7 – Areas Subject to Natural Hazards:*

*To protect people and property from natural hazards.*

**Finding:** Goal 7 requires local governments to adopt plans to reduce risk. The Goal requires local governments to consider the benefits of maintaining natural hazard areas as open space, recreation, and other low density uses and to mitigate risks.

Multnomah County has supported Goal 7 confirming the benefits of keeping steeper sloped forest lands in forest uses and permitting recreational uses in its CFU zone. Additionally, landslide risks



are minimized through application of the County's Hillside Development (HD) overlay zone and code provisions. The HD zone includes a number of requirements related to the assessment and documentation of risk and restrictions on development where slopes exceed 25%. Where slopes exceed 25%, property owners are required to obtain a report and recommendations from a geotechnical professional, documenting the risks associated with potential landslides and measures that can be taken to mitigate those risks. Metro has undertaken that effort with respect to its planned Burlington Creek Forest visitor improvements. Goal 7 is satisfied.

#### Goal 8 – Recreational Needs:

*To satisfy the recreational needs of the citizens of the state and visitors and, where appropriate, to provide for the siting of necessary recreational facilities including destination resorts.*

**Finding:** As provided by the Comprehensive Plan, the requirement for meeting recreational needs is the responsibility of the County and government agencies, such as Metro, having responsibility for recreation areas, facilities and opportunities.

Multnomah County does not own or manage any parks or recreational facilities. The County relies on others, including Metro, to provide for a wide range of natural areas, parks, and recreational activities to serve County residents.

Metro, as a parks service provider, has its roots in Multnomah County and the County's park system. In 1995, Metro assumed ownership and operation of a number of park and recreational facilities previously owned and operated by the County, including Oxbow Regional Park, Blue Lake Regional Park, Glendoveer Golf Course and Fitness Trail, Howell Territorial Park, Gleason Memorial Boat Ramp, Broughton Beach, Chinook Marine Facility, historic cemeteries, and a number of other facilities. Metro also owns and manages a number of natural areas and nature preserves in Multnomah County managed to protect water quality, promote fish and wildlife habitat, and provide access to nature. Metro's facilities provide a diverse range of outdoor recreational opportunities and experiences, including boating, hiking, bicycling, horseback riding, bird watching, and general scenic and recreational access.

Today, Metro Parks and Nature protects water quality, fish and wildlife habitat and creates opportunities to enjoy nature close to home through a connected system of parks, trails and natural areas. Connecting with nature provides physical, mental, and spiritual benefits for the County's residents.

The Master Plan is designed to provide a long-term vision and implementation strategy to guide land management and public use of the North Tualatin Mountains. *See Exhibit 2.* The plan was developed by land and property managers, landscape architects, scientists, planners, naturalists, project stakeholders, and community participants. Goal 8 is satisfied.

#### Goal 11 – Public Facilities and Services:

*To plan and develop a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for urban and rural development.*

**Finding:** Goal 11 requires local governments to plan and develop a timely, orderly and efficient arrangement of public facilities and services. The Goal requires that urban and rural development be guided and supported by types and levels of urban and rural public facilities and services appropriate for, but limited to, the needs and requirements of the urban, urbanizable, and rural areas to be served.



Goal 11 also requires the timely, orderly, and efficient arrangement of public services, which refers to a system or plan that coordinates the type, locations and delivery of public facilities and services in a manner that best supports the existing and proposed land uses.

In rural Multnomah County, except for the Goal provision which prohibits rural lands from being supported by urban services such as sewer, Goal 11 has limited application, as public facilities are not needed to support proposed uses as most (such as sewer/septic, water/well, and drainage/sheet flow) are accommodated on individual properties.

The subject Master Plan does not plan for uses that require support from public facilities. All potential services needs are planned for on-site accommodation. For example, if water is desired, a well can be installed.

The application is consistent with Goal 11.

Goal 12 – Transportation:

*To provide and encourage a safe, convenient and economic transportation system.*

**Finding:** Goal 12 requires local governments to develop a transportation plan. Goal 12 is implemented through LCDC's transportation planning rule (TPR) – OAR, Division 12. The TPR requires local governments to assure that the allowed uses are consistent with the identified function, capacity, and level of service of the transportation facility.

OAR 660-012-0060 involves a two-part analysis. The first is whether or not the proposed amendment would significantly affect the transportation system or is otherwise exempt from TPR compliance. If not exempt and the plan amendment "significantly affects" a transportation facility, the impacts must be mitigated in one or more of four ways specified in OAR 660-012-00660(3). If an amendment does not significantly affect a transportation system or is otherwise exempt, compliance with the TPR is demonstrated.

The subject comprehensive plan amendment does not "significantly affect" a transportation facility as described in 660-012-0060(1).<sup>3</sup> The uses allowed by the plan amendment will not result in types or levels of land uses that would result in levels of travel or access inconsistent with the functional classification of a transportation facility, nor would they violate roadway performance standards. Exhibit 5. Compliance with the TPR is thus demonstrated.

The property is and can be adequately served by county roads which provide access to Highway 30.

---

<sup>3</sup> OAR 660-012-0060(1) provides:

"A plan or land use regulation amendment significantly affects a transportation facility if it would:

(a) Changes the functional classification of an existing or planned transportation facility;

(b) Changes standards implementing a functional classification system;

(c) Result in ...

(A) Types or levels of travel or access that are inconsistent with the functional classification of an existing or planned transportation facility;

(B) Degrade the performance of an existing or planned transportation facility such that it would not meet the performance standards identified in the TSP or comprehensive plan; or

(C) Degrade the performance of an existing or planned transportation facility that is otherwise projected to not meet the performance standards identified in the TSP or comprehensive plan."



The application is consistent with Goal 12.

**Section VII: Conclusion**

Applicant has demonstrated with findings supported by substantial evidence that a Comprehensive Plan text amendment is warranted. Applicant respectfully requests that the North Tualatin Mountain Access Master Plan be included as an appendix to the County's Comprehensive Plan to guide restoration and recreation activities on the public property.

Respectfully Submitted,

A handwritten signature in black ink, appearing to read 'G Shepherd', written in a cursive style.

Gary Shepherd  
Office of Metro Attorney

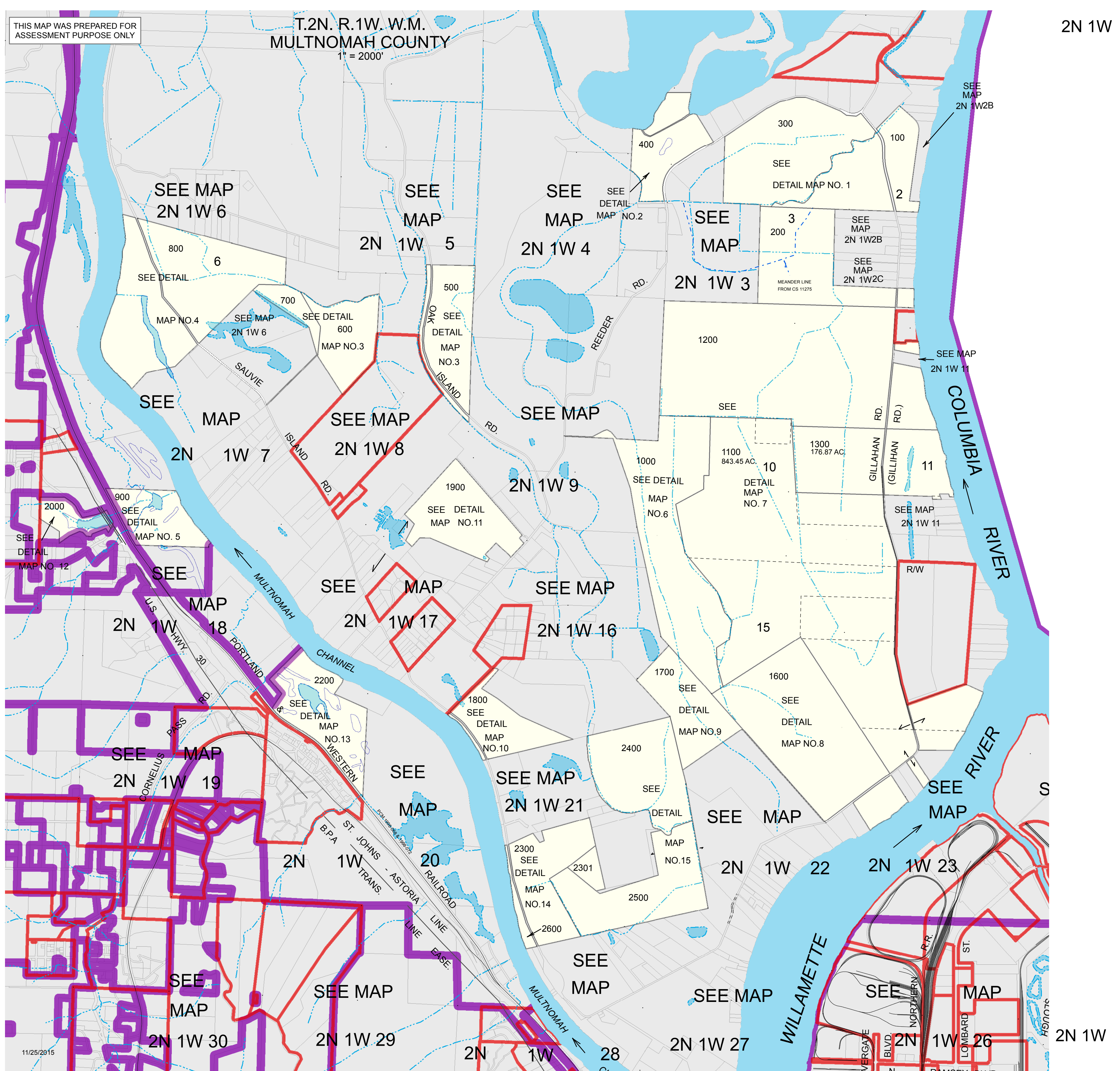


THIS MAP WAS PREPARED FOR  
ASSESSMENT PURPOSE ONLY

T.2N. R.1W. W.M.  
MULTNOMAH COUNTY

$$1'' = 2000'$$

2N 1W



11/25/2015

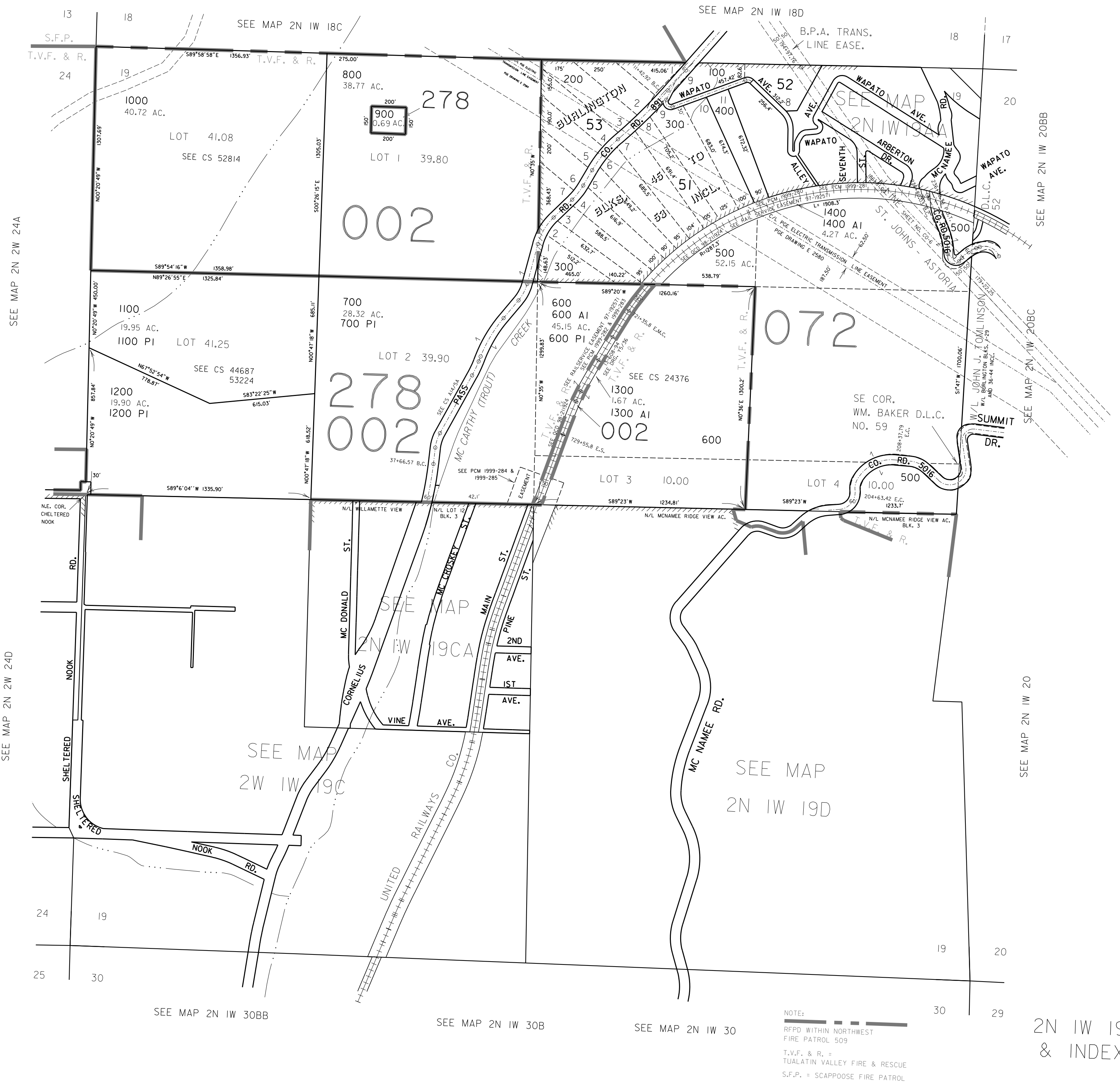


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MULTNOMAH COUNTY

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2N 1W 19  
& INDEX



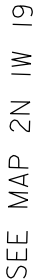


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NE1/4 NE1/4 SEC. 19 T.2N. R.1W. W.M.  
MULTNOMAH COUNTY

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SEE MAP 2N 1W 20B

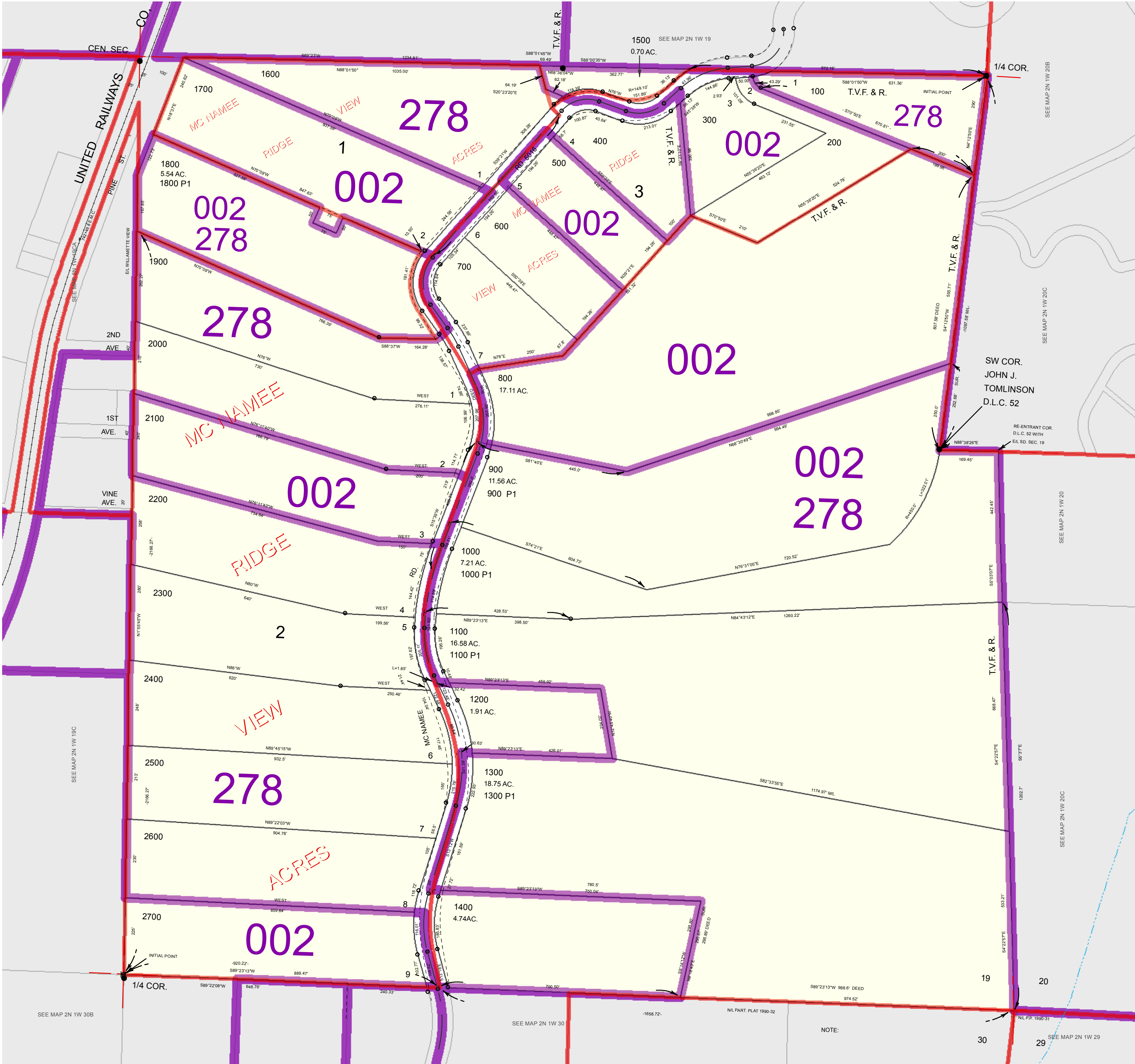
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2N 1W 19D



2N 1W 19D





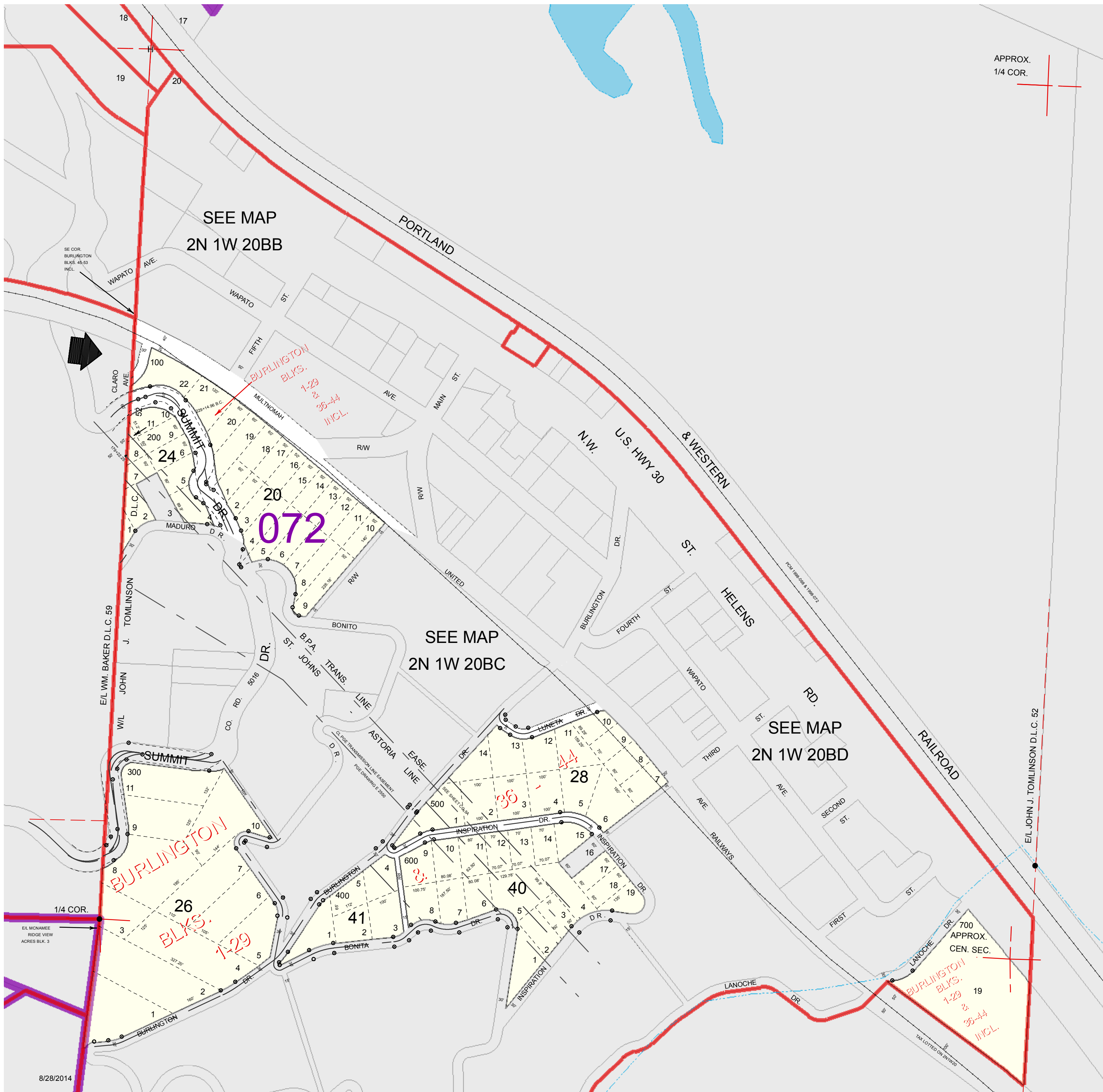


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MULTNOMAH COUNTY

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2N 1W 20B

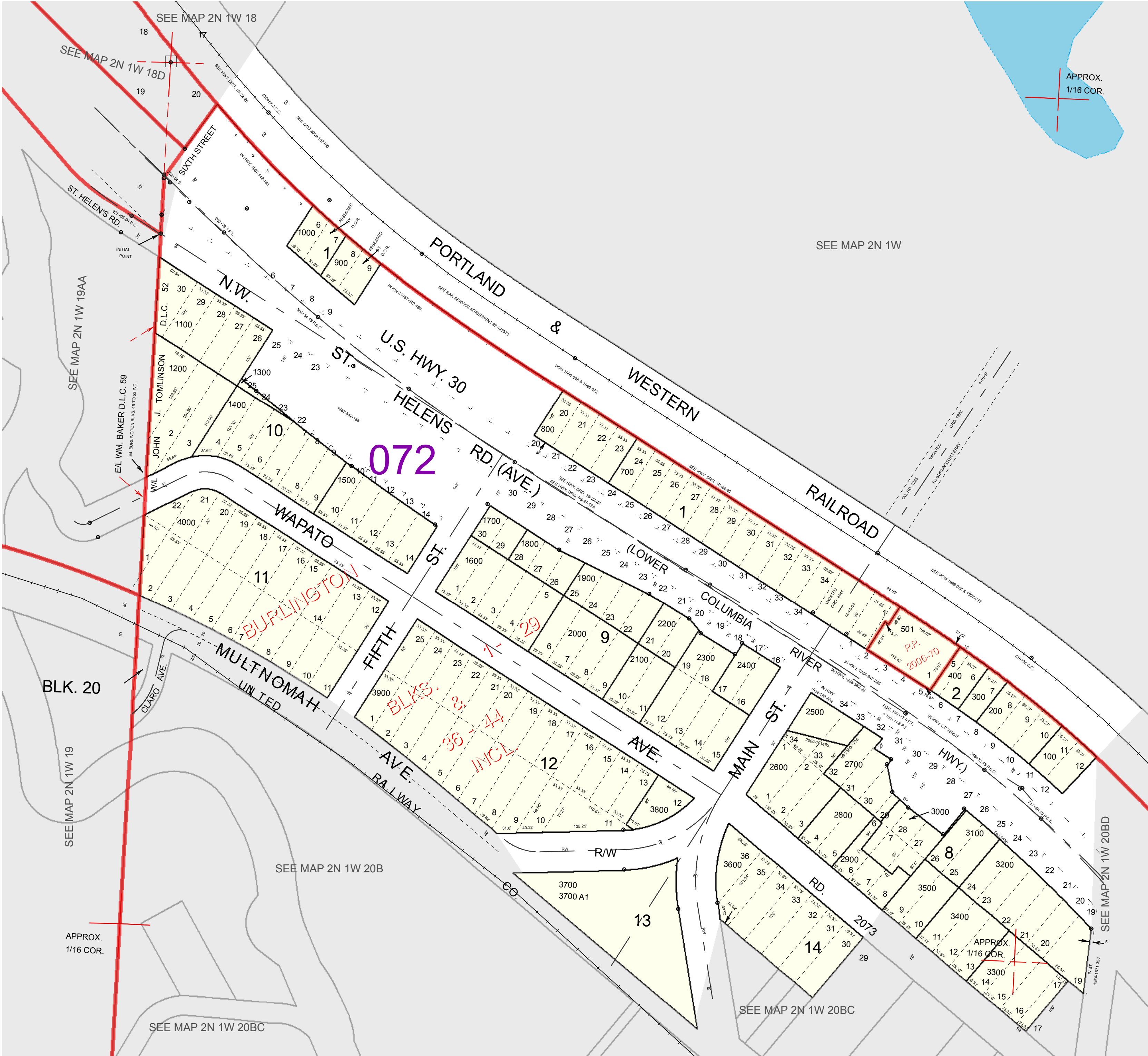


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MULTNOMAH COUNTY

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2N 1W 20BB



9/3/2014

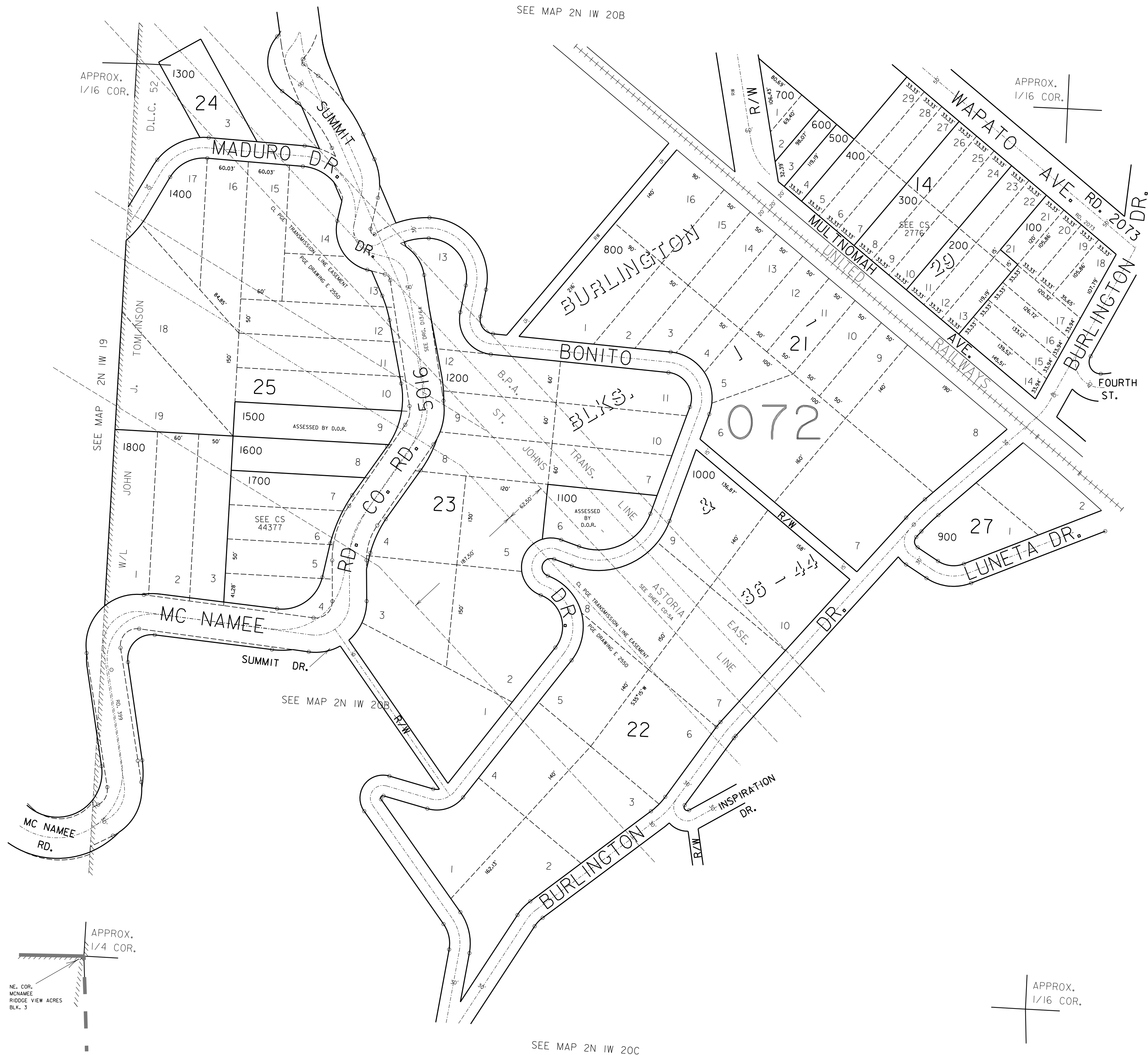


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CANCELLED NO.  
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SEE MAP 2N 1W 20BD

2N 1W 20BC

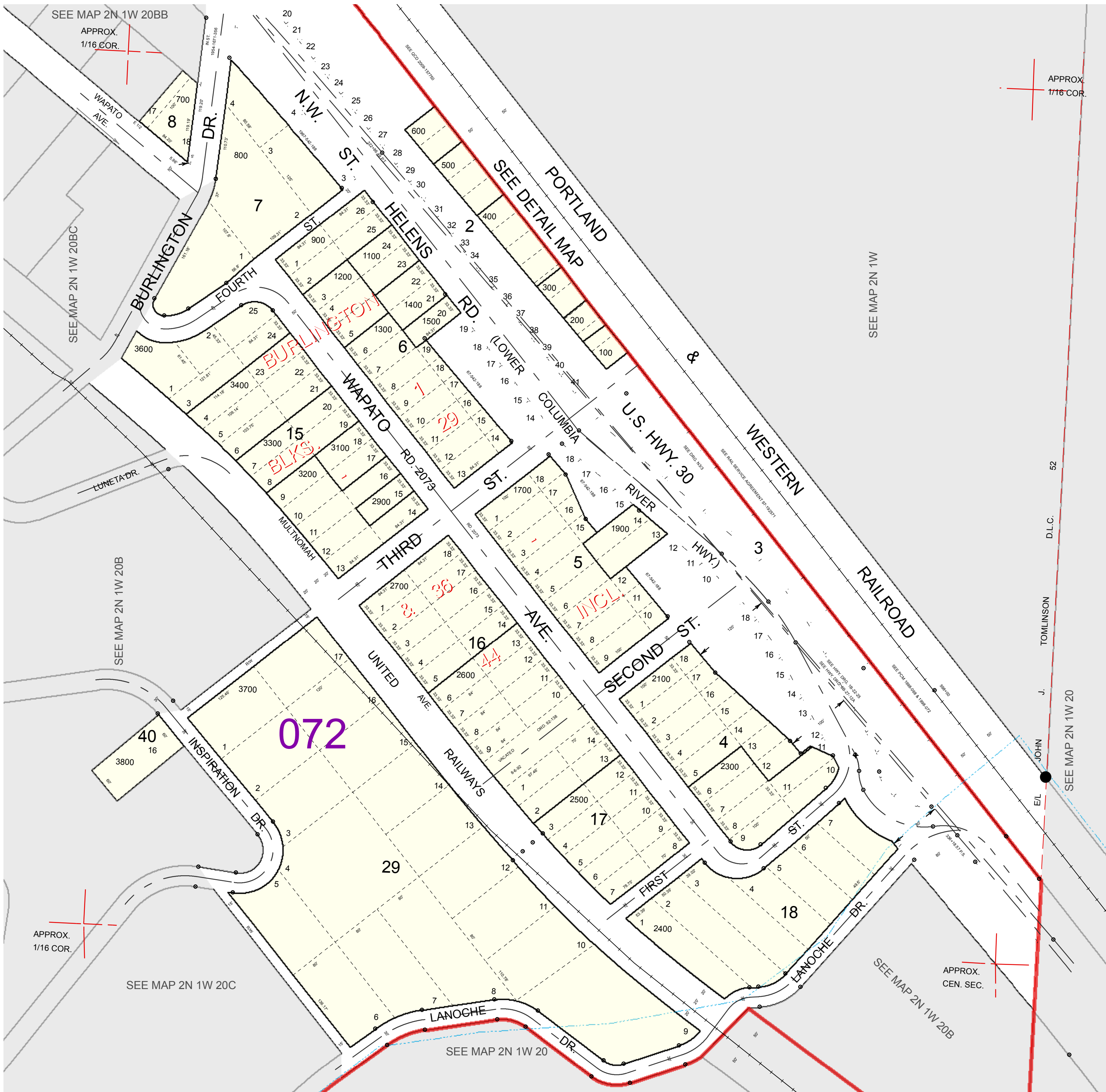


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MULTNOMAH COUNTY

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2N 1W 20BD



2N 1W 20BD



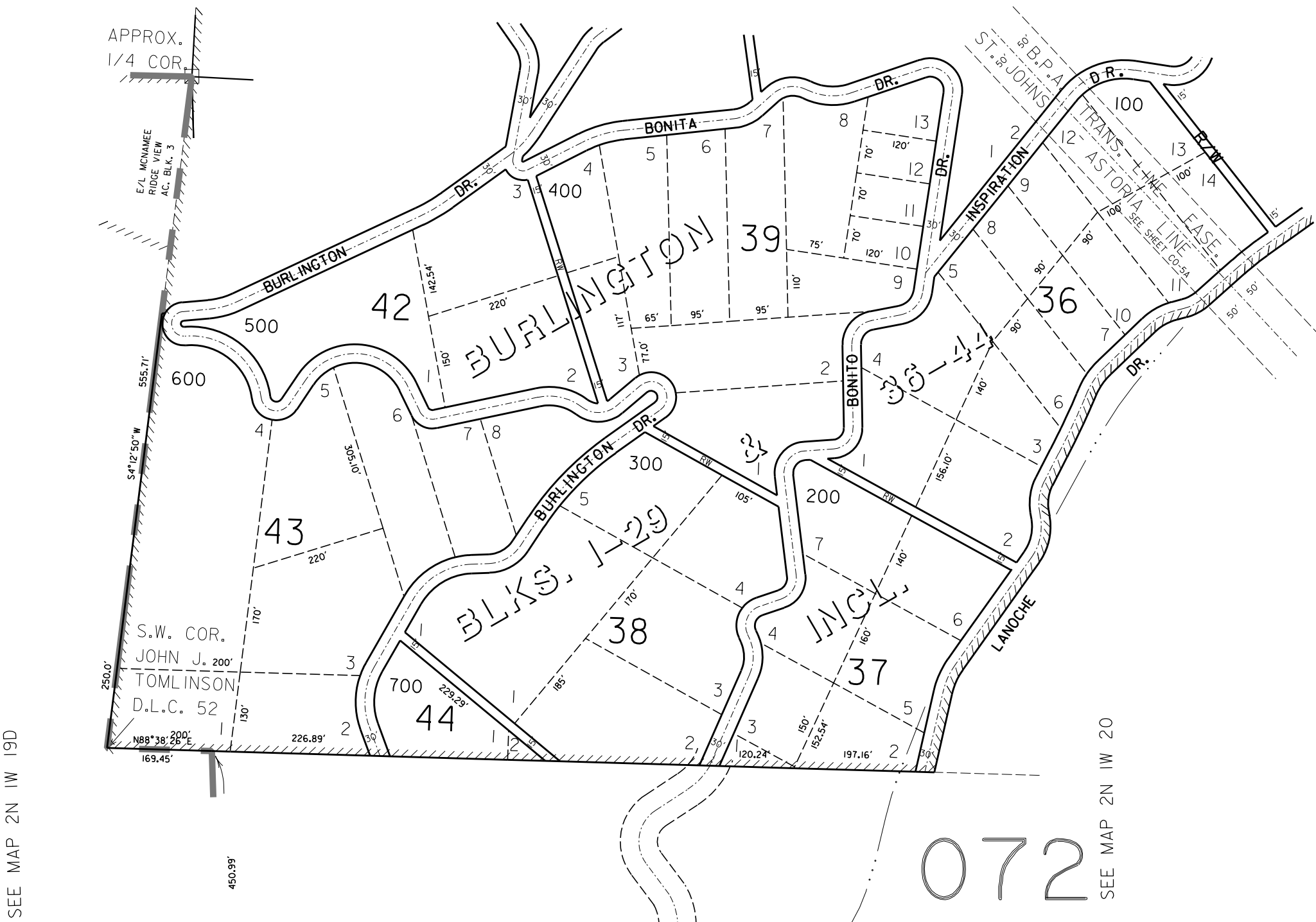
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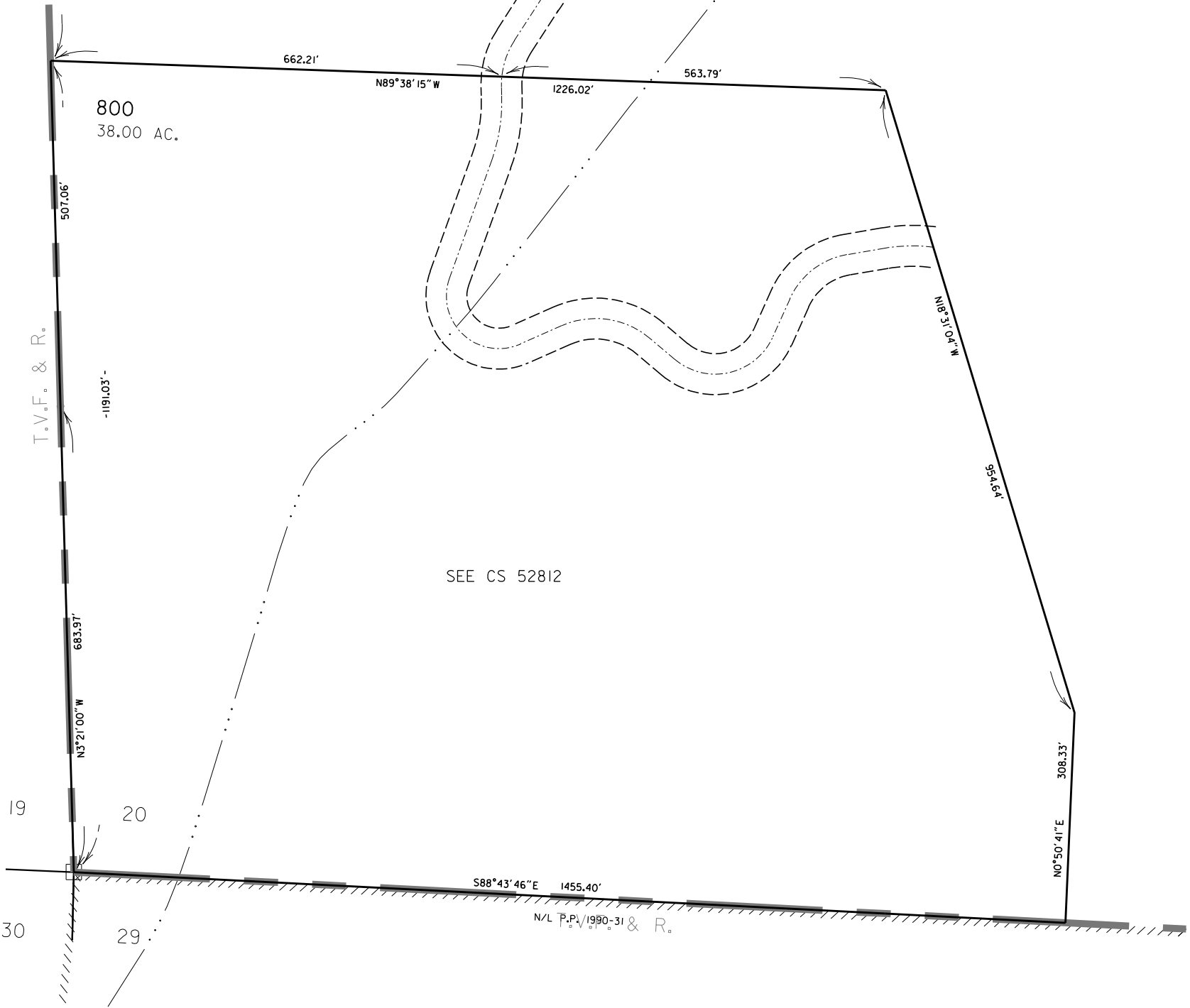
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2N 1W 20C



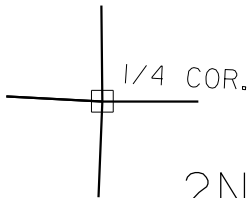
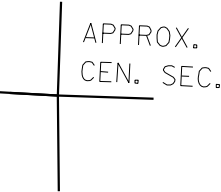
SEE MAP 2N 1W 19D

SEE MAP 2N 1W 20



SEE MAP 2N 1W 29

NOTE:  
T.V.F. & R. =  
TUALATIN VALLEY FIRE & RESCUE



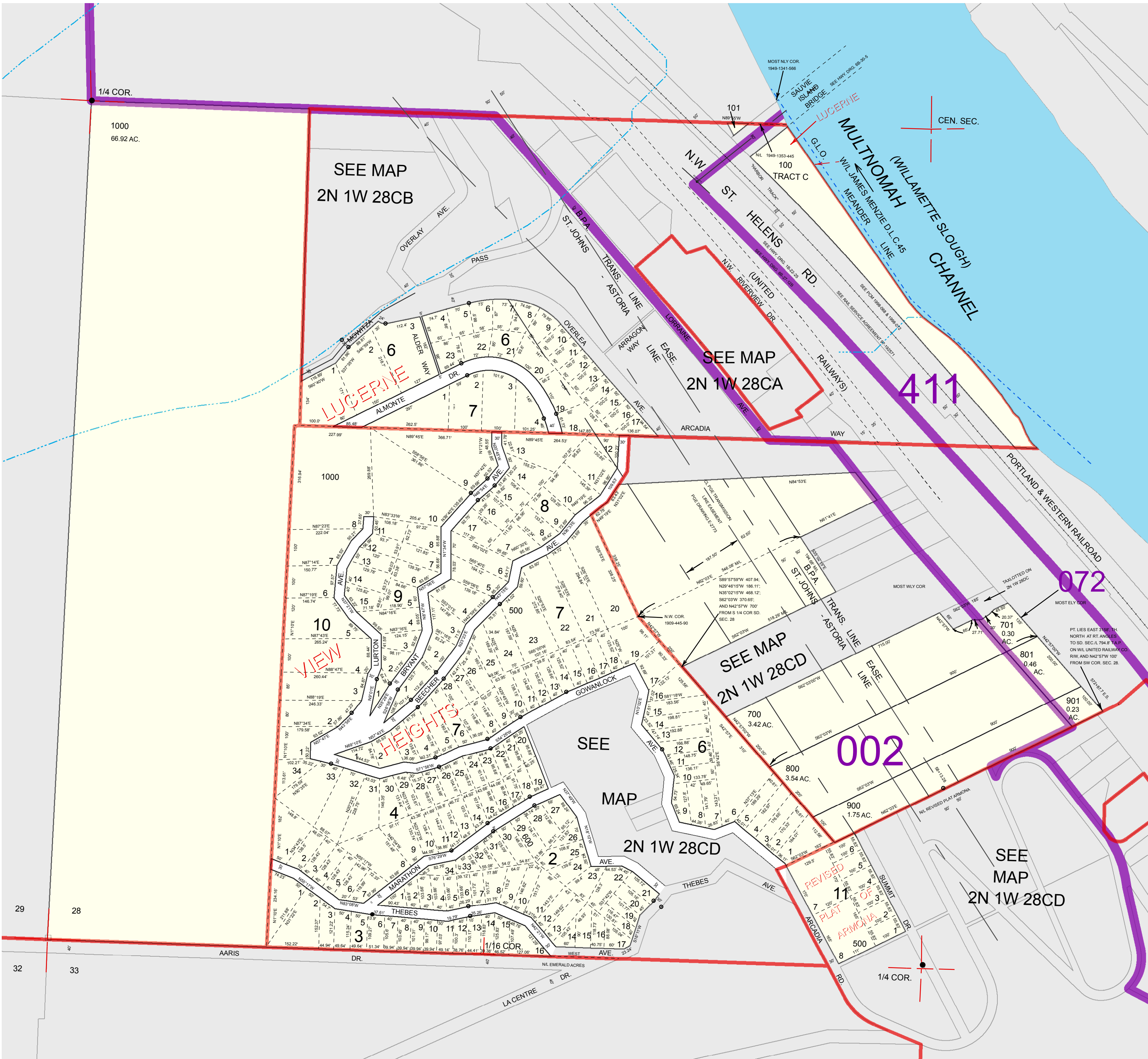
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2N 1W 28C



2N 1W 28C

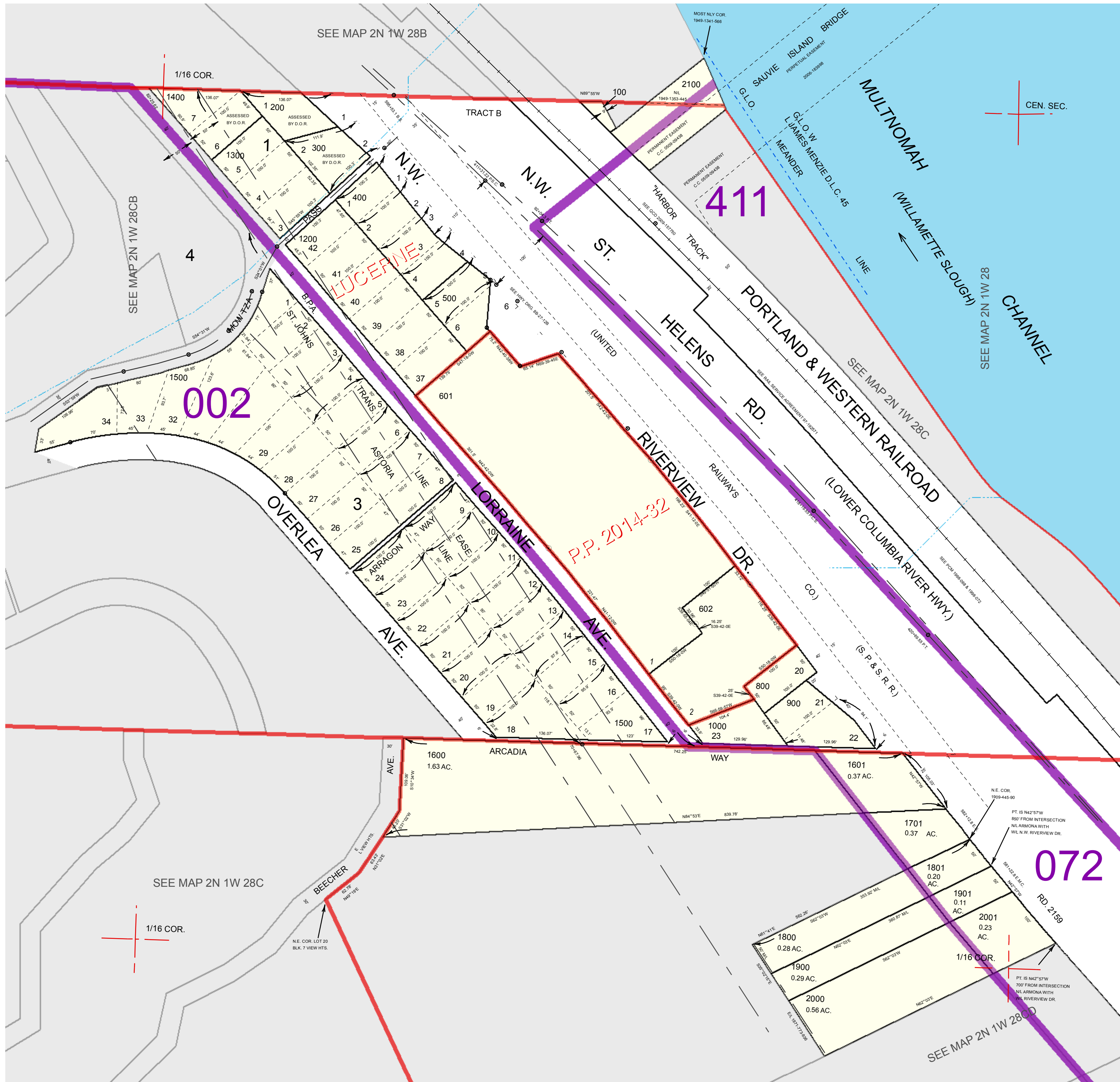


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MULTNOMAH COUNTY

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2N 1W 28CA



2N 1W 28CA

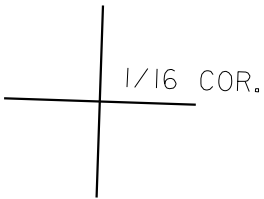


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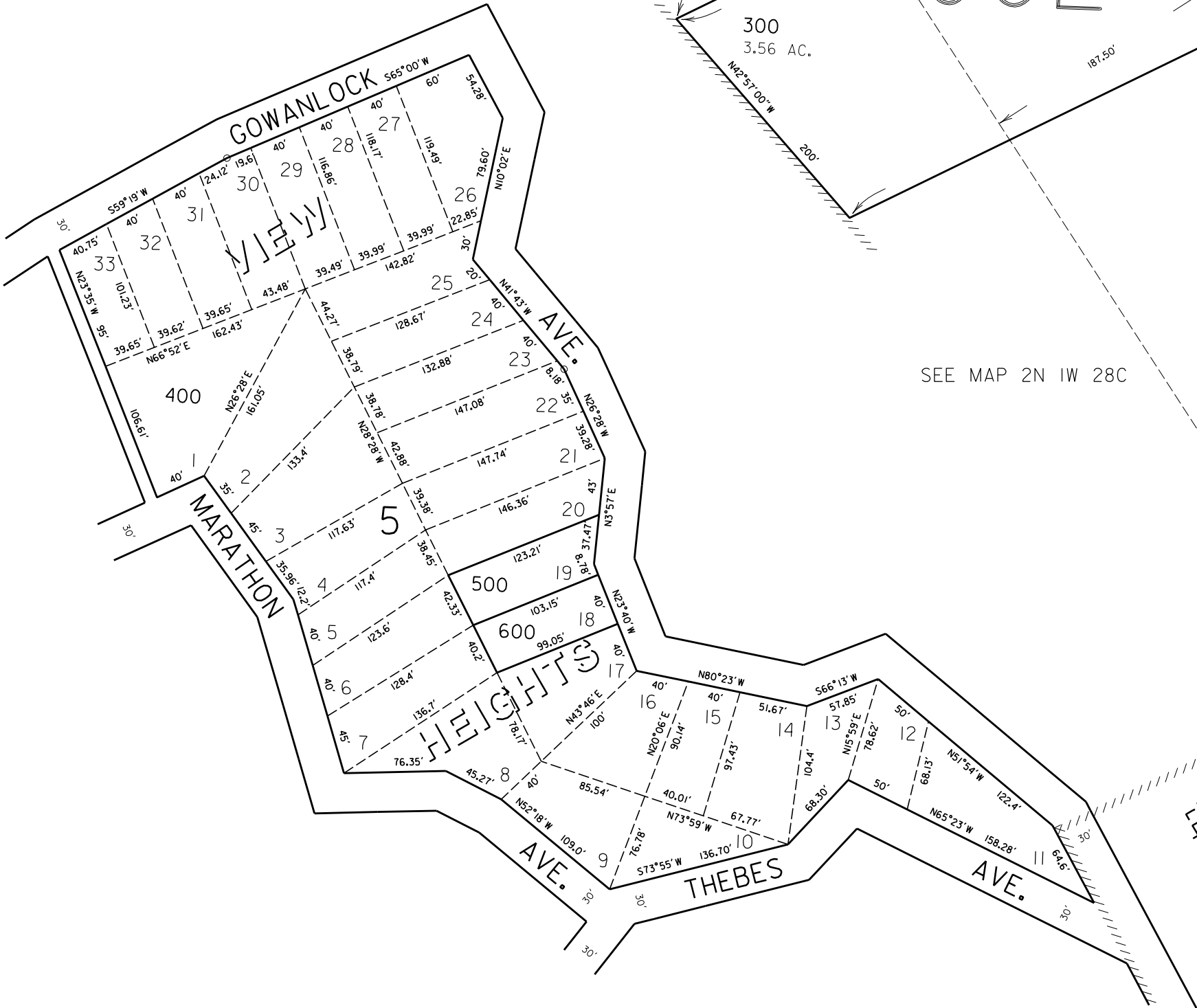
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SEE MAP 2N 1W 28CA



SEE MAP 2N 1W 28C

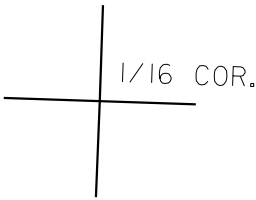
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SEE MAP 2N 1W 28C

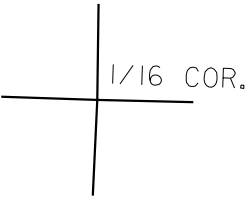
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  - 900

SEE MAP 2N 1W 328D



SEE MAP 2N 1W 33B

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PLAT  
OF  
ARMONA DR.



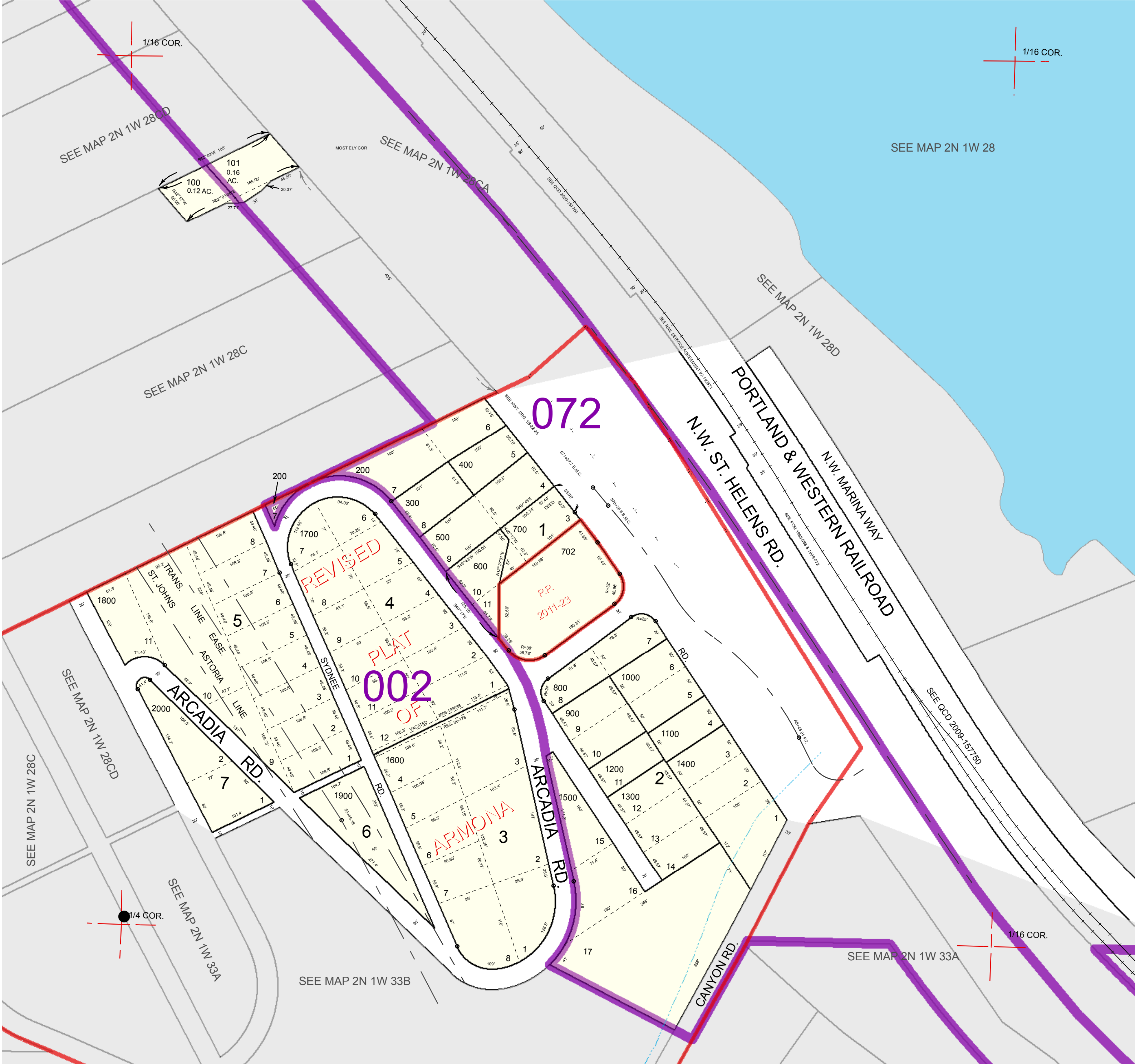
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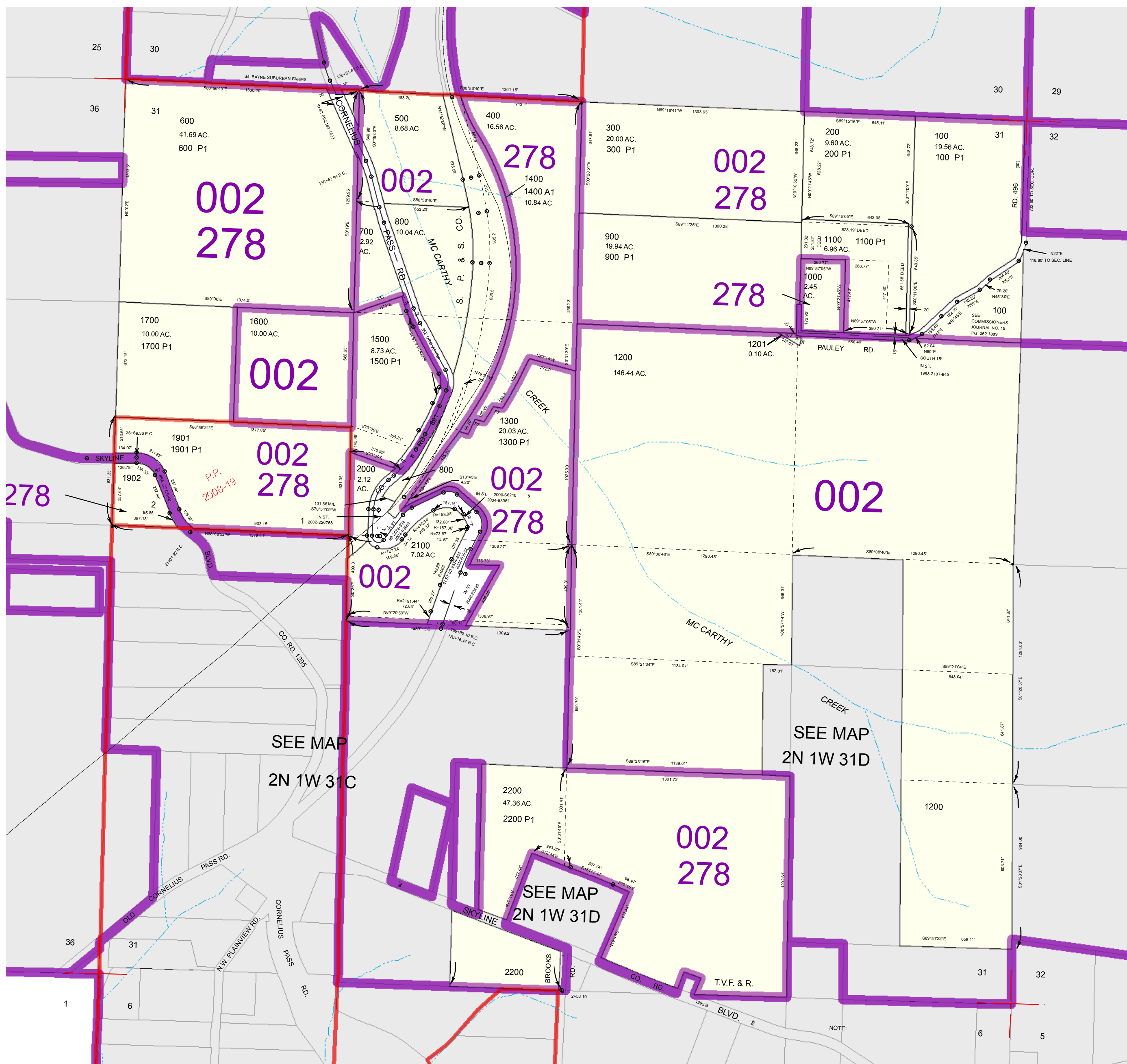




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1" = 400'

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2N 1W 31



SE1/4 SEC. 31 T.2N. R.1W. W.M.  
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1" = 200'

CEN. SEC.

SEE MAP 2N IW 31

2N 1W 31D

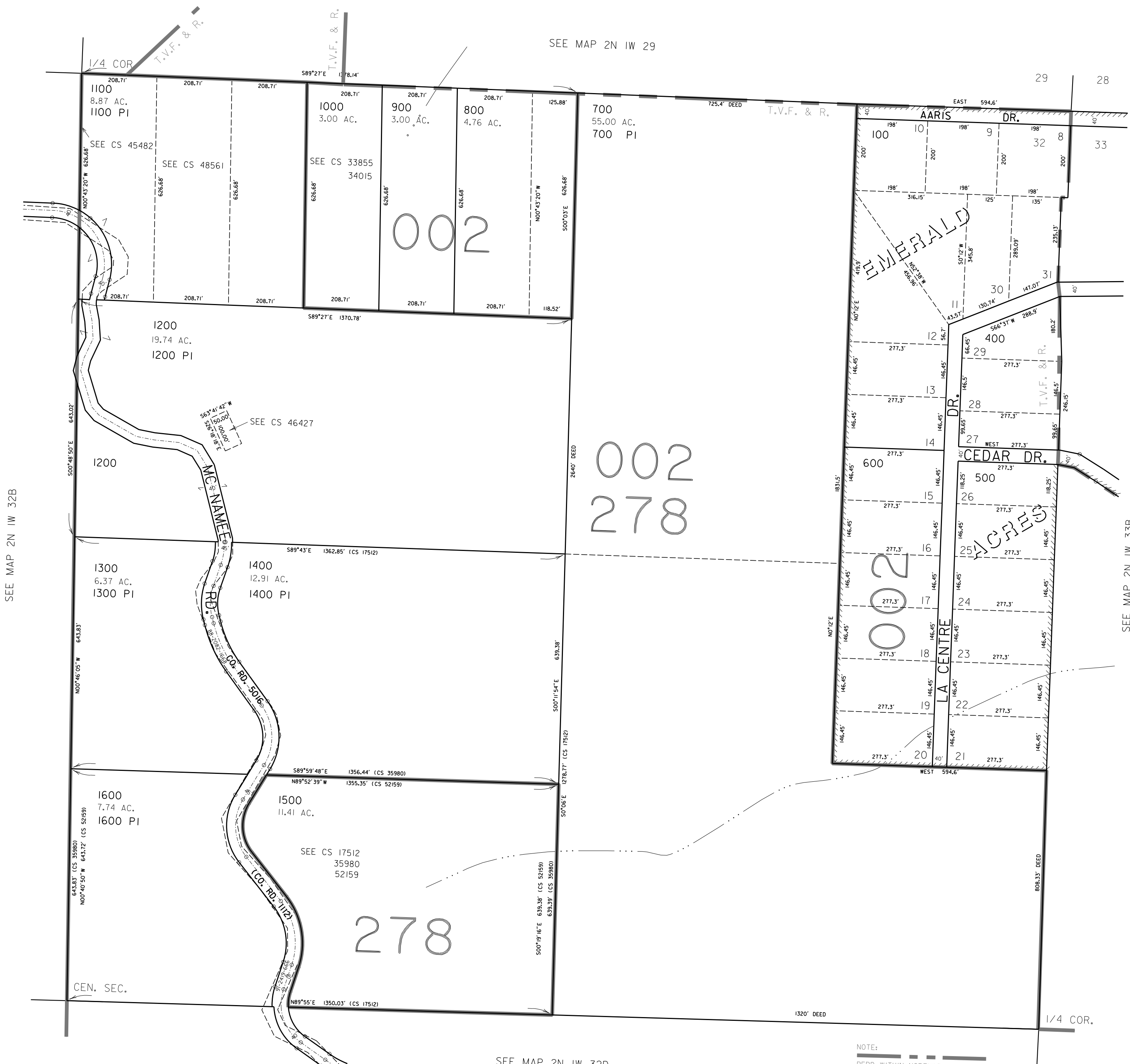
NOTE: \_\_\_\_\_  
 RFPD WITHIN NORTHWEST  
 FIRE PATROL 509  
 T.F.V. & R. =  
 TUALATIN VALLEY FIRE & RESCUE  
 S.F.P. = SCAPPOOSE FIRE PATROL



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NE1/4 SEC. 32 T.2N. R.1W. W.M.  
MULTNOMAH COUNTY  
1" = 200'

2N 1W 32A



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NOTE:  
RFPD WITHIN NORTHWEST  
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S.F.P. = SCAPPOOSE FIRE PATROL

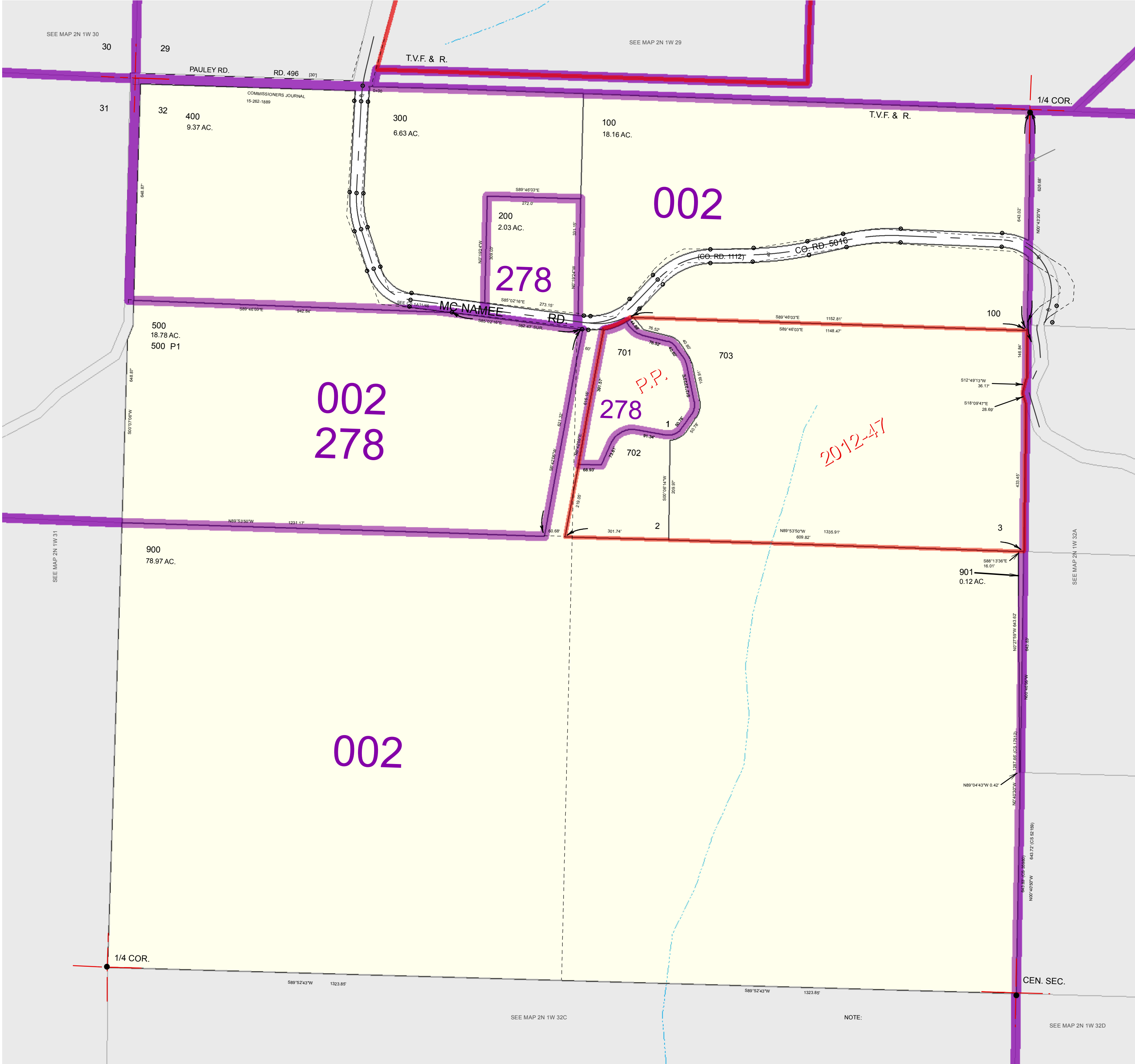
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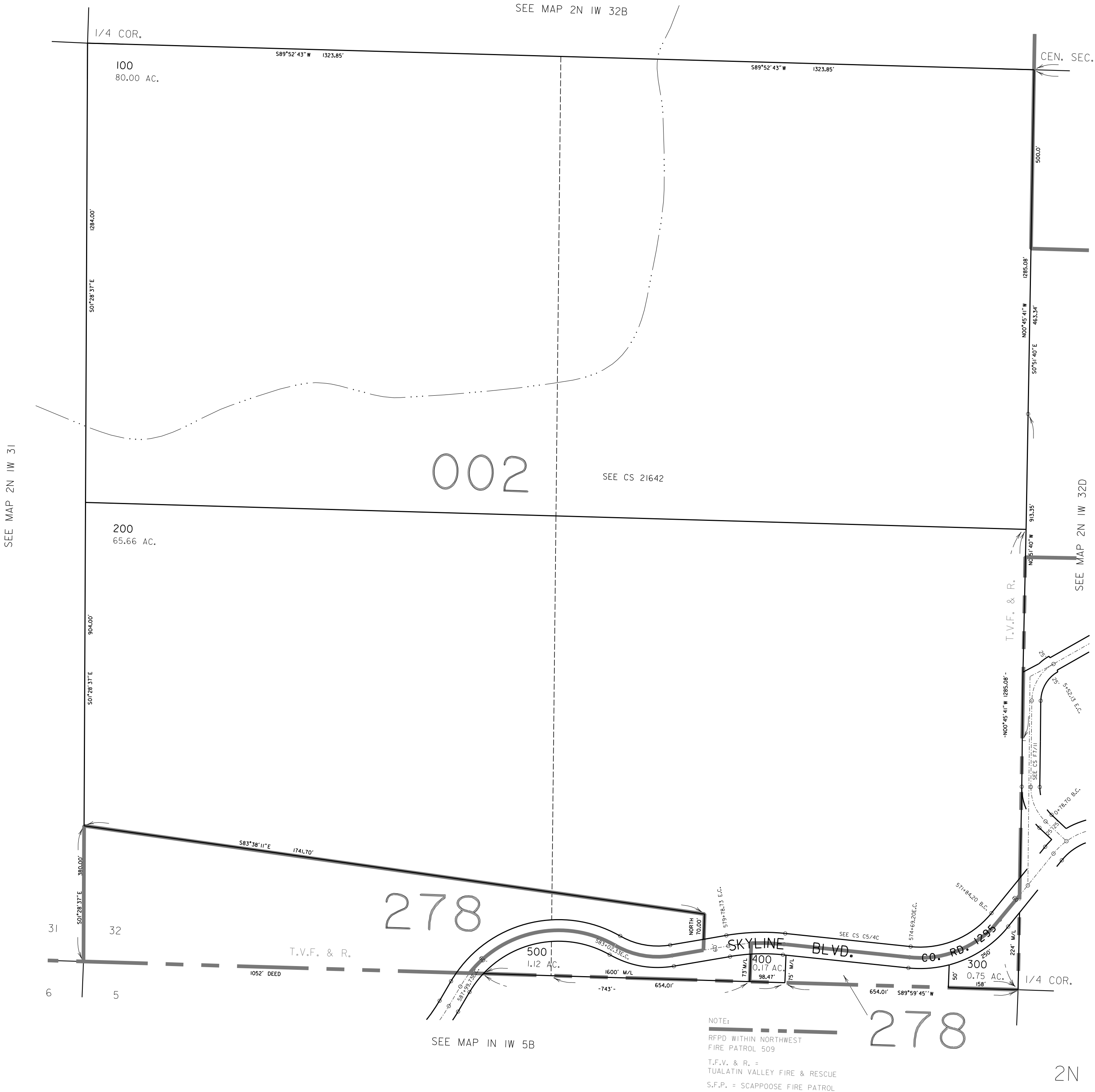




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MULTNOMAH COUNTY

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& INDEX

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SEE MAP 2N IW 34

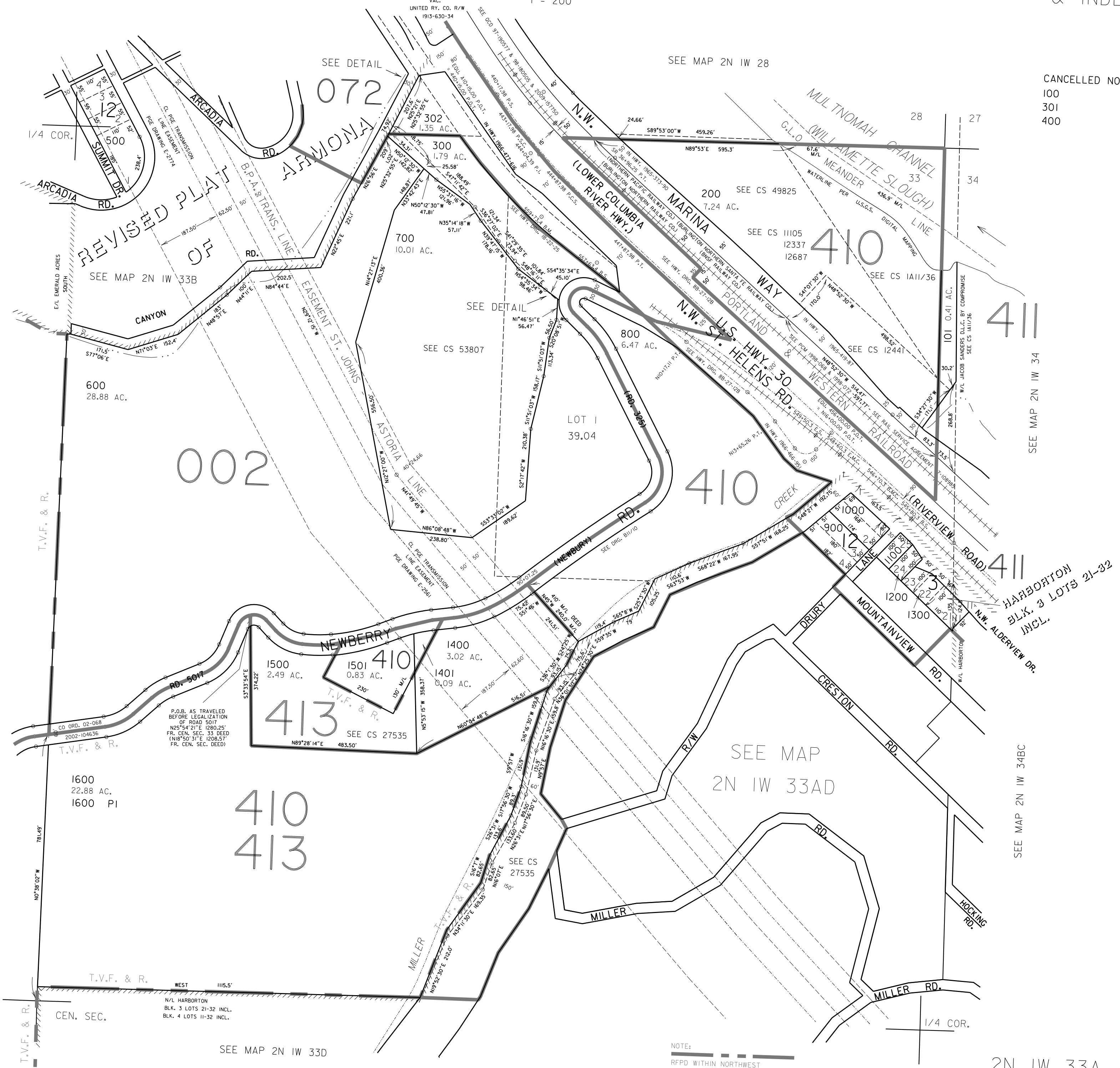
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SEE MAP 2N IW 33D

SEE MAP 2N IW 28

SEE MAP  
2N IW 33AD

NOTE:  
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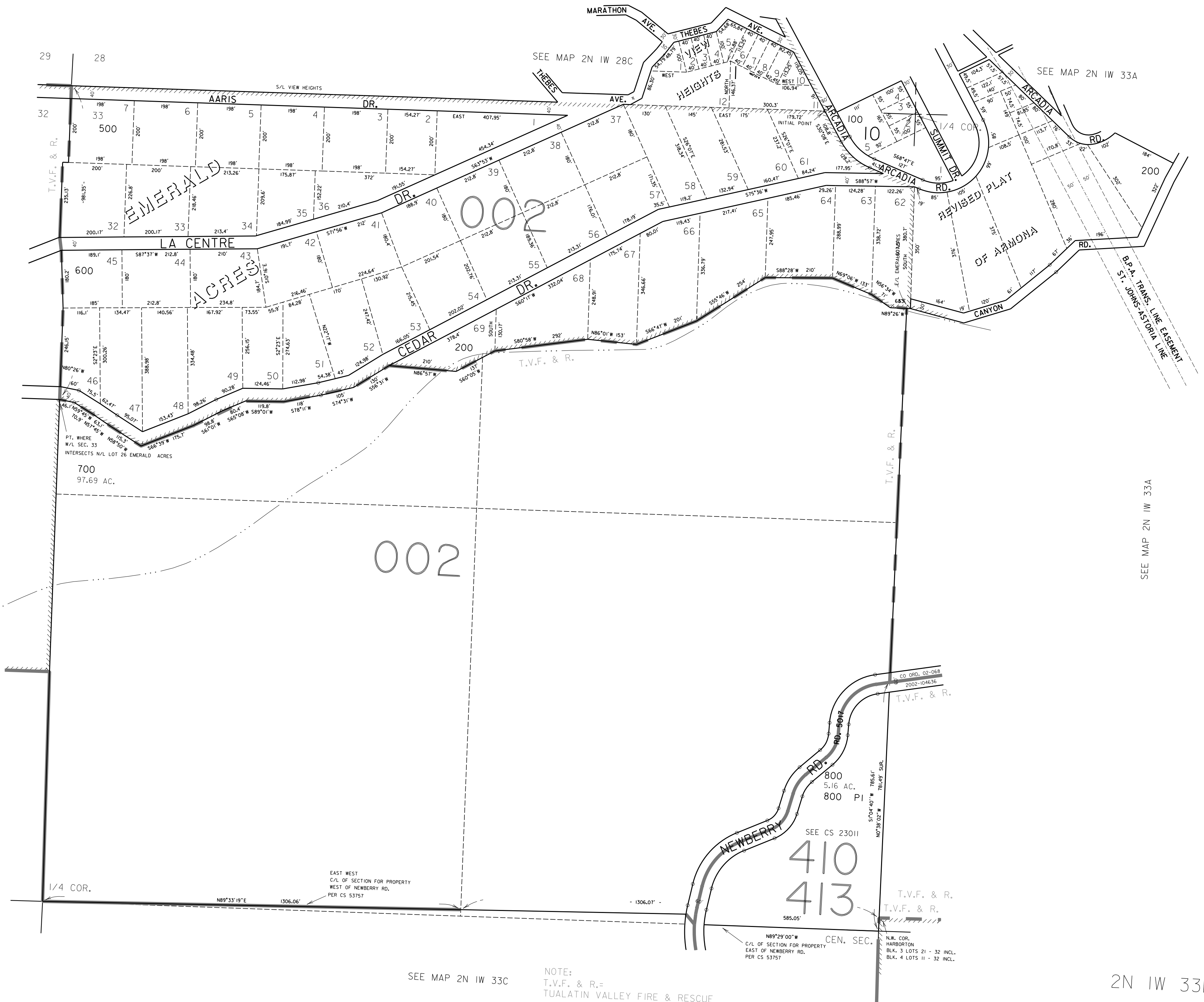
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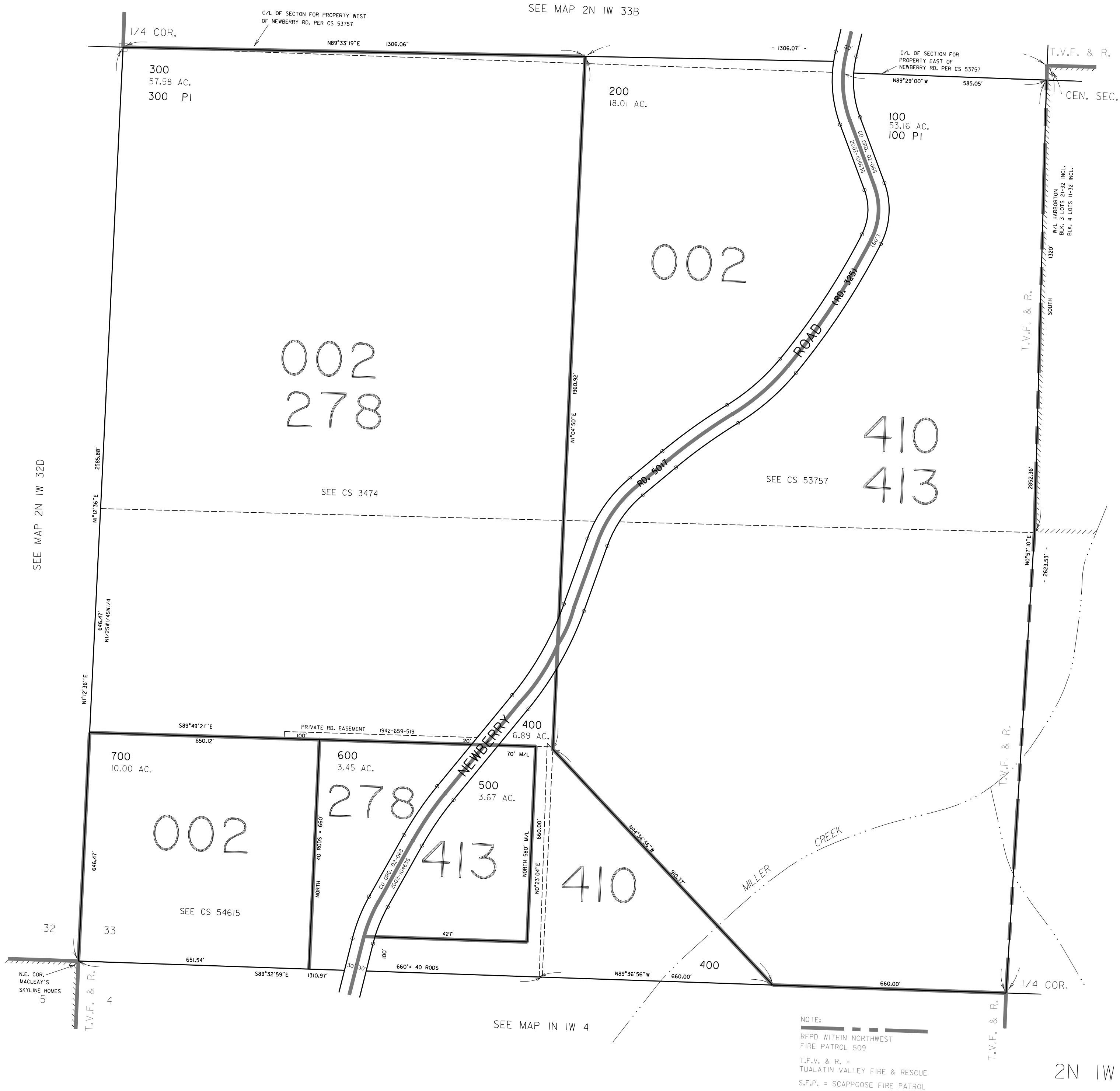
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2N 1W 33C





IN IW 5B

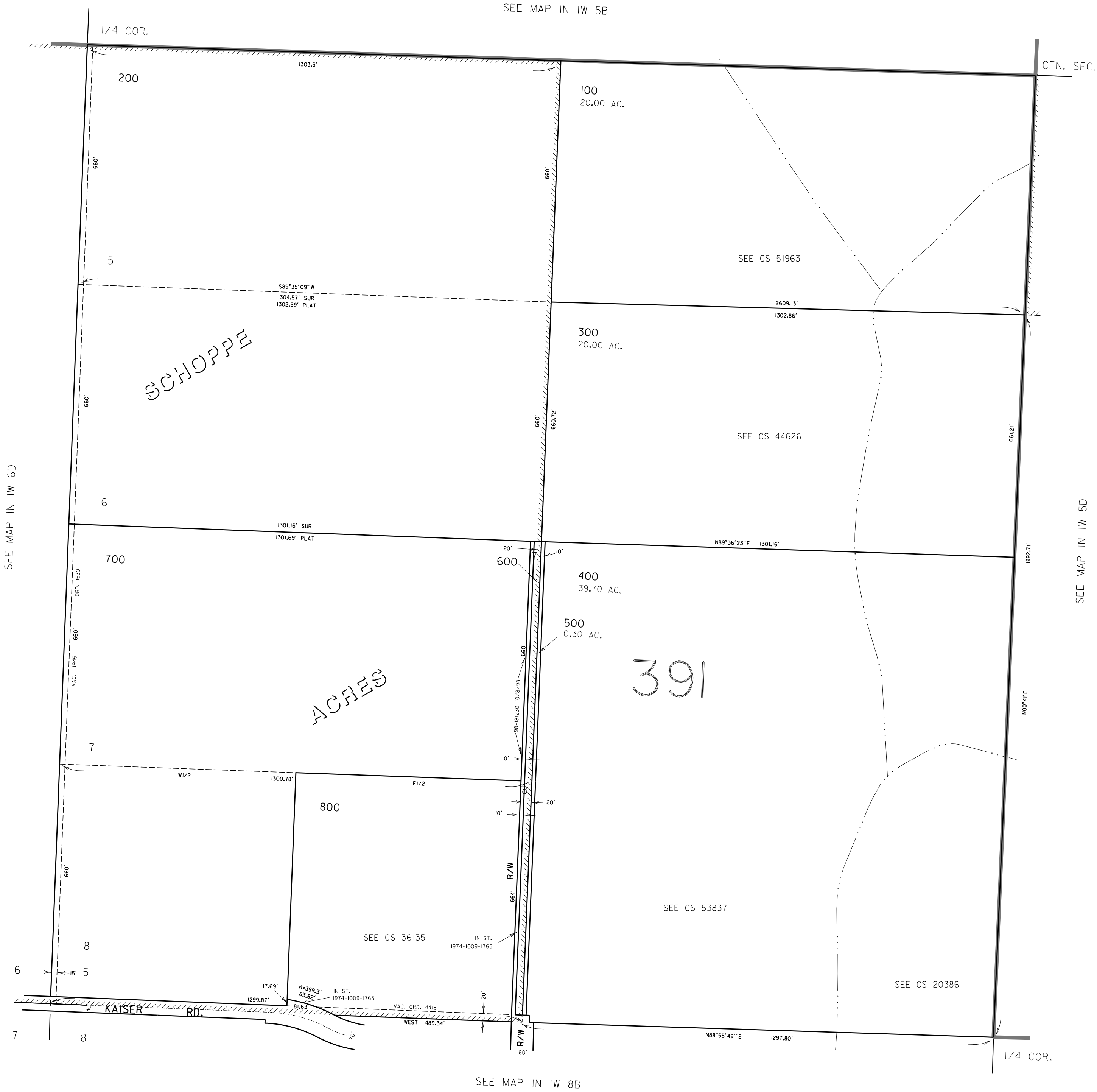




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IN IW 5C



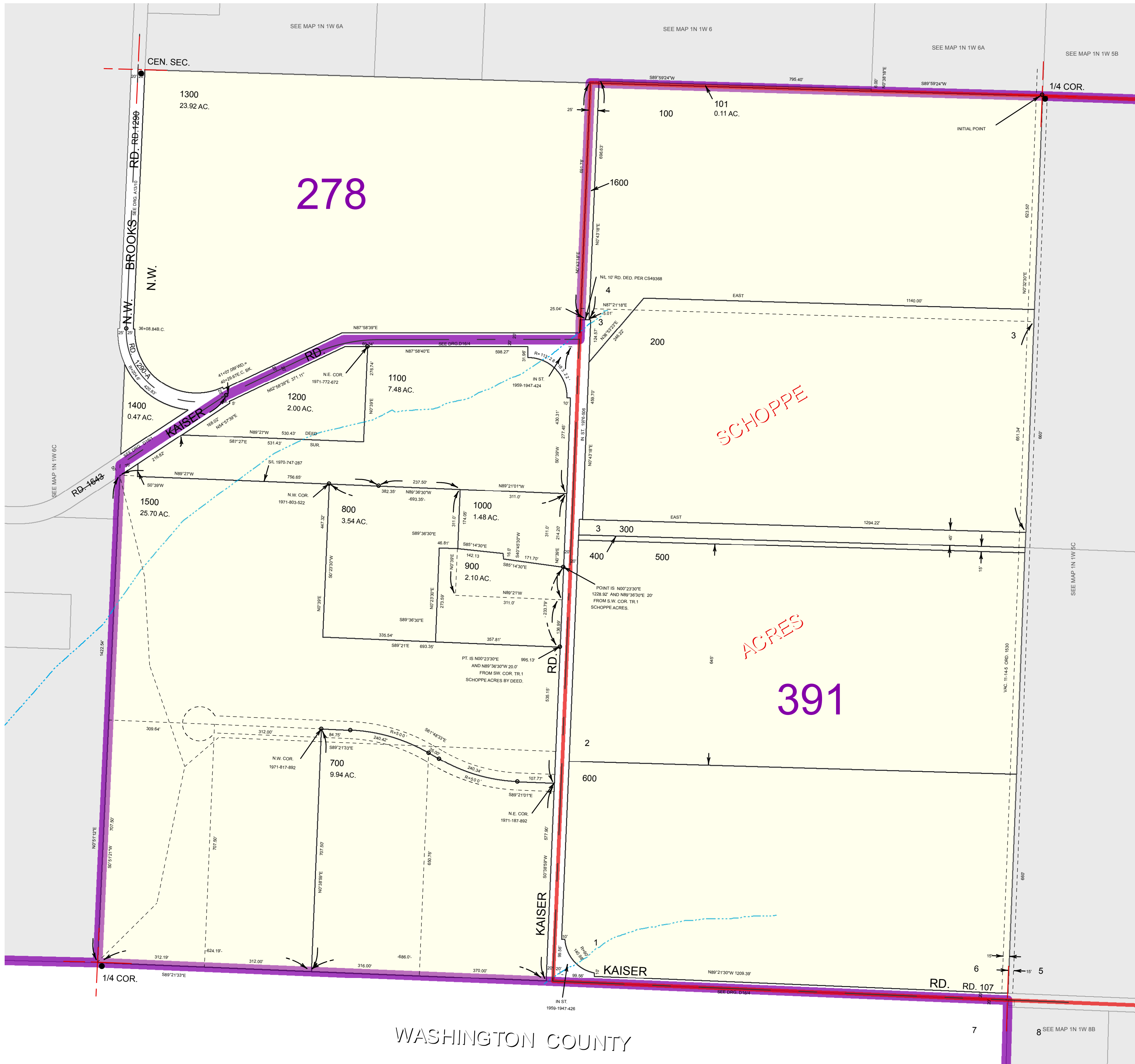
IN IW 5C



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MULTNOMAH COUNTY  
1" = 200'

1N 1W 6D



1N 1W 6D



IN IW 8B







# NORTH TUALATIN MOUNTAINS ACCESS MASTER PLAN

**April 2016**

Prepared by:  
Metro Parks and Nature  
600 NE Grand Avenue  
Portland, Oregon 97232



Clean air and clean water do not stop at city limits or county lines. Neither does the need for jobs, a thriving economy, and sustainable transportation and living choices for people and businesses in the region. Voters have asked Metro to help with the challenges and opportunities that affect the 25 cities and three counties in the Portland metropolitan area.

Metro works with communities to support a resilient economy, keep nature close by and respond to a changing climate. Together we're making a great place, now and for generations to come.

Connecting with nature provides physical, mental and spiritual benefits for the Portland metropolitan area's 2 million residents, giving them a respite from urban life. Studies show that parks and natural areas make neighborhoods more desirable and increase home values. They also help young people get outdoors, exercise and appreciate the natural world,

As Metro invests in livable communities, connections with nature are as critical as homes, jobs and transportation. Metro's portfolio of land protects water quality and wildlife habitat. Parks and trails increase housing values and attract employers to the region, providing welcome access to the great outdoors for people who live in urban and suburban neighborhoods. Perhaps most importantly, Oregonians' sense of place is rooted in the forests, rivers and meadows that Metro is helping to protect.



# ACKNOWLEDGEMENTS

Creating this access master plan required the commitment, support and involvement of many people who dedicated time and resources. The project team would like to thank the following individuals for their interest and involvement in developing a vision for North Tualatin Mountains Natural Area.

## METRO COUNCIL

Tom Hughes, Council President  
Shirley Craddick, Council District 1  
Carlotta Collette, Council District 2  
Craig Dirksen, Council District 3  
Kathryn Harrington, Council District 4  
Sam Chase, Council District 5  
Bob Stacey, Council District 6

## STAKEHOLDER ADVISORY COMMITTEE

Valance Brenneis, Portland Community College  
Laurel Erhardt, Skyline Ridge Neighbors  
Brad Graff, Skyline Ridge Neighbors  
Jerry Grossnickle, Forest Park Neighborhood Association  
Andy Jansky , Northwest Trails Alliance  
Shawn Looney, West Multnomah Soil and Water Conservation District  
Renee Myers, Forest Park Conservancy  
Travis Neumeyer, Trackers Earth  
Jinnet Powell, Skyline School  
Emily Roth , Portland Parks & Recreation  
Jim Thayer, Oregon Recreation Trails Advisory Committee  
Roger Warren, Oregon Department of Forestry  
Susan Watt, Skyline Ridge Neighbors



# EXECUTIVE SUMMARY

On the northwest edge of Forest Park sit four voter-protected natural areas in the North Tualatin Mountains, totaling 1,300 acres.

Thanks to 20 years of voter investments, Metro has been able to protect water quality, restore fish and wildlife habitat and – soon – provide new opportunities for people to connect with nature. Visitors will soon be able to enjoy hikes through lush forests, rides on trails optimized for off-road cycling, panoramic views of Sauvie Island and more, all while restoration continues.

The North Tualatin Mountains master plan is the culmination of two years of conversations with the community to craft a vision for the future of these four special places. Metro received hundreds of comments, ranging from wanting to keep all four sites completely closed to public access to wanting extensive trails and other improvements across all four sites.

Metro's recommendation falls in between those two bookends. At the North Tualatin Mountains, the top priority is to protect water quality and preserve core habitat areas 30 acres or larger, including upland forests and streams that wildlife depend on for connections between Forest Park and the Coast Range.

Within those parameters are opportunities to provide visitors with new destinations to experience nature. Metro is recommending official public access and visitor improvements at two of the four sites: Burlington Creek Forest and McCarthy Creek Forest natural areas. The recommendation calls for new multi-use trails and continued use of former logging roads at the two sites. Equestrian riders will continue to have local access to former logging roads at both sites. Improvements at Burlington would be made first, with improvements at McCarthy made later as money becomes available.

There are no planned visitor improvements at Ennis Creek Forest and North Abbey Creek Forest natural areas, except for a provision for the future Pacific Greenway Trail through Ennis.

Habitat restoration will continue at all four sites. Metro is committed to restoring old-growth habitat, increasing the biodiversity of forests, preserving habitat connectivity, supporting wildlife and protecting clean water. Unneeded roads will be decommissioned, dense stands of young trees will be thinned and native shrubs will be planted in areas formerly occupied by invasive plants. Metro's approach to conservation is to manage for habitats rather than individual species. Nurturing healthy forests and streams at the North Tualatin Mountains will create healthy habitat for a variety of native animals, such as elk, migratory birds and northern red-legged frogs, which are listed by the state as a sensitive species under threat.

The North Tualatin Mountains is just the type of place voters throughout the region had in mind when they invested in protecting natural resources and acquiring land for future parks. Metro intends to develop access to this treasured place in a way that ensures healthy habitats and meaningful experiences in nature.



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# 1. INTRODUCTION

Just north of Forest Park, a collection of four voter-protected properties form the North Tualatin Mountains. Old logging roads weave through clusters of mostly young Douglas fir trees and other upland forest habitat. On a clear day, joggers, hikers, horseback riders and mountain bikers can see Sauvie Island, and Cascade peaks to the east.

This plan plays an important role in delivering on Metro's Parks and Nature mission: protecting clean water, fish and wildlife habitat, and creating opportunities to enjoy nature close to home. It also advances the Metro Parks and Nature System Plan, which identifies the Tualatin Mountains naturehood – one of 11 distinct geographies in Metro's portfolio – as a focus area for managing and restoring large blocks of upland forest. Future investments are designed to build on an existing site conservation plan that protects biodiversity and connects wildlife habitat, while also inviting people to connect with nature in the North Tualatin Mountains.

Providing public access is a critical part of Metro's work to protect, restore and celebrate the landscape. Spending time outdoors supports healthy, active lifestyles and provides opportunities for peace, quiet and renewal.

## NATURAL AREAS LEVY

In 2013, voters approved a five-year levy to help care for regional parks and natural areas. As a result, Metro is restoring habitat, and expanding opportunities to experience and learn about nature across the greater Portland metropolitan region. Roughly half of all levy funds go toward land restoration and management, including controlling invasive plants, planting native species, and improving habitat for fish and wildlife. The remainder of the levy pays for park maintenance and improvements, volunteer programs, conservation education, community grants and natural area improvements for visitors. The 2013 levy identified sites in the North Tualatin Mountains as opportunities to provide access to nature. This access master plan and visitor improvements at the North Tualatin Mountains are funded by the levy.





## PLAN PURPOSE

Metro Parks and Nature protects water quality, fish and wildlife habitat and creates opportunities to enjoy nature close to home through a connected system of parks, trails and natural areas.

This access master plan is designed to provide a long-term vision and implementation strategy to guide future public use and development of the North Tualatin Mountains. This plan establishes project goals and objectives, outlines site resources and conditions, and summarizes the planning process. Employing principles of landscape ecology and landscape-level design strategies, this plan identifies access locations and approximate trail locations. It also presents a general plan for development of trailheads and strategies for implementing future development.

Metro intends to develop access to the North Tualatin Mountains in a sensitive and balanced way that ensures healthy habitats and continued preservation of the many ecological benefits this site provides for our region. Low levels of access are anticipated for the vast majority of the natural area.

## SETTING AND LOCATION

An arm of the Oregon Coast Range, the Tualatin Mountains extend into the greater Portland area along the Columbia River, dividing the lowlands of the Willamette and Columbia rivers from the Tualatin Valley. Forest Park, managed by the City of Portland, stretches nearly eight miles along the northeast slope of the Tualatin Mountains, covering 5,000 acres and earning distinction as the nation's largest natural urban forest reserve. The North Tualatin Mountains is a collection of four discontinuous sites north of Forest Park, totaling approximately 1300 acres. Collectively, the sites that make up the North Tualatin Mountains preserve large blocks of upland forest, streams and habitat connectivity between Forest Park, Washington County and the Coast Range.

The area is in Multnomah County, outside of Portland city limits. It is generally located between Newberry Road and Cornelius Pass Road to the west of Highway 30. One of the sites, North Abbey Creek, is south and west of Skyline Road. In the North Tualatin Mountains, logging roads weave through forest that has been primarily managed for commercial timber and agriculture. Upland forests are mostly comprised of densely spaced Douglas fir trees, planted about twenty years ago. Patches of older forest are occasionally found, generally adjacent to streams; and a few open areas remain where forests were cleared for agriculture or home sites. The North Tualatin Mountains are home to wildlife typical of young Douglas fir forests such as deer, elk, frogs and salamanders. Metro is actively restoring the sites to improve forest health and habitat diversity, enhance wildlife habitat and protect water quality.

## REGIONAL CONTEXT

In 1995 and 2006, voters approved two general obligation bond measures to protect water quality, wildlife habitat and outdoor recreation opportunities across the region. This public investment and commitment is responsible for the growth of Metro's portfolio of natural areas, which today totals roughly 17,000 acres.

Some properties have been identified for visitor improvements, designed to complement Metro's commitment to clean water and healthy wildlife habitat. However, the majority of Metro's portfolio is unlikely to be developed with formal public access. Most of the remaining land is managed as natural areas, where restoration is the focus and public access is not promoted. A handful of sites are designated as habitat preserves, where Metro actively discourages public use other than guided tours or special activities due to sensitive species and fragile habitats.





Figure 2.1: North Tualatin Mountains map



The North Tualatin Mountains comprise only a handful of properties in Metro’s regional portfolio suitable for recreation access; in other words, we believe that with thoughtful planning, limited development will not threaten its value to regional conservation. These sites provides a variety of opportunities to allow people to experience the land they’ve helped protect, and share in the benefits of nature close to home.

In preparation for both bond measures, Metro identified target areas with specific conservation goals to guide acquisition throughout the region. North Abbey Creek Forest, was acquired to meet goals of the Rock Creek target area, including to protect the riparian corridors and important upland habitat in the Abbey Creek headwaters, and to acquire and protect a natural corridor along the main stem of Abbey Creek linking its confluence at Rock Creek to the Westside Trail and to Forest Park. Burlington Creek, Ennis Creek, and McCarthy Creek Forests, were acquired to meet goals of the Forest Park target area.

Metro acquired property in the North Tualatin Mountains in order to:

- keep important wildlife and riparian corridors intact;
- protect upland habitat and headwater areas important to preserving the region’s water quality; and
- provide trail connections between the region’s largest urban park and public lands in the Oregon Coast Range.

Burlington Creek Forest was slated to become housing prior to its acquisition.

Protecting habitat and water quality on these sites is at the heart of Metro’s work. Providing opportunities to experience nature and provide regional trail connections is also central to our mission. People who experience nature are more likely to value and protect it.

## PLANNING PROCESS OVERVIEW

The central goal of the master plan development process was to identify the best locations for formalized recreation access and amenities. To help answer this question, Metro engaged community members and scientists in looking at the four individual sites that together comprise the North Tualatin Mountains. A Stakeholder Advisory Committee was established for the project, and met five times to share technical expertise and insights into community needs and desires. Committee meetings, four community events, conversations with community members, and numerous comments submitted online helped to identify places to provide access, and where to prioritize protection of undisturbed core habitat areas.

This process relied on available data, principles of landscape ecology, the expertise and experience of local natural resource scientists and wildlife biologists, and landscape-scale design strategies to determine the most appropriate opportunities for public access and connecting with nature.



## 2. EXISTING CONDITIONS

### THE FOUR SITES: CURRENT ACCESS, USES AND CHARACTER

The North Tualatin Mountains provide a variety of views and forest experiences. In areas that have been cleared for timber harvest, utilities or home sites, views across the Tualatin Valley, Sauvie Island and the Cascade mountains offer a broad perspective of how the sites fit into the region's geography. There are opportunities to see and hear wildlife, including elk, bobcat, songbirds and hawks, which have been frequently observed on the sites. Together with undeveloped private lands in the area, the North Tualatin Mountains provide habitat connectivity between Forest Park and the Coast Range.

Two of the sites, Burlington Creek Forest and Ennis Creek Forest, are located on the east-facing slopes of the mountain ridge and are similar in character to Forest Park, with fairly steep topography and forested hillsides. McCarthy Creek Forest and North Abbey Creek Forest are west of the main ridgeline and are more open, with areas of more gentle topography.



Figure 2.2: North Tualatin Mountains map



### **Burlington Creek Forest (339 acres)**

Of the four sites, Burlington Creek Forest has the most current use by people. People walk and ride bikes and horses on existing logging roads and access the site primarily via McNamee Road. Visitors can walk about a mile and a half loop, or access the Ancient Forest Preserve, which is owned and managed by the Forest Park Conservancy. This patch of old growth forest offers a stark contrast to the forest that grows on most of the site. The old grove provides a good opportunity for visitors to see what most of Burlington Creek Forest will become over time. By and large, the site's steep ridges and valleys were logged about twenty years ago and replanted with Douglas fir.

McNamee Road, Cornelius Pass Road and the railroad along the northeast site boundary all cross through Burlington Creek Forest. Additional infrastructure includes logging roads and the Portland General Electric (PGE) power line corridor running the length of the site on the northeast side. The logging road that meanders along the power line corridor offers views of Sauvie Island and the peaks of the Cascade Range on a clear day.

Connectivity between Burlington Creek Forest and Burlington Bottoms Wetlands and Multnomah Channel is impeded by US Highway 30, residential development, and the Burlington Northern railroad. The Burlington Water District services the neighborhood below, and maintains a water tank on the site.



*Figure 2.3: Burlington Creek Forest*



**Ennis Creek Forest (350 acres)**

The northern half of Ennis Creek Forest is similar in character to Burlington Creek Forest, composed of young conifer and hardwood forest. The site is separated from Burlington Creek on the lower portions of the ridgeline by an operational rock quarry. On the southern part of the site, instead of alternating steep ridges and valleys typical of the Tualatin Mountains, the north and south forks of Ennis Creek flow through more gentle topography. The forest is older, and has a higher diversity of trees, shrubs and groundcover.

Existing infrastructure includes the power line corridor and infrastructure associated with the small operating farm and rental house at the south end of the property.

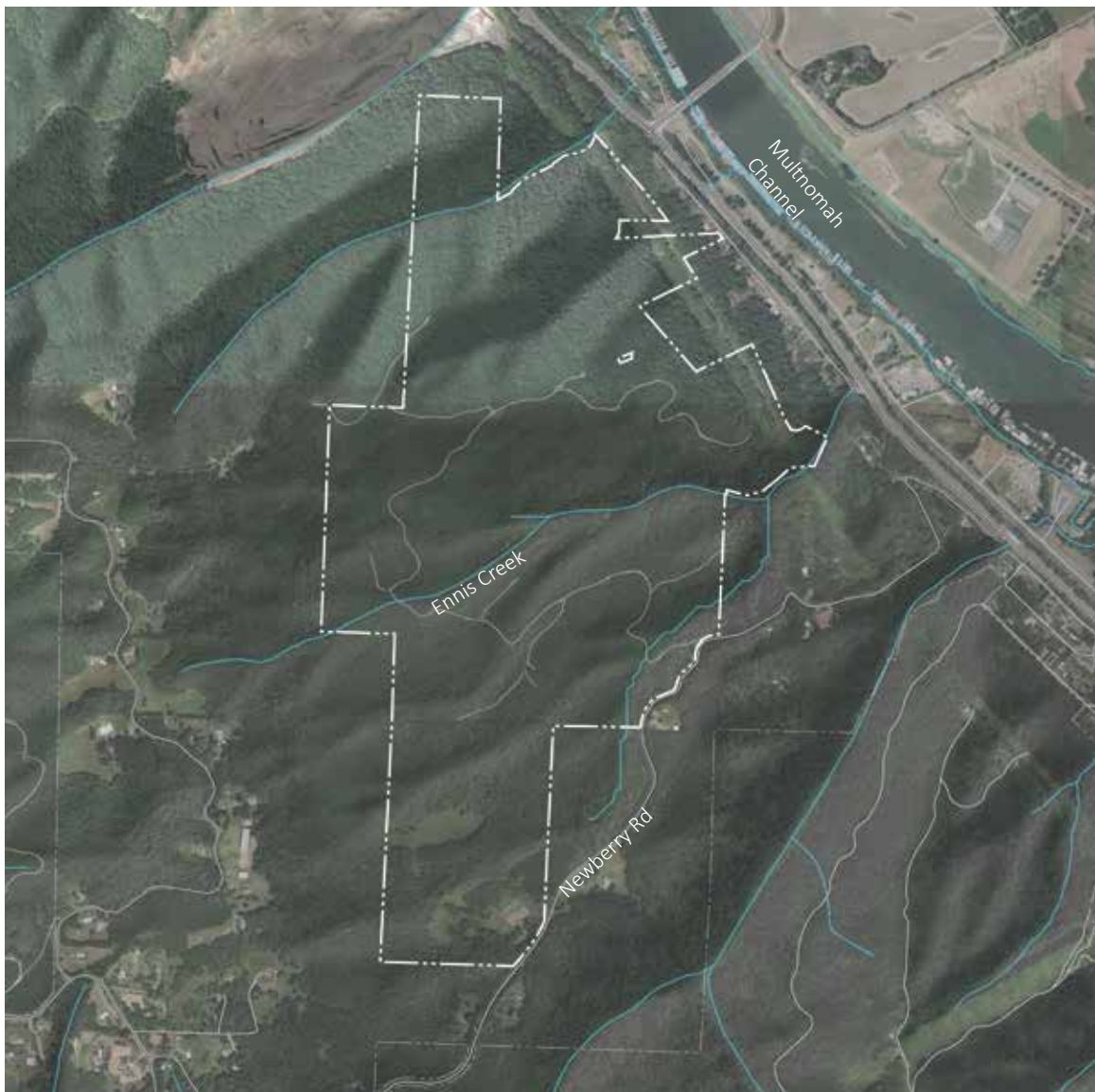


Figure 2.4: Ennis Creek Forest



### **McCarthy Creek Forest (402 acres)**

McCarthy Creek Forest is located west of McNamee Road. A meadow at the northwest corner of the site offers spectacular views of the Tualatin Valley and the Coast Range, and is frequented by a local herd of elk. A second viewpoint offers a perspective of the McCarthy Creek Valley as it curves northward to follow Cornelius Pass to the Multnomah Channel. The site protects over five miles of McCarthy Creek and its tributaries, and approximately one-third of the entire McCarthy Creek watershed. A network of old logging roads traverses this former commercial tree farm. Most of the roads are in a degraded condition. Though the majority of the property was logged, there is a 20-acre patch of mature forest (60 to 80 years old) in the northwest corner of the natural area. Hikers and equestrians walk or ride the loop road at the south half of the site. Schools and youth organizations have also visited the site for field trips, managed by special use permit.



*Figure 2.5: McCarthy Creek Forest*



### **North Abbey Creek Forest (211 acres)**

Burlington, Ennis and McCarthy Creek forests are all located on the northeast side of Skyline Ridge, which defines the edge of the Tualatin River watershed. North Abbey Creek Forest, located southwest of Skyline Ridge, is the only one of the four North Tualatin Mountains sites in the Tualatin River watershed. The site protects the headwaters of North Abbey Creek, which flows the length of the site through a steep canyon. The forest here includes bigleaf maple, Douglas fir and a diverse understory. Large open areas are frequented by a local herd of elk. Open areas also provide opportunities to develop shrub-dominated habitat for pollinators and neotropical migratory birds.

Maintenance access to North Abbey Creek Forest exists from the north and south of the site. Current public uses are primarily educational in nature, managed by special use permit. Additionally, residents from the neighborhood to the east occasionally access the east side of the property via informal trails that connect North Abbey to neighborhood association land.



*Figure 2.6: North Abbey Creek Forest*



## LOCAL HISTORY

Before European settlement, the Atfalati (also called Tualatin) tribe of the Kalapuya inhabited villages on the Tualatin Plains and the hills around Forest Grove. It is thought that the northern areas of the Tualatin Mountains were used primarily for gathering and hunting rather than settlements. In 1883, Newberry Road was established as a County Road, and logging began around that time. The Skyline Neighbors have compiled a history of the area, and highlights are shown in Figure 2.7.

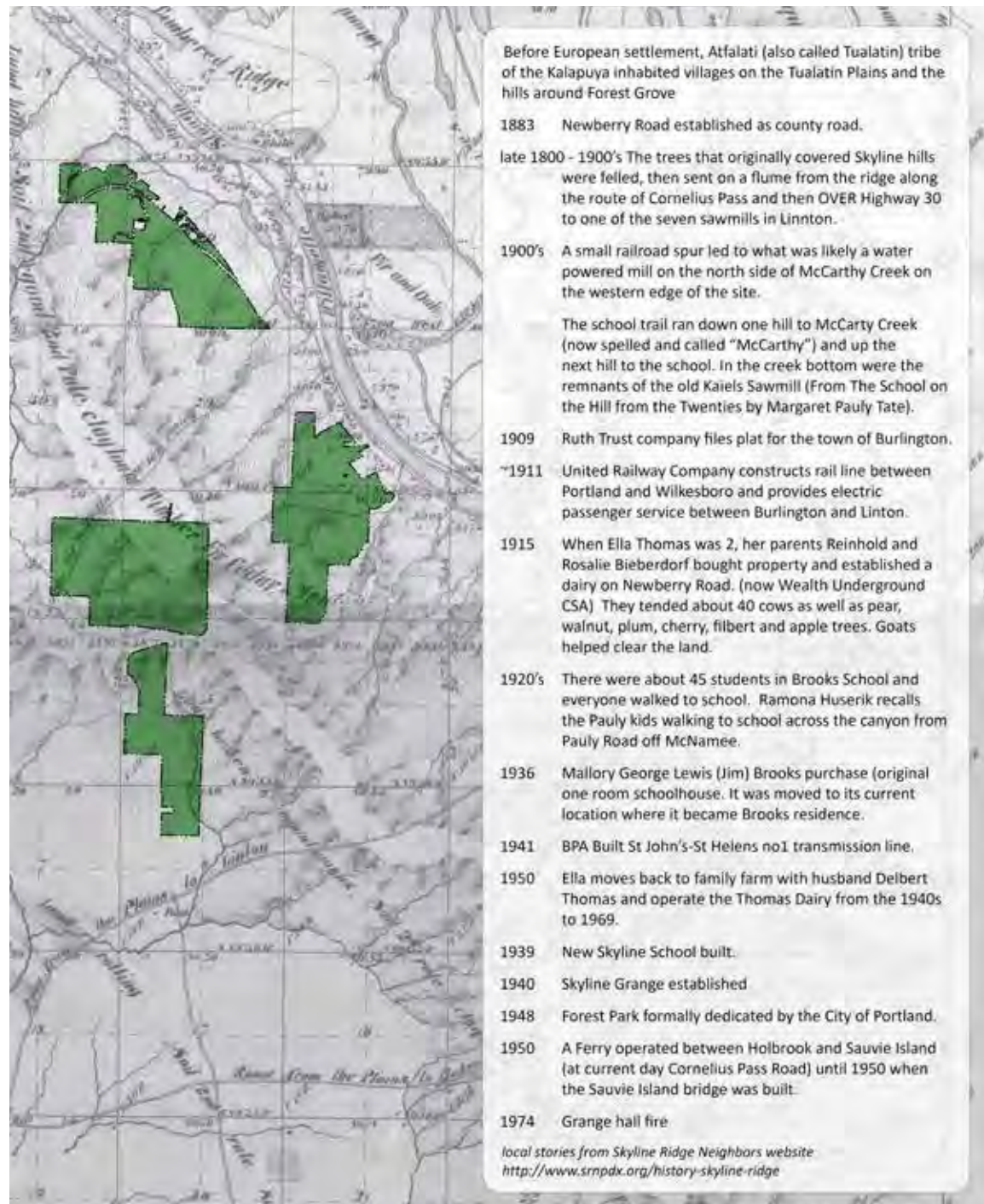


Figure 2.7: General Land Ordinance map (approximate site location highlighted in green). Local history excerpts of from Skyline Neighbors website.



## GEOLOGY

The Tualatin Mountains are the forested ridgeline also referred to locally as the Tualatin Hills, or Portland's West Hills. They rise steeply from the edge of the Portland Basin and their western slopes descend gradually, becoming the Tualatin Valley.

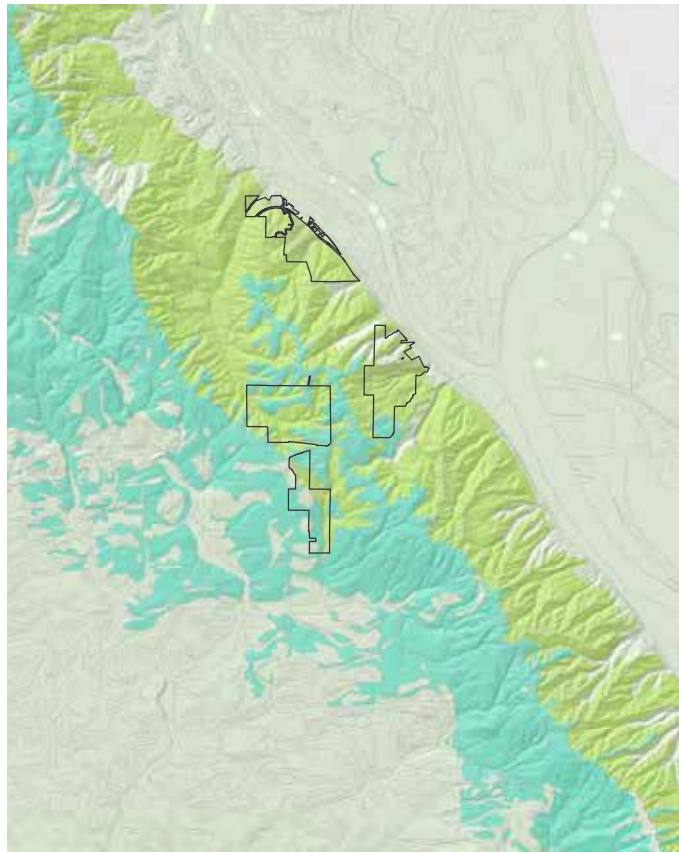
The Tualatin Mountains are made of basalt which originated from the Grand Ronde Basalt Flows, a part of the larger Columbia River Basalt Flows. Masses of lava flowed from eastern Oregon tens of millions of years ago, before the formation of the Cascade Range. Columbia basalts are the base rocks of our entire region. As thick as 900 feet in places, these are the dark, sturdy rocks that form the bluffs of the North Tualatin Mountains, and along the Willamette River and Columbia River Gorge.

The Tualatin Mountains are bound by the Portland Hills Fault along their eastern edge. The formation of the ridgeline resulted from a fold in the surface known as an anticline, where the top of the ridgeline is the crease of the fold, and the oldest layers of rock are at the center of the fold. Layered on top of the basalt is a thick layer of glacial silt, called loess, which is believed to have been deposited by east winds, thought to be more prevalent during the ice ages. In some locations in the Tualatin Mountains the loess is over 100 feet thick.

## SOILS

The soils of the Tualatin Mountains formed in the loess material known as Portland Hills Silt. The predominant soil classifications in the Tualatin Mountains are Goble silt loam, and Cascade silt loam. As seen in Figure 2.8, the Goble soils are primarily found on the east side of the ridge, and Cascade silt loam is found mostly west of the ridge. This pattern holds true as you look more closely at the four sites.

The Goble soils, which are moderately well drained, predominate at Burlington and Ennis. The Cascade soils, somewhat poorly drained soils, are more prevalent at McCarthy and North Abbey, where Goble soils are found in the stream corridors with Cascade silt loam on the ridges.



*Figure 2.8: Map showing predominant soils: Cascade silt loam on the west side of skyline ridge, and Goble silt loam on the east side.*



## TOPOGRAPHY

Overall, the topography of the four sites is steep with typical slopes between 20 and 50 percent. The east-facing slopes of Burlington and Ennis Creek forests form the western boundary of the Columbia/Willamette floodplain. These slopes fall from elevations of 600 to 800 feet to near sea level at their base.

Roads in the area generally align with the tops of ridgelines. As shown in Figure 2.9, Skyline Ridge divides at McNamee Road, and McCarthy Creek Forest sits just west of this intersection. West of this divide, the mountains slope more gradually toward the Tualatin Valley. At McCarthy and North Abbey, the ridgetop slopes are less steep, with steeper slopes near the stream corridors.

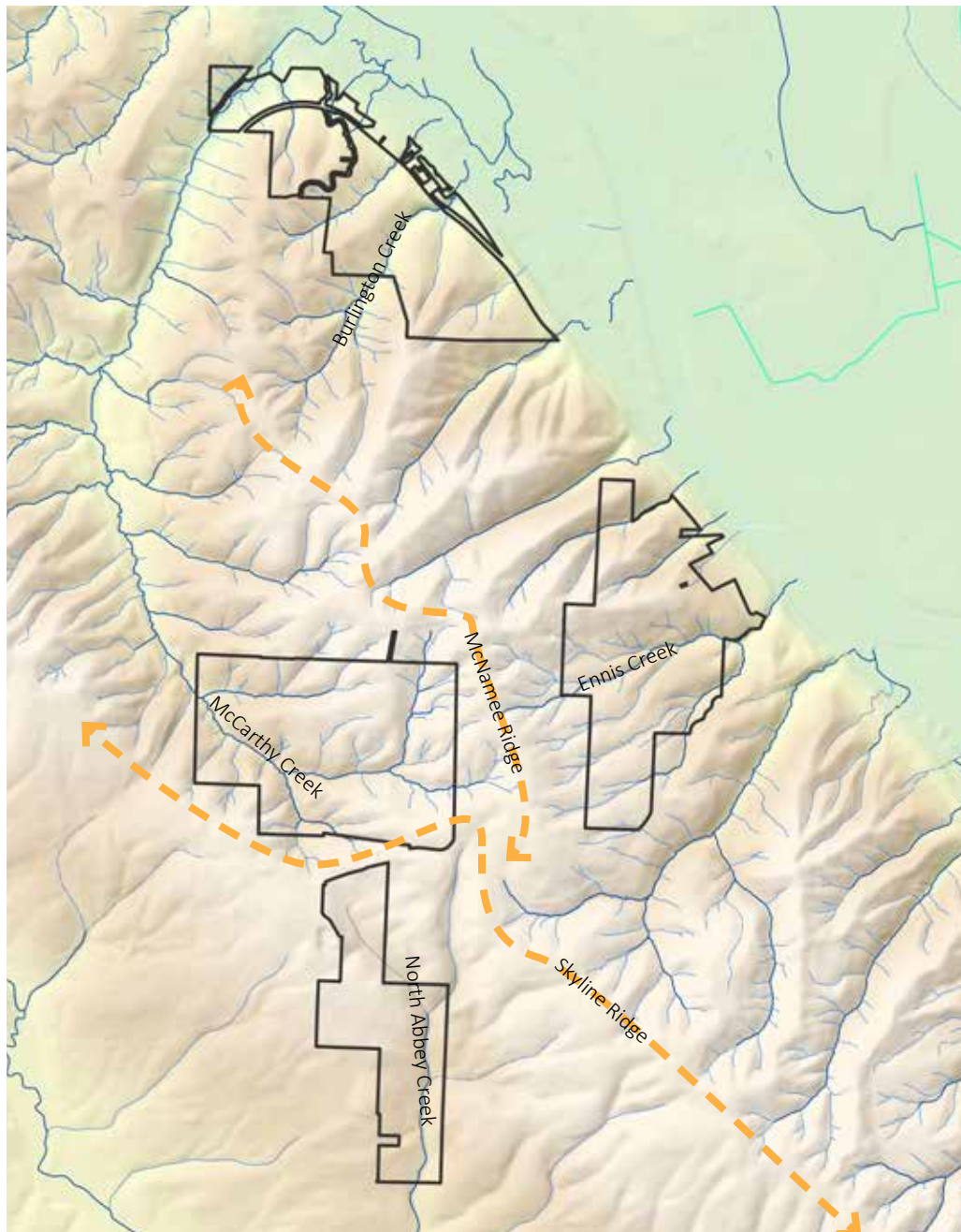


Figure 2.9: North Tualatin Mountains topography and drainages



## HYDROLOGY AND WATER QUALITY

North Tualatin Mountains Natural Area protects significant sections of four streams and associated riparian forest habitat. The sites also protect headwater areas of McCarthy, Ennis and North Abbey creeks.

Burlington Creek, Ennis Creek and several unnamed streams flow eastward through steep valleys to the base of the ridge. At Ennis Creek, the Multnomah Channel flows along the base of the ridge. The roughly 400-acre J.R. Palensky Wildlife Mitigation Area (Burlington Bottoms), owned by the Bonneville Power Administration (BPA) and managed by Oregon Department of Fish and Wildlife (ODFW), lie at the base of Burlington Creek Forest.

Ennis Creek and its many unnamed tributaries occupy the southern half of the Ennis Creek Forest site. The southern half of Ennis Creek Forest is less steep, and field observations indicate that the area appears to have wetter soils and, potentially, a higher likelihood of forested wetlands.

McCarthy Creek drains a 400 acre area bounded by Skyline on the south and McNamee on the east. With over 5 miles of main stem and tributaries, the natural area protects about a third of the watershed of McCarthy Creek. Existing roads, developed for logging, are in various conditions including a north-south running road that crosses many small drainages and has experienced road slumps and culvert failures. Current plans call for decommissioning roads north of the loop road.

North Abbey Creek Forest is the only one of the four sites located in the Tualatin River Watershed. The northern part of the site protects headwaters of North Abbey Creek, which flows through a steep ravine along the length of the eastern site boundary.

Large conifers and down wood have been removed from many of the North Tualatin riparian areas, resulting in incised (eroded) stream channels and slumping stream banks. Old logging roads are a significant source of sediment in North Tualatin Mountains streams. Sediment harms water quality and degrades amphibian and fish habitat. Water quality is also threatened by the many culverts found on-site; old and under-sized, they block wildlife movement and increase the risk of culvert failure and stream sedimentation. Specific Metro activities to protect and improve water quality are discussed in Chapter 3.

## VEGETATION AND HABITAT

### Historic Conditions

Historically, the North Tualatin Mountains were dominated by upland forest, described as mesic mixed conifer forest with mostly deciduous understory. The natural area may have included Douglas fir, western hemlock, red cedar, grand fir, bigleaf maple, yew, dogwood, white oak, red alder. Historic burns were recorded at the southern half of Burlington and the southern half of North Abbey.

### Existing Condition

In recent history these lands have been managed primarily for commercial timber harvest and agriculture. Much of the area was logged in the early 1990s. Today, the North Tualatin Mountains natural areas have hundreds of acres of former commercial tree farms dominated by young stands of Douglas fir. As a result, the sites are characterized by upland forest with densely planted Douglas-fir trees that are about 20 to 30 years old. Standing dead trees (snags) and down wood have been removed by previous property owners through clearcut harvesting or other land uses. Metro is actively managing the forests to reduce the number of conifers per acre, to keep trees healthy, preserve hardwoods and native shrubs, and increase down dead wood. Several patches of older forest (60 to 80 years old) remain at the southern end of Ennis Creek Forest, and along McCarthy and North Abbey Creeks.



Open areas exist in places that had been cleared for pasture, agriculture or home sites. In addition, the PGE power line corridor runs generally north-south the length of Burlington Creek and Ennis Creek Forest sites. The open areas provide opportunities for shrub dominated plant communities which provide important feeding and breeding habitat for neotropical migrant birds as well as other wildlife. Metro has maintained some existing open areas by controlling tree encroachment.

### **Desired Future Condition**

The Site Conservation Plan, available under separate cover, identifies desired future conditions for riparian and upland forests, upland early successional shrub, and oak savanna, shown in Figure 2.10 and described briefly below.

**Upland Forest:** Upland forests are composed primarily of native trees and shrubs such as Douglas fir, big-leaf maple, Oregon grape, salal and sword fern. Especially important to migrating and nesting songbirds, woodpeckers, mammals such as Douglas squirrel and deer, and seasonal habitat for salamanders, frogs and turtles. Urbanization has fragmented and reduced the amount of upland forest.



**Riparian Forests:** Riparian forests protect water quality and provide important habitat near the headwaters of Burlington, Ennis, and McCarthy Creeks, which flow into the Multnomah Channel, and North Abbey Creek, a tributary of the Tualatin River. Tributary creeks and confluence areas provide clean and cold water, nutrients and refuge areas for important fish species.

**Upland Early Successional Shrub:** Shrub dominated communities provide food and cover for neotropical migrant songbirds and create habitat for a variety of pollinator species. Small scale agricultural sites, recently logged areas, and utility clearings are opportunities to manage for early successional upland forest shrubs.

**Oak Savanna:** Oak savanna and oak woodlands harbor many unique plant and animal species. Once common, it is now rare in our region.

## **FISH AND WILDLIFE**

There is a substantial body of research about Pacific Northwest forest habitats and the wildlife that use them at different stages of forest development. This research, input from external experts in habitat and wildlife, and application of conservation biology principles (discussed in Chapter 3) informs Metro's approach to site management. As such, a thorough ecological inventory and assessment has not been done for the North Tualatin Mountains.

The following is a brief summary of known information about wildlife in North Tualatin Mountains.

### **Mammals**

While no formal mammal surveys have been conducted, staff, visitors and neighbors have observed a wide variety of mammals typically associated with upland forest habitat and riparian forests of this area including elk, black-tail deer, coyote, bobcat, Douglas squirrels, Townsend chipmunks, and mountain beavers. Elk and elk sign is commonly observed at North Abbey, McCarthy and Ennis. It is less frequently observed at Burlington.



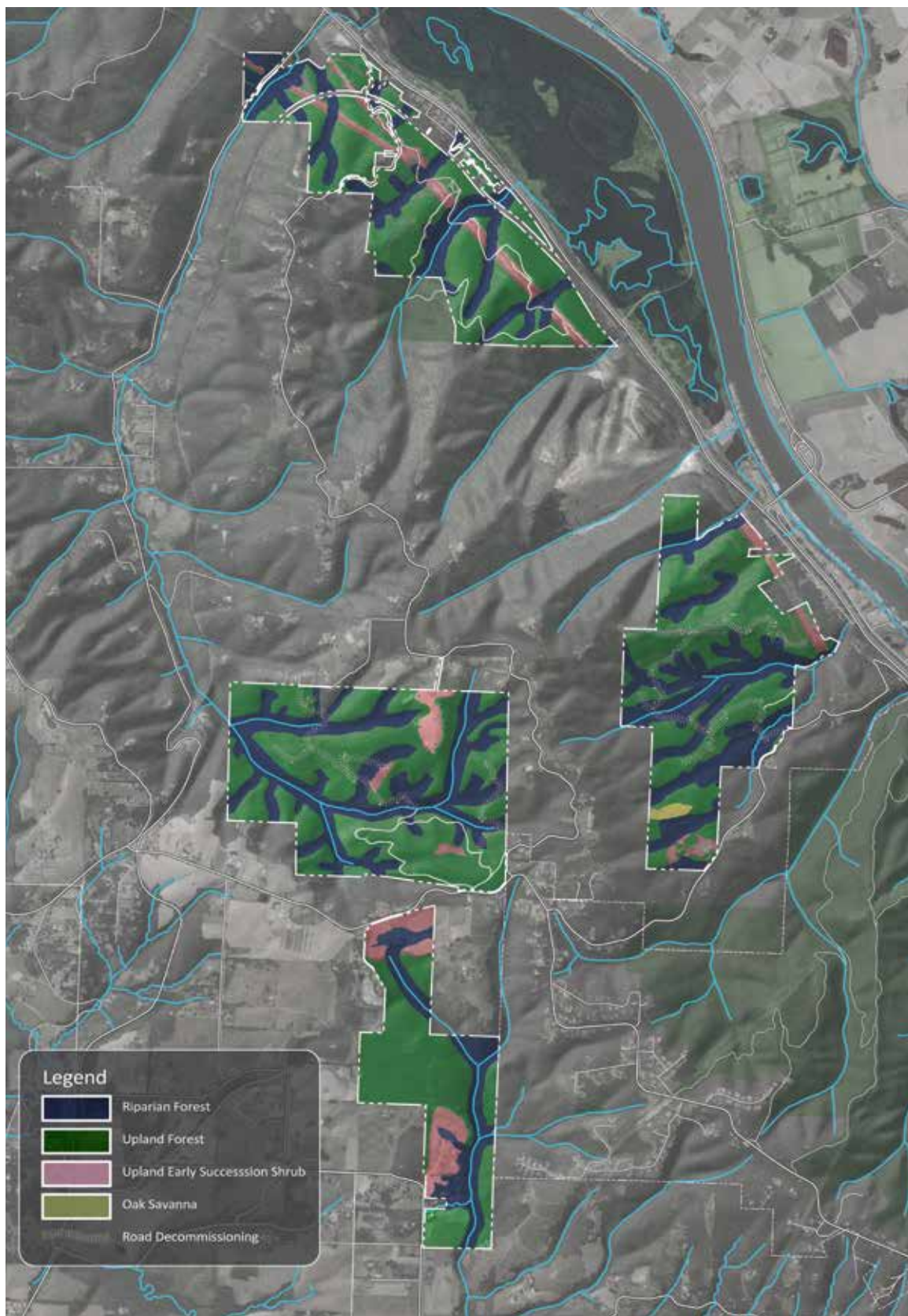


Figure 2.10: Site Conservation Plan map showing conservation targets for desired future condition.



## **Birds**

Between May 15 and June 30, 2015, consultants hired by Metro conducted habitat-associated breeding bird point count surveys at all four natural areas to obtain baseline information on relative abundance. Eight or nine species were detected at each site during the count period. Staff has observed a greater diversity of species in past breeding seasons; food abundance was lower in 2015, an unusually dry year. Surveys will continue for a minimum of three years, through 2017.

## **Amphibians**

Metro staff and volunteers conducted terrestrial amphibian surveys at McCarthy Creek in 2015. Two species, including northern red-legged frogs, were identified. Red-legged frogs have also been observed at Burlington and Ennis Creek Forests. Red-legged frogs are noteworthy for several reasons. Red-legged frogs are considered a conservation strategy species by ODFW and considered declining and vulnerable. They are also somewhat of a local celebrity. Although U.S. Highway 30 poses a significant barrier, some amphibians successfully migrate between Burlington Creek and Ennis Creek forests and breeding habitat on the opposite side of highway 30. A group of volunteers (Harborton Frog Rescue) catches and transports them across highway 30 near Ennis Creek Forest during late winter and early spring when they migrate to lay eggs in wetlands.

## **Fish**

Coho salmon and steelhead utilize lower McCarthy Creek for spawning. McCarthy is listed by the Oregon Department of Fish and Wildlife as Essential Salmonid Habitat. Native cutthroat and brook lamprey are also present in the lower McCarthy watershed.

Both coho and steelhead utilize North Abbey Creek natural area for spawning and rearing, and other native fish are also likely present. Water quality in the upper watershed directly influences water quality in the lower watershed. There is no record of fish use in Burlington Creek or Ennis Creek although it is possible that native fish use the lower reaches with less steep gradients.

## **Insects**

Insects play many invaluable roles in healthy ecosystems, such as pollinating flowering plants, decomposing organic matter and providing food for many species.

## **SURROUNDING LAND USES:**

Three of the four North Tualatin Mountains sites are located within the Skyline Ridge neighborhood. The fourth site, North Abbey Creek Forest, is in the Forest Park neighborhood. The sites are surrounded by a mixture of land uses including residential, agriculture, timber harvest, and gravel extraction.

Surrounding land uses of note include the following:

- **Quarry:** An operational quarry, located along U.S. Highway 30 between Burlington Creek Forest and Ennis Creek Forest. There is a trail easement held by the Forest Park Conservancy on the property to establish a trail connection between Ennis Creek and Burlington Creek forests, once quarry operations are completed.
- **Residential:** Residential areas composed primarily of rural residential parcels typically one acre or more, and with many 20 acres or greater in size. Many of the large residential parcels adjacent to Burlington Creek Forest have conservation easements.
- **Ancient Forest Preserve:** The Ancient Forest, owned and managed by the Forest Park Conservancy, protects nearly 40 acres of old growth forest adjacent to the Burlington Creek Forest site. The conservancy welcomes visitors to the Ancient Forest and has recently extended the trail system.



- **Burlington Bottoms:** The roughly 400-acre Burlington Bottoms wetlands, owned by Bonneville Power Administration (BPA) and managed by Oregon Department of Fish and Wildlife (ODFW), lie northeast of Burlington Creek Forest
- **Forest Park:** The City of Portland's Forest Park lies south, across Newberry Road from Ennis Creek Forest. The northern section of Forest Park has the most intact habitat, and the least amount of public use relative to other areas of the park.
- **Skyline School:** Skyline School is located on Skyline Road, southwest of McCarthy Creek Forest. It is separated from the site by several privately owned residential parcels.

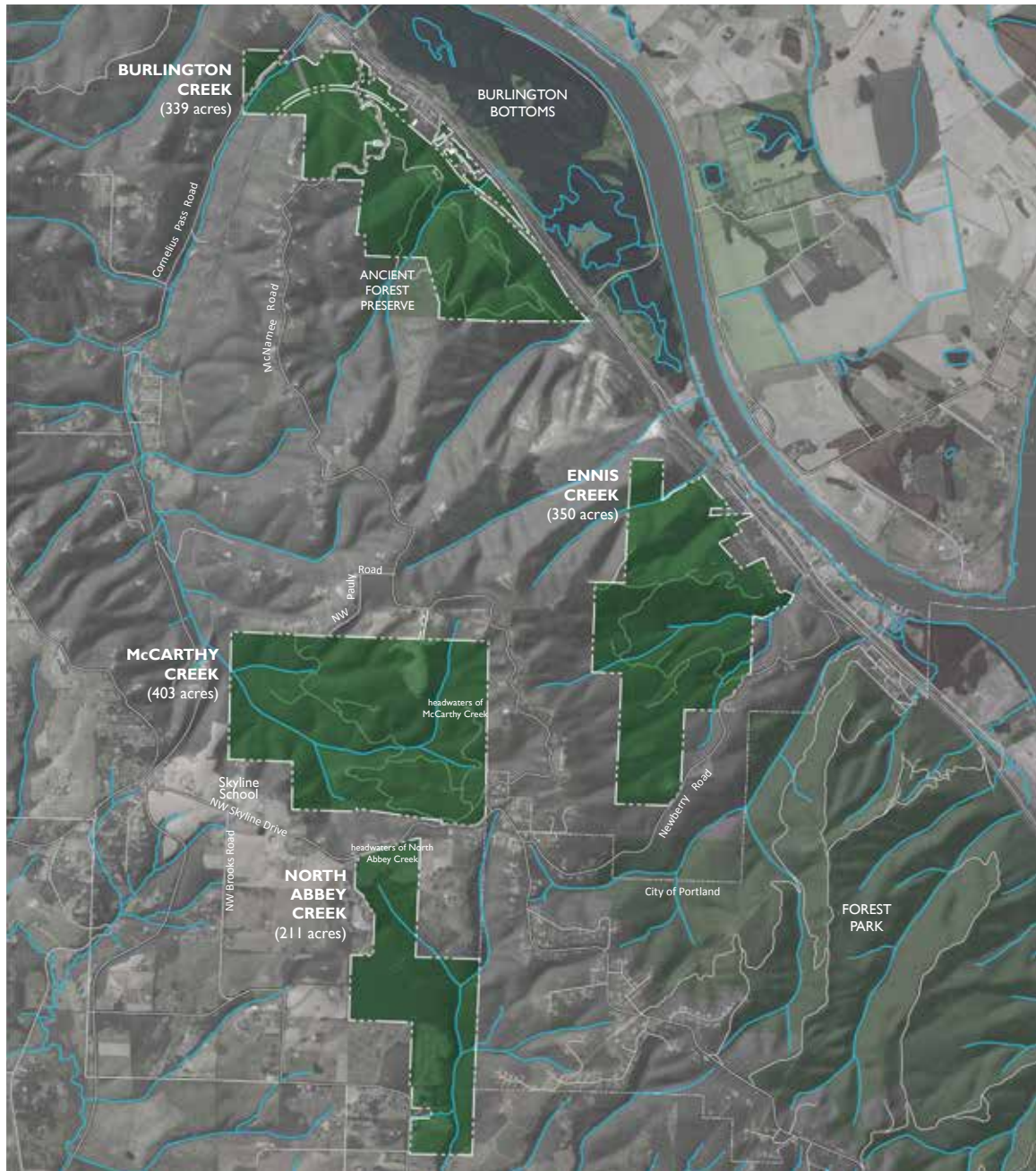


Figure 2.11: Site Conservation Plan map showing conservation targets for desired future condition.



### 3. MANAGEMENT AND ACCESS PLANNING

Development of this access master plan began in fall 2014. However, Metro's work to restore the land – purchased with voter-approved bond funds between 1995 and 2015 – began much earlier. This chapter presents a summary of Metro's science-based approach to site management and conservation, followed by a discussion of the planning process through which this plan was developed.

#### A SCIENCE-BASED APPROACH

During the access planning process, Metro scientists provide baseline information about current conditions, conservation targets and habitat restoration goals. Metro scientists draw on recognized conservation biology principles, site knowledge, research and external experts to provide a description of a natural area's natural resource values. They evaluate possible impacts of potential access opportunities and work with the planning team to develop access opportunities that are compatible with the wildlife and water quality goals for a natural area.

This process to identify priority locations and activities for recreation builds on the work of Metro scientists and land managers to stabilize and restore the ecological health of the site.

#### SITE STABILIZATION

Site transformation starts with a short-term strategy to mitigate degrading conditions and establish an improving trend in ecological function. This "stabilization" period typically lasts two to five years. Some tasks are nearly universal. Metro always works to control invasive plants, for example, replacing them with species that better support wildlife and improve water quality. Other tasks are property-specific, and many require specialty contract crews to ensure that Metro moves in a timely fashion across all its properties. Examples of stabilization actions include controlling erosion, forest thinning, reforestation and mitigating stream incision.

To date, vegetation management and site stabilization activities in the North Tualatin Mountains include thinning to improve forest health, which also reduces long-term fuel and fire risk; culvert maintenance to reduce sedimentation; and invasive species management. At all four sites, tree thinning is planned and/or underway, which will help to restore a more complex forest structure, provide more diverse habitat, and make forests more resilient to disease and wildfire. At Burlington, Ennis, McCarthy and North Abbey creeks, Metro is developing key wildlife habitat features like snags and down dead wood. Stream restoration is underway at North Abbey Creek.

Management activities related to current visitors has included installing and maintaining signs and gates to encourage appropriate use of the sites; addressing encroachment issues; surveys to identify property boundaries; maintaining safety for increased visitation; and addressing and removing unauthorized trails in partnership with Northwest Trail Alliance.

Metro is maintaining roads needed for management activities such as brushing and cleaning culverts and ditches. Roads not needed for ongoing management of the sites will be decommissioned to reduce road-related erosion, water quality impacts, habitat fragmentation and disturbance.



Staff has been fostering partnerships with West Multnomah Soil and Water Conservation District, City of Portland, Forest Park Conservancy, Trout Mountain Forestry and Portland Audubon to support this and future work.



## RESTORATION

When Metro acquires a new natural area, we think about how to maximize the habitat value of the site given both the specific local conditions and the larger landscape context. There is strong science pointing to the importance of diverse communities of native plants in order to benefit numerous species.

Restoration begins with a Site Conservation Plan (SCP) which identifies conservation targets, key ecological attributes of each target, and an understanding of the greatest threats to achieving conservation goals. Restoration and long-term management strategies based on this analysis guide future efforts toward achieving the site's desired future condition.

The Site Conservation Plan for North Tualatin Mountains outlines strategies to restore old growth habitat and complex forest structure by thinning to favor large tree diameters and deep tree crowns, providing down wood, and increasing understory complexity. It also calls for creation of shrub communities to support neotropical migrants and pollinators.

### Ecological Thinning

The North Tualatin Mountains have hundreds of acres of former commercial tree farms dominated by young stands of Douglas-fir. Reducing the number of conifers per acre helps keep trees healthy and preserves hardwoods and especially native shrubs that, in turn, support important elements of biodiversity. Large diameter trees are lacking in the North Tualatin Mountains and are valuable for wildlife and water quality. Thinning accelerates tree growth and makes forests more resilient to disease and wildfire. Many of the trees removed during thinning stay on site and provide habitat as down wood. Thinning has begun at North Abbey, McCarthy Creek, Ennis and Burlington Creek forests. Thinning may continue at Burlington, Ennis and McCarthy Creek in 2016-2017. Many of these stands will need a second round of thinning in 15 to 30 years to achieve habitat goals, at which time they will be large enough to provide significant standing and down dead wood.



### Standing and Down Dead Wood

Standing dead trees (snags) and down wood have been removed by previous property owners through clearcut harvesting or other land uses. Adding them back into the forests by topping trees and dropping and leaving logs on the ground provides wildlife habitat, moisture retention, erosion protection and nutrient storage. Metro is developing key wildlife habitat like snags and down dead wood at all four North Tualatin Mountains sites.



### Native Shrubs and Understory

From a larger landscape view, early seral habitat is an increasingly uncommon aspect of the landscape, contributing to regional declines in species that depend on those habitats. Metro plans to establish diverse native shrub communities at North Tualatin Mountains, which benefit neo-tropical migratory birds and invertebrate species that utilize the early seral shrub habitat for feeding and breeding.

Hardwoods and shrubs provide valuable food and shelter for many bird species but are typically suppressed or shaded out by fast-growing conifers in young forests. At all four sites, forest thinning will help to retain hardwood trees, create growing space for native shrubs, provide more diverse



habitat, and make forests more resilient to disease and wildfire. Depending on the understory response after thinning, planting may be necessary to speed the establishment of native shrubs and the creation of a diverse understory

### **Stream Restoration**

Large conifers and down wood have been removed from many of the North Tualatin Mountains riparian areas, resulting in incised (eroded) stream channels and slumping stream banks. Growing big conifers quickly and adding large wood into streams helps improve stream conditions and water quality. Metro is actively working on stream restoration at North Abbey Creek, and recently placed 16 downed wood logjams along the creek to help curb stream erosion.



### **Culvert Removal and Road Decommissioning**

Old logging roads are a significant source of sediment in streams, which harms water quality and degrades fish habitat. Repairing or decommissioning and revegetating old roads reduce the risk of soil erosion and sediment in streams. Many culverts in the North Tualatin Mountains are old and under-sized, blocking wildlife movement and increasing the risk of failure and the amount of sediment into streams, resulting in decreased water quality. Removing or replacing culverts improves water quality and provides better wildlife connectivity. Metro will decommission unneeded roads and remove or replace undersized and failing culverts.

## **PLANNING FOR ACCESS**

The master planning process began in fall 2014 and included strategic site analysis and a robust community engagement process. A brief summary follows.

### **Site Analysis**

#### ***Feasibility of Access and Parking***

Five potential entry locations were evaluated to understand the feasibility of providing safe ingress and egress. Analysis was done for existing maintenance entrances to Burlington from the south side of McNamee Road, to the southern end of Ennis from Newberry Road, to the northern end of North Abbey from Skyline Blvd., and two locations at McCarthy were evaluated: an entrance at the south end of the site from Skyline Blvd, and one at the north end of the site from McNamee Rd. The five locations were all determined to be feasible with varying degree of improvements needed to provide safe, visible access and the appropriate sight distances for vehicles turning in and out of the site.

#### ***Trail Construction Feasibility***

The International Mountain Biking Association (IMBA) was engaged in the planning process to evaluate the feasibility of trail construction. IMBA generated a memo outlining recommended design, construction details, and construction methods for soft surface trail implementation.

### **Stakeholders and Community Engagement**

The planning process followed a cyclical, four-step strategy involving a series of internal and external stakeholder meetings followed by Metro Council member updates and public open house events. A Stakeholder Advisory Committee was composed of local agency representatives, public officials, recreation advocates, environmental activists and residents. Internal coordination involved collaboration with Metro natural resource scientists, land managers, communications staff, operations supervisors, planners and various senior leadership from departmental and program management.



### ***Stakeholder Advisory Committee***

The project Stakeholder Advisory Committee (SAC) met five times, at key project milestones. The committee included representatives of Forest Park Conservancy, Forest Park Neighborhood Association, Northwest Trails Alliance, Oregon Department of Forestry, Oregon Recreation Trails Advisory Committee, Portland Community College, Portland Parks & Recreation, Skyline Ridge Neighbors, Skyline School, Trackers Earth, and West Multnomah Soil and Water Conservation District. In addition to contributing their time and insight to the planning discussion, the SAC was actively involved in neighborhood outreach and assisted at four community events.

### ***Community Outreach and Engagement***

Metro held four community events to engage the broader public in the planning process. The first two events were held at the Skyline Grange. To accommodate larger community events as the project generated interest, the third and fourth events took place at Skyline School. Approximately 40 people attended the first event, and between 150 and 250 people attended the following three events. Staff collected comments via questionnaires and one-on-one discussions.

Metro staff met informally with neighbors, providing additional opportunities to weigh in. Nearby neighbors had an opportunity to preview open house materials and talk with staff prior to the fourth event. In addition to the information presented at community events, Metro posted information online and solicited the public to submit comments online.



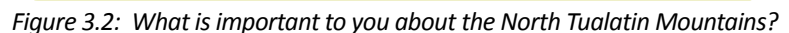
*Figure 3.1: Open house at Skyline School in November 2015*



Members of the public weighed in on what they value about the sites; they also shared their experiences of the sites and wildlife in the area. They provided insight into the types of activities they'd like to participate in, the types of trail systems they think are appropriate, and where they think access should be accommodated and prioritized. Over 500 comments were received through surveys, Metro's website, emails and informal conversations. Below is a summary of what we heard.

At the first open house Metro asked participants what they value about the North Tualatin Mountains, and what they would be excited to do there. Community members value that there are large areas of protected open space so close to the city. People expressed a desire for trails, and opportunities to experience nearby nature. The community also expressed the importance of continuing to protect wildlife habitat and water quality.

The discussion at the second community event was focused on identifying sensitive areas and opportunities for activity areas on the site. Participants shared the types of activities they want to participate in including hiking, cycling, being in nature, volunteering, horseback riding and dog walking. Metro also heard from community members who do not think access opportunities and new trails should be considered on the sites. We also heard about local wildlife including elk, red-legged frogs and other wildlife.





### ***Trail System***

The third open house focused on a discussion about trail system types. The community was asked about the types of trails they want to experience. Many people expressed a preference for different types of uses, including hiking, off-road cycling and equestrian trails. We heard that loop trails are preferred to out and back trails, and to use existing road networks for access where possible to minimize new trail construction. Metro also heard that off-road cycling on a single track trail is preferred to logging roads. One of the alternatives shown at the third open house included a hiking trail through North Abbey Creek Forest. We heard significant opposition to this option, and the trail was subsequently removed from the proposed plan.

### ***Preferred Alternative***

At the fourth open house, a draft preferred alternative was presented that incorporates ideas and feedback brought forth at the previous open houses. Overall, Metro heard that we accurately captured feedback from previous drafts. We took further input at this open house and heard more information from neighbors about a local herd of elk, and concern about trails potentially impacting their movement. The true extent of the impact of this trail on elk use at the meadow is unknown at this time. Although the elk herd is not considered regionally significant by ODFW, it is highly valued by some members of the community. In response to this concern, the viewpoint trail is not included in the Master Plan recommendation.



## 4. MASTER PLAN RECOMMENDATIONS

### GOALS AND OBJECTIVES

#### **Protect fish and wildlife habitat and water quality.**

Protecting and enhancing wildlife habitat and water quality are central to Metro's work and the goals of this project. Using the best available science as a guide, the project will provide new public access in a way that maintains the sites' core ecological function.

##### ***Objectives***

- Protect large blocks of forest and core habitat areas.
- Integrate landscape-level analysis and regional thinking into decision-making about providing access and locating access features.
- Locate new trails where habitat is already fragmented and minimize new fragmentation.
- Provide appropriate setbacks from streams, wetlands, and seasonally wet and sensitive areas.
- Minimize stream crossings where other routes are possible and use bridges and boardwalks, instead of culverts, where appropriate.
- Avoid constructing new trails in areas of high natural resource value or high erodibility.
- Use best practices for sustainable trail construction such as cross-slope, rolling grades, and drainage dips to move water off-trail and avoid erosion.
- Monitor for water quality and habitat impacts.

#### **Provide opportunities for meaningful experiences of nature.**

Access to nature supports healthy, active outdoor lifestyles and people depend on nature for peace, quiet and renewal. The North Tualatin Mountains are an opportunity for all to share in these benefits. People experience and connect with nature in many different ways this project will provide a variety of opportunities.

##### ***Objectives***

- Provide welcoming entries and clear way-finding and interpretive signs.
- Provide a system of trails that serve appropriate multiple uses including hiking, off-road cycling and wildlife viewing.
- Provide a variety of trail experiences (various widths, lengths, loops, and challenge levels) and trails designed to encourage proper trail use.
- Provide access to viewpoints and appropriate routes to key features.
- Provide information about accessibility and challenge level.
- Provide opportunities to learn about local habitat, site history, restoration and regional context.
- Increase visitors' awareness of natural resources on-site.
- Provide opportunities for volunteering and participating in education programs.
- Provide opportunities for discovery.



**Consider safety, management and durability.**

Metro is committed to ensuring the public's safety and enjoyment of North Tualatin Mountains and strives to manage the public's investment in the most effective and cost-efficient way. The access master plan and its implementation will protect the public's safety and welfare and maximize operational efficiencies to protect the public's investment.

**Objectives**

- Involve visitors in maintenance and site stewardship to promote a more intimate awareness of habitat and water quality.
- Promote stewardship through volunteer trail patrol.
- Develop partnerships with volunteer organizations.
- Provide simple and clear way-finding signs, use durable vandal-resistant materials.
- Design trails that are safe and challenging.
- Implement safety and security measures such as gated entries to control access at night, ranger patrols, and employment of security patrols as needed.
- Work with Multnomah County to address site-related transportation requirements.
- Assure privacy of neighbors by controlling access and providing setbacks and buffers.
- Coordinate with local fire and police service providers to help enforce rules and ensure safety.

**SUMMARY OF MASTER PLAN RECOMMENDATIONS****Core Habitat Areas**

The proposed plan preserves 970 acres of protected core habitat at the four sites. This includes preserving the Ennis Creek Forest (350 acres) and North Abbey Creek Forest (211 acres) sites as relatively undisturbed core habitat areas. No improvements are planned at these sites, other than a provision for the future Pacific Greenway Trail through Ennis Creek Forest. The plan also protects as many undisturbed habitat areas of 30 acres or greater as possible. Out of an existing 1300 acres, this plan preserves roughly 970 acres of core habitat, or nearly three-fourths of the total acreage of the North Tualatin Mountains sites. This includes about 90 acres at Burlington, 350 acres at Ennis, 320 acres at McCarthy Creek Forest, and 210 acres at North Abbey Creek.

**Opportunities to Experience Nature**

This access master plan identifies opportunities to discover, learn about and experience nature at Burlington Creek Forest and the southeastern portion of McCarthy Creek Forest. The plan recommends continued use of 4 miles of existing logging road in Burlington and McCarthy Creek forests, and proposed an additional 5.5 miles of new multi-use trails for Burlington Creek Forest. The recommendation includes trailheads at Burlington Creek and McCarthy Creek forests with non-flushing restroom facilities and parking areas to accommodate approximately 15 cars each.

Access improvements at Burlington Creek are planned to be developed first, and access improvements at McCarthy Creek would be developed in the future as phase two.

**Streams and Water Quality**

The North Tualatin Mountains protect significant sections of four streams, and portions of their headwaters. The plan recommends decommissioning over 3 miles of logging roads, a significant source of sediment in streams, in McCarthy Creek, North Abbey Creek and Ennis Creek forests. Trail design and engineering will employ best practices for sustainable trail construction. Well-designed trails will limit impacts to streams and headwater areas by minimizing erosion, locating trails away from stream corridors and limiting the number stream crossings.



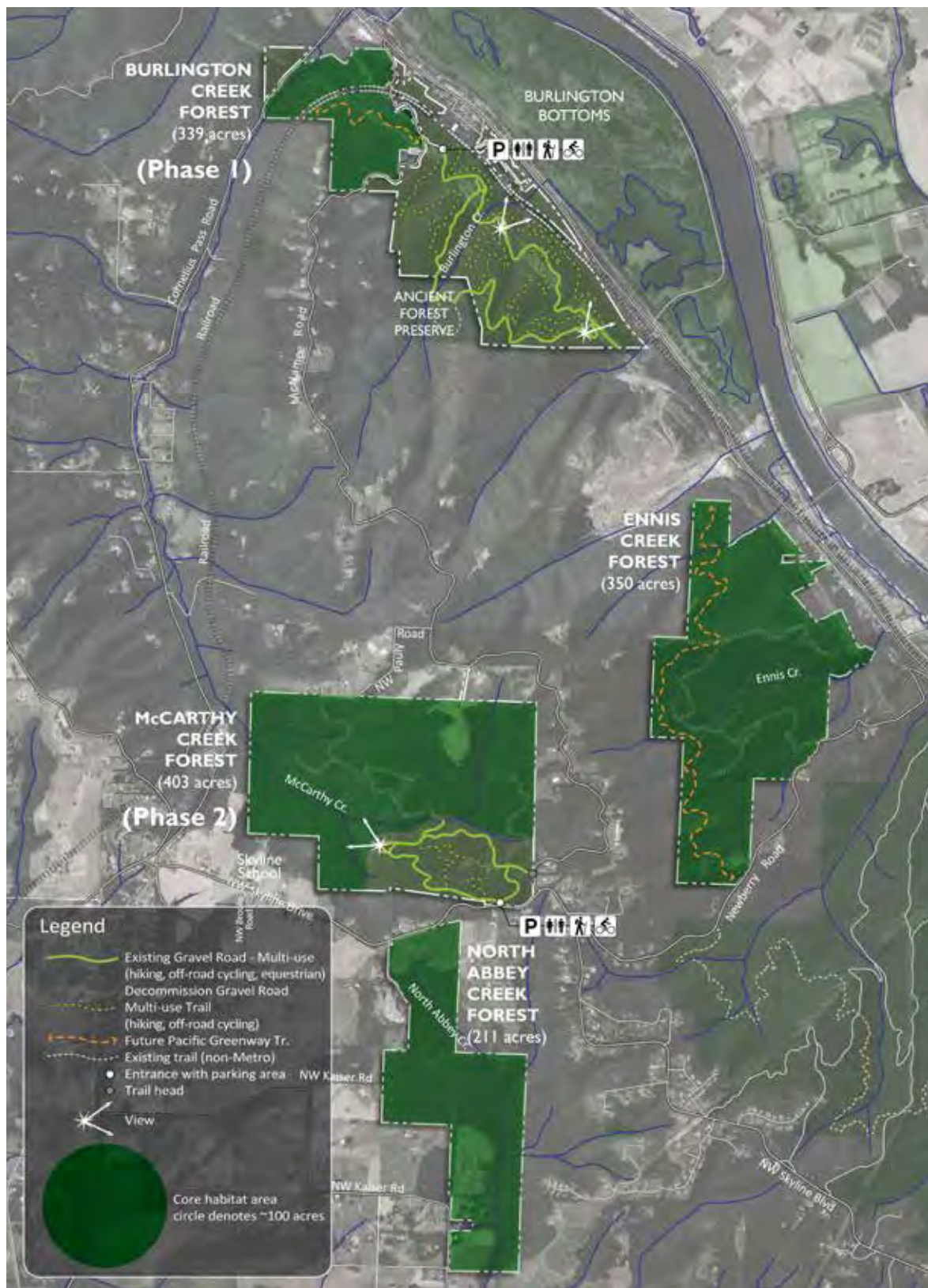


Figure 4.1: Master Plan Recommendation



## Burlington Creek Forest

Proposed improvements at Burlington Creek Forest include parking for approximately 15 cars, a trailhead, shared use trails, designed specifically for hiking and off-road cycling. Visitors to Burlington Creek Forest will be able to continue walking, and riding bikes and horses on the nearly 3 miles of existing logging roads on the site. In addition, the plan recommends 5.5 miles of new multi-use trails.

Multi-use trails will accommodate hikers and beginner and intermediate riders, and provide several trail options. Visitors will be able to see views of Sauvie Island and the Cascade Range. Trails will be designed to minimize potential for conflicts between hikers, and cyclist through the use of speed checks and one-way trails where appropriate.

Plans call for construction of improvements at Burlington as part of Phase 1 implementation.

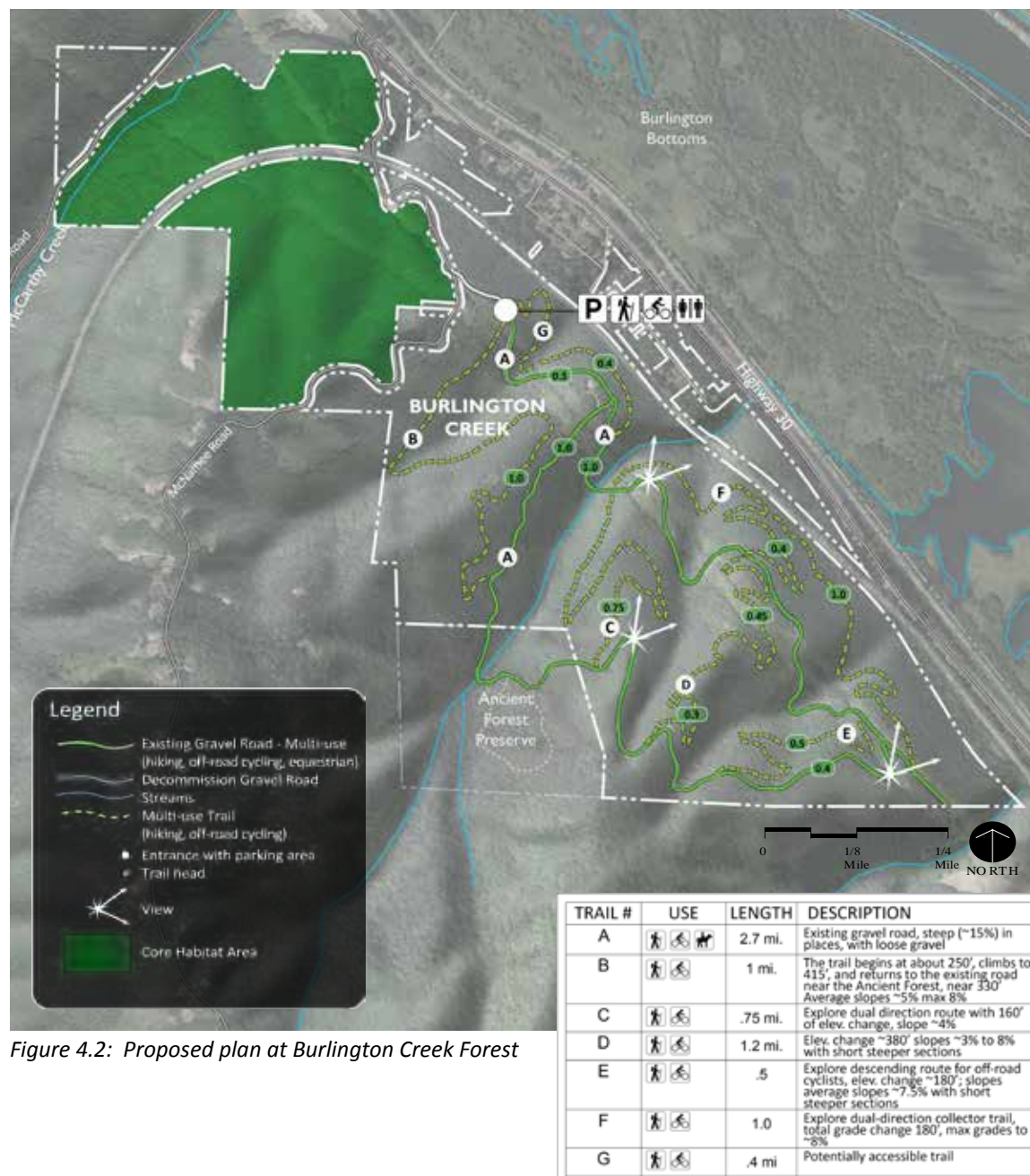


Figure 4.2: Proposed plan at Burlington Creek Forest



## McCarthy Creek Forest

Proposed improvements at McCarthy Creek Forest include parking for approximately 15 cars, a trailhead, interpretive and way finding signs, picnic tables and shared use trails. An existing 1 mile loop road will continue to be enjoyed by hikers, cyclists and equestrians. Roughly 1 mile of new multi-use trail is recommended.

The visitor's experience at McCarthy Creek Forest will focus on the stream. A loop trail, along the old logging road, descends to an expansive view of the McCarthy Creek valley. A spur trail, also on an old logging road, leads visitors down to experience of creek. This concept-level design takes advantage of one of the site's best views while preserving core habitat along the north and west parts of the sites. It provides visitors opportunities to experience McCarthy Creek from multiple vantage points.

The earlier preferred alternative recommended including a trail through the northeastern portion of McCarthy that would have offered visitors access to a viewpoint with stunning vistas of the Tualatin Valley and Coast Range. To address concerns about elk that frequent a meadow in this area and because the extent of the potential impact of this trail on elk use at the meadow is unknown at this time, this trail is not included in this master plan. This trail may be considered in the future if further investigation compellingly demonstrates that access to the meadow is unlikely to affect elk persistence in the area.

The improvements at McCarthy will be built during a future project phase, which provides an opportunity to apply lessons learned during the first phase of the project implementation at Burlington Creek Forest.

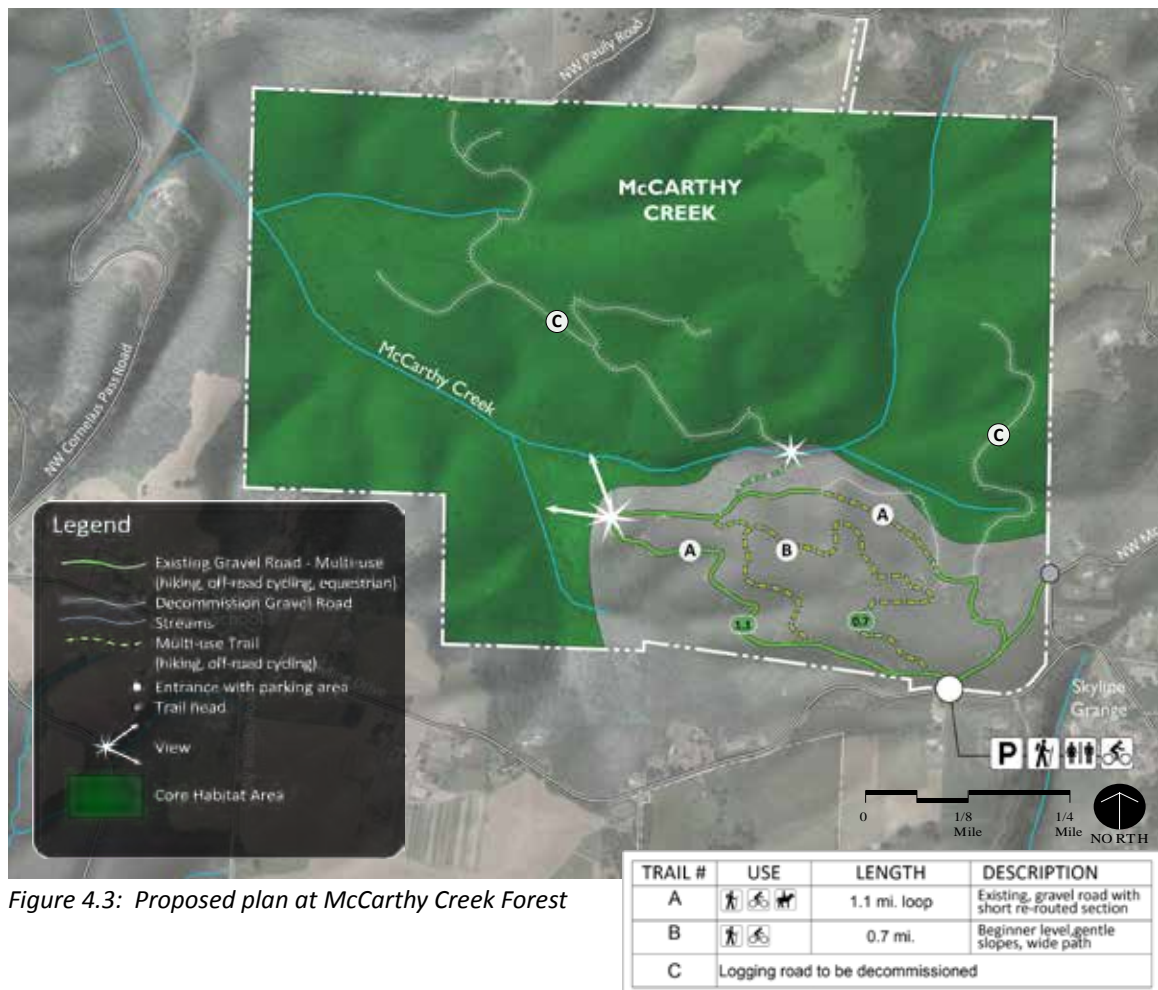


Figure 4.3: Proposed plan at McCarthy Creek Forest



## Access and Parking

As standard practice, Metro controls vehicular access to parking using automatic gates. Gates will be closed and locked in the evenings. The parking area at Burlington Creek will provide parking for approximately 15 vehicles. An overflow area will accommodate an additional five cars. Parking will be closely monitored, and overflow parking on McNamee Road will not be allowed.



At McCarthy Creek, the parking lot will accommodate 15 to 20 cars. An additional non-vehicular entrance will be maintained at McNamee Road for visitors accessing the site from the neighborhood.

For the two sites where new parking lots are proposed, additional feasibility analysis was completed to determine feasibility and rough costs of building parking areas, and to understand how much parking each site can accommodate.

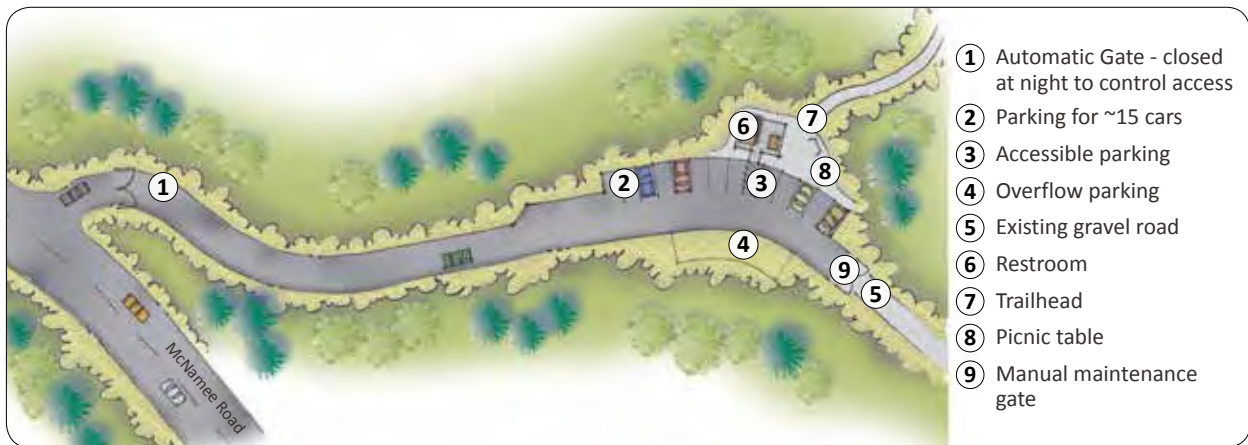


Figure 4.4 Proposed entry and parking lot at Burlington Creek Forest will accommodate ~15 cars.

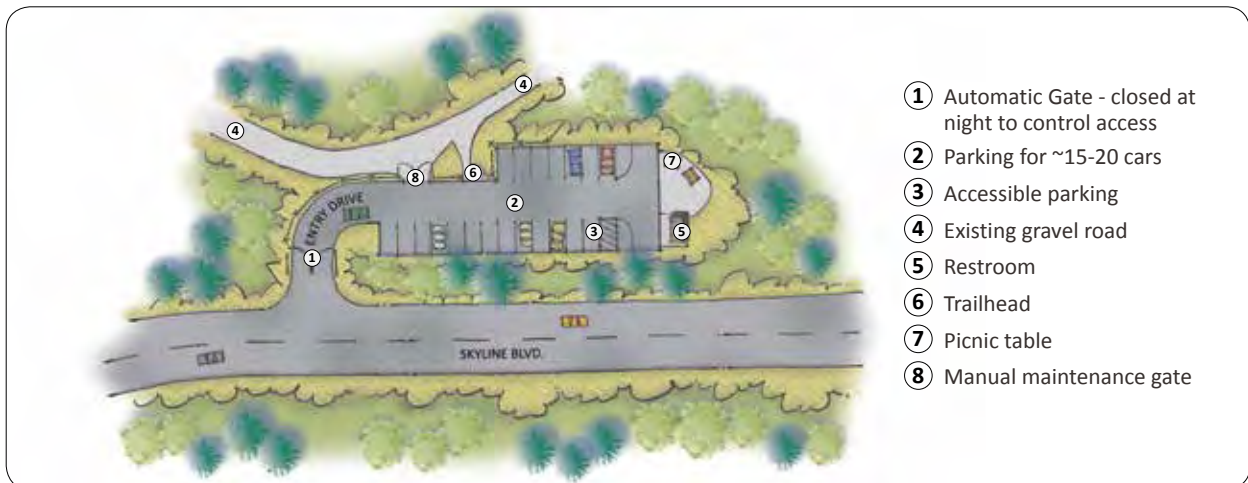


Figure 4.5: Proposed entry and parking lot at McCarthy Creek Forest will accommodate ~15 cars.



Trailhead facilities are proposed at the parking areas. These include restrooms (vault toilets or port-a-potty), benches, picnic tables, trash receptacles, bike racks, and interpretive and directional signs. One or two picnic tables may be included at each trailhead.

### **Adaptive Management**

Once this project is implemented, trails, parking and other access improvements should be monitored to make sure that they function as intended. In the future, as we learn more, plans should be adjusted to accommodate lessons learned. Additional trail or trail connections, seasonal or permanent trail closures, adjustments to parking areas, and additional amenities should be considered as need arises.

## **KEY CONSIDERATIONS**

### **Regional Connectivity**

Preserving core habitat and regional connectivity is the primary consideration in determining where to propose new access locations. Because there is no agreed upon standard for a “wildlife corridor”, the planning effort relies on broadly accepted conservation principles that have been developed by researchers in the field of conservation science. These principles are the results of many studies that collect data over large areas and long periods of time. Metro staff scientists apply these principles at the site and landscape scale to help determine the best management approach on individual sites.

Principles include:

- protecting large blocks of forest;
- maximizing unfragmented core habitat areas of 30 acres or greater;
- managing for no or very low use at many sites;
- restoring habitat to improve natural area value to wildlife and water quality;
- reducing the presence of dogs; and
- applying research-based practices to management activities

The recommended alternative for North Tualatin Mountains focuses most access in Burlington Creek Forest, which is the site that is currently most heavily used. The proposed plan preserves the Ennis Creek Forest and North Abbey Creek Forest sites as relatively undisturbed core habitat areas. No improvements are planned, other than a provision for the future Pacific Greenway Trail through Ennis Creek Forest.

### **Streams and Water Quality**

The North Tualatin Mountains protect significant sections of four streams, and portions of their headwaters. Prior management has resulted in eroded stream channels and slumping stream banks. Old logging roads are a significant source of sediment in streams, which harms water quality and degrades fish habitat. Metro is actively restoring these streams to increase canopy cover, and reduce in stream sediment and erosion.

### **Species-Specific Considerations**

In general, Metro manages for habitat conditions rather than targeting individual species. Exceptions are made when the needs of a high-priority species are not addressed via habitat-level approaches. Partners and community members have expressed particular interest or concern about several species known or thought to occur on-site. Following is a brief summary of key species considerations and how they have informed this plan.



## **Elk**

Elk are found throughout areas in and around the North Tualatin Mountains. The North Tualatin Mountains herd is part of the Willamette Unit, which is an ODFW “de-emphasis area”. Because of this, ODFW allows a longer hunting season and has more liberal tag regulations, including not tracking bull – cow ratios. Although the elk are born and raised around humans, and are relatively acclimated to some human activity, trail development at Burlington and McCarthy may change their movement patterns. That said, according to ODFW, available forage – and especially grass -- is one of the biggest issues limiting Elk in the North Tualatin Mountains; fragmented habitat has a lesser impact.

According to observations of the North Tualatin Mountains as a whole, elk frequent several meadows in the area and migrate between these sites and into Forest Park. Given that these elk move within a relatively large area, frequently cross busy roads, and use backyards and farm fields, an increase in human use of a small portion of the North Tualatin Mountains sites is not likely to cause significant effects on the elk population.

Elk are charismatic and great to see along the Tualatin Mountains Ridge. Through this planning process, participating community members have expressed how important this herd of elk is to people who live in the area. For this reason, and to minimize disturbances to local elk movement, this plan does not propose access to the view across the Tualatin Valley to the Coast Range, at this time.

## **Amphibians**

Amphibians, including red-legged frogs, are known to move seasonally between Burlington Creek and Ennis Creek forests and breeding habitat on the opposite side of highway 30, including the Palensky Wildlife Area (Burlington Bottoms), managed by ODFW. Both Burlington Creek and Ennis Creek forests provide important foraging and overwintering habitat for red-legged frogs.

There are some concerns that proposed trail development in Burlington Creek Forest may negatively affect red-legged frogs and other native amphibians. Trails are not proposed at Ennis Creek Forest, where amphibians are also known to seasonally migrate.

Trail design and engineering will minimize stream crossings and employ amphibian friendly crossings where needed, minimize soil erosion and trail rutting. Trails will be closed at night when the seasonal movement of red-legged frogs typically occurs, and seasonal closure will be considered.

Restoration work at both Burlington Creek and Ennis Creek forests will improve foraging and overwintering habitat including creating down wood and maintaining a diverse understory and tree canopy.

In addition, increased access provides a unique opportunity to raise awareness of red-legged frogs’ yearly migration. Metro is partnering with the Harborton Frog Shuttle volunteers to collect frog and salamander data as well as documenting culvert conditions and suitability for amphibian crossing of HWY 30. We are in year two of a three year study, the results may help inform ODOT culvert replacement design to improve wildlife crossings in the area.

## **Dog Walking**

Throughout the process we heard from people who want to walk their dogs in the North Tualatin Mountains. Metro acknowledges that this is a desire from members of the community. We also heard from others in the community who support Metro’s no dog policy. Dogs and other pets can damage sensitive habitat and threaten wildlife the region has worked hard to protect. People have many options when they want to spend time outdoors with their pets, but very few places they can depend on to experience nature without dogs. For these reasons, the policy will continue to apply at all of our sites, including the North Tualatin Mountains.



## Regional Trails

Dating back to the 1992 Greenspaces Master Plan, providing regional trail connections from Forest Park to the north has been identified as a long-term goal. Proposed trail alignments accommodate the Pacific Greenway Trail, a regional trail envisioned to connect Forest Park to the Coast Range. Determining which trail segments will become the regional trail in the future will require additional evaluation and work with partners. For this reason, they are not designated as part of this plan.

## Trails Design

The proposed trail network responds to the Metro Parks and Nature System Plan by creating a diversity of trail experiences with respect to location, story-telling, and challenge level. A sustainably designed multi-use trail system will connect visitors to nature and wildlife.

Trails will employ best practices in design and construction, such as appropriate surface materials and wildlife-friendly drainageway crossings to minimize impacts to habitat. Trail layout will include setbacks from private properties, streams, and sensitive habitat, and alignments that will discourage shortcuts. Interpretive points and distance markers will be incorporated throughout the trail system. “You are here” orientation maps and messages to help enhance wayfinding and minimize impacts to the resources will be incorporated into interpretive signs.

The proposed trail alignments pay close attention to the locations of existing streams and drainages, using existing stream crossing locations when possible to minimize new stream crossings. If a new drainageway crossing is unavoidable, it will be designed to minimize impact by crossing perpendicular to streams, and using bridges instead of culverts where possible. The proposed trail alignments avoid trails running along streams.

## Existing Gravel Roads

At McCarthy and Burlington Creek, about 4 miles of existing gravel roads will remain to provide continued access for walkers, cyclists and equestrians. These existing roads are typically about 14 feet wide, and steep in places. Existing gravel roads will also provide maintenance access.



## Multi-Use Trails

New multi-use trails will be designed to accommodate hikers and cyclists. This includes about 1 mile at McCarthy and 5.5 miles at Burlington Creek.

Shared trails will be designed to accommodate multiple uses. Where topography allows, trail grades will be gentle, though some sections may still exceed guidelines for accessibility. Where grades are within guidelines for accessibility and outdoor recreation, a firm, stable crushed rock trail surface will be constructed. Best practices, such as sight distances and passing areas will be employed to minimize potential for conflicts between different user groups. Trail design will control off-road cyclists’ speed with short uphill sections.



In some places, where topography is steeper, multi-use trails may include off-road cyclists in the one direction only. Travel direction will be evaluated during the design and engineering phase, and will be based on topography, trail alignment and safety considerations.



## Hiking

The multi-use trails at Burlington and McCarthy Creek forests will meander up and down forested slopes. Hiking experiences will generally be of moderate to high challenge level. Over the years, visitors will be able to see the forest mature as the young trees grow and the forests gain complexity and habitat value. Trails are all recommended to be multi-use. The following strategies ensure trails are safe for both cyclists and hikers:

- Provide sight distances;
- Slow cyclists through trail design;
- Providing passing and resting places along the trail.

## Off-Road Cycling

Off-road cycling is a growing trend statewide as well as in the greater Portland metro region. It is one way that people experience and spend time in nature. This plan recommends providing off-road cycling opportunities in the North Tualatin Mountains. Any trail or access to nature has some impact on wildlife, however based on available research, a definitive conclusion can't be made about whether experiencing nature by hiking or by off-road cycling poses greater impacts to wildlife. Many potential impacts to habitat from trails such as erosion, trail widening, and ruts can be prevented using best practices for trail construction and management.

Trails will be designed to provide a variety of beginner and intermediate challenge levels, and the trail network offers opportunities to enjoy a variety of loops. The following design strategies help make a fun and safe experience for hikers and off-road cyclists:

- Control speed through trail design;
- Avoid long sustained grades, stacking switchbacks and incorporating climbing turns;
- Limit overall average longitudinal slope of each trail segment to ten percent;
- Use curves to create interest, manage storm water runoff, control speed, and have fun;
- Provide clear visibility and long sight distances at curves and intersections; and
- Provide resting points and passing opportunities.



Beginner trails will be designed with wider trail beds and gentler grades. These are appropriate for inexperienced riders, helping develop skills and build confidence. Related design guidelines include:

- Building shorter trails, closer to the parking area;
- Offering trails that are wider, with average grades of less than five percent;
- Using trail surfaces that are generally firm and stable;
- Potentially offering flowing, single-track-style sections; and
- Integrating limited challenging features and limiting small obstacles such as roots and rocks.



Intermediate-level trails will be designed with more narrow trails and steeper grades for more confident riders and offer a variety of moderate level challenges. Such trails may:

- Be located farther from entry and designed to be more challenging;
- Include loose or uneven trail surfaces;
- Offer moderate grades, and possibly short steep sections; and
- Be designed with turns, obstacles and uphill sections to moderate speeds and naturally slow riders.

### **Accessible Trails**

While topographic conditions within the Burlington Creek and McCarthy Creek sites make it challenging to develop a trail network that meets accessible trail guidelines, this plan recommends identifying opportunities to provide access to nature at both sites, for people with varying levels of ability. The opportunity to provide an accessible trail to the McCarthy Creek viewpoint should be explored. In addition, information about trail grades, width, and surfacing will be provided at trailheads and on Metro's website, so visitors can evaluate for themselves whether the trail meets their level of ability.

### **Bridges**

The trail system takes advantage of two existing crossings of Burlington Creek. However, several bridges of varying types and sizes will be necessary to cross smaller drainages on the site. Bridges of wood and steel construction may be required. Additionally, small, hand-built drainage crossings will likely be needed to ensure that trails hold intended alignments without unreasonable detours during the wetter months.

### **Viewpoints**

Viewpoints with supplemental interpretive signs are proposed at key locations. Interpretive signs at these locations will focus on context of the North Tualatin Mountains within the region, different types of habitat, views and watershed restoration. These viewpoints create the opportunity to discuss the critical importance of water quality in urban streams and the connections between Burlington Creek, McCarthy Creek, Burlington Bottoms wetlands, and the Multnomah Channel.



### **Bird-Watching Opportunities**

One of the key conservation targets in the North Tualatin Mountains is young shrub habitat. This type of shrub habitat is becoming less common in the region and specifically targets pollinators and neotropical migrant birds. This plan recommends enhancing bird-watching opportunities by offering amenities such as bird blinds in areas where shrub habitat is being maintained. At Burlington Creek, spots along the existing powerline corridor provide great opportunities to watch for birds in this unique habitat.

### **Education and Interpretive Story-Telling**

The North Tualatin Mountains have many stories to tell. The following are central themes for future nature education and interpretive features throughout the natural area:





### ***Tualatin Mountains Geology and Geography***

The local geology and geography of North Tualatin Mountains share the Columbia River Basalt with areas throughout the region, but the uplift that has created the Tualatin Mountain range plays a unique role in the region's geography.

### ***Forestry Practices (old growth vs young forest)***

The proximity of Burlington Creek to the Ancient Forest Preserve will give visitors an opportunity to experience how different a twenty-five year-old forest feels to walk through compared to one with trees that are over a hundred years old. Visitors will be able to learn from and participate in forest restoration activities, and watch the Burlington Creek Forest change over time. They will be able to witness the benefit of down wood, and watch the understory develop and layers of duff collect over time.

### ***Streams, Hydrology and Habitat***

The McCarthy Creek watershed is an opportunity to teach about the health of the watershed. Stories and experiences include: the big picture view of McCarthy Creek valley, the close up experience of water cascading through the stream, the wildlife that rely on cold clean streams, and the importance of clean water close to home.

The proximity of Burlington Creek Forest to Burlington Bottoms provides a unique opportunity to talk about the historic hydrologic connection between the wetlands in the floodplain, and the upland and riparian forests of the Tualatin Mountains. Prior to urbanization, similar wetlands were likely found all along the eastern edge of the Tualatin Mountains. It provides an opportunity to highlight red-legged frogs' migration patterns and habitat loss due to urbanization, and fortify efforts to improve their chances.

### ***The Tualatin Mountains Elk***

The interpretation and planning of programs at McCarthy Creek has an opportunity to celebrate the local elk herd.

### ***Local History***

There are many local stories that can be told about the North Tualatin Mountains. School children used to cross through the McCarthy Valley to get to the Skyline School. There was a wooden flume along the route of the railroad used to transport logs to the base of McCarthy Creek. Ferries transported people to local dances on Sauvie Island. These are just some of the stories that can be found on the Skyline Neighbors website.



## 5. IMPLEMENTATION

### PHASING

The access improvements identified in the access master plan will be implemented through a phased approach. The first phase will focus on enabling safe, code compliant public access to Burlington Creek. Building McCarthy Creek as part of phase two will provide an opportunity to apply lessons learned from Burlington Creek Forest. Phase 1 elements at Burlington will include:

- Parking lot
- Gates and security elements
- Restrooms (non-flushing)
- Trails
- Signs and interpretive elements

### DESIGN AND ENGINEERING

#### **Parking Lot Construction**

A preliminary feasibility analysis was completed for a proposed 15 car parking lot at Burlington Creek. Because of the site's steep slopes, a geotechnical engineer will need to be consulted during the design and engineering phase of the project.

#### **Trail Design and Construction**

Trails alignments are conceptual, meaning they give a general feel for the path – but are not yet fine-tuned. The next step will be to work closely with the Metro science team, professional trail contractors, professional trail building consultants and engineers to determine the actual alignment of trails on the ground. This effort will refine the trail routes to best fit the site. Trails will be routed around sensitive areas, wet areas, trees, stumps, springs, boulders and other habitat features.

Trail construction will employ best practices to construct a sustainable trail system that minimizes erosion, including Forest Service and National Park Service standards, guidelines and specifications, and follow guidelines outlined in Metro's trail design documents: "Green Trails: Guidelines for environmentally friendly trails" and Portland's Trail Design Guidelines.

The following should be considered in design and engineering of the trails:

#### ***Trail Alignment***

Once alignment has been flagged, the alignment will be surveyed by biologists for sensitive habitat such as wetlands, and nesting areas.

#### ***Trail Construction***

While it is important for the trail construction to be led by professional trail contractors, there are also opportunities to include volunteers in this process. From trail clearing to finish grading and planting, activities appropriate for including volunteers should be identified throughout the construction process.

Throughout the planning process, interest in participating in this work was expressed by several trail user groups including Northwest Trails Alliance representatives, the equestrian community, and other open house attendees. Established trail volunteer groups offer an opportunity to include volunteers in helping to help build, maintain, and monitor trails on an ongoing basis.



## **Wayfinding and Interpretive Design**

Wayfinding signs need to be simple and clear to ensure that trail users understand the appropriate use of trails. At Burlington Creek Forest, interpretive signs should highlight red-legged frogs' use of the site, their life-cycle and what is known about their migration. This is an important opportunity to raise awareness of the importance of this amphibian in our region. At McCarthy Creek, interpretive signs should highlight the stream, its tributaries, and important habitat and connectivity along the stream corridor between the ridge and the Multnomah Channel. Interpretive design should reflect site stories outlined in Chapter 4.

## **PERMITTING**

The project will need to be permitted through Multnomah County prior to construction. Land use approval will be required, as well as building permits to meet construction codes.

## **ANTICIPATED COST**

A planning level cost estimate was prepared based on elements shown in the draft master plan for the parking lots and trail networks. The estimate is based on the diagrammatic plans and assumptions made for materials, quality and construction, and is based on 2015 unit costs for each specific work item.

Escalation index numbers through 2019 are as follows:

- 2016 – 0.045
- 2017 – 0.045
- 2018 – 0.045
- 2019 – 0.045

As we move forward through permitting, design and engineering, we will make modifications to align with the budget amounts. Planning level cost estimates for access improvements for Burlington Creek and McCarthy Creek forests are included Appendix C.

## **PARTNERSHIP OPPORTUNITIES**

Partnerships and volunteers have proven valuable in all aspects of park management throughout the region and are essential in leveraging limited public funds. There will be a number of ways that volunteers can become involved at North Tualatin Mountains to enhance habitat quality for wildlife and help ensure a quality experience for the public. Key opportunities are described briefly below.

### **Site Stewardship**

Site Stewardship provides “eyes and ears” above and beyond what staff can provide. Through routine walking and monitoring of the trails, volunteer site stewards can alert staff early to issues that need addressing. They can also serve as “ambassadors” for North Tualatin Mountains, answer questions and ensure that visitors are abiding by rules and trail etiquette.

Site stewardship agreements with organizations representing individual user groups are an opportunity to foster an ethic of taking care of the land, trails and helping to improve habitat. Stewardship agreements would include responsibility to encourage appropriate use of trails and the site.



**Nature Education**

Volunteer naturalists help expand program offerings beyond what staff alone offer. Metro has a well-established volunteer naturalist program in place and relies on these very dedicated and highly trained volunteers to lead nature walks for the general public and civic groups, and to deliver outdoor education programs such as school field trips.

**Restoration**

Currently, Metro uses volunteers to assist in restoration efforts. Many of these volunteers perform ongoing monitoring to help assess and evaluate the success of restoration and other management activities. Other volunteer activities will include invasive plant removal and native seed collection.



## 6. OPERATIONS AND MAINTENANCE

### PARK REGULATIONS

All rules and regulations at North Tualatin Mountains will be consistent with Metro's Title 10, which outlines regulations "governing the use of Metro owned and operated regional parks and greenspaces facilities by members of the public in order to provide for protection of wildlife, plants and property, and to protect the safety and enjoyment of persons visiting these facilities."

For public security and safety, hours of operation and regulatory signs will be installed at each access point. An orientation map of the natural area will be installed at the parking area to assist visitors and emergency and police response teams with way-finding. Regulatory signs will include public use restrictions on dogs, fires, camping, motorized vehicles, hunting, smoking, intrusive noise, plant collecting and other uses outlined in Metro's Title 10. Due to conflicts with wildlife, a "no dogs" policy will be enforced consistent with all other Metro-managed natural areas.

### STAFFING

Once the Burlington Creek Forest and McCarthy Creek Forest sites are formally open, staff in three distinct program areas will be required to ensure successful maintenance and operation of the site. Key responsibilities for each are noted below.

#### Rangers:

- Manage day-to-day operations of the site
- Maintain gravel and paved trails
- Provide security and manage illegal camping

#### Land Managers:

- Oversee and/or perform monitoring, restoration and enhancement projects
- Maintain natural areas
- Maintain soft surface trails and all trail clearance corridors
- Manage and clean up illegal camping

#### Scientists:

- Coordinate monitoring, restoration and enhancement projects

### ADAPTIVE MANAGEMENT

Once this project is implemented, trails and trail use will need to be monitored for appropriate use, and to make sure that they function as intended. The system of trails, and trail uses should be modified in the future to adapt to new information, new site conditions and lessons learned about how people and wildlife use the site.

### SAFETY AND SECURITY

#### Access Control

Vehicle access will be controlled to prevent after hours use. Each of the vehicular entrances will be controlled with automatic gates, which will be locked after hours. Site boundaries are marked with carsonite posts to clearly delineate the public/private edge. Fencing will be considered and installed only on an as-needed basis to control access in problem locations where other measures are not sufficient.



### **Trail Monitoring and Maintenance**

Routine trail maintenance on a year-round basis will not only improve trail safety, but will also prolong the longevity of North Tualatin Mountains' trails. The key to trail maintenance will be to institute regularly scheduled monitoring to identify trail problems early, and to catch and address "social" or "demand" trails. Monitoring can be a time consuming task. Trail volunteer groups will provide vital assistance in monitoring the site above and beyond what staff can provide.

During the first year after construction, and after the first heavy rains, close attention should be paid to drainage and erosion patterns on soft surface trails. It is common for trails to need additional maintenance and adjustment during the first season. Ongoing trail maintenance activities will typically include vegetation clearing and pruning along trails to keep passages and selected views open, erosion control measures, trail pavement surfacing and stabilization, bridge and culvert clearing and upkeep, litter and illegal dumping clean-up, replacing signs, and closing "social trails" through the use of natural barriers and vegetation.

### **Managing Parking**

The parking lot at Burlington Creek will be designed to accommodate about 15 cars, including one ADA parking space. Overflow parking cannot be accommodated on McNamee Road. Metro may need to coordinate with Multnomah County to install "no parking" signs to ensure people don't park on McNamee. Parking rules will be strictly enforced by Metro staff and an on-contract security service .

### **Maintenance of Park Facilities and Amenities**

Routine maintenance of the park will include cleaning the restrooms, litter pick-up and general monitoring. Routine seasonal maintenance of the natural area facilities will include upkeep of the restroom building, benches and picnic tables, signs, and mowing of grass areas.

### **Fire Suppression Plan**

Metro's restoration work and long term management strategy includes identifying and reducing fire risks where possible. Additionally, an Incident Action Plan is developed for each site that includes information to assist Metro and cooperating agencies responding to a fire on Metro property. Incident actions plans shall be developed for both Burlington and McCarthy prior to implementing formal public access. We follow the Oregon Department of Forestry Industrial Fire Precaution Levels and restrictions, may close areas in very high fire conditions, may prohibit fires and smoking on properties during high fire conditions, and work with local fire prevention and suppression agencies.



## APPENDIX A: COMMUNITY FEEDBACK





## Metro | *Meeting minutes*

Meeting: North Tualatin Mountains Comprehensive Plan  
Date/time: September 18<sup>th</sup>, 2014  
Place: Skyline Grange Hall  
Purpose: First public engagement event

---

Over 40 attendees at the event  
80 comments

Comment Summary is as follows, organized by Value:

- Conservation
  - Volunteer work
  - Stream restoration
  - Wildlife surveying
  - Invasive species removal
  - Habitat restoration
  - No access to the public
  - Protection against impacts from recreation
  - Wildlife corridor to the Coast Range
  - Proximity to Forest Park and Burlington Bottoms
  - Oak woodlands
  - Continued land acquisition to connect sites
  - Proximity to the city
  - Diverse upland habitat
  - Bird habitat
  - No paved trails
  - Preservation for future generations
  - Clean air
- Education
  - Teaching water quality monitoring
  - Teaching stream ecology
  - School field trips
  - Proximity to Skyline School
  - Proximity to PCC Rock Creek
  - Proximity to city provide opportunities to educate the general public
  - Parking for school buses
  - Nature workshops
  - Wildlife surveying
- Recreation
  - Birding
  - Hiking
  - Trail running
  - Mountain biking
  - Nature viewing
  - Horseback riding



- Dog walking
- Dog walking via a permit system
- Fishing
- Taking pictures and nature photography
- Restrooms at trailheads
- Soft-surface (opposed to paved) trails
- Loop trails
- Access to site via TriMet
- Relaxation and tranquility
- Wildlife viewing
- Backcountry camping
- Mushroom hunting
- Separation of bikes from hikers
- Sketching/drawing
- Proximity to city



# NORTH TUALATIN MOUNTAINS CONTEXT

Coast Range  
Mountains

Columbia County

Washington County  
Multnomah County

10 miles

5 miles

Tualatin Valley

Sauvie Island

Forest Park

Multnomah County

**Parks:** Burlington Bottoms, Forest Park, Howell Territorial Park, Mason Hill Park, Pier Park

**Neighborhoods:** Skyline Ridge, Burlington, Linnton, St. Johns, Forest Park, Sauvie Island

**Schools:** Skyline School, West Union School, Sauvie Island School, PCC Rock Creek

25 minutes from downtown Portland

TriMet Bus #16

## North Tualatin Mountains

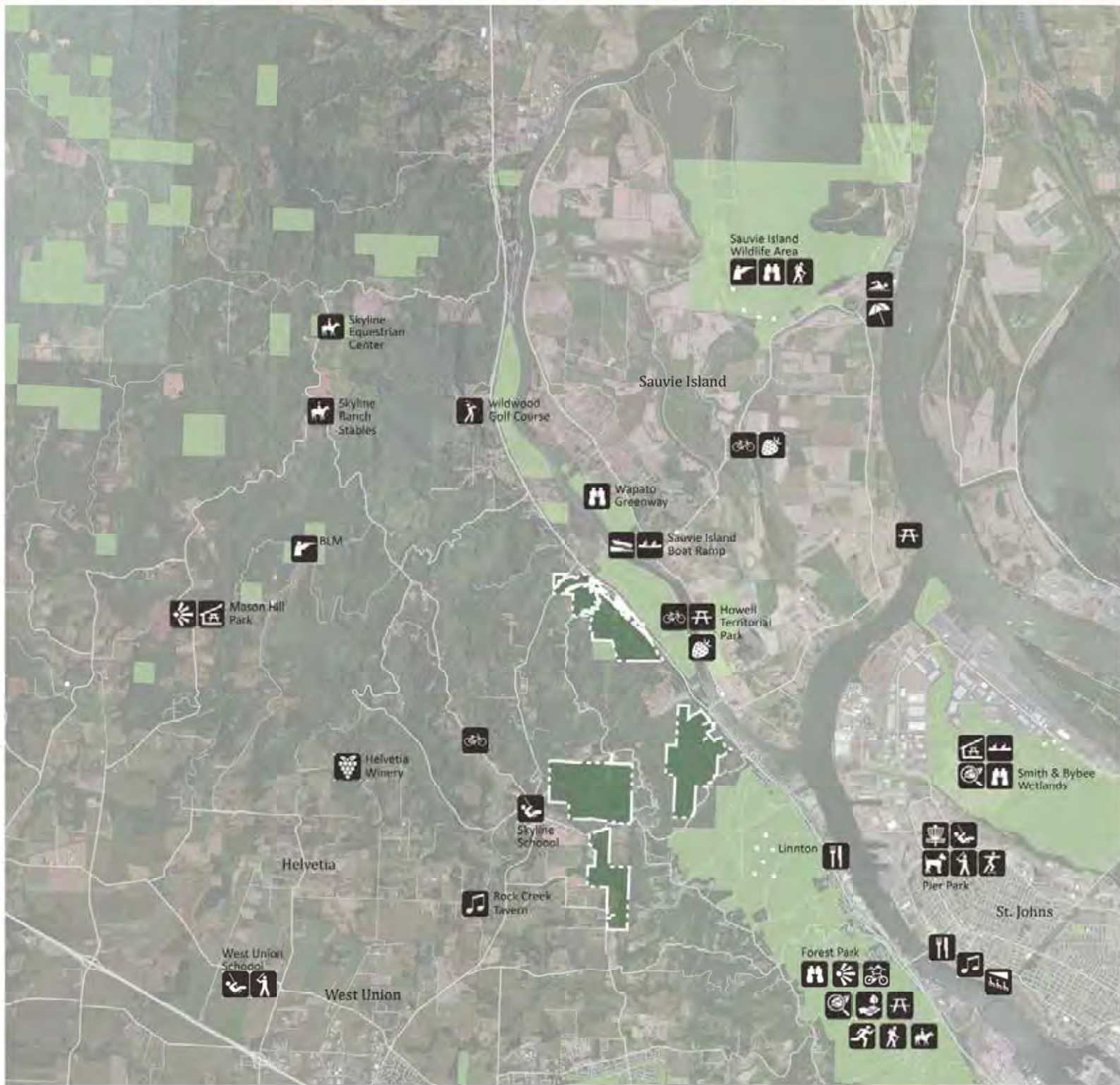
- Four properties which total approximately 1300 acres
- Land historically used for timber and agriculture
- Primarily forested with young even age stands of douglas fir and some open areas

## Tualatin Mountains

- An arm of the coast range, the Tualatin Mountains form Portland's West Hills. They define the western edge of the Portland Basin, separating it from the Tualatin Valley
- The Tualatin Mountains provide important habitat for migrating fish and amphibians in the Willamette River
- Forest Park preserves 5,000 acres of the Tualatin Mountains



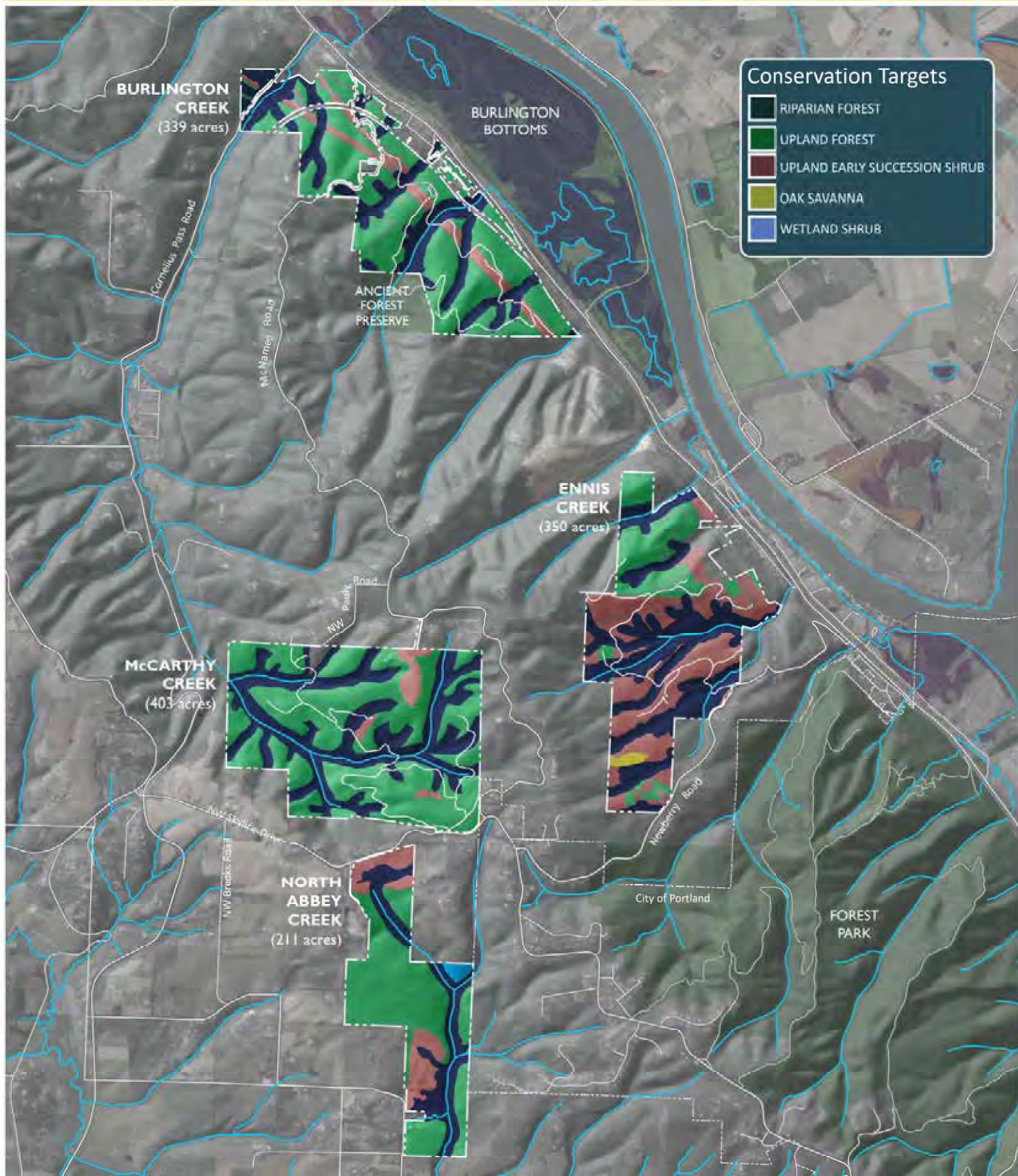
# NEARBY ACTIVITIES



- |               |                  |                 |                |              |                  |
|---------------|------------------|-----------------|----------------|--------------|------------------|
| Berry picking | Field sports     | Hunting         | Movie theater  | Playground   | View point       |
| Cycling       | Fruit picking    | Jogging         | Nature ed      | Public beach | Volunteer        |
| Dining        | Golfing          | Live music      | Paddling       | Skate park   | Wildlife viewing |
| Disc golf     | Hiking           | Boat ramp       | Picnic shelter | Swimming     | Wine tasting     |
| Dog park      | Horseback riding | Mountain biking | Picnicking     |              |                  |



# NORTH TUALATIN MOUNTAINS CONSERVATION





# NORTH TUALATIN MOUNTAINS HABITAT

## Riparian Forest

- Riparian forests protect water quality and provide important habitat near the headwaters of Burlington, Ennis, and McCarthy Creeks, which flow into the Multnomah Channel, and North Abbey Creek, a tributary of the Tualatin River
- Tributary creeks and confluence areas provide clean and cold water, nutrients and refuge areas for important fish species.



## Upland Forest

- Upland forest is composed primarily of native trees and shrubs such as Douglas fir, big-leaf maple, Oregon grape, salal and sword fern.
- Especially important to migrating and nesting songbirds, woodpeckers, mammals such as Douglas squirrel and deer, and seasonal habitat for salamanders, frogs and turtles.
- Urbanization has fragmented and reduced the amount of this habitat.

## Upland Early Successional Shrub

- Shrub dominated communities provide food and cover for neotropical migrant songbirds and create habitat for a variety of pollinator species.
- Small scale agricultural sites, recently logged areas, and utility clearings are opportunities to manage for early successional upland forest shrubs.



## Oak Savanna

Oak savanna harbors many unique plant and animal species. Once common, it is now rare in our region.

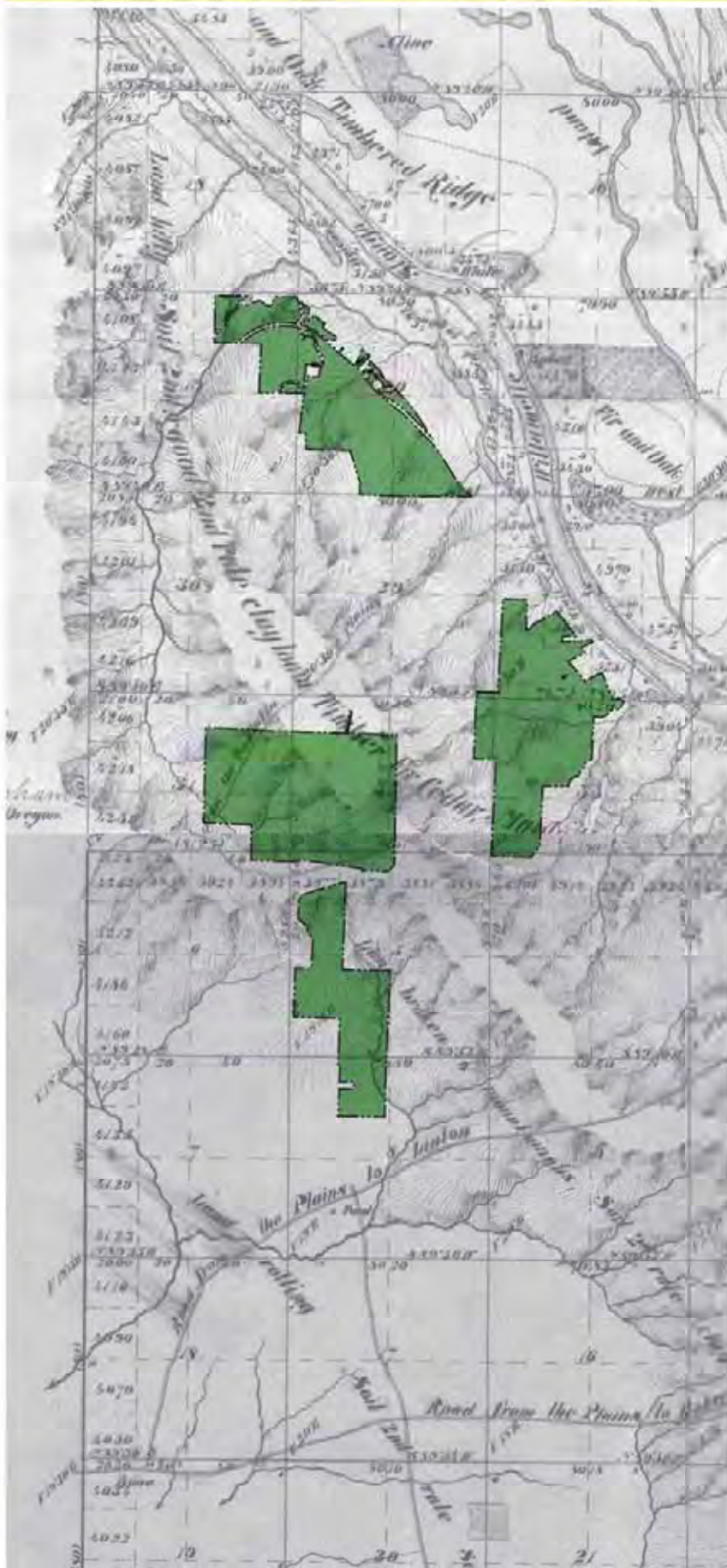
## Shrub Wetland

Shrub wetlands are important to many at-risk species and provide invertebrate food for songbirds and other animals.





# NORTH TUALATIN MOUNTAINS HISTORY



Before European settlement, Atfalati (also called Tualatin) tribe of the Kalapuya inhabited villages on the Tualatin Plains and the hills around Forest Grove

1883 Newberry Road established as county road.

late 1800 - 1900's The trees that originally covered Skyline hills were felled, then sent on a flume from the ridge along the route of Cornelius Pass and then OVER Highway 30 to one of the seven sawmills in Linnton.

1900's A small railroad spur led to what was likely a water powered mill on the north side of McCarthy Creek on the western edge of the site.

The school trail ran down one hill to McCarthy Creek (now spelled and called "McCarthy") and up the next hill to the school. In the creek bottom were the remnants of the old Kaiels Sawmill (From The School on the Hill from the Twenties by Margaret Pauly Tate).

1909 Ruth Trust company files plat for the town of Burlington.

~1911 United Railway Company constructs rail line between Portland and Wilkesboro and provides electric passenger service between Burlington and Linnton.

1915 When Ella Thomas was 2, her parents Reinhold and Rosalie Bieberdorf bought property and established a dairy on Newberry Road. (now Wealth Underground CSA) They tended about 40 cows as well as pear, walnut, plum, cherry, filbert and apple trees. Goats helped clear the land.

1920's There were about 45 students in Brooks School and everyone walked to school. Ramona Huserik recalls the Pauly kids walking to school across the canyon from Pauly Road off McNamee.

1936 Mallory George Lewis (Jim) Brooks purchase (original one room schoolhouse. It was moved to its current location where it became Brooks residence.

1941 BPA Built St John's-St Helens no1 transmission line.

1950 Ella moves back to family farm with husband Delbert Thomas and operate the Thomas Dairy from the 1940s to 1969.

1939 New Skyline School built.

1940 Skyline Grange established

1948 Forest Park formally dedicated by the City of Portland.

1950 A Ferry operated between Holbrook and Sauvie Island (at current day Cornelius Pass Road) until 1950 when the Sauvie Island bridge was built.

1974 Grange hall fire

local stories from Skyline Ridge Neighbors website  
<http://www.srnpx.org/history-skyline-ridge>



# NORTH TUALATIN MOUNTAINS MANAGEMENT



## Access control and site management

- Managing gates
- Installing signs to manage encourage appropriate use of the sites (ie no hunting, no dogs)
- Addressing encroachments issues
- Maintaining safety for increased visitation
- Evaluating slope stability
- Addressing and removing rogue trails (partnership with Northwest Trail Alliance)

## Existing roads

- Assess roads to mitigate water quality impacts, and evaluate future need for maintenance access
- Road maintenance for fire access and maintenance
- Culvert replacement



## Vegetation management & restoration opportunities

- Fuel reduction to reduce fire risk
- Invasive species management, including mapping, allocating resources, and controlling invasives
- Fostering partnerships with West Multnomah Soil and Water Conservation District, City of Portland and, Forest Park Conservancy, Trout Mountain Forestry, The National Audubon Society
- Identification of opportunities and strategy to restore old growth habitat and complex forest structure by thinning to select for future legacy trees, providing down wood, and increasing understory complexity
- Development of shrub communities to support neotropical migrants and pollinators





# NORTH TUALATIN MOUNTAINS BURLINGTON CREEK



## Burlington Creek

- 339 acres
- Northeast slopes of Tualatin Mountains
- Adjacent to the Ancient Forest Preserve (managed by the Forest Park Conservancy)
- Forest is primarily a young, even-aged stand of Douglas fir
- Connection to Burlington Bottoms and Multnomah Channel blocked by US 30, residential development, and the railroad along the NE edge of the site
- McNamee Road and the railroad bisect the site
- Existing logging roads
- BPA power line through the site
- Views toward Sauvie Island





# NORTH TUALATIN MOUNTAINS

## ENNIS CREEK

### Ennis Creek

- 350 acres
- Northeast slopes of Tualatin Mountains
- Forest is primarily a young, even-aged stand of Douglas fir
- Ennis Creek was most recently logged
- A CSA (community sustained agriculture) operates at south end of site
- Elk are present on the site

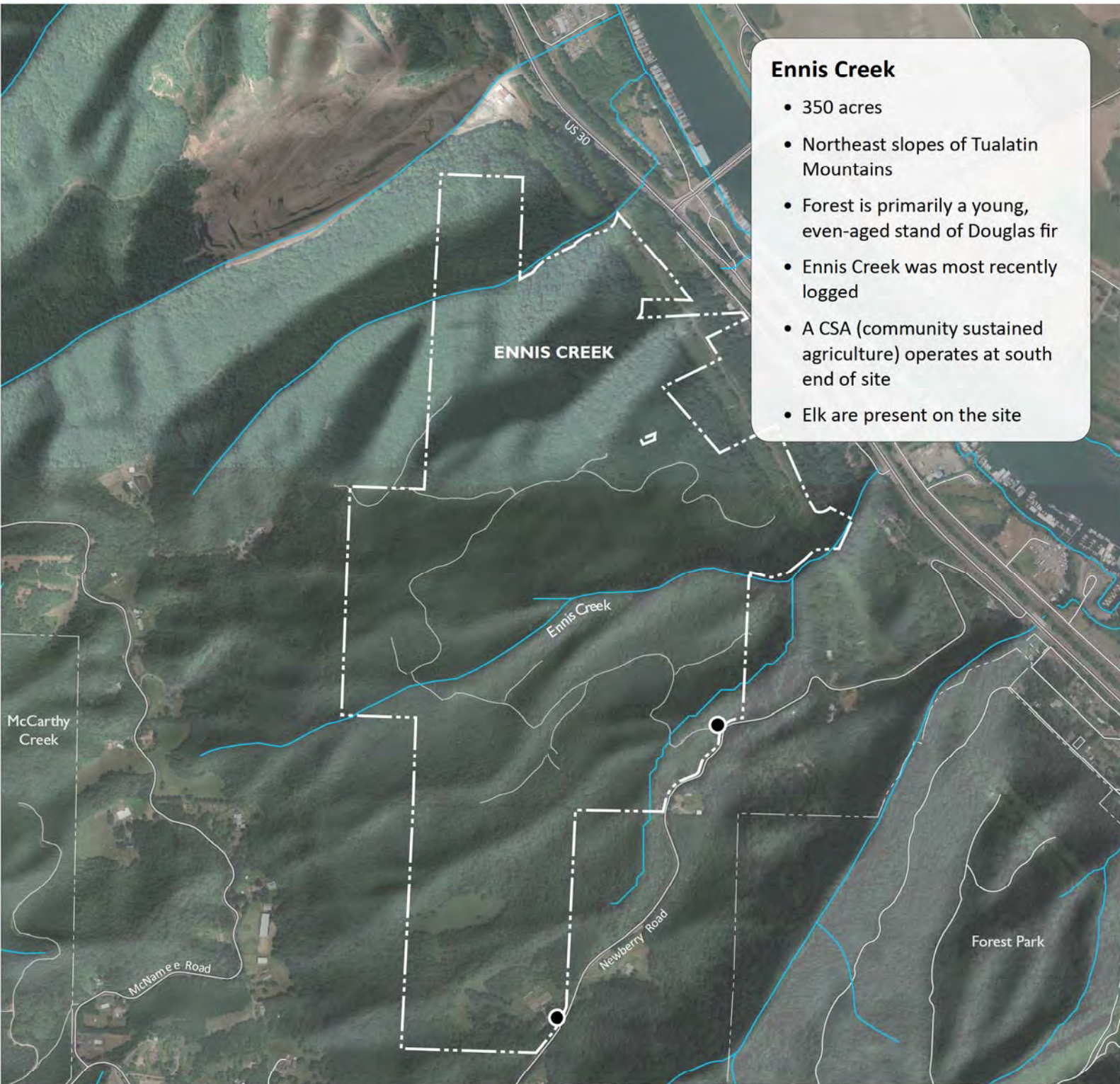


photo by Tracy Waters

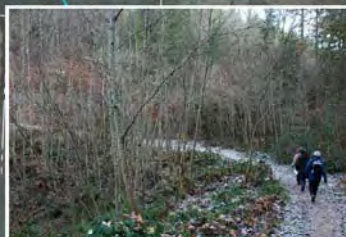




# NORTH TUALATIN MOUNTAINS MCCARTHY CREEK

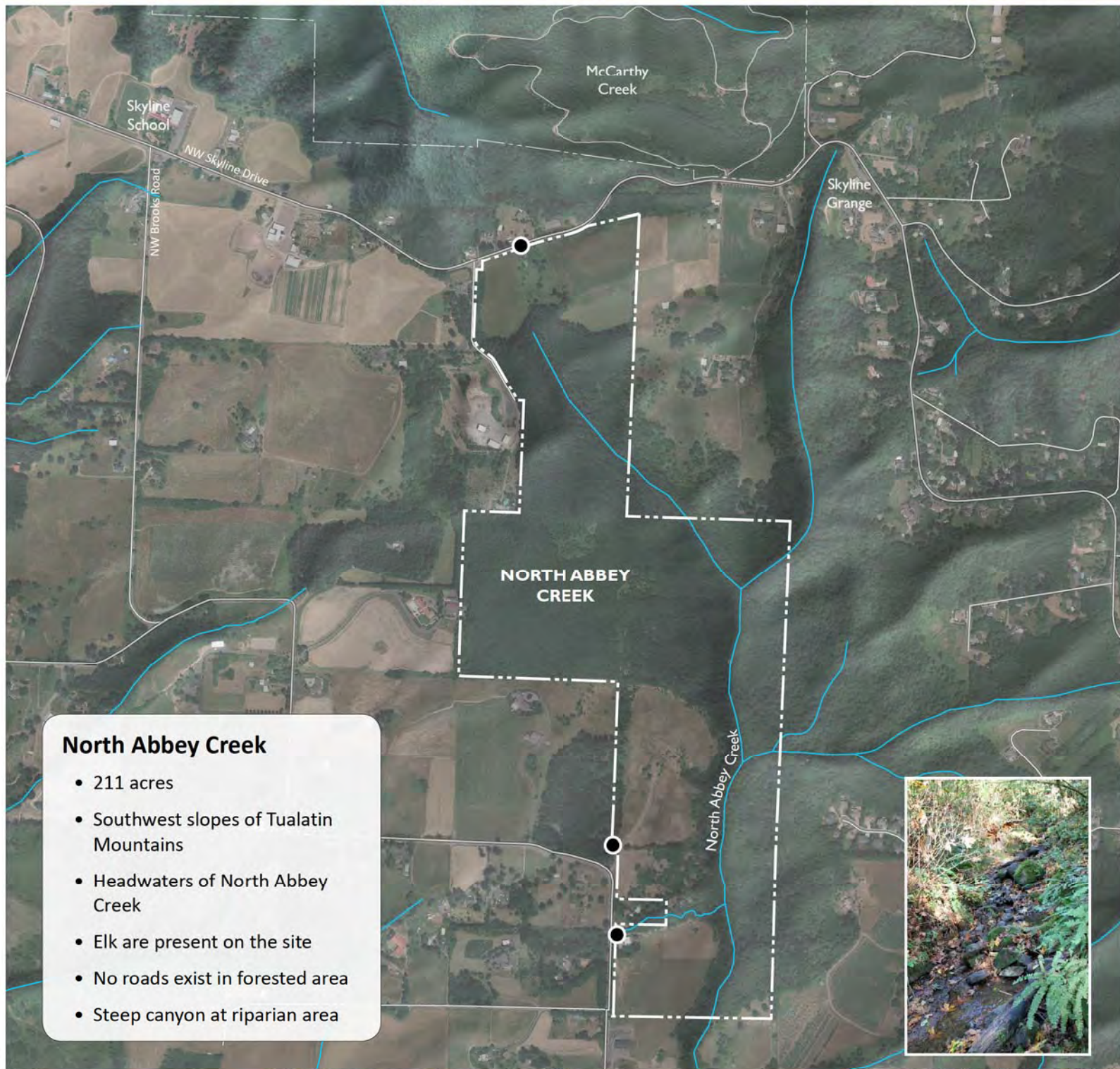
## McCarthy Creek

- 403 acres
- Southwest slopes of Tualatin Mountains
- Headwaters of McCarthy Creek
- Elk are present on the site
- Views of Tualatin Valley/Coast Range
- Mostly young forest with some older trees





# NORTH ABBEY CREEK



## North Abbey Creek

- 211 acres
- Southwest slopes of Tualatin Mountains
- Headwaters of North Abbey Creek
- Elk are present on the site
- No roads exist in forested area
- Steep canyon at riparian area







## Metro | *Meeting minutes*

Meeting: North Tualatin Mountains Comprehensive Plan  
Date/time: December 2<sup>nd</sup>, 2014 5:30-7:30  
Place: Skyline Grange Hall  
Purpose: Second public engagement event, review phase 2 of Comprehensive Planning

---

Approximately 250 attendees at the event  
135 Comment cards were received

- The community even format was generally informal, with brief presentations at 6:00. Mark Davison introduced the project. He was followed by Counselor Chase, and then Dave Elkin gave an overview of the information presented on boards around the room.
- Overall the message from the Metro project team was that we know there are a lot of mountain bikers in the room as well as neighbors and people concerned for wildlife and we are here to listen.
- Feedback was gathered through comment cards (135 total), A dot exercise, Where do you see elk exercise and through many one on one conversations
- We planned for about 100 people, and had 2 sign tables at the entry, and 10 pies
- Displays included the following Boards from Community Event #1
  - Project Map
  - Project Context (“where do you live?” pins)
  - Nearby Activities
  - Local History
  - Habitat conservation targets (2 boards)
- Displays included the following new displays
  - What we heard at Community Event 1
  - Where do you see elk (I will look for stickers) might be fun to add other wildlife to this too birds/ bob cats/ bears? Oh my!
  - Habitat Area (Kate)
  - Opportunity Areas (Olena)
  - Opportunity Areas at each site (4 boards)
  - 3 Activities boards for Dot Exercise
- There was a volunteer/ Naturalist table, where Shielagh had a model of an elk hoof and other cool wildlife stuff
- Dot exercise:
  - People were given 3 dots numbered 1-3, and asked to priorities their top 3 activities that they want to do at North Tualatin Mountains
  - Results of the dot exercise were as follows:



| <b>Activity</b>               | <b>Most Important</b> | <b>Very Important</b> | <b>Important</b> | <b>Total</b> |
|-------------------------------|-----------------------|-----------------------|------------------|--------------|
| Volunteer Work                | 0                     | 7                     | 10               | 17           |
| Conservation Education        | 7                     | 6                     | 13               | 26           |
| Wildlife Viewing              | 17                    | 9                     | 14               | 40           |
| Art                           | 1                     | 2                     | 0                | 3            |
| Being in Nature               | 19                    | 29                    | 35               | 83           |
| Scenic Viewing                | 0                     | 3                     | 10               | 13           |
| Picnicking                    | 0                     | 0                     | 3                | 3            |
| Playing                       | 1                     | 10                    | 11               | 22           |
| Hiking                        | 7                     | 47                    | 35               | 89           |
| Trail Running                 | 2                     | 43                    | 22               | 67           |
| Horseback Riding              | 3                     | 0                     | 2                | 5            |
| Mountain Biking               | 191                   | 56                    | 41               | 288          |
| <b>Added by participants:</b> |                       |                       |                  |              |
| Paragliding                   | 1                     |                       | 2                | 3            |
| Hiking with Dog               | 2                     | 2                     | 2                | 6            |

- Overall, the response from the mountain biking community was generally positive, happy that Metro is listening and very enthusiastic and anxious about building trails
- Response from neighbors and other community members was also generally positive, and though there are concerns about mountain biking, there was also acknowledgement that there is a demand in the region that needs to be addressed.



## WHAT IS IMPORTANT TO YOU ABOUT THE NORTH TUALATIN MOUNTAINS?



## WHAT DO YOU WANT TO DO AT THE NORTH TUALATIN MOUNTAINS?





# NORTH TUALATIN MOUNTAINS HABITAT AREAS

## BURLINGTON CREEK FOREST

### Burlington Creek

The Burlington Creek Forest is adjacent to the Ancient forest preserve, owned and managed by the Forest Park Conservancy. The only access to the Ancient Forest Preserve is from McNamee Rd. through Burlington Creek Forest.

### West McCarthy

The west side of McCarthy has been less disturbed in recent years. The roads on the west side of McCarthy have not been maintained and are in poor condition.

This area provides an opportunity to preserve a large patch of undisturbed habitat with some older forest and riparian connectivity.

## MCCARTHY CREEK FOREST (403 acres)

### North Abbey

The North Abbey Cr. forest site is relatively narrow. Stretching from its headwaters at the north end of the site, the North Abbey Creek riparian corridor extends through the length of the site.

Elk are known to use the entire North Abbey site.

The site includes older forest with diverse understory, as well as open areas that provide opportunities for pollinator habitat.

The site has been used for education programs by Trackers Earth and Self Enhancement Inc.

## NORTH ABBEY CREEK FOREST (211 acres)

Trackers Earth  
NW Kaiser Rd

Self Enhancement Inc

North Abbey Creek headwaters

North Abbey Cr.

## ENNIS CREEK FOREST (350 acres)

### Legend

-  RIPARIAN CORRIDORS AND HEADWATERS
-  ELK AREAS
-  OLDER FOREST
-  POWER LINE
-  CONSERVATION EDUCATION

### Conservation Focus

#### Headwaters and riparian corridors:

Protecting headwaters of McCarthy and North Abbey Creeks as well as the riparian corridors in the North Tualatin Mountains is a priority.

#### Diverse forests:

Many of the existing forests have been recently cut and are comprised of even aged stands. Restoration of forest diversity, involving selective thinning to release large trees and targeted planting of understory species, will be a focus in upland and riparian forest areas.

#### Early successional shrub:

Small scale agricultural sites, recently logged areas, and utility clearings are opportunities to manage for early successional upland forest shrubs and oak savannah. Shrub dominated communities provide food and cover for neotropical migrant songbirds and create habitat for a variety of pollinator species. Savannah offers habitat for pollinators and elk herds.

#### Key undisturbed habitat areas:

It is important to preserve a large swath of unfragmented habitat without trails (several hundred acres is ideal, but may not be feasible on these sites) Elk are known to use many of the areas forests and open areas.

**Biodiversity corridors:** Potential biodiversity corridors provide connections through the landscape allowing wildlife to move among sites and habitat anchors.

### South Ennis

At the southern end of Ennis, the forest is older and more diverse with open meadows where elk have been observed.

This area offers potential for future connectivity to Forest Park.

Wealth Underground Farm, a CSA (Community Sustained Agriculture) operates on the south end of the property.

FOREST PARK

City of Portland

NW Skyline Blvd

Newberry Road

Skyline School  
NW Skyline Drive

NW Brooks Road

NW Pauls Road

NW Pauls Road

McNamee Road

Cornelius Pass Road

BURLINGTON BOTTOMS

ANCIENT FOREST PRESERVE

legacy tree

Potential Biodiversity Corridors

Potential Biodiversity Corridors

Potential Biodiversity Corridors

Potential Biodiversity Corridors

Potential Biodiversity Corridors

Potential Biodiversity Corridors

Potential Biodiversity Corridors

Potential Biodiversity Corridors

Potential Biodiversity Corridors



# NORTH TUALATIN MOUNTAINS OPPORTUNITY AREAS

## BURLINGTON CREEK FOREST (339 acres)

### North Burlington

Contained between McNamee Road and the railroad tracks, this area could provide opportunities for shorter loops.

### Central Burlington

Forest diversity is a restoration focus in these young even-aged forests. This includes thinning, planting understory plants and planting diverse tree species.

The main access to the Ancient Forest Preserve is from McNamee Rd. This access would require extensive safety improvements to provide a formalized public entry.

## ANCIENT FOREST PRESERVE

### South Burlington

Although it is adjacent to the Ancient Forest Preserve, this is primarily a young, even-aged forest stand, and will be managed to accelerate development of forest diversity and legacy trees.

The power line road is well maintained and offers views toward Sauvie Island and the Columbia River.

## BURLINGTON BOTTOMS

## MCCARTHY CREEK (403 acres)

### North McCarthy

Open meadows at the top of the ridge provide excellent views of the coast range and Chehalis Ridge, the western edge of the Tualatin Valley. Elk are sometimes seen in these meadows.

Restoration efforts in these open areas include planting Oregon oaks and native shrubs.

An entry off McNamee would require moderate safety improvements to provide a formalized public entry.

### South McCarthy

Similar to the forests at Ennis and Burlington, this forest was recently planted, and restoration aims to increase diversity of tree species, age and understory plants.

A formalized public entry from NW Skyline Drive would require modest safety improvements. The area offers potential for a small parking area and entry. NW Kaiser Rd

## NORTH ABBEY CREEK FOREST (211 acres)

### North Abbey

The North Abbey Creek forest site is relatively narrow. Stretching from its headwaters at the north end of the site, the North Abbey Creek riparian corridor extends through the length of the site. Elk are known to use the entire area.

North Abbey's diverse habitat areas provide a variety of educational opportunities. Self Enhancement Inc. and Trackers Earth have held successful educational programs at North Abbey, and the opportunity exists to continue to host similar programs in the future.

## ENNIS CREEK FOREST (350 acres)

### North Ennis

Restoration work aims to increase diversity of tree species, age and understory plants by thinning to encourage large healthy trees and planting native understory plants.

Though there are no formal access points, an informal access is used by neighbors to the northeast.

Existing access road along the ridge offers views toward Sauvie Island.

### Central Ennis










Restoration work aims to increase diversity of tree species, age and understory plants by thinning to encourage large healthy trees and planting native understory plants.

Access from Newberry Road limited to maintenance vehicles because of steep grades and poor visibility.

## Legend

-  RECREATION OPPORTUNITY AREA
-  RIPARIAN CORRIDORS
-  ELK AREAS
-  OLDER FOREST
-  POWER LINE
-  VIEW POINT
-  PRIMARY ACCESS OPPORTUNITY
-  SECONDARY ACCESS OPPORTUNITY
-  MAINTENANCE ACCESS
-  POTENTIAL TRAIL CONNECTION

## Activities

-  VOLUNTEERING
-  CONSERVATION EDUCATION
-  NATURE VIEWING
-  SCENIC VIEWING
-  PLAYING
-  PICNICKING
-  HIKING
-  TRAIL RUNNING
-  MOUNTAIN BIKING



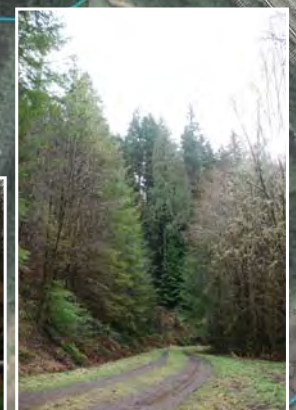
# NORTH TUALATIN MOUNTAINS BURLINGTON CREEK

## Burlington Creek Forest

- 339 acres
- Northeast slopes of Tualatin Mountains
- Adjacent to the Ancient Forest Preserve (managed by the Forest Park Conservancy)
- Forest is primarily a young, even-aged stand of Douglas fir
- Connection to Burlington Bottoms and Multnomah Channel blocked by US 30, residential development, and the railroad along the NE edge of the site
- McNamee Road and the railroad bisect the site
- BPA power line through the site
- Views toward Sauvie Island

### Legend

-  RECREATION OPPORTUNITY AREA
-  RIPARIAN CORRIDORS
-  VIEW POINT
-  PRIMARY ACCESS OPPORTUNITY
-  SECONDARY ACCESS OPPORTUNITY
-  POTENTIAL TRAIL CONNECTION

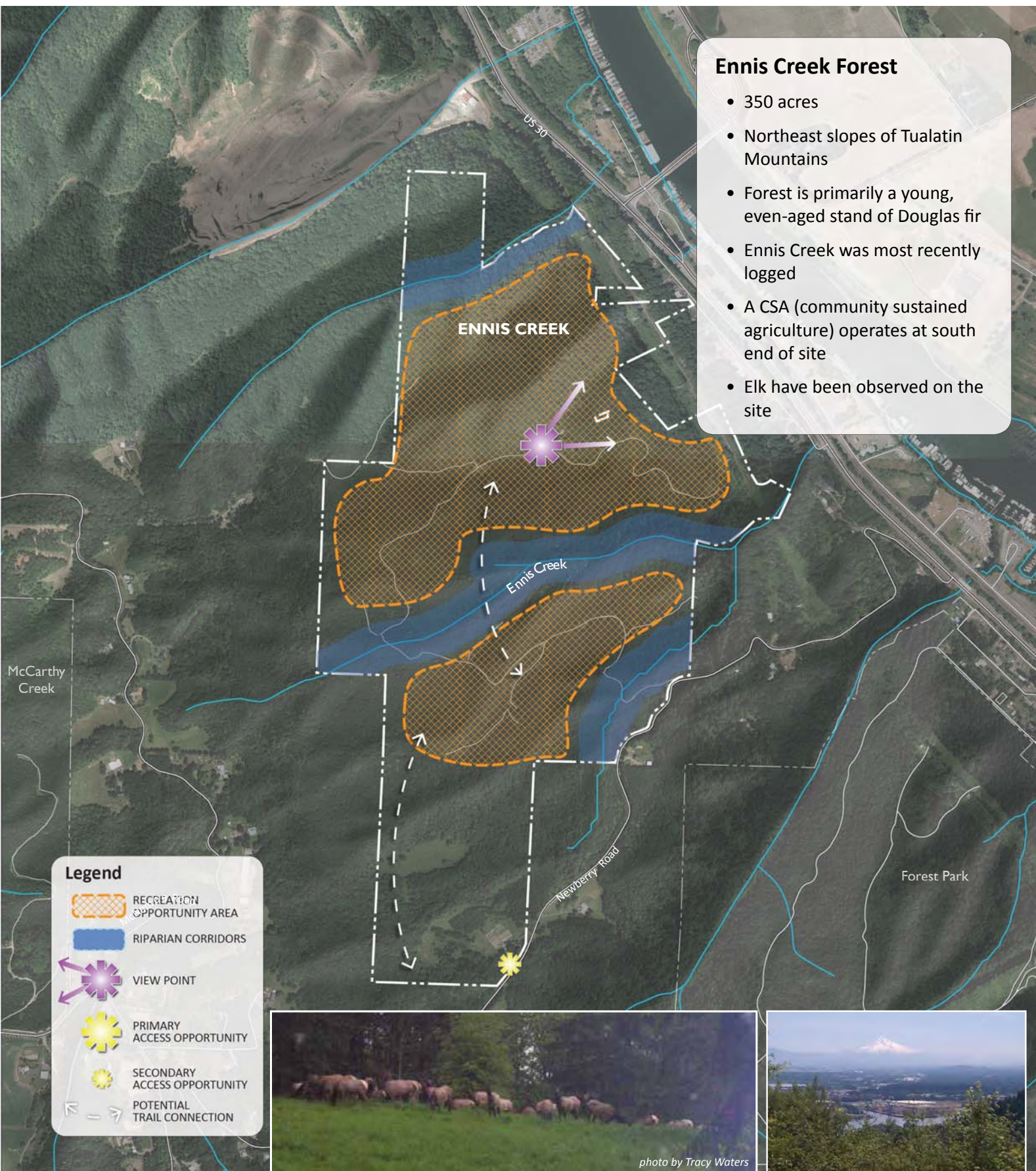




# ENNIS CREEK

## Ennis Creek Forest

- 350 acres
- Northeast slopes of Tualatin Mountains
- Forest is primarily a young, even-aged stand of Douglas fir
- Ennis Creek was most recently logged
- A CSA (community sustained agriculture) operates at south end of site
- Elk have been observed on the site



### Legend

- RECREATION OPPORTUNITY AREA
- RIPARIAN CORRIDORS
- VIEW POINT
- PRIMARY ACCESS OPPORTUNITY
- SECONDARY ACCESS OPPORTUNITY
- POTENTIAL TRAIL CONNECTION



photo by Tracy Waters

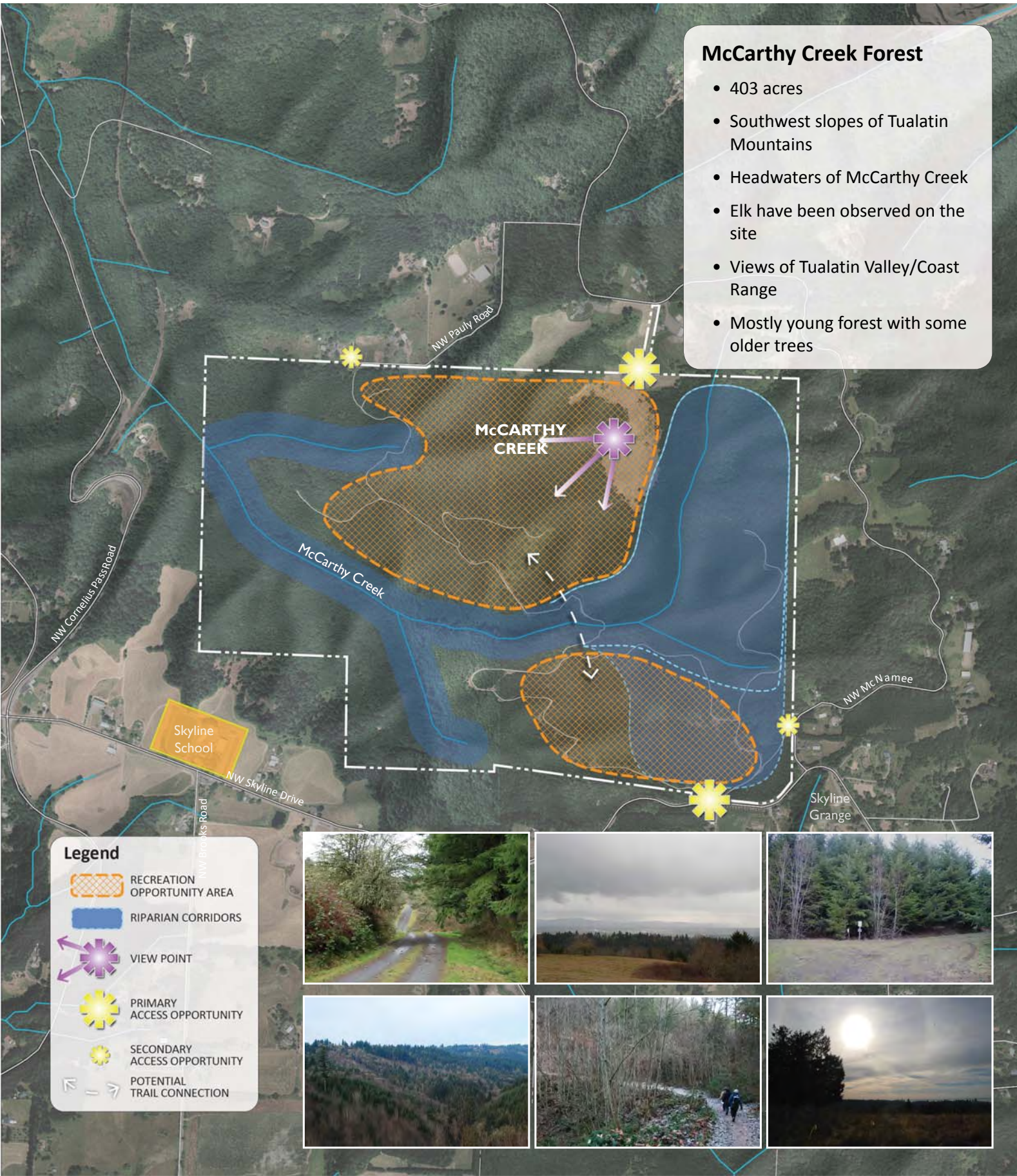




# NORTH TUALATIN MOUNTAINS MCCARTHY CREEK

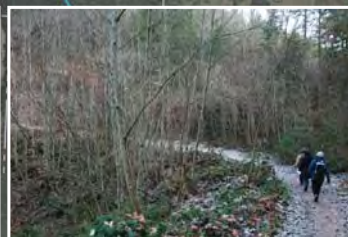
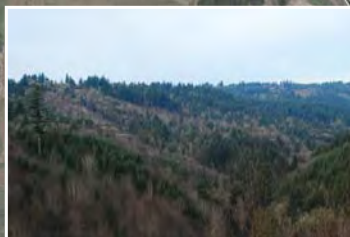
## McCarthy Creek Forest

- 403 acres
- Southwest slopes of Tualatin Mountains
- Headwaters of McCarthy Creek
- Elk have been observed on the site
- Views of Tualatin Valley/Coast Range
- Mostly young forest with some older trees



### Legend

- RECREATION OPPORTUNITY AREA
- RIPARIAN CORRIDORS
- VIEW POINT
- PRIMARY ACCESS OPPORTUNITY
- SECONDARY ACCESS OPPORTUNITY
- POTENTIAL TRAIL CONNECTION





## North Abbey Creek Forest

- 211 acres
- Southwest slopes of Tualatin Mountains
- Headwaters of North Abbey Creek
- Elk have been observed on the site
- No roads exist in forested area
- Steep canyon at riparian area

### Legend

-  RECREATION OPPORTUNITY AREA
-  RIPARIAN CORRIDORS
-  VIEW POINT
-  PRIMARY ACCESS OPPORTUNITY
-  SECONDARY ACCESS OPPORTUNITY
-  POTENTIAL TRAIL CONNECTION





# NORTH TUALATIN MOUNTAINS ACTIVITIES

Rank your top 3 activities for the project. Place one dot next to each of your 3 priorities.

**1** most important

**2** very important

**3** important



## Volunteer Work



## Playing



## Trail running



## Scenic Viewing





# NORTH TUALATIN MOUNTAINS

## ACTIVITIES

Rank your top 3 activities for the project. Place one dot next to each of your 3 priorities.

**1** most important

**2** very important

**3** important



### Conservation Education



### Picnicking



### Mountain biking



### Horseback riding





# NORTH TUALATIN MOUNTAINS ACTIVITIES

Rank your top 3 activities for the project. Place one dot next to each of your 3 priorities.

**1** most important

**2** very important

**3** important



## Wildlife Viewing



## Hiking



## Art



## Being in Nature







# Metro | *Meeting minutes*

Meeting: North Tualatin Mountains Comprehensive Plan  
Date/time: May 6th, 2015 6:00-8:00  
Place: Skyline School  
Purpose: Third public engagement event, review phase 3 of Comprehensive Planning

---

Approximately 75 attendees at the event  
64 Comment cards were received

- The community even format was generally informal, with brief presentations at 6:30. Dan Moeler introduced the project. He was followed by Counselor Chase, and then Robert Spurlock gave an overview of the information presented on boards around the room.
- Media were given the opportunity for a briefing at 5:15. Jonathan Maus attended
- Overall the message from the Metro project team was that protecting habitat and water quality is our first priority, but access to nature is also important. We believe that we can provide access to these sites while protecting habitat. Three types of trail networks (shared, a mix of shared and separated and all separated) were shown on 3 of the sites. Only hiking trails were proposed for North Abbey Creek.
- Feedback was gathered through surveys (64 total), and through many one on one conversations
- We planned for about 200 people, and had 2 sign tables at the entry, and ?? pies
- Displays included the following Boards from Community Event #1 and 2
  - Project Context
  - Local History
  - Habitat conservation targets (2 boards)
  - Habitat areas
  - project timeline
- Displays included the following new displays
  - What we heard at mtg 2
  - Facilities 1
  - Facilities 2
  - Day use area
  - Restoration projects
  - Restoration projects map
  - Values
- Displays included the following for each of the sites
  - Visitor Experience
  - Trail network concepts
- There was a Naturalist table, where Shielagh had a model of an elk hoof and other cool wildlife stuff
- What we heard:
  - People were generally supportive of the approach to protecting habitat while providing trail access opportunities
  - A group of neighbors that live to the south and west of North Abbey Creek were not supportive of any trail access or day use area at North Abbey Creek site



# NORTH TUALATIN MOUNTAINS

## WHAT WE HEARD

At Community Event 2 in December we asked attendees to rank their top 3 activities (most important/very important/important) for the project. See below for what we heard.

### TOP THREE ACTIVITIES



**Off-road Cycling**



**Hiking**



**Being in Nature**



### OTHER ACTIVITIES



**Trail running**



**Wildlife Viewing**



**Conservation Education**



**Playing**



**Volunteer Work**



**Scenic Viewing**



**Horseback riding**



**Art**



**Picnicking**





# NORTH TUALATIN MOUNTAINS VALUES

The North Tualatin Mountains Natural Area preserves valuable habitat, streams and biodiversity corridors between Forest Park and the Coast Range. Protecting habitat and water quality on these sites is Metro's first priority.

Access to nature supports healthy, active outdoor lifestyles and people depend on nature for peace, quiet and renewal. The North Tualatin Mountains are an opportunity for all to share in these benefits.

Metro intends to develop access to these sites in a sensitive and balanced way that ensures healthy habitats and a meaningful experience of nature.



We plan to develop trail access on some, but not all, of the sites. We do not intend to develop all the trails shown.

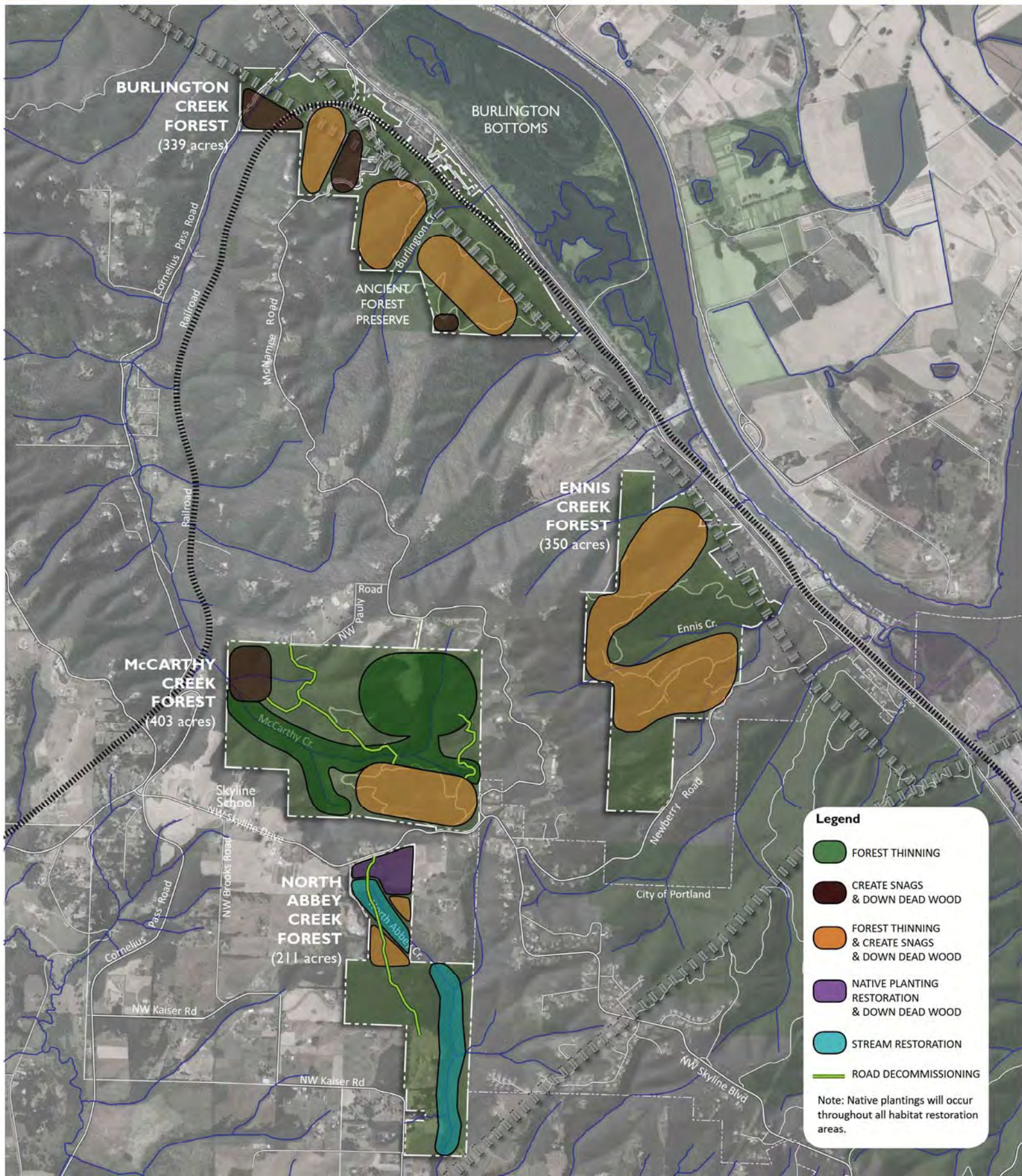
The trail concepts show examples of trails system types and the range of possibilities.



Please fill out the survey and give us your feedback on the types of trails, trail systems and visitor experiences that you like.



# NORTH TUALATIN MOUNTAINS HABITAT RESTORATION





# NORTH TUALATIN MOUNTAINS HABITAT RESTORATION

## Forest Thinning



The North Tualatin Mountains natural areas have hundreds of acres of former commercial tree farms dominated by young stands of Douglas fir. Reducing the number of conifers per acre helps keep trees healthy and preserves hardwoods and native shrubs. Large diameter trees are lacking in the North Tualatin Mountains natural areas and are valuable for wildlife and water quality. Thinning accelerates tree growth and makes forests more resilient to disease and wildfire. Many of the trees removed during the thinning will stay on site and provide habitat as down wood.

## Create Snags and Down Dead Wood

Standing dead trees (snags) and down wood have been removed by previous property owners through clearcut harvesting or other land uses. Adding them back into the forests by topping trees and dropping and leaving logs on the ground provides wildlife habitat and nutrient storage.



## Native Plantings



Hardwoods and shrubs provide valuable food and shelter for many bird species but are often shaded out by fast growing conifers in young forests. Planting after thinning will help jump start the establishment of native shrubs and the creation of a diverse understory.



## Stream Restoration



Large conifers and down wood have been removed from many of the North Tualatin riparian areas, resulting in incised (eroded) stream channels and slumping stream banks. Growing big conifers quickly and adding large wood into streams helps improve stream conditions and water quality.

## Remove or Replace Culverts



Many culverts in the North Tualatin Mountains natural areas are old and under-sized, blocking wildlife movement and increasing the risk of failure and the amount of sediment into streams, resulting in decreased water quality. Removing or replacing culverts improves water quality and provides better wildlife connectivity.

## Road Decommissioning

Old logging roads are a significant source of sediment in streams, which harms water quality and degrades fish habitat. Regrading and revegetating old roads reduce the risk of soil erosion and sediment in streams.





# NORTH TUALATIN MOUNTAINS BURLINGTON CREEK

Burlington Creek Forest is part of the North Tualatin Mountains. This site's steep ridges and valleys were logged about twenty years ago and replanted with Douglas fir. The landscape is generally accessible due to existing logging roads. The southwest corner of the Burlington Creek Forest is adjacent to the Forest Park Conservancy's Ancient Forest Preserve.

## HABITAT

Burlington Creek Forest protects an important link in habitat connectivity between Forest Park and coast range forest. This type of upland forest is especially important to migrating and nesting songbirds, woodpeckers, mammals such as Douglas squirrel and deer, and seasonal habitat for salamanders, frogs and turtles. Shrub dominated communities along the powerline corridor provide food and cover for neotropical migrant songbirds and create habitat for a variety of pollinator species.



## TRAIL EXPERIENCE

Trails in Burlington Creek Forest would explore the ridges and valleys of the site. Burlington Creek Forest offers a great setting for a day hike or family picnic. Glimpses of a wooden railroad trestle recall the area's timber and railroad history. The Pacific Greenway Trail, a potential future regional trail connection, might someday connect coast range trails and Forest Park through the site. The Ancient Forest Preserve, managed by the Forest Park Conservancy would also be accessed from Burlington's day use area.



## VIEWPOINTS

A power transmission corridor traverses the site, providing a clearing in the forest canopy. The trail crosses the corridor in several places, allowing visitors openings in the trees to see views of Sauvie Island and on a clear day several Cascade peaks.



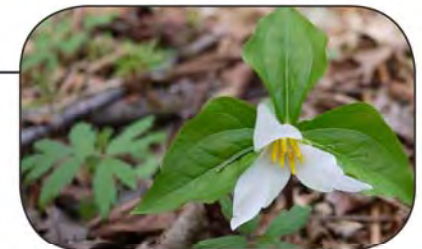
## ENTRANCE/DAY USE AREA

The primary access to this site is via McNamee Road, which requires safety improvements in order to accommodate a public entrance and day use area. A day use area could provide a small parking area, shelter and restrooms.



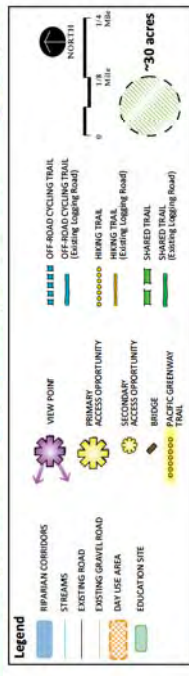
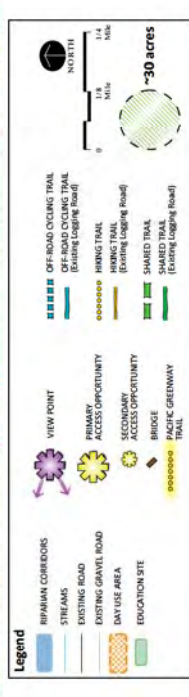
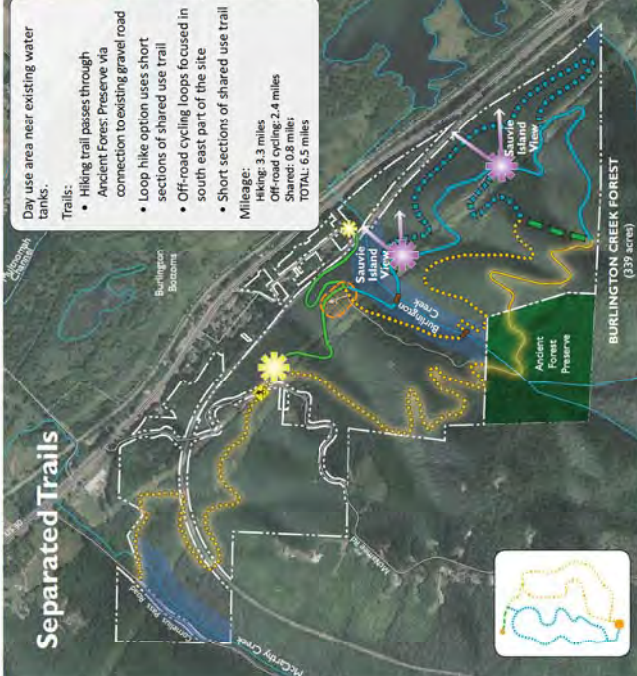
## EDUCATION OPPORTUNITIES

Burlington Creek Forest and the Ancient Forest Preserve provide a delightful setting in the trees, and a dynamic place to observe a variety of forest ages, and learn about restoration and healthy forest habitat. Views of Sauvie Island and Columbia River provide a first hand observation of the region's geography.





# NORTH TUALATIN MOUNTAINS BURLINGTON CREEK





# NORTH TUALATIN MOUNTAINS ENNIS CREEK



Instead of alternating steep ridges and valleys that are typical of the Tualatin Mountains, the north and south forks of Ennis Creek flow through more gentle topography. Forested wetlands provide habitat for amphibians, like red-legged frogs, a local celebrity species that plays an important ecological role. This site also has a rich agricultural history and includes an active small farm.

## HABITAT

Like Burlington to the north, Ennis Creek Forest protects an important link in habitat connectivity between Forest Park and coast range forest. Habitat corridors like this one support local species biodiversity. Ennis Creek's Forested wetlands provide habitat for red-legged frogs. Elk can sometimes be seen moving through the power line corridor or grazing in that areas that remain open from past agricultural operations.



## TRAIL EXPERIENCE

Gentle sloping trails would allow visitors to meander through second growth forests. Boardwalks and footbridges help protect habitat while inviting visitors to learn about Ennis Creek's plants, mammals, birds, and amphibians. At the edge of a small clearing there might be a sunny spot to picnic and the possibility of seeing elk graze. In the future, the Pacific Greenway Trail may provide a regional trail connection between coast range trails and Forest Park.



## VIEWPOINTS

A trail climbs to a ridge-top vista of Sauvie Island and the Columbia River. On a clear day, the backdrop includes several Cascade peaks.



## ENTRANCE/DAY USE AREA

An access point off of Newberry Road provides the best opportunity for a day use area at the site. It is currently developed as a home site and the area has been in agricultural use for decades. In the future, visitors could be greeted by a small parking lot nested between the forest edge and farmstead site. The day use area could provide restrooms, picnicking, and a short nature trail with opportunities to learn about the site's history and habitat.



## EDUCATION OPPORTUNITIES

Educational opportunities are abundant in Ennis Creek Forest. The forest provides a good home for red-legged frogs. Views of Sauvie Island and Columbia River are an opportunity to observe the region's geography first hand. The site's agricultural history offers many opportunities for connecting with and learning about nature and history.

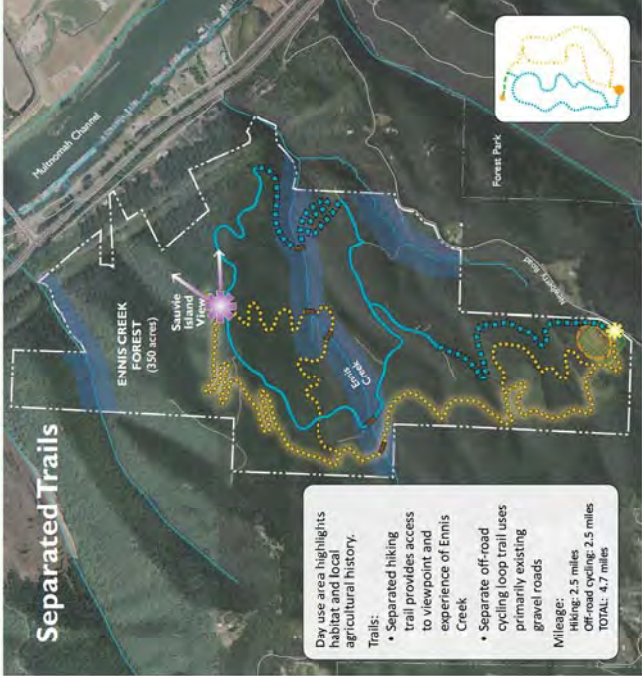
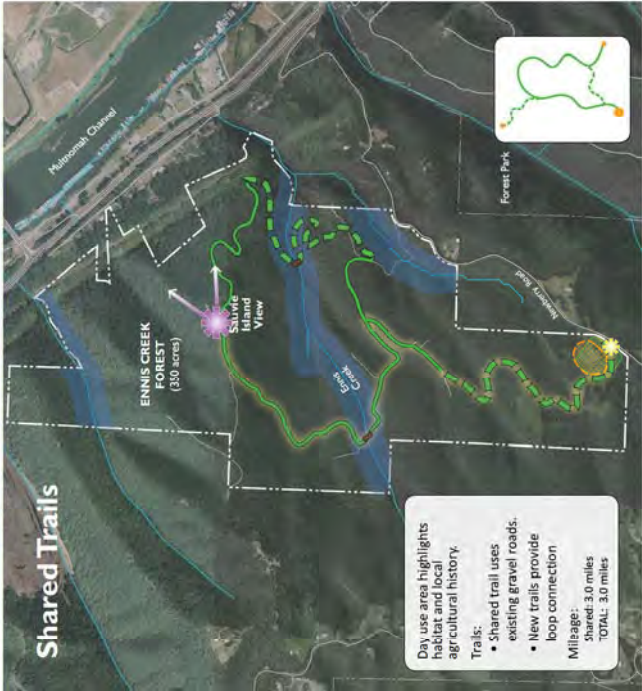




MAKING GREAT PLACE Metro

# NORTH TUALATIN MOUNTAINS

## ENNIS CREEK





# NORTH TUALATIN MOUNTAINS MCCARTHY CREEK



McCarthy Creek Forest is part of the Tualatin Mountains, the ridge which extends from the coast range along the Columbia River and separates the Columbia/Willamette floodplain from the Tualatin Valley. The Tualatin Mountains are characterized by steep ridges and valleys dominated by upland and riparian forest. McCarthy Creek flows west then north, through the Tualatin Mountains ridge via Cornelius Pass before emptying into the Multnomah Channel.

## HABITAT

Riparian forests protect water quality and provide important habitat near the headwaters of McCarthy Creek. Older forests provide diverse canopy along the stream. The upland forest is composed primarily of second growth Douglas fir, big-leaf maple, Oregon grape, salal and sword fern. Upland forests are especially important to migrating and nesting songbirds, woodpeckers, mammals such as Douglas squirrel and elk, and seasonal habitat for salamanders, frogs and turtles.



## TRAIL EXPERIENCE

The varied topography of the site offers opportunities for a variety of family friendly trail experiences. There is an opportunity for a gently graded trail that culminates in a beautiful vista across the Tualatin Valley. For off-road cycling, there might be a choice of descending routes with varying levels of challenge. For hiking, a loop trail could explore McCarthy Creek's valley.



## VIEWPOINTS

The Tualatin Valley View offers a unique vantage point across Hillsboro and Cornelius to Chehalem Ridge and the Coast Range. This vista provides a good vantage point from which to experience how the site fits into the region's geography. The McCarthy Creek View offers a perspective of the creek's valley as it curves toward the north on it's way to Multnomah Channel.



## ENTRANCE/DAY USE AREA

An access point off of Skyline Drive offers an opportunity for a day use area at the southern end of the site. A day use area at this location could include a small parking lot, shelter and restrooms.



## EDUCATION OPPORTUNITIES

Stories of the local area include early settlers' kids walking to school along a route which crossed the valley, led down to McCarthy Creek and back up to Skyline School. For Skyline School students, this could be an opportunity to connect kids to nature and the local history of the community. Volunteer stewardship opportunities could focus on improving the forest understory, and monitoring trails to ensure they are well maintained and used properly.





# NORTH TUALATIN MOUNTAINS MCCARTHY CREEK

## Shared Trails



## Mix of Shared & Separated Trails



## Separated Trails





# NORTH TUALATIN MOUNTAINS NORTH ABBEY CREEK



At the north boundary of the site, Skyline Ridge defines the edge of the Tualatin River watershed. North Abbey Creek Forest is the only North Tualatin Mountains site that is in the Tualatin River watershed. The site includes the headwaters of North Abbey Creek. Its forest is older and more diverse, with big leaf maple, Douglas fir and a diverse understory. Large open areas offer elk habitat, opportunities for early successional pollinator habitat, and a unique bird watching experience. The site offers a potential opportunity for a future regional trail connection to the Waterhouse Trail (to the south).

## HABITAT

Native shrub dominated restoration areas provide pollinator habitat, and food and cover for neotropical migrant songbirds. Riparian forests protect water quality and provide important habitat near the headwaters of North Abbey Creek, a tributary of the Tualatin River. Tributary creeks and confluence areas provide clean and cold water, nutrients and refuge areas for many important local species.



## TRAIL EXPERIENCE

North Abbey Creek offers an opportunity for a narrow trail to meander through pollinator habitat, descend into the forest, and follow an old logging road grade above North Abbey Creek. Stop here to listen for varied thrush or black headed grosbeak. Look for some of your favorite understory plants, waterleaf, trillium or fringe cup. How many different ferns can you find? This trail opportunity offers the potential for a future connection to the Waterhouse Trail in Washington County.



## VIEWPOINTS

The open areas offer views out across the west hills looking east and south. Views include pastoral landscapes and nearby hills.



## ENTRANCE/DAY USE AREA

The south access offers opportunities to support education and volunteer programs. A small day use area at the north end of the site could provide a unique bird watching experience or an opportunity to walk along a short trail through the woods.



## EDUCATION OPPORTUNITIES

Local schools' field trips can focus on birds, pollinators, frogs, stream ecology, or wildlife tracking. Metro's recent educational partnerships with Self Enhancement Inc, an organization supporting at-risk urban youth, and Trackers Earth, which promotes outdoor leadership and nature education for all ages, have focused on North Abbey Creek.





# NORTH TUALATIN MOUNTAINS NORTH ABBEY CREEK

Trail at  
Edge of Site

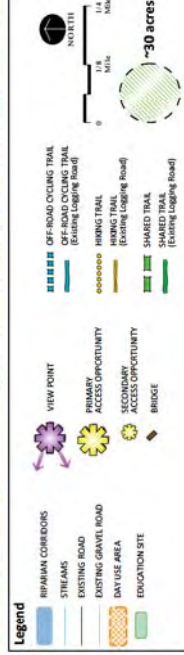
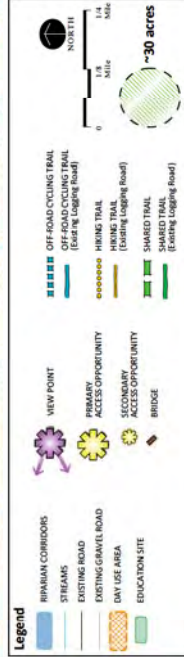
Day use area highlights  
pollinator habitat and unique  
bird watching opportunities.  
Trail hugs western edge of  
property to leave large intact  
habitat patch.

Mileage:  
Hiking: 1.8 miles  
TOTAL: 1.8 miles

Trail follows  
Road Grade

Day use area highlights  
pollinator habitat and unique  
bird watching opportunities.  
Trail follows decommissioned  
road grade through forest.

Mileage:  
Hiking: 1.4 miles  
TOTAL: 1.4 miles





# NORTH TUALATIN MOUNTAINS DAY USE AREA

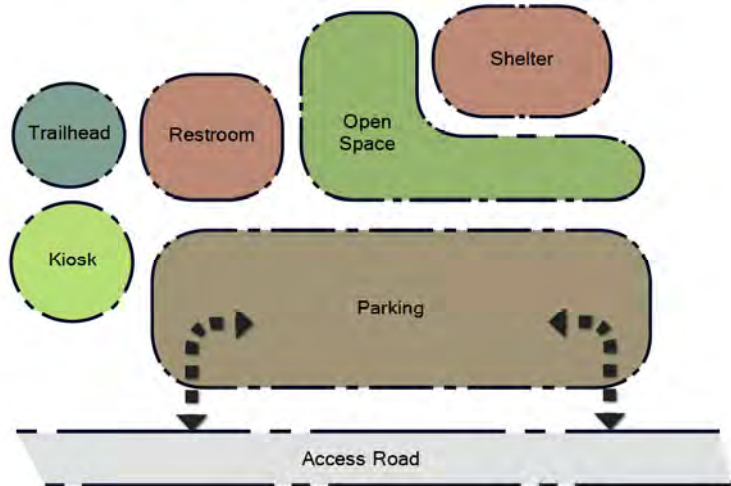
## Shelters



## Trailheads



## Schematic



## Parking Lots



## Restrooms



## Birding Features





# NORTH TUALATIN MOUNTAINS FACILITIES

## Bridges



## Overlooks



## Boardwalks



## Resting Places





# NORTH TUALATIN MOUNTAINS FACILITIES

## Trails



## Trail Types

### Shared



Designed to minimize user conflicts

- Long sight lines ensure both hikers and off-road cyclists are aware of each other.
- Trail design can slow cyclists down often with choke points, obstacles and turns
- Wide spots allow passing

### Hiking



Designed to maximize hiking experience

- Offer more direct connection to viewpoints and other destinations
- Opportunities for nature trails and interpretation
- Grades can be steeper for hikers

### Off-Road Cycling



Optimized for off-road cycling

- Many curves and turns
- Varied topography with alternating ascent and descent
- Offer a variety of challenge levels
- Trails will be family friendly





## Metro | Meeting minutes

Meeting: North Tualatin Mountains Comprehensive Plan  
Date/time: November 16<sup>th</sup> and 17<sup>th</sup>, 2015 5:30-7:30  
Place: Skyline Grange Hall  
Purpose: Second public engagement event, review phase 2 of Comprehensive Planning

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Approximately 200 attendees attended two back-to-back community events and shared the comments below. Another 29 people filled out an online comment form.

- Increased traffic
- Mt. biking trails fragmenting habitat
- Too many trails, maintain/protect wildlife connectivity
- Too much recreation, not enough wildlife protection
- Already enough trails
- Would like a safe place to ride horses close to the city, other than Tryon Creek State Park
- Parking for horse trailer
- Have someone from equestrian community be a part of the stakeholder advisory committee in the future
- Horse trails and parking in the developed areas of the plans
- Bike trails are too close to the ancient forest in the Burlington Creek area, bikers may not follow rules
- Respect and understand the wisdom of residents
- Nature over recreation
- Mountain bikers have a commercial interests (from a neighbor)
- Good job of informing neighbors of public meetings
- Recreation with the smallest impact possible
- Mountain bikes are not compatible with wildlife, equestrians and hikers are more so
- Portland area is severely lacking in off road cycling access
- Cyclists are villainized by other nature enthusiasts. Mountain bikers are experienced stewards of open spaces. We all want the similar ends.
- I voted to protect wildlife and land, not to turn into parks for the city
- These plans do not live up to the bond measure. Wildlife first.
- Ensure wildlife is not impacted through preservation
- Limit trail development
- Hikers only
- Show trail plans sooner
- Providing off road cycling trails near the city would reduce hundreds of long distance car trips every week.
- Trail separation would be better for mountain bikers and hikers
- Would like to see more miles of bike only trails – off road cyclists will continue to drive long distances to “real trail networks”



- Mountain bike users are trail builders, nature lovers, athletes and responsible people who just want to experience our natural resources just like any other users.
- Less trail intersections and longer sections of trail would make them more user friendly
- A 15 mile loop with three entry points, but none of those should be within this zone.
- Off-road cyclists care about the environment they ride in.
- People need to experience nature to appreciate it.
- Forest Park has enough trails and there are new trails in Vernonia. Mountain bikers should earn their right to go back to Forest Park and use the trail already in place.
- How will these trails be treated differently than the mis-used trails at Forest Park?
- I want legal single track mountain bike trails.
- Parking access areas look too small in volume of parking
- Excited to play outside as a family in our neighborhood
- I want to walk and bicycle in the North Tualatin Mountains.
- How does this plan connect to the regional trail system?
- Bikers and hikers conflict with elk calving
- Consider the maintenance of roads proposed to be used for access to trails.
- Could improve the process by having planning meetings in Portland
- Listen to science, not just NIMBY
- Maximize “bad” land by roads/rail to increase trail mileage
- Clear signage and maps along the entries and trails so users know which type of activity is allowed.
- Interpretive signage will help encourage people to protect what’s there.
- These metro properties provide a clean slate for sustainable trail design and evaluation for impact on nature without historic political baggage.
- Allow NMTA to build the trails so they will be built with a strong knowledge of sustainability and trail erosion protection
- Make meetings closer Portland
- Boot brush station at trail heads
- Create a bike trail park north of Cornelius Pass Rd.
- Conservation Bond is being used to build a parking lot
- Add more “challenge” to the type of mountain bike trails
- Create a forum for online comments to engage people that cannot attend meetings
- All metro residents to be able to experience mountain biking since we all pay taxes
- A legal trail would be nice
- How does having horses maintain water quality? What about waste?
- Create more multiuse trails
- Seasonal closures of impending trails would satisfy wildlife needs and demands of trail use
- Avid riders would love to lead a group of skeptical folks to show that mountain biking can be safe, fun and friendly to all ages
- Consider “one way” trails to avoid conflicts
- Trails will bring unwanted traffic and upset neighbors
- Traffic will be hazardous to existing roads and dangerous for bikers
- Creating trails closer to Portland creates access to nature for low income families who cannot afford to drive all the way to Bend for recreation



- Concern that metro is not fulfilling it's obligation under measure no. 26-80 to protect wildlife. Some of the public land is being put to harm wildlife.
- Volunteers for trail work would be easy to find
- The trails proposed would be too short to support a good mountain biking experience.
- Creation of Mountain bike trails would exclude hikers based on safety issues & uses taxpayer dollars to appease special interest group.
- Designs at current trailheads. Use QR codes
- Conservation and mountain biking can co exist. They are not mutually exclusive
- Just as Bybee, Smith and Oxbow have educational opportunities, so should this project. Connecting students with native habitat/ restoration is ideal
- Metro has done a great job listening to the community
- What funds will be used to maintain, repair and patrol the trails in years to come?
- Secondary service provides fire, medical, police and road maintenance- RR trestle improvement. How will these be addressed?
- Staggered rollout (focus on one area first) is good
- This is a limited scope and does not satisfy the needs of the cycling community by limiting to two sites then limiting those sites leaves everyone unsatisfied.
- Both times, upon arrival it wasn't clear what I was looking at. The organizers are helpful in explaining but I find it not intuitive.
- Make meeting times user friendly. NOT in the middle of the week
- How does metro acquire land anyway?
- Have meetings closer to downtown
- Horses destroy trails, like in the Wallows
- Protection of natural areas does not include mountain bike trails or horses
- Like the idea of proposed closures during key periods for wildlife
- Consult specialists, professionals and biologists on the impact before any planning
- There was mention of "stakeholders." – seems we all are
- Metro's policy of "no dogs" in natural areas is great
- Trimet access to the trailhead
- Bike paths to trails with smaller parking lots and secure bike storage at hiking trail heads would be great
- High fees for car parking
- Dog friendly hiking areas would be ideal
- A wildlife corridor must be established to link forest park with the coastal mountain range to preserve the diverse gene pool of wildlife
- I am confused by the limit metro has placed on developing of access to their public spaces
- The proposed plan does not provide meaningful ways to experience nature
- Do not show trails in areas and then remove them
- Think bigger! We need a comprehensive trail network & greater access to nature & transportation options that don't involve cars
- Plan a dirt trail to the coast
- Plan carefully because once activity is institutionalized, it's impossible to change it back



- Provide published scientific papers on the website in advance of the meetings so the audience can be educated about the basic ecological, social, geographic tenets by which the system will be designed
- Monitor which trails are being used by horses to study impact
- Be sure to design trails to follow hillside contours and for bike trails, slight vertical alignment changes to encourage water runoff & naturally slow bikes
- This has been a great public involvement process. I look forward to helping build and maintain these trails
- Human access and development should be limited to existing logging roads
- Metro did a bait and switch and is not honoring the 2006 bond that we all voted for-No new trails
- Entrance to corridor is 12 feet from my front door. I don't want activity at my front door
- The lands were better off privately owned. They existed better in nature that way
- There are already too many trails at Burlington Creek
- McCarthy Creek Trails will disturb elk calving areas
- We do not want the North Tualatin Mountains turned into an adventure park
- Metro should do a scientific study on the elk and other wildlife prior to planning recreation areas
- Mountain bikes and wildlife are not compatible
- This plan creates fragmentation
- This land will provide vital recreational access to a growing community

Displays included the following boards

- Project Overview
- History
- Habitat Types
- Conservation
- Restoration Work
- What we've heard
- Conservation Principles
- Design Strategies
- Recommended Alternative
- Burlington Creek
- Burlington Entry
- McCarthy Creek
- McCarthy Entry
- Trail Design
- Next Steps



# NORTH TUALATIN MOUNTAINS PROJECT OVERVIEW

## Values

The North Tualatin Mountains Natural Area preserves valuable habitat, streams and biodiversity corridors between Forest Park and the Coast Range.

Access to nature supports healthy, active outdoor lifestyles and people depend on nature for peace, quiet and renewal. The North Tualatin Mountains are an opportunity for all to share in these benefits.

It is possible to protect these resources while giving people opportunities to connect with nature. Metro intends to develop access to these sites in a way that ensures healthy habitats and a meaningful experiences of nature.

## North Tualatin Mountains

Four properties which total approximately 1300 acres

This land was historically used for timber and agriculture. It is primarily forested with young even-aged stands of Douglas fir with some open areas.

Thanks to voters, the sites were acquired as part of Forest Park and Rock Creek target areas, with goals of protecting wildlife habitat and connectivity; water quality; and opportunities to access to nature.

## The project

The 2013 levy identified sites in the North Tualatin Mountains as opportunities to provide access to nature.

The purpose of this master plan is to identify where the best places are in these four sites are to provide amenities such as parking, restrooms and trails.

Coast Range  
Mountains

Columbia County

Washington County  
Multnomah County

10 miles

5 miles

Sauvie  
Island

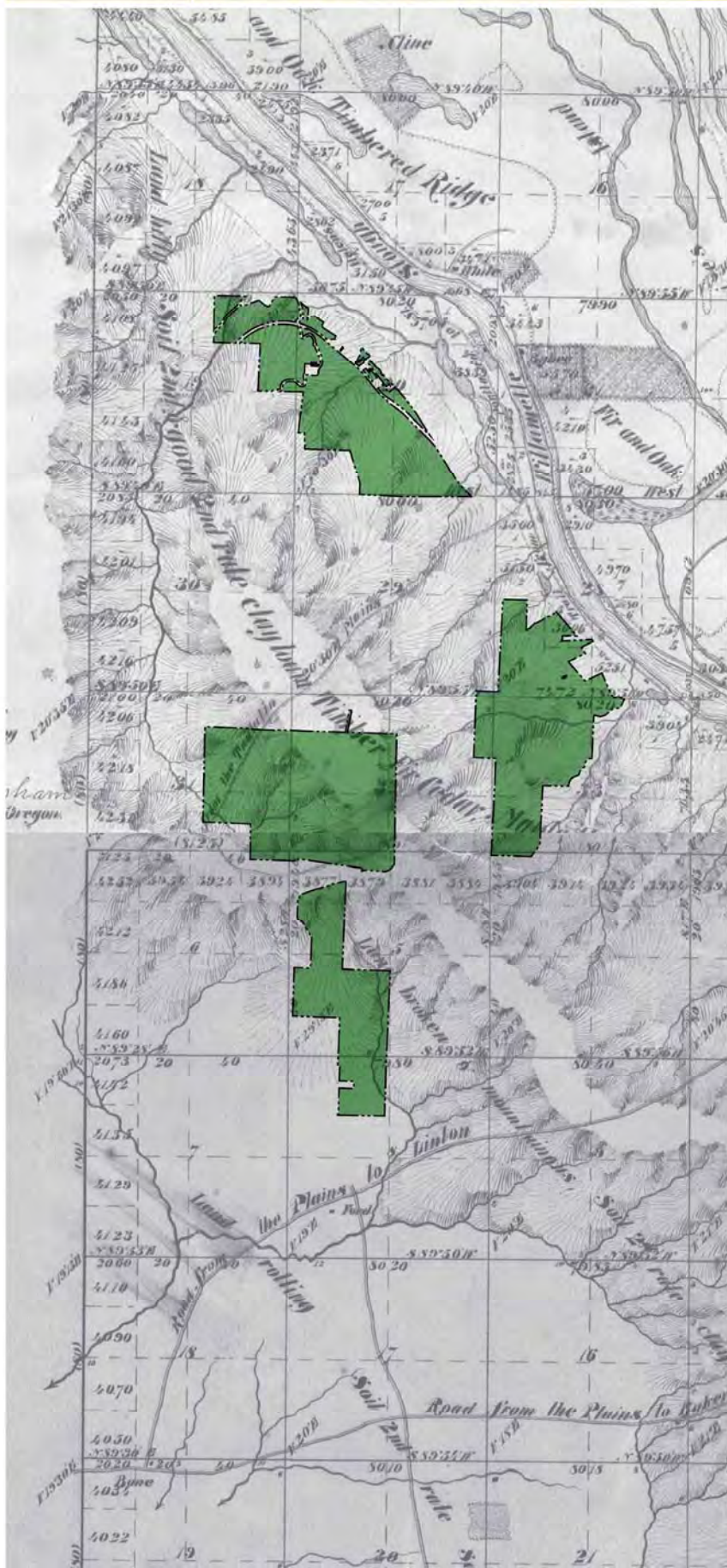
Forest  
Park

Tualatin  
Valley

Multnomah County  
Clackamas County



# NORTH TUALATIN MOUNTAINS HISTORY



Before European settlement, Atfalati (also called Tualatin) tribe of the Kalapuya inhabited villages on the Tualatin Plains and the hills around Forest Grove

1883 Newberry Road established as county road.

late 1800 - 1900's The trees that originally covered Skyline hills were felled, then sent on a flume from the ridge along the route of Cornelius Pass and then OVER Highway 30 to one of the seven sawmills in Linnton.

1900's A small railroad spur led to what was likely a water powered mill on the north side of McCarthy Creek on the western edge of the site.

The school trail ran down one hill to McCarthy Creek (now spelled and called "McCarthy") and up the next hill to the school. In the creek bottom were the remnants of the old Kaiels Sawmill (From The School on the Hill from the Twenties by Margaret Pauly Tate).

1909 Ruth Trust company files plat for the town of Burlington.

~1911 United Railway Company constructs rail line between Portland and Wilkesboro and provides electric passenger service between Burlington and Linton.

1915 When Ella Thomas was 2, her parents Reinhold and Rosalie Bieberdorf bought property and established a dairy on Newberry Road. (now Wealth Underground CSA) They tended about 40 cows as well as pear, walnut, plum, cherry, filbert and apple trees. Goats helped clear the land.

1920's There were about 45 students in Brooks School and everyone walked to school. Ramona Huserik recalls the Pauly kids walking to school across the canyon from Pauly Road off McNamee.

1936 Mallory George Lewis (Jim) Brooks purchase (original one room schoolhouse. It was moved to its current location where it became Brooks residence.

1941 BPA Built St John's-St Helens no1 transmission line.

1950 Ella moves back to family farm with husband Delbert Thomas and operate the Thomas Dairy from the 1940s to 1969.

1939 New Skyline School built.

1940 Skyline Grange established

1948 Forest Park formally dedicated by the City of Portland.

1950 A Ferry operated between Holbrook and Sauvie Island (at current day Cornelius Pass Road) until 1950 when the Sauvie Island bridge was built.

1974 Grange hall fire

local stories from Skyline Ridge Neighbors website  
<http://www.srnpx.org/history-skyline-ridge>



# NORTH TUALATIN MOUNTAINS HABITAT TYPES

## Riparian Forest

Riparian forests protect water quality and provide important habitat near the headwaters of Burlington, Ennis, and McCarthy Creeks, which flow into the Multnomah Channel, and North Abbey Creek, a tributary of the Tualatin River

Tributary creeks and confluence areas provide clean and cold water, nutrients and refuge areas for important fish species.



## Upland Forest

Upland forest is composed primarily of native trees and shrubs such as Douglas fir, big-leaf maple, Oregon grape, salal and sword fern.

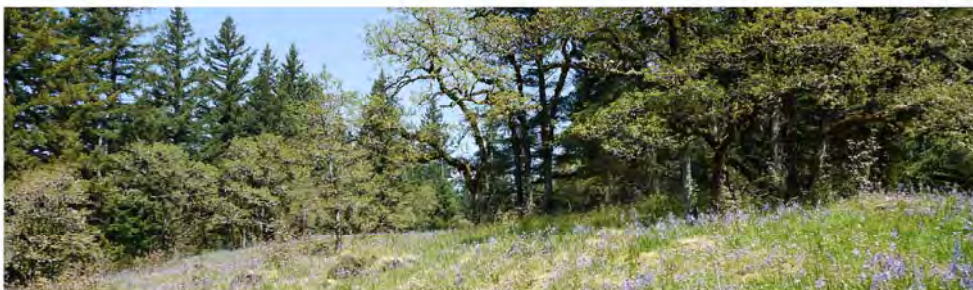
Especially important to migrating and nesting songbirds, woodpeckers, mammals such as Douglas squirrel and deer, and seasonal habitat for salamanders, frogs and turtles.

Urbanization has fragmented and reduced the amount of upland forest habitat.

## Upland Early Successional Shrub

Shrub dominated communities provide food and cover for neotropical migrant songbirds and create habitat for a variety of pollinator species.

Small scale agricultural sites, recently logged areas, and utility clearings are opportunities to manage for early successional upland forest shrubs.



## Oak Savanna

Oak savanna harbors many unique plant and animal species. Once common, it is now rare in our region.

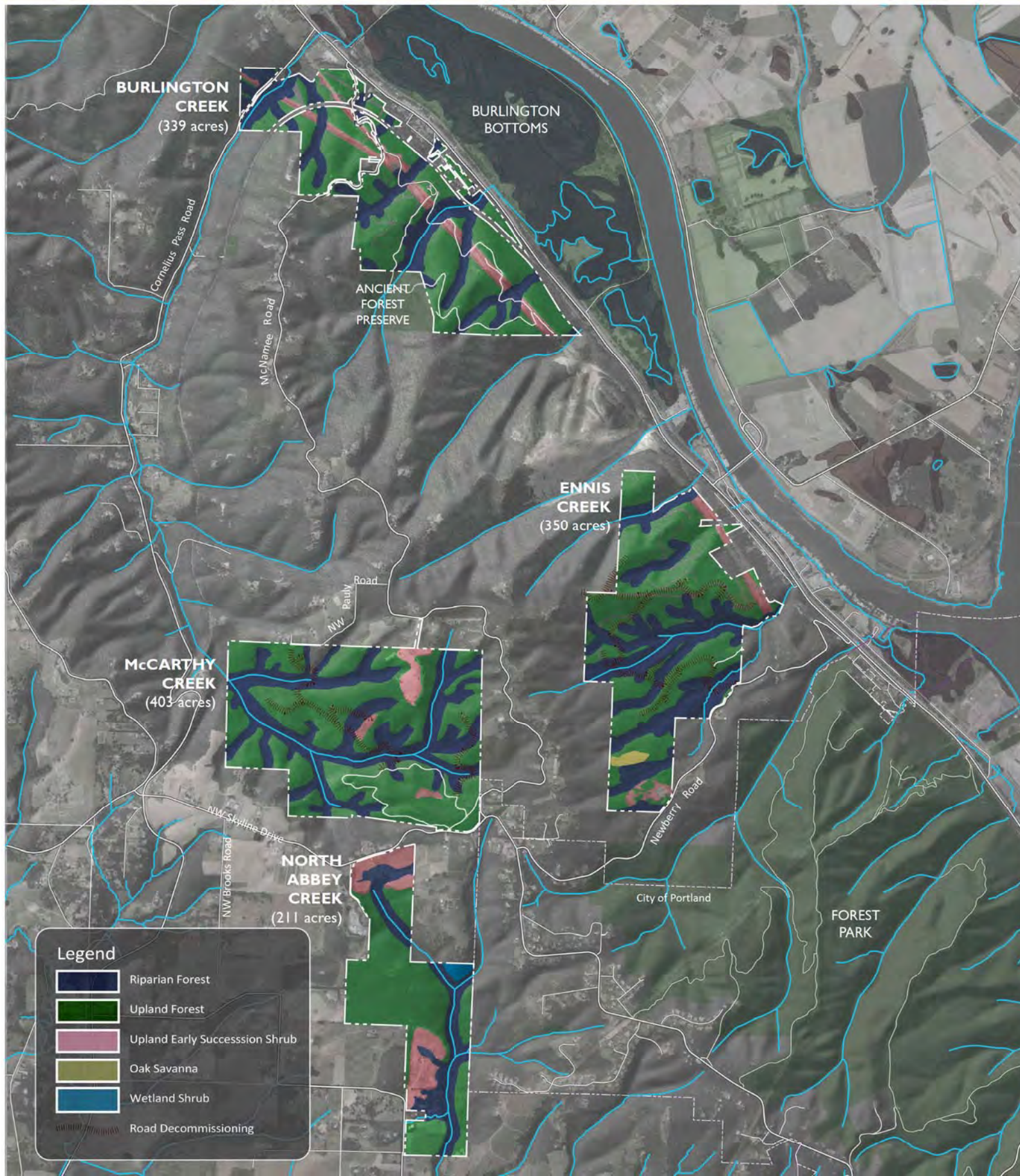
## Shrub Wetland

Shrub wetlands are important to many at-risk species and provide invertebrate food for songbirds and other animals.





# NORTH TUALATIN MOUNTAINS CONSERVATION





# NORTH TUALATIN MOUNTAINS RESTORATION WORK

## Forest Thinning



The North Tualatin Mountains natural areas have hundreds of acres of former commercial tree farms dominated by young stands of Douglas fir. Reducing the number of conifers per acre helps keep trees healthy and preserves hardwoods and native shrubs. Large diameter trees are lacking in the North Tualatin Mountains natural areas and are valuable for wildlife and water quality. Thinning accelerates tree growth and makes forests more resilient to disease and wildfire. Many of the trees removed during thinning stay on site and provide habitat as down wood.

*Thinning has begun at North Abbey and McCarthy Creek. Forests. Burlington and Ennis will be thinned over the next year.*

## Create Snags and Down Dead Wood

Standing dead trees (snags) and down wood have been removed by previous property owners through clearcut harvesting or other land uses. Adding them back into the forests by topping trees and dropping and leaving logs on the ground provides wildlife habitat and nutrient storage.

*At Burlington, Ennis, McCarthy and North Abbey, Metro is developing key wildlife habitat like snags and down dead wood.*



## Native Plantings



Hardwoods and shrubs provide valuable food and shelter for many bird species but are often shaded out by fast growing conifers in young forests. Planting after thinning will help jump start the establishment of native shrubs and the creation of a diverse understory.

*At all four sites, forest thinning will help to retain hardwood trees, create "breathing room" for native shrubs to grow, provide more diverse habitat, and make forests more resilient to disease and wildfire..*



## Stream Restoration



Large conifers and down wood have been removed from many of the North Tualatin riparian areas, resulting in incised (eroded) stream channels and slumping stream banks. Growing big conifers quickly and adding large wood into streams helps improve stream conditions and water quality.

*Metro is actively working on stream restoration at North Abbey Creek. We recently placed 16 downed wood logjams along the creek to help curb stream erosion.*

## Decommission Roads and Remove / Replace Culverts



*Metro will decommissioning unneeded roads and remove or replace undersized and failing culverts.*

Old logging roads are a significant source of sediment in streams, which harms water quality and degrades fish habitat. Regrading and revegetating old roads reduce the risk of soil erosion and sediment in streams.

Many culverts in the North Tualatin Mountains natural areas are old and under-sized, blocking wildlife movement and increasing the risk of failure and the amount of sediment into streams, resulting in decreased water quality. Removing or replacing culverts improves water quality and provides better wildlife connectivity.



# NORTH TUALATIN MOUNTAINS WHAT WE'VE HEARD

Through three public open houses,  
online and mail-in questionnaires, and  
phone calls, letters, and meetings,

we have heard...



## Protect open space

- You value that there are large areas of protected open space so close to the city
- Balance conservation with recreation, accommodate ecological function and human use
- Protect wildlife habitat and water quality
- Protect elk habitat

## Access to nature close to home

- Opportunities to access close-in "wilderness"
- Ride to ride opportunities

## Protect wildlife and water quality

- You value elk, red-legged frogs, and other wildlife in the North Tualatin Mountains
- Concern that activities will impact wildlife habitat
- We should be thoughtful about where and how much access we provide
- Please use best practices to build trails that don't impact water quality
- Avoid wetlands and frog habitat



## Type and amount of access is important

- We've heard concern that activities will impact wildlife habitat
- Consider carrying capacities
- We have heard from some that only very limited access should be provided to the sites
- We've heard from some who don't think off-road cycling is appropriate here

## Excitement for opportunities to be in nature

- Without having to drive too far outside of the city
- Desire to experience the sites by hiking, off-road cycling, or horseback riding
- Desire to be in nature
- Interest in wildlife viewing, scenic viewing, and opportunities to learn about nature, and volunteer



## Trail design

- Preference for trails that are separate for different types of uses, or a mix of shared and separated trails.
- We heard that Loop trails are preferred to out and back trails
- Use existing road networks for access, where possible
- Use best practices in trail design like cross-slope and rolling grades to move water off the trail

## Trail management

- We have heard concern about conflicts between different trail uses, and that trails need to be designed specifically for their specific uses

## Other amenities

- Provide designated parking areas
- Garbage cans and restrooms



# NORTH TUALATIN MOUNTAINS CONSERVATION PRINCIPLES



*At a regional scale, the sites that Metro manages have been identified as either opportunities for nature parks, natural areas or nature preserves, depending on the sensitivity of the sites. The most fragile habitats preclude all but the lightest use by people.*

*North Tualatin Mountains have been identified as an opportunity for access. While the sites contribute greatly to conservation at a regional scale, the area's contribution to regional conservation is not necessarily compromised by access via hiking or off-road cycling.*

*The master planning process, which identifies access locations and broad trail corridors, relies on species habitat needs, landscape ecology principles, the expertise and experience of local wildlife biologists and landscape scale design strategies to determine where the most appropriate opportunities are for public access and connection to nature.*

## Maintain regional connectivity

- Acquire lands to connect regional significant focal areas and connect our region to surrounding public lands
- Restore habitat to improve natural area value to wildlife and water quality

*North Tualatin Mountains acquisitions increase connectivity between Forest Park and the Coast Range. Restoration at all four North Tualatin Mountains sites is improving wildlife habitat and water quality.*

## Protect large areas of habitat

- Protect large blocks of forest
- Maximize unfragmented core habitat areas of 30 acres or greater
- Maintain some sites in a low or no use state

*The recommended alternative identifies Ennis Creek and North Abbey Creek Forests for protection as large blocks of core habitat. The western half of McCarthy Creek Forest is also identified as core habitat.*

*The plan maximizes protection of undisturbed habitat areas of 30 acres or greater and regional habitat connectivity.*

## Protect wetlands and streams

- Minimize stream crossings, and when necessary cross streams at a perpendicular angle and use bridges instead of culverts where possible.
- Avoid trails running adjacent to and parallel to streams

*The recommended alternative uses existing stream crossings when possible, avoids stream corridors.*

## Reduce fragmentation

- Decommission roads that are not needed for maintenance
- Locate access in areas that have existing use and in places that are fragmented by existing roads or trails
- Use old road networks for trails when possible

*The recommended alternative identifies 3.5 miles of old road in McCarthy Creek and Ennis Creek Forests to be decommissioned. The recommended alternative focuses most access in Burlington Creek Forest, which is the site that is currently most heavily used.*

## Manage for habitat protection

- Minimize presence of dogs
- Restrict access at times when wildlife is more sensitive to human disturbance such as during breeding (nesting, elk calving, amphibian migration)
- Rely on local subject area experts for guidance on important species, including elk, amphibians and birds

*Metro employs several staff biologists, has worked with local wildlife experts and enforces a no-dogs policy.*

## Improve habitat via restoration

- Restoration activities such as thinning, road decommissioning creating standing and down dead wood, and planting natives improve conditions for wildlife and create a forest that is more resilient to disease and wildfire

*Metro is actively restoring forests and stream, habitat on all four sites. (see restoration boards for details)*





# NORTH TUALATIN MOUNTAINS DESIGN STRATEGIES



*In the design and engineering phase, we will refine trail locations and design. During this process, we look more closely to make sure specific trail routes avoid sensitive areas, and use best practices in trail design to build trails that are durable, and do not cause erosion.*

## Habitat protection

- Locate new trails where habitat is already fragmented
- Avoid habitat for sensitive and listed species; provide appropriate setbacks from streams, corridors and sensitive areas
- Use bridges and boardwalks, instead of culverts, where appropriate
- Avoid constructing new trails in areas of high natural resource value

## Water quality

- Decommission roads that are failing
- Minimize stream crossings where other routes are possible
- Align trails parallel rather than perpendicular to contours
- Maintain appropriate setbacks from wetlands and seasonally wet areas
- Be aware of seasonal moisture at toes of slope, north slopes and intermittent drainages
- Use best management practices such as cross-slope, rolling grades, and drainage dips to move water off trail and avoid erosion

## Meaningful experience of nature

- Provide welcoming entries and clear way-finding signs
- Provide a variety of trail experience (various width, length, loops, challenge level) and trails designed appropriately for anticipated use to encourage proper trail use
- Provide access to viewpoints, and appropriate routes to key features
- Provide information about accessibility and challenge level
- Provide opportunities to learn about local habitat, site history, restoration and regional context
- Increase visitors' awareness of natural resources on site
- Provide opportunities for discovery

## Safety, management & durability

- Involve visitors in maintenance and site stewardship to promote a more intimate awareness of habitat and water quality
- Promote stewardship through volunteer trail patrol
- Develop partnerships with volunteer organizations
- Simple and clear way-finding signs, use durable vandal resistant materials
- Design trails that are safe and challenging
- Safety and security measures include gated entries to control access at night, daily ranger patrols, and employment of security patrols as needed





# NORTH TUALATIN MOUNTAINS RECOMMENDED ALTERNATIVE

## Key Elements

**Preserve the Ennis Creek and North Abbey Creek sites** as relatively undisturbed core habitat areas, with no planned improvements, other than a provision for the future Pacific Greenway Trail through Ennis Creek Forest.

**Focus access at Burlington Creek Forest (Phase 1)** which has the most existing use, and smaller patches of existing core habitat.

**Provide access on east side of McCarthy Creek Forest (Phase 2)**, while preserving the more intact habitat on western part of the site. This takes advantage of McCarthy's best views while preserving core habitat, and provides opportunities to see McCarthy Creek from multiple vantage points.

**Maximize protection of undisturbed habitat** areas of 30 acres or greater and regional habitat connectivity.

**Provide opportunities to experience a variety of settings** and views at Burlington Creek and McCarthy Creek Forests.

**Provide a variety of trail experiences at two sites.**

**BURLINGTON  
CREEK  
FOREST**  
(339 acres)  
(Phase 1)

BURLINGTON  
BOTTOMS

ANCIENT  
FOREST  
PRESERVE

**ENNIS  
CREEK  
FOREST**  
(350 acres)

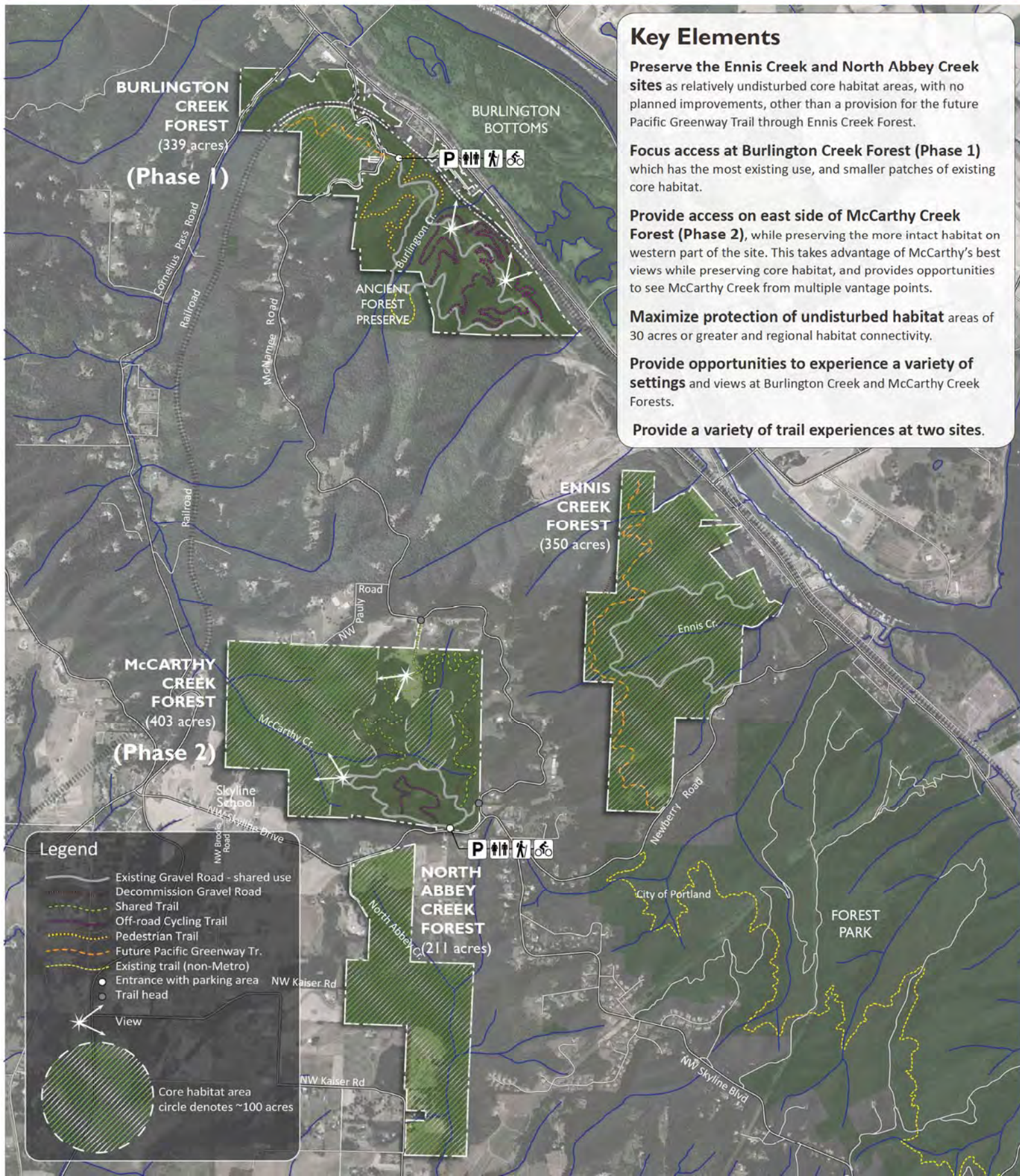
**MCCARTHY  
CREEK  
FOREST**  
(403 acres)  
(Phase 2)

**NORTH  
ABBEY  
CREEK  
FOREST**  
(211 acres)

FOREST  
PARK

## Legend

- Existing Gravel Road - shared use
- Decommission Gravel Road
- Shared Trail
- Off-road Cycling Trail
- Pedestrian Trail
- Future Pacific Greenway Tr.
- Existing trail (non-Metro)
- Entrance with parking area
- Trail head
- View
- Core habitat area  
circle denotes ~100 acres

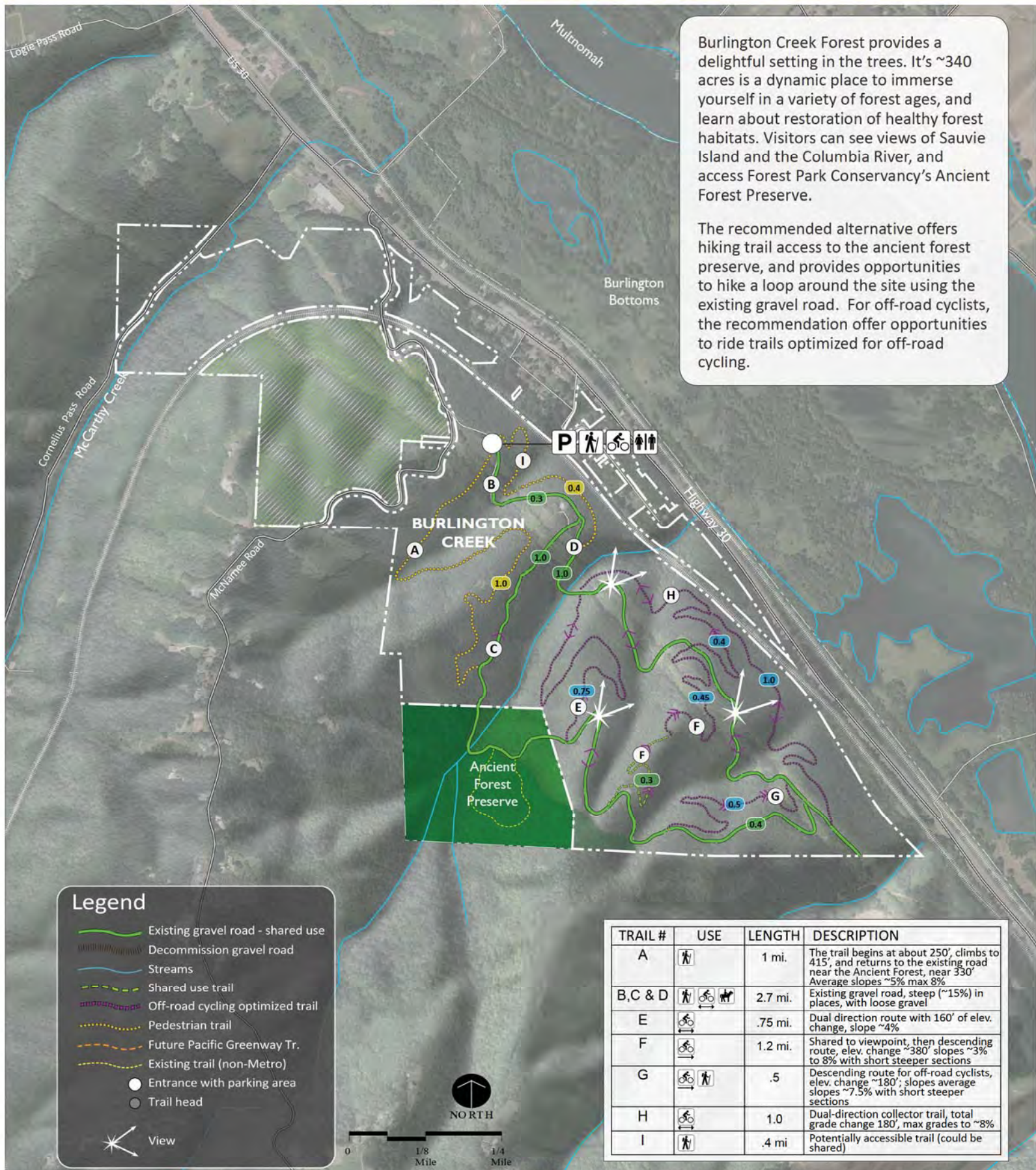




# NORTH TUALATIN MOUNTAINS BURLINGTON CREEK

Burlington Creek Forest provides a delightful setting in the trees. It's ~340 acres is a dynamic place to immerse yourself in a variety of forest ages, and learn about restoration of healthy forest habitats. Visitors can see views of Sauvie Island and the Columbia River, and access Forest Park Conservancy's Ancient Forest Preserve.

The recommended alternative offers hiking trail access to the ancient forest preserve, and provides opportunities to hike a loop around the site using the existing gravel road. For off-road cyclists, the recommendation offer opportunities to ride trails optimized for off-road cycling.



## Legend

- Existing gravel road - shared use
- Decommission gravel road
- Streams
- - - Shared use trail
- - - Off-road cycling optimized trail
- - - Pedestrian trail
- - - Future Pacific Greenway Tr.
- - - Existing trail (non-Metro)
- Entrance with parking area
- Trail head



View



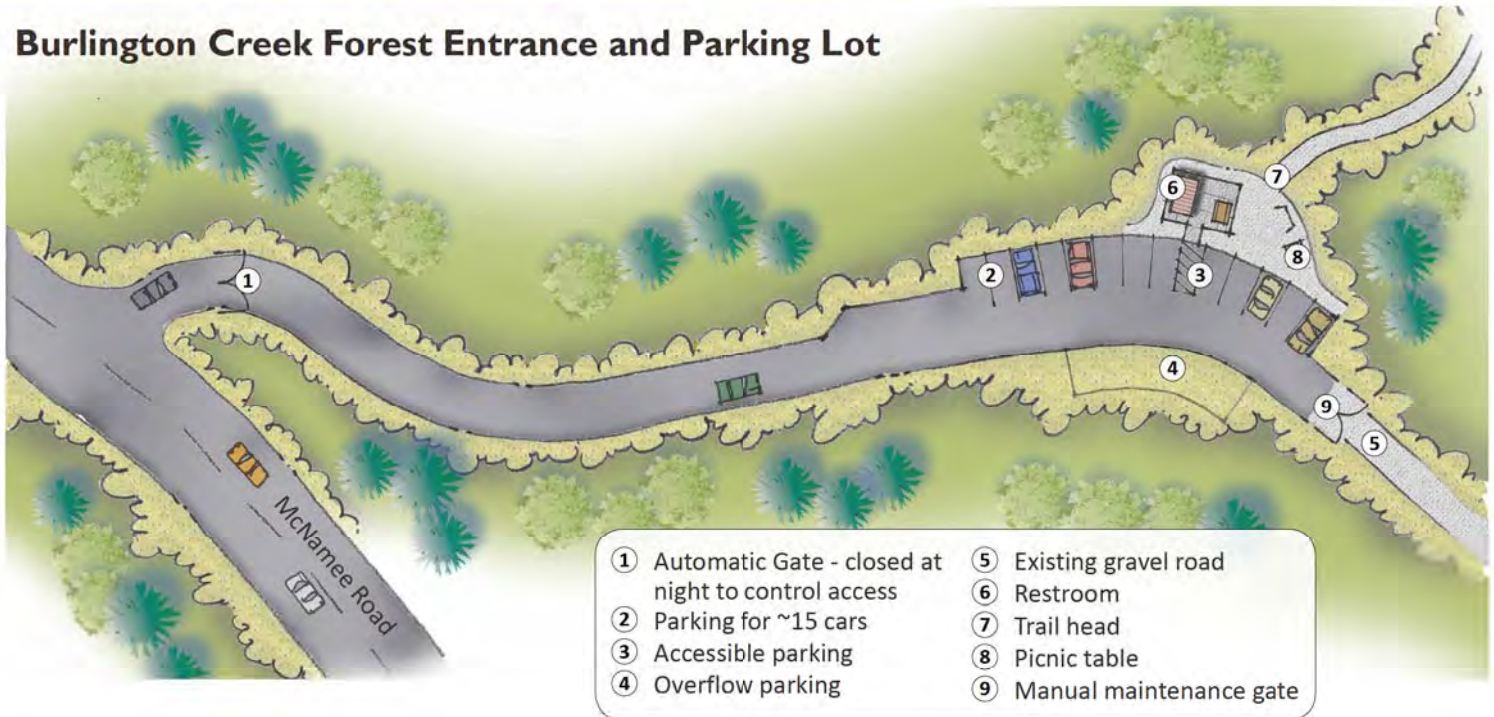
0 1/8 Mile 1/4 Mile

| TRAIL #  | USE | LENGTH  | DESCRIPTION  |
|----------|-----|---------|--|
| A        |     | 1 mi.   | The trail begins at about 250', climbs to 415', and returns to the existing road near the Ancient Forest, near 330'. Average slopes ~5% max 8% |
| B, C & D |     | 2.7 mi. | Existing gravel road, steep (~15%) in places, with loose gravel  |
| E        |     | .75 mi. | Dual direction route with 160' of elev. change, slope ~4%  |
| F        |     | 1.2 mi. | Shared to viewpoint, then descending route, elev. change ~380' slopes ~3% to 8% with short steeper sections                                    |
| G        |     | .5      | Descending route for off-road cyclists, elev. change ~180'; slopes average slopes ~7.5% with short steeper sections                            |
| H        |     | 1.0     | Dual-direction collector trail, total grade change 180', max grades to ~8%   |
| I        |     | .4 mi   | Potentially accessible trail (could be shared)   |



# NORTH TUALATIN MOUNTAINS BURLINGTON ENTRY

## Burlington Creek Forest Entrance and Parking Lot



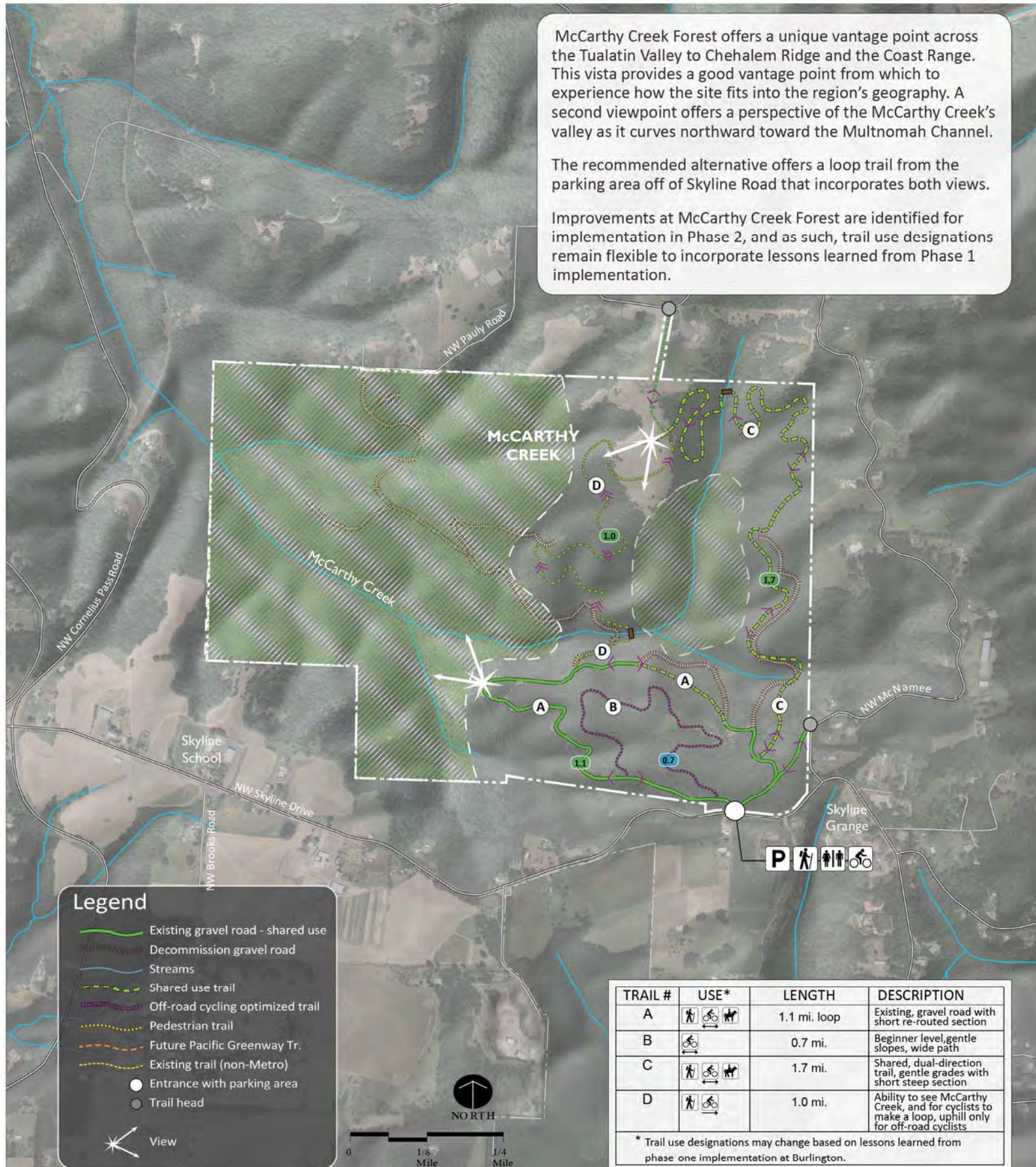


# NORTH TUALATIN MOUNTAINS McCARTHY CREEK

McCarthy Creek Forest offers a unique vantage point across the Tualatin Valley to Chehalem Ridge and the Coast Range. This vista provides a good vantage point from which to experience how the site fits into the region's geography. A second viewpoint offers a perspective of the McCarthy Creek's valley as it curves northward toward the Multnomah Channel.

The recommended alternative offers a loop trail from the parking area off of Skyline Road that incorporates both views.

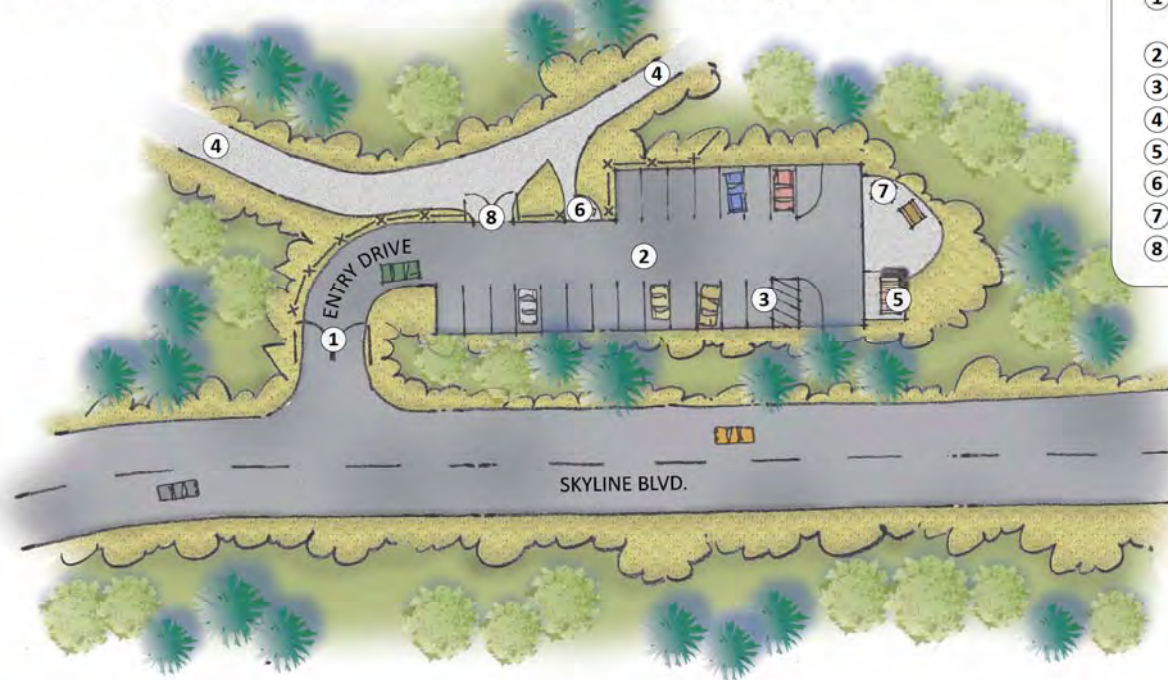
Improvements at McCarthy Creek Forest are identified for implementation in Phase 2, and as such, trail use designations remain flexible to incorporate lessons learned from Phase 1 implementation.





# NORTH TUALATIN MOUNTAINS McCARTHY ENTRY

## McCarthy Creek Forest Entrance and Parking Lot



- ① Automatic Gate - closed at night to control access
- ② Parking for ~15-20 cars
- ③ Accessible parking
- ④ Existing gravel road
- ⑤ Restroom
- ⑥ Trail head
- ⑦ Picnic table
- ⑧ Manual maintenance gate

**Trailhead**



**Viewpoints**



**Picnic Area**



**Parking Lot**





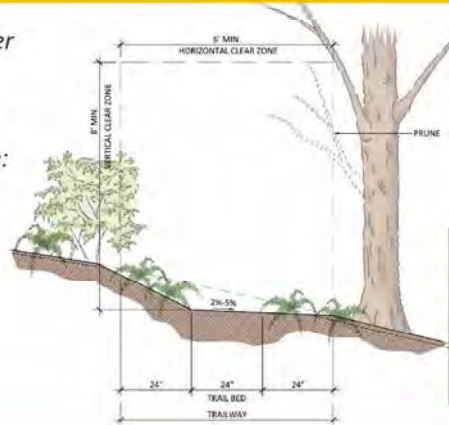
# NORTH TUALATIN MOUNTAINS TRAIL DESIGN

## Hiking trails



The trails at Burlington and McCarthy Creek forests will meander up and down steep forested topography. Hiking experience will generally be of moderate to high challenge level. Over the years, hikers can see younger forests take on characteristics of mature forests. Design strategies specific to hiking trails include:

- Provide resting points and passing opportunities
- Identify opportunities for loop trails where possible, or trail segments that access a destination, like views or the Ancient Forest
- Locate trails so that the visitors see views, vegetation, and wildlife, rather than one another



Width: 18"-30"

Surface: Soil

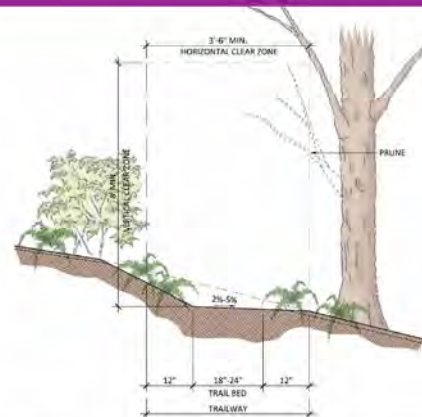
Trail grade (moderate challenge): to 8% (short segments may be steeper); (high challenge): to 15% (short segments steeper than 15%)

## Off-road cycling trails



Burlington and McCarthy Creek Forests offer opportunities to ride trails optimized for off-road cycling. Trails will be designed to provide a variety of challenge levels, and opportunities to create loops. The following design strategies help make a fun and safe experience for all.

- Control speed through trail design
- Avoid long sustained grades, stacking switchbacks and incorporate climbing turns
- Limit overall average longitudinal slope of each trail segment to 10%
- Use curves to create interest, manage runoff, control speed, and have fun
- Provide clear visibility and long sight distances at curves and intersections
- Provide resting points and passing opportunities



## Beginner



Width: 18" (one way singletrack) to 4' (add width & super-elevation at curves as needed)

Surface: varies, typically mineral soils firm and stable

Trail grade: Avg. 5% or less with short sections up to 15%

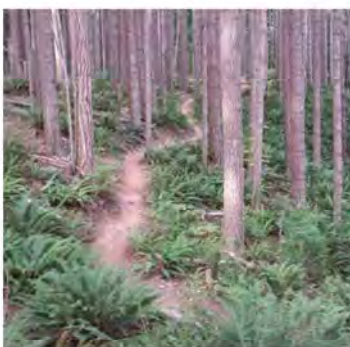
Natural obstacles/Trail features: Limited obstacles 2" or less

Sight Distance: 10'-100' depending on speed/flow

Beginner trails will be designed with wider trail bed and gentler grades. These are appropriate for inexperienced riders, helping develop skills and build confidence.

- Shorter trails, closer to parking area
- Trails that are wider, with average grades <5%
- Trail surface generally firm and stable
- May include flowing single track style sections
- Trail may include small obstacles of roots or rock
- Limited challenging features

## Intermediate



Width: 18" (one way singletrack) to 4' (add width & super-elevation at curves as needed)

Surface: Mineral soils, mostly stable with some variability

Trail grade: Avg. 10% or less with short sections up to 15% or greater

Natural obstacles/Trail features: Unavoidable obstacles 8" tall or less

Sight Distance: 10'-100' depending on speed/flow

Intermediate level trails will be designed with more narrow trails and steeper grades for more confident riders and offer a variety of moderate level challenges.

- Trails that are farther from entry will be designed to be more challenging
- Trail surface may be loose or uneven
- Moderate grades, but may include short steep sections
- Designed with tuns, obstacles and uphill sections to moderate speeds and naturally slow riders



# NORTH TUALATIN MOUNTAINS TRAIL DESIGN

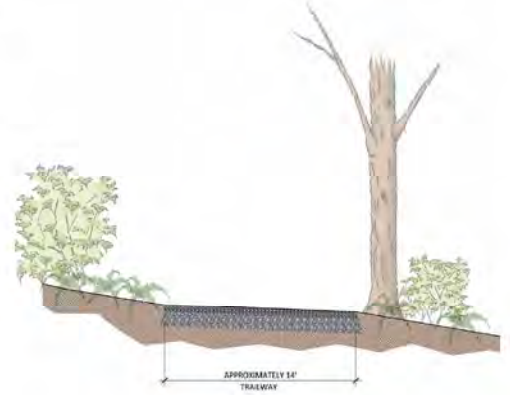
## Shared Trails

### Existing gravel road



*Existing gravel roads will remain where they are needed for maintenance. They are currently used by hikers, off-road cyclists, and horseback riders, and will continue to provide opportunities to experience the sites.*

- Provide dual direction for off-road cyclists hikers, and equestrians
- Typically about 14 feet wide, and steep in places.
- Surface is steep and may be loose or uneven
- Maintenance vehicles will use the roads at times to access the site and powerline corridor



### Dual Direction



*In some places where topography is more gentle, shared trails will accommodate multiple uses in two directions. Trail grades will be gentle, though some sections may still exceed guidelines for accessibility.*

- Where grades are within guidelines for accessibility a smooth crushed rock trail surface will be constructed
- Sight Distance: 40'-100' depending on speed/flow of uses
- Trail grade: 0-5% (to 12% if needed)
- Trail design will control cyclists speed with short uphill sections
- Shared with off road cyclists, hikers, and equestrians
- Moderate grades, may include short steep sections greater than 8%

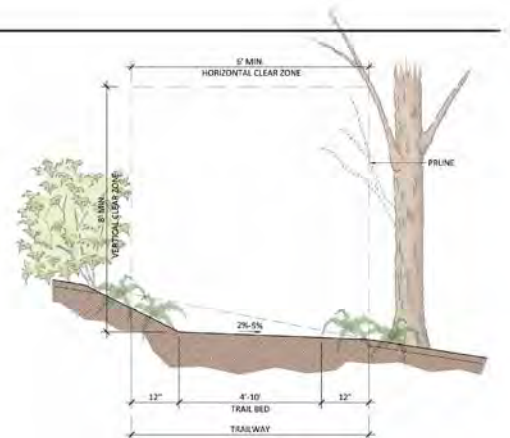


### Uphill for off-road cyclists



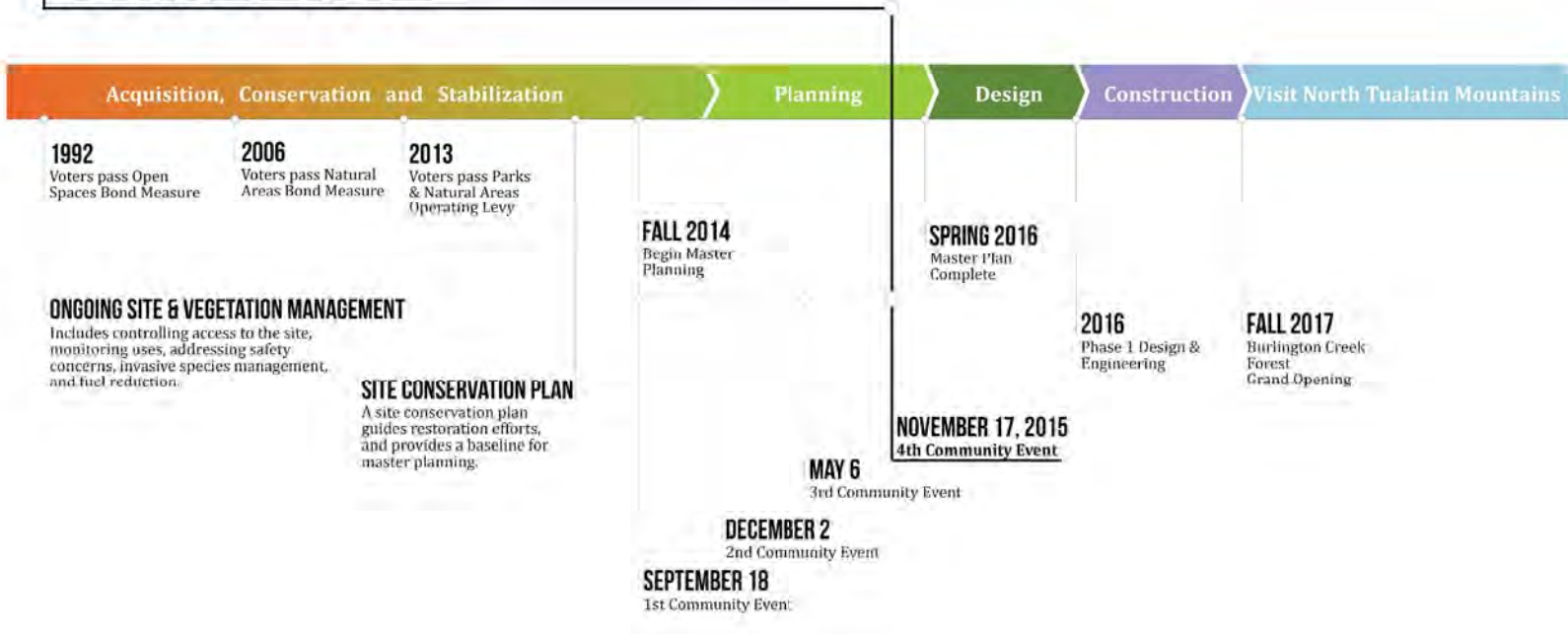
*In some places, where topography is steeper, shared trails will include off-road cyclists in the uphill direction, with separate single use trails in the descending direction for cyclists.*

- One-way (uphill) for off road cycling
- Dual direction for hiking
- Sight Distance: 40'-100' depending on speed
- Moderate grades, may include short steep sections
- Provide resting points and places to pass





## TIMELINE



## NEXT STEPS

### Final Recommendation

- We will incorporate comments on the recommended alternative into an access master plan for the North Tualatin Mountains

### Master Plan

- We will write a Master Plan document. Once the Stakeholder Advisory Committee's feedback has been incorporated, the final draft of the Master Plan will be posted online for public comments.

### Metro Council Adoption

- After the public review period, staff will present the North Tualatin Mountain Master plan for adoption by Metro Council.

### Phase I Implementation

- Design and Engineering for Burlington Creek Forest access will begin once the Master Plan is adopted by council.



## APPENDIX B: PLANNING LEVEL COST ESTIMATE



| Planning level Cost Estimate                          |          |      |            |                  |                    |                    |
|---|----------|------|------------|------------------|--------------------|--------------------|
| Item of Work  | Quantity | Unit | Unit Price | Total Amount     | Category Total     | Contingency (25%)  |
| <b>BURLINGTON CREEK FOREST</b>                        |          |      |            |                  | <b>\$95,000</b>    | <b>\$118,750</b>   |
| Right of way improvements for site access             | 1        | LS   | 95000.00   | \$95,000         | \$0                | \$118,750          |
| Driveway and parking lot improvements                 | 1        | LS   | 276075.00  | \$276,075        | \$0                | \$345,094          |
| Restroom Facility (port-a-potty)                      | 1        | LS   | 20000.00   | \$20,000         | \$0                | \$25,000           |
| Multi-use trail                                       | 29040    | LF   | \$8.00     | \$232,320        | \$0                | \$290,400          |
| Trails on gravel road (enter miles to right)          | 15840    | LF   | 2.00       | \$31,680         | \$0                | \$39,600           |
| Amenities   | 1        | LS   | 40000.00   | \$40,000         | \$0                | \$50,000           |
| Electrical Service                                    | 1        | EA   | 5000.00    | \$5,000          | \$0                | \$6,250            |
| <i>Construction Subtotal</i>                          |          |      |            | \$700,075        | \$700,075          | \$875,094          |
| Mobilization @ 10%                                    | 10%      | EA   | 700075.00  | \$70,008         | \$70,008           | \$87,509           |
| <b>Construction Total</b>                             |          |      |            | <b>\$770,083</b> | <b>\$770,083</b>   | <b>\$962,603</b>   |
| <b>DESIGN, ENGINEERING, PERMITING</b>                 |          |      |            |                  | <b>\$266,025</b>   | <b>\$332,531</b>   |
| Planning  | 1        | EA   | 35000.00   | \$35,000         |                    |                    |
| Design & Engineering                                  | 22%      | EA   | 770082.50  | \$169,418        |                    |                    |
| Permitting  | 8%       | EA   | 770082.50  | \$61,607         |                    |                    |
| <b>Total</b>  |          |      |            |                  | <b>\$1,106,115</b> | <b>\$1,382,643</b> |
| Escalation index numbers through 2019 are as follows: |          |      |            |                  |                    | <b>\$1,382,643</b> |
| 2016 – 0.045  |          |      |            |                  |                    |                    |
| 2017 – 0.045  |          |      |            |                  |                    |                    |
| 2018 – 0.045  |          |      |            |                  |                    |                    |
| 2019 – 0.045  |          |      |            |                  |                    |                    |

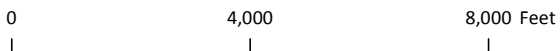
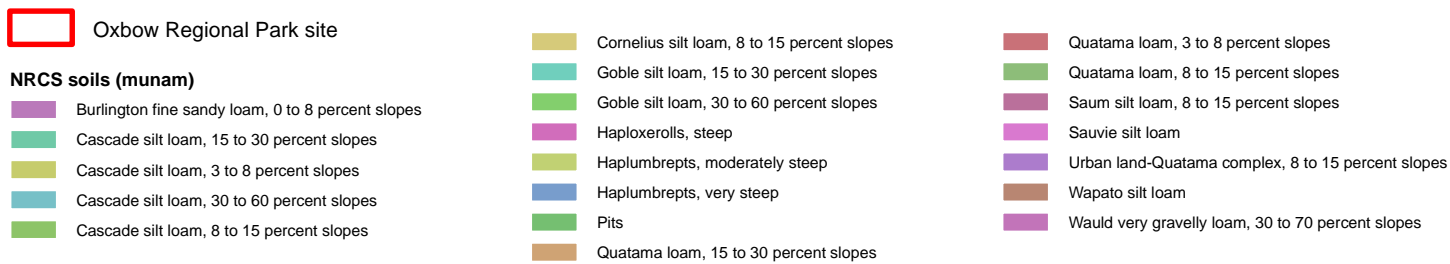
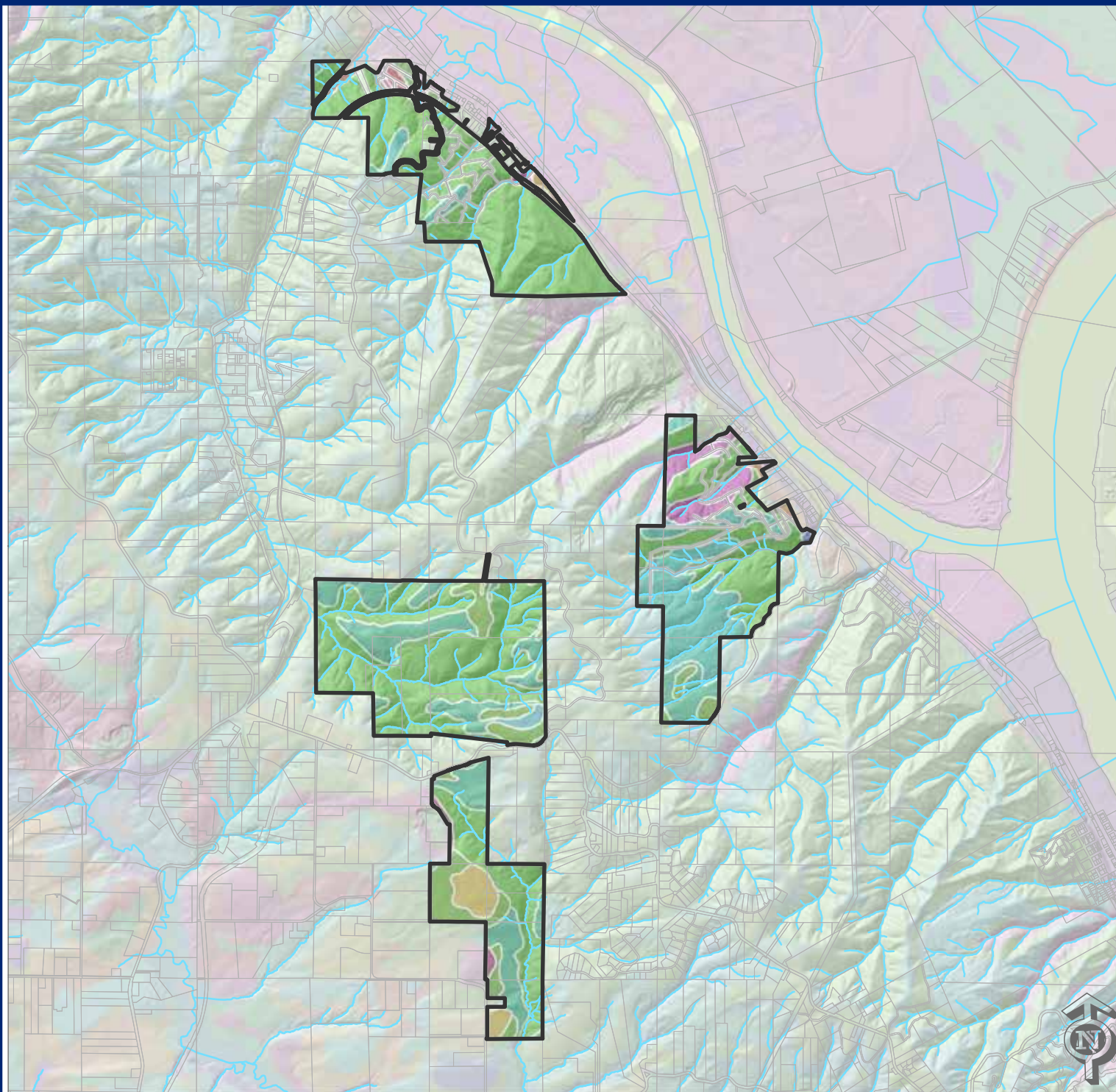
| Planning level Cost Estimate                          |          |      |            |                  |                  |                   |
|---|----------|------|------------|------------------|------------------|-------------------|
| Item of Work  | Quantity | Unit | Unit Price | Total Amount     | Category Total   | Contingency (25%) |
| <b>McCARTHY CREEK FOREST</b>                          |          |      |            |                  | <b>\$53,000</b>  | <b>\$66,250</b>   |
| Right of way improvements for site access             | 1        | LS   | 53000.00   | \$53,000         | \$0              | \$66,250          |
| Driveway and parking lot improvements                 | 1        | LS   | 165660.00  | \$165,660        | \$0              | \$207,075         |
| Restroom Facility (port-a-potty)                      | 1        | LS   | 20000.00   | \$20,000         | \$0              | \$25,000          |
| Multi-use trail                                       | 5280     | LF   | \$8.00     | \$42,240         | \$0              | \$52,800          |
| Trails on gravel road (enter miles to right)          | 5280     | LF   | 2.00       | \$10,560         | \$0              | \$13,200          |
| Amenities   | 1        | LS   | 40000.00   | \$40,000         | \$0              | \$50,000          |
| Electrical Service                                    | 1        | EA   | 5000.00    | \$5,000          | \$0              | \$6,250           |
| <i>Construction Subtotal</i>                          |          |      |            | \$336,460        | \$336,460        | \$420,575         |
| Mobilization @ 10%                                    | 10%      | EA   | 336460.00  | \$33,646         | \$33,646         | \$42,058          |
| <b>Construction Total</b>                             |          |      |            | <b>\$370,106</b> | <b>\$370,106</b> | <b>\$462,633</b>  |
| <b>DESIGN, ENGINEERING, PERMITING</b>                 |          |      |            |                  | <b>\$146,032</b> | <b>\$182,540</b>  |
| Planning  | 1        | EA   | 35000.00   | \$35,000         |                  |                   |
| Design & Engineering                                  | 22%      | EA   | 370106.00  | \$81,423         |                  |                   |
| Permitting  | 8%       | EA   | 370106.00  | \$29,608         |                  |                   |
| <b>Total</b>  |          |      |            |                  | <b>\$549,784</b> | <b>\$687,230</b>  |
| Escalation index numbers through 2019 are as follows: |          |      |            |                  |                  | <b>\$687,230</b>  |
| 2016 – 0.045  |          |      |            |                  |                  |                   |
| 2017 – 0.045  |          |      |            |                  |                  |                   |
| 2018 – 0.045  |          |      |            |                  |                  |                   |
| 2019 – 0.045  |          |      |            |                  |                  |                   |



## APPENDIX C: SOILS



# SOILS





| <b>SYMBOL</b> | <b>MAP UNIT NAME</b>       | <b>DESCRIPTION</b>  |
|---------------|----------------------------|---|
|               | Burlington fine sandy loam | The Burlington series consists of deep, somewhat excessively drained soils that formed in mixed alluvium. Burlington soils are on wind-reworked, dune-like terraces and have slopes of 0 to 15 percent. The Burlington soils are on terraces along the lower Columbia River and its tributaries at elevations of 20 to 50 feet.   |
|               | Cornelius silt loam        | The Cornelius series consists of moderately deep to a fragipan, moderately well drained soils that formed in silty loess-like materials. Cornelius soils are on uplands and have slopes of 2 to 60 percent. The Cornelius soils are on gently sloping to rolling low hills and steep hill slopes with convex, long slopes and ridgetops at elevations of 350 to 800 feet. The soils formed in loess-like material over mixed, fine-silty old alluvium of mixed origin.  |
|               | Cascade silt loam          | The Cascade series consists of moderately deep to a fragipan, somewhat poorly drained soils that formed in silty materials. Cascade soils are on uplands and have slopes of 3 to 60 percent. The Cascade soils are on smooth or rolling, convex, long slopes and ridgetops at elevations of 250 to 1,400 feet. Slopes range from 3 to 60 percent. The soils formed in loess-like materials.   |
|               | Haploxerolls steep         |   |
|               | Haplumbrepts, very steep   |   |
|               | Saum silt loam             | The Saum series consists of very deep, well drained soils that formed in basalt colluvium. The Saum soils are on summits and side slopes in areas affected by mass movement. Slopes range from 2 to 90 percent. The Saum soils are on summits and side slopes in areas that have been affected by mass movement. Slopes are 2 to 90 percent. The soils occur at elevations of 250 to 1600 feet. The soils formed in colluvium and residuum from various members of the Columbia River Basalt Group (CRBG).        |
|               | Sauvie silt loam           | The Sauvie series consists of deep, poorly drained soils that formed mainly in alluvium. Sauvie soils are on flood plains and have slopes of 0 to 3 percent. The Sauvie soils are on flood plains along the lower Columbia River and its tributaries. Slopes are 0 to 3 percent. The soils formed in recent alluvium with some mixing with volcanic ash. They are at elevations of 10 to 40 feet in a climate with cool dry summers and cool moist winters.   |
|               | Urban land quatama complex |   |
|               | Wauld very gravelly loam   | The Wauld series consists of moderately deep, well drained soils that formed in residuum and colluvium weathered from basalt. Wauld soils are on north slopes of uplands and have slopes of 30 to 70 percent. The Wauld soils are commonly on north-facing escarpments along the Columbia River and its major tributaries at elevations of 250 to 1,000 feet. Slopes range from 30 to 70 percent. The soils formed in eolian material mixed with colluvium from mixed sources and residuum weathered from basalt. |



|         |                  |  |
|---------|------------------|--|
| 17 D, E | Goble silt loam  | <p>The Goble series consists of moderately deep to a fragipan, moderately well drained soils that formed in silty loess over old alluvium of mixed origin. Goble soils are on long convex upland slopes and ridgetops and have slopes of 2 to 80 percent. The Goble soils are on smooth or rolling hills with convex, long slopes and ridgetops on all exposures at elevations of 200 to 1,800 feet. The soils formed in loess over mixed old alluvium or slope wash.</p> <p>(Moderately well-drained soils on rolling ridgetops and convex side slopes of ridgetops).</p> |
| 37 B, C | Quatama loam     | <p>The Quatama series consists of deep, moderately well drained soils that formed in stratified glaciolacustrine deposits. Quatama soils are on low terraces and have slopes of 0 to 30 percent. Quatama soils are on nearly level to gently sloping, low terraces with short, steep escarpment fronts at elevations of 95 to 400 feet. The soils formed in loamy, old alluvium of mixed origin.</p> <p>(Moderately well-drained soil on low terraces, elevation 75-400 feet. )</p>  |
| 55      | Wapato silt loam | <p>The Wapato series consists of very deep, poorly drained soils that formed in loamy mixed alluvium. Wapato soils are on flood plains. Slopes are 0 to 3 percent.</p> <p>The Wapato soils are in depressions on flood plains and basin-like areas. Elevations are 100 to 2,500 feet. The slope is 0 to 3 percent. The soils formed in silty recent alluvium.</p> <p>(Poorly drained floodplain soil. Present along lower Burlington Creek Forest in the site's northern extent.)</p>  |



# North Tualatin Mountain Forests



Burlington Creek Forest Natural Area | July 2014

Ennis Creek Forest Natural Area | July 2014

McCarthy Creek Forest Natural Area | Oct. 2015

*Updated June 2016*



Metro | *Making a great place*



Clean air and clean water do not stop at city limits or county lines. Neither does the need for jobs, a thriving economy, and sustainable transportation and living choices for people and businesses in the region. Voters have asked Metro to help with the challenges and opportunities that affect the 25 cities and three counties in the Portland metropolitan area.

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Sam Chase, District 5  
Bob Stacey, District 6

Auditor  
Brian Evans

# MAKING A GREAT PLACE



Metro



## North Tualatin Mountains – Burlington and Ennis

### Approvals for Site Conservation Plan

Date first routed: 07-21-2014

*Please return to Lori Hennings (Primary author: Curt Zonick)*

Jonathan Soll

Signature



Date

8/26/14

Dan Moeller

Signature



Date

8/28/14

Mark Davison

Signature

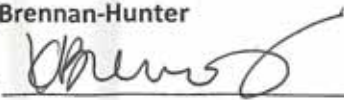


Date

8/29/14

Kathleen Brennan-Hunter

Signature



Date

9/2/14



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# NORTH TUALATIN MOUNTAIN FORESTS NATURAL AREA

The North Tualatin Mountain Forests Natural Area describes a collection of three Metro natural area sites located in the northern portion of the Tualatin Mountains, just north of Forest Park. Collectively, the three sites – Burlington Creek Forest, Ennis Creek Forest and McCarthy Creek Forest – protect almost 1,000 acres of natural areas in the north Tualatin Mountains. This site conservation plan integrates the three sites into one guiding document, with separate chapters dedicated to each site.

## CHAPTER 1 | BURLINGTON CREEK FOREST NATURAL AREA

### INTRODUCTION

The 350-acre Burlington Creek Forest site is part of the Metro Forest Park target area, located on the eastern face of the northern Tualatin Mountains, north of Forest Park and west of Highway 30 in west Multnomah County.

The area surrounding Burlington Creek Forest contains a mixture of land uses including residential, timber harvest, gravel extraction and golf course. The City of Portland's Forest Park lies south of the site. The ~400-acre BPA-owned and ODFW-managed Burlington Bottoms wetlands lies east and downslope of the site, across Highway 30.

The site is drained by Burlington Creek and several small unnamed seasonal streams.

### PLANNING AREA

Although Burlington Creek Forest's planning area is defined by the site's boundaries, i.e., Metro ownership, there are large expanses of privately- and publicly-owned properties nearby that share habitat features with the forest, and influence its potential ecological viability and larger landscape value. These properties are important to the development of effective conservation strategies for Burlington Creek Forest, but detailed evaluations of their stewardship classification, targets, etc. are beyond the scope of this plan.

#### Key staff

Curt Zonick, natural resources scientist  
Adam Stellmacher, lead natural resources specialist  
Jeff Merrill, natural resources scientist  
Nathaniel Marquiss, natural resources technician  
Katy Weil, wildlife monitoring coordinator  
Robert Spurlock, parks and natural areas planner  
Laurie Wulf, property management specialist  
Barbara Edwardson, real estate negotiator

#### Key private landowners

Brian Lightfoot  
Michael Baker  
Forest Park Conservancy  
Skyline Ridge Neighbors



## EXISTING PLANNING DOCUMENTS

1. *Forest Stand Management Recommendations; Metro's Agency Creek and Ennis Creek Tracts*, a forest stand assessment conducted by Trout Mountain Forestry in 2012. The document is located at: <M:\PN\Regional Properties\Forest Park Connections TA\Stewardship-Property Management\Stand Mgt.>
2. An assessment of pre-commercial thinning options for the site, including recommendations, was conducted by Trout Mountain Forestry in 2013/2014. A final report is pending.
3. *Greater Forest Park Conservation Initiative*, a 2013 document prepared by the Forest Park Conservancy in cooperation with the City of Portland, Metro and others. The document is located at: <M:\PN\Regional Properties\Forest Park Connections TA\Stewardship-Property Management\Forest Park\GFPCI Report.>
4. *Forest Park Ecological Prescriptions*, a 2011 Forest Park management plan developed by the City of Portland, with input from Metro, Audubon, the Forest Park Conservancy and others. The document is located at: <M:\PN\Regional Properties\Forest Park Connections TA\Stewardship-Property Management\Forest Park\City of Portland, Forest Park Ecological Prescriptions.>

## SITE DESCRIPTION

The primary access points for the Burlington Creek Forest are along McNamee Road. The site is dominated by hardwood, Douglas-fir and mixed hardwood/conifer forest. Most of the forest at the site is just over 20 years old, following logging and reforestation of approximately 250 acres of the site in the early 1990s. Logging roads remain, providing good access. Because the site lies along the eastern side of the Tualatin Mountains, slopes are steep (30-60 percent) over much of the site. The lower/eastern edge is encumbered by railroad and utility uses, and these areas are among the most challenged by non-native weed populations.

### Soils present at Burlington Creek Forest

| MAP SOIL SYMBOL | MAP UNIT NAME    | DESCRIPTION  |
|-----------------|------------------|--|
| 17 D, E         | Goble silt loam  | Moderately well-drained soils on rolling ridgetops and convex side slopes of ridgetops.                    |
| 37 B, C         | Quatama loam     | Moderately well-drained soil on low terraces, elevation 75-400 feet.                                       |
| 55              | Wapato silt loam | Poorly drained floodplain soil. Present along lower Burlington Creek Forest in the site's northern extent. |

### Historic habitats at Burlington Creek Forest

| ~ % COVER | HABITAT TYPE          | HISTORIC HABITAT DESCRIPTION BY GLO SURVEYOR NOTES  |
|-----------|-----------------------|---|
| 100%      | Closed forest; upland | Northern half of site: Mesic mixed conifer forest with mostly deciduous understory. May include Douglas fir, western hemlock, red cedar, grand fir, bigleaf maple, yew, dogwood, white oak, red alder.<br><br>Southern half of site: FFHC, but burned, often with scattered trees surviving fire. |

## RECENT MANAGEMENT HISTORY

The site has been managed with road maintenance and forest edge weed abatement priorities over the past 10-15 years. Periodic mowing along the access roads, and culvert cleaning/replacement actions have been implemented as needed. Actions to suppress English ivy infestations, primarily in



the site's northeast extent, began in 2013 and are expected to continue through 2015. Forest stand assessment and complementary pre-commercial thinning assessments were conducted in 2012 and 2013, and are expected to lead to selective thinning in 2015 to enhance forest structure, preserve maturing tree canopy, and understory native herb and shrub diversity.

## ACCESS AND RECREATION

The Parks and Natural Areas Planning group is developing a new visitor experience overview that will be added to this site conservation plan as an appendix at a later date. Metro will also develop a comprehensive plan for the site in late 2014 and early 2015.

Metro staff conducted an internal process to consider an appropriate level of access for each of its natural areas. The access designation is offered as a starting point, with the understanding that judgment will always be needed on a case-by-case basis, and indicates that some part of that site could accept people at the stated level. It does not suggest that the entire site should have that level of access.

The designated access level at Burlington Creek Forest is *Natural Area – High*. Access at this type of sites is allowed and may be promoted on a site-by-site basis. Parking areas may or may not be developed at these sites to facilitate access if necessary; restrooms may be installed on a site-by-site basis; basic rules and site identification signage are standard; soft surface, mineral soil or gravel trails are formalized and wayfinding signage may be posted to channel access and protect sensitive habitat. These sites are visited weekly or bi-weekly by Metro staff to inspect for unauthorized use and to conduct maintenance. These sites could move to a Nature Park designation in the future.

At present, hikers, joggers, mountain bikers and equestrians occasionally use the old logging roads on the site.

## NATURAL RESOURCES OF SPECIAL INTEREST

With the exception of areas of heavy weed infestation along the access roads and the utility easements, the site is becoming well-represented by native cover. This site contributes to a larger block of protected forest land, including greater Forest Park and other Metro sites in this target area.

Maturing canopy-producing trees have begun to shade-suppress the extensive non-native blackberry infestations that dominated cover at the site following logging in the early 1990s. Isolated Oregon oak clusters occur at the site, primarily along the railroad and interface with residential properties at the low elevation side of the site.

A thorough ecological inventory and assessment has not been done for the site. Listed and rare species, such as Chinook salmon (juvenile Chinook salmon were detected during fish surveys on Burlington Creek Forest in 2012), northern red-legged frog and others almost certainly occur in Burlington Creek Forest. Coho and winter steelhead are present in lower Burlington Creek Forest.

### Rare species known to occur at Burlington Creek Forest

|  | ORBIC<br>LIST | FEDERAL<br>STATUS | URBANIZING FLORA (2009) |
|--|---------------|-------------------|-------------------------|
| <i>No documented occurrences of rare species, though species like red-legged frogs, Chinook salmon, steelhead, etc. seem likely.</i> | N/A           | N/A               | N/A                     |



## CONSERVATION TARGETS

There are three conservation targets for Burlington Creek Forest:

1. Upland forest
2. Riparian forest
3. Upland shrub

## CURRENT AND DESIRED FUTURE CONDITION OF CONSERVATION TARGETS

### Non-technical status and desired future condition of targets at Burlington Creek Forest

| TARGET               | CURRENT CONDITION   | DESIRED FUTURE CONDITION   |
|----------------------|---|--|
| Upland closed forest | Generally good habitat structure, with increasing sparse but present understory of native shrubs and herbs. Canopy closure is reducing understory blackberry cover. Ivy is a concern needing vigilance, especially east and north of the railroad. Edges are ongoing weed maintenance areas, especially for blackberry and broadleaf herbaceous weeds like knapweed and thistles. | Accelerating forest stand maturation accompanied by increase in forest floor wood accumulations, native understory diversity and cover, and increased snag and wildlife trees. A reduction in edge weed cover, and eradication or near total control of ivy and other shade-tolerant system modifying weeds. |
| Riparian forest      | Generally good, although areas of erosion and weed establishment are a problem. Better assessment of this habitat at the site is needed.  | Opportunities to enhance stream canopy cover/shading, % native vegetation cover, and improve instream structure are likely present. Further investigation and planning are necessary before associated project can be implemented.   |
| Upland shrub         | These units are generally associated with the utility corridors. Condition varies throughout the site, with some areas in good to very good condition with well-established native cover and limited non-native infestations, to areas with heavy blackberry and Scots broom needing intensive management.  | Desired conditions are for native shrubs and herbs to dominate cover with a limited presence of non-native plant species that are not displacing natives, and can be controlled with occasional weed abatement every 3-5 years.  |



## Key ecological attributes for upland forest at Burlington Creek Forest

| CATEGORY                 | KEA   | INDICATOR  | ----- INDICATOR RATING -----                                     |  |  |
|--------------------------|---|--|--|--|--|
|                          |   |  | POOR   | FAIR                                       | GOOD   |
| <b>Condition</b>         | Native tree and shrub richness                    | Number of native tree and shrub species per acre   | <5 species per 0.4 ha (1 ac)                                     | 5-8 species 0.4 ha (1 ac)                  | 8-12 species per 0.4 ha (1 ac)   |
| <b>Condition</b>         | Vegetative structure: native tree and shrub layer | % native tree and shrub canopy cover (combined)  | <25% cover   | 25-50% cover                               | 50-75% cover   |
| <b>Condition</b>         | Mature trees                                      | Number and size (dbh) of species such as Douglas fir, western red cedar, western hemlock and grand fir | Mature trees lacking   | <3 per ac with dbh >24 in                  | 3-5 per ac with dbh >24 in   |
| <b>Condition</b>         | Standing and downed dead trees                    | Average # snags and large wood (> 50 cm, or 20 in, DBH) per acre                                       | < 5 snags and <5% down wood                                      | 5-11 snags and 5-10% down wood             | 12-18 snags and 10-20% down wood with moderate variety of size and age classes |
| <b>Landscape context</b> | Edge condition                                    | % of edge bordered by natural habitats and/or managed for conservation                                 | Patch surrounded by non-natural habitats (0-25% natural habitat) | 25%+ of patch bordered by natural habitats | 50-75% of patch bordered by natural habitats or managed for conservation       |

\*Desired future condition



### Key ecological attributes for riparian forest (streams or rivers) at Burlington Creek Forest

| CATEGORY    | KEA                              | INDICATOR                  | ----- INDICATOR RATING -----  |  |  |
|-------------|----------------------------------|----------------------------|---|--|--|
|             |                                  |                            | POOR  | FAIR   | GOOD   |
| Condition   | Vegetative structure: tree layer | % native tree canopy cover | <20% cover  | 20-30% cover   | 30-40% cover   |
| Condition** | Riparian habitat continuity      | Gaps in woody vegetation   | >2 gaps >50 m (55 yards)<br>OR<br>>3 or more 25-50 m (27-55 yards) gaps | 1 or 2 gaps >50 m (54 yards)<br>OR<br>2 or more gaps between 15-25 m (16-27 yards) | 1, 25-50 m (27-55 y) gap<br>OR<br>2 or more gaps between 15-25 m (16-27 yards) |

\*Desired future condition

\*\* This KEA may not be appropriate where native turtles are present, because nesting turtles require some open habitat. Patches of bare ground may be present.

### Key ecological attributes for upland shrub habitat at Burlington Creek Forest

| CATEGORY  | KEA                               | INDICATOR                       | ----- INDICATOR RATING -----   |                                 |                                 |
|-----------|-----------------------------------|---------------------------------|--------------------------------|---------------------------------|---------------------------------|
|           |                                   |                                 | POOR                           | FAIR                            | GOOD                            |
| Condition | Vegetative structure: shrub layer | % native shrub canopy cover     | <10% cover                     | 10-25% cover                    | 25-50%                          |
| Condition | Native shrub richness             | # native shrub species per acre | <2 species per 0.4 ha (1 acre) | 2-5 species per 0.4 ha (1 acre) | 6-9 species per 0.4 ha (1 acre) |

\*Desired future condition

### THREATS TO CONSERVATION TARGETS AT BURLINGTON CREEK FOREST

Burlington Creek Forest is primarily threatened by factors that limit forest stand health (overstocking, disease, non-native species), which occur along property edges, along the more open, logging/access roads and public roads, and under and adjacent to timber harvest areas. A comprehensive plan, scheduled for 2016, will address future following a comprehensive plan, scheduled for 2016. Resulting public access increases and associative infrastructure will be implemented to protect vegetation and wildlife.

#### Threats at conservation targets at Burlington Creek Forest

| CONSERVATION TARGET  | STRESS (DEGRADED KEA)                 | SEVERITY  | SCOPE    | OVERALL STRESS RANK | SOURCE (THREATS)  |
|----------------------|---------------------------------------|-----------|----------|---------------------|---|
| Upland forest        | Forest stand structure – mature trees | High      | High     | High                | Overstocking competition                                |
| Upland shrub habitat | Vegetative structure: shrub layer     | Very High | High     | Very High           | Non-native shrub species (e.g. blackberry)              |
| Riparian vegetation  | Canopy cover and continuity           | Moderate  | Moderate | Moderate            | Fragmentation, previous logging, non-native shrub cover |



## Climate change considerations

Climate change is anticipated to affect summer temperatures and availability of water in summer. Other indirect effects of climate change may include range shifts of plants and animals, some native to North America and some not, and increased competition by these species. It is possible that climate change may touch every key ecological attribute, though effects on some KEAs may be more important than others.

### Direct effects that may occur

- Increased summer temperatures
- Increased severity of winter rain events
- Decreased water availability in summer

### Indirect effects that may occur

- Increased risk of wildfire in hotter, dryer summers
- Range shifts by undesirable plants increasing competition
- Disease introductions and/or increased vulnerability to disease
- Loss of synchronicity of plant reproduction and pollinators
- Loss of synchronicity of resident and migratory animals and food sources (e.g., insect hatches)
- Increased erosion in streams caused by the flashier winter rain events
- In upland forests, plant growth and survival may be affected by increased summer temperatures and reduced water availability in summer.

## STRATEGIC ACTIONS

Enhancement and management strategies recommended for the site target improvements to forest structure, vegetation diversity and non-native species suppression. Priority actions are described below.

### List of proposed strategies at Burlington Creek Forest

| STRATEGY   | SOURCES OF STRESS IT ADDRESSES   | FOCAL CONSERVATION TARGETS/KEAS AFFECTED  | WHY IS IT IMPORTANT AND ANY TIMING ISSUES   | MEASURE(S) OF SUCCESS                     | RANK   |
|--|--|---|---|---|--------|
| Treat exotics, especially <i>Rubus armeniacus</i> and <i>Hedera helix</i><br>Survey and treat EDRR species and system-changing invasives | Competition from exotic plants   | Upland forest: % native tree and shrub canopy cover (combined)<br>Upland shrub: % native shrub canopy cover | Periodic treatments of certain exotics are essential to avoid losing native plants                            | Establish and maintain KEA rating of Good | Medium |
| Selectively thin upland forest patches that are accessible to machine harvest or affordable chainsaw thinning during the next 2-3 years  | Reduces overstocking that is causing a loss of living tree canopy and understory native vegetation diversity | Upland forest: Number of native tree and shrub species per acre   | Strategy will implement a pre-commercial thinning action recommended by the 2012 Forest Stand Management plan | Visual assessment/ KEA                    | High   |



| STRATEGY   | SOURCES OF STRESS IT ADDRESSES                   | FOCAL CONSERVATION TARGETS/KEAS AFFECTED | WHY IS IT IMPORTANT AND ANY TIMING ISSUES   | MEASURE(S) OF SUCCESS  | RANK   |
|--|--|--|---|------------------------|--------|
| Increase forest understory diversity of upland forests | Habitat simplicity; resiliency to climate change | % native tree and shrub canopy cover     | Enhances resiliency to climate change while providing better wildlife habitat, forest soil benefits, weed suppression | Visual assessment/ KEA | Medium |
| Reduce non-native cover in upland shrublands           | Non-native species competition                   | % native canopy cover                    |   | Visual assessment/ KEA | Medium |

**Strategy ranking:**

**High:** must do within 5 years to protect target viability

**Medium:** target will persist without it but will degrade over 5-10 years or require additional future management

**Low:** addresses a non-critical threat or one that is unlikely to threaten target viability within 10 years

## SPECIFIC ACTIONS AND FUNDING REQUIREMENTS

Enhancement and management strategies, as they pertain to the site's conservation targets, are described below.

### Specific actions to implement strategies tied to conservation targets at Burlington Creek Forest

| STRATEGY  | TARGET   | PRIORITY (HOW SOON)        | SPECIFIC TASKS  | ESTIMATED COST   |
|---|--|----------------------------|---|--|
| Develop response as knowledge develops  | Riparian forest                                  | Low – 10 years out or more | Monitor spread of ash borer and work with USDA and/or ODA on treatment options  | Nominal; part of routine work  |
| Treat exotics, especially <i>Rubus armeniacus</i> ; <i>Hedera helix</i>   | Upland forest                                    | High – ASAP                | Sweep upland forest habitat to treat exotics  | \$15,000 every 5 years? (about 5 crew days)  |
| Interplant to increase understory diversity   | Upland forest                                    | Moderate – next 5 years    | Develop a plant list of desired understory species (woody and herbaceous) and interplant to introduce sustainable cover of those species, if needed.                              | \$35,000   |
| Selectively thin upland forest patches that are accessible to machine harvest in the next 2-3 years (~65 acres) | Upland forest                                    | High – next 3 years        | Implement a combination of machine and chainsaw thinning to selectively open overstocked forests to increase forests stand structure, diversity and resiliency to climate change. | \$20,000; costs could be offset by commercial thinning revenue, or increased if commercial logging offset is limited and chainsaw thinning is required |
| Treat exotics, especially <i>Rubus armeniacus</i> ; <i>Cytisus scoparius</i>                                    | Upland shrub and forest understory post-thinning | High – next 10 years       | Targeted herbicide applications   | \$30-50,000  |
| Interplant to increase understory diversity   | Upland shrub                                     | Moderate                   | Revegetation  | \$20,000   |
| Treat exotics, especially <i>Rubus armeniacus</i>   | Riparian forest                                  | Moderate                   | Targeted herbicide applications   | \$15,000   |
| Interplant to increase understory diversity   | Riparian forest                                  | Moderate                   | Revegetation  | \$10,000   |
| Boost snags and downed wood   | Upland forest                                    | Moderate                   | Selective topping and girding/ tree-falling, create wildlife piles  | \$15,000   |
| Increase instream complexity  | Riparian forest                                  | Moderate                   | Instream LWD placement  | \$30,000   |
| Increase riparian canopy and stream shading   | Riparian forest                                  | High                       | Interplanting with canopy tree species  | \$10,000   |



## **MONITORING PLAN**

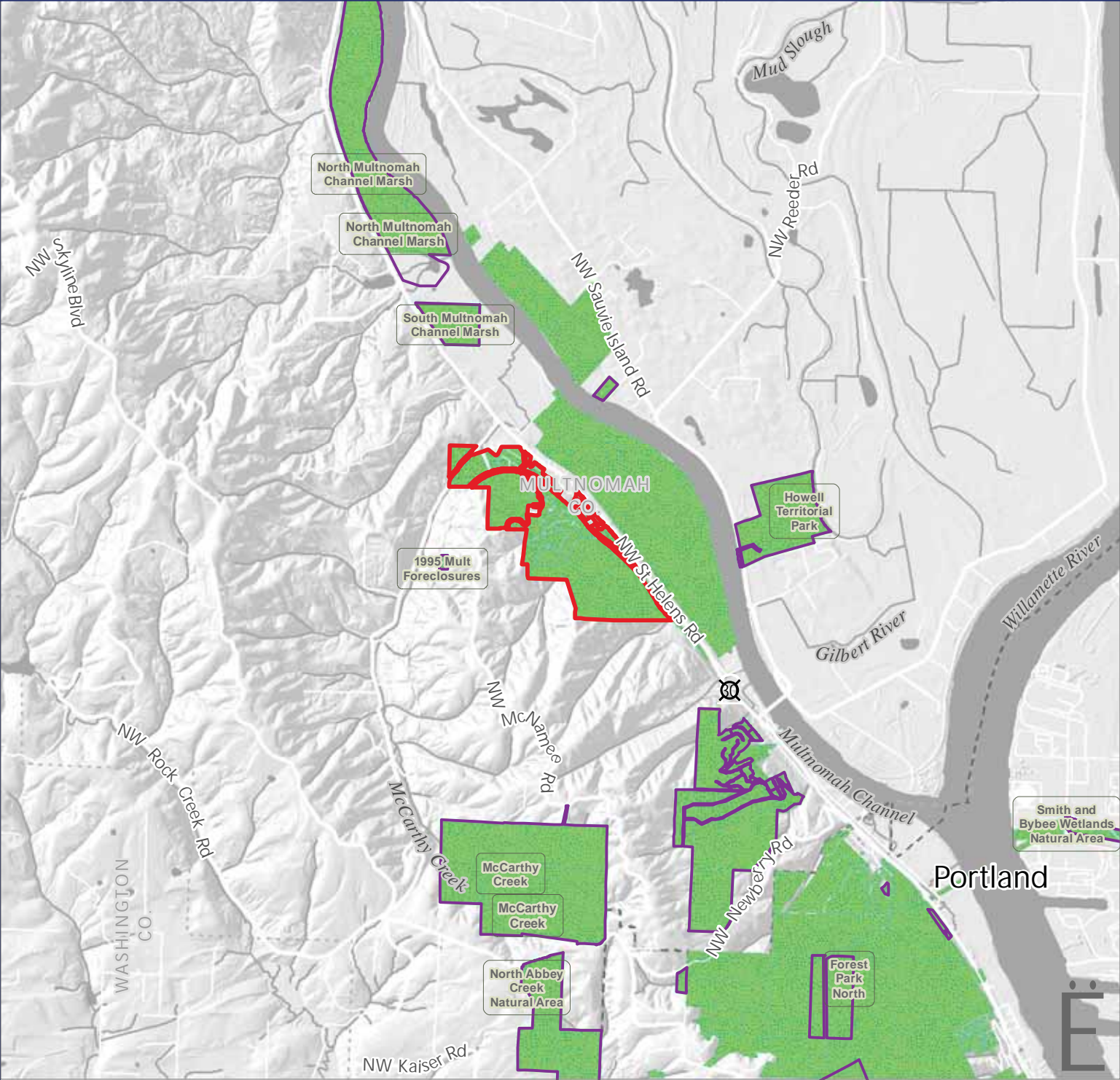
Monitoring for key ecological attributes associated with the site's conservation targets will largely be done via periodic visual assessment. In addition, periodic wildlife monitoring would be appropriate for the North Tualatin Mountains sites, focusing on long-term tracking of the avian community and periodic assessment of the terrestrial salamander population as it relates to increasing understory and large woody material improvements over time.




## **CURRENT PARTNERS, PARTNER PROJECTS AND POTENTIAL PARTNERS**

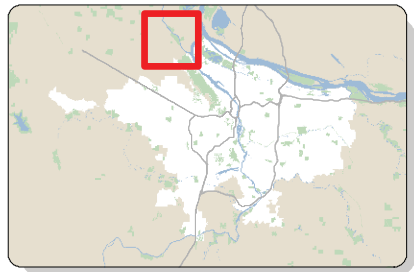
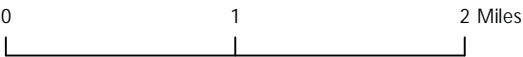
- West Multnomah Soil and Water Conservation District
- City of Portland
- Forest Park Conservancy
- Trout Mountain Forestry
- The National Audubon Society



# Vicinity Map



-  Burlington Creek Forest site
-  Other Metro sites
-  Park and/or natural area





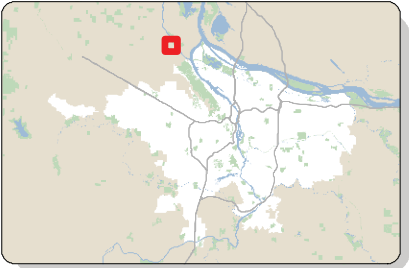
# Site Map



- Burlington Creek Forest site
- Other Metro sites

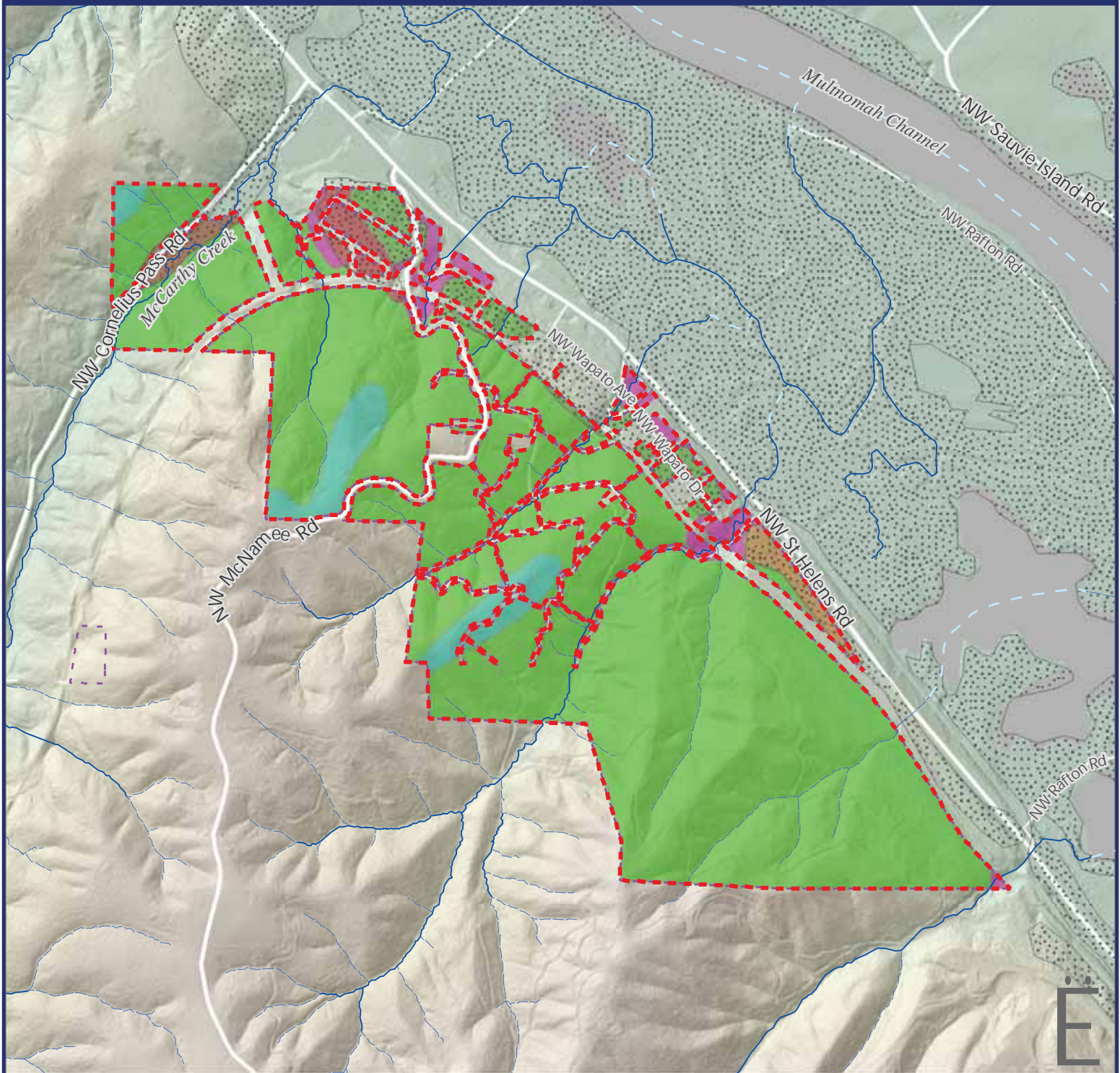
- Bond Measure**
- 1995 Bond Measure
  - 2006 Bond Measure

- NHD Flowlines**
- Intermittent stream
  - Perennial stream





# Soils



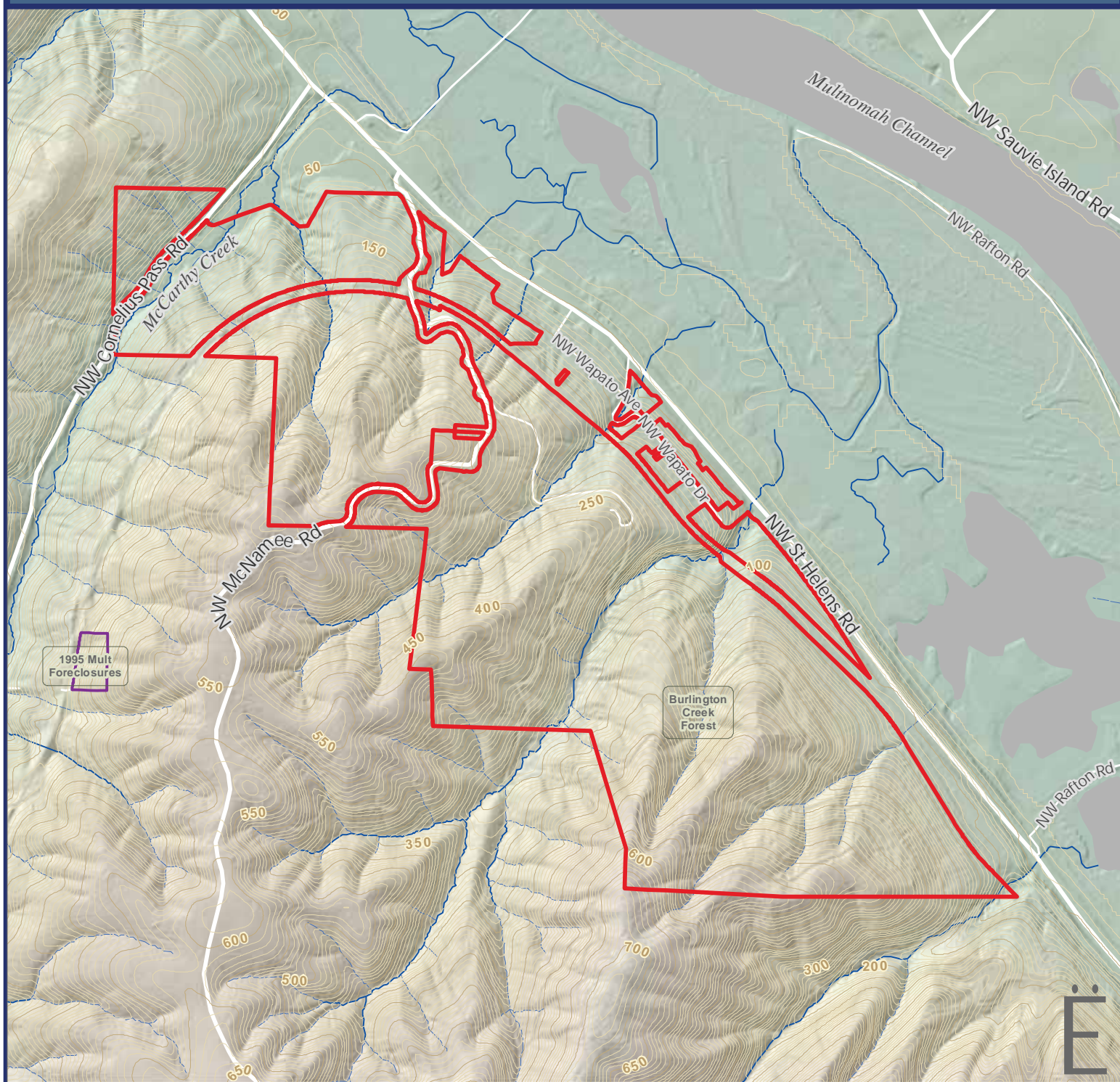
- |  |                              |                   |   |                                       |                                      |
|--|------------------------------|-------------------|---|---------------------------------------|--------------------------------------|
|  | Burlington Creek Forest site | <b>NRCS soils</b> |   | Quatama loam, 15 to 30 percent slopes |                                      |
|  | Other Metro sites            |                   | Burlington fine sandy loam, 0 to 8 percent slopes |                                       | Quatama loam, 3 to 8 percent slopes  |
|  | Hydric soils                 |                   | Goble silt loam, 15 to 30 percent slopes          |                                       | Quatama loam, 8 to 15 percent slopes |
|  |                              |                   | Goble silt loam, 30 to 60 percent slopes          |                                       | Sauvie silt loam                     |
|  |                              |                   | Haploxerolls, steep                               |                                       | Wapato silt loam                     |

0 1,500 3,000 Feet





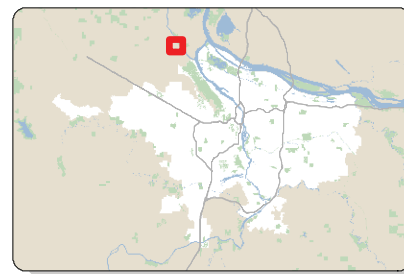
# Topography



- Burlington Creek Forest site
- Other Metro sites

## NHD Flowlines

- Intermittent stream
- Perennial stream

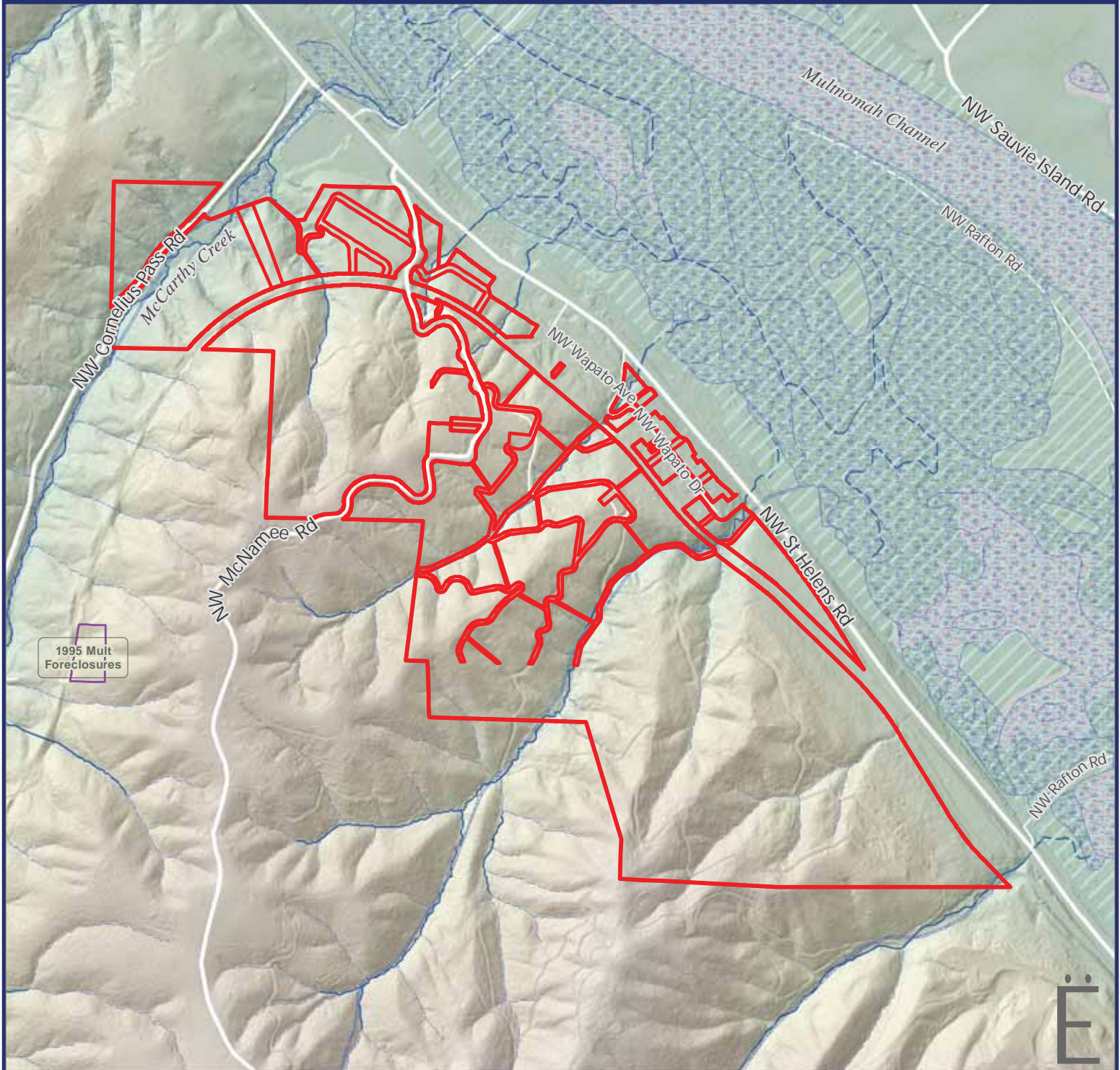


0 1,500 3,000 Feet





# Hydrology



Burlington Creek Forest site

Other Metro sites

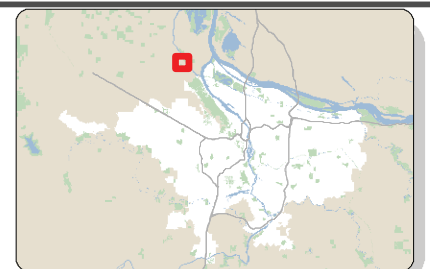
Wetlands

100 year floodplain

## NHD Flowlines

Intermittent stream

Perennial stream

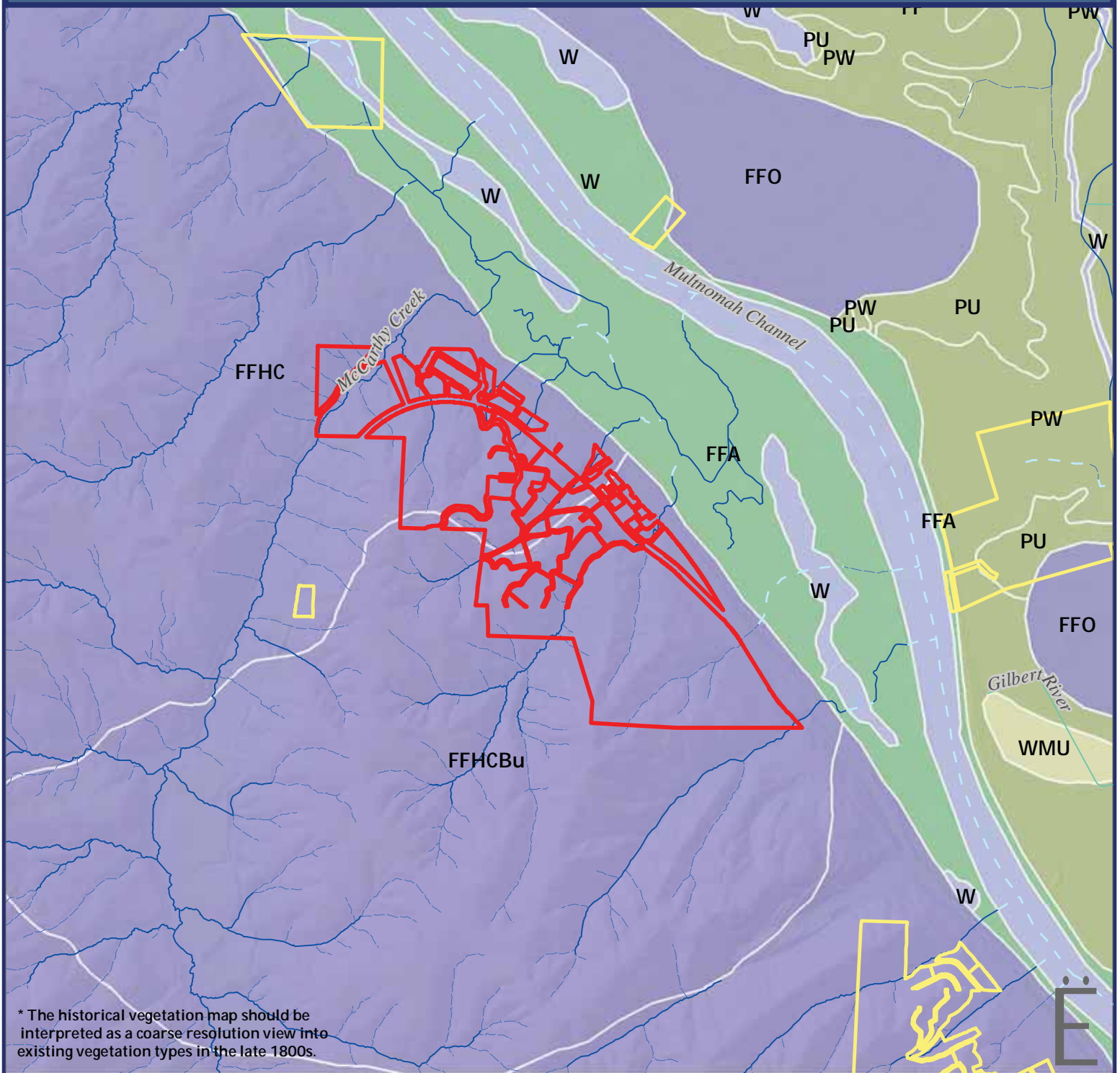


0 1,500 3,000 Feet





# Historical Vegetation (1851-1910)



\* The historical vegetation map should be interpreted as a coarse resolution view into existing vegetation types in the late 1800s.

- Burlington Creek Forest site
- Other Metro sites

## Historical vegetation

- Closed forest; Riparian & Wetland
- Closed forest; Upland
- Emergent wetlands
- Prairie
- Water

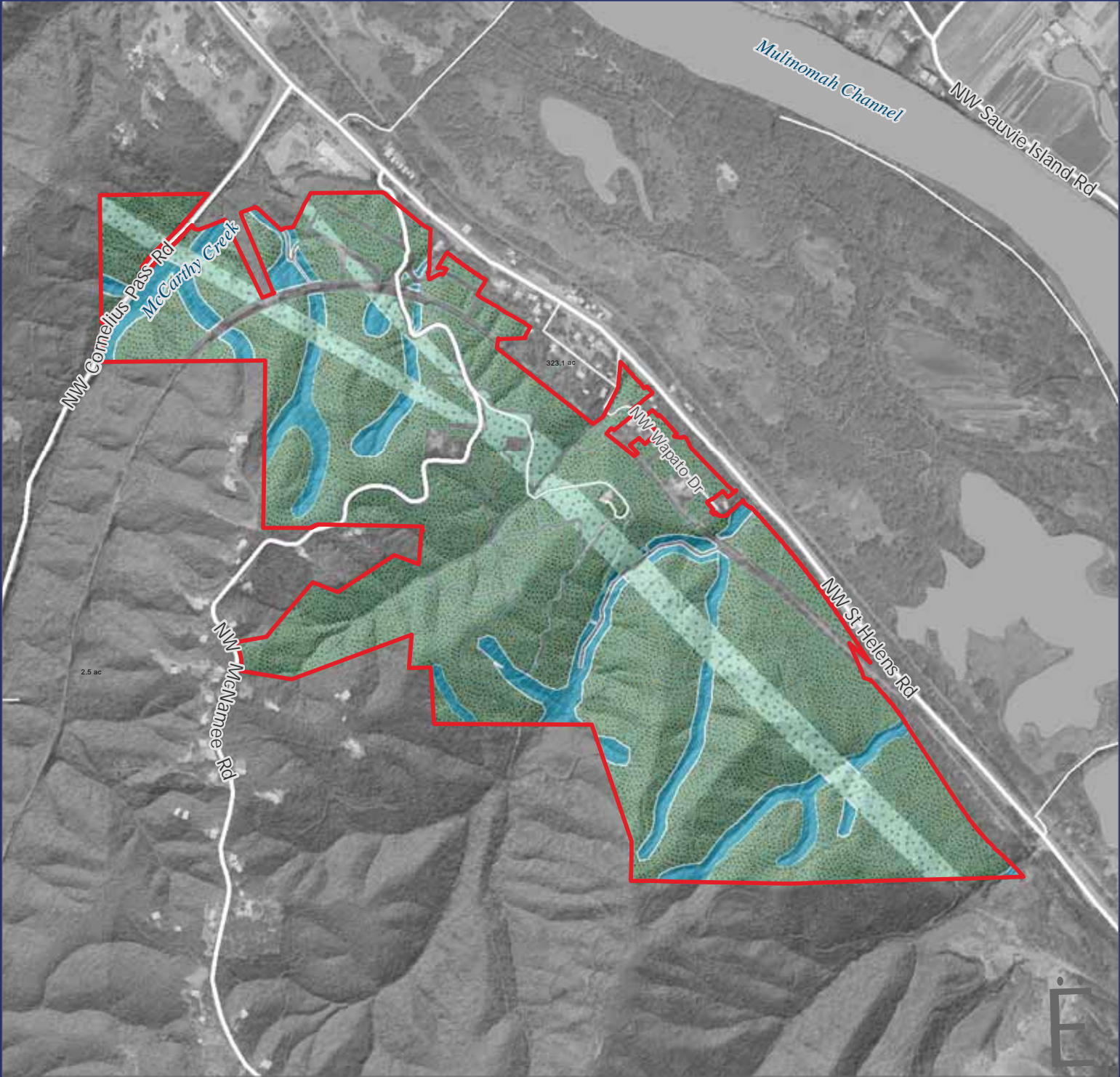
\* Labels refer to vegetation subclasses. Detailed descriptions can be found in T:\OBMO\GIS\DATA\_V\vegetation\Historical

0 2,000 4,000 Feet

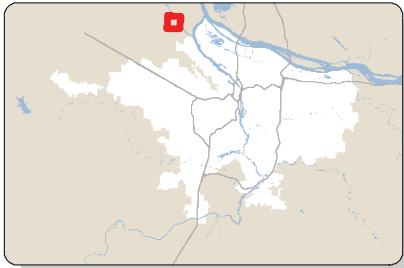




# CURRENT COVER

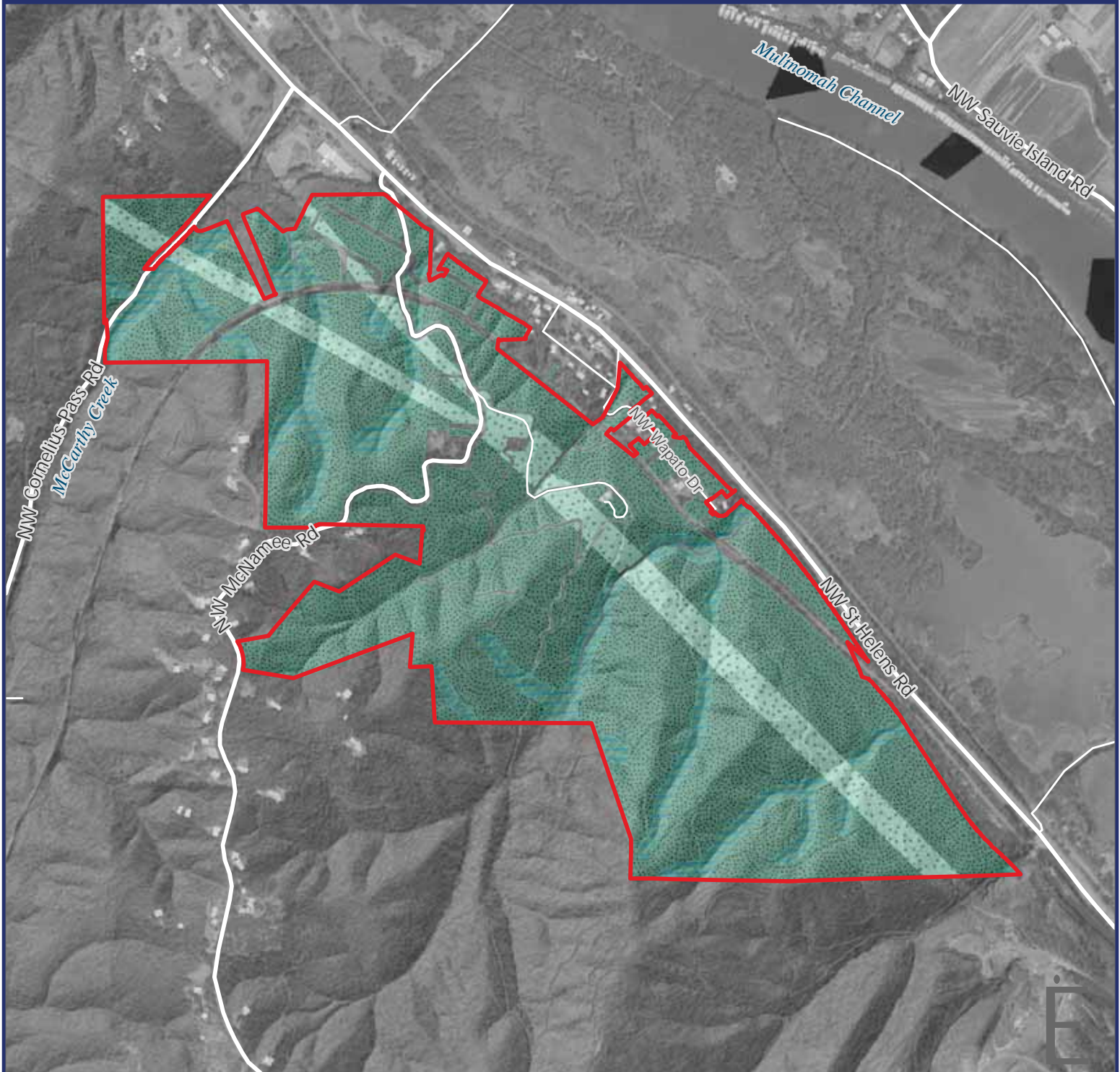


-  Burlington Creek Forest site
-  Riparian forest
-  Upland forest - mixed
-  Upland forest - shrub (stage)

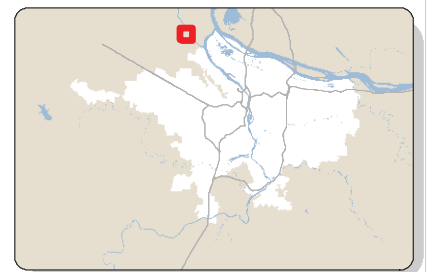




# CONSERVATION TARGETS



- Burlington Creek Forest site
- Riparian forest
- Upland forest
- Upland forest - shrub (early successional)

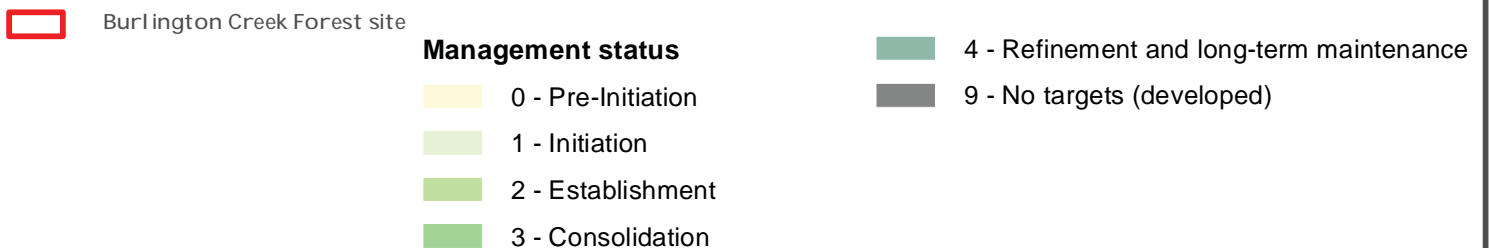
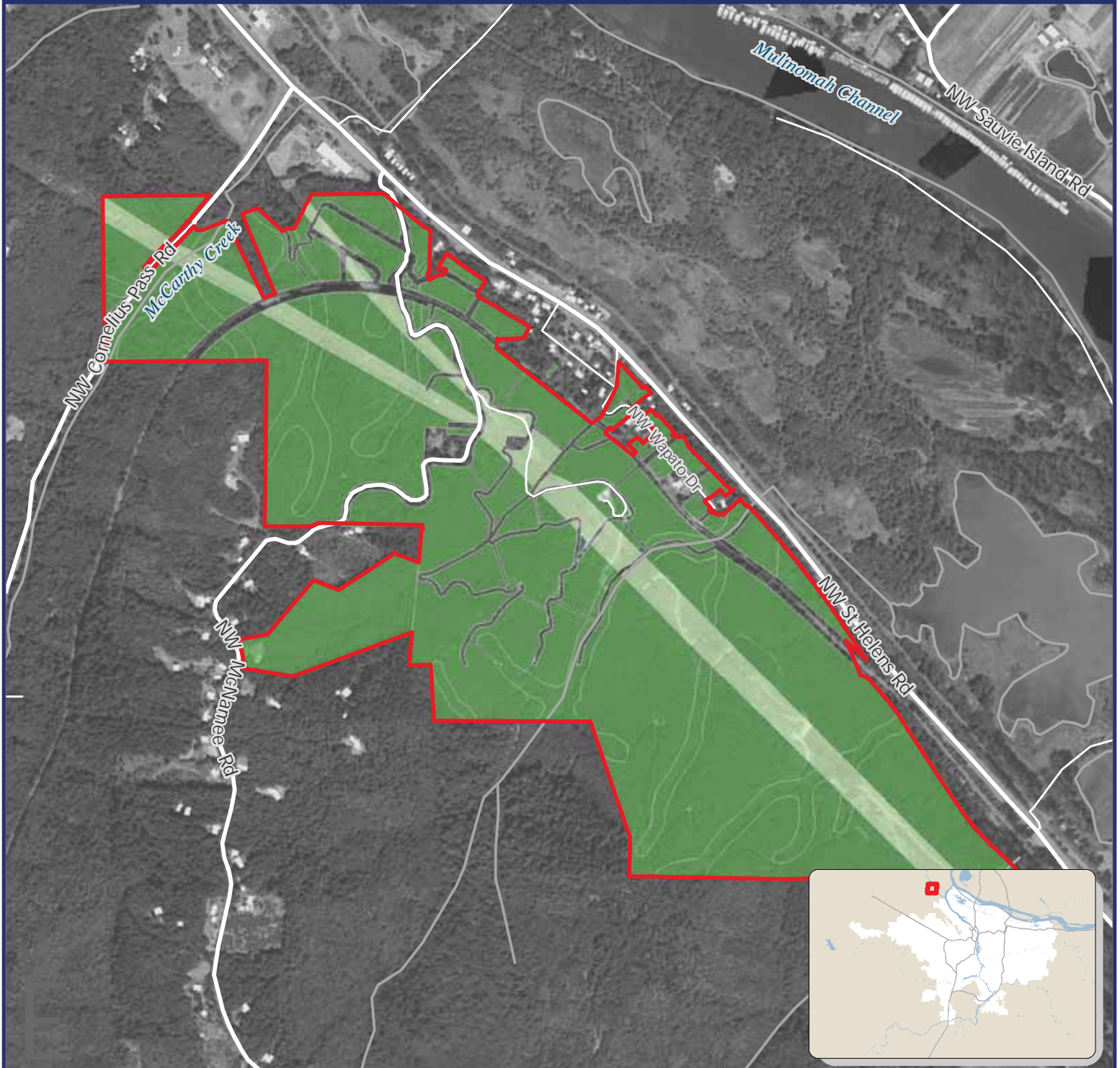


0 1,300 2,600 Feet





# MANAGEMENT STATUS



0 1,300 2,600 Feet





## CHAPTER 2 | ENNIS CREEK FOREST

### INTRODUCTION

The 320-acre Ennis Creek Forest site is part of the Forest Park target area, located on the eastern face of the northern Tualatin Mountains, north of Forest Park and west of Highway 30 in west Multnomah County. In total, the Forest Park target area contains almost 1,000 acres of natural areas in the north Tualatin Mountains.

The area surrounding Ennis Creek Forest contains a mixture of land uses including residential, timber harvest, gravel extraction and golf course. The City of Portland's Forest Park lies south of the site. The ~400-acre BPA-owned and ODFW-managed Ennis Bottoms wetlands lies northeast of the site, and the town of Burlington lies east and across Highway 30 from the site.

The site is drained by Ennis Creek and several small unnamed seasonal streams.

### PLANNING AREA

Although Ennis Creek Forest's planning area is defined by the site's boundaries, (i.e., Metro ownership) there are large expanses of privately and publicly owned properties nearby that share habitat features with the forest, and influence its potential ecological viability and larger landscape value. These properties are important to the development of effective conservation strategies for Ennis Creek Forest, but detailed evaluations of their stewardship classification, targets, etc. are beyond the scope of this plan.

#### Key staff

Curt Zonick, natural resources scientist  
Adam Stellmacher, lead natural resources specialist  
Jeff Merrill, natural resources scientist  
Nathaniel Marquiss, natural resources technician  
Katy Weil, wildlife monitoring coordinator  
Robert Spurlock, parks and natural areas planner  
Laurie Wulf, property management specialist  
Barbara Edwardson, real estate negotiator

#### Key private landowners

Brian Lightfoot  
Michael Baker  
Forest Park Conservancy  
Skyline Ridge Neighbors

### EXISTING PLANNING DOCUMENTS

1. *Forest Stand Management Recommendations; Metro's Agency Creek and Ennis Creek Tracts*, a forest stand assessment conducted by Trout Mountain Forestry in 2012. The document is located at: <M:\PN\Regional Properties\Forest Park Connections TA\Stewardship-Property Management\Stand Mgt.>



2. An assessment of pre-commercial thinning options for the site, including recommendations, was conducted by Trout Mountain Forestry in 2013/2014. A final report is pending.
3. *Greater Forest Park Conservation Initiative*, a 2013 document prepared by the Forest Park Conservancy in cooperation with the City of Portland, Metro and others. The document is located at: [M:\PN\Regional Properties\Forest Park Connections TA\Stewardship-Property Management\Forest Park\GFPCI\\_Report](M:\PN\Regional Properties\Forest Park Connections TA\Stewardship-Property Management\Forest Park\GFPCI_Report).
4. *Forest Park Ecological Prescriptions*, a 2011 Forest Park management plan developed by the City of Portland, with input from Metro, Audubon, the Forest Park Conservancy and others. The document is located at: <M:\PN\Regional Properties\Forest Park Connections TA\Stewardship-Property Management\Forest Park\City of Portland, Forest Park Ecological Prescriptions>.

## SITE DESCRIPTION

The primary access points for Ennis Creek Forest are along McNamee Road. The site is dominated by hardwood, Douglas-fir and mixed hardwood/conifer forest. Most of the forest at the site is just over 20 years old, following logging and reforestation of approximately 250 acres of the site in the early 1990s. Logging roads remain, providing good access to large areas of the site. Because the site lies along the eastern side of the Tualatin Mountains, slopes are steep (30-60 percent) over much of the site. The lower/eastern edge is encumbered by railroad and utility uses, and these areas are among the most challenged by non-native weed populations.

### Soils present at Ennis Creek Forest

| MAP SOIL SYMBOL | MAP UNIT NAME    | DESCRIPTION  |
|-----------------|------------------|--|
| 17 D, E         | Goble silt loam  | Moderately well-drained soils on rolling ridgetops and convex side slopes of ridgetops.                    |
| 37 B, C         | Quatama loam     | Moderately well-drained soil on low terraces, elevation 75-400 feet.                                       |
| 55              | Wapato silt loam | Poorly drained floodplain soil. Present along lower Burlington Creek Forest in the site's northern extent. |

### Historic habitats at Ennis Creek Forest

| ~ % COVER | HABITAT TYPE          | HISTORIC HABITAT DESCRIPTION BY GLO SURVEYOR NOTES  |
|-----------|-----------------------|---|
| 100%      | Closed forest; upland | Mesic mixed conifer forest with mostly deciduous understory. May include Douglas fir, western hemlock, red cedar, grand fir, bigleaf maple, yew, dogwood, white oak, red alder. |

## RECENT MANAGEMENT HISTORY

The site has been managed with road maintenance and forest edge weed abatement priorities over the past 10-15 years. Periodic mowing along the access roads, and culvert cleaning/replacement actions as needed have been implemented. Actions to suppress English ivy infestations, primarily in the site's northeast extent, began in 2013 and are expected to continue through 2015. Forest stand assessment and complimentary pre-commercial thinning assessments were conducted in 2012 and 2013, and are expected to lead to selective thinning in 2015 to enhance forest structure, preserve maturing tree canopy, and understory native herb and shrub diversity.



## ACCESS AND RECREATION

The Parks and Natural Areas Planning group is developing a new visitor experience overview that will be added to this site conservation plan as an appendix at a later date. Metro will also develop a comprehensive plan for the site in late 2014 and early 2015.

Metro staff conducted an internal process to consider an appropriate level of access for each of its natural areas. The access designation is offered as a starting point, with the understanding that judgment will always be needed on a case-by-case basis, and indicates that some part of that site could accept people at the stated level. It does not suggest that the entire site should have that level of access.

The designated access level at Ennis Creek Forest is *Natural Area – High*. Access at this type of site is allowed and may be promoted on a site-by-site basis. Parking areas may or may not be developed at these sites to facilitate access if necessary; restrooms may be installed on a site-by-site basis; basic rules and site identification signage are standard; soft surface, mineral soil or gravel trails are formalized and wayfinding signage may be posted to channel access and protect sensitive habitat. These sites are visited weekly or bi-weekly by Metro staff to inspect for unauthorized use and to conduct maintenance. These sites could move to a Nature Park designation in the future.

At present, hikers, joggers, mountain bikers and equestrians occasionally use the old logging roads on the site.

## NATURAL RESOURCES OF SPECIAL INTEREST

With the exception of areas of heavy weed infestation along the access roads and the utility easements, the site is becoming well-represented by native cover. This site contributes to a larger block of protected forest land, including Forest Park and other Metro sites in this target area.

Maturing canopy-producing trees have begun to shade-suppress the extensive non-native blackberry infestations that dominated cover at the site following logging in the early 1990s. Isolated Oregon oak clusters occur at the site, primarily along the railroad and interface with lower residential properties.

A thorough ecological inventory and assessment has not been done for the site. Listed and rare species, such as northern red-legged frog and others almost certainly occur at the site.

### Rare species known to occur at Ennis Creek Forest

|  | ORBIC<br>LIST | FEDERAL<br>STATUS | URBANIZING FLORA (2009) |
|--|---------------|-------------------|-------------------------|
| <i>No documented occurrences of rare species, though species like red-legged frogs, Chinook salmon, steelhead, etc. seem likely.</i> | N/A           | N/A               | N/A                     |

## CONSERVATION TARGETS

There are three conservation targets for Ennis Creek Forest:

1. Upland forest
2. Riparian forest
3. Upland shrub



## CURRENT AND DESIRED FUTURE CONDITION OF CONSERVATION TARGETS

### Non-technical status and desired future condition of targets at Ennis Creek Forest

| TARGET               | CURRENT CONDITION   | DESIRED FUTURE CONDITION  |
|----------------------|---|---|
| Upland closed forest | Generally good habitat structure, with increasingly sparse but present understory of native shrubs and herbs. Canopy closure reducing understory blackberry cover. Ivy is concern needing vigilance, but Ennis Creek Forest carries a greatly reduced ivy infestation compared to Burlington Creek Forest. Edges are ongoing weed maintenance areas, especially for blackberry and broadleaf herbaceous weeds like knapweed and thistles.   | Accelerating forest stand maturation accompanied by increase in forest floor wood accumulations, native understory diversity and cover, and increased snag and wildlife trees. A reduction in edge weed cover, and eradication or near total control of ivy and other shade-tolerant system modifying weeds.  |
| Riparian forest      | Generally good, although areas of erosion and weed establishment are a problem. Better assessment of this habitat at the site is needed.  | Opportunities to enhance stream canopy cover/shading, % native vegetation cover, and improve instream structure are likely present. Further investigation and planning necessary before associated project can be implemented.  |
| Upland shrub         | <p>These units are generally associated with the utility corridors. Condition varies throughout the site, with some areas in good to very good condition with well-established native cover and limited non-native infestations, to areas with heavy blackberry and Scots broom needing intensive management.</p> <p>This habitat also includes the open fields near the rental house and the small 4-acre elk meadow on the southwest portion of the site. The unit is currently dominated by non-native herbs and grasses, and fringed with lingering blackberry.</p> | <p>Desired conditions are for native shrubs and herbs to dominate cover with a limited presence of non-native plant species that are not displacing natives, and can be controlled with occasional weed abatement every 3-5 years.</p> <p>Desired condition for the open fields is one representing greater native grass and forb cover to provide open grazing areas for elk. Occasional maintenance mowing and spot spraying should be the only management needed, every 3-5 years to control blackberry and broadleaf weeds. Long term natural recruitment of trees and shrubs may move this conservation target towards upland closed forest.</p> |



### Key ecological attributes for upland forest at Ennis Creek Forest

| CATEGORY          | KEA   | INDICATOR  | ----- INDICATOR RATING -----                                     |  |  |
|-------------------|---|--|--|--|--|
|                   |   |  | POOR   | FAIR                                       | GOOD   |
| Condition         | Native tree and shrub richness                    | Number of native tree and shrub species per acre   | <5 species per 0.4 ha (1 ac)                                     | 5-8 species 0.4 ha (1 ac)                  | 8-12 species per 0.4 ha (1 ac)   |
| Condition         | Vegetative structure: native tree and shrub layer | % native tree and shrub canopy cover (combined)  | <25% cover   | 25-50% cover                               | 50-75% cover   |
| Condition         | Mature trees                                      | Number and size (dbh) of species such as Douglas fir, western red cedar, western hemlock and grand fir | Mature trees lacking   | <3 per ac with dbh >24 in                  | 3-5 per ac with dbh >24 in   |
| Condition         | Standing and downed dead trees                    | Average # snags and large wood (> 50 cm, or 20 in, DBH) per acre                                       | < 5 snags and <5% down wood                                      | 5-11 snags and 5-10% down wood             | 12-18 snags and 10-20% down wood with moderate variety of size and age classes |
| Landscape context | Edge condition                                    | % of edge bordered by natural habitats and/or managed for conservation                                 | Patch surrounded by non-natural habitats (0-25% natural habitat) | 25%+ of patch bordered by natural habitats | 50-75% of patch bordered by natural habitats or managed for conservation       |

\*Desired future condition

### Key ecological attributes for riparian forest (streams or rivers) at Ennis Creek Forest

| CATEGORY    | KEA                              | INDICATOR                  | ----- INDICATOR RATING -----  |  |  |
|-------------|----------------------------------|----------------------------|---|--|--|
|             |                                  |                            | POOR  | FAIR   | GOOD   |
| Condition   | Vegetative structure: tree layer | % native tree canopy cover | <20% cover  | 20-30% cover   | 30-40% cover   |
| Condition** | Riparian habitat continuity      | Gaps in woody vegetation   | >2 gaps >50 m (55 yards)<br>OR<br>>3 or more 25-50 m (27-55 yards) gaps | 1 or 2 gaps >50 m (54 yards)<br>OR<br>2 or more gaps between 15-25 m (16-27 yards) | 1, 25-50 m (27-55 y) gap<br>OR<br>2 or more gaps between 15-25 m (16-27 yards) |

\*Desired future condition

\*\* This KEA may not be appropriate where native turtles are present, because nesting turtles require some open habitat. Patches of bare ground may



### Key ecological attributes for upland shrub habitat at Ennis Creek Forest

| CATEGORY  | KEA                               | INDICATOR                       | ----- INDICATOR RATING -----   |                                 |                                 |
|-----------|-----------------------------------|---------------------------------|--------------------------------|---------------------------------|---------------------------------|
|           |                                   |                                 | POOR                           | FAIR                            | GOOD                            |
| Condition | Vegetative structure: shrub layer | % native shrub canopy cover     | <10% cover                     | 10-25% cover                    | 25-50%                          |
| Condition | Native shrub richness             | # native shrub species per acre | <2 species per 0.4 ha (1 acre) | 2-5 species per 0.4 ha (1 acre) | 6-9 species per 0.4 ha (1 acre) |

\*Desired future condition

### THREATS TO CONSERVATION TARGETS AT ENNIS CREEK FOREST

Ennis Creek Forest is primarily threatened by factors that limit forest stand health (overstocking, disease, non-native along property edges, along the more open, logging/access roads and public roads, and under and adjacent to the utility comprehensive plan, scheduled for 2016. Resulting public access increases and associative infrastructure, if they occur

#### Threats to conservation targets at Ennis Creek Forest

| CONSERVATION TARGET  | STRESS (DEGRADED KEA)                 | SEVERITY  | SCOPE    | OVERALL STRESS RANK | SOURCE (THREAT)   |
|----------------------|---------------------------------------|-----------|----------|---------------------|---|
| Upland forest        | Forest stand structure – mature trees | High      | High     | High                | Overstocking competition                                    |
| Upland shrub habitat | Vegetative structure: shrub layer     | Very High | High     | Very High           | Non-native shrub species (e.g. blackberry)                  |
| Riparian vegetation  | Canopy cover and continuity           | Moderate  | Moderate | Moderate            | Fragmentation, previous logging, loss of native shrub cover |



## Climate change considerations

Climate change is anticipated to affect summer temperatures and availability of water in summer. Other indirect effects of climate change may include range shifts of plants and animals, some native to North America and some not, and increased competition by these species. It is possible that climate change may touch every key ecological attribute, though effects on some KEAs may be more important than others.

### Direct effects that may occur

- Increased summer temperatures
- Increased severity of winter rain events
- Decreased water availability in summer

### Indirect effects that may occur

- Increased risk of wildfire in hotter, dryer summers
- Range shifts by undesirable plants increasing competition
- Disease introductions and/or increased vulnerability to disease
- Loss of synchronicity of plant reproduction and pollinators
- Loss of synchronicity of resident and migratory animals and food sources (e.g., insect hatches)
- Increased erosion in streams caused by the flashier winter rain events
- In upland forests, plant growth and survival may be affected by increased summer temperatures and reduced water availability in summer.

## STRATEGIC ACTIONS

Enhancement and management strategies recommended for the site target improvements to forest structure, vegetation diversity, and non-native species suppression. Priority actions are described below.

### List of proposed strategies at Ennis Creek Forest

| STRATEGY   | SOURCES OF STRESS IT ADDRESSES  | FOCAL CONSERVATION TARGETS/KEAS AFFECTED  | WHY IS IT IMPORTANT AND ANY TIMING ISSUES   | MEASURE(S) OF SUCCESS                     | RANK   |
|--|---|---|---|---|--------|
| Treat exotics, especially <i>Rubus armeniacus</i> and <i>Hedera helix</i>  | Competition from exotic plants  | Upland forest: % native tree and shrub canopy cover (combined)<br>Upland shrub: % native shrub canopy cover | Periodic treatments of certain exotics are essential to avoid losing native plants                                    | Establish and maintain KEA rating of Good | Medium |
| Selectively thin upland forest patches accessible to machine harvest or affordable chainsaw thinning during next 2-3 years | Reduces over-stocking that is causing loss of living tree canopy and understory native vegetation diversity | Upland forest: Number of native tree and shrub species per acre   | This strategy will implement a pre-commercial thinning action recommended by the 2012 Forest Stand Management plan    | Visual assessment/ KEA                    | High   |
| Increase forest understory diversity of upland forests   | Habitat simplicity; resiliency to climate change  | % native tree and shrub canopy cover  | Enhances resiliency to climate change while providing better wildlife habitat, forest soil benefits, weed suppression | Visual assessment/ KEA                    | Medium |



| STRATEGY                                     | SOURCES OF STRESS IT ADDRESSES | FOCAL CONSERVATION TARGETS/KEAS AFFECTED | WHY IS IT IMPORTANT AND ANY TIMING ISSUES | MEASURE(S) OF SUCCESS  | RANK   |
|--|--------------------------------|--|---|------------------------|--------|
| Reduce non-native cover in upland shrublands | Non-native species competition | % native canopy cover                    |   | Visual assessment/ KEA | Medium |

**Strategy ranking:**

**High:** must do within 5 years to protect target viability

**Medium:** target will persist without it but will degrade over 5-10 years or require additional future management

**Low:** addresses a non-critical threat or one that is unlikely to threaten target viability within 10 years

## SPECIFIC ACTIONS AND FUNDING REQUIREMENTS

Enhancement and management strategies, as they pertain to the site's conservation targets, are described below.

### Specific actions to implement strategies tied to conservation targets at Ennis Creek Forest

| STRATEGY  | TARGET   | PRIORITY (HOW SOON)        | SPECIFIC TASKS   | ESTIMATED COST  |
|---|--|----------------------------|--|---|
| Monitor spread of ash borer and work with USDA and/or ODA on treatment options                                    | Riparian forest                                  | Low – 10 years out or more | Develop response as knowledge develops   | Nominal; part of routine work   |
| Treat exotics, especially <i>Rubus armeniacus</i> ; <i>Hedera helix</i>   | Upland forest                                    | High – ASAP                | Sweep upland forest habitat to treat exotics   | \$15,000 every 5 years? (about 5 crew days)   |
| Interplant to increase understory diversity   | Upland forest                                    | Moderate – next 5 years    | Develop a plant list of desired understory species (woody and herbaceous) and interplant to introduce sustainable cover of those species   | \$25,000  |
| Selectively thin upland forest patches that are accessible to machine harvest in the next 2-3 years (~ 100 acres) | Upland forest                                    | High – next 3 years        | Implement a combination of machine and chainsaw thinning to selectively open overstocked forests to increase forests stand structure, diversity and resiliency to climate change | \$20,000, though these costs could be offset by commercial thinning revenue, or increased if commercial logging offset is limited and chainsaw thinning is required |
| Treat exotics, especially <i>Rubus armeniacus</i> ; <i>Cytisus scoparius</i>                                      | Upland shrub and forest understory post-thinning | High – next 10 years       | Targeted herbicide applications  | \$30-40,000   |
| Interplant to increase understory diversity   | Upland shrub                                     | Moderate                   | Revegetation   | \$15,000  |
| Treat exotics, especially <i>Rubus armeniacus</i>   | Riparian forest                                  | Moderate                   | Targeted herbicide applications  | \$15,000  |
| Interplant to increase understory diversity   | Riparian forest                                  | Moderate                   | Revegetation   | \$10,000  |
| Boost snags and downed wood   | Upland forest                                    | Moderate                   | Selective topping and girding/tree-falling   | \$15,000  |
| Increase instream complexity  | Riparian forest                                  | Moderate                   | Instream LWD placement   | \$20,000  |
| Increase riparian canopy and stream shading   | Riparian forest                                  | High                       | Interplanting with canopy tree species   | \$10,000  |



## **MONITORING PLAN**

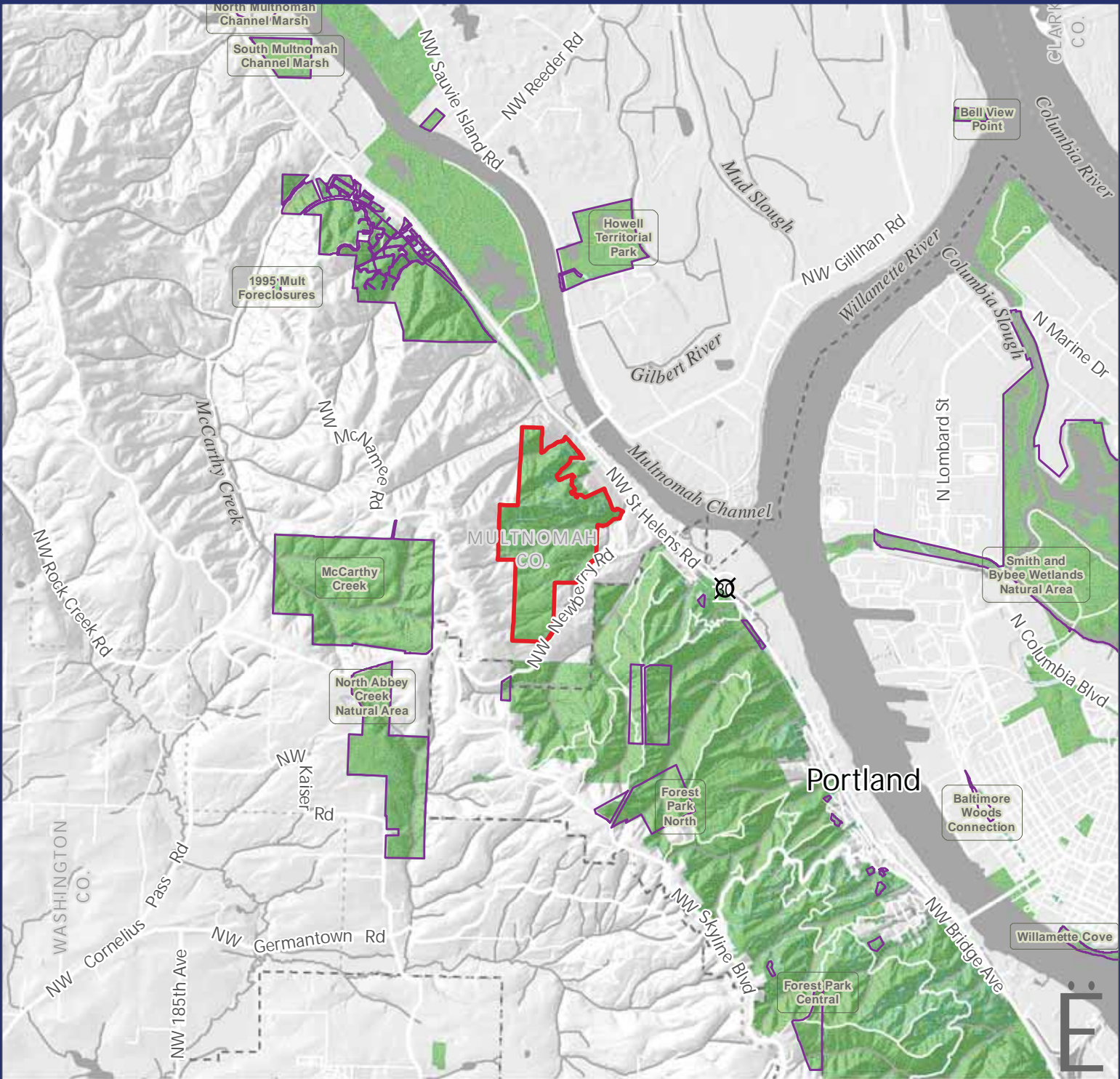
Monitoring for key ecological attributes associated with the site's conservation targets will largely be done via periodic visual assessment. In addition, periodic wildlife monitoring would be appropriate for the North Tualatin Mountains sites, focusing on long-term tracking of the avian community and periodic assessment of the terrestrial salamander population as it relates to increasing understory and large woody material improvements over time.

## **CURRENT PARTNERS, PARTNER PROJECTS AND POTENTIAL PARTNERS**

- West Multnomah Soil and Water Conservation District
- City of Portland
- Forest Park Conservancy
- Trout Mountain Forestry
- The National Audubon Society

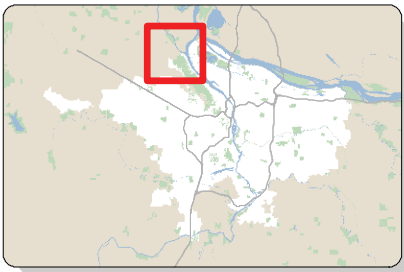


# Vicinity Map



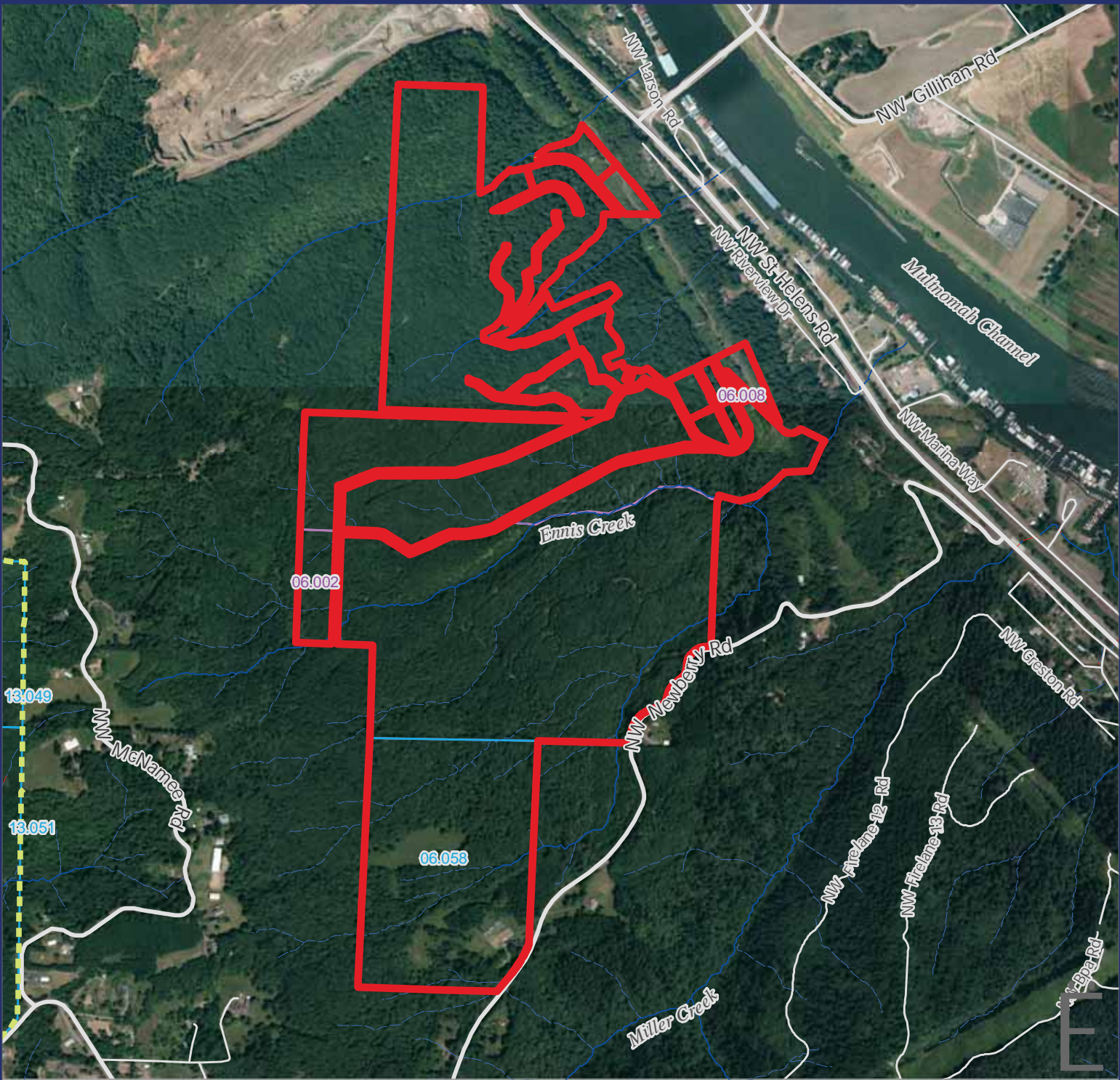
- Ennis Creek Forest site
- Other Metro sites
- Park and/or natural area


0 1 2 Miles







# Site Map




 Ennis Creek Forest site


 Other Metro sites


**Bond Measure**


 1995 Bond Measure

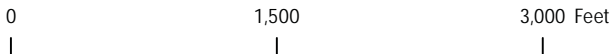
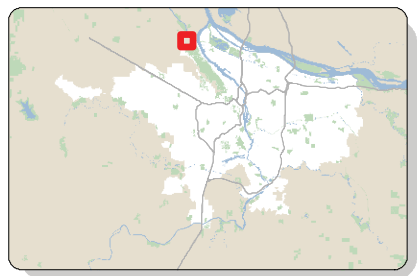
 2006 Bond Measure

**NHD Flowlines**

 Intermittent stream

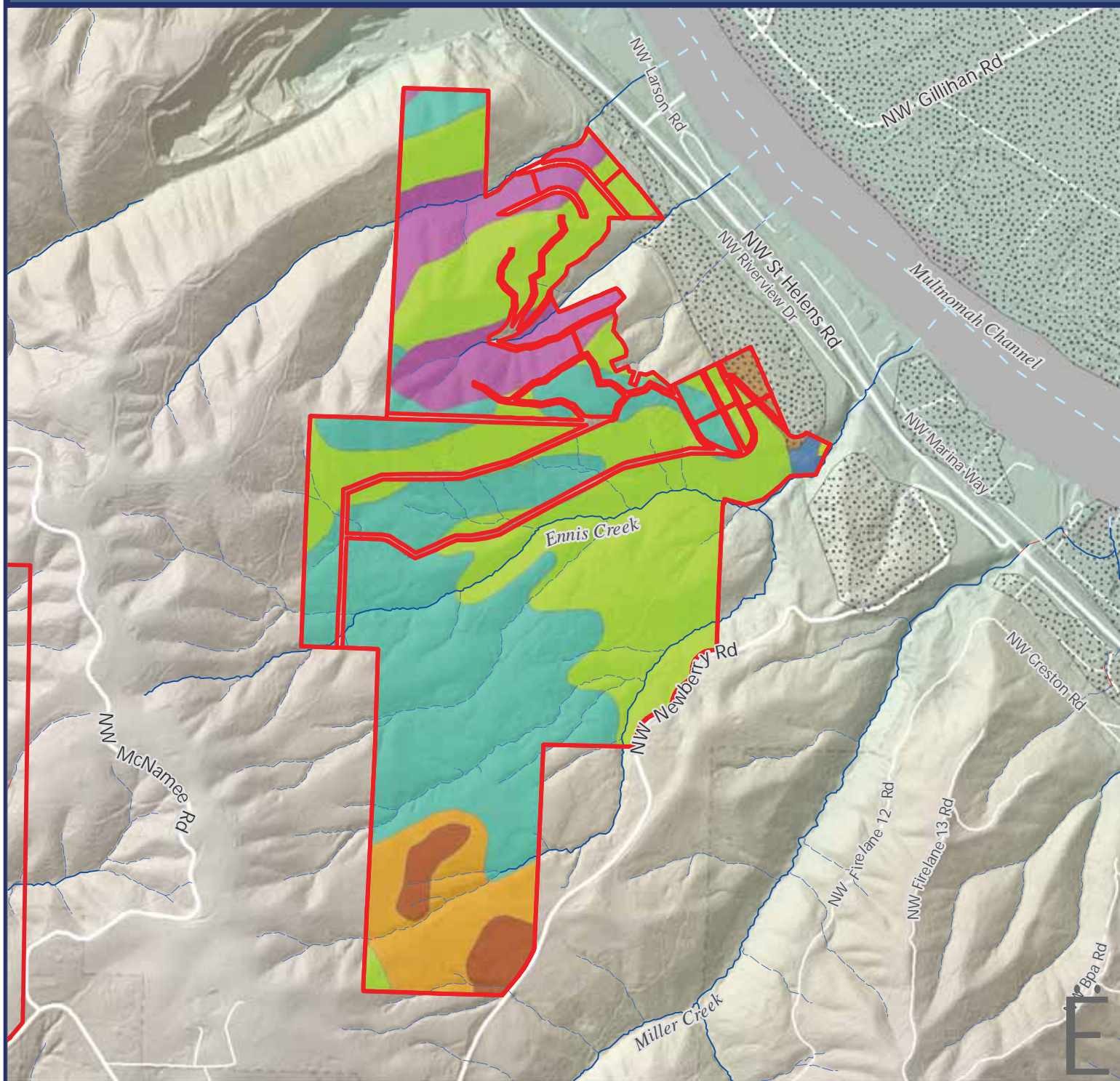
 Perennial stream

 Pipeline





# Soils



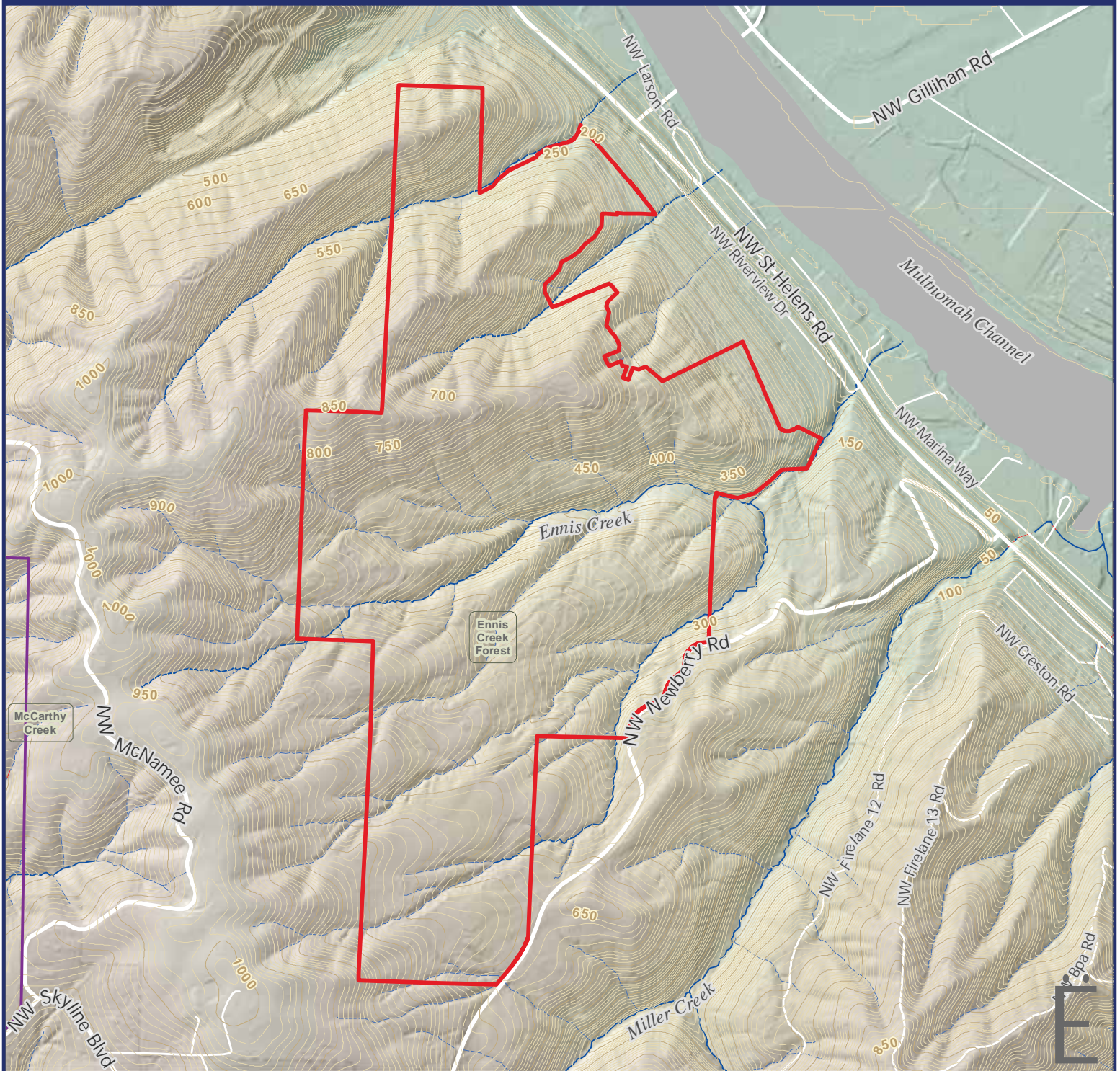
- |                         |  |  |
|-------------------------|--|--|
| Ennis Creek Forest site | <b>NRCS soils</b>                          | Haplumbrepts, moderately steep                     |
| Other Metro sites       | Cascade silt loam, 15 to 30 percent slopes | Haplumbrepts, very steep                           |
| Hydric soils            | Cascade silt loam, 8 to 15 percent slopes  | Quatama loam, 15 to 30 percent slopes              |
|                         | Goble silt loam, 15 to 30 percent slopes   | Urban land-Quatama complex, 8 to 15 percent slopes |
|                         | Goble silt loam, 30 to 60 percent slopes   | Would very gravelly loam, 30 to 70 percent slopes  |

0 1,500 3,000 Feet





# Topography



Ennis Creek Forest site



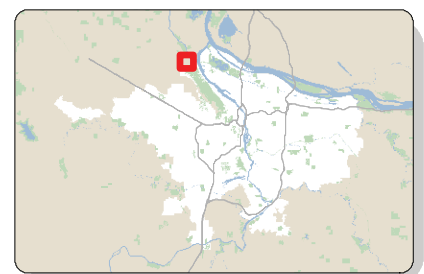
Other Metro sites

## NHD Flowlines

Intermittent stream

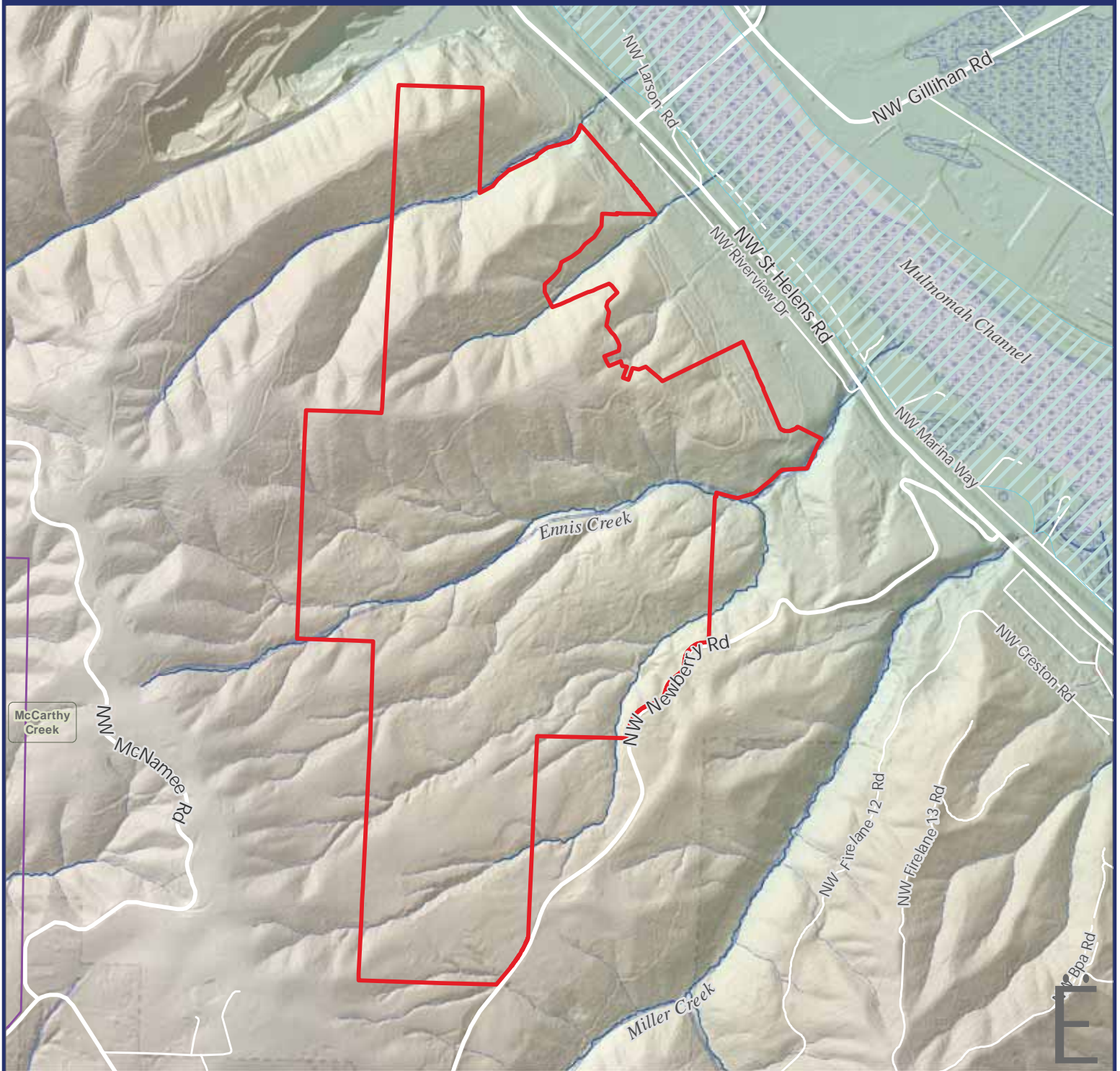
Perennial stream

Pipeline





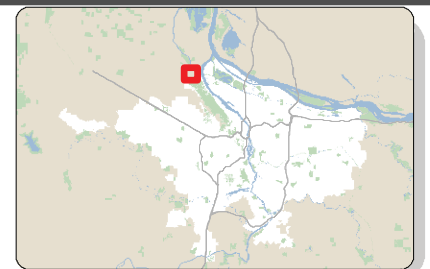
# Hydrology



- Ennis Creek Forest site
- Other Metro sites
- 100 year floodplain
- Wetlands

## NHD Flowlines

- Intermittent stream
- Perennial stream
- Pipeline



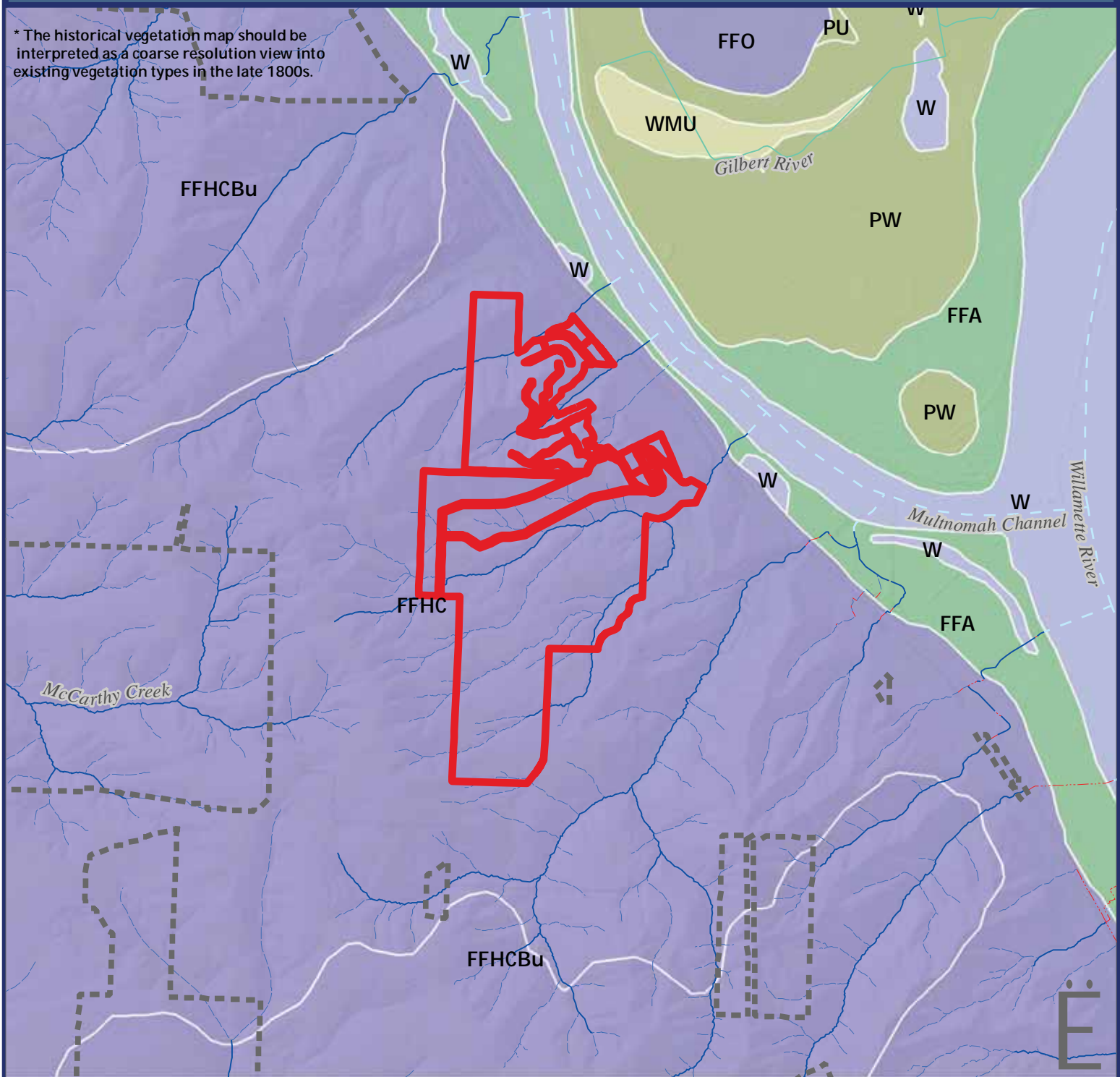
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# Historical Vegetation (1851-1910)

\* The historical vegetation map should be interpreted as a coarse resolution view into existing vegetation types in the late 1800s.



- Ennis Creek Forest site
- Other Metro sites

## Historical vegetation

- Closed forest; Riparian & Wetland
- Closed forest; Upland
- Emergent wetlands
- Prairie
- Water

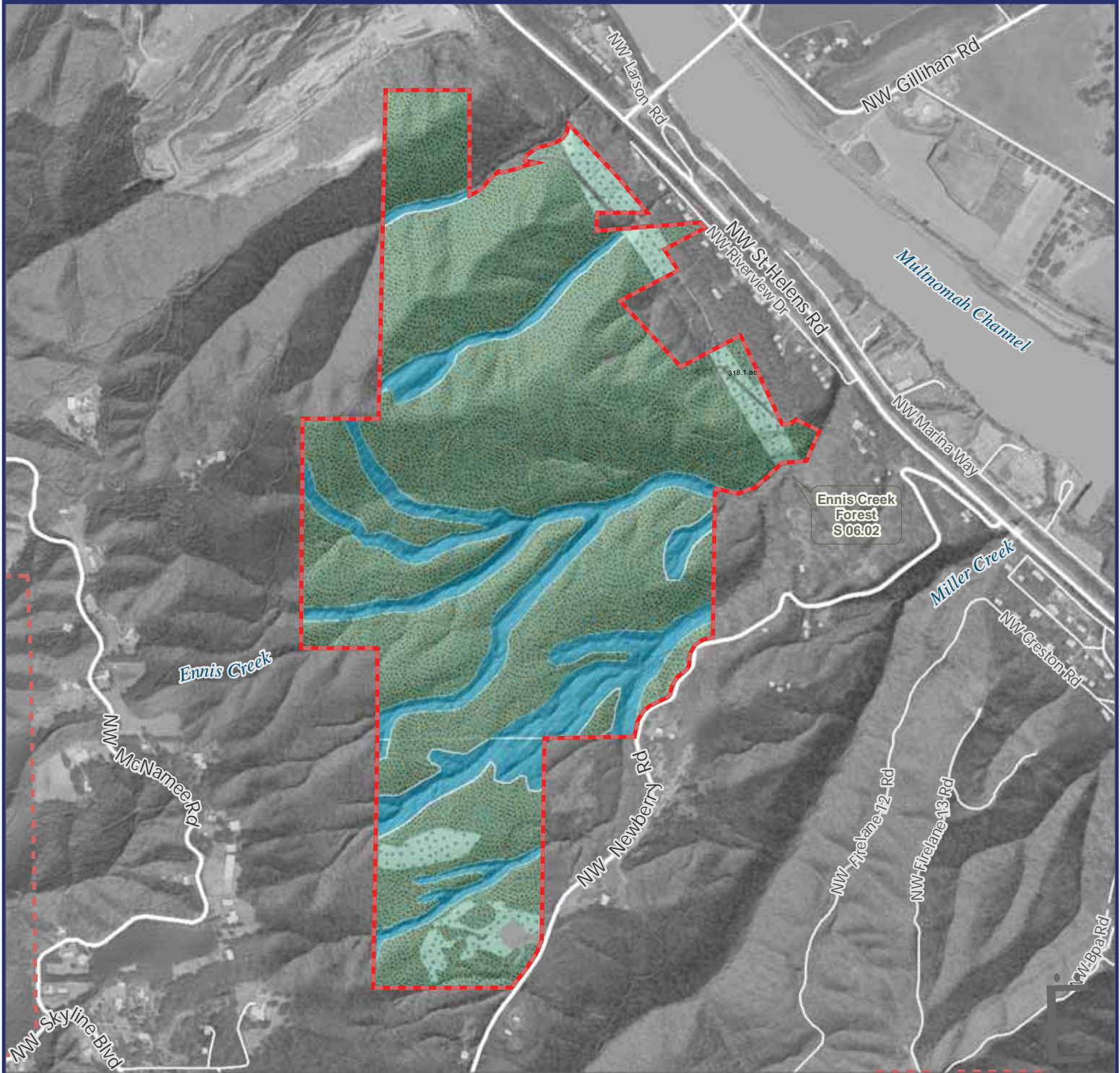
\* Labels refer to vegetation subclasses.  
Detailed descriptions can be found in  
T:\OBMO\GIS\DATA\_V\vegetation\Historical

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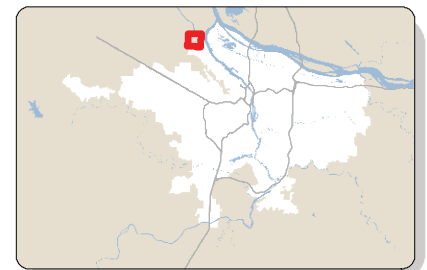


# CURRENT COVER



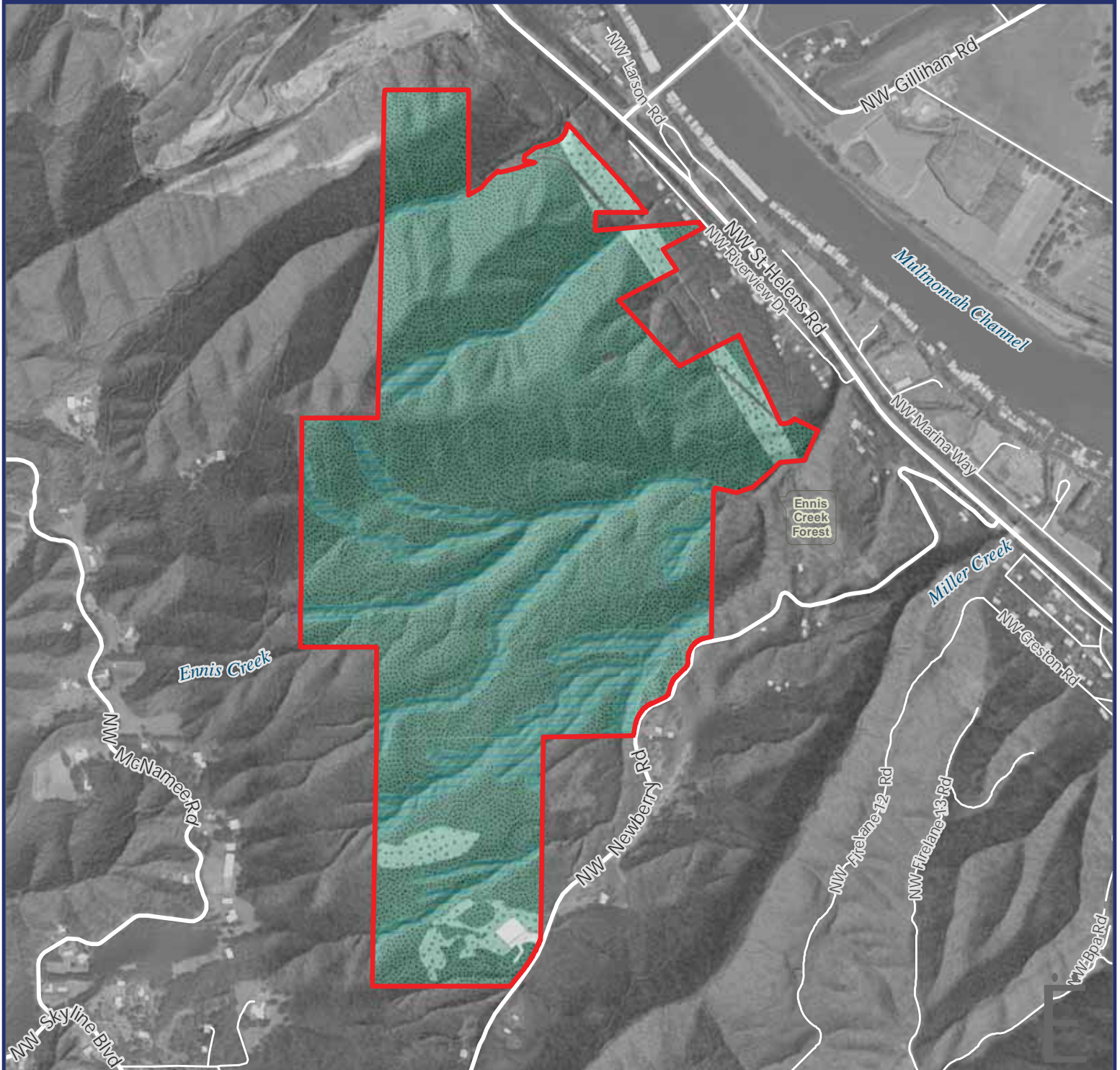
- |  |                         |  |                               |
|--|-------------------------|--|-------------------------------|
|  | Ennis Creek Forest site |  | Developed - (impervious)      |
|  | Other Metro sites       |  | Riparian forest               |
|  |                         |  | Upland forest - mixed         |
|  |                         |  | Upland forest - shrub (stage) |

0 1,300 2,600 Feet



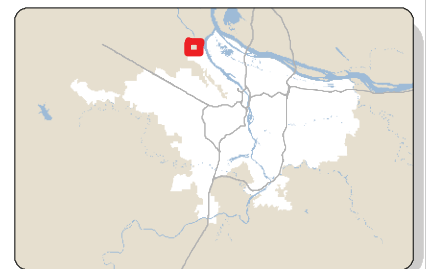


# CONSERVATION TARGETS



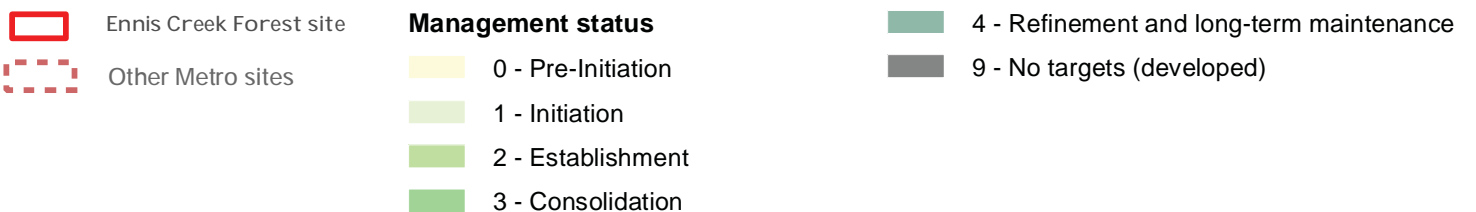
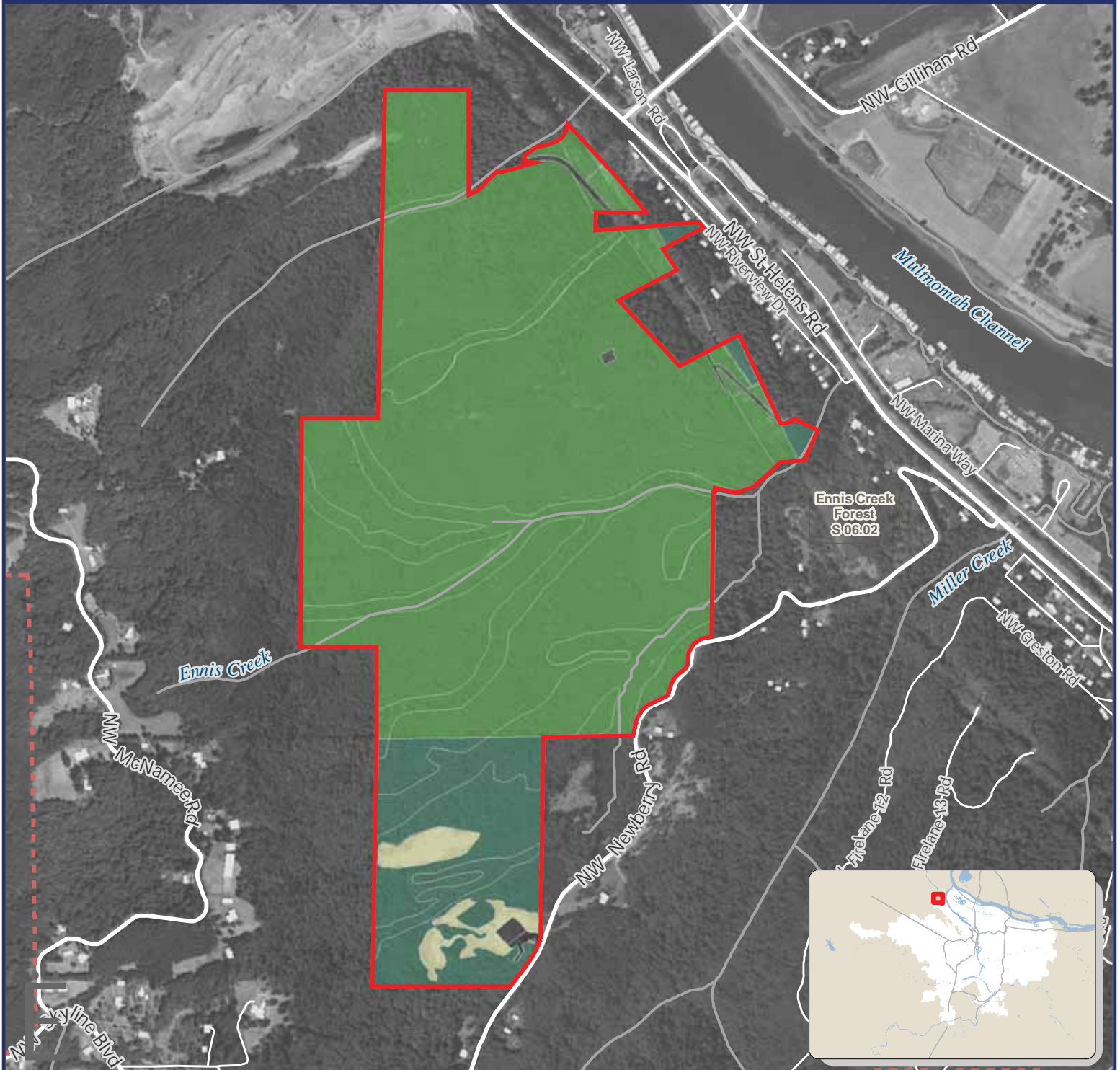
- |   |  |   |               |
|---|--|---|---------------|
|   | Ennis Creek Forest site                    |  | No targets    |
|  | Riparian forest                            |  | Upland forest |
|  | Upland forest - shrub (early successional) |   |               |

0 1,300 2,600 Feet





# MANAGEMENT STATUS



0 1,300 2,600 Feet





## CHAPTER 3 | McCARTHY CREEK NATURAL AREA

### INTRODUCTION

The 400-acre McCarthy Creek Natural Area is part of the North Tualatin Mountains focal area and is located on the eastern face of the northern Tualatin Mountains, north of Forest Park and north of Skyline Road in west Multnomah County.

The area surrounding the McCarthy Creek Natural Area contains a mixture of land uses including residential, schools, agriculture and timber harvest. Metro's Burlington Creek Forest Natural Area (including a portion of the lower McCarthy Creek watershed) to the northeast, Ennis Creek Natural Area to the southeast, and North Abbey Creek Natural Area to the south are all in close proximity to the site. The city of Portland's Forest Park lies south of the site (see vicinity map).

### PLANNING AREA

Although McCarthy Creek's planning area is defined by the site's boundaries, i.e., Metro ownership, there are large expanses of privately and publicly owned properties nearby that share habitat features with the forest and influence its potential ecological viability and larger landscape value. These properties are important to the development of effective conservation strategies for McCarthy Creek, but detailed evaluations of their stewardship classification, targets, etc. are beyond the scope of this plan.

#### Key staff

Kate Holleran, natural resources scientist  
Jeff Merrill, natural resources scientist  
Ryan Jones, natural resources specialist  
Jonathan Soll, conservation science manager  
Katy Weil, wildlife monitoring coordinator  
Olena Turula, parks and natural areas planner  
Robert Spurlock, parks and natural areas planner  
Laurie Wulf, property management specialist  
Bonnie Lyn Shoffner, restoration volunteer coordinator

#### Key private landowners

Brian Lightfoot  
Michael Baker  
Forest Park Conservancy  
Skyline Ridge Neighbors

### EXISTING PLANNING DOCUMENTS

All documents are available from Metro on request:

*McCarthy Creek Stabilization Plan (2012)* documents the activities that will be implemented as part of the new acquisition stabilization process.

*McCarthy Creek Road Management Plan (2012)* documents road management options and recommendations for the natural area.



*Greater Forest Park Conservation Initiative*, a 2013 document prepared by the Forest Park Conservancy in cooperation with the City of Portland, Metro and others.

*Forest Park Ecological Prescriptions*, a 2011 Forest Park management plan developed by the City of Portland, with input from Metro, Audubon Society, Forest Park Conservancy and others.

## SITE DESCRIPTION

The entire site sits within the upper McCarthy Creek watershed. Most of the forests at the site are less than 30 years old, following logging and reforestation of approximately 350 acres in the early 1990s. Slightly older forest structure exists in the narrow riparian zones protected from logging. Logging roads exist, providing access to the southeastern corner. The north-south road crosses numerous small drainages and is in a degraded condition, with multiple slumps and failing culverts. Current plans call for decommissioning roads north of the loop road. Slopes are steep (30-60 percent) over much of the site.

The primary access points for the McCarthy Creek Natural Area are along Skyline Road. Secondary access points are on McNamee Road and Pauley Road. The site is dominated by hardwood, Douglas fir and mixed conifer/hardwood forests.

### Soils present at McCarthy Creek

| MAP SOIL SYMBOL | MAP UNIT NAME     | DESCRIPTION   |
|-----------------|-------------------|---|
| 17 C, E         | Goble silt loam   | Moderately well-drained soils on low terraces, rolling ridgetops and convex side slopes of ridgetops. |
| 7 C, D, E       | Cascade silt loam | Varying slopes, highly erodible.  |

### Historic habitats at McCarthy Creek

| ~ % COVER | HABITAT TYPE          | HISTORIC HABITAT DESCRIPTION BY GLO SURVEYOR NOTES  |
|-----------|-----------------------|---|
| 100%      | Closed forest; upland | Mesic mixed conifer forest with mostly deciduous understory. May include Douglas fir, western hemlock, red cedar, grand fir, bigleaf maple, yew, dogwood, white oak, red alder. |

## RECENT MANAGEMENT HISTORY

Recent site management has focused on implementation of the stabilization plan with an emphasis on weed control, forest stand assessments and road management. Road decommissioning is tentatively scheduled for 2016. The forest stand assessment currently being conducted is expected to lead to selective thinning in 2015-2017 to enhance forest structure, preserve maturing tree canopy and understory native herb and shrub diversity.

### Management summary 2012-2014

| YEAR | TREATMENT  |
|------|--|
| 2012 | Road ROW mowing<br>Field mowing<br>Blackberry treatment<br>Scotch broom treatment<br>Road assessment |



| YEAR | TREATMENT  |
|------|--|
| 2013 | Road ROW mowing<br>Blackberry and other broadleaf treatments<br>Boundary survey<br>Early seral habitat enhancement |
| 2014 | Road ROW mowing<br>Bare root planting<br>Seedling release circle spray<br>Forest stand assessment (ongoing)        |

## ACCESS AND RECREATION

### Current use

The loop road just north of Skyline Road is listed in a local hiking guide. Though no formal use surveys have been conducted, the loop road appears to receive low use by hikers, dog walkers and to a lesser degree off-road cyclists (mountain bikers). Parking is limited to 2-3 cars at the entrance gate. Some unauthorized equestrian use and off-road vehicle use has been observed.

### Comprehensive plan

The Parks and Natural Areas Planning group, in collaboration with the Conservation, Communications, Education and Visitor Services teams, is currently leading the development of a comprehensive plan for the four North Tualatin Mountains sites, which is expected to be completed in fall 2015. The plan will identify access and visitor experience opportunities at the four sites and provide a recommendation for how to balance access improvements across the sites while protecting habitat and water quality. McCarthy Creek Natural Area provides opportunity to support activities such as hiking, off-road cycling, bird watching, being in nature, scenic viewing and others. Two access points are being considered. If planned, a day use area at one of these will likely include a parking area, picnic shelter, restrooms, kiosk and trailheads; a secondary access could include a small ADA parking lot.

## NATURAL RESOURCES OF SPECIAL INTEREST

A young Douglas fir forest is not a regionally rare habitat type. However, the size of this natural area (400 acres) and its proximity to other large blocks of forested habitat make it a regionally important site. Within the 400-acre site there are over 250 acres of interior forest habitat. Interior forest habitats have relatively stable habitat and low disturbance conditions and provide critical habitat for species sensitive to edge conditions such as predation and parasitism.

Additionally, the natural area protects approximately 15 percent of the McCarthy Creek watershed and many of the upper watershed headwater streams. A 20-acre patch of forest dominated by Douglas fir, Western red cedar and big leaf maple in the northwest corner of the natural area and remnant older trees in the narrow riparian zones provide some structural diversity. Legacy logging roads and failing culverts exist throughout the upper watershed and are a priority for decommissioning to reduce risks of failures delivering sediment to the streams. Isolated Oregon oak clusters occur at the site, as well as small groups of black cottonwood.

A thorough ecological inventory and assessment has not been done for the site. Listed and rare species, such as Chinook salmon (juvenile Chinook salmon were detected during fish surveys on



McCarthy Creek in 2012), northern red-legged frog and others almost certainly occur in McCarthy Creek and in more mature forests. Coho and winter steelhead are present in lower McCarthy Creek.

#### Rare species known to occur at McCarthy Creek

|   | ORBIC<br>LIST | FEDERAL<br>STATUS | URBANIZING FLORA (2009) |
|---|---------------|-------------------|-------------------------|
| <i>No documented occurrences of rare species occur at McCarthy Creek; more investigation is needed.</i> | N/A           | N/A               | N/A                     |

## CURRENT AND DESIRED FUTURE CONDITION OF CONSERVATION TARGETS

### Non-technical status and desired future condition of targets at McCarthy Creek

| TARGET               | CURRENT CONDITION   | DESIRED FUTURE CONDITION  |
|----------------------|---|---|
| Upland closed forest | Simplified habitat structure due to previous management as a tree farm. The site lacks large trees, snags and down wood, and retains a mosaic of native understory and sparse understory due to shade and/or blackberry competition. Current forest stand assessment process should provide a better understanding of understory conditions. Canopy closure is reducing understory blackberry cover as well as native understory diversity. Holly and ivy are present and should be treated as part of any habitat restoration project. Edges will be ongoing weed maintenance areas. | Late successional forest habitat within forest floor wood accumulations, native understory diversity and cover, and increased snag and wildlife trees. Reduced edge weed cover and control of ivy and other shade-tolerant system modifying weeds.  |
| Riparian forest      | Generally in fair condition though lacks large trees and dead wood. Riparian forests are composed of narrow buffers of older forest along streams bordered by young, mixed forests.   | Late successional forest habitat with increases in forest floor wood accumulations, native understory diversity and cover, and increased snag and wildlife trees. Opportunities to improve instream structure are likely present. Further investigation and planning are necessary before associated projects can be implemented. |
| Upland shrub         | These patches are a minor component of the site and include a 15-acre abandoned pasture that was recently planted to shrubs with a minor component of Oregon white oak, and two areas of failed conifer regeneration that have been enhanced with additional conifer removal.   | Desired conditions are for native shrubs and herbs to dominate cover with a limited presence of non-native plant species that are not displacing natives, and can be controlled with occasional weed abatement every 3-5 years.   |



### Key ecological attributes for upland forest at McCarthy Creek Natural Area

| CATEGORY         | KEA                            | INDICATOR  | ----- INDICATOR RATING ----- |                                |  |
|------------------|--------------------------------|--|------------------------------|--------------------------------|--|
|                  |                                |  | POOR                         | FAIR                           | GOOD   |
| <b>Size</b>      | Forested habitat patch size    | Patch size (includes native shrub patches or natural clearings)  | <12 ha (30 ac)               | 12-40 ha (30-100 ac)           | 40-61 ha (100-150 ac)  |
| <b>Condition</b> | Native tree and shrub richness | Number of native tree and shrub species per acre   | <5 species per 0.4 ha (1 ac) | 5-8 species 0.4 ha (1 ac)      | 8-12 species per 0.4 ha (1 ac)   |
| <b>Condition</b> | Mature trees                   | Number and size (dbh) of species such as Douglas fir, western red cedar, western hemlock and grand fir | Mature trees lacking         | <3 per ac with dbh >24 in      | 3-5 per ac with dbh >24 in   |
| <b>Condition</b> | Standing and downed dead trees | Average # snags and large wood (> 50 cm, or 20 in, DBH) per acre                                       | < 5 snags and <5% down wood  | 5-11 snags and 5-10% down wood | 12-18 snags and 10-20% down wood with moderate variety of size and age classes |

\*Desired future condition

### Key ecological attributes for riparian forest (streams or rivers) at McCarthy Creek Natural Area

| CATEGORY         | KEA                               | INDICATOR  | ----- INDICATOR RATING ----- |              |               |
|------------------|-----------------------------------|--|------------------------------|--------------|---------------|
|                  |                                   |  | POOR                         | FAIR         | GOOD          |
| <b>Condition</b> | Vegetative structure: shrub layer | % native shrub cover   | <10% cover                   | 10-25% cover | 25-50% cover  |
| <b>Condition</b> | Native herbaceous layer richness  | # native species of grasses, herbs, forbs and ferns, at least half of which are riparian-associated, per 0.4 ha (1 ac) | <5 species                   | 6-12 species | 12-18 species |

\*Desired future condition



### Key ecological attributes for upland shrub habitat at McCarthy Creek Natural Area

| CATEGORY  | KEA                               | INDICATOR                       | ----- INDICATOR RATING -----   |                                 |                                 |
|-----------|-----------------------------------|---------------------------------|--------------------------------|---------------------------------|---------------------------------|
|           |                                   |                                 | POOR                           | FAIR                            | GOOD                            |
| Condition | Vegetative structure: shrub layer | % native shrub canopy cover     | <10% cover                     | 10-25% cover                    | 25-50%                          |
| Condition | Native shrub richness             | # native shrub species per acre | <2 species per 0.4 ha (1 acre) | 2-5 species per 0.4 ha (1 acre) | 6-9 species per 0.4 ha (1 acre) |

\*Desired future condition

### THREATS TO CONSERVATION TARGETS AT McCARTHY CREEK NATURAL AREA

McCarthy Creek Natural Area is primarily threatened by factors that limit forest stand health (overstocking, disease, issues occur along property edges. The site also has modest, unplanned public use, which may increase in the future. Infrastructure, if they occur, would also likely result in increases in weed and human disturbance threats to native vegetation.

#### Threats at conservation targets at McCarthy Creek Natural Area

| CONSERVATION TARGET  | STRESS (DEGRADED KEA)                 | SEVERITY  | SCOPE    | OVERALL STRESS RANK | SOURCE (THREATS)  |
|----------------------|---------------------------------------|-----------|----------|---------------------|---|
| Upland forest        | Forest stand structure – mature trees | High      | High     | High                | Overstocking competition  |
| Upland shrub habitat | Vegetative structure: shrub layer     | Very High | High     | Very High           | Overstocking competition, non-native species (e.g., Scotch broom, blackberry) |
| Riparian vegetation  | Native herbaceous layer richness      | Moderate  | Moderate | Moderate            | Previous land management activities, tree farm                                |



## Climate change considerations

Climate change is anticipated to affect summer temperatures and availability of water in summer. Other indirect effects of climate change may include range shifts of plants and animals, some native to North America and some not, and increased competition by these species. It is possible that climate change may touch every key ecological attribute, though effects on some KEAs may be more important than others.

### Direct effects that may occur

- Increased summer temperatures
- Increased severity of winter rain events
- Decreased water availability in summer

### Indirect effects that may occur

- Increased risk of wildfire in hotter, dryer summers
- Range shifts by undesirable plants increasing competition
- Disease introductions and/or increased vulnerability to disease
- Loss of synchronicity of plant reproduction and pollinators
- Loss of synchronicity of resident and migratory animals and food sources (e.g., insect hatches)
- Increased erosion in streams caused by the flashier winter rain events
- In upland forests, plant growth and survival may be affected by increased summer temperatures and reduced water availability in summer.

## STRATEGIC ACTIONS

Enhancement and management strategies recommended for the site target improvements to forest structure, vegetation diversity and non-native species suppression. Priority actions are described below.

### List of proposed strategies at McCarthy Creek Natural Area

| STRATEGY  | SOURCES OF STRESS IT ADDRESSES  | FOCAL CONSERVATION TARGETS/KEAS AFFECTED   | WHY IT IS IMPORTANT AND ANY TIMING ISSUES   | MEASURE(S) OF SUCCESS                     | RANK   |
|---|---|--|---|---|--------|
| Treat exotics, especially <i>Rubus armeniacus</i> and <i>Hedera helix</i> .<br>Survey and treat EDRR species and system-changing invasives. | Competition from exotic plants.   | Riparian forest: % native shrub and herbaceous cover (combined).<br>Upland shrub: % native shrub canopy cover. | Periodic treatments of certain exotics are essential to avoid losing native plants.                                 | Establish and maintain KEA rating of Good | Medium |
| Selectively thin upland forest patches that are accessible to machine harvest or affordable chainsaw thinning during the next 2-3 years.    | Reduces overstocking that is causing a loss of living tree canopy and understory native vegetation diversity. | Upland forest: number and size of native tree and shrub species per acre.                                      | This strategy will implement a pre-commercial thinning action recommended by the 2012 Forest Stand Management plan. | Visual assessment/ KEA                    | High   |



| STRATEGY  | SOURCES OF STRESS IT ADDRESSES                                  | FOCAL CONSERVATION TARGETS/KEAS AFFECTED | WHY IT IS IMPORTANT AND ANY TIMING ISSUES  | MEASURE(S) OF SUCCESS   | RANK   |
|---|---|--|--|---|--------|
| Decommission legacy logging roads not needed for site management. | Delivery of sediment to streams, barriers to wildlife movement. | Native fish.                             | Legacy roads and failing culverts are a source of sediment to McCarthy Creek.  | Miles of road decommissioned and number of culverts removed or improved | High   |
| Increase forest understory diversity of upland forests            | Habitat simplicity; resiliency to climate change.               | % native tree and shrub richness.        | Enhances resiliency to climate change while providing better wildlife habitat, forest soil benefits, weed suppression. | Visual assessment/ KEA  | Medium |
| Reduce non-native cover in upland shrublands                      | Non-native species competition.                                 | % native canopy cover.                   |  | Visual assessment /KEA  | Medium |

**Strategy ranking:**

**High:** must do within 5 years to protect target viability

**Medium:** target will persist without it but will degrade over 5-10 years or require additional future management

**Low:** addresses a non-critical threat or one that is unlikely to threaten target viability within 10 years

## SPECIFIC ACTIONS AND FUNDING REQUIREMENTS

Enhancement and management strategies, as they pertain to the conservation targets, are described below.

### Specific actions to implement strategies tied to conservation targets at McCarthy Creek Natural Area

| STRATEGY   | TARGET                         | PRIORITY (HOW SOON) | SPECIFIC TASKS   | ESTIMATED COST                    |
|--|--------------------------------|---------------------|--|-----------------------------------|
| Selectively thin forest stands to promote late successional structure and improve function | Upland and riparian forest     | High – next 3 years | Implement a combination of machine and chainsaw thinning to selectively open overstocked forests to increase forest stand structure, diversity and resiliency to climate change. | \$40,000-65,000                   |
| Decommission legacy roads, repair or replace any remaining culverts                        | Native fish and water quality* | High                | Implement road management recommendations developed by AKS Engineering.  | \$100,000-150,000                 |
| Treat exotics, especially the non-native ivies, clematis and holly                         | All                            | Moderate            | Forest stand assessment currently in progress may provide more information about scope ivy and holly presence. Sweep upland forest habitat to treat exotics.                     | \$30,000 for the first five years |
| Interplant to increase understory diversity  | Upland forest                  | Low                 | Develop plant list of desired understory species (woody and herbaceous) and interplant to introduce sustainable cover of those species in thinned areas.                         | \$35,000                          |
| Interplant to increase understory diversity  | Upland shrub                   | High                | Re-vegetation.   | \$20,000                          |
| Boost snags and downed wood  | Upland forest                  | Moderate            | Selective topping and girding/ tree-falling, create wildlife piles as part of thinning.  | \$15,000                          |
| Increase instream complexity   | Riparian forest                | Low                 | Instream LWD placement as part of thinning   | \$30,000                          |



## MONITORING PLAN

Monitoring for key ecological attributes associated with the site's conservation targets will largely be done via periodic visual assessment. In addition, periodic wildlife monitoring would be appropriate for the North Tualatin Mountains sites, focusing on long-term tracking of the avian community and periodic assessment of the terrestrial salamander population as it relates to increasing understory and large woody material improvements over time.

## KEY STAKEHOLDERS

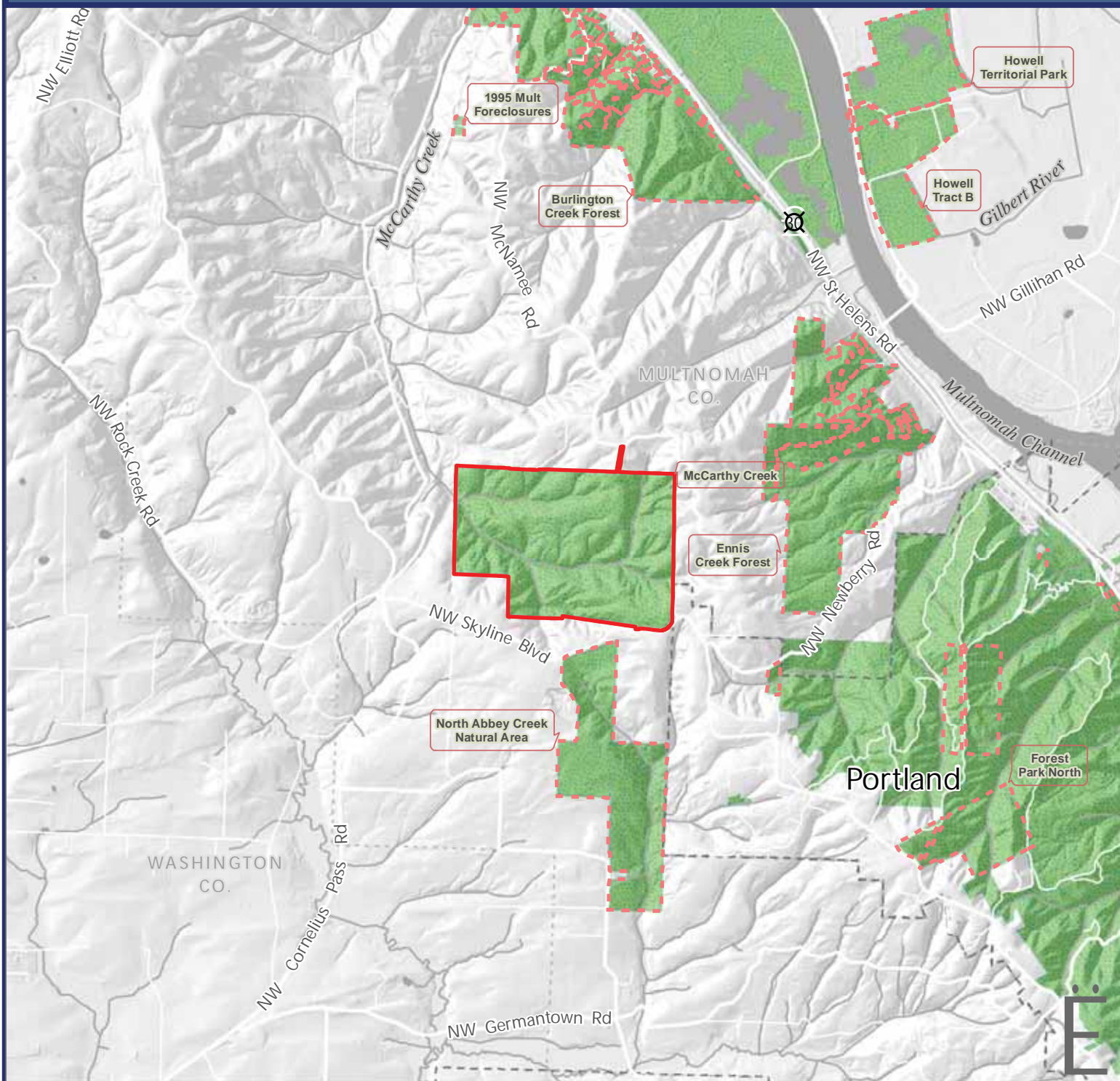
- West Multnomah Soil and Water Conservation District: Michael Ahr, [michael@wmswcd.org](mailto:michael@wmswcd.org)
- City of Portland: Kendra Peterson-Morgan, [kendra.peterson-morgan@portlandoregon.gov](mailto:kendra.peterson-morgan@portlandoregon.gov)
- Forest Park Conservancy: Renee Meyers, [renee@forestparkconservancy.org](mailto:renee@forestparkconservancy.org)
- Trout Mountain Forestry: Mike Messier, [mike@troutmountain.com](mailto:mike@troutmountain.com)

## PUBLIC INVOLVEMENT AND OUTREACH

The access off of Skyline Blvd., though parking is limited, and the loop road provide relatively easy access for small public events. McCarthy Creek Natural Area has been utilized by conservation and outdoor education groups such as TrackersNW. Skyline Elementary School has expressed an interest in exploring environmental education opportunities at the site. Self Enhancement, Inc. has utilized the nearby North Abbey Natural Area.

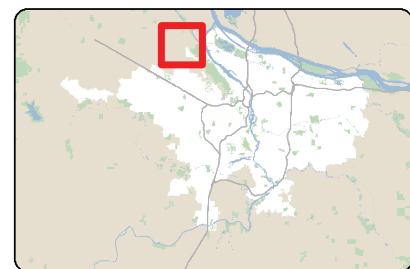


# VICINITY MAP



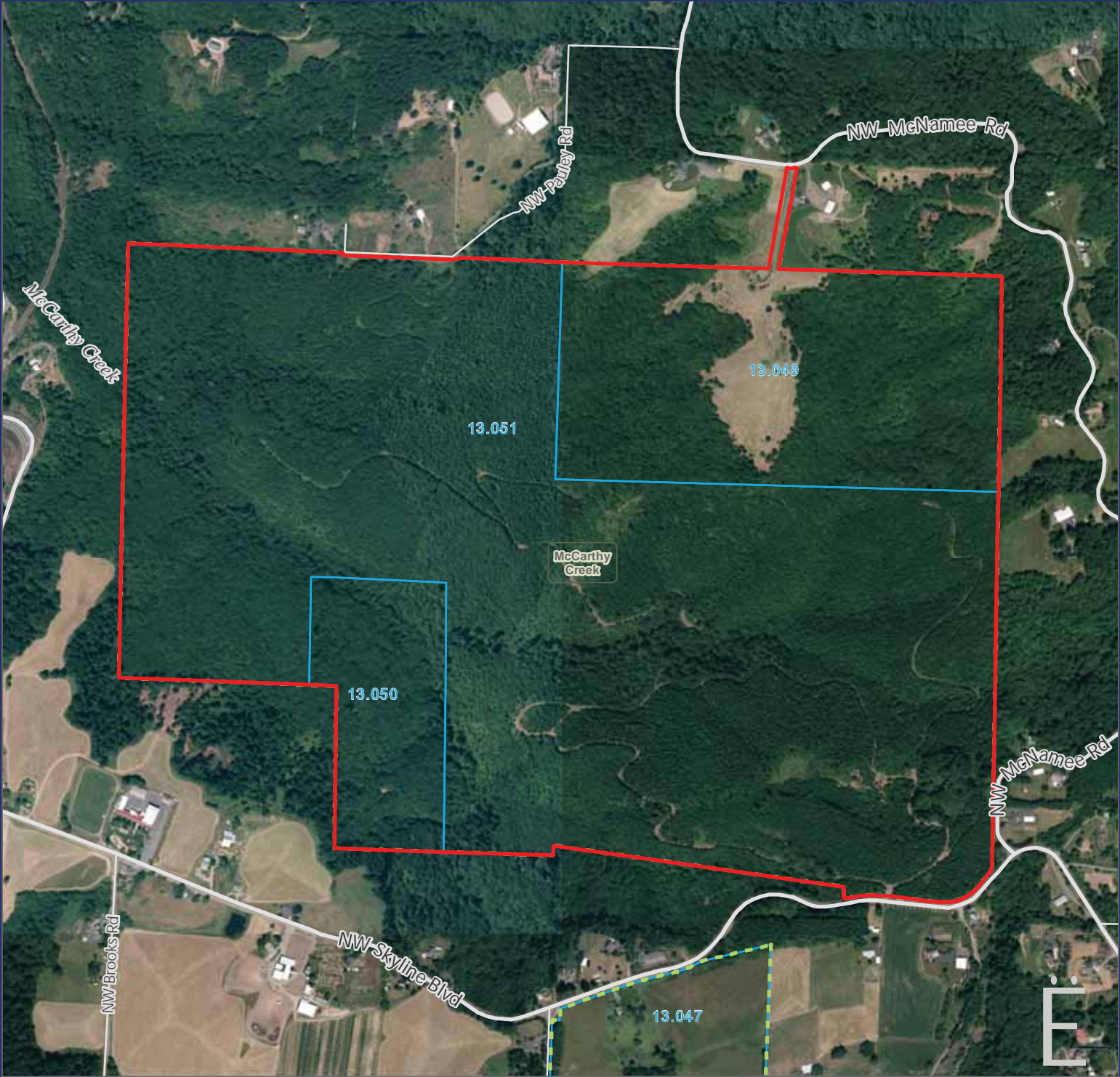
- McCarthy Creek site
- Other Metro sites
- Park and/or natural area




0 1 2 Miles

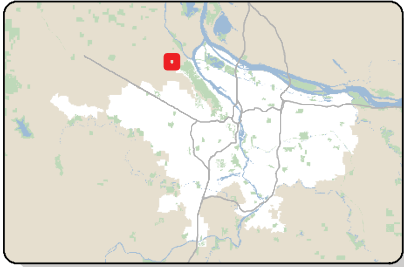




# SITE MAP



-  McCarthy Creek site
-  Other Metro sites
- Bond Measure**
-  2006 Bond Measure

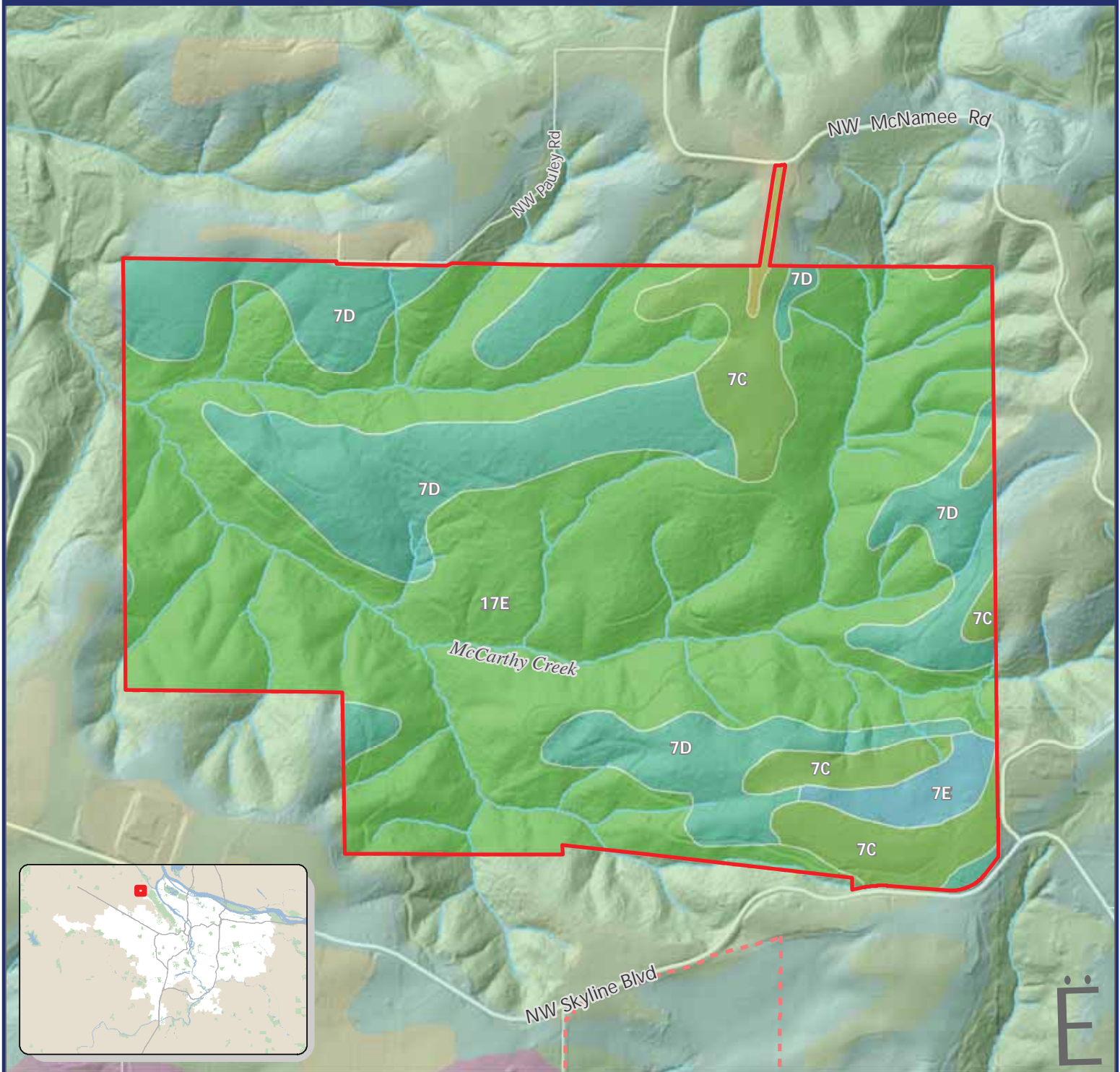


0 1,100 2,200 Feet





# SOILS



McCarthy Creek



Other Metro sites



Hydric soils

## NRCS soils on Site



Cascade silt loam, 15 to 30 percent slopes



Cascade silt loam, 3 to 8 percent slopes



Cascade silt loam, 30 to 60 percent slopes



Cascade silt loam, 8 to 15 percent slopes



Goble silt loam, 30 to 60 percent slopes

0

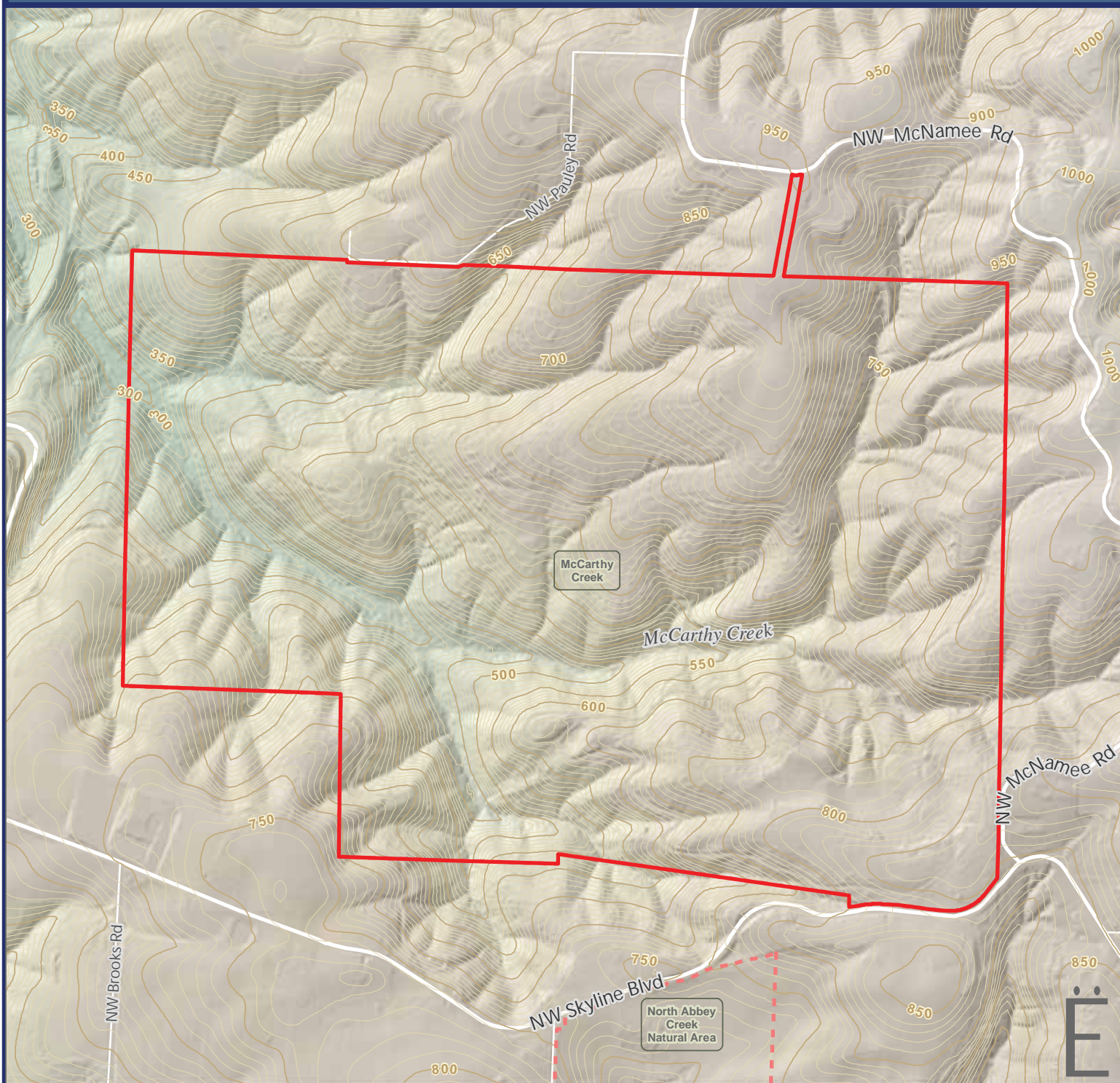
1,000



2,000 Feet



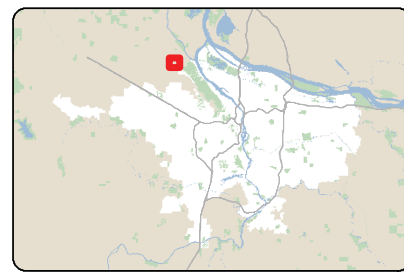


# TOPOGRAPHY



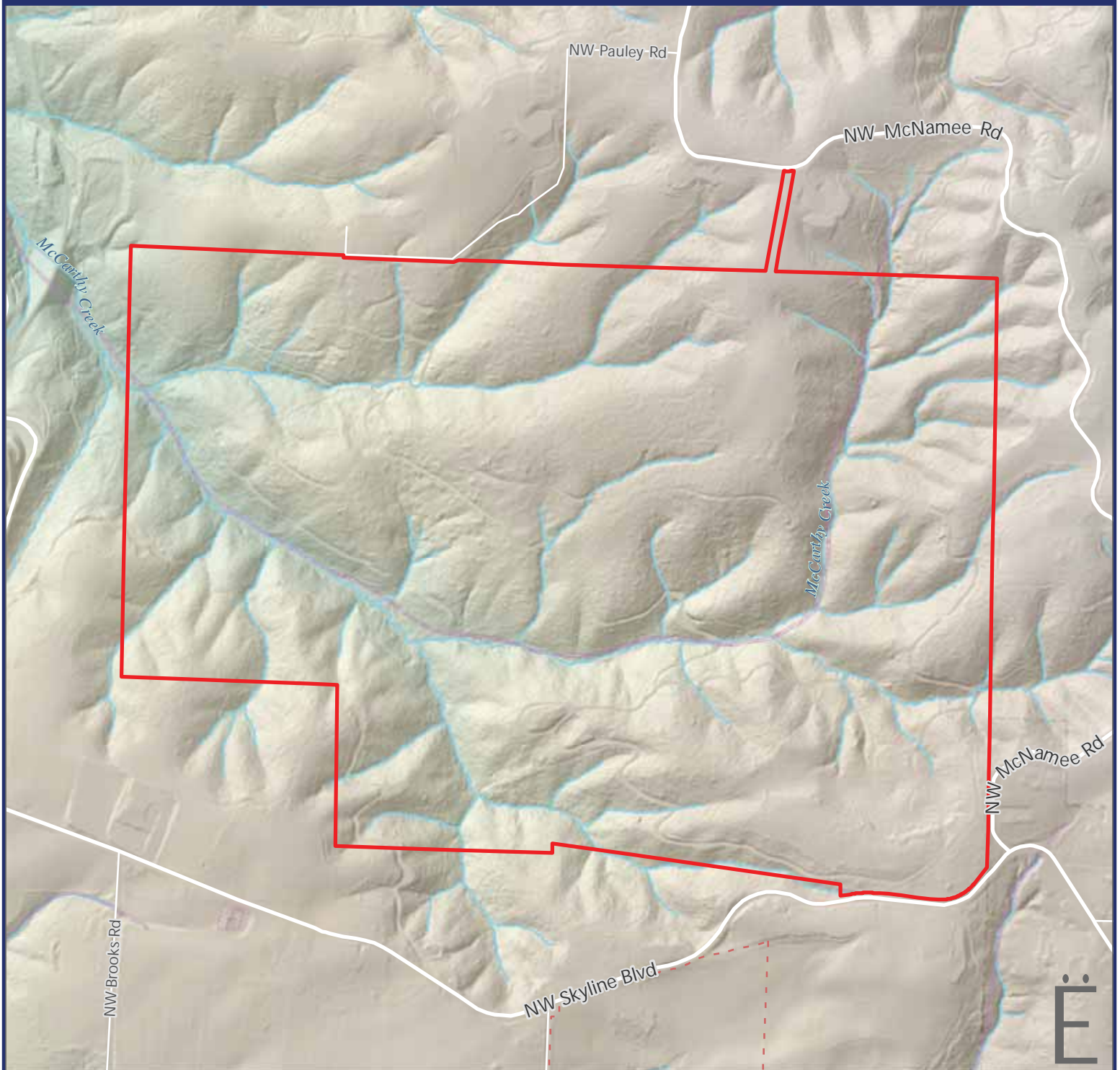
-  McCarthy Creek site
-  Other Metro sites




0 1,100 2,200 Feet



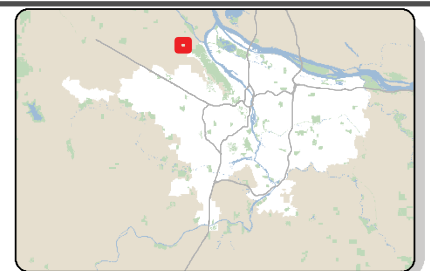


# HYDROLOGY



-  McCarthy Creek site
-  Other Metro sites
-  100 year floodplain
-  Wetlands (Wetlands Conservancy data)

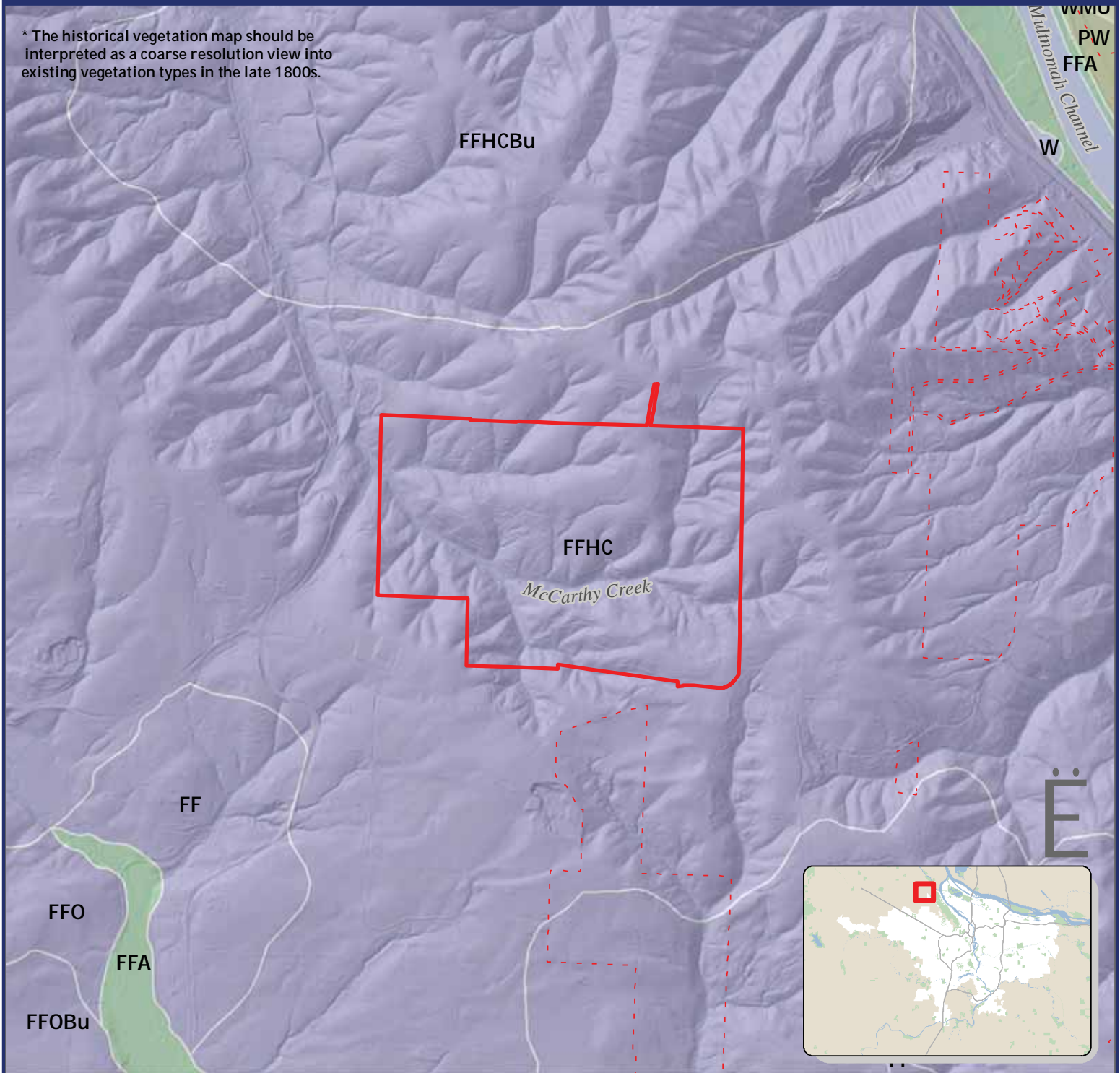
0 1,100 2,200 Feet





# HISTORICAL VEGETATION (1851-1910)

\* The historical vegetation map should be interpreted as a coarse resolution view into existing vegetation types in the late 1800s.



- McCarthy Creek site
- Other Metro sites

## Historical vegetation

- Closed forest; Riparian & Wetland
- Closed forest; Upland
- Emergent wetlands
- Prairie
- Water
- Streams

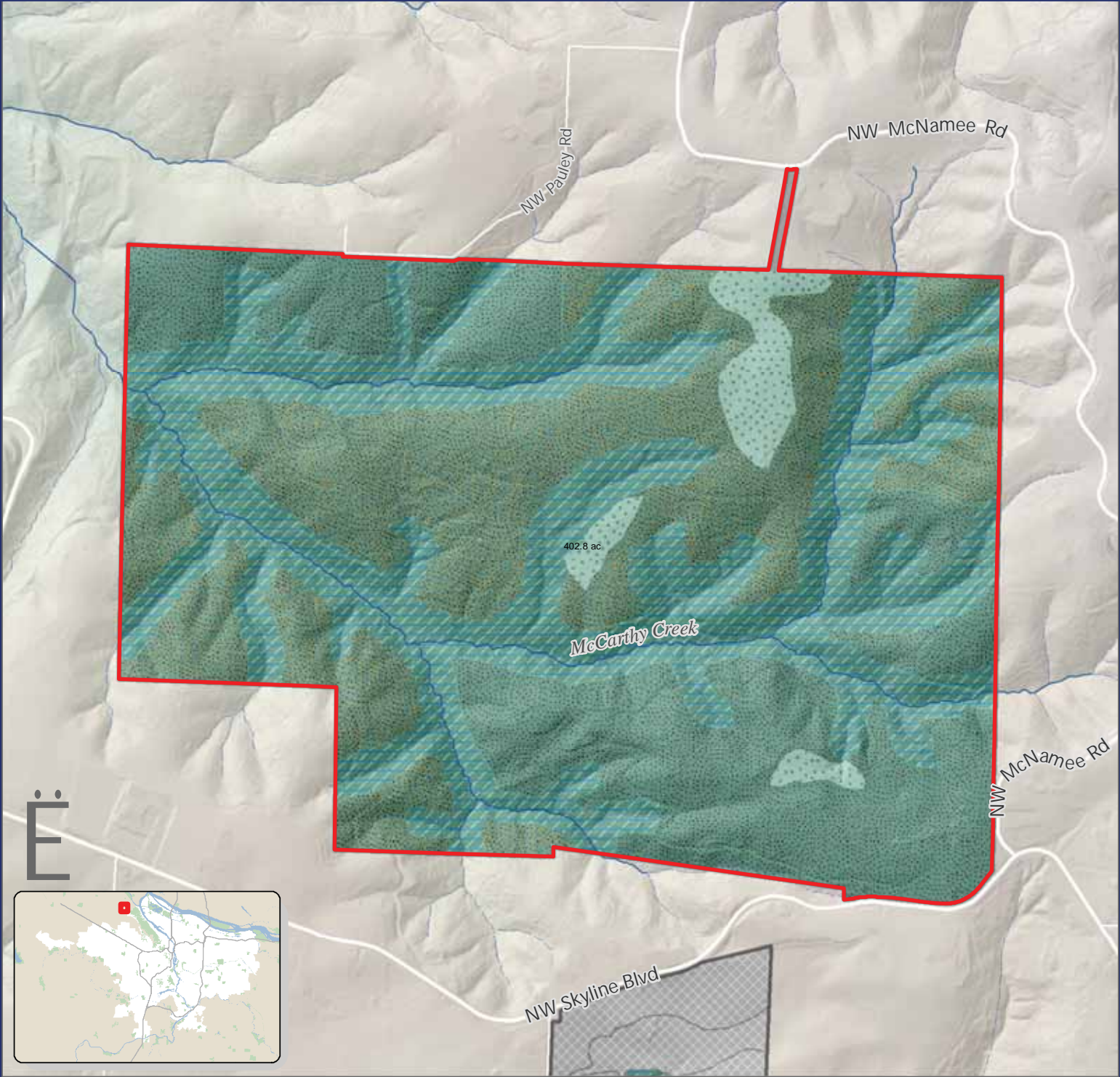
\* Labels refer to vegetation subclasses.  
Detailed descriptions can be found in  
T:\OBMO\GIS\DATA\_V\vegetation\Historical

0 2,000 4,000 Feet





# CURRENT COVER



- McCarthy Creek site
- Other Metro sites

- Current cover**
- Developed - (impervious)
  - Developed - (pervious/non ag)
  - Riparian forest

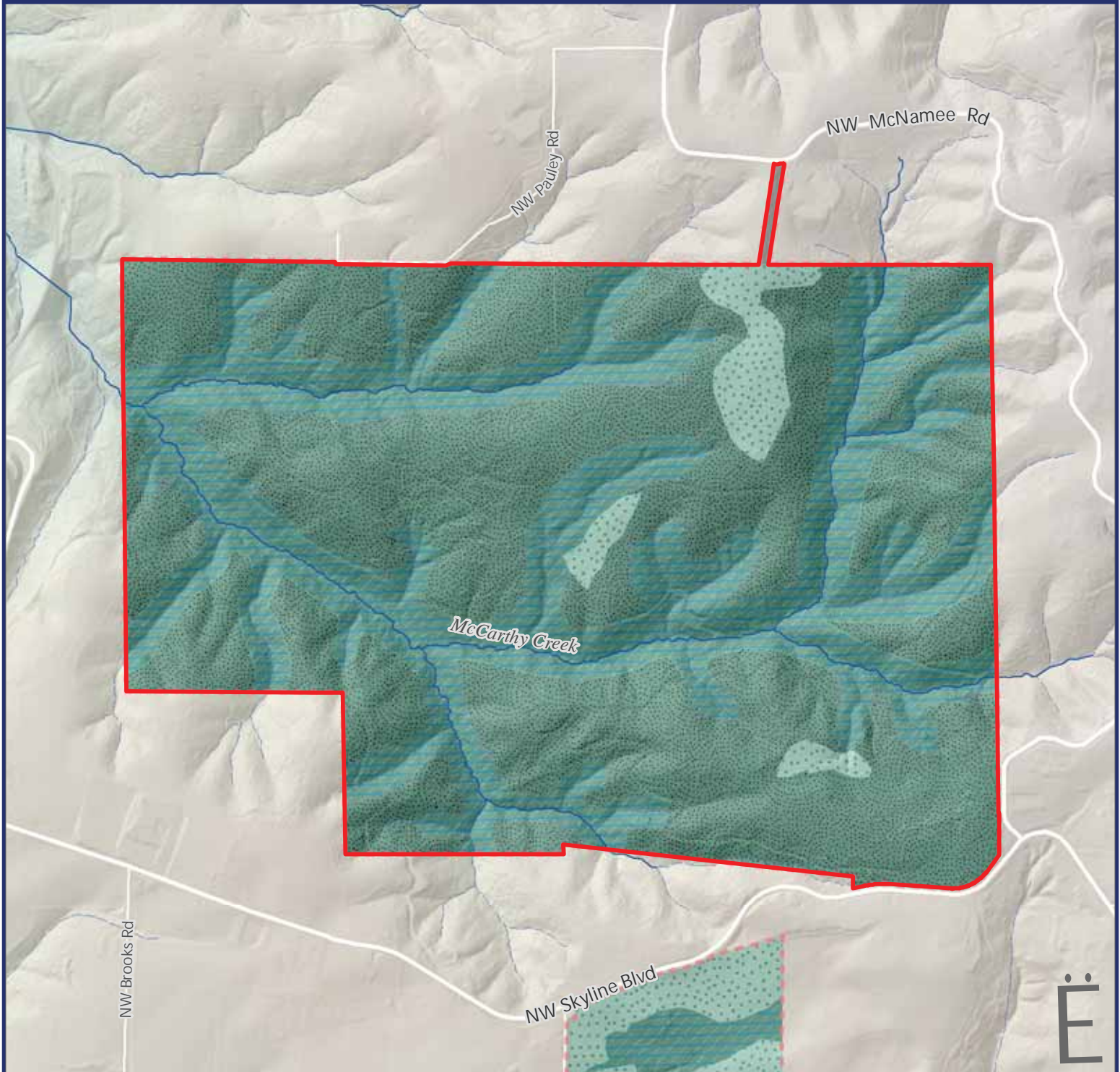
- Upland forest - coniferous
- Upland forest - mixed
- Upland forest - shrub (stage)

0 1,000 2,000 Feet





# CONSERVATION TARGETS



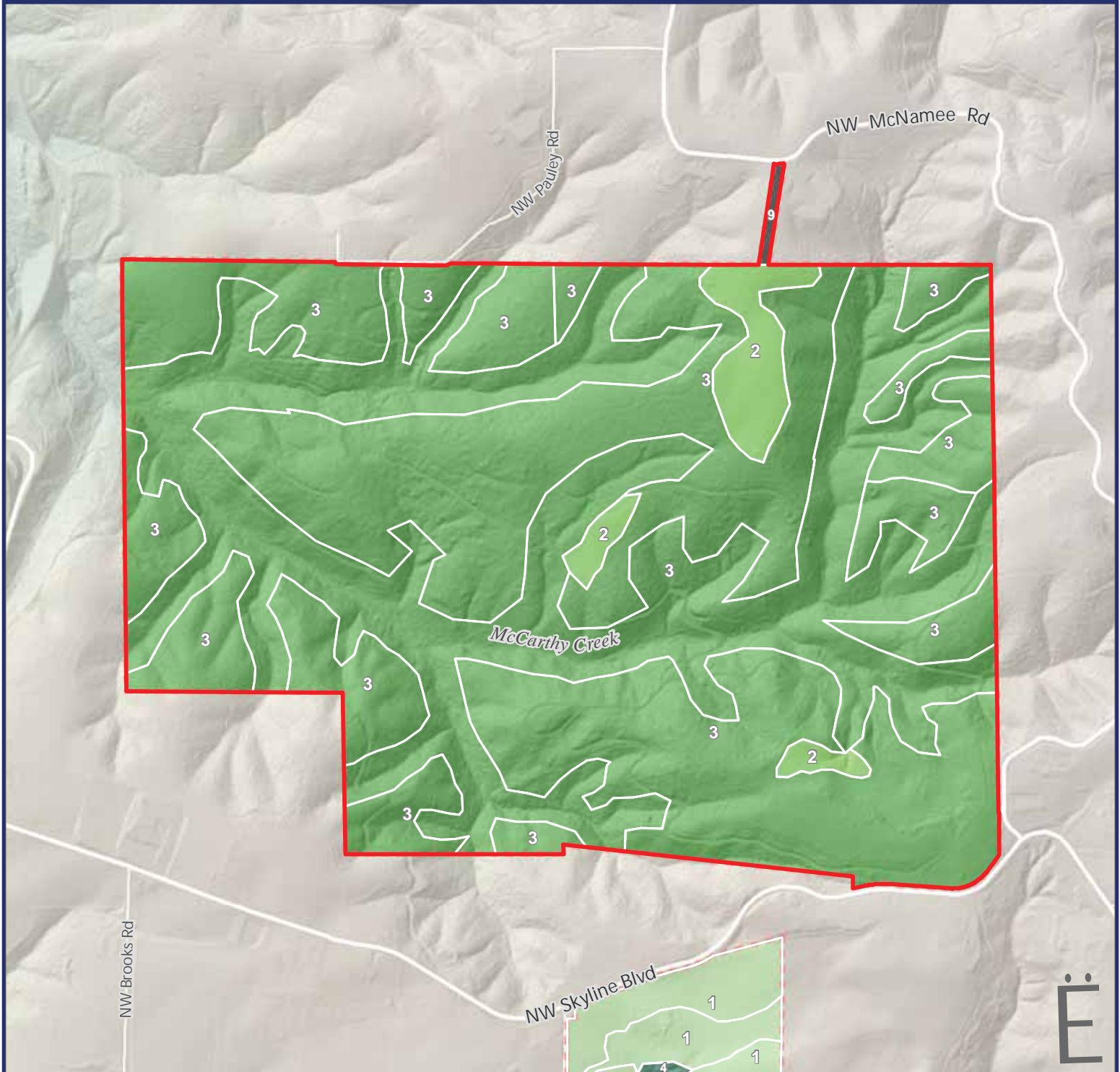
- |  |   |  |
|--|---|--|
|  site                | <b>Conservation targets</b>   |  Upland forest                              |
|  Other Metro sites   |  No Targets      |  Upland forest - shrub (early successional) |
| <b>NHD Flowlines</b>   |  Riparian forest |  |
|  Intermittent stream |   |  |
|  Perennial stream    |   |  |
|  Pipeline            |   |  |

0 1,000 2,000 Feet





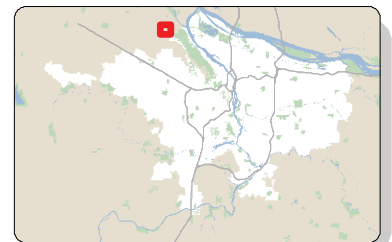
# CONSERVATION TARGET STATUS



- site
- Other Metro sites

## Management status

- 1 - Initiation
- 2 - Establishment
- 3 - Consolidation
- 4 - Refinement and long-term maintenance
- 9 - No targets (developed)



0 1,000 2,000 Feet





# Carlson Geotechnical

A Division of Carlson Testing, Inc.

Phone: (503) 601-8250

Fax: (503) 601-8254

Bend Office (541) 330-9155  
Eugene Office (541) 345-0289  
Salem Office (503) 589-1252  
Tigard Office (503) 684-3460



## EXHIBIT 4

**Report of  
Geotechnical Investigation and Geologic Hazard Reconnaissance  
Burlington Creek Forest Nature Park  
NW McNamee Road  
Multnomah County, Oregon**

**CGT Project Number G1704662**

Prepared for

Ms. Karen Vitkay  
Metro  
600 NE Grand Avenue  
Portland, Oregon 97232-2736

September 13, 2017



# Carlson Geotechnical

A Division of Carlson Testing, Inc.

Phone: (503) 601-8250

Fax: (503) 601-8254

Bend Office  
Eugene Office  
Salem Office  
Tigard Office

(541) 330-9155  
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September 13, 2017

Ms. Karen Vitkay  
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600 NE Grand Avenue  
Portland, Oregon 97232-2736

**Report of  
Geotechnical Investigation and Geologic Hazard Reconnaissance  
Burlington Creek Forest Nature Park  
NW McNamee Road  
Multnomah County, Oregon**

CGT Project No. G1704662

Dear Ms. Vitkay:

Carlson Geotechnical (CGT), a division of Carlson Testing, Inc. (CTI), is pleased to submit this report summarizing our geotechnical investigation and geologic hazard reconnaissance for the proposed Burlington Creek Forest Nature Park project. The site is located within the Burlington Creek Forest along NW McNamee Road in Multnomah County, Oregon. We performed our work in general accordance with CGT Proposal GP7579R2, dated July 10, 2017. Written authorization for our services was provided on July 31, 2017, in the form of Metro Contract No. 734785. A previous version of this report was issued on August 31, 2017. This report has been revised to reflect the current (September 5, 2017) design drawings.

We appreciate the opportunity to work with you on this project. Please contact us at 503.601.8250 if you have any questions regarding this report.

Respectfully Submitted,  
**CARLSON GEOTECHNICAL**



Ryan T. Houser, CEG  
Senior Engineering Geologist  
[rhouser@carlsontesting.com](mailto:rhouser@carlsontesting.com)



EXPIRES: 12/31/2018

Jeffrey P. Quinn, P.E.  
Project Geotechnical Engineer  
[jquinn@carlsontesting.com](mailto:jquinn@carlsontesting.com)



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## 1.0 INTRODUCTION

Carlson Geotechnical (CGT), a division of Carlson Testing, Inc. (CTI), is pleased to submit this report summarizing our geotechnical investigation and geologic hazard reconnaissance for the proposed Burlington Creek Forest Nature Park project. The site is located within the Burlington Creek Forest along NW McNamee Road in Multnomah County, Oregon, as shown on the attached Site Location, Figure 1.

### 1.1 Project Description

CGT developed an understanding of the proposed project based on our correspondence with you and design drawings dated September 2017. Based on our review, we understand the project will include:

- New trailhead development, including:
  - Construction of a new parking lot for up to 25 passenger cars.
  - Prefabricated restroom structure.
  - Information kiosk.
  - A retaining wall up to about 8 feet in retained height will be required to reach finished grades along the north (downslope) portion of the access drive.
- New hiking-only and shared hiking-cycling trails that will be 24 to 48 inches wide, with minimal cuts and fills to level the trail cross sections. We anticipate trail surfaces will consist of native soils, and that trails will be constructed using standard trail construction considerations presented in the United States Forest Service Trail Construction and Maintenance Notebook<sup>1</sup> and IMBA's Trail Solutions Design Guide<sup>2</sup>. Trail gradients will be typically less than 5%, with maximum gradients of up to about 10%. Proposed trails currently include:
  - Trail A, a 0.9-mile hiking/cycling trail, with three stream crossings consisting of wood or fiberglass bridge structures measuring 5-feet-wide by 15-feet-long (Crossing 1), 5-feet-wide by 18-feet-long (Crossing 2), and 5-feet-wide by 20-feet-long (Crossing 3).
  - Trail AA, a 0.7-mile hiking/cycling trail, with one stream crossing consisting of a 5-foot-wide by 20-foot-long fiberglass bridge structure (Crossing 5).
  - Trail B, a 0.4-mile hiking/cycling trail.
  - Trail C, a 0.1-mile hiking/ cycling trail on an existing road bed.
  - Trail D, a 0.1-mile hiking trail with one stream crossing consisting of a 4-foot-wide by 15-foot-long bridge structure (Crossing 4). Bridge construction materials are to be determined.
  - Trail E, a 0.8-mile hiking/cycling trail.
  - Trail F, a 0.3-mile hiking/cycling trail.
  - Trail G, a 1.2-mile hiking/cycling trail.
  - Trail H, a 0.6-mile hiking/cycling trail, with one stream crossing consisting of a 4-foot-wide by 15-foot-long bridge structure (Crossing 6). Bridge construction materials are to be determined.
- Existing gravel roadways will be maintained for mixed hiking/mountain biking/equestrian use.

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<sup>1</sup> USDA Forest Service, 2007. Trail Construction and Maintenance Notebook. United States Department of Agriculture, Publication No. 0723-2806-MTDC.

<sup>2</sup> International Mountain Bicycling Association, 2004. Trail Solutions. IMBA, 272p.



## **1.2 Scope of Work**

### **1.2.1 Geotechnical Investigation**

The purpose of our geotechnical investigation was to explore shallow subsurface conditions at the site in order to provide geotechnical recommendations for design and construction of the proposed trailhead and stream crossings. Our scope of work included the following:

- Contact the Oregon Utilities Notification Center to mark the locations of public utilities within a 20-foot radius of our explorations.
- Explore shallow subsurface conditions at the site by advancing 19 hand auger borings, 15 Wildcat Dynamic Cone Penetrometer (WDCP) tests and 3 Dynamic Cone Penetrometer (DCP) tests to depths of up to about 8 feet below ground surface (bgs). Details of the subsurface investigation are presented in Appendix A.
- Classify the materials encountered in the explorations in accordance with American Society for Testing and Materials (ASTM) Soil Classification Method D2488 (visual-manual procedure).
- Collect representative soil samples from within the hand auger borings in order to perform laboratory testing and to confirm our field classifications.
- Perform laboratory testing on selected samples collected during our subsurface exploration.
- Provide a technical narrative describing surface and subsurface deposits, and local geology of the site, based on the results of our explorations and published geologic mapping.
- Provide a site vicinity map and a site plan showing the locations of the explorations relative to existing site features.
- Provide logs of the explorations, including results of laboratory testing on selected soil samples.
- Provide geotechnical recommendations for site preparation and earthwork.
- Provide geotechnical engineering recommendations for design and construction of shallow spread foundations, retaining walls, floor slabs, and flexible pavements.
- Provide recommendations for the Seismic Site Class, mapped maximum considered earthquake spectral response accelerations, and site seismic coefficients.
- Provide a qualitative evaluation of seismic hazards at the site, including liquefaction potential, earthquake-induced settlement and landsliding, and surface rupture due to faulting or lateral spread.
- Provide this written report summarizing the results of our geotechnical investigation and recommendations for the project.

### **1.2.2 Geologic Hazard Reconnaissance**

The purpose of our reconnaissance was to identify geologic hazards that may affect the proposed project and provide background for the Geotechnical Reconnaissance and Stability Preliminary Study needed as part of the Hillside Development Permit application. The findings of our geologic hazard reconnaissance are presented in Appendix B.

## **2.0 SITE DESCRIPTION**

### **2.1 Site Geology**

In general, the site is underlain by Tertiary Columbia River Basalt that is overlain by wind-blown silt (loess) deposits and alluvium related to the on-site creeks. Site geology is presented in detail in Appendix B, Section B.3.2.



## 2.2 Site Surface Conditions

The trailhead will be located on the east side of NW McNamee Road along an existing gravel-surfaced access road. The inboard (south) side of existing access road is cut into the north-facing slope, at gradients up to about 1 horizontal to 1 vertical (1H:1V), while the outboard (north) side descended below the access road at gradients up to about 2H:1V. The cut slopes are generally vegetated with underbrush (blackberry bushes, ferns, etc) and the outboard slopes were densely vegetated with coniferous trees and underbrush.

The proposed trails will generally be located along northeast-trending ridgelines generally between NW McNamee Road to the west and Highway 30 to the northeast. The area was densely vegetated with deciduous and coniferous trees, and underbrush. Gradients varied greatly throughout the project area, but were typically less than about 2H:1V.

Site surface conditions are described in greater detail in Appendix B, Section B.4.0.

## 2.3 Subsurface Conditions

### 2.3.1 Subsurface Investigation & Laboratory Testing

Our subsurface investigation consisted of nineteen hand auger borings, fifteen Wildcat Dynamic Cone Penetrometer (WDCP) tests and three Dynamic Cone Penetrometer (DCP) tests to depths of up to about 8 feet below ground surface (bgs). The approximate exploration locations are shown on the Overall Site Plan and Trailhead Site Plan, attached as Figures 2 and 3, respectively. Details regarding the subsurface investigation, logs of the explorations, and results of laboratory testing are presented in Appendix A. Subsurface conditions encountered during our investigation are summarized below.

### 2.3.2 Subsurface Materials

Logs of the explorations are presented in Appendix A. The following describes each of the subsurface materials encountered at the site.

#### Forest Duff

Forest duff consisting of a thin layer of leaves, branches, pine needles, and other organic material was encountered at the surface of the majority of the explorations. The forest duff was up to about 6 inches thick.

#### Undocumented Gravelly Silt Fill (ML Fill)

Undocumented gravelly silt fill was encountered at the surface of HA TH-5 adjacent to the existing access roadway. Undocumented fill refers to materials placed without (available) records of subgrade conditions or evaluation of compaction. The gravelly silt fill was typically tan, damp, exhibited low plasticity, contained angular gravel up to about 2 inches in diameter, and extended to a depth of about 1/3-foot bgs.

#### Silt (ML) - Loess

Encountered at the surface of the site or underlying the forest duff in the majority of the borings (except C-3/NW, C-3/SE, C-5/W, and TH-5) was native silt (ML). This soil was typically light brown, dry to moist, non-plastic to low-plasticity, and varied in consistency from very soft to very stiff. This silt is consistent with descriptions by others of loess (wind-blown sediment) mapped in the vicinity of the site. This soil extended to a depth of about 2½ feet bgs in HA C-2/NE, 1¾ foot bgs in HA C-6/E, and to the total depths explored, from about 4 to 8 feet bgs, in borings HA C-1/N, C-1/S, C-2/SW, C-4/NE, C-4/SW, C-5/E, C-6/W, TH-1 through TH-4, TH-6, and TH-7.



Silt (ML) - Alluvium

Native alluvial silt (ML) was encountered at the surface of HA C-3/NW and C-5/W, and underlying the forest duff in C-3/SE. This soil was typically soft to very stiff, light brown, dry, exhibited low plasticity, and extended to depths of about 1½ feet in HA C-3/NW, 3 feet in C-3/SE, and to the total depth explored, 1 foot bgs, in C-5/W.

Silty Gravel (GM) - Alluvium

Underlying the silt alluvium HA C-3/NW was silty gravel alluvium. The silty gravel was typically medium dense, gray and tan, damp, subangular, and up to 2 inches in diameter. Practical refusal of the hand auger was encountered at a depth of about 1¾ feet bgs in C-3/NW.

Lean Clay to Gravelly Lean Clay (CL) – Residual Soil

Underlying the silt loess in C-2/NE, underlying the silt alluvium in C-3/SE, and underlying the gravelly silt fill in TH-5 was lean clay. The lean clay was typically medium stiff to very stiff, light brown with tan and orange mottling, moist, exhibited medium plasticity, and contained trace angular basalt fragments. The lean clay in HA C-3/SE was gravelly, with about 55 percent passing the US No. 200 Sieve. The lean clay was consistent with residual soil forming from the in-place weathering of the Columbia River Basalt. Practical refusal of the hand auger was met in the lean clay at depths of about 3 to 3¾ feet bgs.

Predominantly Weathered Basalt (RX)

Underlying the silt loess in HA C-6/E was predominantly weathered basalt. The predominantly weathered basalt was typically very soft (R1), tan to gray, vesicular, and contained fragments of moderately weathered basalt. Practical refusal of the hand exploration equipment was encountered at a depth of about 2½ feet bgs in the predominantly weathered basalt.

2.3.3 Groundwater

We did not encounter groundwater within the depths explored at the site conducted during August 2017. To determine approximate regional groundwater levels in the area, we researched well logs available on the Oregon Water Resources Department (OWRD)<sup>3</sup> website for wells located within Section 20, Township 2 North, Range 1 West, Willamette Meridian. Our review indicated that groundwater levels in the area varied with surface elevations and generally ranged from about 20 to 75 feet bgs. It should be noted groundwater levels vary with local topography. In addition, the groundwater levels reported on the OWRD logs often reflect the purpose of the well, so water well logs may only report deeper, confined groundwater, while geotechnical or environmental borings will often report any groundwater encountered, including shallow, unconfined groundwater. Therefore, the levels reported on the OWRD well logs referenced above are considered generally indicative of local water levels and may not reflect actual groundwater levels at the project site. We anticipate that groundwater levels will fluctuate due to seasonal and annual variations in precipitation, changes in site utilization, or other factors. Additionally, the on-site, native silt, lean clay, and basalt bedrock are conducive to formation of perched groundwater. Seasonal groundwater levels in the area of the proposed stream crossings are tied to the water level in the stream channels and should be anticipated to be near-surface during the winter months.

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<sup>3</sup> Oregon Water Resources Department, 2017. Well Log Records, accessed August 2017, from OWRD web site: [http://apps.wrd.state.or.us/apps/gw/well\\_log/](http://apps.wrd.state.or.us/apps/gw/well_log/).



### 3.0 SEISMIC CONSIDERATIONS

#### 3.1 Seismic Design

Section 1613.3.2 of the 2014 Oregon Structural Specialty Code (2014 OSSC) requires that the determination of the seismic site class be based on subsurface data in accordance with Chapter 20 of the American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures (ASCE 7). Based on the results of the explorations and review of geologic mapping, we have assigned the site as Site Class D for the subsurface conditions encountered. Earthquake ground motion parameters for the site were obtained based on the United States Geological Survey (USGS) Seismic Design Values for Buildings - Ground Motion Parameter Web Application<sup>4</sup>. Latitude 45.644865 ° North and Longitude 122.845679° West were input as the site location (trailhead location). The following table shows the recommended seismic design parameters for the site.

**Table 1 Seismic Ground Motion Values**

| Parameter                                    |  | Value  |
|--|--|--------|
| Mapped Acceleration Parameters               | Spectral Acceleration, 0.2 second ( $S_s$ )            | 1.014g |
|  | Spectral Acceleration, 1.0 second ( $S_1$ )            | 0.449g |
| Coefficients<br>(Site Class D)               | Site Coefficient, 0.2 sec. ( $F_A$ )                   | 1.095  |
|  | Site Coefficient, 1.0 sec. ( $F_v$ )                   | 1.551  |
| Adjusted MCE Spectral<br>Response Parameters | MCE Spectral Acceleration, 0.2 sec. ( $S_{MS}$ )       | 1.110g |
|  | MCE Spectral Acceleration, 1.0 sec. ( $S_{M1}$ )       | 0.696g |
| Design Spectral Response Accelerations       | Design Spectral Acceleration, 0.2 seconds ( $S_{DS}$ ) | 0.740g |
|  | Design Spectral Acceleration, 1.0 second ( $S_{D1}$ )  | 0.464g |

#### 3.2 Seismic Hazards

##### 3.2.1 Liquefaction

In general, liquefaction occurs when deposits of loose/soft, saturated, cohesionless soils, generally sands and silts, are subjected to strong earthquake shaking. If these deposits cannot drain quickly enough, pore water pressures can increase, approaching the value of the overburden pressure. The shear strength of a cohesionless soil is directly proportional to the effective stress, which is equal to the difference between the overburden pressure and the pore water pressure. When the pore water pressure increases to the value of the overburden pressure, the shear strength of the soil approaches zero, and the soil can liquefy. The liquefied soils can undergo rapid consolidation or, if unconfined, can flow as a liquid. Structures supported by the liquefied soils can experience rapid, excessive settlement, shearing, or even catastrophic failure.

For fine-grained soils, susceptibility to liquefaction is evaluated based on penetration resistance and plasticity, among other characteristics. Criteria for identifying non-liquefiable, fine-grained soils are constantly evolving. Current practice<sup>5</sup> to identify non-liquefiable, fine-grained soils is based on plasticity characteristics of the soils, as follows: (1) liquid limit greater than 47 percent, (2) plasticity index greater than 20 percent, and (3) moisture content less than 85 percent of the liquid limit. Soils identified as susceptible to liquefaction are analyzed using the industry standard “simplified procedure”, originally published by Seed and

<sup>4</sup> United States Geological Survey, 2017. Seismic Design Parameters determined using: “U.S. Seismic Design Maps Web Application - Version 3.1.0,” from the USGS website <http://geohazards.usgs.gov/designmaps/us/application.php>.

<sup>5</sup> Seed, R.B. et al., 2003. Recent Advances in Soil Liquefaction Engineering: A Unified and Consistent Framework. Earthquake Engineering Research Center Report No. EERC 2003-06.



Idriss<sup>6</sup> in 1971 and updated continually since that time. The susceptibility of sands, gravels, and sand-gravel mixtures to liquefaction is typically assessed based on penetration resistance, as measured using SPTs, CPTs, or Becker Hammer Penetration tests (BPTs).

Based on the lack of saturated conditions and anticipated generally shallow depth to bedrock, the soils encountered at the site are considered non-liquefiable within the depths explored. This judgment is supported by the liquefaction hazard map<sup>7</sup> for the area, which indicates a “No Hazard” potential of liquefaction at this site. The mapping indicates the Columbia River floodplain generally north of Highway 30 has a high potential for liquefaction.

### 3.2.2 Slope Instability

The site is located within the Tualatin Mountains and the slopes are characterized as having a high susceptibility to landslides<sup>8</sup>. Based on the steep slopes and landslide-prone surficial materials (loess), seismically induced slope instability is commensurate with the overall landslide hazard mapping (high hazard). Landslide hazards are discussed in more detail in Appendix B.

### 3.2.3 Surface Rupture

#### 3.2.3.1 Faulting

The site is mapped on or very near the mapped fault trace for the Portland Hills fault. Studies have conclude this fault<sup>9</sup> is active, based on contemporary seismicity in the vicinity of the fault, and seismic reflection and other data suggesting that the fault cuts late Pleistocene layered strata. These include sand and silt deposited by Pleistocene floods approximately 12,800 to 15,000 years ago<sup>10</sup>. Should significant movement of the Portland Hills fault occur the risk of surface rupture at the site is relatively high, but difficult to characterize further due to the uncertainty regarding the precise location of the fault trace relative to the footprint of the site.

#### 3.2.3.2 Lateral Spread

Surface rupture due to lateral spread can occur on sites underlain by liquefiable soils that are located on or immediately adjacent to slopes steeper than about 3 degrees (20H:1V), and/or adjacent to a free face, such as a stream bank or the shore of an open body of water. During lateral spread, the materials overlying the liquefied soils are subject to lateral movement downslope or toward the free face. Given the lack of liquefiable soils at the site, the risk of surface rupture due to lateral spread is considered negligible.

## 4.0 CONCLUSIONS

Based on the results of our field explorations and analyses, the site may be developed as described in Section 1.1, provided the recommendations presented in this report are incorporated into the design and development.

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<sup>6</sup> Seed, H.B., and Idriss, I.M., 1971, Simplified Procedure for Evaluating Soil Liquefaction Potential, Journal of Geotechnical Engineering Division, ASCE, 97(9), 1249-1273.

<sup>7</sup> Oregon Department of Geology and Mineral Industries, 2017. Oregon Statewide Geohazards Viewer, accessed August 2017, from DOGAMI web site: <http://www.oregongeology.org/sub/hazvu/index.htm>.

<sup>8</sup> Oregon Department of Geology and Mineral Industries, 2017. Oregon Statewide Geohazards Viewer, accessed August 2017, from DOGAMI web site: <http://www.oregongeology.org/sub/hazvu/index.htm>.

<sup>9</sup> Wong et al., 2001. The Portland Hills Fault: An Earthquake Generator or Just Another Old Fault?, Oregon Geology, V63, number 2.

<sup>10</sup> Madin and Hemphill-Haley, 2001. The Portland Hills Fault at Rowe Middle School, Oregon Geology V63 p47.



## **4.1 Geologic Hazards**

As noted above and discussed in Appendix B, the site may potentially be affected by multiple geologic hazards, including landslides and surface rupture due to faulting. The development proposed at the site does not include construction of habitable structures and the potential for loss of life due to any of these hazards is relatively low. It is our opinion that the proposed development will not have any significant impact on the existing hazards and, as such, does not pose an increase in risk for neighboring properties. This assumes that the recommendations contained in this report are incorporated into the final design of the project. Minor adjustments to final trail locations will take place during construction. Provided the trails are developed in the general vicinity as currently understood, the finalized trails will similarly not have any significant impact on the existing hazards.

## **4.2 Geotechnical Considerations**

### **4.2.1 Trailhead Development**

Satisfactory subgrade support for new pavements, foundations, retaining walls and structural fills can be provided by the native, medium stiff or better loess (ML) or residual soil (CL) encountered near the surface of the site.

### **4.2.2 Trail Construction**

The proposed trails will include minimal cutting to achieve finished grades. CGT recommends trail sideslopes be constructed at gradients of 2H:1V or less to reduce the potential for erosion and localized instability.

### **4.2.3 Stream Crossings**

Satisfactory subgrade support for new bridge abutments along the proposed trails can be provided by the native, medium stiff or better loess (ML), alluvium (ML, GM), residual soil (CL), or predominantly weathered basalt (RX) encountered near the surface of the site.

Specific recommendations for design and construction of the project are presented in the following sections.

## **5.0 RECOMMENDATIONS**

The recommendations presented in this report are based on the information provided to us, results of our field investigation and analyses, laboratory data, and professional judgment. CGT has observed only a small portion of the pertinent subsurface conditions. The recommendations are based on the assumptions that the subsurface conditions do not deviate appreciably from those found during the field investigation. CGT should be consulted for further recommendations if the design of the proposed development changes and/or variations or undesirable geotechnical conditions are encountered during site development.

## **5.1 Site Preparation**

### **5.1.1 Stripping**

Existing vegetation, forest duff, topsoil, rooted soils, and undocumented gravelly silt fill (ML Fill) should be removed from within, and for a minimum 5-foot margin around, proposed fill, building, pavement, and bridge abutment areas. Based on the results of our field explorations, stripping depths are anticipated to be less than 1-foot bgs. These materials may be deeper or shallower away from our explorations. Accordingly, the geotechnical engineer or their representative should provide recommendations for actual stripping depths based on observations during site stripping. Vegetation and rooted soils should be transported off-site for



disposal, or stockpiled for later use in landscaped areas. Excavated soils (ML, CL) in the trailhead area may be reused as structural fill if properly moisture conditioned as described in Section 5.4.1.1 below.

#### 5.1.2 Existing Utilities & Below-Grade Structures

All existing utilities at the site should be identified prior to excavation. Abandoned utility lines beneath new structures, pavements, and hardscaping features should be completely removed or grouted full. Soft, loose, or otherwise unsuitable soils encountered in utility trench excavations should be removed and replaced with structural fill in conformance with Section 5.4 this report. While not anticipated, buried structures (i.e. footings, foundation walls, retaining walls, slabs-on-grade, tanks, etc.), if encountered during site development, should be completely removed and replaced with structural fill in conformance with Section 5.4.

#### 5.1.3 Erosion Control

Erosion and sedimentation control measures should be employed in accordance with applicable County and State regulations.

### 5.2 **Temporary Excavations**

#### 5.2.1 Overview

Conventional earthmoving equipment in proper working condition should be capable of making necessary excavations for the anticipated site cuts as described earlier in this report. All excavations should be in accordance with applicable OSHA and state regulations. It is the contractor's responsibility to select the excavation methods, to monitor site excavations for safety, and to provide any shoring required to protect personnel and adjacent improvements. A "competent person", as defined by OR-OSHA, should be on-site during construction in accordance with regulations presented by OR-OSHA. CGT's current role on the project does not include review or oversight of excavation safety.

#### 5.2.2 OSHA Soil Type

For use in the planning and construction of temporary excavations up to 10 feet in depth, an OSHA soil type "B" can be used for the fine-grained soils (ML, CL) encountered near the surface of the site.

#### 5.2.3 Utility Trenches

Temporary trench cuts should stand near vertical to depths of approximately 4 feet in the native alluvium (ML, GM), loess (ML), residual soil (CL), and basalt bedrock encountered at the site. Some instability may develop if seepage occurs. If seepage undermines the stability of the trench, or if sidewall caving is observed during excavation, the sidewalls should be flattened or shored. Depending on the time of year trench excavations occur, trench dewatering may be required in order to maintain dry working conditions, particularly if the invert elevations of the proposed utilities are below the groundwater level. If groundwater is present at the base of utility excavations, we recommend placing trench stabilization material at the base of the excavations. Trench stabilization material should be in conformance with Section 5.4.4.

#### 5.2.4 Excavations Near Foundations

Excavations near footings should not extend within a 1½H:1V (horizontal:vertical) plane projected out and down from the outside, bottom edge of the footings. In the event excavation needs to extend below the referenced plane, temporary shoring of the excavation and/or underpinning of the subject footing may be required. The geotechnical engineer should be consulted to review proposed excavation plans for this design case to provide specific recommendations.



### **5.3 Wet Weather Considerations**

For planning purposes, the wet season should be considered to extend from late September to late June. It is our experience that dry weather working conditions should prevail between early July and mid-September. Notwithstanding the above, soil conditions should be evaluated in the field by the geotechnical engineer or their representative at the initial stage of site preparation to determine whether the recommendations within this section should be incorporated into construction.

#### **5.3.1 Overview**

Due to the fines content, the native silt alluvium and loess (ML), and residual soil (CL) are susceptible to disturbance during wet weather. Trafficability of these soils may be difficult, and significant damage to subgrade soils could occur, if earthwork is undertaken without proper precautions at times when the exposed soils are more than a few percentage points above optimum moisture content. For wet weather construction, site preparation activities may need to be accomplished using track-mounted equipment, loading removed material onto trucks supported on granular haul roads, or other methods to limit soil disturbance. The geotechnical engineer or their representative should evaluate the subgrade during excavation by probing rather than proof rolling. Soils that have been disturbed during site preparation activities, or soft or loose areas identified during probing, should be over-excavated to firm, stable subgrade, and replaced with imported granular structural fill in conformance with Section 5.4.2.

#### **5.3.2 Geotextile Separation Fabric**

We recommend a geotextile separation fabric be placed to serve as a barrier between the prepared subgrade and granular fill/base rock in areas of repeated or heavy construction traffic. The geotextile fabric should meet the requirements presented in the current Oregon Department of Transportation (ODOT) Standard Specification for Construction, Section 02320.

#### **5.3.3 Granular Working Surfaces (Haul Roads & Staging Areas)**

Haul roads subjected to repeated heavy, tire-mounted, construction traffic (e.g. dump trucks, concrete trucks, etc.) will require a minimum of 18 inches of imported granular material. For light staging areas, 12 inches of imported granular material should be sufficient. Additional granular material or geo-grid reinforcement may be recommended based on site conditions and/or loading at the time of construction. The imported granular material should be in conformance with Section 5.4.2 and have less than 5 percent material passing the U.S. Standard No. 200 Sieve. The prepared subgrade should be covered with geotextile fabric (Section 5.3.2) prior to placement of the imported granular material. The imported granular material should be placed in a single lift (up to 24 inches deep) and compacted using a smooth-drum, non-vibratory roller until well-keyed.

#### **5.3.4 Footing Subgrade Protection**

A minimum of 3 inches of imported granular material is recommended to protect fine-grained, footing subgrades from foot traffic during inclement weather. The imported granular material should be in conformance with Section 5.4.2. The maximum particle size should be limited to 1 inch. The imported granular material should be placed in one lift over the prepared, undisturbed subgrade, and compacted using non-vibratory equipment until well keyed.

### **5.4 Structural Fill**

The geotechnical engineer should be provided the opportunity to review all materials considered for use as structural fill (prior to placement). Samples of the proposed fill materials should be submitted to the



geotechnical engineer a minimum of 5 business days prior their use on site<sup>11</sup>. The geotechnical engineer or their representative should be contacted to evaluate compaction of structural fill as the material is being placed. Evaluation of compaction may take the form of in-place density tests and/or proof roll tests with suitable equipment. Structural fill should be evaluated at intervals not exceeding every 2 vertical feet as the fill is being placed.

#### 5.4.1 On-Site Soils – General Use

##### 5.4.1.1 Native Alluvium (ML), Loess (ML), and Residual Soil (CL)

Re-use of these soils as structural fill may be difficult because these soils are sensitive to small changes in moisture content and are difficult, if not impossible, to adequately compact during wet weather. We anticipate the moisture content of these soils will be higher than the optimum moisture content for satisfactory compaction. Therefore, moisture conditioning (drying) should be expected in order to achieve adequate compaction. If used as structural fill, these soils should be free of organic matter, debris, and particles larger than 4 inches. When used as structural fill, these soils should be placed in lifts with a maximum pre-compaction thickness of about 8 inches at moisture contents within –1 and +3 percent of optimum, and compacted to not less than 92 percent of the material's maximum dry density, as determined in general accordance with ASTM D1557 (Modified Proctor).

##### 5.4.1.2 Gravelly Silt Fill (ML Fill), Silty Gravel Alluvium (GM), Predominantly Weathered Basalt (RX)

Due to their limited aerial extent at the site, we anticipate these materials will not be produced in sufficient quantities to be reused as structural fill.

If the on-site materials cannot be properly moisture-conditioned and/or processed, we recommend using imported granular material for structural fill.

#### 5.4.2 Imported Granular Structural Fill – General Use

Imported granular structural fill should consist of angular pit or quarry run rock, crushed rock, or crushed gravel that is fairly well graded between coarse and fine particle sizes. The granular fill should contain no organic matter, debris, or particles larger than 4 inches, and have less than 5 percent material passing the U.S. Standard No. 200 Sieve. For fine-grading purposes, the maximum particle size should be limited to 1½ inches. The percentage of fines can be increased to 12 percent of the material passing the U.S. Standard No. 200 Sieve if placed during dry weather, and provided the fill material is moisture-conditioned, as necessary, for proper compaction. Imported granular fill material should be compacted to not less than 95 percent of the material's maximum dry density, as determined in general accordance with ASTM D1557 (Modified Proctor). Proper moisture conditioning and the use of vibratory equipment will facilitate compaction of these materials.

Granular fill materials with high percentages of particle sizes in excess of 1½ inches are considered non-moisture-density testable materials. As an alternative to conventional density testing, compaction of these materials should be evaluated by proof roll test observation (deflection tests), where accepted by the geotechnical engineer.

#### 5.4.3 Floor Slab Base Rock

Floor slab base rock should consist of well-graded granular material (crushed rock) containing no organic matter or debris, have a maximum particle size of ¾ inch, and have less than 5 percent material passing the

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<sup>11</sup> Laboratory testing for moisture density relationship (Proctor) is required. Tests for gradation may be required.



U.S. Standard No. 200 Sieve. Floor slab base rock should be placed in one lift and compacted to not less than 95 percent of the material's maximum dry density as determined in general accordance with ASTM D1557 (Modified Proctor). We recommend "choking" the surface of the base rock with sand just prior to concrete placement. Choking means the voids between the largest aggregate particles are filled with sand, but does not provide a layer of sand above the base rock. Choking the base rock surface reduces the lateral restraint on the bottom of the concrete during curing.

#### 5.4.4 Trench Base Stabilization Material

If groundwater is present at the base of utility excavations, trench base stabilization material should be placed. Trench base stabilization material should consist of a minimum of 1 foot of well-graded granular material with a maximum particle size of 4 inches and less than 5 percent material passing the U.S. Standard No. 4 Sieve. The material should be free of organic matter and other deleterious material, placed in one lift (up to 24 inches thick), and compacted until well-keyed.

#### 5.4.5 Trench Backfill Material

Trench backfill for the utility pipe base and pipe zone should consist of granular material as recommended by the utility pipe manufacturer. Trench backfill above the pipe zone should consist of well-graded granular material containing no organic matter or debris, have a maximum particle size of  $\frac{3}{4}$  inch, and have less than 8 percent material passing the U.S. Standard No. 200 Sieve. As a guideline, trench backfill should be placed in maximum 12-inch-thick lifts. The earthwork contractor may elect to use alternative lift thicknesses based on their experience with specific equipment and fill material conditions during construction in order to achieve the required compaction. The following table presents recommended relative compaction percentages for utility trench backfill.

| <b>Table 1      Utility Trench Backfill Compaction Recommendations</b>                                     |   |  |
|--|---|--|
| <b>Backfill Zone</b>   | <b>Recommended <u>Minimum</u> Relative Compaction</b> |  |
|  | <b>Structural Areas<sup>1</sup></b>                   | <b>Landscaping Areas</b>                             |
| Pipe Base and Within Pipe Zone   | 90% ASTM D1557 or pipe manufacturer's recommendation  | 88% ASTM D1557 or pipe manufacturer's recommendation |
| Above Pipe Zone  | 92% ASTM D1557  | 90% ASTM D1557                                       |
| Within 3 Feet of Design Subgrade   | 95% ASTM D1557  | 90% ASTM D1557                                       |
| <sup>1</sup> Includes proposed building, pavement areas, structural fill areas, exterior hardscaping, etc. |   |  |

### 5.5 **Permanent Slopes**

#### 5.5.1 Overview

Permanent cut or fill slopes constructed at the site, if any, should be graded at 2H:1V or flatter. Constructed slopes should be overbuilt by a few feet depending on their size and gradient so that they can be properly compacted prior to being cut to final grade. The surface of all slopes should be protected from erosion by seeding, sodding, or other acceptable means. Adjacent on-site and off-site structures should be located at least 5 feet from the top of slopes.

#### 5.5.2 Placement of Fill on Slopes

New fill should be placed and compacted against horizontal surfaces. Where slopes exceed 5H:1V (horizontal to vertical), the slopes should be keyed and benched prior to structural fill placement in general



accordance with the attached Fill Slope Detail, Figure 4. If subdrains are needed on benches, subject to the review of the CGT geotechnical representative, they should be placed as shown on the attached Fill Slope Detail. In order to achieve well-compacted slope faces, slopes should be overbuilt by a few feet and then trimmed back to proposed final grades. A representative from CGT should observe the benches, keyways, and associated subdrains, if needed, prior to placement of structural fill.

## **5.6 Shallow Foundations – Restroom Facility**

### **5.6.1 Subgrade Preparation**

Satisfactory subgrade support for shallow foundations associated with the proposed retaining walls, restroom, and kiosk can be obtained from the native, medium stiff to better loess (ML), native, medium stiff to better residual soil (CL) or new structural fill that is properly placed and compacted on these materials during construction. These materials first encountered at depths of about 0 to ½-foot bgs within our explorations at the trailhead. The geotechnical engineer or their representative should be contacted to observe subgrade conditions prior to placement of forms, reinforcement steel, or granular backfill (if required). If soft, loose, or otherwise unsuitable soils are encountered, they should be over-excavated as recommended by the geotechnical representative at the time of construction. The resulting over-excavation should be brought back to grade with imported granular structural fill in conformance with Section 5.4.2. The maximum particle size of over-excavation backfill should be limited to 1½ inches. All granular pads for footings should be constructed a minimum of 6 inches wider on each side of the footing for every vertical foot of over-excavation.

### **5.6.2 Minimum Footing Width & Embedment**

Minimum footing widths should be in conformance with the current OSSC. As a guideline, CGT recommends individual spread footings have a minimum width of 24 inches. We recommend continuous wall footings have a minimum width of 18 inches. All footings should be founded at least 18 inches below the lowest, permanent adjacent grade to develop lateral capacity and for frost protection.

### **5.6.3 Bearing Pressure & Settlement**

Footings founded as recommended above should be proportioned for a maximum allowable soil bearing pressure of 2,000 pounds per square foot (psf). This bearing pressure is a net bearing pressure, applies to the total of dead and long-term live loads, and may be increased by one-third when considering seismic or wind loads. For foundations founded as recommended above, total settlement of foundations is anticipated to be less than 1 inch. Differential settlements between adjacent columns and/or bearing walls should not exceed ½-inch. If an increased allowable soil bearing pressure is desired, the geotechnical engineer should be consulted.

### **5.6.4 Lateral Capacity**

A maximum passive (equivalent fluid) earth pressure of 150 pounds per cubic foot (pcf) is recommended for design of footings cast neat into excavations in suitable native soil or confined by the recommended imported granular structural fill that is properly placed and compacted during construction. The recommended earth pressure was computed using a factor of safety of 1½, which is appropriate due to the amount of movement required to develop full passive resistance. In order to develop the above capacity, the following should be understood:

1. Concrete must be poured neat in excavations or the foundations must be backfilled with imported granular structural fill,



2. The adjacent grade must be level,
3. The static ground water level must remain below the base of the footings throughout the year.
4. Adjacent floor slabs, pavements, or the upper 12-inch-depth of adjacent, unpaved areas should not be considered when calculating passive resistance.

We recommend the following frictional coefficients for foundation support of the proposed restroom facility:

- An ultimate coefficient of friction equal to 0.35 may be used when calculating resistance to sliding for concrete footings founded on the native soils described above.
- An ultimate coefficient of friction equal to 0.45 may be used when calculating resistance to sliding for concrete footings founded on a minimum of 6 inches of imported granular structural fill (crushed rock) that is properly placed and compacted during construction.

#### 5.6.5 Subsurface Drainage

Recognizing the fine-grained soils encountered at this site, placement of foundation drains is recommended at the outside base elevations of perimeter continuous wall footings. Foundation drains should consist of a minimum 4-inch diameter, perforated, PVC drainpipe wrapped with a non-woven geotextile filter fabric. The drains should be backfilled with a minimum of 2 cubic feet of open graded drain rock per lineal foot of pipe. The drain rock should also be encased in a geotextile fabric in order to provide separation from the surrounding fine-grained soils. Foundation drains should be positively sloped and should outlet to a suitable discharge point. The geotechnical engineer or their representative should observe the drains prior to backfilling. Roof drains should not be tied into foundation drains.

### 5.7 **Rigid Retaining Walls**

#### 5.7.1 Footings

Retaining wall footings should be designed and constructed in conformance with the recommendations presented in Section 5.5, as applicable.

#### 5.7.2 Wall Drains

We recommend placing a retaining wall drain at the base elevation of the heel of the retaining wall footing. Retaining wall drains should consist of a minimum 4-inch-diameter, perforated, HDPE (High Density Polyethylene) drainpipe wrapped with a non-woven geotextile filter fabric. The drains should be backfilled with a minimum of 2 cubic feet of open graded drain rock per lineal foot of pipe. The drain rock should be encased in a geotextile fabric in order to provide separation from the surrounding soils. Retaining wall drains should be positively sloped and should outlet to a suitable discharge point. The geotechnical engineer or their representative should be contacted to observe the drains prior to backfilling. Roof or area drains should not be tied into retaining wall drains.

#### 5.7.3 Wall Backfill

Retaining walls should be backfilled with imported granular structural fill in conformance with Section 5.4.2 and contain less than 5 percent passing the U.S. Standard No. 200 Sieve. The backfill should be compacted to a minimum of 90 percent of the material's maximum dry density as determined in general accordance with ASTM D1557 (Modified Proctor). When placing fill behind walls, care must be taken to minimize undue lateral loads on the walls. Heavy compaction equipment should be kept at least "H" feet from the back of the walls, where "H" is the height of the wall. Light mechanical or hand tamping equipment should be used for compaction of backfill materials within "H" feet of the back of the walls.



#### 5.7.4 Design Parameters & Limitations

For rigid retaining walls founded, backfilled, and drained as recommended above, the following table presents parameters recommended for design.

**Table 2      Design Parameters for Rigid Retaining Walls**

| Retaining Wall Condition   | Modeled Backfill Condition | Static Equivalent Fluid Pressure (S <sub>A</sub> ) | Seismic Equivalent Fluid Pressure (S <sub>AE</sub> ) |
|--|----------------------------|--|--|
| Not Restrained from Rotation   | Level (i = 0)              | 32 pcf   | 44 pcf   |
| Restrained from Rotation   | Level (i = 0)              | 54 pcf   | 62 pcf   |
| <u>Note 1:</u> Refer to the attached Figure 5 for a graphical representation of static and seismic loading conditions. Seismic component of active thrust acts at 0.6H above the base of the wall. |                            |  |  |
| <u>Note 2:</u> Seismic (dynamic) lateral loads were computed using the Mononobe-Okabe Equation as presented in the 1997 Federal Highway Administration (FHWA) design manual.                       |                            |  |  |

The above design recommendations are based on the assumptions that:

- (1) The walls consist of concrete cantilevered retaining walls ( $\beta = 0$  and  $\delta = 24$  degrees, see Figure 5).
- (2) The walls are 10 feet or less in height.
- (3) The backfill is drained and consists of imported granular structural fill ( $\phi = 38$  degrees).
- (4) No line load or point load surcharges are imposed behind the walls.
- (5) The grade behind the wall is level, or sloping down and away from the wall, for a distance of 10 feet or more from the wall.
- (6) The grade in front of the walls is level or sloping up for a distance of at least 5 feet from the wall.

Re-evaluation of our recommendations will be required if the retaining wall design criteria for the project vary from these assumptions.

## 5.8 **Floor Slabs**

### 5.8.1 Subgrade Preparation

Satisfactory subgrade support for slabs constructed on grade, supporting up to 100 psf area loading, can be obtained from the medium stiff to better loess (ML), or new structural fill that is properly placed and compacted on these materials during construction. The geotechnical engineer or their representative should observe floor slab subgrade soils to evaluate surface consistencies. If soft, loose, or otherwise unsuitable soils are encountered, they should be over-excavated as recommended by the CGT geotechnical representative at the time of construction. The resulting over-excavation should be brought back to grade with imported granular structural fill as described in Section 5.4.2.

### 5.8.2 Crushed Rock Base

Concrete floor slabs should be supported on a minimum 6-inch-thick layer of crushed rock (base rock) in conformance with Section 5.4.3. For design cases where a vapor barrier or retarder is not placed below the slab, the surface of the base rock should be choked with sand just prior to concrete placement. Choking means the voids between the largest aggregate particles are filled with sand, but does not provide a layer of sand above the base rock. Choking the base rock surface reduces the lateral restraint on the bottom of the concrete during curing.



### **5.8.3 Design Considerations**

For floor slabs constructed as recommended, a modulus of subgrade reaction of 125 pounds per cubic inch (pci) is recommended for the design of the floor slab. Floor slabs constructed as recommended will likely settle less than ½-inch. For general floor slab construction, slabs should be jointed around columns and walls to permit slabs and foundations to settle differentially.

### **5.8.4 Subgrade Moisture Considerations**

Liquid moisture and moisture vapor should be expected at the subgrade surface. The recommended crushed rock base is anticipated to provide protection against liquid moisture. Where moisture vapor emission through the slab must be minimized, e.g. impervious floor coverings, storage of moisture sensitive materials directly on the slab surface, etc., a vapor retarding membrane or vapor barrier below the slab should be considered. Factors such as cost, special considerations for construction, floor coverings, and end use suggest that the decision regarding a vapor retarding membrane or vapor barrier be made by the architect and owner.

If a vapor retarder or vapor barrier is placed below the slab, its location should be based on current American Concrete Institute (ACI) guidelines, ACI 302 Guide for Concrete Floor and Slab Construction. In some cases, this indicates placement of concrete directly on the vapor retarder or barrier. Please note that the placement of concrete directly on impervious membranes increases the risk of plastic shrinkage cracking and slab curling in the concrete. Construction practices to reduce or eliminate such risk, as described in ACI 302, should be employed during concrete placement.

## **5.9 Flexible Pavements**

### **5.9.1 Subgrade Preparation**

Subgrade preparation of pavements should be in conformance with Section 5.6.1 of this report. Pavement subgrade surfaces should be crowned (or sloped) for proper drainage in accordance with specifications provided by the project civil engineer.

### **5.9.2 Input Parameters**

Design of the flexible pavement sections presented below was based on the parameters presented in the following table and design approaches from:

- The American Association of State Highway and Transportation Officials (AASHTO) 1993 “Design of Pavement Structures” manual,
- The Asphalt Pavement Association of Oregon (APAO) 2003 “Asphalt Pavement Design Guide”, and
- The Oregon Department of Transportation (ODOT) 2011 “Pavement Design Guide”.



**Table 3**

| Input Parameter                 | Design Value <sup>1</sup>   |
|---------------------------------|-----------------------------|
| Pavement Design Life            | 20 years                    |
| Annual Percent Growth           | 0 percent                   |
| Serviceability                  | 4.2 initial<br>2.5 terminal |
| Reliability <sup>2</sup>        | 75 percent                  |
| Standard Deviation <sup>2</sup> | 0.49                        |
| Drainage Factor <sup>3</sup>    | 1.0                         |

**Input Parameters Assigned for Pavement Design**

| Input Parameter                     | Design Value <sup>1</sup>   |
|-------------------------------------|---|
| Resilient Modulus                   | Subgrade: Lean (CL) or Silt (ML)<br>Crushed Aggregate Base <sup>4</sup>   |
| Structural Coefficient <sup>2</sup> | Crushed Aggregate Base <sup>5</sup><br>Asphalt  |
| Vehicle Traffic <sup>6</sup>        | APAO Level II "Light"<br>Parking Stalls for Passenger Vehicles<br>APAO Level III "Low Moderate"<br>Drive Lanes (Assumes about 10 trucks/day over 20-year design life) |
|                                     | 6,000 psi<br>22,500 psi<br>0.10<br>0.42<br>50,000 ESALs<br>100,000 ESALs  |

<sup>1</sup> If any of the above parameters are incorrect, please contact us so that we may revise our recommendations, if warranted.

<sup>2</sup> Value based on guidelines presented in Section 5.3 of the 2011 ODOT Pavement Design Guide for flexible pavements.

<sup>3</sup> Assumes good drainage away from pavement, base, and subgrade is achieved by proper crowning of subgrades.

<sup>4</sup> Values based on experience with similar base aggregate materials and prepared as recommended in this report.

<sup>5</sup> Values based on DCP test results in borings HA TH-5, HA TH-6, and HA TH-7 and published correlations presented in Section 5.2 of the 2011 ODOT Pavement Design Guide for flexible pavements.

<sup>6</sup> ESAL = Total 18-Kip equivalent single axle load. Traffic levels taken from Table 3.1 of APAO manual. If an increased traffic load is estimated, please contact us so that we may refine the traffic loading and revise our recommendations, if warranted.

### 5.9.3 Recommended Minimum Pavement Sections

The following table presents the minimum flexible pavement sections for the traffic levels indicated in the preceding table, based on the referenced design procedures.

**Table 4 Recommended Minimum Pavement Sections**

| Material                                     | Minimum Thickness (inches)                    |  |
|--|---|--|
|  | APAO Level II<br>(Passenger Car Traffic Only) | APAO Level III<br>(Entrance/Service Drive Lanes) |
| Asphalt Pavement (inches)                    | 3   | 4  |
| Crushed Aggregate Base (inches) <sup>a</sup> | 9   | 9  |
| Subgrade Soils                               | Prepared in accordance with Section 5.6.1.    |  |

<sup>a</sup> Thickness shown assumes dry weather construction. A granular sub-base section and/or a geotextile separation fabric may be required in wet conditions in order to support construction traffic and protect the subgrade. Refer to Section 5.3 for additional discussion.

### 5.9.4 Asphalt & Base Course Materials

Asphalt pavement and base course material should conform to the most recent State of Oregon Standard Specifications for Highway Construction. Place aggregate base in one lift, and compact to not less than 95 percent of the material's maximum dry density, as determined in general accordance with ASTM D1557 (Modified Proctor). Asphalt pavement should be compacted to at least 91 percent of the material's theoretical maximum density, as determined in general accordance with ASTM D2041 (Rice Specific Gravity).

## 5.10 Bridge Abutments – Gabion Baskets

Based on a constructability and economic standpoint, we are of the opinion that Gabion basket abutment foundations will be a suitable foundation type for the proposed bridge crossing structures. Gabion basket



bridge abutments consist of rectangular rock-filled wire baskets ("gabions") founded on native soils. All gabion wall materials should be in general conformance with Section 02340 of the ODOT 2015 Oregon Standard Specifications for Construction.

#### 5.10.1 Subgrade Preparation for Abutment Foundations

Satisfactory subgrade support for the proposed gabion basket abutments can be obtained by placing a minimum, 6-inch-thick layer of imported granular structural fill in conformance with Section 5.4.2 over the native, medium stiff or better loess (ML), medium stiff/dense or better alluvium (ML, GM), medium stiff or better residual soil (CL), or predominately weathered basalt (RX) encountered near the surface of the site in hand auger borings advanced near the anticipated abutment locations. The following table indicates the anticipated bearing soil for each bridge abutment:

| Bridge Abutment                 | Anticipated Bearing Soils                      | Geologic Interpretation | Associated Exploration |
|---------------------------------|--|-------------------------|------------------------|
| Crossing 1 – North Abutment     | Medium stiff to better silt (ML)               | Loess                   | HA C-1/N               |
| Crossing 1 – South Abutment     | Medium stiff to better silt (ML)               | Loess                   | HA C-1/S               |
| Crossing 2 – Northeast Abutment | Medium stiff to better silt (ML)               | Loess                   | HA C-2/NE              |
| Crossing 2 – Southwest Abutment | Medium stiff to better silt (ML)               | Loess                   | HA C-2/SW              |
| Crossing 3 – Northwest Abutment | Medium dense to better silty gravel (GM)       | Alluvium                | HA C-3/NW              |
| Crossing 3 – Southeast Abutment | Medium stiff to better gravelly lean clay (CL) | Residual Soil           | HA C-3/SE              |
| Crossing 4 – Northeast Abutment | Medium stiff to better silt (ML)               | Loess                   | HA C-4/NE              |
| Crossing 4 – Southwest Abutment | Medium stiff to better silt (ML)               | Loess                   | HA C-4/SW              |
| Crossing 5 – East Abutment      | Medium stiff to better silt (ML)               | Loess                   | HA C-5/E               |
| Crossing 5 – West Abutment      | Medium stiff to better silt (ML)               | Alluvium                | HA C-5/W               |
| Crossing 6 – East Abutment      | Predominantly decomposed basalt (RX)           | Columbia River Basalt   | HA C-6/E               |
| Crossing 6 – West Abutment      | Medium stiff to better silt (ML)               | Loess                   | HA C-6/W               |

After site preparation as recommended above, and prior to construction of the gabion basket abutments, the geotechnical engineer or his representative should observe the exposed foundation subgrade soils to confirm conditions consistent with those observed during our field investigation and to identify potential areas of excessive yielding. The geotechnical engineer or his representative should evaluate the subgrade during excavation by probing, since proof rolling (typically done with heavy construction equipment) will not be possible due to the isolated site location. If areas of soft soil or excessive yielding are identified, the affected material should be over-excavated to firm, stable subgrade, and replaced with imported granular structural fill in conformance with Section 5.4.2 of this report.

#### 5.10.2 Bearing Pressure & Coefficient of Friction

Gabion basket abutments founded as recommended above should be proportioned for a maximum allowable soil bearing pressure of 2,000 pounds per square foot (psf). This bearing pressure is a net bearing pressure, applies to the total of dead and long-term live loads, and may be increased by one-third when considering seismic or wind loads.

An ultimate coefficient of friction equal to 0.45 may be used when calculating resistance to sliding for gabion basket abutments founded on the recommended minimum of 6 inches of imported granular structural fill (crushed rock) that is properly placed and compacted during construction.



### 5.10.3 Gabion Rock Fill

Acceptable rock fill should be hard, durable, angular, and uniformly-graded. Typical rock sizes range between not be less than 4 inches in any given dimension and no larger than 8 inches in any given dimension. However, the rock fill size will depend on the opening size of the gabion baskets and is usually dependent on the manufacturer's recommendations.

### 5.10.4 Horizontal Setback from Descending Slopes

In order to minimize the effects of stream scour and undercutting of the stream banks, we recommend that gabion foundations constructed within or near descending slopes (i.e., stream banks) should be setback a minimum of 10 feet from the slope surface. This distance should be measured between the face of the slope and the bottom, outside edge of the respective foundation. Organic topsoil and loose surface soils (if present) should not be included when determining this distance. The geotechnical engineer or his representative should be contacted to observe foundation subgrade conditions and confirm this recommended minimum setback is achieved. Any additional setback distances determined from either a design high water level or a hydraulic scour analysis should be considered. Hydraulic analyses were beyond the scope of our assignment.

## 5.11 **Trail Construction Considerations**

CGT recommends trail design and construction take into account the following considerations:

- CGT recommends trails be graded by cutting (in lieu of filling) wherever possible to minimize the potential for improper loading of a slope and/or abrupt gradient changes. Cut slopes should have a maximum gradient of 2H:1V, as recommended in Section 5.5 above.
- Trails should be graded to allow sheetflow runoff across the trail wherever possible to avoid collection of stormwater runoff. This may be accomplished by minimizing grade changes across the trail, allowing a slight downslope gradient of the trail bed (outsloped tread), and through grade reversals along running slopes of the trails.
- If stormwater runoff collection is unavoidable, water should not be discharged in a concentrated manner, which may result in erosion. Level spreaders or erosion control structures (e.g. gravel at the discharge point) may be utilized to minimize erosion potential.

## 5.12 **Additional Considerations**

### 5.12.1 Trailhead Drainage

Subsurface drains should be connected to the nearest storm drain, on-site infiltration system (to be designed by others) or other suitable discharge point. Paved surfaces and grading near or adjacent to buildings should be sloped to drain away from the building. Surface water from paved surfaces and open spaces should be collected and routed to a suitable discharge point. Surface water should not be directed into foundation drains.

### 5.12.2 Expansive Potential

The near surface native soils consist of low plasticity silt (ML) and lean clay (CL). These soils are not considered to be susceptible to appreciable movements from changes in moisture content. Accordingly, no special considerations are required to mitigate expansive potential of the near surface soils at the site.



## **6.0 RECOMMENDED ADDITIONAL SERVICES**

### **6.1 Design Review**

Geotechnical design review is of paramount importance. We recommend the geotechnical design review take place prior to releasing bid packets to contractors.

### **6.2 Observation of Construction**

Satisfactory earthwork, foundation, floor slab, and pavement performance depends to a large degree on the quality of construction. Sufficient observation of the contractor's activities is a key part of determining that the work is completed in accordance with the construction drawings and specifications. Subsurface conditions observed during construction should be compared with those encountered during subsurface explorations, and recognition of changed conditions often requires experience. We recommend that qualified personnel visit the site with sufficient frequency to detect whether subsurface conditions change significantly from those observed to date and anticipated in this report. We recommend the geotechnical engineer or their representative attend a pre-construction meeting coordinated by the contractor and/or developer. The project geotechnical engineer or their representative should provide observations and/or testing of at least the following earthwork elements during construction:

- Site Stripping and Demolition
- Subgrade Preparation for Shallow Foundations, Retaining Walls, Bridge Abutments, Structural Fills, Floor Slabs, and Pavements
- Compaction of Structural Fill and Utility Trench Backfill
- Compaction of Base Rock for Floor Slabs and Pavements
- Compaction of HMA for Pavements

It is imperative that the owner and/or contractor request earthwork observations and testing at a frequency sufficient to allow the geotechnical engineer to provide a final letter of compliance for the earthwork activities.

## **7.0 LIMITATIONS**

We have prepared this report for use by the owner/developer and other members of the design and construction team for the proposed development. The opinions and recommendations contained within this report are not intended to be, nor should they be construed as a warranty of subsurface conditions, but are forwarded to assist in the planning and design process.

We have made observations based on our explorations that indicate the soil conditions at only those specific locations and only to the depths penetrated. These observations do not necessarily reflect soil types, strata thickness, or water level variations that may exist between or away from our explorations. If subsurface conditions vary from those encountered in our site explorations, CGT should be alerted to the change in conditions so that we may provide additional geotechnical recommendations, if necessary. Observation by experienced geotechnical personnel should be considered an integral part of the construction process.

The owner/developer is responsible for ensuring that the project designers and contractors implement our recommendations. When the design has been finalized, prior to releasing bid packets to contractors, we recommend that the design drawings and specifications be reviewed by our firm to see that our recommendations have been interpreted and implemented as intended. If design changes are made, we request that we be retained to review our conclusions and recommendations and to provide a written



modification or verification. Design review and construction phase testing and observation services are beyond the scope of our current assignment, but will be provided for an additional fee.

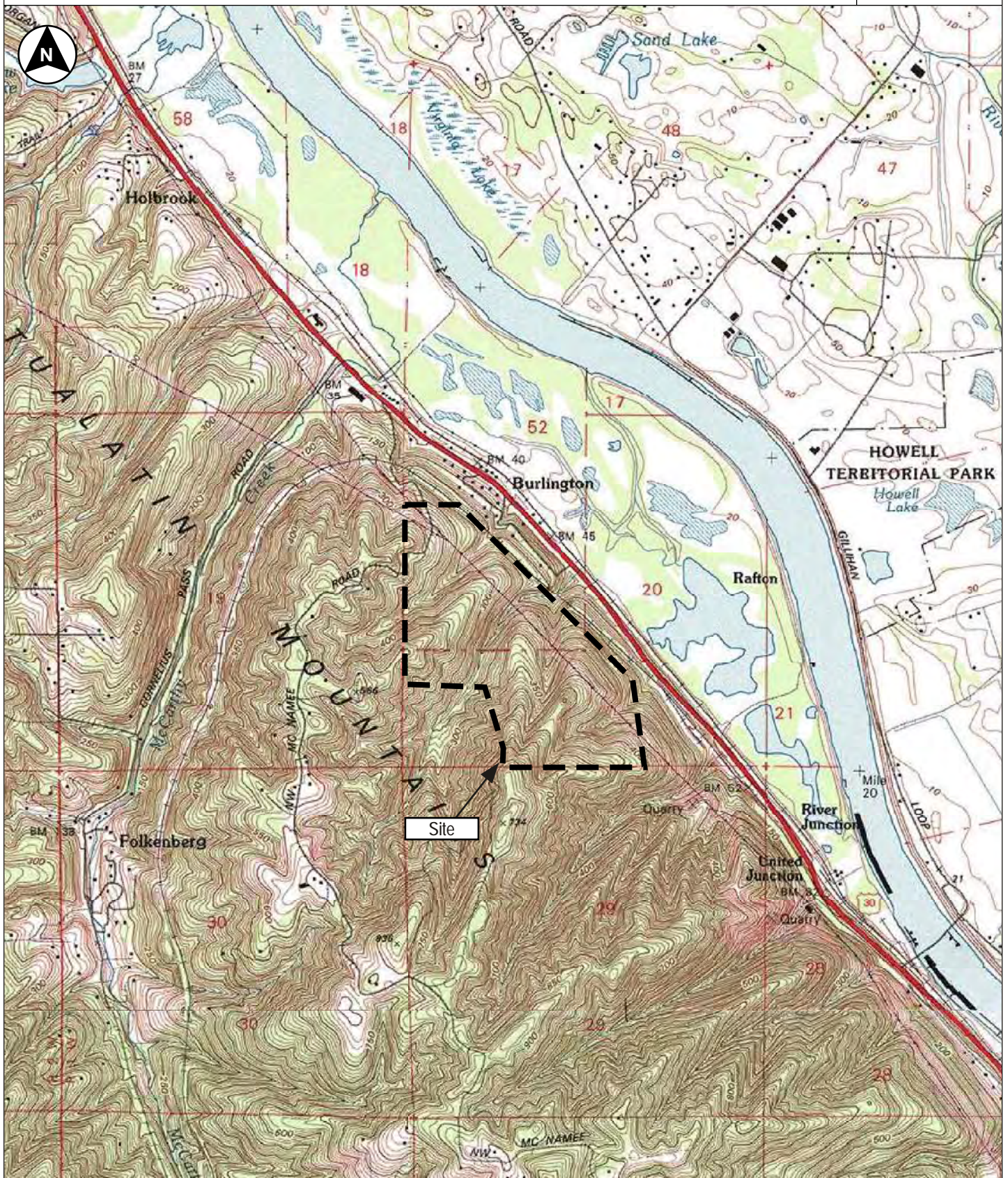
The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design.

Geotechnical engineering and the geologic sciences are characterized by a degree of uncertainty. Professional judgments presented in this report are based on our understanding of the proposed construction, familiarity with similar projects in the area, and on general experience. Within the limitations of scope, schedule, and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this report was prepared; no warranty, expressed or implied, is made. This report is subject to review and should not be relied upon after a period of three years



**BURLINGTON CREEK FOREST NATURE PARK - MULTNOMAH COUNTY, OREGON**  
**Project Number G1704662**

**FIGURE 1**  
**Site Location**



Drafted by: RTH

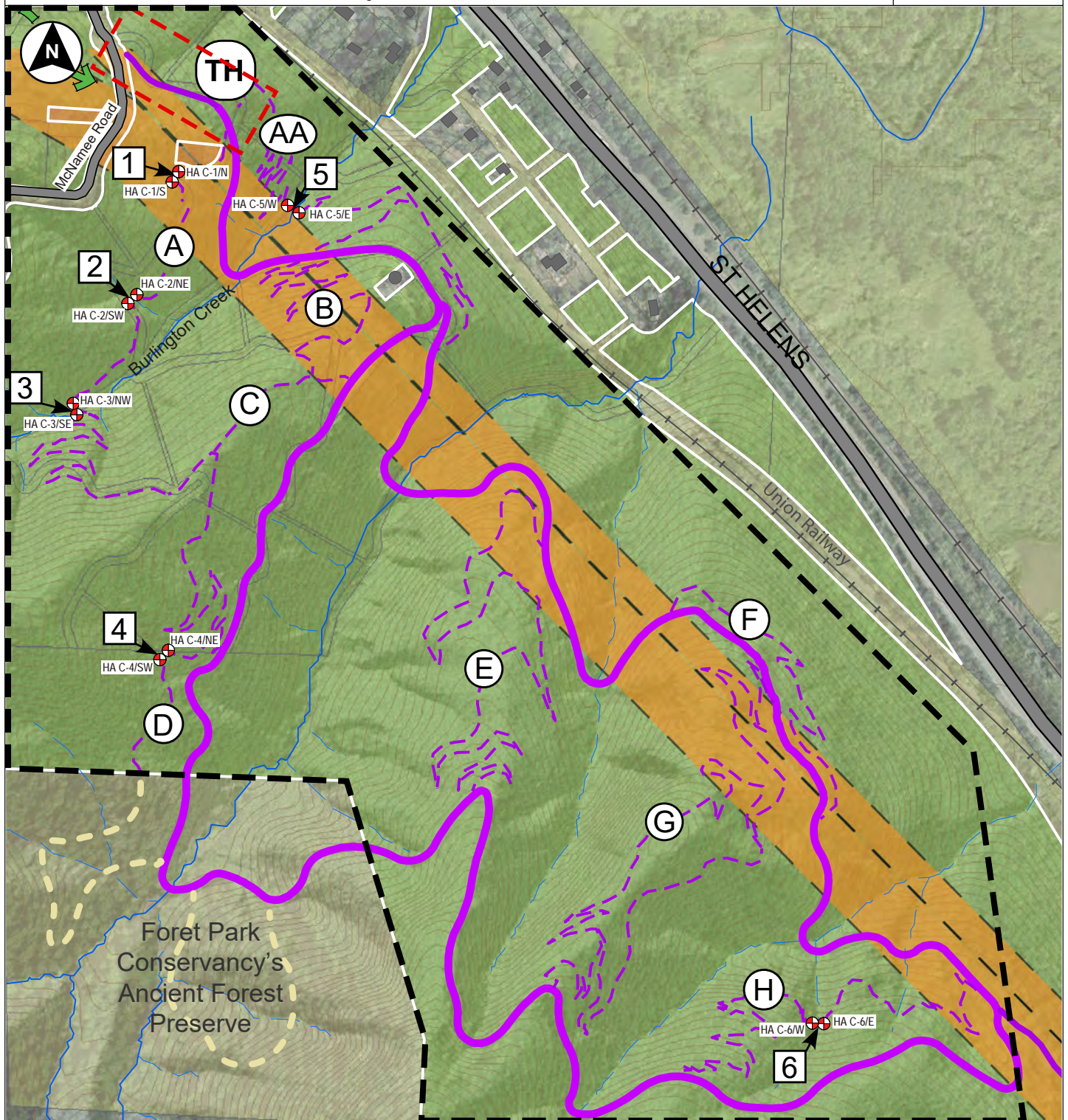
Map created with TOPO!™, © 2006 National Geographic Holdings  
 USGS 7.5 Minute Topographic Map Series, Sauvie Island, Oregon  
 Quadrangle, 1990.  
 Township 2 North, Range 1 West, Section 20 Willamette Meridian

Latitude: 45.644865° North  
 Longitude: 122.845679° West

1 Inch = 2,000 feet





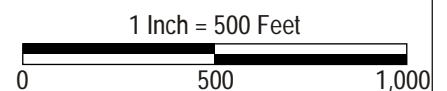


**LEGEND**

- |         |                                |     |                                   |
|---------|--------------------------------|-----|-----------------------------------|
| HA TH-7 | Hand auger boring              | (H) | Proposed Trail (from Metro)       |
|         | Trailhead Site Plan (Figure 3) | 1   | Drainage Crossing (from Metro)    |
|         | Approximate Site Boundary      |     | Existing Access Road (from Metro) |



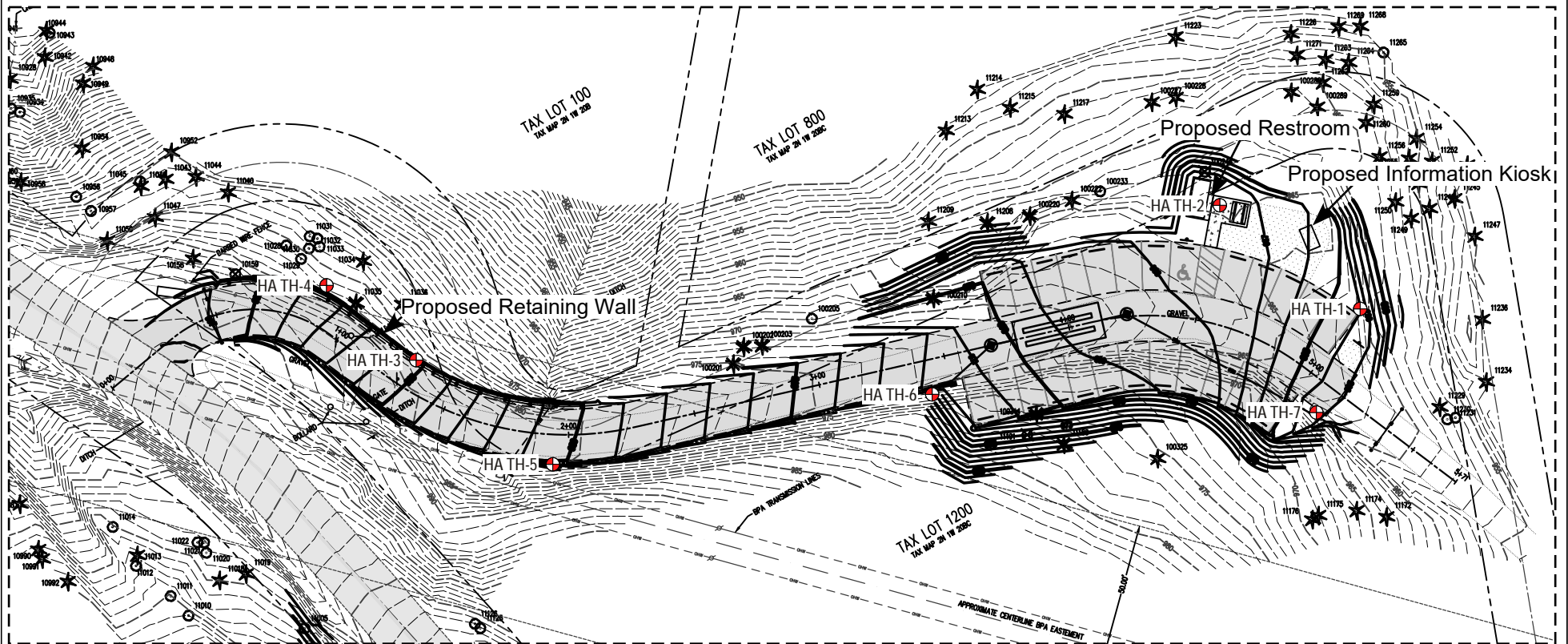
NOTES: Drawing based on Burlington Creek Forest Nature Park, September 2017, prepared by Metro, and observations made while on site. All exploration locations should be considered approximate.





**BURLINGTON CREEK FOREST NATURE PARK - MULTNOMAH COUNTY, OREGON**  
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**FIGURE 3**  
**Trailhead Site Plan**



Approximate figure location shown on Figure 2.

**LEGEND**

HA TH-7 Hand auger boring

1 Inch = 60 Feet

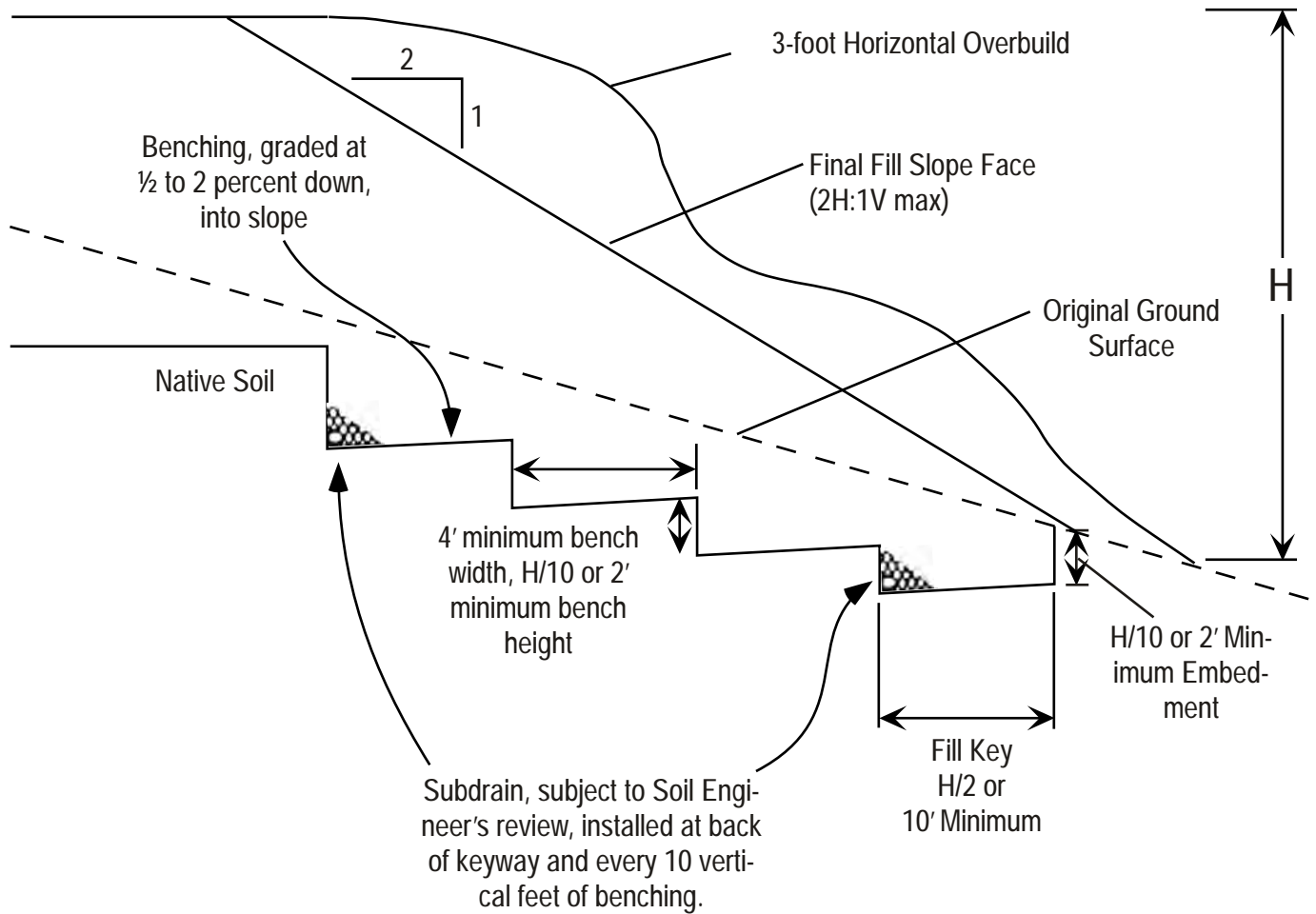


NOTES: Drawing based on observations made while on site and Burlington Parking Site Plan prepared by AKS Engineering, dated 9/5/17. All exploration locations should be considered approximate.



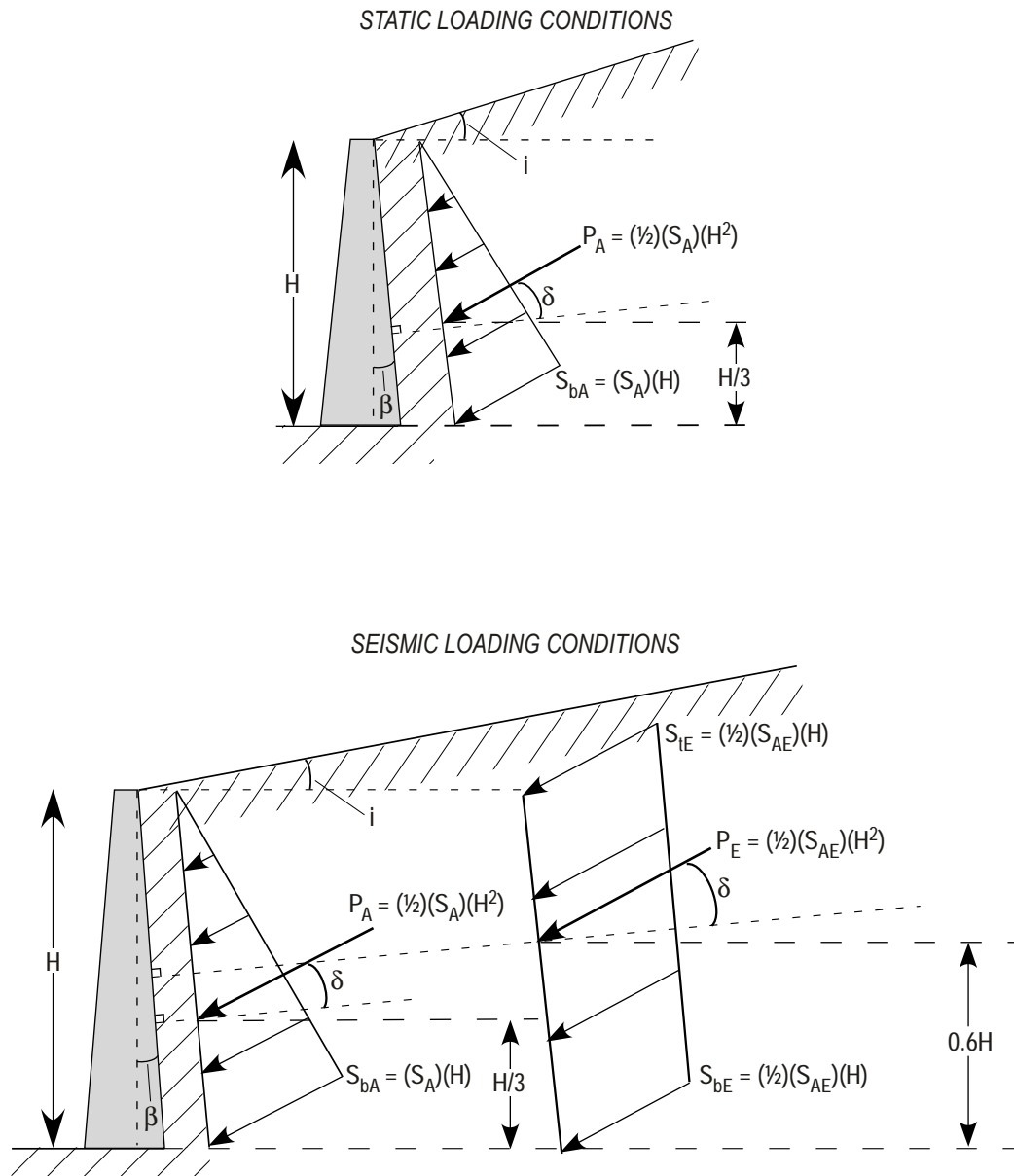
Drafted by: RTH







ACTIVE LATERAL PRESSURE DISTRIBUTION



LEGEND

$P_A$  = Static active thrust force acting at a triangular distribution on wall (lb/ft<sup>3</sup>)

$P_E$  = Dynamic component of active thrust force acting at a uniform distribution on wall (lb/ft)

$i$  = Slope of backfill (degrees)\*\*

$S_A$  = Active (static) component of equivalent fluid pressure (lb/ft<sup>3</sup>)\*

$S_{tE}$  = Active earth pressure (dynamic) at the top of the wall (lb/ft<sup>3</sup>)

$S_{bA}$  = Active earth pressure (static) at the bottom of the wall (lb/ft<sup>3</sup>)

$\phi$  = Internal angle of friction for backfill (degrees)\*\*

$\delta$  = Angle from normal of back of wall (degrees). Based on friction developing between wall and backfill\*\*

$\beta$  = Slope of back of wall (degrees)\*\*

$S_{AE}$  = Dynamic component of equivalent fluid pressure (lb/ft<sup>3</sup>)\*

$S_{bE}$  = Active earth pressure (dynamic) at bottom of the wall (lb/ft<sup>3</sup>)\*

\*Refer to report text for calculated values    \*\*Refer to report text for modeled/assumed values



Notes

1. Uniform pressure distribution of seismic loading is based on empirical evaluations [Sherif et al, 1982 and Whitman, 1990].
2. Placement of seismic resultant force at 0.6H is based on wall behavior and model test results [Whitman, 1990].



# Carlson Geotechnical

A Division of Carlson Testing, Inc.  
Phone: (503) 601-8250  
Fax: (503) 601-8254

Bend Office (541) 330-9155  
Eugene Office (541) 345-0289  
Salem Office (503) 589-1252  
Tigard Office (503) 684-3460



## Appendix A: Subsurface Investigation and Laboratory Testing

**Burlington Creek Forest Nature Park  
NW McNamee Road  
Multnomah County, Oregon**

**CGT Project Number G1704662**

September 13, 2017

*Prepared For:*

Ms. Karen Vitkay  
Metro  
600 NE Grand Avenue  
Portland, Oregon 97232-2736

*Prepared by*  
**Carlson Geotechnical**

|                                |                  |
|--------------------------------|------------------|
| Exploration Key.....           | Figure A1        |
| Soil Classification.....       | Figure A2        |
| ODOT Rock Classification ..... | Figure A3        |
| Boring Logs.....               | Figures A4 – A22 |



## **A.1.0 SUBSURFACE INVESTIGATION**

Our field investigation consisted of nineteen hand auger borings completed in August 2017. The approximate exploration locations are shown on the Overall Site Plan and Trailhead Site Plan, attached to the geotechnical report as Figures 2 and 3, respectively. The exploration locations shown therein were estimated based on measurements taken with hand-held GPS units and should be considered approximate. Surface elevations indicated on the logs were estimated from the topographic maps (Figures 2 and 3), and should be considered approximate. Elevations assigned to the stream crossing explorations were based on Figure 2, which has a 10-foot contour interval. Therefore, the elevations should be considered to be within  $\pm 5$  feet. Elevations assigned to the trailhead explorations were based on Figure 3, which has a 1-foot contour interval and should be considered to be within  $\pm 1$  foot.

### **A.1.1 Hand Auger Borings**

CGT advanced two hand auger borings near each of the proposed bridge abutments for crossings 1 through 6 to depths of up to 5 feet bgs. Hand augers were named based on the crossing number and direction relative to the proposed bridge (e.g. HA C3-NW for the hand auger on the northwest side of crossing 3). Seven additional hand auger borings (HA TH-1 through TH-7) were advanced in the area of the proposed trailhead facility to depths of up to 8 feet bgs.

Many of the hand augers were terminated due to practical refusal. Practical refusal occurs when the auger cannot be advanced further, often due to coarse gravel particles in the soil. The hand auger borings were loosely backfilled with the excavated materials upon completion.

### **A.1.2 In-Situ Testing - Wildcat Dynamic Cone Penetrometer (WDCP) Tests**

We performed fifteen dynamic cone penetrometer tests in conjunction with selected hand auger borings (near the proposed bridge abutments and retaining walls) to depths of up to about 5½ feet bgs. The WDCP tests were performed using a Wildcat Dynamic Cone Penetrometer (WDCP) provided and operated by CGT. The WDCP test is described on the attached Exploration Key, Figure A1.

### **A.1.3 In-Situ Testing - Dynamic Cone Penetrometer (DCP) Tests**

We performed three dynamic cone penetrometer tests in conjunction with selected hand auger borings (in areas of proposed pavements) to depths of up to about 3 feet bgs. The DCP tests were performed using a Salem Tools Dynamic Cone Penetrometer (DCP) provided and operated by CGT. The DCP test is described on the attached Exploration Key, Figure A1.

### **A.1.4 Material Classification & Sampling**

Representative grab samples were obtained at select intervals from cuttings collected from the hand auger borings. A qualified member of CGT's staff collected the samples and logged the soils in general accordance with the Visual-Manual Procedure (ASTM 2488) and ODOT Rock Classification Criteria. An explanation of these classification systems are attached as Figures A2 and A3. The grab samples were stored in sealable plastic bags and transported to our soils laboratory for further examination and testing. Our geotechnical staff visually examined all samples in order to refine the initial field classifications.

### **A.1.5 Subsurface Conditions**

Subsurface conditions are summarized in Section 2.3 of the geotechnical report. Detailed logs of the explorations are presented on the attached exploration logs, Figures A4 through A22.



#### **A.2.0 LABORATORY TESTING**

Laboratory testing was performed on samples collected in the field to refine our initial field classifications and determine in-situ parameters. Laboratory testing included the following:

- Seventeen moisture content determinations (ASTM D2216).
- Three Atterberg limits (plasticity) tests (ASTM D4318).
- Four percentage passing the U.S. Standard No. 200 Sieve tests (ASTM D1140).

Results of the laboratory tests are shown on the exploration logs.



**BURLINGTON CREEK FOREST NATURE PARK - MULTNOMAH COUNTY, OREGON**  
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**FIGURE A1**  
**Exploration Key**

**GEOTECHNICAL LABORATORY TESTING**



Atterberg limits (plasticity) test results (ASTM D4318): PL = Plastic Limit, LL = Liquid Limit, and MC= Moisture Content (ASTM D2216)

□ FINES CONTENT (%) Percentage passing the U.S. Standard No. 200 Sieve (ASTM D1140)

**SAMPLING**



GRAB

Grab sample



SPT

**Standard Penetration Test (SPT)** consists of driving a 2-inch, outside-diameter, split-spoon sampler into the undisturbed formation with repeated blows of a 140-pound, hammer falling a vertical distance of 30 inches (ASTM D1586). The number of blows (N-value) required to drive the sampler the last 12 inches of an 18-inch sample interval is used to characterize the soil consistency or relative density. The drill rig was equipped with an cat-head or automatic hammer to conduct the SPTs. The observed N-values, hammer efficiency, and  $N_{60}$  are noted on the boring logs.



MC

**Modified California** sampling consists of 3-inch, outside-diameter, split-spoon sampler (ASTM G3550) driven similarly to the SPT sampling method described above. A sampler diameter correction factor of 0.44 is applied to calculate the equivalent SPT  $N_{60}$  value per Lacroix and Horn, 1973.



CORE

**Rock Coring** interval



SH

**Shelby Tube** is a 3-inch, inner-diameter, thin-walled, steel tube push sampler (ASTM D1587) used to collect relatively undisturbed samples of fine-grained soils.

WDCP

**Wildcat Dynamic Cone Penetrometer (WDCP)** test consists of driving 1.1-inch diameter, steel rods with a 1.4-inch diameter, cone tip into the ground using a 35-pound drop hammer with a 15-inch free-fall height. The number of blows required to drive the steel rods is recorded for each 10 centimeters (3.94 inches) of penetration. The blow count for each interval is then converted to the corresponding SPT  $N_{60}$  values.

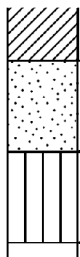
DCP

**Dynamic Cone Penetrometer (DCP)** test consists of driving a 20-millimeter diameter, hardened steel cone on 16-millimeter diameter steel rods into the ground using a 10-kilogram drop hammer with a 460-millimeter free-fall height. The depth of penetration in millimeters is recorded for each drop of the hammer.

POCKET  
PEN. (tsf)

**Pocket Penetrometer** test is a hand-held instrument that provides an approximation of the unconfined compressive strength in tons per square foot (tsf) of cohesive, fine-grained soils.

**CONTACTS**



Observed (measured) contact between soil or rock units.

Inferred (approximate) contact between soil or rock units.

Transitional (gradational) contact between soil or rock units.

**ADDITIONAL NOTATIONS**

*Italics*

Notes drilling action or digging effort

{ Braces }

Interpretation of material origin/geologic formation (e.g. { Base Rock } or { Columbia River Basalt })



**BURLINGTON CREEK FOREST NATURE PARK - MULTNOMAH COUNTY, OREGON**  
**Project Number G1704662**

**FIGURE A2**  
**Soil Classification**

| Classification of Terms and Content   |   |  |   | USCS Grain Size   |  |                                   |
|---|---|--|---|---|--|-----------------------------------|
| NAME: Group Name and Symbol<br>Relative Density or Consistency<br>Color<br>Moisture Content<br>Plasticity<br>Other Constituents<br>Other: Grain Shape, Approximate Gradation<br>Organics, Cement, Structure, Odor, etc.<br>Geologic Name or Formation |   |  | Fines   | <#200 (0.075 mm)  |  |                                   |
|   | Sand  |  | Fine  | #200 - #40 (0.425 mm)   |  |                                   |
|   |   |  | Medium  | #40 - #10 (2 mm)  |  |                                   |
|   | Gravel  |  | Coarse  | #10 - #4 (4.75)   |  |                                   |
|   |   |  | Fine  | #4 - 0.75 inch  |  |                                   |
| Cobbles   |   | Coarse   | 0.75 inch - 3 inches                                  |   |  |                                   |
|   |   | 3 to 12 inches;<br>scattered <15% estimated<br>numerous >15% estimated |   |   |  |                                   |
| Boulders  |   | > 12 inches  |   |   |  |                                   |
| Relative Density or Consistency   |   |  |   |   |  |                                   |
| Granular Material   |   | Fine-Grained (cohesive) Materials                                      |   |   |  |                                   |
| SPT<br>N-Value  | Density   | SPT<br>N-Value   | Torvane tsf<br>Shear Strength                         | Pocket Pen tsf<br>Unconfined  | Consistency  | Manual Penetration Test           |
|   |   | <2   | <0.13   | <0.25   | Very Soft  | Thumb penetrates more than 1 inch |
| 0 - 4   | Very Loose  | 2 - 4  | 0.13 - 0.25   | 0.25 - 0.50   | Soft   | Thumb penetrates about 1 inch     |
| 4 - 10  | Loose   | 4 - 8  | 0.25 - 0.50   | 0.50 - 1.00   | Medium Stiff   | Thumb penetrates about ¼ inch     |
| 10 - 30   | Medium Dense  | 8 - 15   | 0.50 - 1.00   | 1.00 - 2.00   | Stiff  | Thumb penetrates less than ¼ inch |
| 30 - 50   | Dense   | 15 - 30  | 1.00 - 2.00   | 2.00 - 4.00   | Very Stiff   | Readily indented by thumbnail     |
| >50   | Very Dense  | >30  | >2.00   | >4.00   | Hard   | Difficult to indent by thumbnail  |
| Moisture Content  |   |  |   | Structure   |  |                                   |
| Dry: Absence of moisture, dusty, dry to the touch<br>Damp: Some moisture but leaves no moisture on hand<br>Moist: Leaves moisture on hand<br>Wet: Visible free water, likely from below water table   |   |  |   | Stratified: Alternating layers of material or color >6 mm thick<br>Laminated: Alternating layers < 6 mm thick<br>Fissured: Breaks along definite fracture planes<br>Slickensided: Striated, polished, or glossy fracture planes |  |                                   |
|   | Plasticity  | Dry Strength   | Dilatancy   | Toughness   | Blocky: Cohesive soil that can be broken down into small angular lumps which resist further breakdown<br>Lenses: Has small pockets of different soils, note thickness<br>Homogeneous: Same color and appearance throughout |                                   |
| ML<br>CL<br>MH<br>CH  | Non to Low<br>Low to Medium<br>Medium to High<br>Medium to High | Non to Low<br>Medium to High<br>Low to Medium<br>High to Very High     | Slow to Rapid<br>None to Slow<br>None to Slow<br>None | Low, can't roll<br>Medium<br>Low to Medium<br>High  |  |                                   |
| Visual-Manual Classification  |   |  |   |   |  |                                   |
| Major Divisions   |   |  | Group<br>Symbols                                      | Typical Names   |  |                                   |
| Coarse<br>Grained<br>Soils:<br>More than<br>50% retained<br>on No. 200<br>sieve   | Gravels: 50% or more<br><i>retained</i> on<br>the No. 4 sieve   | Clean<br>Gravels   | GW  | Well-graded gravels and gravel/sand mixtures, little or no fines  |  |                                   |
|   |   | Gravels<br>with Fines  | GP  | Poorly-graded gravels and gravel/sand mixtures, little or no fines  |  |                                   |
|   |   |  | GM  | Silty gravels, gravel/sand/silt mixtures  |  |                                   |
|   |   |  | GC  | Clayey gravels, gravel/sand/clay mixtures   |  |                                   |
|   | Sands: More than<br>50% <i>passing</i> the<br>No. 4 sieve       | Clean<br>Sands   | SW  | Well-graded sands and gravelly sands, little or no fines  |  |                                   |
|   |   | Sands<br>with Fines  | SP  | Poorly-graded sands and gravelly sands, little or no fines  |  |                                   |
|   |   |  | SM  | Silty sands, sand/silt mixtures   |  |                                   |
|   |   |  | SC  | Clayey sands, sand/clay mixtures  |  |                                   |
| Fine-Grained<br>Soils:<br>50% or more<br>Passes No.<br>200 Sieve  | Silt and Clays<br>Low Plasticity Fines                          |  | ML  | Inorganic silts, rock flour, clayey silts   |  |                                   |
|   |   |  | CL  | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays  |  |                                   |
|   |   |  | OL  | Organic silt and organic silty clays of low plasticity  |  |                                   |
|   | Silt and Clays<br>High Plasticity Fines                         |  | MH  | Inorganic silts, clayey silts   |  |                                   |
|   |   |  | CH  | Inorganic clays of high plasticity, fat clays   |  |                                   |
| Highly Organic Soils  |   |  | OH  | Organic clays of medium to high plasticity  |  |                                   |
|   |   |  | PT  | Peat, muck, and other highly organic soils  |  |                                   |



ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)



**Table 22: Scale of Relative Rock Weathering**

| Designation             | Field Identification  |
|-------------------------|---|
| Fresh                   | Crystals are bright. Discontinuities may show some minor surface staining. No discoloration in rock fabric.   |
| Slightly Weathered      | Rock mass is generally fresh. Discontinuities are stained and may contain clay. Some discoloration in rock fabric. Decomposition extends up to 1-inch into rock.  |
| Moderately Weathered    | Rock mass is decomposed 50% or less. Significant portions of rock show discoloration and weathering effects. Crystals are dull and show visible chemical alteration. Discontinuities are stained and may contain secondary mineral deposits.  |
| Predominantly Weathered | Rock mass is more than 50% decomposed. Rock can be excavated with geologist's pick. All discontinuities exhibit secondary mineralization. Complete discoloration of rock fabric. Surface of core is friable and usually pitted due to washing out of highly altered minerals by drilling water. |
| Decomposed              | Rock mass is completely decomposed. Original rock fabric may be evident. May be reduced to soil with hand pressure.   |

**Table 23: Scale of Relative Rock Hardness**

| Term           | Hardness Designation | Field Identification  | Approximate Unconfined Compressive Strength |
|----------------|----------------------|---|---|
| Extremely Soft | R0                   | Can be indented with difficulty by thumbnail. May be moldable or friable with finger pressure.  | <100 psi                                    |
| Very Soft      | R1                   | Crumbles under firm blows with point of geology pick. Can be peeled by pocket knife. Scratched with finger nail.                            | 100-1000 psi                                |
| Soft           | R2                   | Can be peeled by pocket knife with difficulty. Cannot be scratched with finger nail. Shallow indentation made by firm blow of geology pick. | 1000-4000 psi                               |
| Medium Hard    | R3                   | Can be scratched by knife or pick. specimen can be fractured with a single firm blow of hammer/geology pick.                                | 4000-8000 psi                               |
| Hard           | R4                   | Can be scratched with knife or pick only with difficulty. Several hard blows required to fracture specimen.                                 | 8000-16000 psi                              |
| Very Hard      | R5                   | Cannot be scratched by knife or sharp pick. Specimen requires many blows of hammer to fracture or chip. Hammer rebounds after impact.       | >16000 psi                                  |

**Table 24: Stratification Terms**

| Term        | Characteristics  |
|-------------|--|
| Laminations | Thin beds (<1cm)   |
| Fissile     | Tendency to break along laminations  |
| Parting     | Tendency to break parallel to bedding, any scale                                 |
| Foliation   | Non-depositional, e.g., segregation and layering of minerals in metamorphic rock |



Tables adapted from the 1987 Soil and Rock Classification Manual, Oregon Department of Transportation.



**FIGURE A4**

## Boring HA TH-1

PAGE 1 OF 1

**CLIENT** Metro

**PROJECT NAME** Burlington Creek Forest Nature Park

PROJECT NUMBER G1704662

**PROJECT LOCATION** Burlington, OR

**DATE STARTED** 8/10/17      **GROUND ELEVATION** 962 ft

**ELEVATION DATUM** Figures 2 and 3

**WEATHER** Sunny ~70F      **SURFACE** Grass

LOGGED BY DE REVIEWED BY RTH

DRILLING CONTRACTOR CGT


SEEPAGE ---

## EQUIPMENT

GROUNDWATER AT END ---

**DRILLING METHOD** 3-Inch Hand Auger & WDCP

**GROUNDWATER AFTER DRILLING** ---

| ELEVATION<br>(ft) | GRAPHIC<br>LOG | GROUP SYMBOL | MATERIAL DESCRIPTION   | GROUNDWATER | DEPTH<br>(ft) | SAMPLE TYPE<br>NUMBER   | RECOVERY %<br>(RQD) | WDCP<br>N <sub>60</sub> VALUE | POCKET PEN.<br>(tsf) | DRY UNIT WT.<br>(pcf) | ▲ WDCP N <sub>60</sub> VALUE ▲ |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|                   |                |              |  |             |               |   |                     |                               |                      |                       | MC                             |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                   |                |              |  |             |               |   |                     |                               |                      |                       | □ FINES CONTENT (%) □          |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                   |                |              |  |             |               |   |                     |                               |                      |                       | 0                              | 20 | 40 | 60 | 80 | 100 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 960               |                | ML           | <b>SILT:</b> Hard, light brown, dry, medium plasticity, roots up to ¼ inch in diameter in upper 1 foot. { Loess }<br><br>Moist below ~1 foot bgs.<br><br><br>Trace fine sand below ~3 feet bgs.<br><br><br>Dark brown below ~5 feet bgs. |             | 0             |   |                     |                               | 25                   |                       |                                |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                   |                |              |  |             | 2             |  | GRAB 1              |                               | 25                   |                       |                                |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |





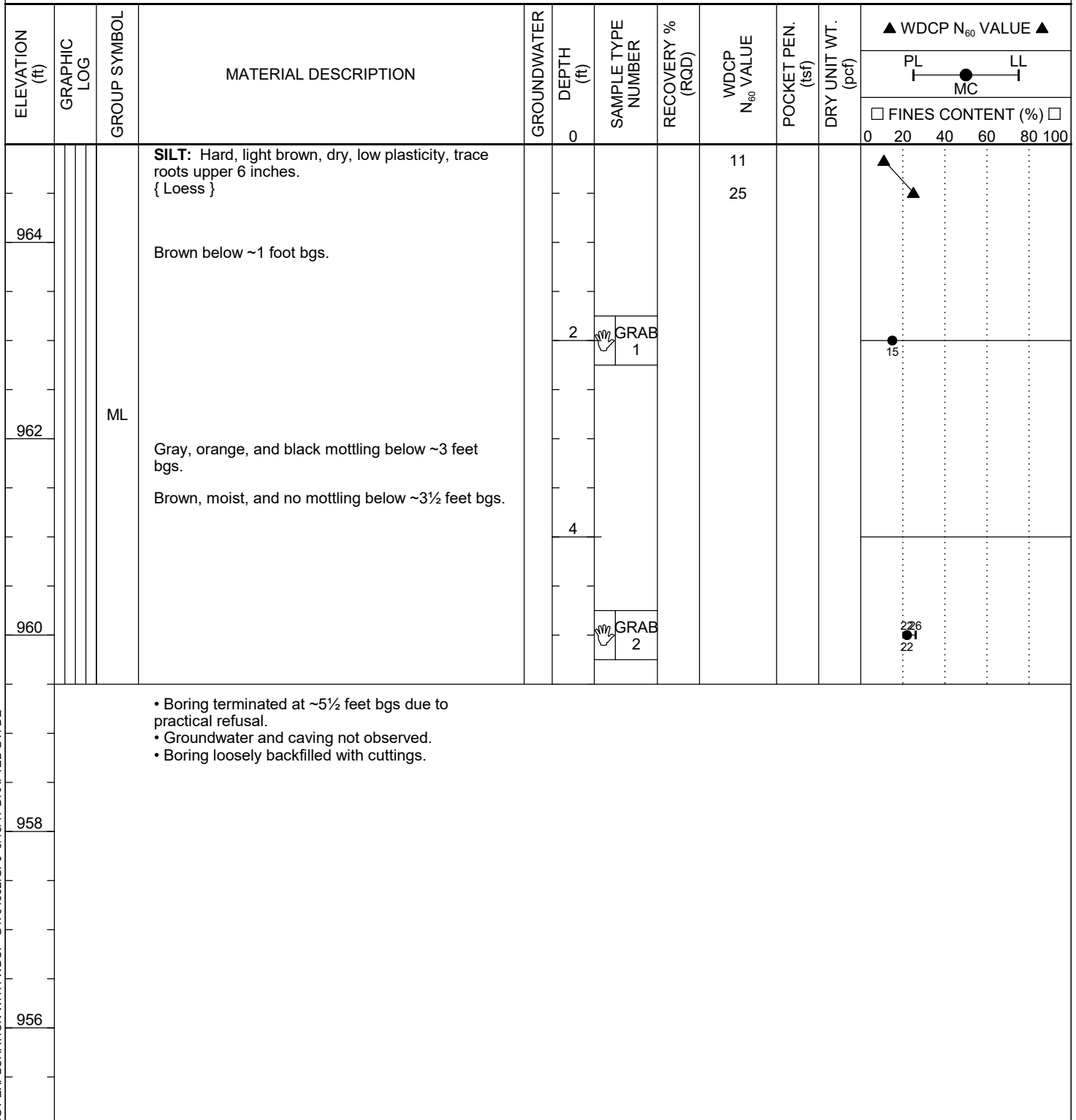
Carlson Geotechnical  
7185 SW Sandburg Street, Suite 200  
Tigard, Oregon 97281  
(503) 601-8250  
www.carlsontesting.com

## FIGURE A5

### Boring HA TH-2

PAGE 1 OF 1

|                     |                          |                            |                                     |
|---------------------|--------------------------|----------------------------|-------------------------------------|
| CLIENT              | Metro                    | PROJECT NAME               | Burlington Creek Forest Nature Park |
| PROJECT NUMBER      | G1704662                 | PROJECT LOCATION           | Burlington, OR                      |
| DATE STARTED        | 8/10/17                  | GROUND ELEVATION           | 965 ft                              |
| WEATHER             | Sunny ~75F               | ELEVATION DATUM            | Figures 2 and 3                     |
| SURFACE             | Scattered Vegetation     | LOGGED BY                  | DE                                  |
| DRILLING CONTRACTOR | CGT                      | REVIEWED BY                | RTH                                 |
| EQUIPMENT           |                          | SEEPAGE                    | ---                                 |
| DRILLING METHOD     | 3-Inch Hand Auger & WDCP | GROUNDWATER AT END         | ---                                 |
|                     |                          | GROUNDWATER AFTER DRILLING | ---                                 |



CGT EXPLORATION WITH WDCP G1704662.GPJ 9/13/17 DRAFTED BY: DE



**CLIENT** Metro

**PROJECT NAME** Burlington Creek Forest Nature Park

**PROJECT NUMBER** G1704662

**PROJECT LOCATION** Burlington, OR

DATE STARTED 8/10/17

**GROUND ELEVATION** 983 ft

**ELEVATION DATUM** Figures 2 and 3

**WEATHER** Sunny ~80F

**SURFACE** Scattered Vegetation

LOGGED BY DE

REVIEWED BY RTHDRILLING CONTRACTOR CGT

SEEPAGE ---

## EQUIPMENT

GROUNDWATER AT END ---

**DRILLING METHOD** 3-Inch Hand Auger & WDCP

**GROUNDWATER AFTER DRILLING** ---

| ELEVATION<br>(ft) | GRAPHIC<br>LOG | GROUP SYMBOL | MATERIAL DESCRIPTION   | GROUNDWATER  | DEPTH<br>(ft) | SAMPLE TYPE<br>NUMBER | RECOVERY %<br>(RQD) | WDCP<br>N <sub>60</sub> VALUE | POCKET PEN.<br>(tsf) | DRY UNIT WT.<br>(pcf) | ▲ WDCP N <sub>60</sub> VALUE ▲ |    |    |    |    |     |    |
|-------------------|----------------|--------------|--|--|---------------|-----------------------|---------------------|-------------------------------|----------------------|-----------------------|--------------------------------|----|----|----|----|-----|----|
|                   |                |              |  |  |               |                       |                     |                               |                      |                       | PL                             | LL |    |    |    |     |    |
|                   |                |              |  |  |               |                       |                     |                               |                      |                       | MC                             |    |    |    |    |     |    |
|                   |                |              |  |  |               |                       |                     |                               |                      |                       | □ FINES CONTENT (%) □          |    |    |    |    |     |    |
|                   |                |              |  |  |               |                       |                     |                               |                      |                       | 0                              | 20 | 40 | 60 | 80 | 100 |    |
| 982               |                | ML           | <b>SILT:</b> Hard, light brown, dry, low plasticity, trace roots in upper 3 inches.<br>{ Loess }                             |  |               |                       |                     | 3                             |                      |                       |                                |    |    |    |    |     |    |
|                   |                |              | Moist below ~1½ feet bgs.  |  |               |                       | 5                   |                               |                      |                       |                                |    |    |    |    |     |    |
|                   |                |              |  |  |               |                       | 10                  |                               |                      |                       |                                |    |    |    |    |     |    |
|                   |                |              |  |  |               |                       | 19                  |                               |                      |                       |                                |    |    |    |    |     |    |
|                   |                |              |  |  |               |                       | 25                  |                               |                      |                       |                                |    |    |    |    |     |    |
|                   |                |              |  |  |               |                       | 25                  |                               |                      |                       |                                |    |    |    |    |     |    |
|                   |                |              |  |  |               |                       | 25                  |                               |                      |                       |                                |    |    |    |    |     |    |
| 980               |                |              |  | Light gray and orange mottling below ~2½ feet bgs. |               |                       |                     | GRAB<br>1                     |                      |                       |                                |    | 26 |    |    |     | 88 |
|                   |                |              |  | No mottling below ~3 feet bgs.                     |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |    |
|                   |                |              |  |  |               | 4                     |                     |                               |                      |                       |                                |    |    |    |    |     |    |
| 978               |                |              | Very stiff and trace fine sand below ~5 feet bgs.  |  |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |    |
|                   |                |              |  |  | 6             |                       |                     |                               |                      |                       |                                |    |    |    |    |     |    |
|                   |                |              | Hard below ~6 feet bgs.  |  |               |                       | GRAB<br>2           |                               |                      |                       |                                | 24 |    |    |    |     |    |
| 976               |                |              | • Boring terminated at ~6½ feet bgs.<br>• Groundwater and caving not observed.<br>• Boring loosely backfilled with cuttings. |  |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |    |
| 974               |                |              |  |  |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |    |





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FIGURE A7

Boring HA TH-4

|                     |                          |                            |                                     |
|---------------------|--------------------------|----------------------------|-------------------------------------|
| CLIENT              | Metro                    | PROJECT NAME               | Burlington Creek Forest Nature Park |
| PROJECT NUMBER      | G1704662                 | PROJECT LOCATION           | Burlington, OR                      |
| DATE STARTED        | 8/10/17                  | GROUND ELEVATION           | 982 ft                              |
| WEATHER             | Sunny ~80F               | ELEVATION DATUM            | Figures 2 and 3                     |
| SURFACE             | Scattered Vegetation     | LOGGED BY                  | DE                                  |
| DRILLING CONTRACTOR | CGT                      | REVIEWED BY                | RTH                                 |
| EQUIPMENT           |                          | SEEPAGE                    | ---                                 |
| DRILLING METHOD     | 3-Inch Hand Auger & WDCP | GROUNDWATER AT END         | ---                                 |
|                     |                          | GROUNDWATER AFTER DRILLING | ---                                 |

| ELEVATION<br>(ft) | GRAPHIC<br>LOG | GROUP SYMBOL | MATERIAL DESCRIPTION  | GROUNDWATER | DEPTH<br>(ft) | SAMPLE TYPE<br>NUMBER | RECOVERY %<br>(RQD) | WDCP<br>N <sub>60</sub> VALUE | POCKET PEN.<br>(tsf) | DRY UNIT WT.<br>(pcf) | ▲ WDCP N <sub>60</sub> VALUE ▲ |    |
|-------------------|----------------|--------------|---|-------------|---------------|-----------------------|---------------------|-------------------------------|----------------------|-----------------------|--------------------------------|----|
|                   |                |              |   |             |               |                       |                     |                               |                      |                       | PL                             | LL |
|                   |                |              |   |             | 0             |                       |                     |                               |                      |                       |                                |    |
|                   |                |              | <b>SILT:</b> Medium stiff to stiff, light brown, dry, low plasticity, trace roots in upper 6 inches.<br>{ Loess } |             |               |                       |                     | 6                             |                      |                       |                                |    |
|                   |                |              |   |             |               |                       |                     | 24                            |                      |                       |                                |    |
|                   |                |              |   |             |               |                       |                     | 22                            |                      |                       |                                |    |
|                   |                |              |   |             |               |                       |                     | 24                            |                      |                       |                                |    |
|                   |                |              |   |             |               |                       |                     | 25                            |                      |                       |                                |    |
|                   |                |              |   |             |               |                       |                     | 25                            |                      |                       |                                |    |
| 980               |                |              | Brown and moist below ~1 foot bgs.  |             | 2             |                       |                     | 25                            |                      |                       |                                |    |
|                   |                |              |   |             |               | GRAB<br>1             |                     | 25                            |                      |                       |                                |    |
|                   |                |              |   |             |               |                       |                     | 25                            |                      |                       |                                |    |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |

- Boring terminated at ~2½ feet bgs due to practical refusal.
- Groundwater and caving not observed.
- Boring loosely backfilled with cuttings.

CGT EXPLORATION WITH WDCP G1704662.GPJ 9/13/17 DRAFTED BY: DE





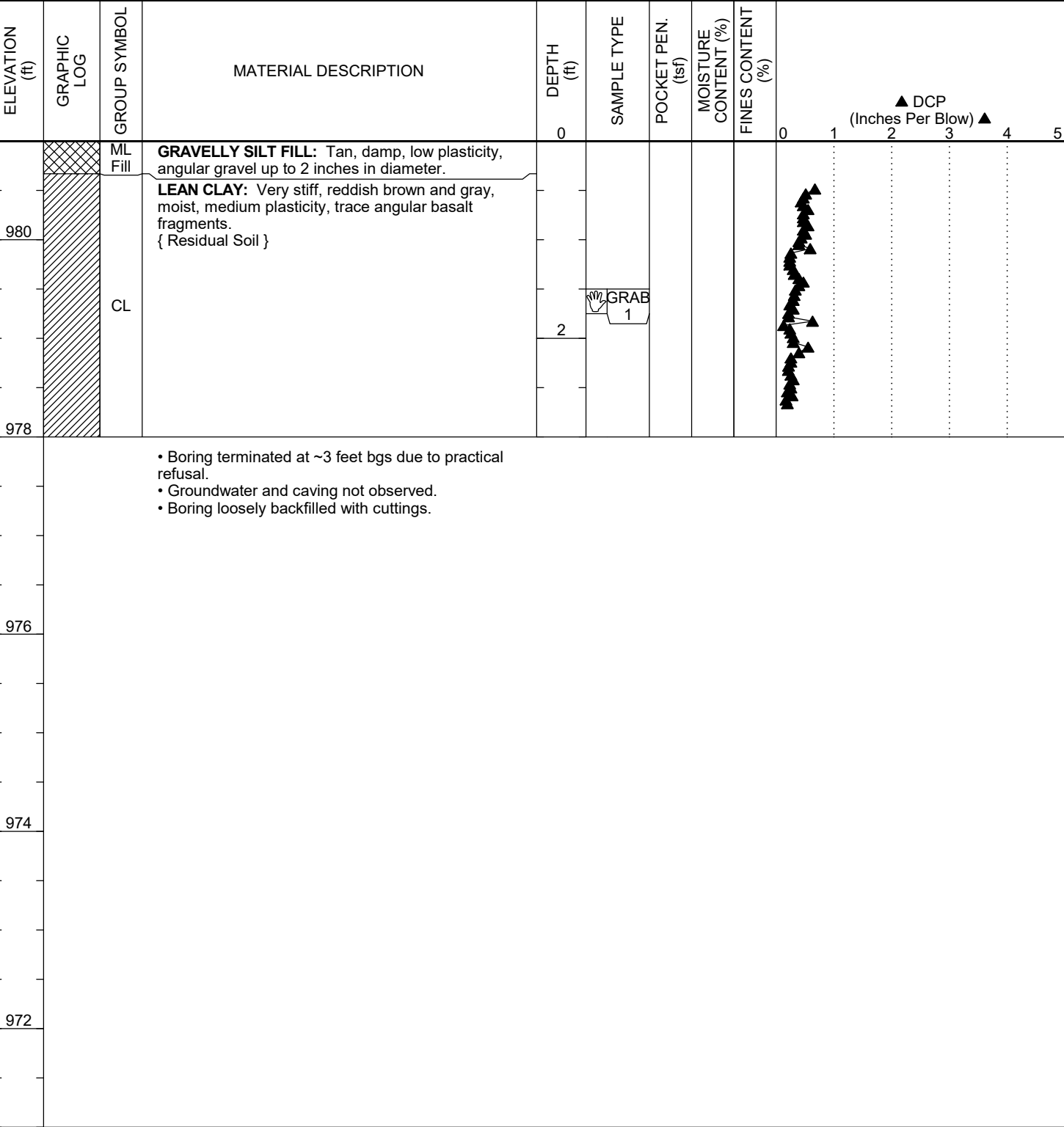
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FIGURE A8

Boring HA TH-5

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|                     |                          |                            |                                     |
|---------------------|--------------------------|----------------------------|-------------------------------------|
| CLIENT              | Metro                    | PROJECT NAME               | Burlington Creek Forest Nature Park |
| PROJECT NUMBER      | G1704662                 | PROJECT LOCATION           | Burlington, OR                      |
| DATE STARTED        | 8/23/17                  | GROUND ELEVATION           | 981 ft                              |
| WEATHER             | Sunny ~70F               | ELEVATION DATUM            | Figures 2 and 3                     |
| SURFACE             | Roadside                 | LOGGED BY                  | RTH                                 |
| DRILLING CONTRACTOR | CGT                      | REVIEWED BY                | JPQ                                 |
| EQUIPMENT           |                          | SEEPAGE                    | ---                                 |
| DRILLING METHOD     | 3-Inch Hand Auger & WDCP | GROUNDWATER AT END         | ---                                 |
|                     |                          | GROUNDWATER AFTER DRILLING | ---                                 |



CGT EXPLORATION WITH DCP G1704662.GPJ 9/13/17 DRAFTED BY: RTH





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## FIGURE A9

### Boring HA TH-6

PAGE 1 OF 1

CLIENT Metro

PROJECT NAME Burlington Creek Forest Nature Park

PROJECT NUMBER G1704662

PROJECT LOCATION Burlington, OR

DATE STARTED 8/23/17 GROUND ELEVATION 972 ft

ELEVATION DATUM Figures 2 and 3

WEATHER Sunny ~70F SURFACE Forest duff

LOGGED BY RTH REVIEWED BY JPQ

DRILLING CONTRACTOR CGT

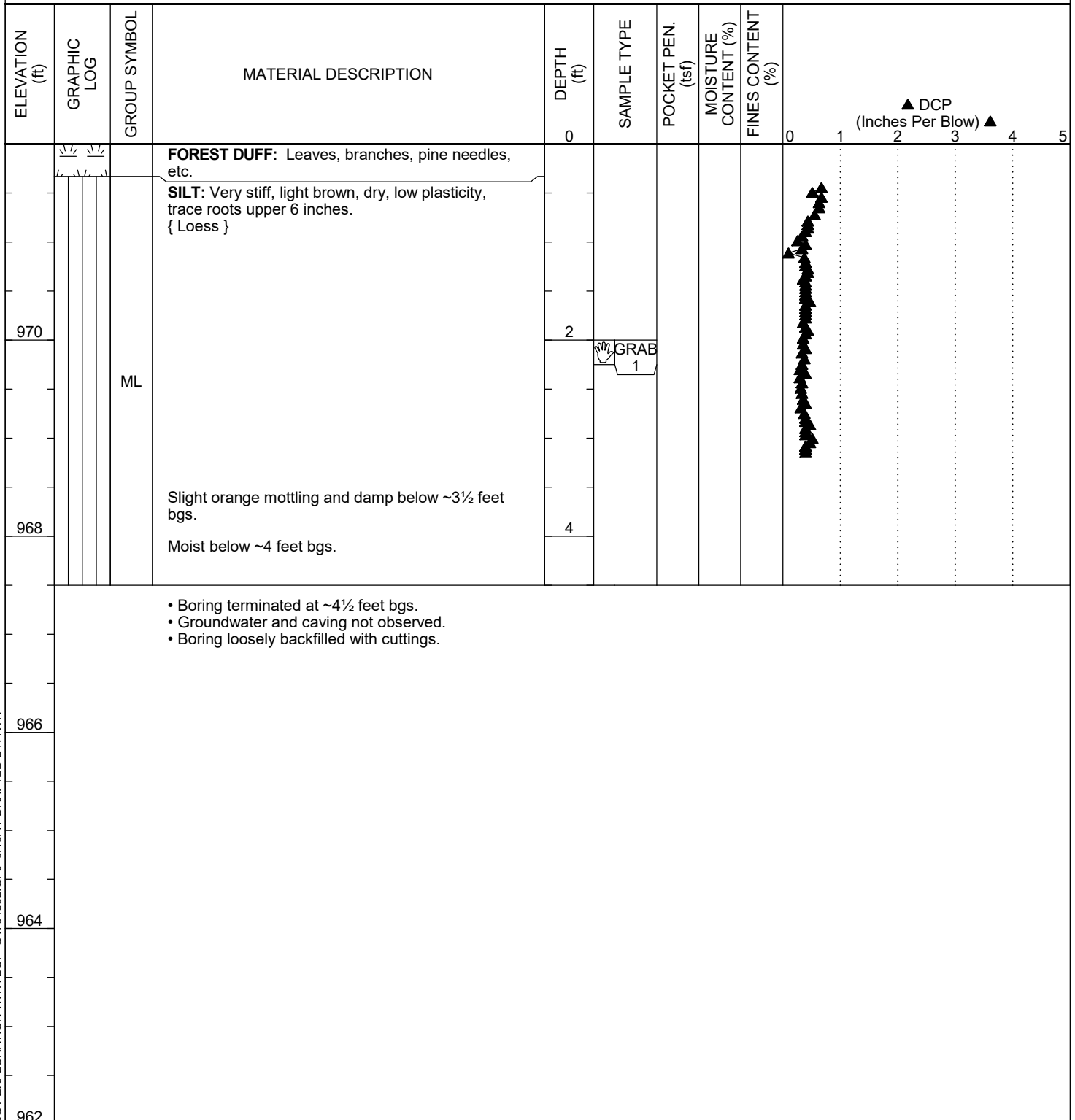
SEEPAGE ---

EQUIPMENT ---

GROUNDWATER AT END ---

DRILLING METHOD 3-Inch Hand Auger & WDCP

GROUNDWATER AFTER DRILLING ---







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FIGURE A10

Boring HA TH-7

PAGE 1 OF 1

|                     |                          |                            |                                     |
|---------------------|--------------------------|----------------------------|-------------------------------------|
| CLIENT              | Metro                    | PROJECT NAME               | Burlington Creek Forest Nature Park |
| PROJECT NUMBER      | G1704662                 | PROJECT LOCATION           | Burlington, OR                      |
| DATE STARTED        | 8/23/17                  | GROUND ELEVATION           | 962 ft                              |
| WEATHER             | Sunny ~70F               | ELEVATION DATUM            | Figures 2 and 3                     |
| SURFACE             | Forest duff              | LOGGED BY                  | RTH                                 |
| DRILLING CONTRACTOR | CGT                      | REVIEWED BY                | JPQ                                 |
| EQUIPMENT           |                          | SEEPAGE                    | ---                                 |
| DRILLING METHOD     | 3-Inch Hand Auger & WDCP | GROUNDWATER AT END         | ---                                 |
|                     |                          | GROUNDWATER AFTER DRILLING | ---                                 |

| ELEVATION<br>(ft) | GRAPHIC<br>LOG | GROUP SYMBOL | MATERIAL DESCRIPTION  | DEPTH<br>(ft) | SAMPLE TYPE | POCKET PEN.<br>(tsf) | MOISTURE<br>CONTENT (%) | FINES CONTENT<br>(%) | 0 | 1 | 2 | 3 | 4 | 5 |
|-------------------|----------------|--------------|---|---------------|-------------|----------------------|-------------------------|----------------------|---|---|---|---|---|---|
| 960               |                | ML           | FOREST DUFF: Leaves, branches, pine needles, etc.   | 0             |             |                      |                         |                      |   |   |   |   |   |   |
|                   |                |              | SILT: Very stiff, light brown, dry, low plasticity, trace roots upper 3 inches. { Loess } | 2             |             |                      |                         |                      |   |   |   |   |   |   |
| 958               |                |              | Moist below ~3 feet bgs.  | 4             | GRAB 1      |                      |                         |                      |   |   |   |   |   |   |

- Boring terminated at ~4½ feet bgs.
- Groundwater and caving not observed.
- Boring loosely backfilled with cuttings.

CGT EXPLORATION WITH DCP G1704662.GPJ 9/13/17 DRAFTED BY: RTH





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# FIGURE A11

## Boring HA C-1/N

PAGE 1 OF 1

CLIENT Metro

PROJECT NAME Burlington Creek Forest Nature Park

PROJECT NUMBER G1704662

PROJECT LOCATION Burlington, OR

DATE STARTED 8/9/17

GROUND ELEVATION 265 ft

ELEVATION DATUM Figures 2 and 3

WEATHER Sunny ~75F

SURFACE Forest duff

LOGGED BY RTH

REVIEWED BY JPQ

DRILLING CONTRACTOR CGT

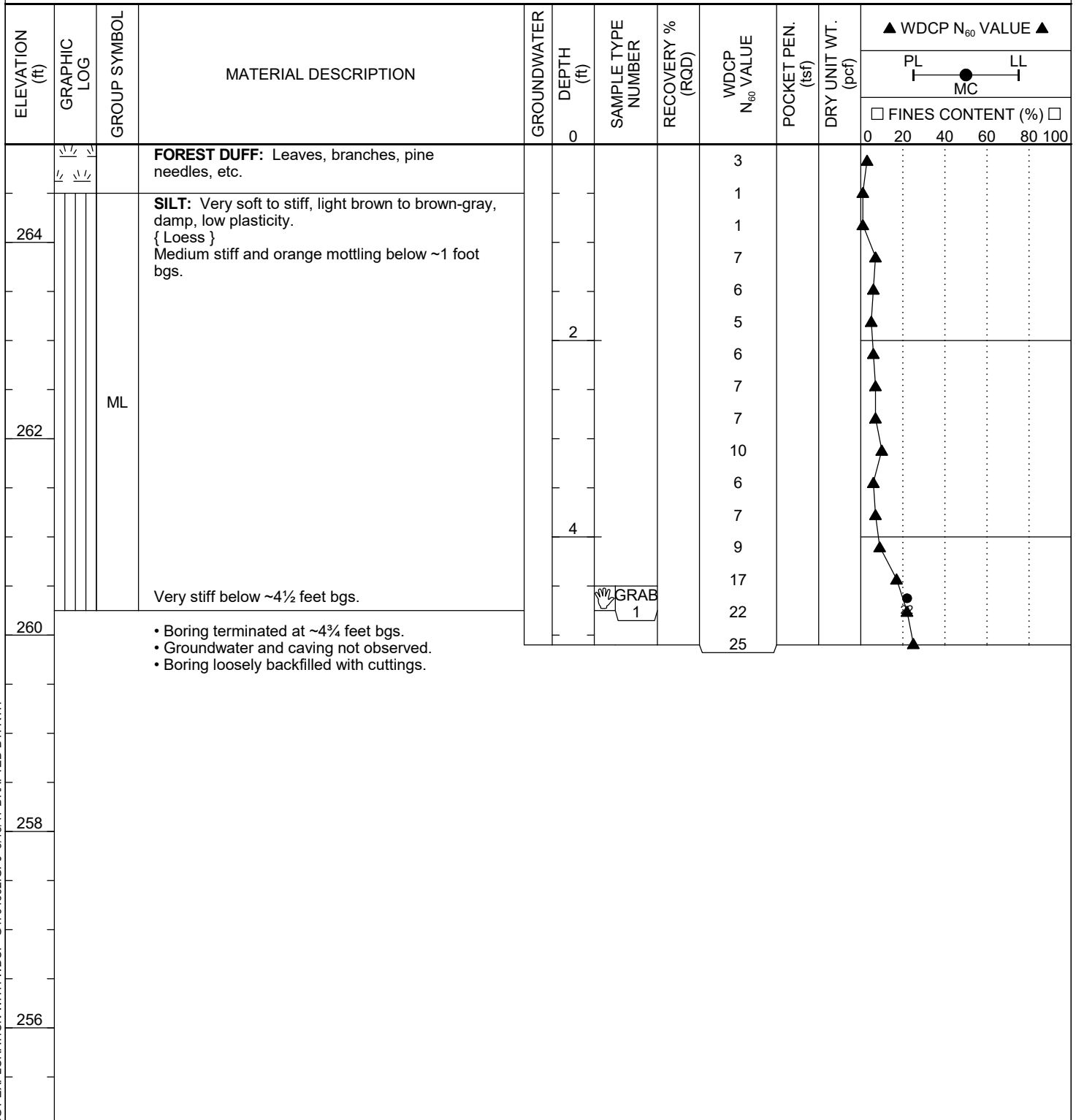
SEEPAGE ---

EQUIPMENT

GROUNDWATER AT END ---

DRILLING METHOD 3-Inch Hand Auger & WDCP

GROUNDWATER AFTER DRILLING ---



CGT EXPLORATION WITH WDCP G1704662.GPJ 9/13/17 DRAFTED BY: RTH





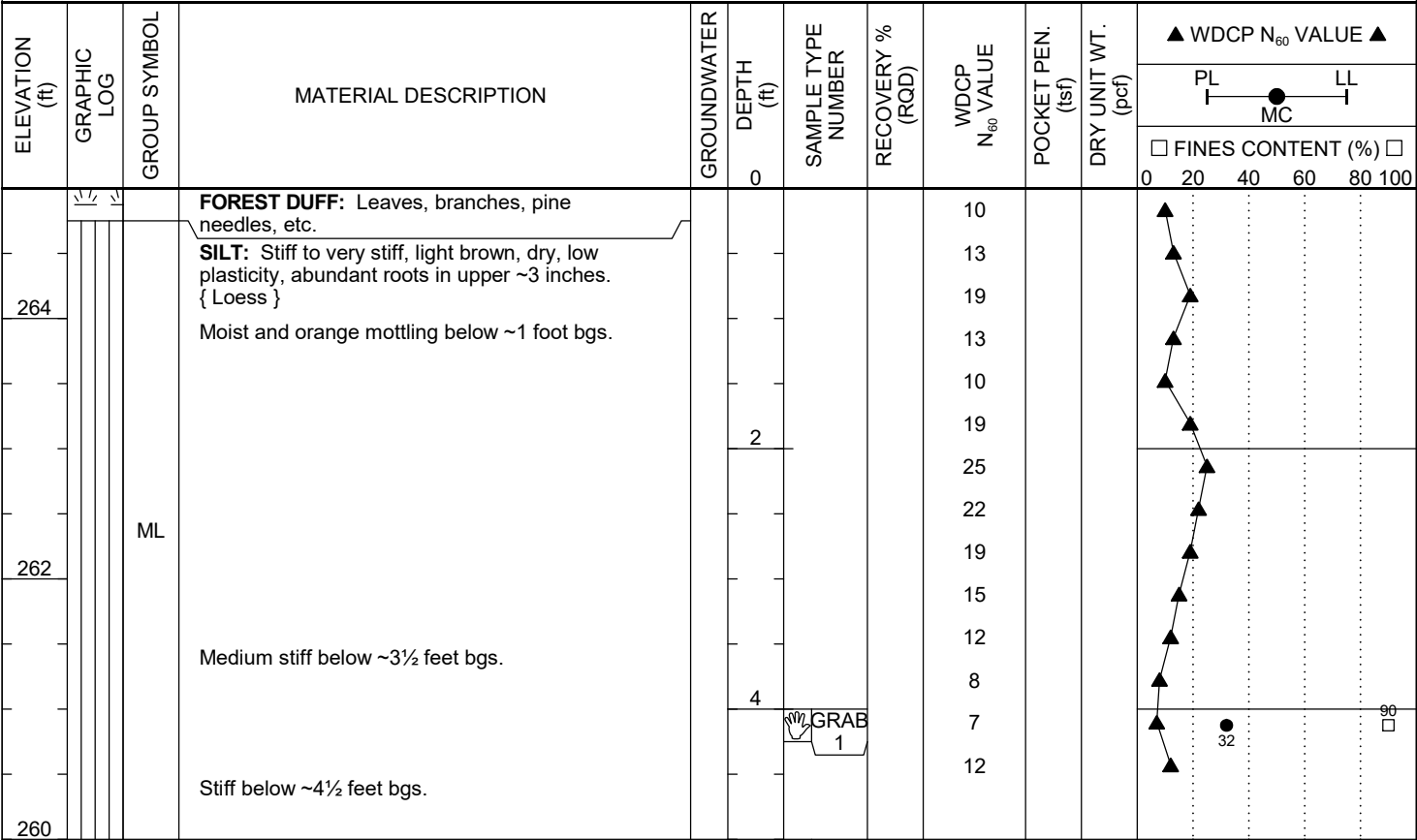
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FIGURE A12

Boring HA C-1/S

PAGE 1 OF 1

|                     |                          |                            |                                     |
|---------------------|--------------------------|----------------------------|-------------------------------------|
| CLIENT              | Metro                    | PROJECT NAME               | Burlington Creek Forest Nature Park |
| PROJECT NUMBER      | G1704662                 | PROJECT LOCATION           | Burlington, OR                      |
| DATE STARTED        | 8/9/17                   | GROUND ELEVATION           | 265 ft                              |
| WEATHER             | Sunny ~75F               | SURFACE                    | Forest duff                         |
| DRILLING CONTRACTOR | CGT                      | ELEVATION DATUM            | Figures 2 and 3                     |
| EQUIPMENT           |                          | LOGGED BY                  | RTH                                 |
| DRILLING METHOD     | 3-Inch Hand Auger & WDCP | REVIEWED BY                | JPQ                                 |
|                     |                          | SEEPAGE                    | ---                                 |
|                     |                          | GROUNDWATER AT END         | ---                                 |
|                     |                          | GROUNDWATER AFTER DRILLING | ---                                 |



- Boring terminated at ~5 feet bgs.
- Groundwater and caving not observed.
- Boring loosely backfilled with cuttings.

CGT EXPLORATION WITH WDCP G1704662.GPJ 9/13/17 DRAFTED BY: RTH





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## FIGURE A13

### Boring HA C-2/NE

PAGE 1 OF 1

CLIENT Metro

PROJECT NAME Burlington Creek Forest Nature Park

PROJECT NUMBER G1704662

PROJECT LOCATION Burlington, OR

DATE STARTED 8/16/17

GROUND ELEVATION 255 ft

ELEVATION DATUM Figures 2 and 3

WEATHER Sunny ~75F

SURFACE Forest duff

LOGGED BY RTH

REVIEWED BY JPQ

DRILLING CONTRACTOR CGT

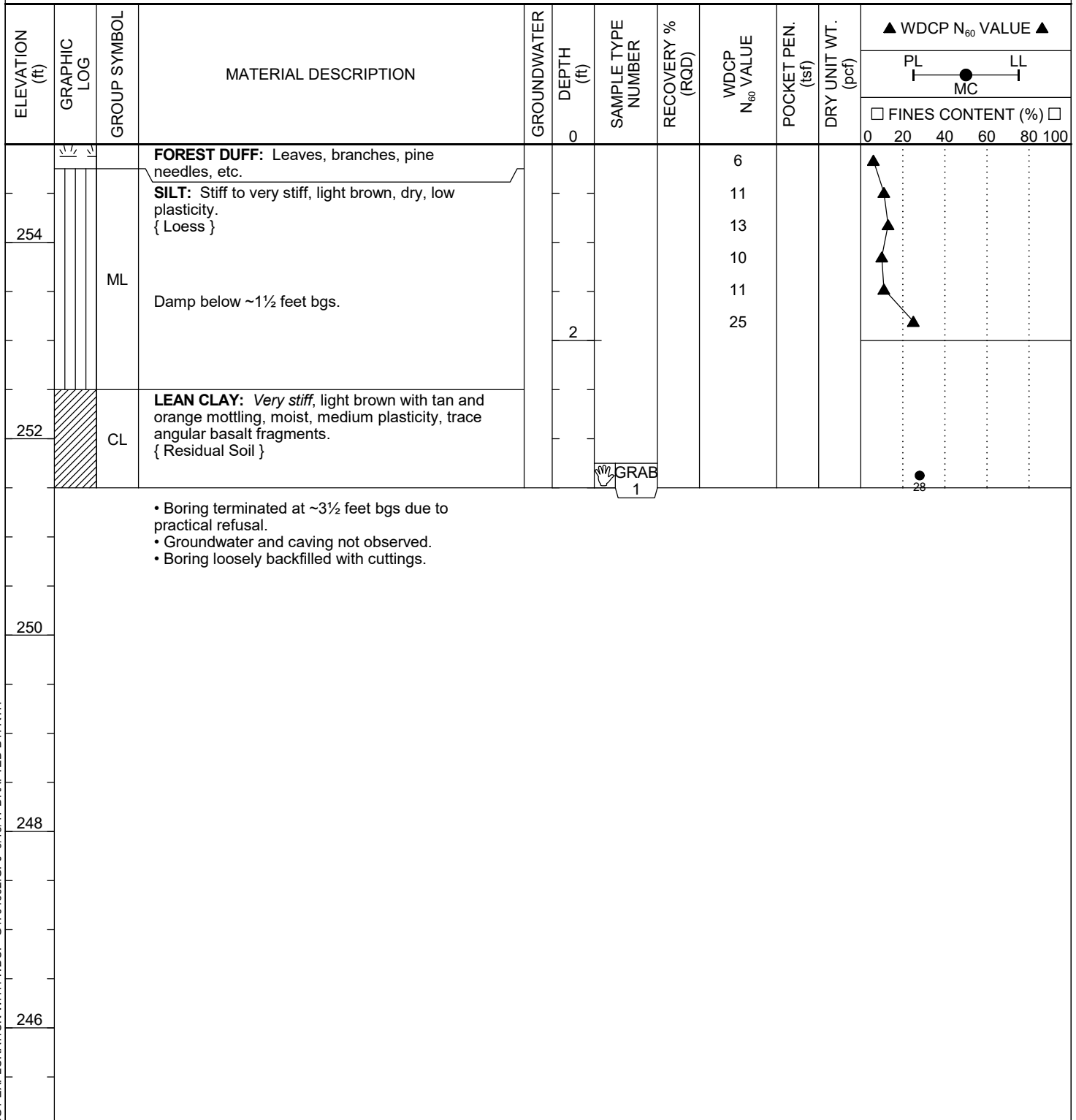
SEEPAGE ---

EQUIPMENT ---

GROUNDWATER AT END ---

DRILLING METHOD 3-Inch Hand Auger & WDCP

GROUNDWATER AFTER DRILLING ---







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# FIGURE A14

## Boring HA C-2/SW

PAGE 1 OF 1

CLIENT Metro

PROJECT NAME Burlington Creek Forest Nature Park

PROJECT NUMBER G1704662

PROJECT LOCATION Burlington, OR

DATE STARTED 8/16/17

GROUND ELEVATION 255 ft

ELEVATION DATUM Figures 2 and 3

WEATHER Sunny ~75F

SURFACE Forest duff

LOGGED BY RTH

REVIEWED BY JPQ

DRILLING CONTRACTOR CGT

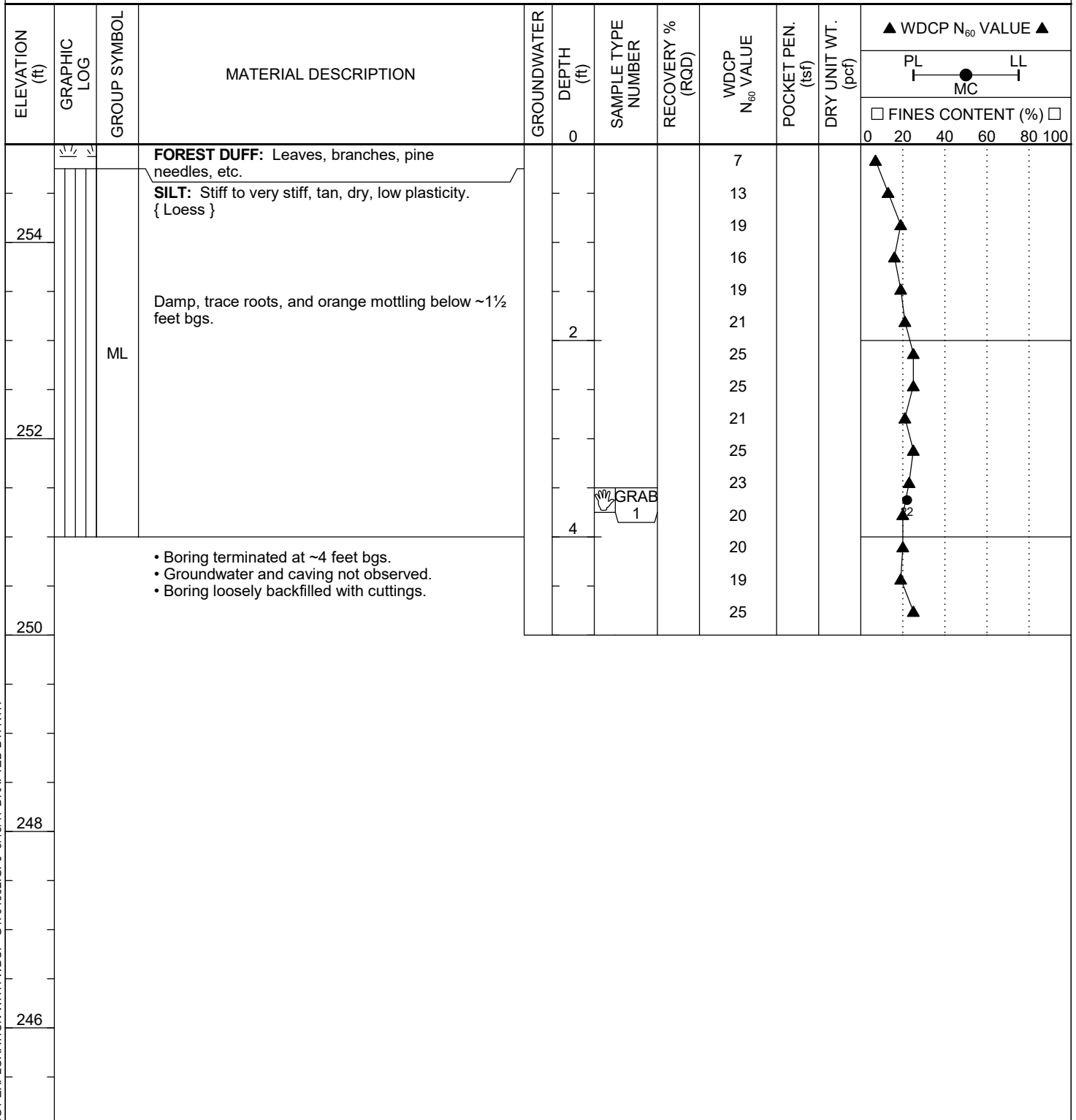
SEEPAGE ---

EQUIPMENT

GROUNDWATER AT END ---

DRILLING METHOD 3-Inch Hand Auger & WDCP

GROUNDWATER AFTER DRILLING ---



CGT EXPLORATION WITH WDCP G1704662.GPJ 9/13/17 DRAFTED BY: RTH



**CLIENT** Metro

**PROJECT NAME** Burlington Creek Forest Nature Park

**PROJECT NUMBER** G1704662

**PROJECT LOCATION** Burlington, OR

**DATE STARTED** 8/16/17

**GROUND ELEVATION** 275 ft

**ELEVATION DATUM** Figures 2 and 3

**WEATHER** Sunny ~75F

**SURFACE** Forest duff

LOGGED BY RTH

REVIEWED BY JPQDRILLING CONTRACTOR CGT

SEEPAGE ---

## EQUIPMENT

GROUNDWATER AT END ---

**DRILLING METHOD** 3-Inch Hand Auger & WDCP

**GROUNDWATER AFTER DRILLING** ---

[illegible]





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## FIGURE A16

### Boring HA C-3/SE

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CLIENT Metro

PROJECT NAME Burlington Creek Forest Nature Park

PROJECT NUMBER G1704662

PROJECT LOCATION Burlington, OR

DATE STARTED 8/16/17 GROUND ELEVATION 275 ft

ELEVATION DATUM Figures 2 and 3

WEATHER Sunny ~75F SURFACE Forest duff

LOGGED BY RTH REVIEWED BY JPQ

DRILLING CONTRACTOR CGT

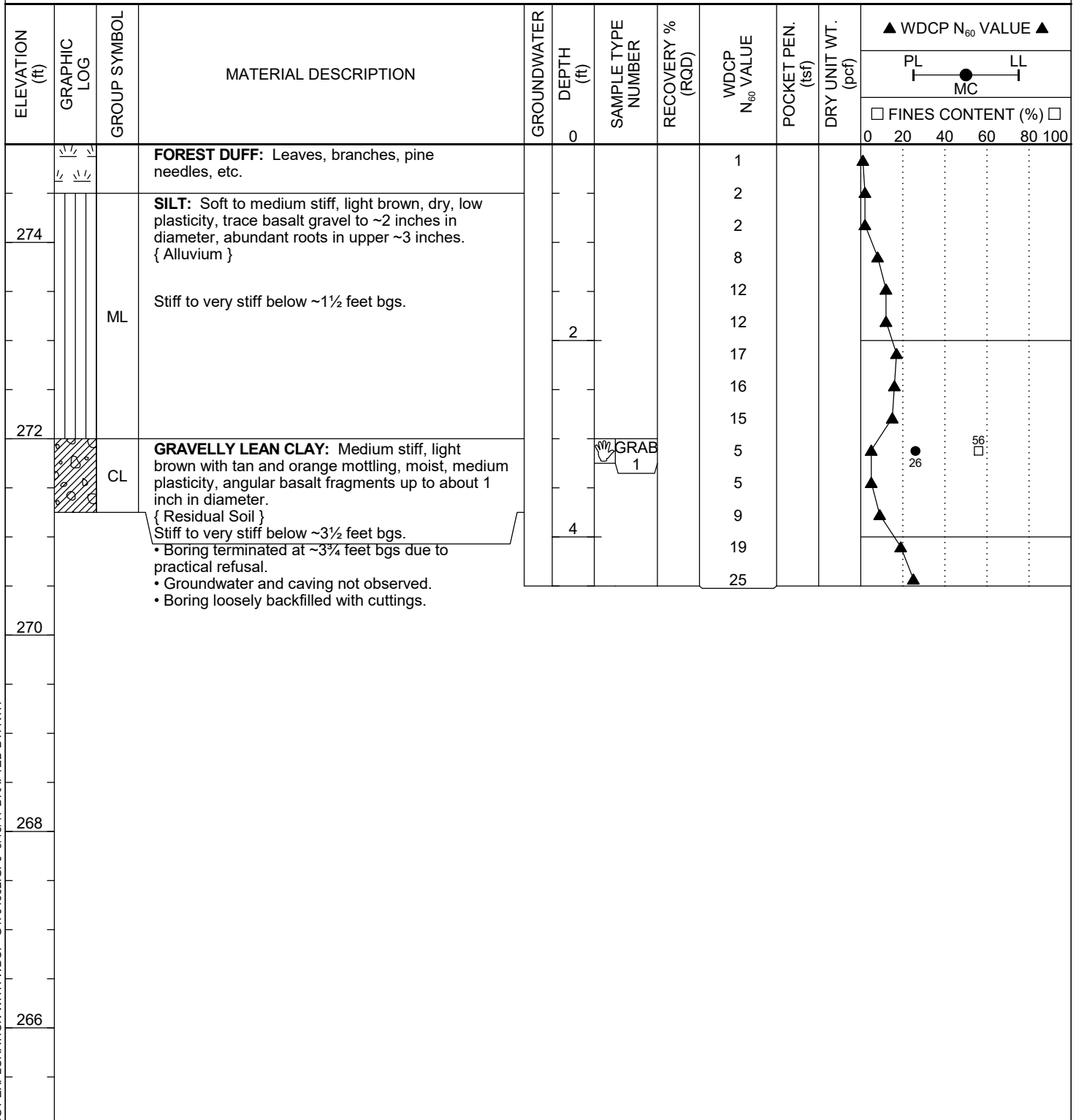
SEEPAGE ---

EQUIPMENT ---

GROUNDWATER AT END ---

DRILLING METHOD 3-Inch Hand Auger & WDCP

GROUNDWATER AFTER DRILLING ---







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## FIGURE A17

### Boring HA C-4/NE

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CLIENT Metro

PROJECT NAME Burlington Creek Forest Nature Park

PROJECT NUMBER G1704662

PROJECT LOCATION Burlington, OR

DATE STARTED 8/8/17

GROUND ELEVATION 320 ft

ELEVATION DATUM Figures 2 and 3

WEATHER Sunny ~75F

SURFACE Forest duff

LOGGED BY RTH

REVIEWED BY JPQ

DRILLING CONTRACTOR CGT

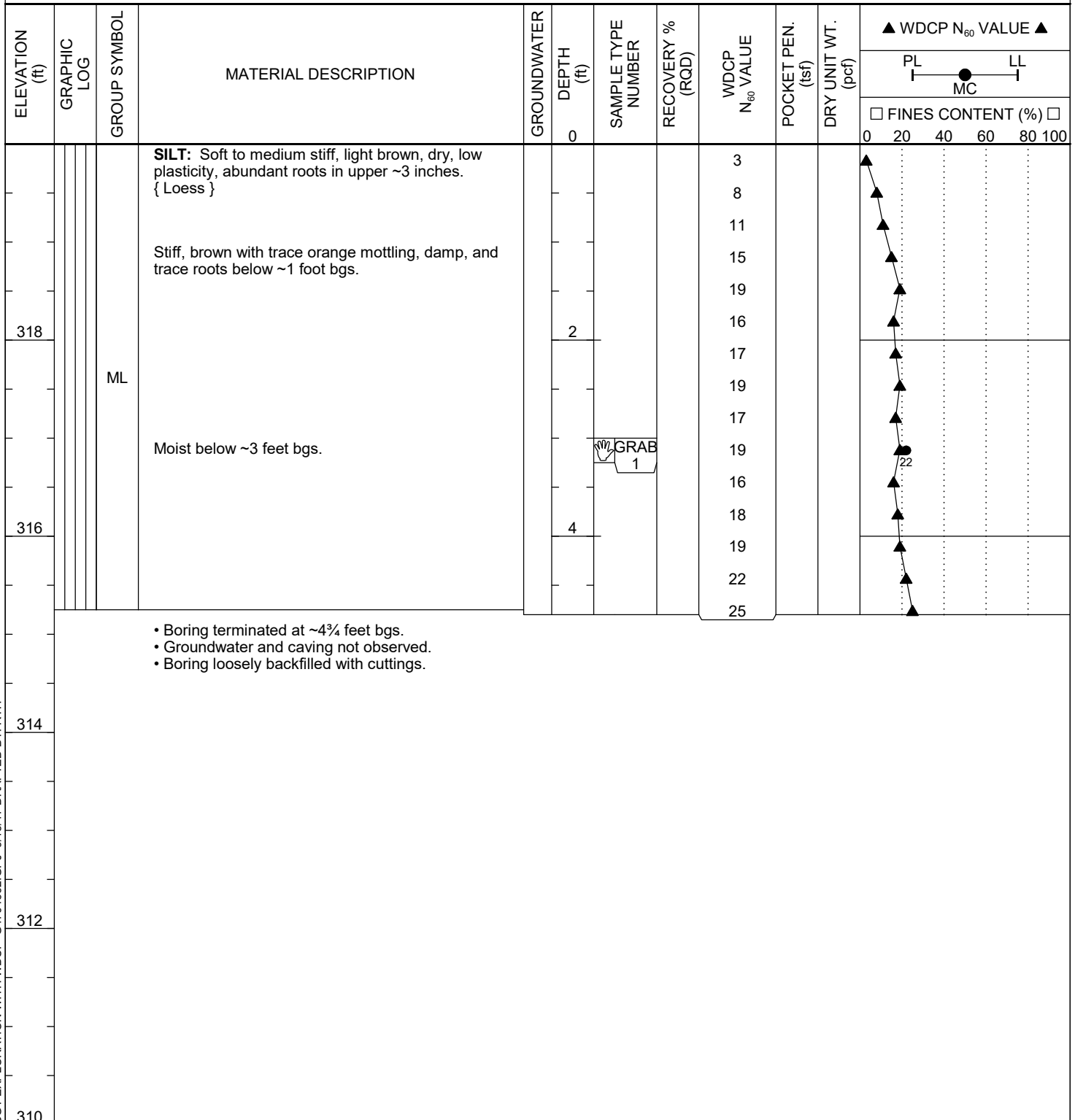
SEEPAGE ---

EQUIPMENT

GROUNDWATER AT END ---

DRILLING METHOD 3-Inch Hand Auger & WDCP

GROUNDWATER AFTER DRILLING ---



CGT EXPLORATION WITH WDCP G1704662.GPJ 9/13/17 DRAFTED BY: RTH





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## FIGURE A18

### Boring HA C-4/SW

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CLIENT Metro

PROJECT NAME Burlington Creek Forest Nature Park

PROJECT NUMBER G1704662

PROJECT LOCATION Burlington, OR

DATE STARTED 8/8/17

GROUND ELEVATION 320 ft

ELEVATION DATUM Figures 2 and 3

WEATHER Sunny ~75F

SURFACE Forest duff

LOGGED BY RTH

REVIEWED BY JPQ

DRILLING CONTRACTOR CGT

SEEPAGE ---

EQUIPMENT

GROUNDWATER AT END ---

DRILLING METHOD 3-Inch Hand Auger & WDCP

GROUNDWATER AFTER DRILLING ---

| ELEVATION<br>(ft) | GRAPHIC<br>LOG | GROUP SYMBOL | MATERIAL DESCRIPTION  | GROUNDWATER | DEPTH<br>(ft) | SAMPLE TYPE<br>NUMBER | RECOVERY %<br>(RQD) | WDCP<br>N <sub>60</sub> VALUE | POCKET PEN.<br>(tsf) | DRY UNIT WT.<br>(pcf) | ▲ WDCP N <sub>60</sub> VALUE ▲ |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|-------------------|----------------|--------------|---|-------------|---------------|-----------------------|---------------------|-------------------------------|----------------------|-----------------------|--------------------------------|----|----|----|----|-----|--|--|----|--|--|---|----|--|--|---|--|--|----|--|--|---|----|--|--|---|--|--|----|--|--|---|----|--|--|---|--|--|----|--|--|---|----|--|--|---|--|--|----|--|--|---|----|--|--|---|--|--|----|--|--|---|----|--|--|---|--|--|----|--|--|---|----|--|--|---|--|--|----|--|--|---|----|--|--|
|                   |                |              |   |             |               |                       |                     |                               |                      |                       | PL                             | LL |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       | MC                             |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       | □ FINES CONTENT (%) □          |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       | 0                              | 20 | 40 | 60 | 80 | 100 |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
| 318               |                | ML           | <b>SILT:</b> Medium stiff, light brown, dry, low plasticity, abundant roots in upper ~8 inches.<br>{ Loess }<br>Damp below ~½ foot bgs.<br><br>Stiff to very stiff below ~1 foot bgs.<br><br>Brown-gray and moist below ~1½ feet bgs. |             | 0             |                       |                     | 5                             |                      |                       | ▲                              |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    | 2   |  |  | 13 |  |  | ▲ |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  | 19 |  |  | ▲ |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  | 17 |  |  | ▲ |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  | 15 |  |  | ▲ |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  | 16 |  |  | ▲ |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  | 12 |  |  | ▲ |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  | 15 |  |  | ▲ |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  | 19 |  |  | ▲ |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              | 13  |             |               | ▲                     |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    | 14 |    |    | ▲   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   | 13 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  |
|                   |                |              | 14  |             |               | ▲                     |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    | 14 |    |    | ▲   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  |
|                   |                |              | 14  |             |               | ▲                     |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    | 14 |    |    | ▲   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  | ▲ |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   | 14 |  |  |
|                   |                |              | 14  |             |               | ▲                     |                     |                               |                      |                       |                                |    |    |    |    |     |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
|                   |                |              |   |             |               |                       |                     |                               |                      |                       |                                |    | 14 |    |    | ▲   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |   |  |  |    |  |  |   |    |  |  |
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- Boring terminated at ~5 feet bgs.
- Groundwater and caving not observed.
- Boring loosely backfilled with cuttings.

CGT EXPLORATION WITH WDCP G1704662.GPJ 9/13/17 DRAFTED BY: RTH





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# FIGURE A19

## Boring HA C-5/E

PAGE 1 OF 1

CLIENT Metro

PROJECT NAME Burlington Creek Forest Nature Park

PROJECT NUMBER G1704662

PROJECT LOCATION Burlington, OR

DATE STARTED 8/9/17

GROUND ELEVATION 165 ft

ELEVATION DATUM Figures 2 and 3

WEATHER Sunny ~75F

SURFACE Forest duff

LOGGED BY RTH

REVIEWED BY JPQ

DRILLING CONTRACTOR CGT

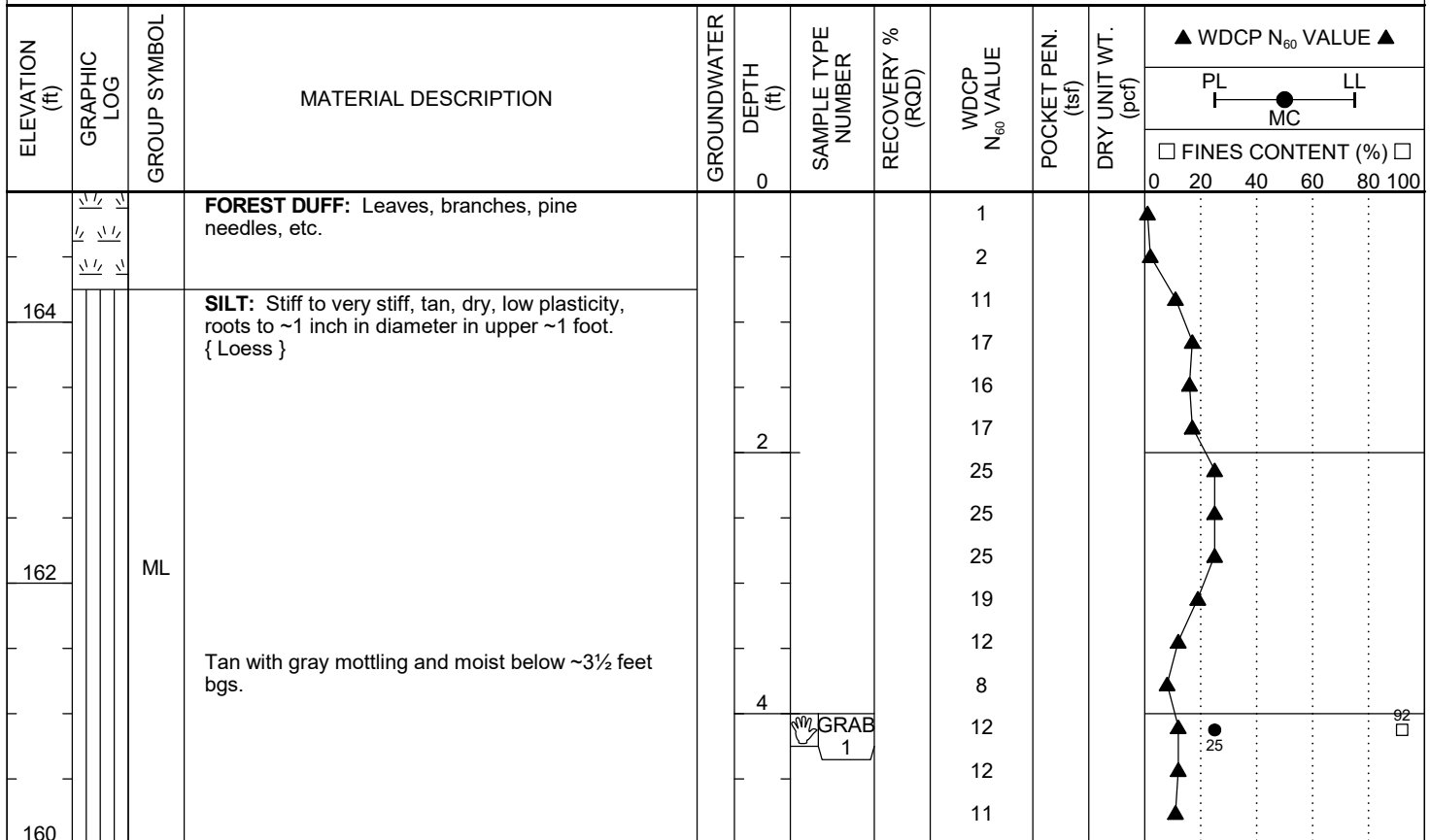
SEEPAGE ---

EQUIPMENT

GROUNDWATER AT END ---

DRILLING METHOD 3-Inch Hand Auger & WDCP

GROUNDWATER AFTER DRILLING ---



- Boring terminated at ~5 feet bgs.
- Groundwater and caving not observed.
- Boring loosely backfilled with cuttings.

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FIGURE A20

Boring HA C-5/W

PAGE 1 OF 1

|                     |                          |                            |                                     |
|---------------------|--------------------------|----------------------------|-------------------------------------|
| CLIENT              | Metro                    | PROJECT NAME               | Burlington Creek Forest Nature Park |
| PROJECT NUMBER      | G1704662                 | PROJECT LOCATION           | Burlington, OR                      |
| DATE STARTED        | 8/9/17                   | GROUND ELEVATION           | 165 ft                              |
| WEATHER             | Sunny ~75F               | SURFACE                    | Forest duff                         |
| DRILLING CONTRACTOR | CGT                      | ELEVATION DATUM            | Figures 2 and 3                     |
| EQUIPMENT           |                          | LOGGED BY                  | RTH                                 |
| DRILLING METHOD     | 3-Inch Hand Auger & WDCP | REVIEWED BY                | JPQ                                 |
|                     |                          | SEEPAGE                    | ---                                 |
|                     |                          | GROUNDWATER AT END         | ---                                 |
|                     |                          | GROUNDWATER AFTER DRILLING | ---                                 |

| ELEVATION<br>(ft) | GRAPHIC<br>LOG | GROUP SYMBOL | MATERIAL DESCRIPTION   | GROUNDWATER | DEPTH<br>(ft) | SAMPLE TYPE<br>NUMBER | RECOVERY %<br>(RQD) | WDCP<br>N <sub>60</sub> VALUE | POCKET PEN.<br>(tsf) | DRY UNIT WT.<br>(pcf) | ▲ WDCP N <sub>60</sub> VALUE ▲ |    |    |    |        |
|-------------------|----------------|--------------|--|-------------|---------------|-----------------------|---------------------|-------------------------------|----------------------|-----------------------|--------------------------------|----|----|----|--------|
|                   |                |              |  |             |               |                       |                     |                               |                      |                       | PL      LL<br> ----- <br>MC    |    |    |    |        |
| 164               |                | ML           | SILT: <i>Soft to medium stiff</i> , light brown, dry, low plasticity, trace basalt gravel to ~2 inches in diameter, abundant roots in upper ~3 inches.<br>{ Alluvium } |             | 0             |                       |                     |                               |                      |                       | 0                              | 20 | 40 | 60 | 80 100 |

- Boring terminated at ~1 foot bgs due to practical refusal on a cobble.
- Groundwater and caving not observed.
- Boring loosely backfilled with cuttings.

CGT EXPLORATION WITH WDCP G1704662.GPJ 9/13/17 DRAFTED BY: RTH



**CLIENT** Metro

**PROJECT NAME** Burlington Creek Forest Nature Park

**PROJECT NUMBER** G1704662

**PROJECT LOCATION** Burlington, OR

**DATE STARTED** 8/8/17 **GROUND ELEVATION** 360 ft

**ELEVATION DATUM** Figures 2 and 3

**WEATHER** Sunny ~75F      **SURFACE** Forest duff

LOGGED BY RTH REVIEWED BY JPQ

DRILLING CONTRACTOR CGT

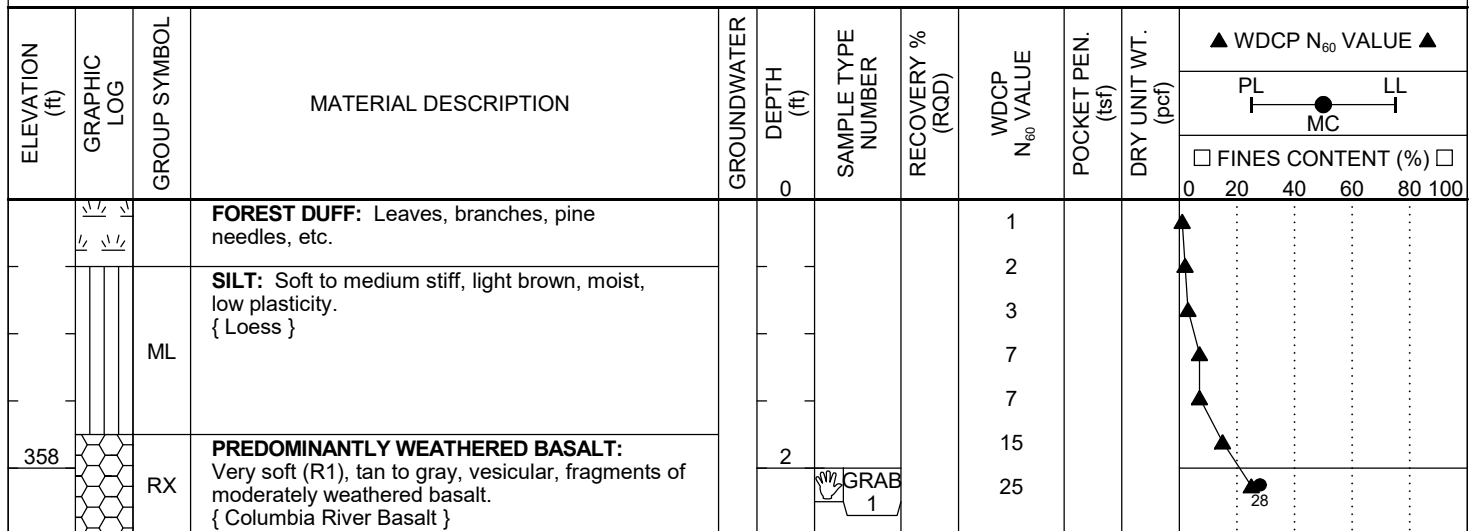
SEEPAGE ---

## EQUIPMENT

GROUNDWATER AT END ---

**DRILLING METHOD** 3-Inch Hand Auger & WDCP

**GROUNDWATER AFTER DRILLING** ---



- Boring terminated at ~2½ feet bgs due to practical refusal.
- Groundwater and caving not observed.
- Boring loosely backfilled with cuttings.



**CLIENT** Metro

**PROJECT NAME** Burlington Creek Forest Nature Park

**PROJECT NUMBER** G1704662

**PROJECT LOCATION** Burlington, OR

**DATE STARTED** 8/8/17      **GROUND ELEVATION** 360 ft

**ELEVATION DATUM** Figures 2 and 3

**WEATHER** Sunny ~75F      **SURFACE** Forest duff

LOGGED BY RTH REVIEWED BY JPQ

DRILLING CONTRACTOR CGT

SEEPAGE ---

## EQUIPMENT

GROUNDWATER AT END ---

**DRILLING METHOD** 3-Inch Hand Auger & WDCP

**GROUNDWATER AFTER DRILLING** ---

[illegible]

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# Carlson Geotechnical

A Division of Carlson Testing, Inc.

Phone: (503) 601-8250

Fax: (503) 601-8254

Bend Office (541) 330-9155  
Eugene Office (541) 345-0289  
Salem Office (503) 589-1252  
Tigard Office (503) 684-3460



## Appendix B: Geologic Hazards Reconnaissance

**Burlington Creek Forest Nature Park  
NW McNamee Road  
Multnomah County, Oregon**

**CGT Project Number G1704662**

September 13, 2017

*Prepared For:*

Ms. Karen Vitkay  
Metro  
600 NE Grand Avenue  
Portland, Oregon 97232-2736

*Prepared by*  
**Carlson Geotechnical**



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## ATTACHMENTS

|                            |           |
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| Geologic Map .....         | Figure B2 |
| Landslide Inventory.....   | Figure B3 |

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## **B.1.0 INTRODUCTION**

### **B.1.1 Background**

We understand that portions of the proposed trail network will fall within the Multnomah County Slope Hazard Overlay, and therefore a Hillside Development Permit Application needs to be completed for the proposed project. A portion of the Slope Hazard overlay is shown on the attached Figure B1, which also shows the approximate location of the proposed trail network. The proposed trailhead development lies outside of the Slope Hazard Overlay.

### **B.1.2 Purpose and Scope of Work**

The purpose of our geologic hazards assessment was to address the requirements of Multnomah County Code (MCC) Section 33.5515(E) for Hillside Development Permits (HDPs), which is attached as Appendix C. Our assessment included the following:

- Review available literature for landslide hazards in the vicinity of the site.
- Review readily available historical aerial photographs of the site.
- Review available topographic, geologic, and geologic hazard maps for the area.
- Perform a surface reconnaissance of the site. The reconnaissance was performed by a Certified Engineering Geologist (CEG) licensed by the State of Oregon.
- Review subsurface explorations performed as part of the geotechnical investigation.
- Provide **qualitative** conclusions regarding the existing landslide hazard, as well as the potential impacts of the proposed development on the hazard, and vice versa.
- Provide an opinion regarding whether the site is suitable for the proposed development from a geologic standpoint.
- Provide this written report summarizing the results of our engineering geologic reconnaissance in general accordance with the MCC guidelines and complete the Multnomah County HDP Form-1 (attached).

## **B.2.0 LITERATURE & MAP REVIEW**

### **B.2.1 Topographic Maps**

Topography in the vicinity of the site is shown on the USGS 7.5 minute topographic map for the Sauvie Island quadrangle, shown on Figure 1. We also reviewed topographic data available at DOGAMI's lidar data viewer website<sup>1</sup> and the topographic information provided by Metro (Figures 2 and 3). The site is located within Tualatin Mountains northwest of Portland, Oregon. The site includes a series of northeast-plunging ridges separated by Burlington Creek and several unnamed drainages that discharge onto the Columbia River floodplain. Slope morphology in the vicinity of the site is generally characterized by rounded, convex slopes with incised, dendritic drainages. Slope gradients across the site generally range from about 10H:1V (horizontal to vertical) along the ridge tops to about 2H:1V on the steeper ridge side slopes. Slope gradients observed during the site reconnaissance are described in detail in Section B.3.0 below.

---

<sup>1</sup> Oregon Department of Geology and Mineral Industries, 2017. 2007 Aerial Lidar Survey Data, accessed August 2017, from National Oceanic and Atmospheric Administration (NOAA) Data Access Viewer, <https://coast.noaa.gov/dataviewer/#/>.



## **B.2.2 Geologic Maps**

Available geological mapping<sup>2</sup> of the area indicates that the site is located on the northeast limb of the Portland Hills Anticline and is underlain by the Winter Water and Sentinel Bluffs Members of the Miocene Columbia River Basalt Group. The basalt in the area is mantled in most places with a layer of Pleistocene loess (wind-blown silt) and/or colluvium (a mix of loess, clay, and basalt fragments) that can be up to tens of feet thick and is prone to landslides.

The geologic map does not show any mapped landslide deposits within the project area. A small portion of the southeastern corner of the site is mapped as landslide deposits. This mapped landslide is described further in the following section. A portion of the geologic map is included as Figure B2.

## **B.2.3 Landslide Mapping**

Landsliding is a common hazard in the Pacific Northwest that can be initiated on marginally stable slopes by human disturbances such as grading and deforestation, and by natural processes including earthquake shaking, volcanism, heavy rainfalls, and rapid snow melt. Common causes for slope failures include intense rainfall, human activities, and seismic activity. Human activities that can contribute to slope failures include loading slopes through construction of new buildings or fill embankments, excavating or over-steepening slopes, and the infiltration or diversion of storm water runoff. For example, excavation into the base of marginally stable slopes or adding fill and/or a structure to the top or mid portion of a slope can create a condition where driving forces exceed resisting forces, resulting in slope failure. Redirecting water onto or into slopes may exploit existing planes of weakness within those slopes, causing failures.

Review of the Statewide Landslide Information Database for Oregon (SLIDO)<sup>3</sup> and Landslide Inventory Maps of the Sauvie Island Quadrangle<sup>4</sup> show numerous small earthflow slides at the base of the drainage west of proposed Trail E. A portion of the landslide inventory map is attached as Figure B3. Mapping indicates the northern earthflow that crosses the access road is greater than 150 years old, while the smaller slides upstream (south) have taken place within the last 150 years. The proposed trails do not cross any of the mapped landslides. A portion of Trail E comes within about 75 feet of the headscarp of one of the landslides.

The Oregon Statewide Geohazards Viewer<sup>5</sup> (HazVu) indicates the site has a high landslide hazard, as indicated on Figure B1. The mapping is based primarily on slope gradient.

---

<sup>2</sup> Evarts, R.C., O'Connor, J.E., and Cannon, C.M., 2016, Geologic map of the Sauvie Island quadrangle, Multnomah and Columbia Counties, Oregon, and Clark County, Washington: U.S. Geological Survey, Scientific Investigations Map SIM-3349, scale 1:24,000.

<sup>3</sup> Oregon Department of Geology and Mineral Industries, 2017. Statewide Landslide Information Database for Oregon (SLIDO), accessed August 2017, from DOGAMI web site: <http://www.oregongeology.org/sub/slido/index.htm>.

<sup>4</sup> Burns, William J., Duplantis, Serin, and Mickelson, Katherine A., 2010. Landslide Inventory Maps of the Sauvie Island Quadrangle, Columbia and Multnomah Counties, Oregon, and Clark County, Washington, Oregon Department of Geology and Mineral Industries IMS-40.

<sup>5</sup> Oregon Department of Geology and Mineral Industries, 2017. Oregon Statewide Geohazards Viewer, accessed August 2017, from DOGAMI web site: <http://www.oregongeology.org/sub/hazvu/index.htm>.



### **B.3.0 SITE RECONNAISSANCE**

CGT Engineering Ryan Houser, RG, CEG, performed a reconnaissance of the site and immediate vicinity during August 2017. The following sections summarize observations made by Mr. Houser during his reconnaissance. The site layout, topography, and surface conditions described below are shown on Figures 2, 3, and B3.

#### **B.3.1 Site Surface Conditions**

The proposed project consists of development of trailhead facilities and nine trails, as summarized in Section 1.1 of the geotechnical report. The site is located within the Burlington Creek Forest, and is cut by Burlington Creek and three other unnamed, ephemeral, northeast-trending creeks. Topography observed at the site is consistent with that depicted on Figures 2 and 3 of the main report. For ease in discussion of the site, our reconnaissance is split up by project area in the following sections:

##### **B.3.1.1 Trailhead Area**

The Trailhead area was located along the existing access road on a north-facing slope. In general, the access road was cut into the hillslope and the excavated material was placed on the downslope side of the road to create the relatively level road bed. Runoff was controlled by a shallow ditch on the cut (south) side of the road that conducted water to a culvert (indicated on Figure 3). Vegetation in the area of proposed development consisted mainly of blackberry bushes and grasses, with trees along the northern end in the area of the proposed retaining wall.

Existing cut slopes along the western end of the access road were up to about 10 feet in height and had gradients of up to about 1H:1V. These slopes showed areas of localized minor erosion along portions of the roadside ditch. Native slopes on the north side of this portion of the road generally descended to the north at gradients less than 2H:1V.

Slope gradients in the area of the proposed parking lot and restroom facility were less than those observed in the western portion of the access road, with native slopes generally less than about 4H:1V. Localized cut and fill slopes in this area had gradients up to about 2H:1V.

Proposed grading within the trailhead area will consist of cutting into the south slope and placement of fill to the north to create a relatively level parking area. Grading along the access road will be aided by the construction of a retaining wall up to about 8 feet in height. Minor grading and widening at the west end of the access road will also be performed. Fills in this area will be less than about 4 feet in maximum depth. According to the provided grading plan (Figure 3), the maximum slope gradient for new cut slopes will be 2H:1V.

I did not observe any indication of previous or current slope instability within the proposed Trailhead development area.

##### **B.3.1.2 Trail AA**

Trail AA will start at the Trailhead and will cross a creek valley between two of the ridges, and will be approximately 0.7 miles in length. The northwestern and southeastern portions of the trail will generally



parallel the existing gravel road. Gradients along these portions of the trail were generally less than about 5H:1V, and vegetation consisted primarily of coniferous and deciduous trees with little understory vegetation.

The southeast- and northwest-facing valley sideslopes generally had gradients up to about 3H:1V. Vegetation consisted of dense blackberry, coniferous and deciduous trees, and ferns. The toe of the southeast-facing slope near the northeast-trending creek at Crossing 5 was nearly vertical for about 8 feet, with fractured basalt bedrock exposed along the face. This vertical face appeared to be the result of past streambank erosion. The proposed trail alignment will traverse the southeast-facing valley sideslope by utilizing a series of switchbacks to lessen the overall gradient.

Other than the eroded slope bank observed near Crossing 5, no areas of particular concern were observed along Trail AA during our reconnaissance.

Construction of the northwestern and southeastern portions of the trail will require minor clearing of vegetation and minimal grading. The central portion of the trail, where traversing the creek valley, will require clearing of the dense underbrush and minor grading associated with the switchbacks. Crossing 5 will consist of a 20-foot long bridge. Based on the length of the proposed bridge, we anticipate at least one of the bridge abutments will be constructed near the level of the creek and the other will be on the sideslope of the creek valley.

#### **B.3.1.3    Trail A**

Trail A will extend south from the trailhead and will cross two secondary ridges before dropping into a creek valley. From there, Trail A will cross a primary ridge before terminating at the gravel access road near the southwest corner of the site. The Trail A alignment will be about 0.9 miles in length.

Between the Trailhead and Crossing 1, the proposed Trail A alignment roughly “follows the contour” (minimal elevation change along the trail) across a slope with gradients on the order of 4H:1V. This portion of the trail alignment was located in the PGE/BPA powerline easement, which was densely vegetated with blackberry bushes. The creek at Crossing 1 was dry, with sideslope gradients on the order of 2H:1V.

Between Crossing 1 and Crossing 2, the trail alignment roughly followed the contour across an east-southeast-facing slope with gradients up to about 3H:1V. Vegetation transitioned to oak, cedar, and fir trees with ferns in the understory once south of the PGE/BPA easement. I observed small groups of trees with “pistol butt” morphology near the trail alignment on some of the steeper portions of the slope. This morphology is typically indicative of localized shallow slope instability or slope creep.

The trail alignment paralleled the northeast-trending stream between Crossing 2 and Crossing 3 along an east-southeast-facing slope with gradients up to about 3H:1V. Vegetation consisted primarily of coniferous trees. Numerous cut and felled trees were present along this section of the trail. I observed small groups of trees with “pistol butt” morphology near the trail alignment on some of the steeper portions of the slope.



South of Crossing 3, the trail alignment ascended to the top of the ridge. This slope had localized gradients up to about 2H:1V. The trail alignment will consist of a number of switchbacks to minimize the gradient. This portion of the trail was vegetated with coniferous trees, and a significant number of trees had been cut and felled. The trail alignment descended the ridge to the south to rejoin the gravel access road at the intersection with Trail D. I did not see any indication of slope instability along this portion of the trail alignment.

Construction of Trail A will consist of minor grading to create the 36-48 inch wide trail. Clearing of downed trees and occasional areas of dense vegetation will be necessary along the trail alignment. Development of Trail A will include construction of three creek crossings:

- Crossing 1 will consist of a 15-foot long bridge, and we anticipate the bridge abutments will both be constructed on the sideslopes of the narrow creek valley.
- Crossing 2 will consist of an 18-foot long bridge, and we anticipate the bridge abutments will both be constructed on the sideslopes of the narrow creek valley.
- Crossing 3 will consist of a 20-foot long bridge. Based on the length of the proposed bridge, we anticipate at least one of the bridge abutments will be constructed near the level of the creek and the other will be on the sideslope of the creek valley.

#### **B.3.1.4     Trail B**

Trail B will consist of a series of switchbacks crossing a ridge between two sections of the gravel access road, and will be approximately 0.4 miles in length. Trail B will be developed entirely within the BPA and PGE powerline easements. These easements have been cleared routinely to keep trees from growing into the power lines. As a result, the primary vegetation in this area consisted of dense blackberry bushes and scotch broom with some smaller trees and shrubs.

Slope gradients along the north-northeast-facing portion of Trail B were on the order of 2½H:1V. The proposed trail will have gradients less than 10H:1V, which will be accomplished by constructing a series of switchbacks. Once the proposed trail alignment reaches the top of the ridge, it will turn southwest to intersect with Trail C. Gradients along this portion of the trail were generally less than about 5H:1V.

Minor erosion was noted along the base of the existing cut slope near the existing access roadway at the north end of Trail B. No other areas of particular concern were observed along Trail B during our reconnaissance.

Construction of Trail B will consist of minor grading and clearing to create the 30-inch wide trail. Portions of the trail will follow existing powerline access roadways, where grading will be minimal.

#### **B.3.1.5     Trail C**

Trail C will be constructed along about 0.1 miles of an existing roadbed on the top of a northeast-trending ridge. Slope gradients along the existing roadbed were less than about 12H:1V, and vegetation consisted of mature coniferous trees, deciduous trees, grasses, and occasional blackberry bushes. I did not observe any indication of slope instability along the proposed Trail C alignment. Based on our observations, we anticipate only minimal clearing of brush and minimal grading will be required to complete this trail.



#### **B.3.1.6     Trail D**

Trail D will provide access from the new trail network to trails within the Forest Park Conservancy's Ancient Forest Preserve located southwest of the site, and will be about 0.1 miles in length. The proposed trail will generally parallel the existing gravel road along the east-facing sideslope of the ridge. Slopes along the proposed trail alignment generally descended to the east at gradients of about 3H:1V. Trail D will cross a seasonal southeast-trending drainage at Crossing 4. Slopes in the vicinity of Crossing 4 were locally up to about 1½H:1V. Vegetation along Trail D generally consisted of coniferous trees, ferns, and blackberry bushes along the drainage. A significant number of trees had been cut and felled along the proposed trail alignment.

I observed a small slump measuring about 10 feet in height and about 15 feet in width in the vicinity of proposed Crossing 4. A rotten tree stump remaining after the tree was felled was located near the center of the slump, and the base of the slump was located within the creek bed. This suggests that the slump was caused by erosion of the base of the slope and loss of root cohesion from the decay of the wood.

Construction of Trail D will consist of minor grading to create the 24-inch wide trail. Clearing of downed trees and dense vegetation will be necessary along portions of the trail alignment.

#### **B.3.1.7     Trail E**

Trail E will generally meander along a north-plunging ridgeline in the approximate center of the site, and will be about 0.8 miles in length. Slope gradients ranged from about 6H:1V to 10H:1V along the ridge, with gradients increasing on the east and west faces to about 4H:1V. Vegetation generally consisted of cedar and fir trees with fern and blackberry underbrush. A significant number of trees had been cut and felled along the southern and central portions of the proposed trail alignment. The northern portion of the proposed trail crossed the PGE/BPA powerline easement, which was densely vegetated with blackberry bushes.

As shown on Figure B3, a portion of Trail E passes about 75 feet above (to the southeast) a mapped landslide headscarp. No indication of soil movement was noted at the trail location above the mapped landslide during the site reconnaissance. This portion of the trail will be constructed along an existing skid road, so grading will be minimal.

Construction of Trail E will consist of minor grading to create the 30-inch wide trail. Clearing of downed trees and dense vegetation will be necessary along the majority of the trail alignment.

#### **B.3.1.8     Trail F**

Trail F will create a gently-sloping loop paralleling the gravel access road near the east end of the site, and will be approximately 0.3 miles in length. The trail will generally follow the contour across a northeast-facing slope with gradients up to about 5H:1V. Vegetation consisted primarily of coniferous and deciduous trees with little understory vegetation. A portion of the trail followed a 'skid road' likely constructed during previous logging activities. I did not observe any indication of slope instability along the proposed Trail F.



We anticipate only minor clearing of brush and minimal grading will be required to complete this trail.

#### **B.3.1.9    Trail G**

Trail G will generally meander along a north-northeast-plunging ridgeline, and will be about 1.2 miles in length. Trail G will consist of two trails that split near the gravel access road at the south end of the trail, and rejoin near the PGE/BPA powerline easement near the north end of the trail.

The west branch of the trail alignment will generally follow the top of the ridge, which was typically gently sloping to the northeast with gradients on the order of 10H:1V or flatter. The west branch of the trail crossed slopes with gradients up to about 3H:1V where it extended west of the ridge top. A portion of the west branch followed a 'skid road' which was likely constructed during previous logging activities. Vegetation along the west branch generally consisted of cedar and fir trees with fern and blackberry underbrush. A significant number of trees had been cut and felled along the southern and central portions of the proposed trail alignment. The northern portion of the proposed west branch of the proposed trail alignment was within the PGE/BPA powerline easement, which was densely vegetated with blackberry bushes.

The east branch of the trail alignment traversed the east face of the ridge, and crossed slopes with gradients up to about 2½H:1V. Vegetation along the west branch generally consisted of cedar and fir trees with fern and blackberry underbrush and a significant number of downed trees.

The east and west branches of Trail G will rejoin adjacent to the PGE/BPA powerline easement, which was densely vegetated with blackberry bushes. Slope gradients in this portion of the trail alignment were typically about 5H:1V. At its northernmost end, the trail will descend a 10-foot-tall cut slope with gradients up to about 1H:1V to the gravel access road. I observed localized erosion along the base of this cut slope. Otherwise, no areas of concern were noted during the reconnaissance of Trail G.

Construction of Trail G will consist of minor grading to create the 30-inch wide trail. Clearing of downed trees and occasional areas of dense vegetation will be necessary along the trail alignment. Portions of the trail following the ridge and existing skid road will require minimal grading and clearing.

#### **B.3.1.10   Trail H**

Trail H will be located within the southeastern portion of the development area, and will be approximately 0.6 miles in length. From the gravel access road at the south end of the proposed alignment to Crossing 6, Trail H will traverse a northeast-plunging ridge with slope gradients up to about 3H:1V. Vegetation consisted of coniferous trees with a fern understory. Numerous cut and felled trees were located along the trail alignment. The ridge surface topography was hummocky, which is often indicative of past landsliding. The hummocky features were typically expressed as 10- to 15-foot wide, 6- to 8-foot deep depressions that ran down the slope for 50 to 100 feet. The sideslopes were as steep as 1H:1V. Most of these depressions were filled with debris (tree trunks and branches). Further discussion and interpretation of the hummocky surface are provided in Section B.4.0 below.



Crossing 6 will be located in a narrow creek valley with steep side slopes. Localized gradients are up to about 1½H:1V near the creek. We understand switchbacks will be used to minimize the trail gradient on either side of the crossing. Abundant downed trees were present in this portion of the trail alignment.

East of Crossing 6, the trail alignment crossed two small ridges before rejoining with the gravel access road. This portion of the trail alignment crossed slopes with gradients up to about 2H:1V, and was vegetated with coniferous trees and ferns. The eastern portion of the trail crossed into the PGE/BPA powerline easement, which was densely vegetated with blackberry bushes. At its east end, the trail will descend a 10-foot-tall cut slope with gradients up to about 1H:1V to the gravel access road. I observed localized erosion along the base of this cut slope.

Construction of Trail H will generally consist of minor grading to create the 24 inch wide trail. Additional grading may need to be conducted at the eastern end of the trail along the gravel access road, where the existing steep roadcut may impact the proposed plan. Clearing of downed trees and occasional areas of dense vegetation will be necessary along the trail alignment. Development of Trail H will include construction of one creek crossing (Crossing 6), which will consist of a 15-foot long bridge. We anticipate the bridge abutments will be constructed on the sideslopes of the narrow creek valley.

### **B.3.2 Site Subsurface Conditions**

We advanced hand auger borings as part of the geotechnical investigation, in which we confirmed that the site is underlain by Columbia River Basalt, and mantled by loess (windblown silt) and alluvium. A residual soil resulting from the in-place weathering / decomposition of the basalt was present in several locations. Descriptions of the soils are provided in Section 2.3.2 of the geotechnical report and logs of the borings are presented in Appendix A.

### **B.4.0 FINDINGS AND OPINIONS**

Based on the results of our site reconnaissance and review of the referenced mapping and literature, it is our opinion that the site is geologically suitable for the proposed development. The majority of the proposed development will consist of narrow hiking/mountain biking trails requiring minimal ground disturbance and clearing of vegetation. We observed isolated areas showing indicators of localized shallow instability (soil creep, slumps, etc.). However, we did not observe evidence of large-scale, deep-seated landsliding, and mapping does not indicate the area has a history of such slides. The proposed development does not include construction of habitable structures and is, in our opinion, compatible with the existing landslide hazards at the site. With the use of generally-accepted construction techniques and best management practices, it is our opinion the site can be developed as proposed, without significantly increasing the risk of slope instability that might impact the proposed development or adjacent properties. Specific recommendations for grading and development of the proposed project are provided in Section 5.0 of the geotechnical report. If development plans change from those understood and described in this report, we recommend CGT be contacted to review the proposed development and provide revised commentary, if warranted.

Several specific areas of potential concern for the proposed trail alignments were identified during the reconnaissance, as follows:



- On Trail AA, the toe of the southeast-facing slope near the northeast-trending creek at Crossing 5 was nearly vertical for about 8 feet. The basalt bedrock exposed on the face of this slope appears stable. However, grading of the proposed trail may be difficult to accomplish. This portion of the trail may need to be rerouted to avoid the vertical face.
- The proposed Trail A alignment passed close to several groups of trees exhibiting the 'pistol butt' morphology. CGT recommends proposed trails be rerouted around these areas where possible. If unavoidable, CGT recommends grading through these areas be minimized to the extent possible.
- A slump apparently related to decay of tree roots and creek erosion was identified at Crossing 4. CGT recommends the proposed trail be relocated approximately 30 feet upstream (northwest) of the current location indicated on the plans.
- Steep cut slopes were observed in several areas where the proposed trails will intersect the existing gravel access road. CGT recommends rerouting trails around these steep slopes or reducing the gradient of the existing cut slopes in these areas to 2H:1V or flatter wherever possible.
- Hummocky topography was observed in the southern portion of Trail H. The cause of the hummocky topography was not clear, but may be related to past logging activities. Areas of the hummocky topography had localized slopes with gradients up to about 1H:1V. CGT recommends the trail alignment be adjusted during construction, as needed, to avoid cutting through the noted depressions or being placed immediately at the top of one of the steep slopes.

Notwithstanding the above, construction within hillside areas and known landslide deposits inherently bears greater risk of slope instability. This risk increases in seismically active areas, including the Pacific Northwest. Slopes on and in the immediate vicinity of the site may be susceptible to instability resulting from extraordinary events such as a major earthquake, high rainfall, or human activities, which could occur beyond the site boundaries. The owner must recognize and accept the risk of potential slope instability from causes beyond their control or as yet unrecognized.

It should be noted that a significant number of trees had been cut throughout the project area. The proposed stream crossings will be developed near the existing stream elevations. Debris could pile up on stream crossings, resulting in a debris dam that could threaten the structures during extreme storm events or if debris flows are triggered upslope from the stream crossings.

### **B.5.0 LIMITATIONS**

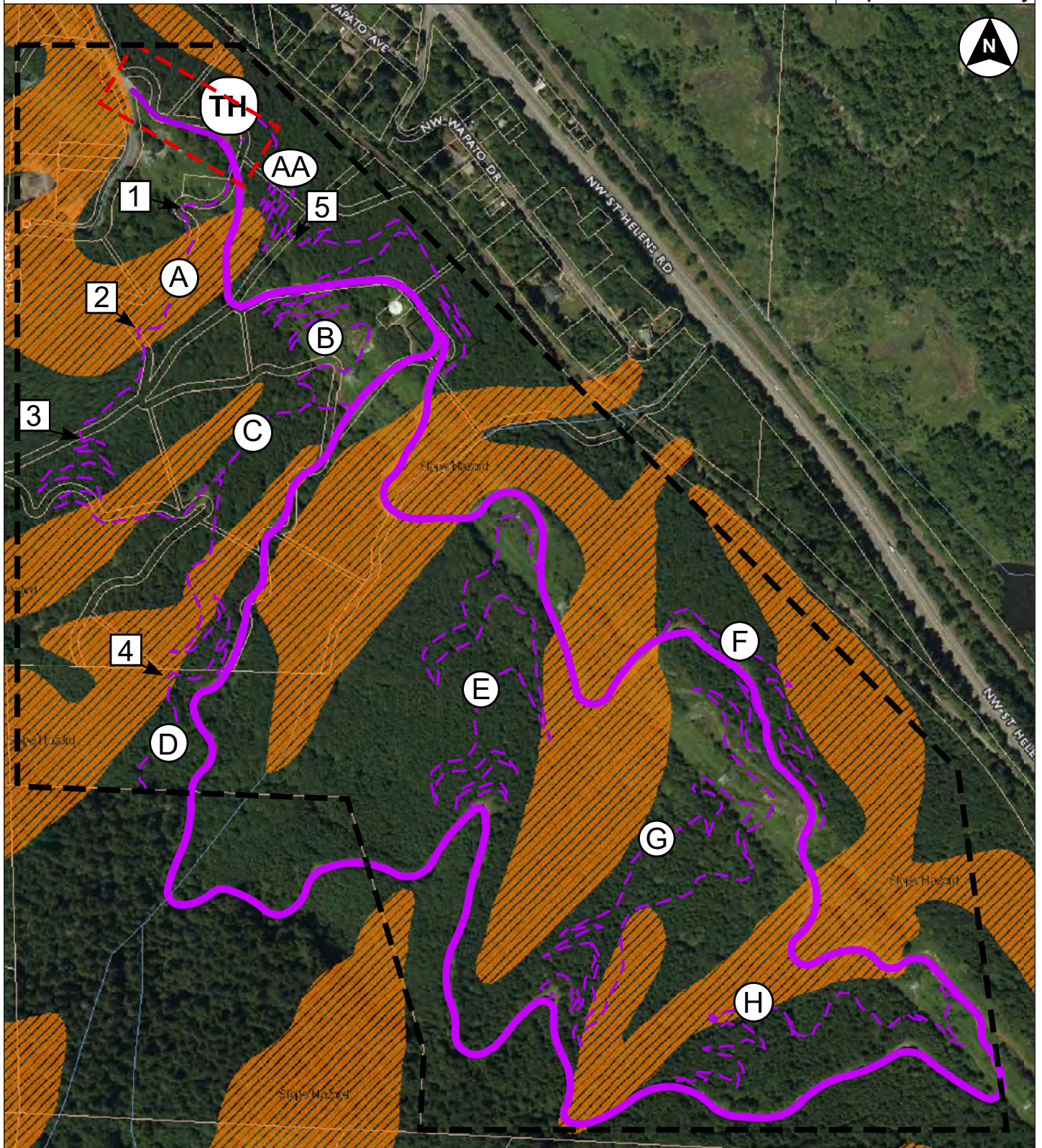
The scope of this assignment was limited to identification and discussion of landslide hazards. Other geologic hazards were not specifically researched or discussed as part of this assignment. Our recommendations are not intended to indicate that all geologic hazards can be mitigated by proper engineering. They are provided to assist the owner/developer and project engineer in evaluating site conditions based on geologic research and preliminary, site specific, surface and subsurface exploration.

This assignment consisted of review of our geotechnical shallow subsurface exploration, visual examination of the site and surrounding properties, and review of readily available geologic resources judged pertinent to the evaluation. Portions of the slopes on the site could not be readily observed, due to the presence of dense vegetation. Accordingly, the limitations of this evaluation must be recognized. An exploration of subsurface conditions at depth was not conducted for this evaluation. An investigation to explore subsurface conditions at depth using deeper soil borings or excavations could be conducted at



additional cost to the owner to further define the risk of unforeseen, adverse geological issues on this site. However, based on our observations and the information available, the risk of unforeseen adverse geological issues on this site appear to be small and could, in our opinion, be assumed by the owner.





**LEGEND**

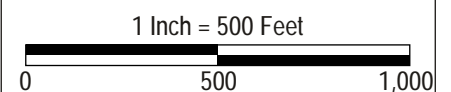
Slope Hazard Overlay

Existing Access Road (from Metro)  
 Trailhead Site Plan (Figure 3)

Proposed Trail (from Metro)  
 Drainage Crossing (from Metro)



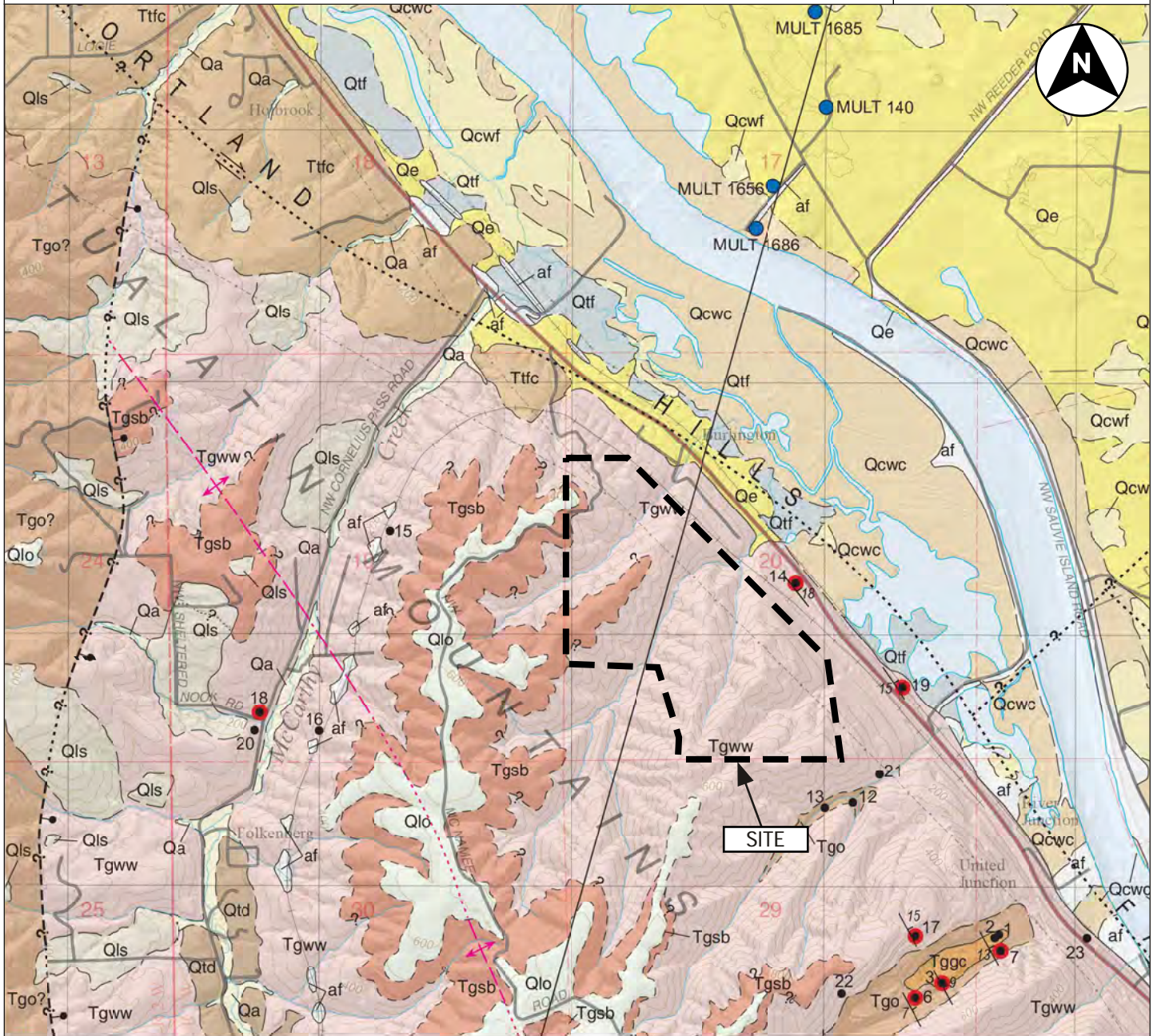
NOTES: 2010 aerial photograph and slope hazard overlay obtained from Multnomah County Land Use Planning Interactive Zoning Map online application accessed August 2017, from Multnomah County website: <http://www4.multco.us/lup/>. All locations should be considered approximate.





**BURLINGTON CREEK FOREST NATURE PARK - MULTNOMAH COUNTY, OREGON**  
**Project Number G1704662**

**FIGURE B2**  
**Geologic Map**



**Surficial Deposits**

- af Artificial Fill (Holocene)
- Qtf Fan Deposits from Tributaries (Holocene and Pleistocene)
- Qa Alluvium of Tributary Floodplains (Holocene and Pleistocene)
- Qe Eolian Deposits (Holocene)

**Basin Fill Deposits**

- Qtc Unnamed Conglomerate (Pleistocene and Pliocene?)
- Ttfc Troutdale Formation, Conglomerate Member (Pliocene and/or Miocene?)
- Tsr Sandy River Mudstone (Pliocene and/or Miocene)

**Columbia River and Willamette River Floodplain Deposits**

- Qcwf Silt and Clay Facies
- Qcwc Sand Facies
- Qls Landslide Deposits (Holocene and Pleistocene)
- Qtd Terrace Deposits (Holocene and Pleistocene)
- Qlo Loess (Holocene?& Pleistocene)
- Qls Cataclysmic-flood Deposits, Sand and Silt Facies (Pleistocene)

**Paleogene Sedimentary Rock Deposits**

- Tsf Scappoose Formation (Oligocene)

**Columbia River Basalt Group  
Grand Ronde Formation**

- Tgsc Sentinel Bluffs Member
- Tgww Winter Water Member
- Tgo Ortle Member
- Tgoc Grouse Creek Member



Map adapted from Evarts, O'Connor, and Cannon, 2016. Geologic Map of the Sauvie Island Quadrangle, Multnomah and Columbia Counties, Oregon and Clark County Washington.

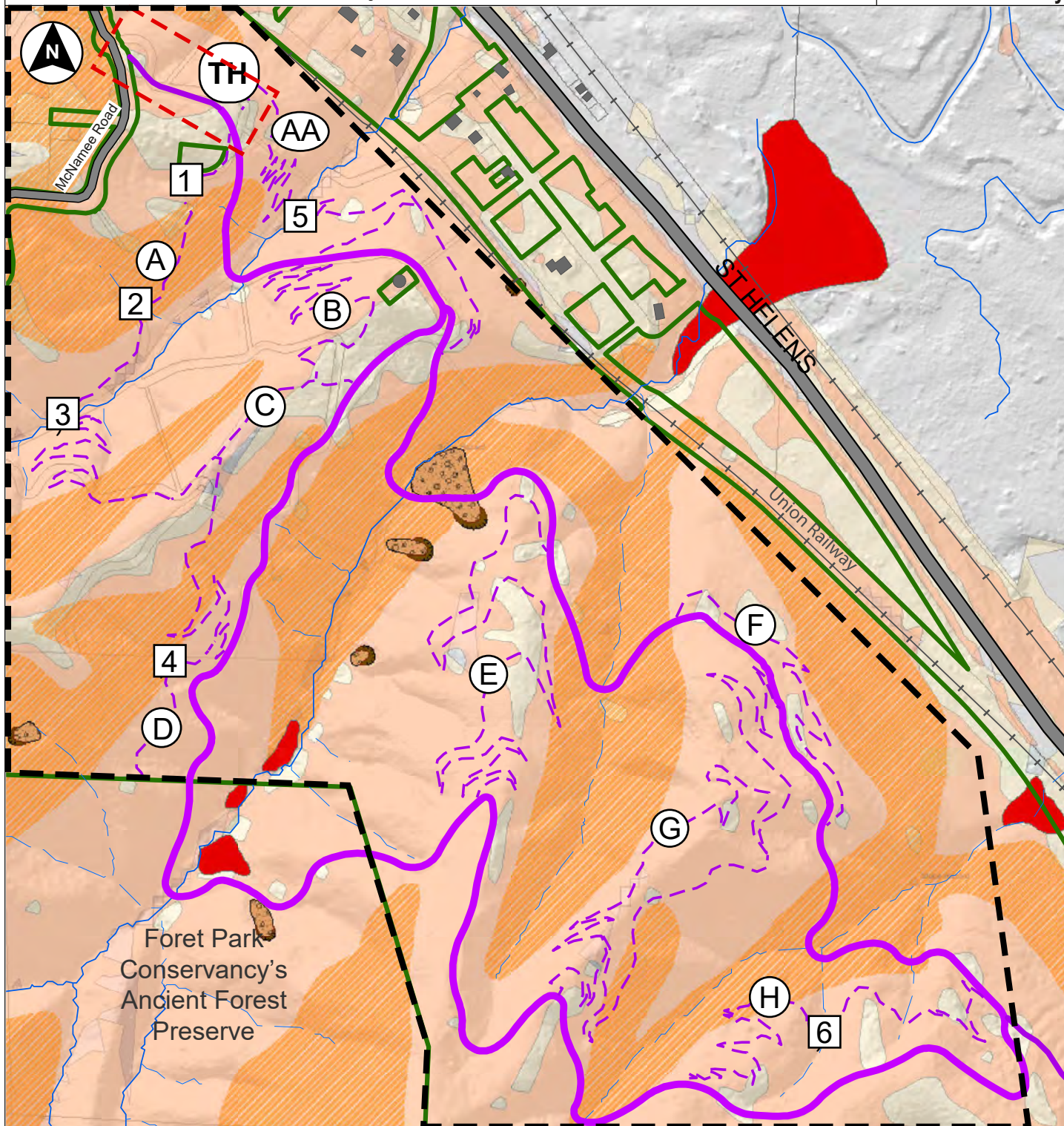
Township 2 North, Range 1 West, Section 20 Willamette Meridian

Latitude: 45.644865° North  
Longitude: 122.845679° West

1 Inch = 2,000 Feet







**LEGEND**



Trailhead Site Plan (Figure 3)

Approximate Site Boundary



Proposed Trail (from Metro)



Drainage Crossing (from Metro)



Existing Access Road (from Metro)



**SLIDO Mapping**

Landslide



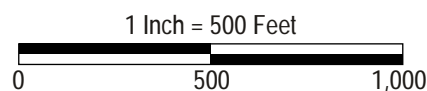
Head Scarp



Fan Deposits



NOTES: Drawing based on Burlington Creek Forest Nature Park, September 2017, prepared by Metro, and data from Oregon Department of Geology and Mineral Industries, Statewide Landslide Information Layer for Oregon. <http://www.oregongeology.org/slido/index.html>.





# Carlson Geotechnical

A division of Carlson Testing, Inc.  
Phone: (503) 601-8250  
Fax: (503) 601-8254

Bend Office (541) 330-9155  
Eugene Office (541) 345-0289  
Salem Office (503) 589-1252  
Tigard Office (503) 684-3460



## Appendix C: Hillside Development Permit (HDP) Form 1

**Burlington Creek Forest Nature Park  
NW McNamee Road  
Multnomah County, Oregon**

**CGT Project Number G1704662**

September 13, 2017

*Prepared For:*

Ms. Karen Vitkay  
Metro  
600 NE Grand Avenue  
Portland, Oregon 97232-2736

*Prepared by*  
**Carlson Geotechnical**





**MULTNOMAH COUNTY**  
LAND USE & TRANSPORTATION PROGRAM  
1600 SE 190th AVE, SUITE 116  
PORTLAND, OREGON 97233-5910  
503-988-3043 Fax: 503-988-3389  
www.co.multnomah.or.us/landuse

**HILLSIDE DEVELOPMENT PERMIT APPLICATION:  
GEOTECHNICAL RECONNAISSANCE AND STABILITY  
PRELIMINARY STUDY  
[HDP Form 1]**

*Note: Response to each question below must be completed or verified by a Certified Engineering Geologist or Geotechnical Engineer, including a State of Oregon Registration Stamp and Number in the space provided on page four. The HDP form 1 addresses Multnomah County Code Section .5515(A)(3), Hillside Development Permits.*

**Site Address:** Burlington Creek Forest, NW McNamee Road

**Legal Description:** 2N1W20 - 00400  
2N1W20B - 00300, 00500, 00600  
2N1W20BC - 00800, 01000, 01200  
2N1W20BD - 03700  
2N1W20C - 00100, 00300, 00400, 00500

**Property Owner's Name:** Metro

**Firm Preparing Report:** Carlson Geotechnical

**Address:** 7185 SW Sandburg Street, Suite 110

Tigard, OR 97223

**Preparer's Name:** Ryan Houser, CEG

**Phone Number:** 503-601-8250

**GENERAL PROPERTY INFORMATION**

1. a. Maximum Slope on Property: 1H:1V Area in which it is located: Road cuts  
Average Slope of Property: 4H:1V
- b. Are there any wetlands or streambeds on the property? **(Please Circle)** Yes No  
If yes, please show on topographical survey or sketch.  
See Figure 2 attached to geotechnical report.
- c. Volume of soil or earth material disturbed, stored, disposed of or used as fill: See Figure 3

Were building plans considered when completing this form? **(Please Circle)** Yes No  
If yes, please note the author and date the plans were prepared.

Design drawings dated September 2017, prepared by Metro (Figures 2 and 3 attached to geotechnical report)



2. What is the general topography of the property? Please attach a topographic survey or sketch with pertinent notes.

Generally slopes down to the northeast, with multiple drainages cutting the site. Topography shown on Figures 2 and 3 attached to geotechnical report and described in Sections B.2.1 and B.3.1 of Appendix B.

3. Are there any visible signs of instability or other potentially adverse site features (Landslides, slumps, mud flow, creep, ravines, fills, cuts, seeps, springs, ponds, etc.) within the surrounding area for a minimum distance of 100 feet beyond the subject property boundaries? Describe and indicate on attached topographic survey or sketch.

Localized areas of creep (leaning trees), possible old slump near Crossing 4, and erosion along stream and existing site roadway cuts. These features were not observed in Trailhead area. Trails will cross multiple streams and near areas of previous landsliding and erosion. See report for discussion and recommendations.

4. Is any earthwork proposed in connection with site development?

(Please Circle)      ☒ Yes      No

If yes, indicate depth and extent of cuts/fills; describe fill types.

Cuts up to about 8 feet and fills up to about 6 feet are planned in conjunction with the Trailhead development. Cuts along trails will be limited to about 2 feet in depth. Creek crossings may involve temporary cuts up to about 5 feet in depth for installation of bridge abutments. Recommendations for grading and fill placement provided in geotechnical report.

5. In your opinion, will the proposed earthwork cause potential stability problems for the subject and/or adjacent properties?

(Please Circle)      Yes      ☒ No

If yes, express probability.

(Please Circle)    Very Probable    Possibly    Possible, but remote

If Very Probable or Possibly, explain.

See report text for additional details.



6. In your opinion, will the proposed development (structures, foundations, parking area, streets, etc.) create potential stability problems for the subject and/or adjacent properties?

(Please Circle)

Yes

☒ No

If yes, express probability.

(Please Circle)

Very Probable

Possibly

Possible, but remote

If Very Probable or Possibly, explain.

With the use of generally accepted construction techniques, it is our opinion the site can be developed as proposed, without significantly increasing the risk of slope instability that might impact the proposed development or adjacent properties. Recommendations for earthwork provided in Section 5.0 of the geotechnical report.

7. In your opinion would the subsurface disposal of sewage effluent on the site (i.e., drain fields) have an adverse affect on stability of the site or adjacent area?

(Please Circle)

Yes

☒ No

If yes, express probability.

(Please Circle)

Very Probable

Possibly

Possible, but remote

If Very Probable or Possibly, explain.

Not applicable



8. If answer is Very Probable or Possibly to questions 4 or 5, is it your opinion, on the basis of a visual evaluation, that adequate stability might be achieved by preferred siting of the development, alternative foundation support, earthwork, drainage, etc.?

(Please Circle)      Very Probable      Possibly      Possible, but remote

If yes, explain.

Trail locations are preliminary; final locations will be determined during construction. See report text for specific recommendations.

9. Do you recommend additional geotechnical studies (i.e., mapping, testing pits or borings, stability analysis, etc.) prior to site development?

(Please Circle)      Very Probable      Possibly      Possible, but remote

If yes, explain.

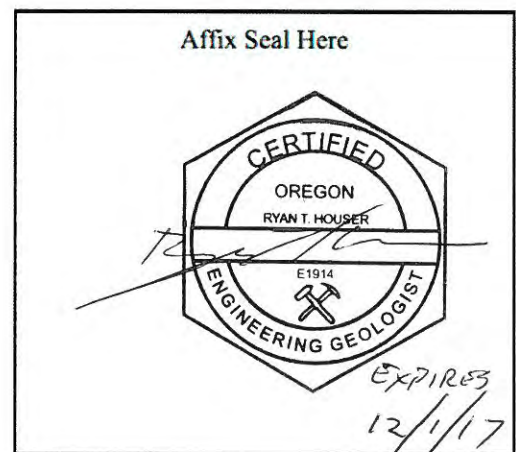
Geotechnical investigation performed as part of current scope of work. No additional studies recommended based on existing plan.

*By signing and affixing the required stamp below, the Certifying Engineering Geologist or Geotechnical Engineer certifies that the site is suitable for the proposed development.*

Signature

Date

Ryan T. Houser  
9/13/17





# **Burlington Creek Forest Area**

**EXHIBIT 5**

## **Transportation Analysis Letter**



**Submitted by: Nemariam Engineers & Associates, LLC**

**July 26<sup>th</sup>, 2017**



## Table of Contents

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| Section III: Applicable Criteria and Findings..... | 2-12 |
| Section IV: Conclusion.....                        | 13   |

## Exhibits

|            |  |
|------------|--|
| Exhibit A: | Zoning Map   |
| Exhibit B: | Proposed Sit Plan  |
| Exhibit C: | Estimated Trips Calculation  |
| Exhibit D: | Transportation Volume Table 30 <sup>th</sup> Highest Hour                    |
| Exhibit E: | Crash Data Information   |
| Exhibit F: | Level of Service Description   |
| Exhibit G: | Traffic Counts/Roadway Classification  |
| Exhibit H: | 2014 KPFF Intersection Sight Distance Evaluation<br>Memorandum               |
| Exhibit I: | Multnomah County Comprehensive Plan Update<br>for 2016 Planned Projects List |

## Exhibits

|          |                         |
|----------|-------------------------|
| Table 1: | Crash Data 2013- 2015   |
| Table 2: | Roadway Characteristics |



**Section I: Introduction**

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This Transportation Analysis Letter addresses transportation impacts of the proposed park related to parking, amenities, restrooms, roadway safety improvements and trails improvements to be constructed at the Burlington Creek Forest Area in Multnomah County, Oregon. Primary access to the site is located on NW McNamee Road approximately half a mile south of the US 30/NW McNamee Road. Information regarding expected trip generation, site plan, access spacing compliance, access sight distance, and safety have been investigated and the results are reported herein.

**Section II: Background**

---

Burlington Creek Forest Nature Park encompasses 354 acres of land in Multnomah County, along the north-eastern border of the Urban Growth Boundary (UGB) just outside of Portland city limits. It is approximately 16 miles north from downtown Portland. The total acreage is located outside the UGB. The local zoning for the park property is shown as commercial forest use (CFU) in the Multnomah County Zoning Map. See Exhibit A for Zoning Map. McNamee Road, Cornelius Pass Road and the railroad along the northeast site boundary all cross through Burlington Creek Forest.

The proposed development includes primary access from NW McNamee Road. See Exhibit B for the proposed Site Plan. Proposed improvements at Burlington Creek Forest include a trailhead, shared use trails, designed specifically for hiking and off-road cycling.

The NW McNamee Road entrance is proposed as the main entrance with an automatic gate that will be closed and locked in the evenings. The parking area will provide parking for 25 parking spaces as shown in Exhibit B. Overflow parking on McNamee Road will not be allowed.

The NW McNamee Road entrance will provide access to access drive, vehicle parking area, vault toilet, two picnic tables, trail systems and an information sign. Approximately five miles of new unpaved trails will be provided to allow visitors to explore Burlington Creek Forest by foot or by off-road bicycle. Over two miles of existing gravel road will also be open to park visitors, including equestrians. The proposed development is intended to protect water quality, fish and wildlife habitat while creating opportunities for the community to recreate and enjoy nature.



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**Section III:                      Applicable Criteria and Findings**

---

Below is a discussion of the applicable criteria listed in *italicized*, followed by **findings** of compliance. The criteria evaluated are identified in the County's March 28<sup>th</sup>, 2017, EP-2017-6780 North Tualatin Mountains Park Master Plan - Comprehensive Plan Amendment, Site Development at Burlington Creek Forest memorandum.

Given the proximity to the proposed entrance, the following intersections were evaluated in this report.

1. US30/NW McNamee Road
2. NW McNamee Road/Project Site Access
3. NW McNamee Road/NW Skyline Boulevard
4. NW Skyline Boulevard/NW Cornelius Pass Road
5. US 30/NW Cornelius Pass Road

Section 3 of *Multnomah County Road Rules* specifies a transportation impact as:

*Any new construction or alteration which increases the number of trips generated by a site by more than 20 percent, by more than 100 trips per day or by more than 10 trips in the peak hour. A minimum increase of 10 new trips per day is required to find a transportation impact.*

**Findings:** Per the trip estimate for Burlington Creek Forest Park discussion below, the proposed use constitutes a "transportation impact" under Multnomah County Road Rules. The calculation for the estimated trips is included in Exhibit C.

Typically, trips generated by proposed developments are estimated using trip rates from *ITE Trip Generation Manual*, however, the *ITE Trip Generation Manual* does not provide trip rates for nature parks of the type proposed. The manual does provide trip rate information for County and Regional parks. However, trip rates for these County and Regional parks are developed based on small sample sizes. In addition, according to the *ITE Trip Generation Manual* the parks surveyed in developing the trip rates widely varied in locations, types and number of facilities. Considering the facts noted above, it is reasonable to assume the *ITE* trip rates are not likely to be representatives of the trip rates generated by the proposed nature park.

Therefore, the site generated trips for the proposed development was estimated based on the weighted average trip data obtained from traffic counts at Mt. Talbert Nature Park and Graham Oaks Nature Park. Trip data from Mt. Talbert Nature Park and Graham Oaks Nature Park were used to estimate trip rates for the proposed development because these parks have the most similar park operations to the currently proposed development. The Nature Parks & Natural Areas data reviewed and trip rate calculations for the proposed



improvements are included in Exhibit C for reference.

- Mt. Talbert Nature Park is a 254 acres nature park in Clackamas County. This nature park offers 4.2 miles of hiking trails. It has 20 existing parking stalls. Mt. Talbert Nature Park generates an average of 4 vehicle trips per hour (0.02 average hourly trips per acre) and 95 daily trips (0.37 daily trips per acre).
- Graham Oaks Nature Park is a 230 acres nature park in Wilsonville. This nature park offers 3.5 miles of hiking trails. It has 25 existing standard parking stalls and 2 ADA parking stalls. On average, Graham Oaks Nature Park generates 3.1 vehicle trips per hour (0.01 average hourly trips per acre) and 74.2 daily vehicle trips on average day (0.32 daily trips per acre).

Based on the hourly and daily trips for Mt. Talbert Nature Park and Graham Oaks Nature Park, the weighted hourly and daily average trips per acre of land for the project site were calculated. The results of the weighted hourly and daily trips per acre of land are 0.02 and 0.35, respectively. Using the results of the weighted average trip rates per acre, the total average hourly and daily trips generated by the project site are approximately 5 and 124 trips, respectively.

Trips generated by the project site during the peak traffic hour can be estimated using the ratio of the 30<sup>th</sup> highest peak hour and average daily traffic volume (ADT). The ratio of the 30<sup>th</sup> highest hour (design hour) and the ADT is known as the K factor. The K factor for US 30 near the project site ranges 11.3% - 12% of ADT as shown in the *2015 Transportation Volume Table* excerpt in Exhibit D. Assuming (on average) 11.7% of the daily trips generated by the site occur during the design hour which usually coincides with peak traffic hour, 14 trips are estimated to be generated by the project site during the peak traffic hour.

In addition, review of the 2017 Oregon/Washington population data revealed that the population within a 30-minute drive time of Burlington Creek Forest Park, Mt. Talbert Nature Park and Graham Oaks Nature Park is 756,870, 1,384,710 and 786,888, respectively. Compared to Mt. Talbert Nature Park and Graham Oaks Nature Park, Burlington Creek Forest Park has fewer people living within a 30-minute drive. For this reason, Burlington Creek Forest Park is likely to generate fewer trips per acre compared to similar parks. Therefore, based on the data analyzed above, the proposed small increase in traffic is not likely to have a significant adverse impact on the surrounding transportation infrastructure.

Section 8.100 of Multnomah County Road Rules states that:

*To protect the public from the detrimental effects of a proposed development, County policy requires Off-site improvements as a condition of a site development permit to:*



### 1. Satisfy safety requirements.

**Finding:** To identify safety-related concerns at intersections near the proposed development, crash data outlined in the *Multnomah County TSP* was evaluated for the following locations. The crash data evaluated in the *County's TSP* is obtained from the *Oregon Department of Transportation (ODOT) Crash Analysis and Reporting Unit Records* for the period of 2007 to 2013.

- **US 30/NW McNamee Road:** Review of the *County's TSP* shows no crash patterns at this location for the period of 2007 through 2013. In addition, review of the most recent ODOT Crash Data for the period of 2013-2015 showed one non-fatal crash. This crash did not involve pedestrians and/or bicyclists.
- **NW McNamee Road/Project Site Access:** Review of the *County TSP* shows that there were no crash patterns at this location for the period of 2007 through 2013. In addition, review of the most recent ODOT Crash Data for the period of 2013-2015 showed no crashes at this location.
- **NW McNamee Road/NW Skyline Boulevard:** Review of the *County's TSP* shows no crash patterns at this location for the period of 2007 and 2013. While NW Skyline Boulevard is one of the areas with a pattern of crashes, there is no pattern of crashes on NW Skyline Boulevard within approximately 500 feet of its intersection with NW McNamee Road. Review of the most recent ODOT Crash Data for the period of 2013-2015 showed no crash at this intersection.
- **NW Skyline Boulevard/NW Cornelius Pass Road:** Review of the *County's TSP* revealed that this intersection is one of the locations with a pattern of crashes. Review of the most recent ODOT Crash Data for the period of 2013-2015 showed 6 non-fatal crashes at this intersection. Of the 6 crashes, 3 crashes are angle, 2 crashes are turning-movement, 1 crash is a sideswipe and 1 crash involved a fixed object. The crashes did not involve pedestrian and/or bicyclist.
- **US 30/NW Cornelius Pass Road:** Review of the *County's TSP* shows no crash patterns at this location for the period of 2007 and 2013. While this intersection is not identified as one of the intersections with crash patterns, NW Cornelius Pass Road and US 30 are identified as areas with crash patterns. In addition, review of the most recent ODOT Crash Data for the period 2013-2015 shows 14 non-fatal crashes.

Of the 14 crashes 8 were rear-end, 3 were turning movement, 2 involved fixed objects and 1 involved sideswipe (overtaking) crashes. There were no crashes involving pedestrians and bicyclists.



**Table 1: Crash Data 2013- 2015**

| <b>Intersection</b>                    | <b>Fatal Crashes</b> | <b>Injury/property damage crashes</b> | <b>Total crashes</b> |
|--|----------------------|---------------------------------------|----------------------|
| US 30/NW McNamee Rd                    | 0                    | 0                                     | 0                    |
| NW McNamee Rd/<br>Project Site Access  | 0                    | 0                                     | 0                    |
| NW Skyline Bl. /NW<br>McNamee Rd       | 0                    | 0                                     | 0                    |
| NW Cornelius Pass Rd/<br>NW Skyline Bl | 0                    | 6                                     | 6                    |
| US 30/ NW Cornelius<br>Pass Rd         | 0                    | 14                                    | 14                   |

The crash data for the period of 2013-2015 is summarized in Table 1 below. The Crash Reports by Type Map excerpt from the County's TSP and the ODOT most recent Crash Data for the period of 2013-2015 are in Exhibit F for reference.

Review of the crash history at the intersections nearest to the project site did not reveal any apparent safety deficiencies. Although two of the study intersections have a history of crashes, considering the availability of alternate routes, the crash frequency at these intersections is not likely to be exacerbated by small increase in trips at the project site. In addition, the county has planned projects to improve safety at these intersections. The projects are listed in the *County's Comprehensive Plan Updated for 2016 "Planned Project List"*. Additional information is provided under *"Planned Improvements"* later in this report."

## **2. Development created capacity needs.**

Multnomah County Design Standards require that: *"All new and improved arterial and major collector roadways in urban areas shall be designed to accommodate a level of service "D" or better during the design hour. In rural areas, such facilities shall be designed to accommodate level of service "C" or better during the design hour. On neighborhood collectors in urban areas, the design level of service shall also be "C" or better."* See Exhibit F for description of the Level of Service Concept.

**Findings:** Multnomah County's TSP, does not provide volume to capacity ratios or levels of service for any intersections in the vicinity of the project site. The capacity analysis described below is based on traffic data obtained from the County's TSP, Multnomah



County Comprehensive Plan Update, 2016, KPFF's 2014 Intersection Sight Distance Memorandum and the *Oregon Department of Transportation 2015 Transportation Volume Table*. See Exhibit G for traffic count excerpts from these publications. The ADT and roadway characteristics for NW McNamee Road, NW Skyline Boulevard, NW Cornelius Pass Road and US 30 are summarized in Table 2 below.

**Table 2: Roadway Characteristics**

| Roadway           | <sup>1</sup> Functional Classification | <sup>1</sup> Year 2006 - 2014 Average Daily Traffic Map  | Travel Lanes | Speed Limit  | Comments  |
|-------------------|--|--|--------------|--|---|
| NW McNamee Rd     | Rural Local                            | < 1,500<br>(245 ADT near project site)<br>(134 near NB Skyline Boulevard)  | 2            | 38 mph (NB); 35 mph (SB)<br><sup>2</sup> (85 <sup>th</sup> percentile speed) | No designated pedestrian/bicyclist facilities and no shoulders on both sides of the street.   |
| US 30             | Rural Principal Arterial               | (17,600 ADT 2015 Counts from ODOT Transportation Volume Table).<br>(24,200 ADT in 2033Multnomah County Comprehensive Plan Update for 2016) | 4            | 50 mph Posted speed  | There are wide shoulders near its intersection with NW McNamee Rd and its intersection with NW Cornelius Pass Rd. There are no designated bicycle/pedestrian facilities.                          |
| NW Skyline Bl.    | Rural Collector Street                 | North of Cornelius pass Road <1,500; South of Cornelius Pass Road 1,500-3,000<br>(2103 ADT both directions west of McNamee Rd)             | 2            | 44 mph<br><sup>2</sup> (85 <sup>th</sup> percentile speed)                   | There are wide shoulders near its intersection with NW Cornelius Pass Rd. There are no shoulders near its intersection with NW McNamee Rd. There are no designated bicycle/pedestrian facilities. |
| Cornelius Pass Rd | Rural Arterial Road                    | 5,000 – 10,000 near US 30; >10,000 near NW Skyline Boulevard   | 2            | 45 mph Posted speed  | There are wide shoulders near its intersection with US 30 and its intersection with NW Skyline Bl. There are no designated bicycle/pedestrian facilities.   |

1=Exhibit G; 2=Exhibit H



Below is an assessment of the study locations' capacity based on the data summarized in Table 2 above.

- **US 30/NW McNamee Road:** This location is a T-intersection with a stop sign on NW McNamee Road. NW McNamee Road has one lane in each direction with double yellow center line pavement marking. US 30 has two-lanes for each approach with two-way left turn-lane in the center and wide shoulders with curbs on both approaches.

The *Multnomah County Comprehensive Plan Update* for 2016 provides estimated increase in daily motor vehicle trips on US 30 near its intersection with NW McNamee Road and NW Cornelius Pass Road for the period of 2013-2033. The vehicle trip on US 30 is projected to increase to 24,000 daily trips in 2033 from the 17,600 daily trips in 2015 (2.03% annual growth rate). See Exhibit G for growth rate information. Traffic counts obtained from the May 5<sup>th</sup>, 2014 Intersection Sight Distance Memorandum show that the average daily traffic volume (ADT) on NW McNamee Road near the project site is 245 daily traffic for both directions. See Exhibit G. None of the documents noted above provide growth rate information for NW McNamee Road. Assuming the growth rate for trips on NW McNamee Road are the same as the growth rate on US 30, the projected daily trips for NW McNamee Road in 2033 would be 340 trips. Assuming the total number of traffic entering the intersection is equal to 11.7% of the ADT, the peak traffic hour entering/exiting the intersection from NW McNamee Road and US 30 are estimated be 40 and 2,810 vehicle trips, respectively.

Site review of this intersection's operation revealed that the traffic approaching the NW McNamee Road from the north is metered by the traffic signal at NW Cornelius Pass Road/US 30. Field observation of the intersection's operation also revealed that the controlled delay at this intersection is approximately less than 15 seconds. The LOS for a stop-controlled approach with less than 15 seconds delay is "B". Based on the projected total traffic volume entering the intersection in 2033 and site review of the intersection, it is reasonable to assume that this intersection will operate at a LOS "C" or better.

**NW McNamee Road/Project Site Access:** This location is a T- intersection without any traffic control devices. NW McNamee Road has one lane for each approach with double yellow center line pavement marking. The project site access is a gated gravel driveway. NW McNamee Road is a narrow roadway with no shoulders and no sidewalk.

As noted above the evening peak hour traffic volume on NW McNamee Road is estimated to be 40 vehicles per hour in 2033 and the traffic served by the proposed development during the peak traffic hour is expected to be 14 vehicles per hour.



With the traffic volume entering this intersection less than 60 vehicles per hour, it is reasonable to anticipate that this intersection will operate at a LOS A.

- **NW McNamee Road/NW Skyline Boulevard:** This location is a T- intersection with a stop sign control on NW McNamee Road. NW McNamee Road has one lane for each approach with double yellow center line pavement marking. The NW Skyline Boulevard has one lane for each approach with a double yellow center line pavement marking. NW Skyline Boulevard and NW McNamee Road are both narrow roadways without shoulders and sidewalks.

Traffic counts obtained from the *May 5<sup>th</sup>, 2014 Intersection Sight Distance Memorandum* show that the 2014 ADT for both approaches of NW McNamee Road and NW Skyline Boulevard near this intersection are 134 and 2103 trips, respectively. The 2014 ADT for NW McNamee Road and NW Skyline Boulevard are presented in Exhibit G. Assuming the annual growth rate for trips on these roadways are the same as the growth rate on US 30, the projected daily trips for NW McNamee Road and NW Skyline Boulevard would be 190 and 2,960 trips, respectively. Assuming the total number of traffic entering the intersection is equal to 11.7% of the ADT, the peak traffic hour traffic entering the intersection from NW McNamee Road and NW Skyline Boulevard are estimated to be 20 and 350 vehicle trips, respectively.

In addition, site review of this intersection revealed that the controlled delay for the stop-controlled approach is less than 10 second. The LOS for a stop-controlled approach with less than 10 seconds delay is "A". Based on the estimated ADT and the site review at this intersection, it is reasonable to assume that this intersection will operate at LOS C or better.

- **NW Skyline Boulevard/NW Cornelius Pass Road:** This location is a four-legged intersection with stop sign on NW Skyline Boulevard. NW Skyline Boulevard has one lane with double yellow center line pavement marking. NW Cornelius Pass Road has one through lane and a left turn-lane each approach and wide shoulders on both approaches.

As shown in Table 2 above, the ADT on NW Cornelius Pass Road near NW Skyline Boulevard is estimated to exceed 10,000 trips. North of Cornelius Pass Road, the ADT on NW Skyline Boulevard is estimated to be less than 1,500 trips; and south of Cornelius pass Road, the ADT on NW Skyline Boulevard is estimated to be between 1,500 to 3,000 ADT in 2014. See Exhibit G. Assuming the traffic growth at this intersection will be the same as the annual growth rate for US 30, the estimated trips on NW Cornelius Pass Road near NW Skyline Boulevard will be more than 13,250 trips in 2033. The estimated year 2033 trips on NW Skyline Boulevard north of NW Cornelius Pass Road will be 1,990 trips; and, south of NW Cornelius Pass the estimated ADT on NW Skyline Boulevard will be between 1,990 and 3, 980 trips.



Assuming the total number of trips entering the intersection during the evening peak hour traffic is equal to 11.7% of the ADT, the estimated evening peak hour trips on NW Cornelius Pass Road near NW Skyline Boulevard will exceed 1,550 vehicle trips per hour. The estimated evening peak hour trips on NW Skyline Boulevard north of NW Cornelius Pass Road will be 230 trips; and, south of NW Cornelius Pass Road the evening peak hour trips on NW Skyline Boulevard will be between 230 and 470 trips per hour.

Site review of this intersection's operation revealed more than 35 seconds delay for the stop-controlled approaches on NW Skyline Boulevard at its intersection with NW Cornelius Pass Road. The LOS for a stop-controlled approach with more than 35 seconds delay is "E". Based on the estimated ADT and the site review at this intersection it is reasonable to anticipate that this intersection will continue to operate at an unacceptable LOS. However, given other access routes and projected trips, the proposed use is not anticipated to adversely impact the intersections LOS.

- **US 30/NW Cornelius Pass Road:** This location is a traffic signal controlled T-intersection with marked pedestrian crossings on the south and west legs. There are no additional pedestrian or bicycle facilities. US 30 at this intersection has two lanes for each approach with a left turn-lane for the northbound approach. NW Cornelius Pass Road has a left turn-lane and a right turn-lane with a pork-chop island. Wide shoulders on all approaches are provided.

As shown in Table 2, the vehicle trip on US 30 is projected to increase from the 17,600 daily trips in 2015 to 24,000 daily trips in 2033 See Exhibit G for growth rate information. The County's TSP estimates ADT on NW Cornelius Pass Road to be 5,000 – 10,000 ADT in 2014. See Exhibit G. None of the documents noted above provide growth rate information for NW Cornelius Pass Road. Assuming the growth rate for trips on NW Cornelius Pass Road are the same as the growth rate on US 30, the projected daily trips for NW Cornelius Pass Road would be 6,620 - 13,250 trips. Assuming the total number of traffic entering the intersection is equal to 11.7% of the ADT, the peak traffic hour entering the intersection from NW Cornelius Pass Road and US 30 are estimated be 770-1,550 and 2,810 vehicle trips respectively.

Site review of this intersection's operation revealed that all vehicles that enter the intersection cleared within one cycle and delays were moderate. Based on the ADT and site review information, it is reasonable to assume this intersection will operate at LOS C.

#### **Access Evaluation:**

Section 4.000 of *Multnomah County Road Rules* requires that:



*“An applicant for access to County roads must either demonstrate that a sight distance requirement is currently met, propose mitigation measures that will meet this standard, or propose alternate measures acceptable to the County Transportation Division to mitigate sub-standard sight distance.”*

*In addition, the County’s Road Rules require that the minimum spacing standard for driveways on local streets be 50 feet.*

**Findings:** KPFF evaluated intersection sight distance for five access points located in the Tualatin Mountains in 2014. The sight distance evaluation included the project site access on NW McNamee Road. The results of the sight distance evaluation for the project site is documented in the *2014 KPFF Intersection Sight Distance Evaluation Memorandum* and summarize below.

The results of the sight distance evaluation showed that the sight distance at the project site access does not meet both Multnomah County’s and AASHTO’s minimum corner sight distance and stopping sight distance standards. The sight distance is limited due to trees, vegetation, a horizontal curve and a hillside on the roadway.

The memorandum recommends removal of the sight distance obstructions and recording restrictive sight distance easements over a portion of the nearby properties. See excerpt of the *2014 KPFF Intersection Sight Distance Evaluation Memorandum* in Exhibit H. With the recommended obstruction removal, the KPFF report indicates that safe and adequate sight distance can be provided.

In addition, review of the proposed access locations showed that there are no accesses within 50 feet of the proposed driveway. The County’s access spacing standard for driveways on local streets is a minimum of 50 feet. Therefore, the proposed access spacing follows the County’s access spacing standard.

**Planned Improvements:** The *Comprehensive Plan Update* for 2016 “*Planned Projects List*” in Exhibit I includes transportation improvements in the project site vicinity. The improvements include the following.

- NW Skyline Boulevard/NW Cornelius Pass Road intersection improvements: The improvements include installation of a traffic signal, providing westbound left-turn lane and through/right lane on Skyline Boulevard.
- NW Skyline Boulevard: Add to shoulder from UGB to Cornelius Pass Road and from Cornelius Pass Road to Rocky Point Road.
- Cornelius Pass Road/US 30 Intersection Improvements: The improvements included a northbound turn lane and shared northbound left-turn/right-turn lane.
- Cornelius Pass Road Improvements: Install photo radar for speed enforcement;



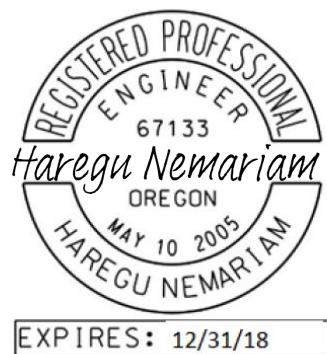
install reflectors, delineators, and traffic striping; conduct speed zone study; and, study the need for climbing lanes, guardrail, drainage and additional shoulder.

The planned projects would focus on improving the surrounding transportation system shortcomings to accommodate projected background traffic demand.

#### **Section IV: Conclusion**

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With the sight distance improvements at the project site access in place, the projected trips anticipated by the proposed development use can safely and adequately be served by the existing transportation system.



09/17/2017







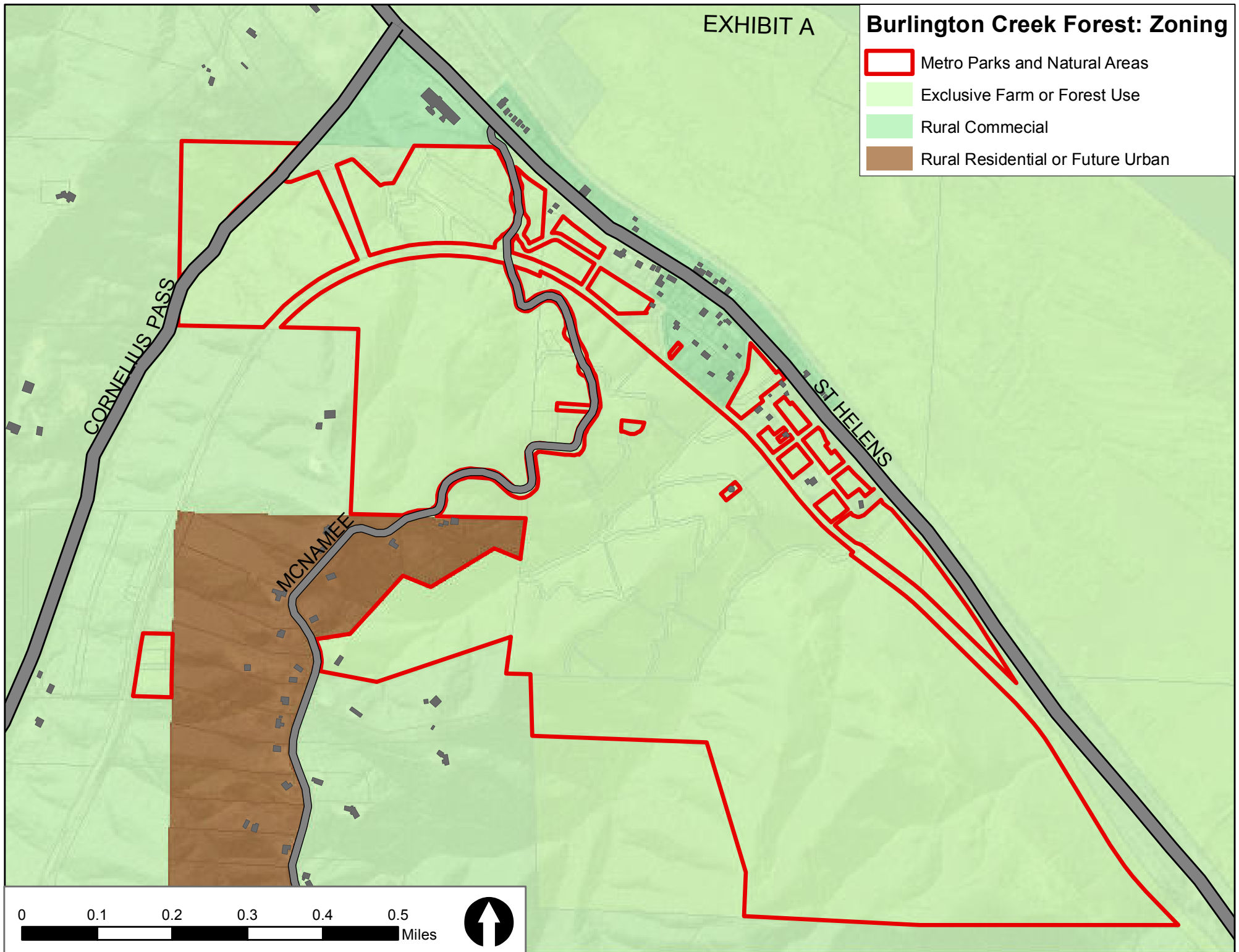
# EXHIBIT A



EXHIBIT A

**Burlington Creek Forest: Zoning**

-  Metro Parks and Natural Areas
-  Exclusive Farm or Forest Use
-  Rural Commercial
-  Rural Residential or Future Urban

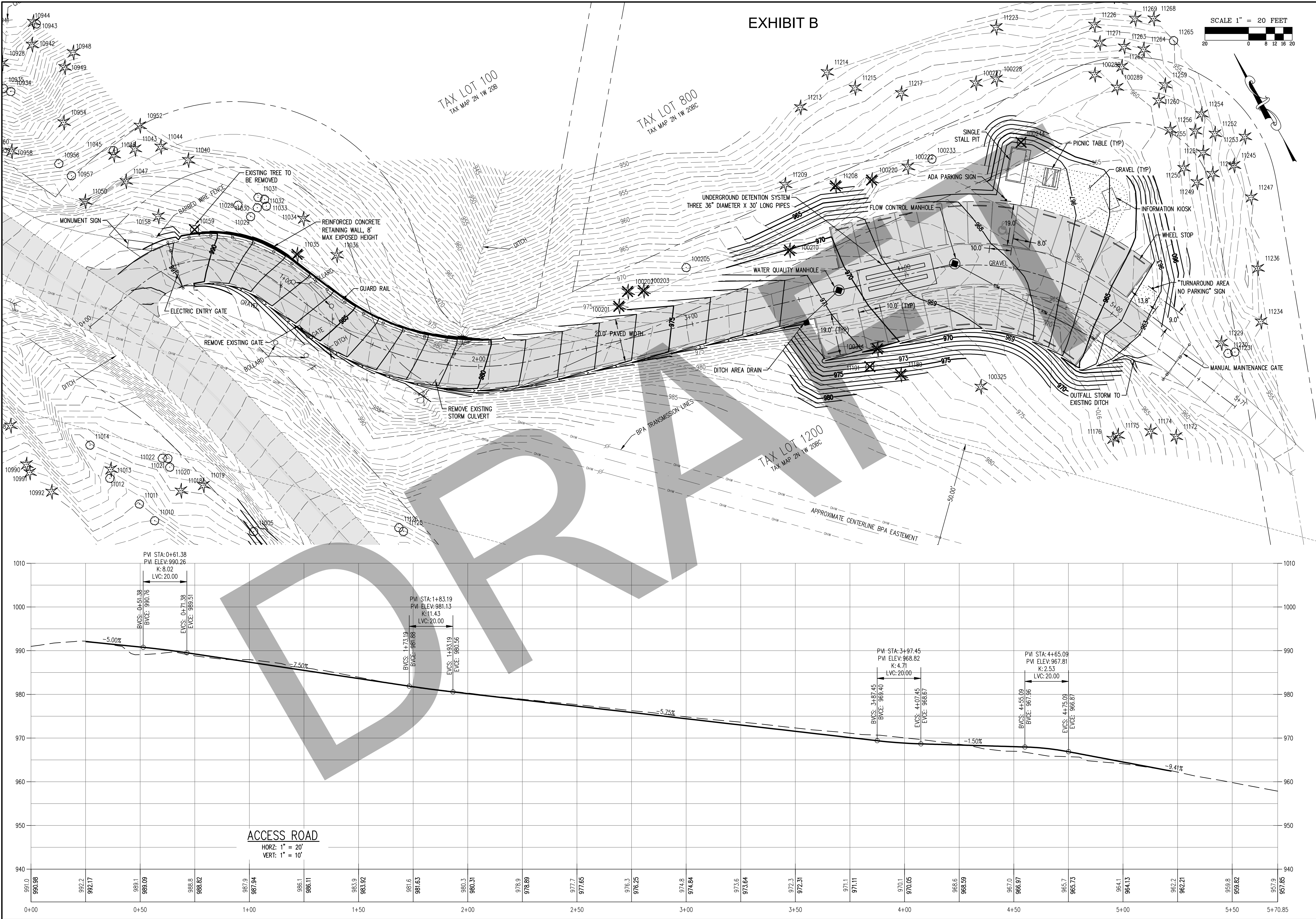




# EXHIBIT B



AKS DRAWING FILE: 4781 SITE PLANNING | LAYOUT: LAYOUT1



AKS  
AKS ENGINEERING & FORESTRY, LLC  
12065 SW HERMAN RD. SUITE 100  
TUALATIN, OR 97062  
P: 503.563.6151  
F: 503.563.6152  
aks-eng.com

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BURLINGTON CREEK  
PARKING METRO  
MULTNOMAH COUNTY OREGON

BURLINGTON PARKING  
SITE PLAN

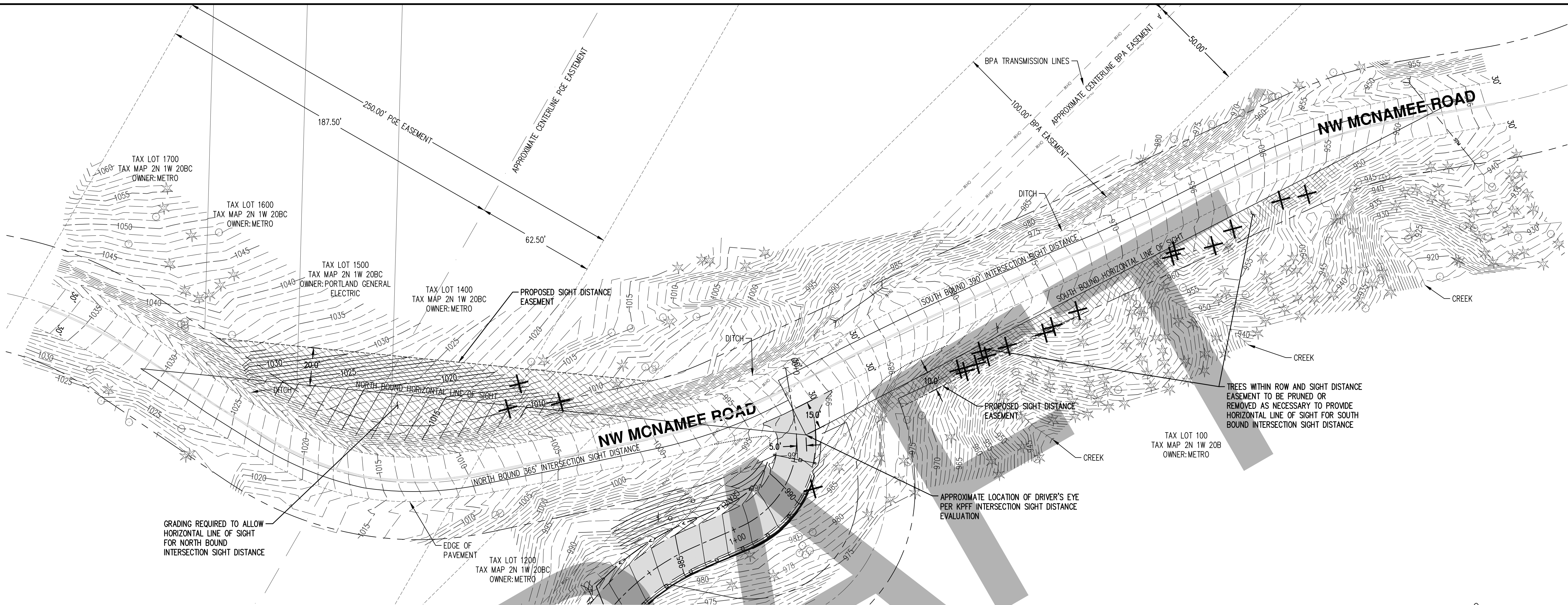
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|--------------|------------|
| DESIGNED BY: | BRB        |
| DRAWN BY:    | AZV        |
| CHECKED BY:  | AHH        |
| SCALE:       | AS NOTED   |
| DATE:        | 09/05/2017 |

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| REVISIONS |
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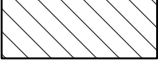

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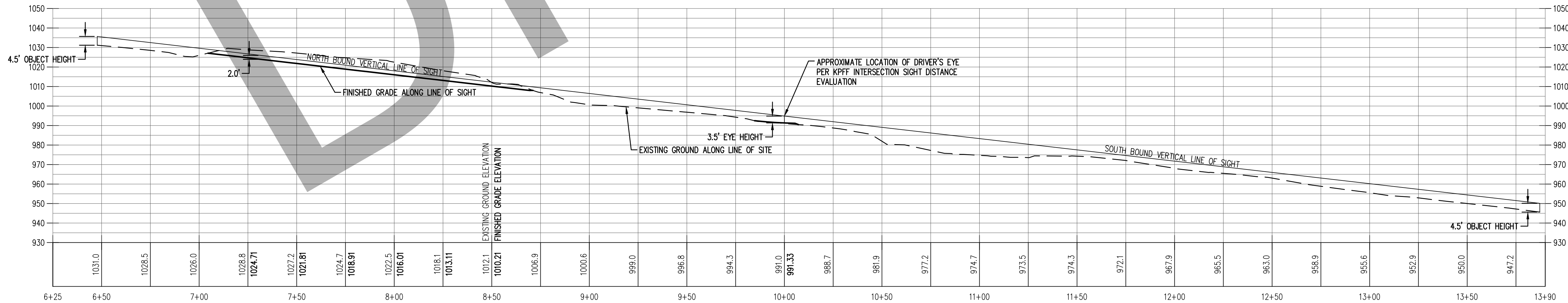
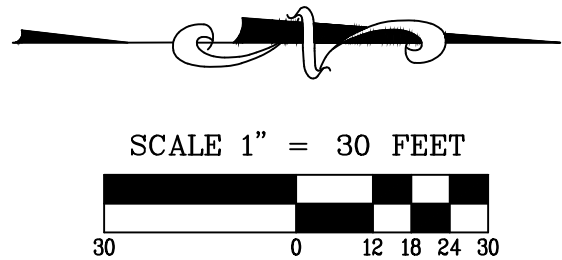


AKS DRAWING FILE: 4781 MCNAMEE SIGHT DISTANCE.DWG | LAYOUT: LAYOUT1



LEGEND:

- SIGHT DISTANCE CLEARING AREA 
- TREE REMOVAL/PRUNING 



SITE DISTANCE

Hor. Scale: 1" = 30'  
Vert. Scale: 1" = 30'

**BURLINGTON CREEK  
PARKING METRO  
MULTNOMAH COUNTY OREGON**

**NW MCNAMEE ROAD SIGHT  
DISTANCE**

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DRAWN BY: AZV  
CHECKED BY: AHH  
SCALE: AS NOTED  
DATE: 07/14/2017

REVISIONS

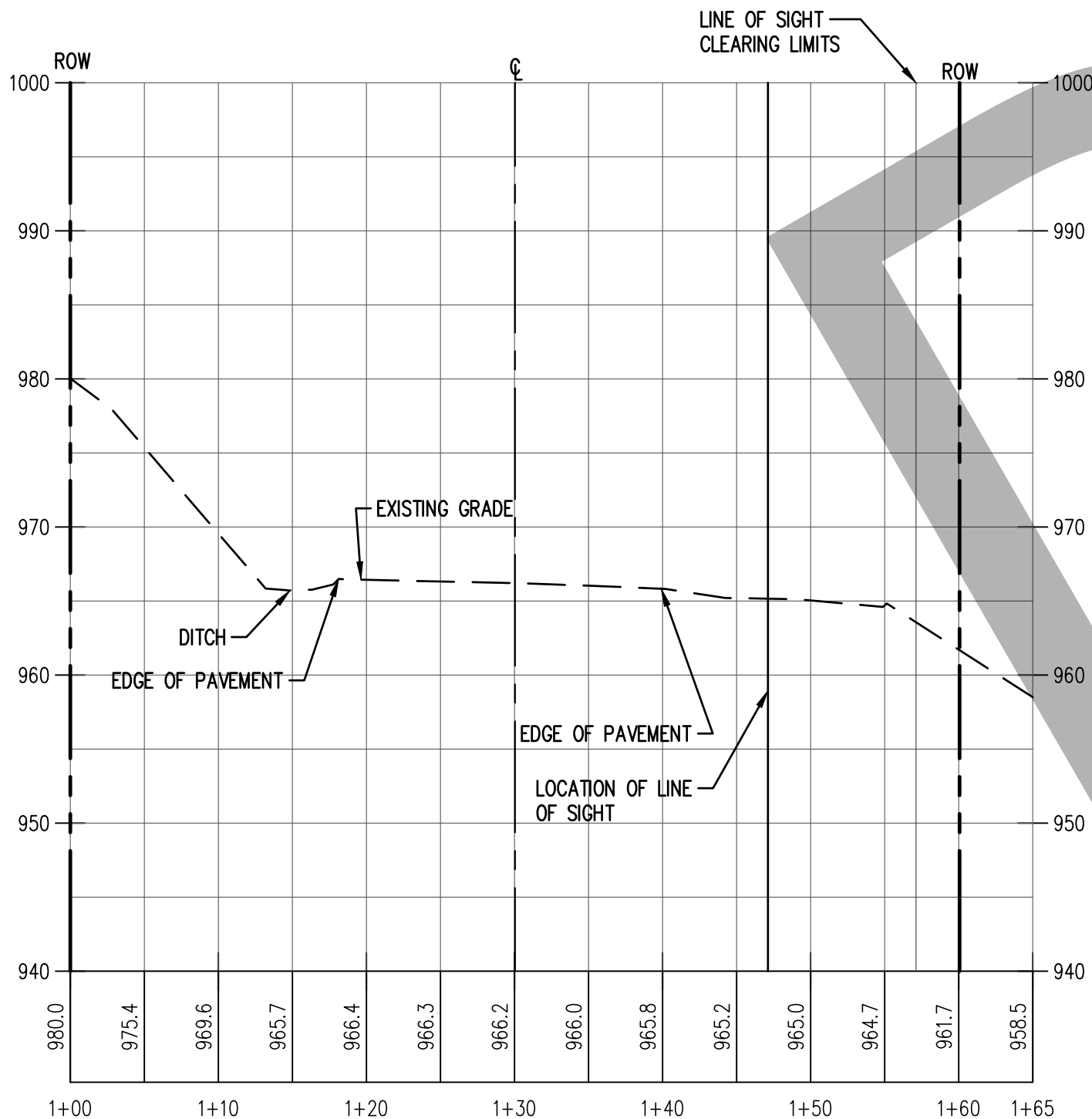
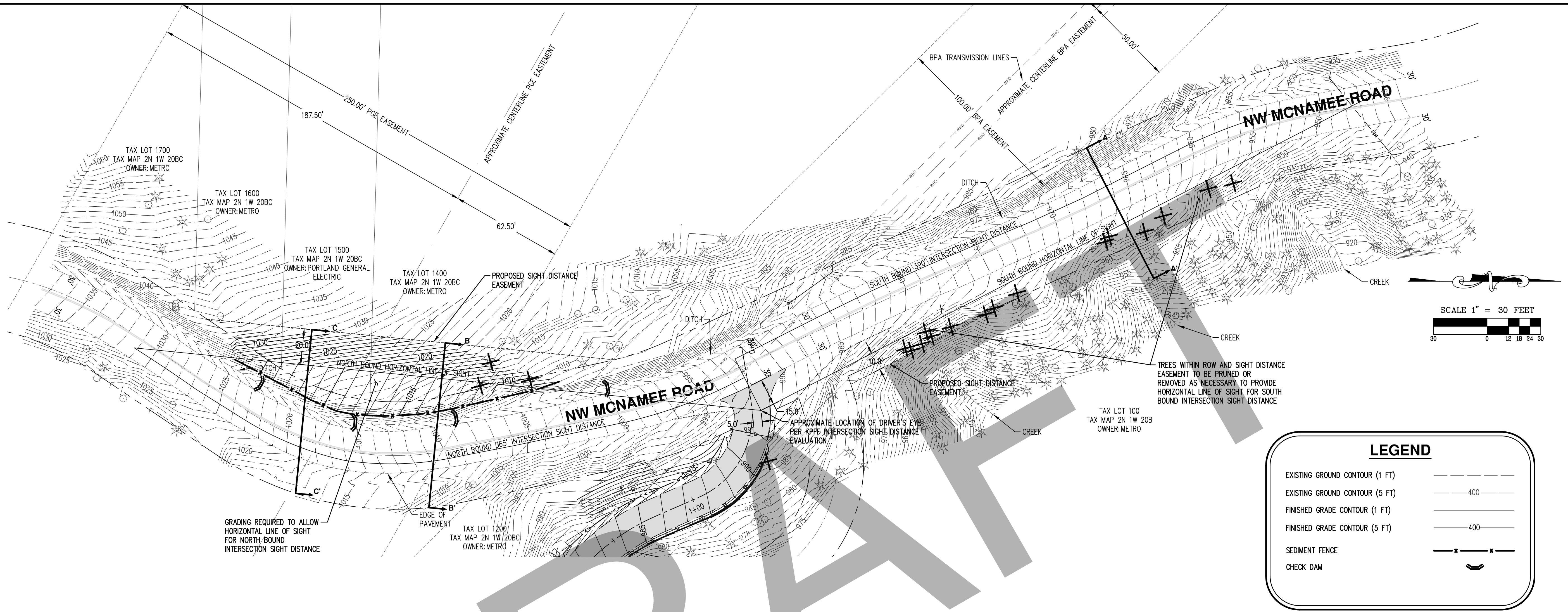
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4781  
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1 OF 2

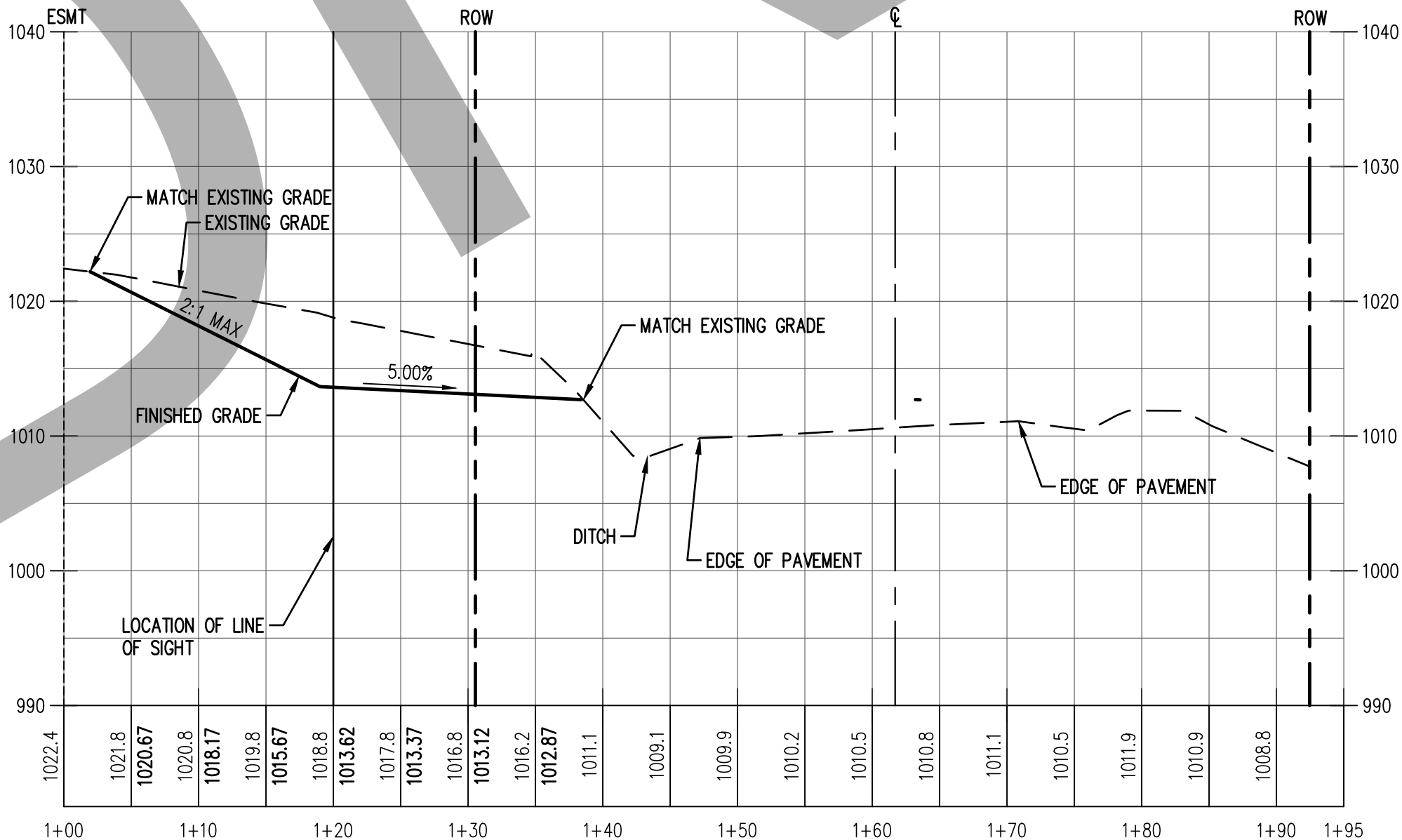
**AKS**  
AKS ENGINEERING & FORESTRY, LLC  
12065 SW HERMAN RD. STE 100  
TUALATIN, OR 97062  
P: 503.563.6151  
F: 503.563.6152  
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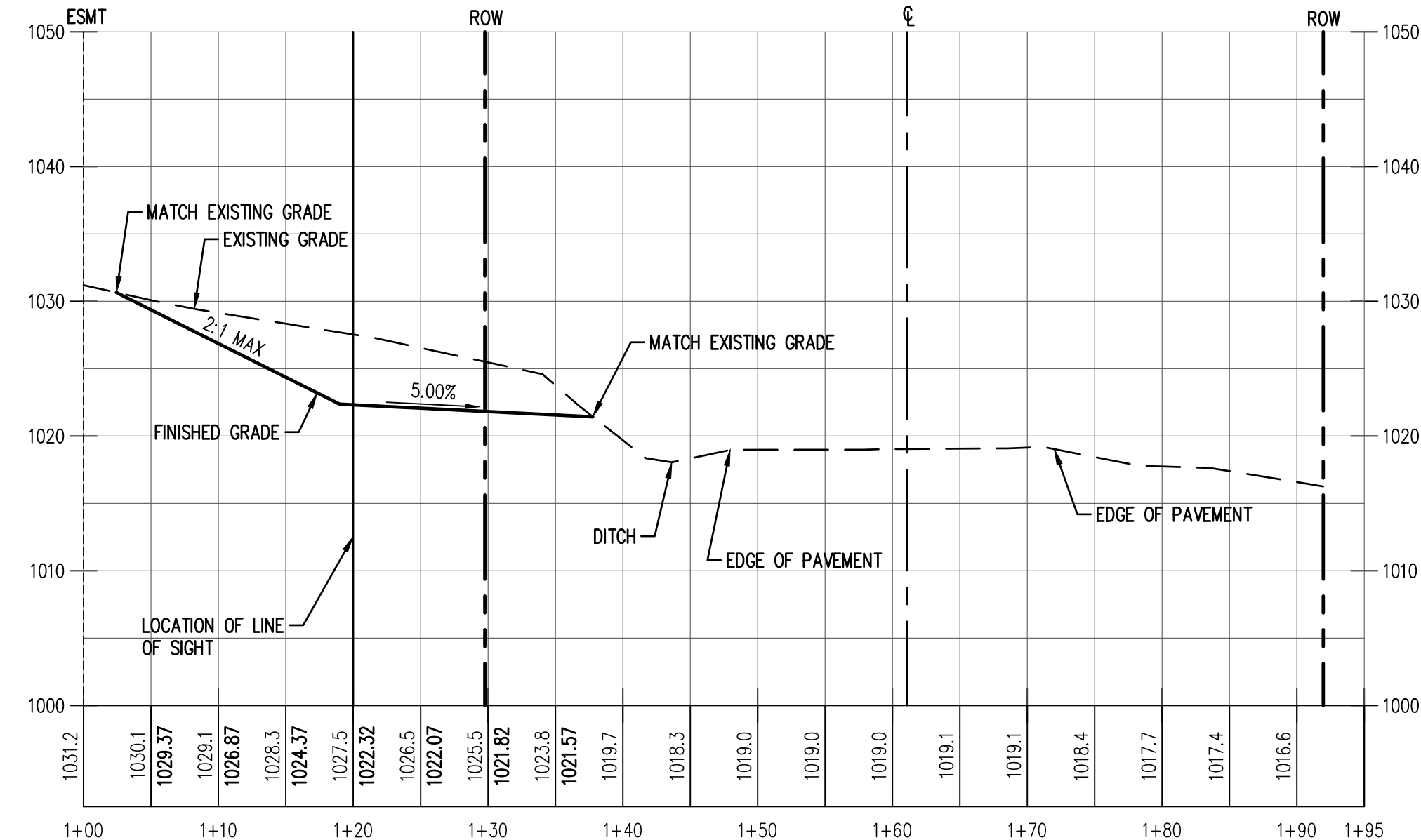
AKS DRAWING FILE: 4781 MCNAMEE SIGHT DISTANCE GRADING.DWG | LAYOUT: LAYOUT1



**A-A'**  
Hor. Scale: 1" = 10'  
Vert. Scale: 1" = 10'



**B-B'**  
Hor. Scale: 1" = 10'  
Vert. Scale: 1" = 10'



**C-C'**  
Hor. Scale: 1" = 10'  
Vert. Scale: 1" = 10'

**AKS**  
AKS ENGINEERING & FORESTRY, LLC  
12065 SW HERMAN RD. STE 100  
TUALATIN, OR 97062  
P: 503.563.6151  
F: 503.563.6152  
aks-eng.com

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**BURLINGTON CREEK  
PARKING METRO  
MULTNOMAH COUNTY OREGON**

**NW MCNAMEE ROAD  
GRADING PLAN**

|              |            |
|--------------|------------|
| DESIGNED BY: | BRB        |
| DRAWN BY:    | AZV        |
| CHECKED BY:  | AHH        |
| SCALE:       | AS NOTED   |
| DATE:        | 07/14/2017 |

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| SHEET         |
| <b>2 OF 2</b> |



# EXHIBIT C



## EXHIBIT C

### Estimated Trip Calucations

| Hourly Trip Rates Per Acre |                         |                         |
|----------------------------|-------------------------|-------------------------|
| Acres                      | Mt. Talbert Nature Park | Graham Oaks Nature Park |
| Hourly Trips               | 4                       | 3.1                     |
| Number of Units            | 254                     | 230                     |
| Hourly Trips/Acre          | 0.016                   | 0.013                   |

|  |                |
|--|----------------|
| Weighted Average Hourly Trips Per Acre = | 0.015          |
| Site Generate Average Hourly Trips=      | 354X0.015=5.31 |

| Daily Trip Rates Per Acre |                         |                         |
|---------------------------|-------------------------|-------------------------|
| Acres                     | Mt. Talbert Nature Park | Graham Oaks Nature Park |
| Daily Trips               | 95                      | 74.2                    |
| Acres                     | 254                     | 230                     |
| Hourly Trips/Acre         | 0.374                   | 0.323                   |

|  |               |
|--|---------------|
| Weighted Average Hourly Trips Per Acre = | 0.350         |
| Site Generate Average Daily Trips=       | 354x0.350=124 |



# EXHIBIT D



## Excerpts of Newell Creek Natural Area Trip Analysis

**Finding:** The proposed development is not adjacent to roadways and intersections that are high accident locations, areas that contain an identified safety concern, or high concentration of pedestrians or bicyclists such as school zones. See the response to subsection (6) standard below.

Therefore, the proposed development does not require a Transportation Impact Study. This letter will address Oregon City's requirements for a Transportation Analysis Letter as stated in section 5 of the *Guidelines for Transportation Impact Analyses*. Section 5 of Oregon City's *Guidelines for Transportation Impact Analyses* provides that a Transportation Analysis Letter shall include the following:

1. *The expected trip generation of the proposed development including the AM peak hour, the PM peak hour, daily traffic, and other germane periods as may be appropriate, together with appropriate documentation and references.*

**Findings:** Typically, trip ratios for new facilities are determined by using the ITE Trip Generation Manual, however, for this development type, the ITE Trip Generation Manual does not provide an identical or even similar use. The ITE Trip Generation Manual does include trip uses for certain types of parks, including county and regional parks, as shown in Table B.

Table B: Trip Generation Rates<sup>2</sup>

| Land Use      | ITE Code | Units | Peak Hour |          |       |         |          |       | Daily |
|---------------|----------|-------|-----------|----------|-------|---------|----------|-------|-------|
|               |          |       | Morning   |          |       | Evening |          |       |       |
|               |          |       | Inbound   | Outbound | Total | Inbound | Outbound | Total |       |
| County Park   | 412      | AC    | 0.01      | 0.01     | 0.02  | 0.05    | 0.04     | 0.09  | 2.28  |
| Regional Park | 417      | AC    | 0.09      | 0.06     | 0.15  | 0.09    | 0.11     | 0.20  | 4.57  |

However, there are some important distinctions that make the above trip generation rates incompatible with, or otherwise higher than those of the proposed nature park development. Regional Parks tend to be much larger than nature parks and natural areas. For example, Oxbow Regional Park is 1,000 acres whereas the proposed natural area will be 233 acres, of which only a fraction will be accessed through trails. In addition, Oxbow Regional Park offers a wider array of recreational activities as well as a world class water destination. Activities, including camping, fishing, boating, swimming, and equestrian trails, available at Oxbow will draw more visitors.

To obtain accurate trip generation rates for the proposed nature park, Metro, with the assistance of other units of local government, has attempted to quantify and thereafter estimate usage for its currently operating and/or recently developed parks. Exhibit F

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<sup>2</sup> Institute of Transportation Engineers, Trip Generation Manual, 9th Edition, 2012.



represents data associated with nature parks and natural areas around the region and further south, including their parking facilities, amenities, and whether or not existing parking is sufficient to serve the use.

Additionally, Metro placed vehicle counters at its nature parks and natural areas around the region. The most similar park operation to the currently proposed development is Mt. Talbert Nature Park in Clackamas. Mt. Talbert Nature Park is 254 acres and offers 4.2 miles of hiking trails. It has twenty parking stalls. By car, Mt. Talbert Nature Park generates an average of 4 trips per hour, 95 daily trips, 666.2 weekly trips, and 2,896.6 monthly trips, with the highest number of trips seen in July and August. No parking management issues have been experienced. *See Exhibit G for Trip Data.*

Another park similar to the proposed development is Graham Oaks Nature Park in Wilsonville. Graham Oaks Nature Park is 230 acres and offers 3.5 miles of hiking trails. It has 25 standard and 2 ADA parking stalls. By car, Graham Oaks Nature Park generates an average of 3.1 trips per hour, 74.2 daily trips, 519 weekly trips, and 2,258.3 monthly trips, with the highest number of trips seen in July and August. Parking management issues have been rare. *See Exhibit G for Trip Data.*

Trip counts at Newell Creek Canyon Natural Area are anticipated to be similar to those at Mt. Talbert and Graham Oaks Nature Parks. Applicant estimates the proposed development will generate approximately 60 to 100 daily weekday trips during the summer peak season, with an estimated 4 to 7 trips per hour in the AM peak period and 5 to 9 trips per hour in the PM peak period, with remaining users scattered throughout the day, with intensity peaking around midday. Although traffic counts for similarly situated Metro parks show daily usage relatively consistent from day to day, applicant estimates that user trips at the proposed park will increase on the weekends, where 100 to 150 trips are anticipated during the peak summer season, with use spread throughout the day. Use will drop off significantly in the winter months when weather conditions are less hospitable.

It is presumed that the majority of users who will enjoy this system will likely live within a 30-minute drive of the primary access point. It is expected that many users will be local, visiting the trails from neighborhoods and schools within a 10-minute walking or bicycling distance.<sup>3</sup>

A volume traffic survey was conducted in Oregon City in 2014. *See Exhibit H for survey results.* As measured west of Molalla Avenue on Warner Milne Road, daily traffic counts were 6,487, distributed nearly equally eastbound and westbound. As measured on Molalla Avenue north of Warner Milne Road, daily traffic counts were 14,919, more heavily

---

<sup>3</sup> The International Mountain Bicycling Association, Trail Solutions Program, Newell Creek Canyon Trail Feasibility Assessment, May 2014.



weighted northbound. As measured on Molalla Avenue south of Warner Milne Road, daily traffic counts were 20,284, distributed nearly equally northbound and southbound.

A small increase in automobile traffic should be anticipated over current levels in order for people to access the trails. In addition, given the existing limited availability of trails for beginning mountain bicycling in the Metro area, this facility is predicted to have some regional draw. The primary access point is appropriately located for vehicle access because of its proximity to Molalla Avenue, South Beaver Creek Road, and Highway 213. Also, many users will commute to and from the trails by foot or bicycle and never utilize a car.<sup>4</sup>

2. *Site plan showing the location of all access driveways or private streets where they intersect with public streets plus driveways of abutting properties and driveways on the opposite side of the street from the proposed development.*

**Findings:** The proposed site plan showing the location of all access driveways or private streets where they intersect with public streets plus driveways abutting properties and driveways on the opposite side of the street from the proposed development is provided as Exhibit B. Also see Table C Roadway Characteristics.

*Table C: Roadway Characteristics<sup>5</sup>*

| Roadway           | Functional Classification | Street type           | Travel Lanes | Speed limit | Comments                               |
|-------------------|---------------------------|-----------------------|--------------|-------------|--|
| Molalla Avenue    | Major Arterial Roadway    | Commercial            | 2-4          | 30-40 mph   | Sidewalks on both sides; no bike lanes |
| Warner Milne Road | Minor Arterial Roadway    | Mixed-use             | 2            | 30 mph      | Sidewalks on both sides; no bike lanes |
| Hilltop Avenue    | Local Roadway             | Mixed-use/Residential | 2            | 25 mph      | Single sidewalk                        |
| Fox Lane          | Local Roadway             | Mixed-use/Residential | 2            | 25 mph      | Single sidewalk                        |
| Gales Lane        | Local Roadway             | Residential           | 2            | 25 mph      | Sidewalks on both sides                |
| Otter Lane        | Local Roadway             | Residential           | 2            | 25 mph      | No sidewalks                           |
| Beaver Lane       | Local Roadway             | Residential           | 2            | 25 mph      | No sidewalks                           |

Primary access to the site is planned at the eastern terminus of Warner Milne Road, one block east of Molalla Avenue. Warner Milne Road is a two-lane road that primarily provides access to adjacent businesses and residences. Molalla Avenue is classified as a major arterial roadway and Warner Milne Road is classified as a minor arterial roadway by Oregon City's TSP. The intersection of Molalla Avenue and Warner Milne Road is a 4-way stop intersection controlled by a tri-colored traffic signal and contains designated turn lanes. See Exhibit I for Oregon City's Functional Classification.

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<sup>4</sup> *Id.*

<sup>5</sup> 2013 Oregon City TSP, Volume 2, Section C.



According to a 2014 Speed Traffic Survey, on Warner Milne Road at Molalla Avenue, the measured 85<sup>th</sup> percentile speed was measured at 33 mph for eastbound traffic and 33 mph for westbound traffic. This is just over the speed limit of 30 mph on Warner Milne Road. North of Warner Milne Road on Molalla Avenue, the measured 85<sup>th</sup> percentile speed was measured at 34 mph for northbound traffic and 34 mph for southbound traffic. This is just under the posted speed limit of 35 mph. South of Warner Milne Road on Molalla Avenue, the measured 85<sup>th</sup> percentile speed was measured at 32 mph for northbound traffic and 31 mph for southbound traffic. This is under the posted speed limit of 35 mph. *See Exhibit H for Speed Traffic Surveys.*

Warner Milne Road intersects with Fox Lane, a local roadway, which provides residential access. Currently, there is no stop control at the intersection of Warner Milne Road and Fox Lane. The proposed accessway may require a stop control on Fox Lane.

The Gales Lane accessway will be used for emergency and maintenance access only. Gales Lane is a local roadway that intersects with Molalla Avenue. It is an unsignalized T-intersection with a stop control on Gales Lane and a center turn lane on Molalla Avenue.

Hilltop Avenue, south of Warner Milne Road, intersects with Molalla Avenue. It is an unsignalized T-intersection with a stop control on Hilltop Avenue. It provides residential access to Fox, Otter, and Beaver Lanes. Hilltop Avenue might be used to access Newell Creek Canyon Natural Area via Fox Lane. The ends of Beaver and Otter Lanes will remain barricaded and will serve as secondary local access to the trailhead and day-use area from the neighborhood to the south. Signs will direct traffic to the ample parking lot to dissuade visitors from parking on local public streets.

With the exception Otter and Beaver Lanes, every roadway in the vicinity of the proposed development has a sidewalk on at least one side of the road. *See Exhibit J for Map of Existing Sidewalks.* Additionally, the intersection of Molalla Avenue and Warner Milne Road is equipped with signalized pedestrian crosswalks. *See Table C: Roadway Characteristics.*

With regard to bike lanes, there is a bike lane on northbound Molalla Avenue that ends at or near Colton Place.<sup>6</sup> A sign signifying its end is posted and is followed by a “share the road” sign. The bike lane resumes northbound at or near Gales Lane. There is a bike lane on southbound Molalla Avenue that ends at or near Gales Lane. A sign signifying its end is

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<sup>6</sup> Roadways periodically dropping bike lanes, as occurs on Molalla Avenue between Warner Milne Road and Beaver Creek Road, were identified as a key transportation gap for bicyclists in the Biking Needs section of 2013 Oregon City TSP, Volume 2, p. 14. Molalla Avenue Streetscape Improvement, including widening sidewalks, sidewalk infill, ADA accessibility, bike lanes, reconfiguration of travel lanes, and addition of bus stop amenities, from Holmes Lane/Hilda Street to Warner Milne Road, was listed as a “Likely to be Funded Transportation” project with medium-term priority. 2013 Oregon City TSP, Volume 2, Section G, p. 11.



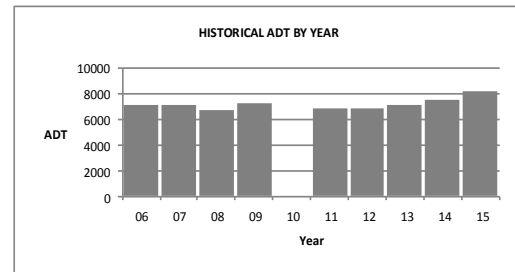
# EXHIBIT E



|                  |   |                   |                         |
|------------------|---|-------------------|-------------------------|
| <b>Location:</b> | US101; MP 3.79; OREGON COAST HIGHWAY NO. 9; 0.01 mile north of Lower Columbia River Highway No. 92 (US30) | <b>Site Name:</b> | Astoria Bridge (04-004) |
|                  |   | <b>Installed:</b> | September, 1995         |

#### HISTORICAL TRAFFIC DATA

| Year | ADT  | Percent of ADT |          |           |           |           |
|------|------|----------------|----------|-----------|-----------|-----------|
|      |      | Max Day        | Max Hour | 10TH Hour | 20TH Hour | 30TH Hour |
| 2006 | 7141 | 164            | 16.6     | 15.0      | 14.6      | 14.4      |
| 2007 | 7127 | 165            | 16.3     | 15.0      | 14.6      | 14.1      |
| 2008 | 6761 | 175            | 17.3     | 15.8      | 15.0      | 14.3      |
| 2009 | 7207 | 191            | 17.2     | 15.9      | 15.0      | 14.6      |
| 2010 | ***  | ***            | ***      | ***       | ***       | ***       |
| 2011 | 6912 | 174            | 18.9     | 16.0      | 15.5      | 15.0      |
| 2012 | 6878 | 168            | 16.8     | 15.2      | 14.7      | 14.5      |
| 2013 | 7171 | 180            | 16.7     | 15.4      | 14.4      | 14.1      |
| 2014 | 7488 | 169            | 17.3     | 14.9      | 14.5      | 14.0      |
| 2015 | 8158 | 178            | 24.0     | 15.3      | 14.5      | 13.9      |



#### 2015 TRAFFIC DATA

|           | Average Weekday Traffic | Percent of ADT | Average Daily Traffic | Percent of ADT |
|-----------|-------------------------|----------------|-----------------------|----------------|
| January   | 6404                    | 78             | 6395                  | 78             |
| February  | 6950                    | 85             | 7231                  | 89             |
| March     | 7178                    | 88             | 7444                  | 91             |
| April     | 7640                    | 94             | 8029                  | 98             |
| May       | 7806                    | 96             | 8211                  | 101            |
| June      | 8654                    | 106            | 9018                  | 111            |
| July      | 10025                   | 123            | 10520                 | 129            |
| August    | 10490                   | 129            | 10890                 | 133            |
| September | 8729                    | 107            | 9363                  | 115            |
| October   | 7545                    | 92             | 7674                  | 94             |
| November  | 6834                    | 84             | 6801                  | 83             |
| December  | 6809                    | 83             | 6324                  | 78             |

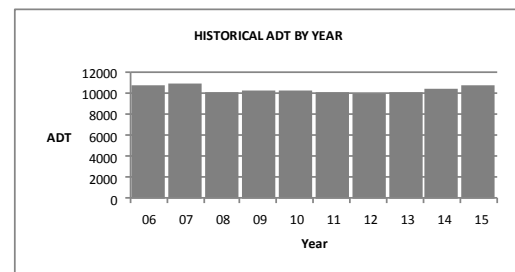
For Vehicle Classification data near this ATR, please go to the following web page:

<https://gis.odot.state.or.us/TransGIS/>

|                  |  |                   |                  |
|------------------|--|-------------------|------------------|
| <b>Location:</b> | US30; MP 53.33; LOWER COLUMBIA RIVER HIGHWAY NO. 92; 1.03 miles west of Rainier Road | <b>Site Name:</b> | Rainier (05-006) |
|                  |  | <b>Installed:</b> | September, 1954  |

#### HISTORICAL TRAFFIC DATA

| Year | ADT   | Percent of ADT |          |           |           |           |
|------|-------|----------------|----------|-----------|-----------|-----------|
|      |       | Max Day        | Max Hour | 10TH Hour | 20TH Hour | 30TH Hour |
| 2006 | 10717 | 146            | 12.7     | 11.8      | 11.5      | 11.4      |
| 2007 | 10986 | 151            | 12.9     | 12.2      | 11.6      | 11.3      |
| 2008 | 10143 | 148            | 12.6     | 12.1      | 11.7      | 11.6      |
| 2009 | 10282 | 156            | 14.3     | 12.7      | 12.4      | 12.0      |
| 2010 | 10195 | 149            | 13.8     | 12.4      | 12.2      | 11.9      |
| 2011 | 9997  | 150            | 13.5     | 12.4      | 12.1      | 11.9      |
| 2012 | 9905  | 157            | 13.4     | 12.6      | 12.1      | 11.8      |
| 2013 | 10029 | 149            | 12.8     | 12.3      | 11.9      | 11.7      |
| 2014 | 10372 | 152            | 13.3     | 12.6      | 12.3      | 11.9      |
| 2015 | 10792 | 161            | 13.4     | 12.2      | 11.6      | 11.4      |



#### 2015 TRAFFIC DATA

|           | Average Weekday Traffic | Percent of ADT | Average Daily Traffic | Percent of ADT |
|-----------|-------------------------|----------------|-----------------------|----------------|
| January   | 8925                    | 83             | 8940                  | 83             |
| February  | 9510                    | 88             | 9860                  | 91             |
| March     | 9940                    | 92             | 10180                 | 94             |
| April     | 10482                   | 97             | 10796                 | 100            |
| May       | 10615                   | 98             | 10932                 | 101            |
| June      | 11064                   | 103            | 11798                 | 109            |
| July      | 12363                   | 115            | 12886                 | 119            |
| August    | 12985                   | 120            | 13472                 | 125            |
| September | 11315                   | 105            | 11874                 | 110            |
| October   | 10324                   | 96             | 10320                 | 96             |
| November  | 9724                    | 90             | 9537                  | 88             |
| December  | 9330                    | 86             | 8908                  | 83             |

For Vehicle Classification data near this ATR, please go to the following web page:

<https://gis.odot.state.or.us/TransGIS/>



# EXHIBIT F





**Figure 5A**

Crash Reports by Type  
(Jan 2009 to March 2014)

**Crash Type**

- ▲ Animal
- ▲ Bicycle
- ▲ Pedestrian
- ▲ Fixed Object
- ▲ Head-On
- ▲ Angle
- ▲ Rear-End
- ▲ Run Off The Road
- ▲ Sideswipe
- ▲ Turning
- Other

Plan Areas

County Boundaries

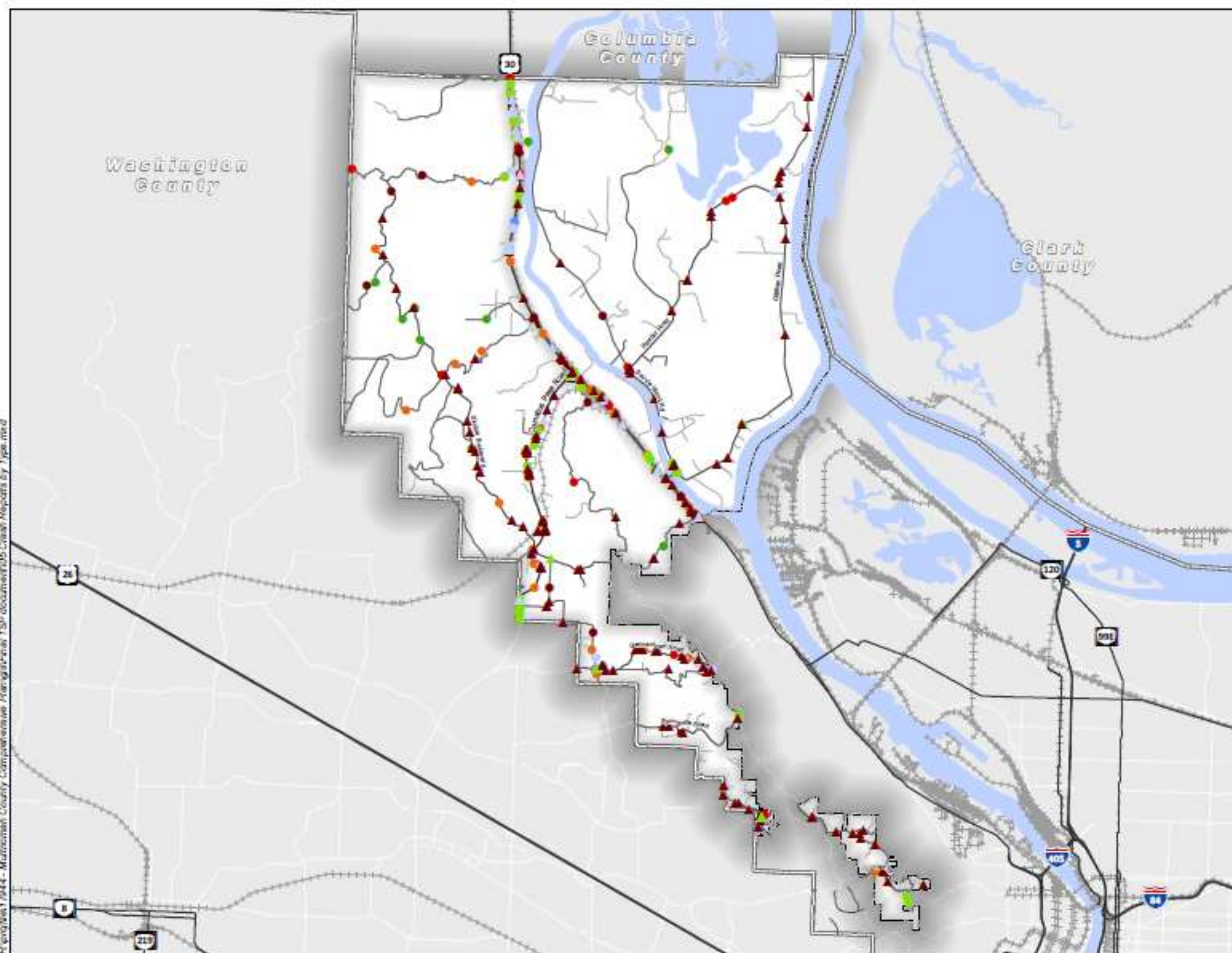
0 0.5 1 2 Miles



Prepared By: Kittelson & Associates, Inc. Date: 8/29/2016

Coordinate System:  
NAD 1983 HARN State Plane Oregon North FIPS 3601

Disclaimer:  
This map is intended for informational purposes only. While this map represents the best data available at the time of publication, Multnomah County makes no claims, representations, or warranties as to its accuracy or completeness. Metadata available upon request.





OREGON DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION  
 TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT  
 CRASH SUMMARIES BY YEAR BY COLLISION TYPE

US 30 Lower Columbia River Hwy (092) & NW McNamee Rd plus 200 feet  
 January 1, 2013 through December 31, 2015

| COLLISION TYPE       | FATAL<br>CRASHES | NON-<br>FATAL<br>CRASHES | PROPERTY<br>DAMAGE<br>ONLY | TOTAL<br>CRASHES | PEOPLE<br>KILLED | PEOPLE<br>INJURED | TRUCKS | DRY<br>SURF | WET<br>SURF | DAY | DARK | INTER-<br>SECTION | INTER-<br>SECTION<br>RELATED | OFF-<br>ROAD |
|----------------------|------------------|--------------------------|----------------------------|------------------|------------------|-------------------|--------|-------------|-------------|-----|------|-------------------|------------------------------|--------------|
| YEAR: 2013           |                  |                          |                            |                  |                  |                   |        |             |             |     |      |                   |                              |              |
| FIXED / OTHER OBJECT | 0                | 0                        | 1                          | 1                | 0                | 0                 | 0      | 0           | 1           | 0   | 1    | 0                 | 0                            | 0            |
| 2013 TOTAL           | 0                | 0                        | 1                          | 1                | 0                | 0                 | 0      | 0           | 1           | 0   | 1    | 0                 | 0                            | 0            |
| FINAL TOTAL          | 0                | 0                        | 1                          | 1                | 0                | 0                 | 0      | 0           | 1           | 0   | 1    | 0                 | 0                            | 0            |

*Disclaimer: A higher number of crashes may be reported as of 2011 compared to prior years. This does not reflect an increase in annual crashes. The higher numbers result from a change to an internal departmental process that allows the Crash Analysis and Reporting Unit to add previously unavailable, non-fatal crash reports to the annual data file. Please be aware of this change when comparing pre-2011 crash statistics.*



OREGON DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION  
 TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT  
 CRASH SUMMARIES BY YEAR BY COLLISION TYPE  
 NW McNamee Rd South of US 30 Lower Columbia River Hwy  
 January 1, 2013 through December 31, 2015

| COLLISION TYPE | FATAL<br>CRASHES | NON-<br>FATAL<br>CRASHES | PROPERTY<br>DAMAGE<br>ONLY | TOTAL<br>CRASHES | PEOPLE<br>KILLED | PEOPLE<br>INJURED | TRUCKS | DRY<br>SURF | WET<br>SURF | DAY | DARK | INTER-<br>SECTION | INTER-<br>SECTION<br>RELATED | OFF-<br>ROAD |
|----------------|------------------|--------------------------|----------------------------|------------------|------------------|-------------------|--------|-------------|-------------|-----|------|-------------------|------------------------------|--------------|
| YEAR: 2013     |                  |                          |                            |                  |                  |                   |        |             |             |     |      |                   |                              |              |
| NON-COLLISION  | 0                | 1                        | 0                          | 1                | 0                | 1                 | 0      | 1           | 0           | 1   | 0    | 0                 | 0                            | 0            |
| 2013 TOTAL     | 0                | 1                        | 0                          | 1                | 0                | 1                 | 0      | 1           | 0           | 1   | 0    | 0                 | 0                            | 0            |
| FINAL TOTAL    | 0                | 1                        | 0                          | 1                | 0                | 1                 | 0      | 1           | 0           | 1   | 0    | 0                 | 0                            | 0            |

*Disclaimer: A higher number of crashes may be reported as of 2011 compared to prior years. This does not reflect an increase in annual crashes. The higher numbers result from a change to an internal departmental process that allows the Crash Analysis and Reporting Unit to add previously unavailable, non-fatal crash reports to the annual data file. Please be aware of this change when comparing pre-2011 crash statistics.*



OREGON DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION  
TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT  
CRASH SUMMARIES BY YEAR BY COLLISION TYPE

NW McNamee Rd & NW Skyline Blvd plus 200 feet  
January 1, 2013 through December 31, 2015

| COLLISION TYPE | FATAL<br>CRASHES | NON-<br>FATAL<br>CRASHES | PROPERTY<br>DAMAGE<br>ONLY | TOTAL<br>CRASHES | PEOPLE<br>KILLED | PEOPLE<br>INJURED | TRUCKS | DRY<br>SURF | WET<br>SURF | DAY | DARK | INTER-<br>SECTION | INTER-<br>SECTION<br>RELATED | OFF-<br>ROAD |
|----------------|------------------|--------------------------|----------------------------|------------------|------------------|-------------------|--------|-------------|-------------|-----|------|-------------------|------------------------------|--------------|
| YEAR: 2014     |                  |                          |                            |                  |                  |                   |        |             |             |     |      |                   |                              |              |
| HEAD-ON        | 0                | 1                        | 0                          | 1                | 0                | 2                 | 0      | 1           | 0           | 1   | 0    | 0                 | 0                            | 0            |
| 2014 TOTAL     | 0                | 1                        | 0                          | 1                | 0                | 2                 | 0      | 1           | 0           | 1   | 0    | 0                 | 0                            | 0            |
| FINAL TOTAL    | 0                | 1                        | 0                          | 1                | 0                | 2                 | 0      | 1           | 0           | 1   | 0    | 0                 | 0                            | 0            |

*Disclaimer: A higher number of crashes may be reported as of 2011 compared to prior years. This does not reflect an increase in annual crashes. The higher numbers result from a change to an internal departmental process that allows the Crash Analysis and Reporting Unit to add previously unavailable, non-fatal crash reports to the annual data file. Please be aware of this change when comparing pre-2011 crash statistics.*



OREGON DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION  
TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT  
CRASH SUMMARIES BY YEAR BY COLLISION TYPE  
NW Skyline Blvd & NW Cornelius Pass Rd plus 200 feet  
January 1, 2013 through December 31, 2015

| COLLISION TYPE       | FATAL<br>CRASHES | NON-<br>FATAL<br>CRASHES | PROPERTY<br>DAMAGE<br>ONLY | TOTAL<br>CRASHES | PEOPLE<br>KILLED | PEOPLE<br>INJURED | TRUCKS | DRY<br>SURF | WET<br>SURF | DAY | DARK | INTER-<br>SECTION | INTER-<br>SECTION<br>RELATED | OFF-<br>ROAD |
|----------------------|------------------|--------------------------|----------------------------|------------------|------------------|-------------------|--------|-------------|-------------|-----|------|-------------------|------------------------------|--------------|
| YEAR: 2015           |                  |                          |                            |                  |                  |                   |        |             |             |     |      |                   |                              |              |
| ANGLE                | 0                | 0                        | 1                          | 1                | 0                | 0                 | 0      | 1           | 0           | 1   | 0    | 1                 | 0                            | 0            |
| TURNING MOVEMENTS    | 0                | 0                        | 1                          | 1                | 0                | 0                 | 1      | 1           | 0           | 1   | 0    | 1                 | 0                            | 0            |
| 2015 TOTAL           | 0                | 0                        | 2                          | 2                | 0                | 0                 | 1      | 2           | 0           | 2   | 0    | 2                 | 0                            | 0            |
| YEAR: 2014           |                  |                          |                            |                  |                  |                   |        |             |             |     |      |                   |                              |              |
| ANGLE                | 0                | 0                        | 1                          | 1                | 0                | 0                 | 0      | 1           | 0           | 1   | 0    | 1                 | 0                            | 0            |
| FIXED / OTHER OBJECT | 0                | 1                        | 0                          | 1                | 0                | 2                 | 0      | 1           | 0           | 0   | 1    | 0                 | 0                            | 1            |
| 2014 TOTAL           | 0                | 1                        | 1                          | 2                | 0                | 2                 | 0      | 2           | 0           | 1   | 1    | 1                 | 0                            | 1            |
| YEAR: 2013           |                  |                          |                            |                  |                  |                   |        |             |             |     |      |                   |                              |              |
| ANGLE                | 0                | 1                        | 0                          | 1                | 0                | 3                 | 0      | 1           | 0           | 1   | 0    | 1                 | 0                            | 0            |
| SIDESWIPE - MEETING  | 0                | 0                        | 1                          | 1                | 0                | 0                 | 0      | 0           | 1           | 1   | 0    | 1                 | 0                            | 0            |
| TURNING MOVEMENTS    | 0                | 0                        | 1                          | 1                | 0                | 0                 | 0      | 1           | 0           | 1   | 0    | 1                 | 0                            | 0            |
| 2013 TOTAL           | 0                | 1                        | 2                          | 3                | 0                | 3                 | 0      | 2           | 1           | 3   | 0    | 3                 | 0                            | 0            |
| FINAL TOTAL          | 0                | 2                        | 5                          | 7                | 0                | 5                 | 1      | 6           | 1           | 6   | 1    | 6                 | 0                            | 1            |

*Disclaimer: A higher number of crashes may be reported as of 2011 compared to prior years. This does not reflect an increase in annual crashes. The higher numbers result from a change to an internal departmental process that allows the Crash Analysis and Reporting Unit to add previously unavailable, non-fatal crash reports to the annual data file. Please be aware of this change when comparing pre-2011 crash statistics.*



OREGON DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION  
TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT  
CRASH SUMMARIES BY YEAR BY COLLISION TYPE

US 30 Lower Columbia River Hwy (092 & NW Cornelius Pass Rd plus 200 feet  
January 1, 2013 through December 31, 2015

| COLLISION TYPE         | FATAL<br>CRASHES | NON-<br>FATAL<br>CRASHES | PROPERTY<br>DAMAGE<br>ONLY | TOTAL<br>CRASHES | PEOPLE<br>KILLED | PEOPLE<br>INJURED | TRUCKS | DRY<br>SURF | WET<br>SURF | DAY | DARK | INTER-<br>SECTION | INTER-<br>SECTION<br>RELATED | OFF-<br>ROAD |
|------------------------|------------------|--------------------------|----------------------------|------------------|------------------|-------------------|--------|-------------|-------------|-----|------|-------------------|------------------------------|--------------|
| YEAR: 2015             |                  |                          |                            |                  |                  |                   |        |             |             |     |      |                   |                              |              |
| FIXED / OTHER OBJECT   | 0                | 1                        | 0                          | 1                | 0                | 2                 | 0      | 1           | 0           | 1   | 0    | 1                 | 0                            | 1            |
| REAR-END               | 0                | 1                        | 1                          | 2                | 0                | 2                 | 0      | 1           | 1           | 0   | 2    | 2                 | 0                            | 0            |
| TURNING MOVEMENTS      | 0                | 0                        | 1                          | 1                | 0                | 0                 | 0      | 0           | 1           | 1   | 0    | 1                 | 0                            | 0            |
| 2015 TOTAL             | 0                | 2                        | 2                          | 4                | 0                | 4                 | 0      | 2           | 2           | 2   | 2    | 4                 | 0                            | 1            |
| YEAR: 2014             |                  |                          |                            |                  |                  |                   |        |             |             |     |      |                   |                              |              |
| REAR-END               | 0                | 2                        | 2                          | 4                | 0                | 2                 | 0      | 2           | 2           | 3   | 1    | 3                 | 0                            | 0            |
| SIDESWIPE - OVERTAKING | 0                | 0                        | 1                          | 1                | 0                | 0                 | 0      | 1           | 0           | 1   | 0    | 1                 | 0                            | 0            |
| TURNING MOVEMENTS      | 0                | 0                        | 2                          | 2                | 0                | 0                 | 0      | 1           | 1           | 1   | 1    | 2                 | 0                            | 0            |
| 2014 TOTAL             | 0                | 2                        | 5                          | 7                | 0                | 2                 | 0      | 4           | 3           | 5   | 2    | 6                 | 0                            | 0            |
| YEAR: 2013             |                  |                          |                            |                  |                  |                   |        |             |             |     |      |                   |                              |              |
| FIXED / OTHER OBJECT   | 0                | 1                        | 0                          | 1                | 0                | 1                 | 0      | 1           | 0           | 0   | 1    | 1                 | 0                            | 1            |
| REAR-END               | 0                | 1                        | 4                          | 5                | 0                | 1                 | 2      | 3           | 2           | 4   | 1    | 3                 | 0                            | 0            |
| 2013 TOTAL             | 0                | 2                        | 4                          | 6                | 0                | 2                 | 2      | 4           | 2           | 4   | 2    | 4                 | 0                            | 1            |
| FINAL TOTAL            | 0                | 6                        | 11                         | 17               | 0                | 8                 | 2      | 10          | 7           | 11  | 6    | 14                | 0                            | 2            |

*Disclaimer: A higher number of crashes may be reported as of 2011 compared to prior years. This does not reflect an increase in annual crashes. The higher numbers result from a change to an internal departmental process that allows the Crash Analysis and Reporting Unit to add previously unavailable, non-fatal crash reports to the annual data file. Please be aware of this change when comparing pre-2011 crash statistics.*



# EXHIBIT G



## Appendix A

### Level of Service Concept

**Levels of Service** - The concept of levels of service uses qualitative measures that characterize operational conditions within a traffic stream and their perception by motorists and passengers. The descriptions of individual levels of service characterize these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience.

Six levels of service are defined for each type of facility for which analysis procedures are available. They are given letter designations, from A to F, with LOS A representing the best operating conditions and LOS F the worst. Each level of service represents a range of operating conditions.

The volume of traffic that can be served under the stop-and-go conditions of LOS F is generally accepted as being lower than that possible at LOS E; consequently, service flow rate E is the value that corresponds to the maximum flow rate, or capacity, on the facility. For most design or planning purposes, however, service flow rates D or C are usually used because they ensure a more acceptable quality of service to facility users.

Levels of service for uninterrupted and interrupted flow facilities vary widely in terms of both the user's perception of service quality and the operational variables used to describe them.

**Measures of Effectiveness** - For each type of facility, levels of service are defined on the basis of one or more operational parameters that best describe the operating quality for the facility type. Although the concept of level of service attempts to address a wide range of operating conditions, limitations on data collection and availability make it impractical to treat the full range of operational parameters for every type of facility. The parameters selected to define levels of service for each facility type are called measures of effectiveness and represent available measures that best describe the quality of operation on the subject facility type. Table B1 presents the primary measures of effectiveness used to define levels of service for each facility type. Each level of service represents a range of conditions, as defined by a range in the parameter(s) presented in the table.

**TABLE B1 Primary Measures of Effectiveness for LOS Definition**

| Type of Facility           | Measure of Effectiveness                   |
|----------------------------|--|
| Freeways                   |  |
| Basic freeway segments     | Density (pc/mi/ln)                         |
| Weaving areas              | Density (pc/mi/ln)                         |
| Ramp junctions             | Flow rates (pcph)                          |
| Multilane highways         | Density (pc/mi/ln)                         |
| Two-lane highways          | Free-flow speed (mph)                      |
| Signalized intersections   | Time delay (percent)                       |
| Unsignalized intersections | Average control delay (sec/veh)            |
| Arterials                  | Average control delay (sec/veh)            |
| Transit                    | Average travel speed (mph)                 |
|                            | Load factor (pers/seat, veh/hr, people/hr) |
| Pedestrians                | Space (sq ft/ped)                          |

**Level of Service for Signalized Intersections** - Level of service for signalized intersections is defined in terms of delay, which is a measure of driver discomfort, frustration, fuel consumption,



and lost travel time. The delay experienced by a motorist is made up of a number of factors that relate to control, geometrics, traffic, and incidentals. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during ideal conditions: in the absence of traffic control, in the absence of geometric delay, in the absence of any incidents, and when there are no other vehicles on the road. This delay is called control delay. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. In contrast, in previous versions of the HCM (1994 and earlier), delay included only stopped delay.

**TABLE B2 Level-of-Service Criteria for Signalized Intersections**

| Level of Service | Control Delay Per Vehicle (Sec) |
|------------------|---------------------------------|
| A                | ?10                             |
| B                | ?10 and ?20                     |
| C                | ?20 and ?35                     |
| D                | ?35 and ?55                     |
| E                | ?55 and ?80                     |
| F                | ?80                             |

Specifically, LOS criteria for traffic signals are stated in terms of the average control delay per vehicle, typically for a 15-min analysis period. The criteria are given in Table B2. Delay may be measured in the field or estimated using procedures presented in the HCM. Delay is a complex measure and is dependent on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group in question.

**LOS A** describes operations with very low control delay, up to 10 sec per vehicle. This level of service occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.

**LOS B** describes operations with control delay greater than 10 and up to 20 sec per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with Los A, causing higher levels of average delay.

**LOS C** describes operations with control delay greater than 20 and up to 35 sec per vehicle. These higher delays may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

**LOS D** describes operations with control greater than 35 and up to 55 sec per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

**LOS E** describes operations with control delay greater than 55 and up to 80 sec per vehicle. This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent occurrences.

**LOS F** describes operations with control delay in excess of 80 sec per vehicle. This level, considered to be unacceptable to most drivers, often occurs with oversaturation, that is, when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios below 1.0 with



many individual cycle failures. Poor progression and long cycle lengths may also be major contributing factors to such delay levels.

***Relating Capacity and Level of Service*** - Because delay is a complex measure, its relationship to capacity is also complex. The levels of service in Table B2 were established on the basis of the acceptability of various amounts of delay to drivers. Although local standards may vary, LOS C may be regarded as a desirable design objective. It is important to note that this concept is not related to capacity in a simple one-to-one fashion.

Previously the lower bound of LOS E was defined to be capacity; that is, the v/c ratio is by definition 1.0. However, it is possible, for example, to have delays in the range of LOS F (unacceptable) while the v/c ratio is below 1.0, perhaps as low as 0.75 to 0.85. Very long delays can occur at such v/c ratios when some combination of the following conditions exists: (a) the cycle length is long, (b) the lane group in question is disadvantaged by the signal timing (has a long red time), and (c) the signal progression for the subject movements is poor.

The reverse is also possible: a saturated lane group (i.e., v/c ratio greater than 1.0) may have short delays if (a) the cycle length is short or (b) the signal progression is favorable for the subject lane group, or both.

Thus, the designation LOS F does not automatically imply that the intersection, approach, or lane group is over capacity, nor does a level of service better than E automatically imply that unused capacity is available.

The procedures and methods in this chapter require the analysis of both capacity and LOS conditions to fully evaluate the operation of a signalized intersection. It is imperative that the analyst recognize the unique relationship of these two concepts as they apply to signalized intersections.

***Level-of-Service Criteria for Unsignalized Intersections*** - The level of service for a TWSC intersection is determined by the computed or measured control delay and is defined for each minor movement. Level of service is not defined for the intersection as a whole. LOS criteria are given in Table B3.

Average control delay less than 10 sec/veh is defined as LOS A. Follow-up times of less than 5 sec/veh have been measured when there is no conflicting traffic for a minor-street movement, so control delays of less than 10 sec/veh are appropriate for low flow conditions.

The proposed LOS criteria for TWSC intersections are somewhat different than the criteria used for signalized intersections. The primary reason for this difference is that drivers expect different levels of performance from different kinds of transportation facilities. The expectation is that a signalized intersection would be designed to carry higher traffic volumes than an unsignalized intersection. In addition, a number of driver behavior considerations combine to make delays at signalized intersections less onerous than delays at unsignalized intersections. For example, drivers at signalized intersections are able to relax during the red interval, whereas drivers on the minor approaches to unsignalized intersections must remain attentive to the task of identifying acceptable gaps and vehicle conflicts. Also, there is often much more variability in the amount of delay experienced by individual drivers at an unsignalized intersection versus that at signalized intersections. For these reasons, it is considered that the control delay threshold for any given level



of service would be less for an unsignalized intersection than it would be for a signalized intersection.

**TABLE B3 Level-of-Service Criteria**

| Level of Service | Delay Range   |
|------------------|---------------|
| A                | ? 10          |
| B                | ? 10 and ? 15 |
| C                | ? 15 and ? 25 |
| D                | ? 25 and ? 35 |
| E                | ? 35 and ? 50 |
| F                | ? 50          |

**Arterial Level of Service** - Arterial level of service is based on average through-vehicle travel speed for the segment, section, or entire arterial under consideration. This parameter is the basic measure of effectiveness arterial LOS. The average travel speed is computed from the running time on the arterial segment or segments and the control delay for through movements at all intersections. To ensure that the arterial is of sufficient length so that average travel speed is a reasonable measure of effectiveness, the arterial's length generally should be at least 1 mi in downtown areas and at least 2 mi in other areas.

Arterial level of service is defined in terms of average travel speed of all through vehicles on the arterial. It is strongly influenced by the number of signals per mile and the average intersection control delay. On a given facility, such factors as inappropriate signal timing, poor progression, and increasing traffic flow can substantially degrade arterial level of service. Arterials with medium to high signal densities (more than two signalized intersections per mile) are even more susceptible to these factors, and poor arterial level of service will probably be observed even before substantial intersection problems occur.

The following general statements may be made regarding arterial level of service:

1. LOS A describes primarily free-flow operations at average travel speeds, usually about 90 percent of the free-flow speed for the arterial classification. Vehicles are seldom impeded in their ability to maneuver in the traffic stream. Delay at signalized intersections is minimal.
2. LOS B represents reasonably unimpeded operations at average travel speeds, usually about 70 percent of the free-flow speed for the arterial classification. The ability to maneuver in the traffic stream is only slightly restricted and delays are not bothersome.
3. LOS C represents stable operations; however, ability to maneuver and change lanes in midblock locations may be more restricted than in LOS B, and longer queues, adverse signal coordination, or both may contribute to lower average travel speeds of about 50 percent of the average free-flow speed for the arterial classification.
4. LOS D borders on a range in which small increases in flow may cause substantial increases in approach delay and hence decreases in arterial speed. LOS D may be due to adverse signal progression, inappropriate signal timing, high volumes, or some combination of these. Average travel speeds are about 40 percent of free-flow speed.
5. LOS E is characterized by significant delays and average travel speeds of one-third the free flow speed or less. Such operations are caused by some combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections, and inappropriate signal timing.



# EXHIBIT H



H:\profile17944 - Multnomah County Comprehensive Plan\gis\Final TSP document\06 Roadway Functional Classifications.mxd

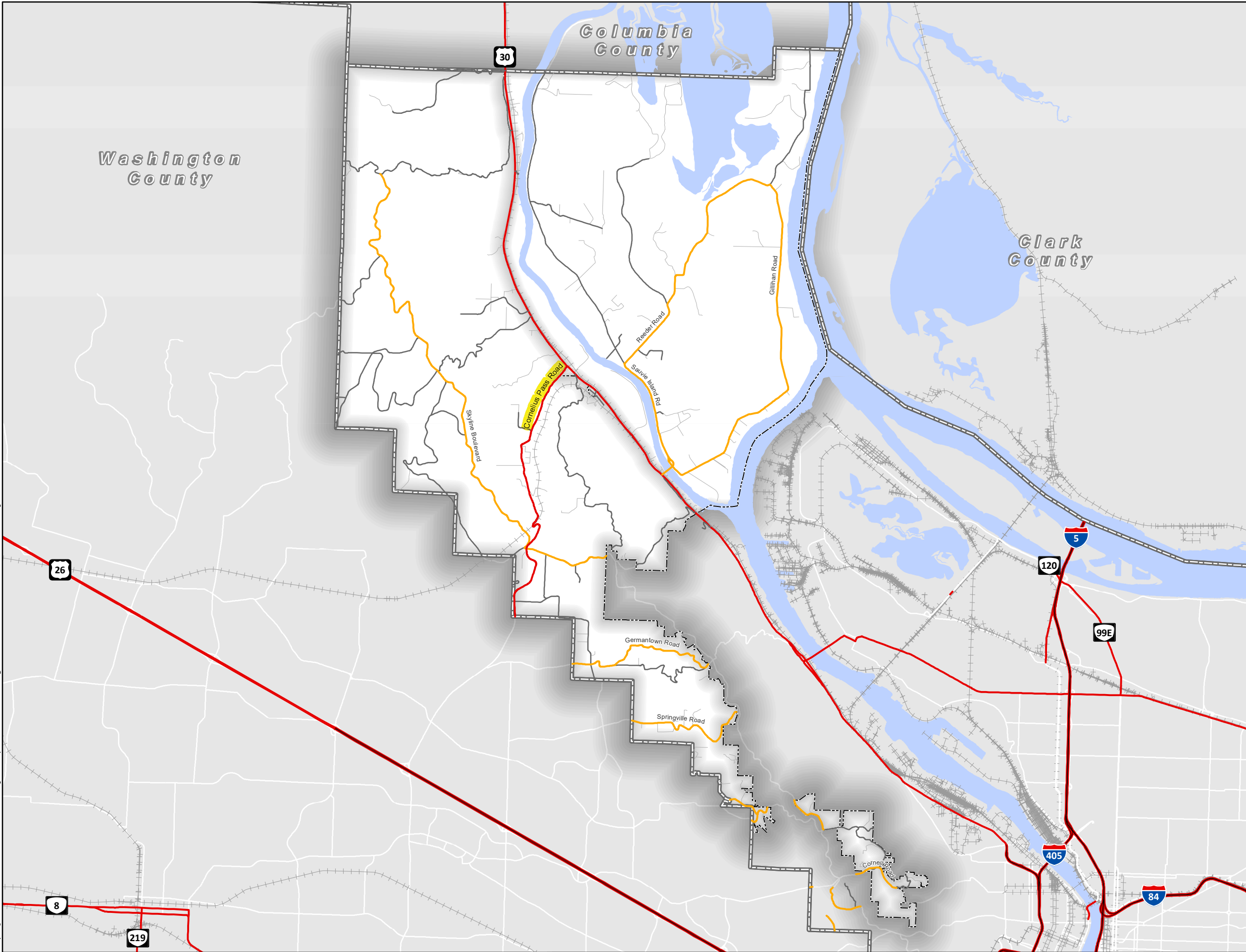


Figure 6A  
Roadway Functional  
Classifications

Roadway Functional  
Classification (MultCo)

- Interstate / Expressway
- Arterials
- Collectors
- Local
- Local (not maintained by county)
- Railroad (ODOT)
- Plan Areas
- County Boundaries

0 0.5 1 2 Miles



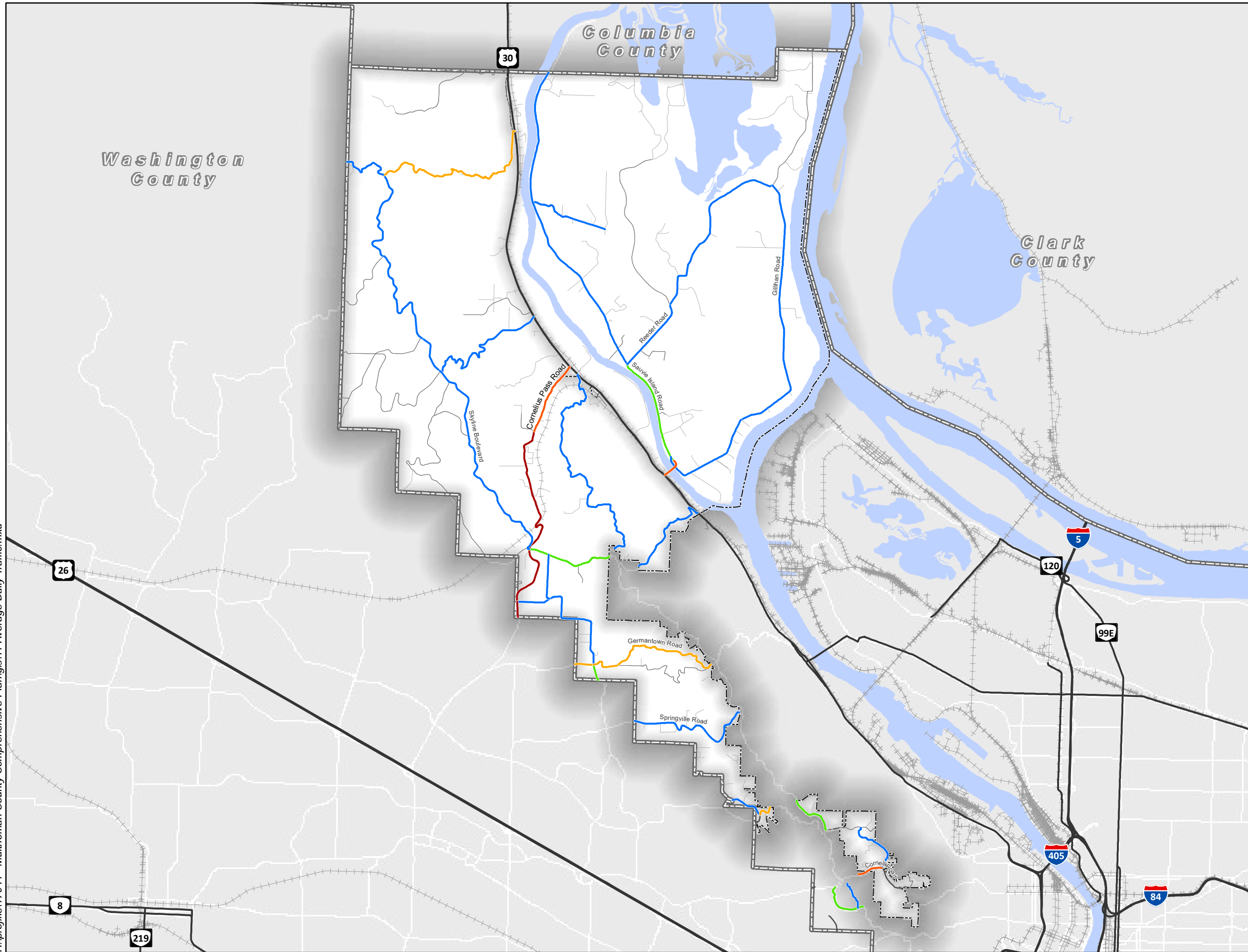
Prepared By: Kittelson & Associates, Inc. Date: 8/29/2016

Coordinate System:  
NAD 1983 HARN State Plane Oregon North FIPS 3601

Disclaimer:  
This map is intended for informational purposes only. While this map represents the best data available at the time of publication, Multnomah County makes no claims, representations, or warranties as to its accuracy or completeness. Metadata available upon request.



H:\profile\17944 - Multnomah County Comprehensive Plan\gis\11 Average Daily Traffic.mxd



## Comprehensive Plan

Figure 11A  
Average Daily Traffic

Average Daily Traffic  
(records from 2006 to 2014)

- <1,500
- 1,500 - 3,000
- 3,001 - 5,000
- 5,001 - 10,000
- >10,000

- Plan Areas
- County Boundaries

0 0.5 1 2 Miles



Prepared By: Kittelson & Associates, Inc. Date: 6/8/2015

Coordinate System:  
NAD 1983 HARN State Plane Oregon North FIPS 3601

Disclaimer:  
This map is intended for informational purposes only. While this map represents the best data available at the time of publication, Multnomah County makes no claims, representations, or warranties as to its accuracy or completeness. Metadata available upon request.



| LOCATION: NW McNamee Rd south of NW Wapato Ave |              |              |               |              |               |               |              |              |              |          |          |          |          |           | QC JOB #: 12456909 |               |                   |  |
|--|--------------|--------------|---------------|--------------|---------------|---------------|--------------|--------------|--------------|----------|----------|----------|----------|-----------|--------------------|---------------|-------------------|--|
| SPECIFIC LOCATION: 0 ft from                   |              |              |               |              |               |               |              |              |              |          |          |          |          |           | DIRECTION: NB/SB   |               |                   |  |
| CITY/STATE: Portland, OR                       |              |              |               |              |               |               |              |              |              |          |          |          |          |           | DATE: Apr 10 2014  |               |                   |  |
| Start Time                                     | 1<br>15      | 16<br>20     | 21<br>25      | 26<br>30     | 31<br>35      | 36<br>40      | 41<br>45     | 46<br>50     | 51<br>55     | 56<br>60 | 61<br>65 | 66<br>70 | 71<br>75 | 76<br>999 | Total              | Pace<br>Speed | Number<br>in Pace |  |
| 12:00 AM                                       | 0            | 0            | 0             | 0            | 0             | 0             | 0            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 0                  | 1-10          | 0                 |  |
| 1:00 AM  | 0            | 0            | 0             | 0            | 0             | 0             | 0            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 0                  | 1-10          | 0                 |  |
| 2:00 AM  | 0            | 0            | 0             | 0            | 0             | 0             | 0            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 0                  | 1-10          | 0                 |  |
| 3:00 AM  | 0            | 0            | 0             | 0            | 0             | 0             | 0            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 0                  | 1-10          | 0                 |  |
| 4:00 AM  | 0            | 0            | 1             | 1            | 1             | 1             | 1            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 5                  | 36-45         | 2                 |  |
| 5:00 AM  | 0            | 1            | 0             | 2            | 2             | 3             | 0            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 8                  | 33-42         | 4                 |  |
| 6:00 AM  | 0            | 1            | 5             | 3            | 5             | 3             | 1            | 1            | 0            | 0        | 0        | 0        | 0        | 0         | 19                 | 25-34         | 8                 |  |
| 7:00 AM  | 0            | 2            | 1             | 3            | 5             | 2             | 1            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 14                 | 26-35         | 8                 |  |
| 8:00 AM  | 1            | 2            | 2             | 2            | 5             | 4             | 0            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 16                 | 31-40         | 9                 |  |
| 9:00 AM  | 0            | 0            | 0             | 5            | 4             | 1             | 1            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 11                 | 26-35         | 9                 |  |
| 10:00 AM                                       | 0            | 2            | 0             | 5            | 7             | 4             | 0            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 18                 | 31-40         | 11                |  |
| 11:00 AM                                       | 1            | 0            | 0             | 3            | 3             | 2             | 1            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 10                 | 31-40         | 5                 |  |
| 12:00 PM                                       | 0            | 0            | 5             | 4            | 3             | 3             | 1            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 16                 | 21-30         | 9                 |  |
| 1:00 PM  | 1            | 0            | 3             | 6            | 3             | 2             | 2            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 17                 | 22-31         | 9                 |  |
| 2:00 PM  | 2            | 0            | 3             | 6            | 4             | 0             | 0            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 15                 | 26-35         | 10                |  |
| 3:00 PM  | 1            | 1            | 1             | 5            | 7             | 3             | 2            | 2            | 0            | 0        | 0        | 0        | 0        | 0         | 22                 | 28-37         | 11                |  |
| 4:00 PM  | 1            | 0            | 1             | 6            | 11            | 0             | 0            | 1            | 0            | 0        | 0        | 0        | 0        | 0         | 20                 | 26-35         | 17                |  |
| 5:00 PM  | 0            | 0            | 1             | 5            | 5             | 0             | 2            | 1            | 0            | 0        | 0        | 0        | 0        | 0         | 14                 | 26-35         | 10                |  |
| 6:00 PM  | 1            | 0            | 2             | 3            | 1             | 3             | 3            | 3            | 1            | 0        | 0        | 0        | 0        | 0         | 17                 | 43-52         | 5                 |  |
| 7:00 PM  | 0            | 0            | 0             | 3            | 5             | 0             | 0            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 8                  | 26-35         | 8                 |  |
| 8:00 PM  | 0            | 0            | 1             | 0            | 3             | 1             | 0            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 5                  | 31-40         | 4                 |  |
| 9:00 PM  | 0            | 1            | 0             | 1            | 1             | 0             | 0            | 0            | 1            | 0        | 0        | 0        | 0        | 0         | 4                  | 26-35         | 2                 |  |
| 10:00 PM                                       | 0            | 0            | 0             | 0            | 4             | 0             | 0            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 4                  | 26-35         | 4                 |  |
| 11:00 PM                                       | 0            | 0            | 0             | 2            | 0             | 0             | 0            | 0            | 0            | 0        | 0        | 0        | 0        | 0         | 2                  | 21-30         | 2                 |  |
| Day Total                                      | 8            | 10           | 26            | 65           | 79            | 32            | 15           | 8            | 2            | 0        | 0        | 0        | 0        | 0         | 245                | 26-35         | 144               |  |
| Percent  | 3.3%         | 4.1%         | 10.6%         | 26.5%        | 32.2%         | 13.1%         | 6.1%         | 3.3%         | 0.8%         | 0.0%     | 0.0%     | 0.0%     | 0.0%     | 0.0%      |                    |               |                   |  |
| ADT<br>245                                     |              |              |               |              |               |               |              |              |              |          |          |          |          |           |                    |               |                   |  |
| AM Peak<br>Volume                              | 8:00 AM<br>1 | 7:00 AM<br>2 | 6:00 AM<br>5  | 9:00 AM<br>5 | 10:00 AM<br>7 | 8:00 AM<br>4  | 4:00 AM<br>1 | 6:00 AM<br>1 |              |          |          |          |          |           | 6:00 AM<br>19      |               |                   |  |
| PM Peak<br>Volume                              | 2:00 PM<br>2 | 3:00 PM<br>1 | 12:00 PM<br>5 | 1:00 PM<br>6 | 4:00 PM<br>11 | 12:00 PM<br>3 | 6:00 PM<br>3 | 6:00 PM<br>3 | 6:00 PM<br>1 |          |          |          |          |           |                    | 3:00 PM<br>22 |                   |  |
| Comments:                                      |              |              |               |              |               |               |              |              |              |          |          |          |          |           |                    |               |                   |  |



| LOCATION: NW McNamee Rd south of NW Pauly Rd |  |          |          |          |          |          |          |          |          |          |          |          |          |           | QC JOB #: 12456907 |               |                   |
|--|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|--------------------|---------------|-------------------|
| SPECIFIC LOCATION: 0 ft from                 |  |          |          |          |          |          |          |          |          |          |          |          |          |           | DIRECTION: EB/WB   |               |                   |
| CITY/STATE: Portland, OR                     |  |          |          |          |          |          |          |          |          |          |          |          |          |           | DATE: Apr 02 2014  |               |                   |
| Start Time                                   | 1<br>15  | 16<br>20 | 21<br>25 | 26<br>30 | 31<br>35 | 36<br>40 | 41<br>45 | 46<br>50 | 51<br>55 | 56<br>60 | 61<br>65 | 66<br>70 | 71<br>75 | 76<br>999 | Total              | Pace<br>Speed | Number<br>in Pace |
| 12:00 AM                                     | 0  | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 0                  | 1-10          | 0                 |
| 1:00 AM                                      | 0  | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 0                  | 1-10          | 0                 |
| 2:00 AM                                      | 0  | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 0                  | 1-10          | 0                 |
| 3:00 AM                                      | 0  | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 0                  | 1-10          | 0                 |
| 4:00 AM                                      | 0  | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 0                  | 1-10          | 0                 |
| 5:00 AM                                      | 0  | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 0                  | 1-10          | 0                 |
| 6:00 AM                                      | 0  | 1        | 0        | 2        | 1        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 4                  | 26-35         | 3                 |
| 7:00 AM                                      | 0  | 1        | 1        | 1        | 3        | 1        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 7                  | 26-35         | 4                 |
| 8:00 AM                                      | 0  | 1        | 2        | 6        | 5        | 1        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 15                 | 26-35         | 11                |
| 9:00 AM                                      | 0  | 0        | 0        | 0        | 5        | 1        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 6                  | 31-40         | 5                 |
| 10:00 AM                                     | 0  | 0        | 2        | 2        | 2        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 6                  | 26-35         | 4                 |
| 11:00 AM                                     | 0  | 0        | 0        | 2        | 3        | 3        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 8                  | 32-41         | 5                 |
| 12:00 PM                                     | 0  | 1        | 0        | 2        | 4        | 1        | 1        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 9                  | 26-35         | 6                 |
| 1:00 PM                                      | 1  | 0        | 0        | 2        | 5        | 0        | 0        | 0        | 1        | 0        | 0        | 0        | 0        | 0         | 9                  | 26-35         | 7                 |
| 2:00 PM                                      | 1  | 0        | 0        | 2        | 2        | 1        | 0        | 0        | 1        | 0        | 1        | 0        | 0        | 0         | 8                  | 26-35         | 4                 |
| 3:00 PM                                      | 0  | 1        | 2        | 1        | 4        | 1        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 9                  | 26-35         | 5                 |
| 4:00 PM                                      | 0  | 1        | 1        | 2        | 6        | 4        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 14                 | 31-40         | 10                |
| 5:00 PM                                      | 0  | 0        | 0        | 4        | 3        | 1        | 1        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 9                  | 27-36         | 6                 |
| 6:00 PM                                      | 0  | 0        | 3        | 3        | 4        | 3        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 13                 | 28-37         | 7                 |
| 7:00 PM                                      | 0  | 0        | 0        | 3        | 1        | 2        | 0        | 0        | 1        | 0        | 0        | 0        | 0        | 0         | 7                  | 26-35         | 4                 |
| 8:00 PM                                      | 0  | 0        | 1        | 4        | 2        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 7                  | 26-35         | 6                 |
| 9:00 PM                                      | 0  | 0        | 0        | 2        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 2                  | 21-30         | 2                 |
| 10:00 PM                                     | 0  | 0        | 0        | 0        | 1        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 1                  | 26-35         | 1                 |
| 11:00 PM                                     | 0  | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0         | 0                  | 1-10          | 0                 |
| Day Total                                    | 2  | 6        | 12       | 38       | 51       | 19       | 2        | 0        | 3        | 0        | 1        | 0        | 0        | 0         | 134                | 26-35         | 88                |
| Percent                                      | 1.5%   | 4.5%     | 9.0%     | 28.4%    | 38.1%    | 14.2%    | 1.5%     | 0.0%     | 2.2%     | 0.0%     | 0.7%     | 0.0%     | 0.0%     | 0.0%      |                    |               |                   |
| ADT<br>134                                   |  |          |          |          |          |          |          |          |          |          |          |          |          |           |                    |               |                   |
| AM Peak<br>Volume                            | 6:00 AM 8:00 AM 8:00 AM 8:00 AM 11:00 AM<br>1 2 6 5 3  |          |          |          |          |          |          |          |          |          |          |          |          |           | 8:00 AM<br>15      |               |                   |
| PM Peak<br>Volume                            | 1:00 PM 12:00 PM 6:00 PM 5:00 PM 4:00 PM 4:00 PM 12:00 PM 1:00 PM 2:00 PM<br>1 1 3 4 6 4 1 1 1 |          |          |          |          |          |          |          |          |          |          |          |          |           | 4:00 PM<br>14      |               |                   |
| Comments:                                    |  |          |          |          |          |          |          |          |          |          |          |          |          |           |                    |               |                   |



## 2015 TRAFFIC VOLUMES ON STATE HIGHWAYS

| Milepoint | 2015 AADT<br>All Vehicles | ATR<br>AVC | Location Description   |
|-----------|---------------------------|------------|--|
|           |                           |            | <b>LOWER COLUMBIA RIVER HIGHWAY NO. 92</b>   |
|           |                           |            | <i>Milepoint indicates distance from Stadium Freeway (I-405), at West Fremont Bridge Interchange in Portland</i> |
| 1.45      | 80200                     |            | West end of ramp structure   |
|           |                           |            | <b>On N.W. Yeon Street</b>   |
| 1.87      | 47600                     |            | 0.10 mile south of N.W. Nicolai Street   |
| 2.38      | 32100                     |            | 0.05 mile southeast of N.W. 26th Avenue  |
| 2.63      | 30600                     |            | 0.05 mile southeast of N.W. 29th Avenue  |
| 3.07      | 28000                     |            | 0.05 mile southeast of N.W. 35th Avenue  |
| 3.76      | 26300                     |            | 0.05 mile southeast of N.W. 44th Avenue  |
| 3.97      | 26000                     |            | 0.05 mile northwest of Kittridge Avenue  |
|           |                           |            | <b>Equation: MP 4.13 BK = MP 4.52 AH</b>   |
| 6.31      | 27700                     |            | 0.10 mile southeast of south approach to St. Johns Bridge, Northeast Portland Highway (US30 Bypass)              |
| 7.42      | 26900                     |            | 0.10 mile northwest of north approach to St. Johns Bridge, Northeast Portland Highway (US30 Bypass)              |
|           |                           |            | <b>West city limits of Portland</b>  |
| 10.75     | 20300                     |            | 0.08 mile south of Sauvie Island Road  |
| 10.95     | 17900                     |            | 0.12 mile north of Sauvie Island Road  |
| 13.12     | 17600                     |            | 0.10 mile south of Cornelius Pass Road   |
| 17.34     | 24600                     |            | 0.05 mile south of Rocky Point Road  |
|           |                           |            | <b>Columbia - Multnomah County Line, MP 18.37</b>  |
| 19.35     | 24100                     |            | 0.30 mile north of Johnsons Landing Road   |
| 20.58     | 28200                     |            | 0.05 mile north of S.W. E.M. Watts Road  |
| 21.24     | 29000                     |            | 0.03 mile south of Scappoose-Vernonia Road   |
| 21.32     | 24700                     |            | 0.05 mile north of Scappoose-Vernonia Road   |
| 23.30     | 25100                     |            | 0.05 mile south of Fullerton Road  |
| 23.40     | 24500                     |            | 0.05 mile north of Fullerton Road  |
| 24.86     | 24400                     |            | 0.05 mile south of Berg Road   |
| 25.53     | 23800                     |            | 0.05 mile north of Church Road   |
| 27.01     | 21300                     |            | 0.05 mile north of Millard Road  |
| 27.54     | 22200                     |            | 0.05 mile south of Firlock Park Boulevard  |
| 27.64     | 21700                     |            | 0.05 mile south of Gable Road  |
| 27.74     | 17900                     |            | 0.05 mile north of Gable Road  |
| 28.58     | 17300                     |            | 0.02 mile north of Columbia Boulevard  |
|           |                           |            | <b>North city limits of St. Helens</b>   |
| 29.47     | 13700                     |            | 0.05 mile north of Deer Island Road  |
| 30.46     | 13000                     |            | 0.07 mile south of "L" Street  |
| 30.58     | 11900                     |            | 0.05 mile north of "L" Street  |
| 30.97     | 12800                     |            | 0.05 mile south of "E" Street  |
| 32.00     | 9800                      |            | 0.39 mile north of Pacific Street  |
| 33.77     | 8800                      |            | 0.20 mile south of Deer Island Frontage Road   |
| 36.58     | 7900                      |            | 0.05 mile north of Tide Creek Road (Shiloh Basin)  |
| 40.56     | 7900                      |            | 0.09 mile north of Nicolai Road (Moorage Road)   |
| 43.07     | 7900                      |            | 0.05 mile south of Graham Road   |
| 45.88     | 7200                      |            | 0.49 mile north of Spring Lane   |
|           |                           |            | <b>On B Street</b>   |
| 46.89     | 8100                      |            | 0.02 mile east of 2nd Street   |



**Table 13 Projected Future State Highway Traffic Volumes**

| Primary Road                   | HWY | MP    | Description   | Future Year |                 | Annual Growth Rate (from 2013 to 2033) |
|--------------------------------|-----|-------|---|-------------|-----------------|--|
|                                |     |       |   | 2033        | Source          |  |
| Columbia River Highway (US 30) | 002 | 18.12 | 0.30 mile east of Jordan Interchange                  | 31,900      | Historic Growth | 1.09                                   |
|                                | 002 | 22.40 | 0.30 mile east of Corbett Interchange                 | 30,200      | Historic Growth | 1.24                                   |
|                                | 002 | 25.19 | 0.20 mile east of Rooster Rock State Park Interchange | 30,400      | Historic Growth | 1.36                                   |
|                                | 002 | 28.16 | 0.30 mile east of Bridal Veil connection              | 28,400      | Historic Growth | 1.40                                   |
|                                | 002 | 31.89 | 0.50 mile east of Multnomah Falls Interchange         | 27,400      | Historic Growth | 1.37                                   |
|                                | 002 | 35.73 | 0.10 mile east of Historic Columbia Highway (US30)    | 27,500      | Historic Growth | 1.40                                   |
| Mt. Hood Highway (US 26)       | 026 | 14.80 | 0.05 mile south of S.E. Palmquist Road                | 32,500      | Model           | 0.89                                   |
|                                | 026 | 18.30 | 0.05 mile northwest of S.E. Haley Road                | 33,300      | Model           | 1.82                                   |
| Lower Columbia River (US 30)   | 092 | 10.75 | 0.08 mile south of Sauvie Island Road                 | 23,300      | Model           | 1.93                                   |
|                                | 092 | 10.95 | 0.12 mile north of Sauvie Island Road                 | 23,800      | Model           | 2.04                                   |
|                                | 092 | 13.12 | 0.10 mile south of Cornelius Pass Road                | 24,200      | Model           | 2.03                                   |
|                                | 092 | 17.34 | 0.05 mile south of Rocky Point Road                   | 30,300      | Model           | 1.64                                   |

## PLANNED PROJECTS

Multnomah County has several different plans that identify transportation improvements in the County's rural unincorporated areas. These projects will be evaluated in the Alternatives Analysis phase of this project to determine if they are still warranted, how they should be prioritized, and if there are additional needs that require additional projects, programs, or policies to address them. Table 14 provides a summary of the currently planned projects by area in the County's Capital Improvement Plan (CIP) and in each of the Rural Area Plans and TSPs (if applicable). The multimodal project locations are shown in Figures 20A, 20B, 21A and 21B.



| LOCATION: NW Skyline Blvd west of NW McNamee Rd |              |              |              |              |                |                |                |               |              |              |               |          |          |           | QC JOB #: 12456906 |               |                   |
|---|--------------|--------------|--------------|--------------|----------------|----------------|----------------|---------------|--------------|--------------|---------------|----------|----------|-----------|--------------------|---------------|-------------------|
| SPECIFIC LOCATION: 0 ft from                    |              |              |              |              |                |                |                |               |              |              |               |          |          |           | DIRECTION: NB/SB   |               |                   |
| CITY/STATE: Portland, OR                        |              |              |              |              |                |                |                |               |              |              |               |          |          |           | DATE: Apr 16 2014  |               |                   |
| Start Time                                      | 1<br>15      | 16<br>20     | 21<br>25     | 26<br>30     | 31<br>35       | 36<br>40       | 41<br>45       | 46<br>50      | 51<br>55     | 56<br>60     | 61<br>65      | 66<br>70 | 71<br>75 | 76<br>999 | Total              | Pace<br>Speed | Number<br>in Pace |
| 12:00 AM  | 0            | 0            | 0            | 0            | 1              | 2              | 2              | 0             | 0            | 0            | 0             | 0        | 0        | 0         | 5                  | 36-45         | 4                 |
| 1:00 AM   | 0            | 0            | 0            | 0            | 0              | 0              | 2              | 0             | 0            | 0            | 0             | 0        | 0        | 0         | 2                  | 36-45         | 2                 |
| 2:00 AM   | 0            | 0            | 0            | 0            | 0              | 2              | 0              | 0             | 0            | 0            | 0             | 0        | 0        | 0         | 2                  | 31-40         | 2                 |
| 3:00 AM   | 0            | 0            | 0            | 0            | 0              | 0              | 1              | 0             | 0            | 0            | 0             | 0        | 0        | 0         | 1                  | 36-45         | 1                 |
| 4:00 AM   | 0            | 0            | 0            | 0            | 1              | 3              | 1              | 1             | 0            | 0            | 0             | 0        | 0        | 0         | 6                  | 31-40         | 4                 |
| 5:00 AM   | 0            | 0            | 0            | 0            | 1              | 11             | 12             | 2             | 3            | 0            | 0             | 0        | 0        | 0         | 29                 | 36-45         | 22                |
| 6:00 AM   | 0            | 0            | 0            | 1            | 8              | 29             | 23             | 7             | 3            | 0            | 0             | 0        | 0        | 0         | 71                 | 36-45         | 51                |
| 7:00 AM   | 3            | 0            | 2            | 5            | 20             | 53             | 60             | 17            | 1            | 0            | 0             | 0        | 0        | 0         | 161                | 36-45         | 113               |
| 8:00 AM   | 2            | 1            | 0            | 0            | 14             | 58             | 34             | 10            | 1            | 0            | 0             | 0        | 0        | 0         | 120                | 36-45         | 92                |
| 9:00 AM   | 0            | 2            | 0            | 4            | 14             | 36             | 15             | 7             | 2            | 0            | 0             | 0        | 0        | 0         | 80                 | 36-45         | 51                |
| 10:00 AM  | 3            | 0            | 0            | 4            | 23             | 40             | 26             | 7             | 1            | 0            | 0             | 0        | 0        | 0         | 104                | 36-45         | 66                |
| 11:00 AM  | 1            | 0            | 1            | 0            | 5              | 33             | 27             | 2             | 0            | 0            | 0             | 0        | 0        | 0         | 69                 | 36-45         | 60                |
| 12:00 PM  | 1            | 0            | 0            | 2            | 9              | 29             | 15             | 7             | 1            | 0            | 1             | 0        | 0        | 0         | 65                 | 36-45         | 44                |
| 1:00 PM   | 1            | 0            | 0            | 3            | 11             | 24             | 18             | 7             | 0            | 0            | 0             | 0        | 0        | 0         | 64                 | 36-45         | 41                |
| 2:00 PM   | 2            | 0            | 1            | 6            | 17             | 43             | 37             | 12            | 5            | 2            | 0             | 0        | 0        | 0         | 125                | 36-45         | 80                |
| 3:00 PM   | 4            | 5            | 2            | 1            | 17             | 74             | 63             | 19            | 4            | 0            | 0             | 0        | 0        | 0         | 189                | 36-45         | 137               |
| 4:00 PM   | 7            | 0            | 1            | 2            | 18             | 108            | 161            | 55            | 5            | 3            | 0             | 0        | 0        | 0         | 360                | 36-45         | 269               |
| 5:00 PM   | 4            | 0            | 1            | 1            | 33             | 113            | 150            | 37            | 4            | 0            | 0             | 0        | 0        | 0         | 343                | 36-45         | 263               |
| 6:00 PM   | 7            | 2            | 2            | 0            | 20             | 57             | 53             | 15            | 3            | 0            | 0             | 0        | 0        | 0         | 159                | 36-45         | 109               |
| 7:00 PM   | 0            | 0            | 0            | 2            | 8              | 21             | 13             | 7             | 1            | 0            | 0             | 0        | 0        | 0         | 52                 | 36-45         | 34                |
| 8:00 PM   | 0            | 0            | 0            | 1            | 11             | 17             | 11             | 4             | 0            | 0            | 0             | 0        | 0        | 0         | 44                 | 36-45         | 28                |
| 9:00 PM   | 0            | 0            | 0            | 1            | 2              | 14             | 8              | 0             | 0            | 0            | 0             | 0        | 0        | 0         | 25                 | 36-45         | 22                |
| 10:00 PM  | 0            | 0            | 0            | 0            | 4              | 6              | 5              | 0             | 0            | 0            | 0             | 0        | 0        | 0         | 15                 | 36-45         | 11                |
| 11:00 PM  | 0            | 2            | 0            | 1            | 1              | 7              | 1              | 0             | 0            | 0            | 0             | 0        | 0        | 0         | 12                 | 31-40         | 8                 |
| Day Total                                       | 35           | 12           | 10           | 34           | 238            | 780            | 738            | 216           | 34           | 5            | 1             | 0        | 0        | 0         | 2103               | 36-45         | 1517              |
| Percent   | 1.7%         | 0.6%         | 0.5%         | 1.6%         | 11.3%          | 37.1%          | 35.1%          | 10.3%         | 1.6%         | 0.2%         | 0.0%          | 0.0%     | 0.0%     | 0.0%      |                    |               |                   |
| ADT<br>2103                                     |              |              |              |              |                |                |                |               |              |              |               |          |          |           |                    |               |                   |
| AM Peak<br>Volume                               | 7:00 AM<br>3 | 9:00 AM<br>2 | 7:00 AM<br>2 | 7:00 AM<br>5 | 10:00 AM<br>23 | 8:00 AM<br>58  | 7:00 AM<br>60  | 7:00 AM<br>17 | 5:00 AM<br>3 |              |               |          |          |           | 7:00 AM<br>161     |               |                   |
| PM Peak<br>Volume                               | 4:00 PM<br>7 | 3:00 PM<br>5 | 3:00 PM<br>2 | 2:00 PM<br>6 | 5:00 PM<br>33  | 5:00 PM<br>113 | 4:00 PM<br>161 | 4:00 PM<br>55 | 2:00 PM<br>5 | 4:00 PM<br>3 | 12:00 PM<br>1 |          |          |           | 4:00 PM<br>360     |               |                   |
| Comments:                                       |              |              |              |              |                |                |                |               |              |              |               |          |          |           |                    |               |                   |



# EXHIBIT I





**DATE:** May 5, 2014

**PROJECT:** 312064.50-Metro North Tualatin  
Mountain Access

**SUBJECT:** Intersection Sight Distance Evaluation

**TO:** Robert Spurlock  
Metro

**FROM:** Curt Vanderzanden, PE, Principal  
KPFF Consulting Engineers

**PHONE:** (503)813-7560

**PHONE:** 503-542-3808

**EMAIL:** Robert.Spurlock@oregonmetro.gov

**EMAIL:** curt.vanderzanden@kpffcivil.com

## Introduction

At the request of Metro, KPFF has completed an intersection site distance evaluation for five existing access points located in the Tualatin Mountains; two along NW McNamee Road, one on NW Newberry Road, and two along Skyline Boulevard. The purpose of this evaluation is to determine if existing conditions provide adequate sight distance to meet Multnomah County standards and to identify what improvements would be necessary to meet those standards.

## Field Work

On April 3, 2014, KPFF staff performed a site visit, documenting, through photos and field measurements, the available sight distance. At each location, and in each travel direction, measurements of the available sight distance were taken, from a point 15 feet from the edge of pavement, and a height of eye of 3.5 feet, to the center of each approaching travel lane, with a height of object of 4.25 feet. To assist in the sight distance evaluation, Kittelson and Associates performed a speed study to determine the 85<sup>th</sup> percentile speeds in each direction of travel at each access point. The speed study was completed on April 18, 2014, and is included as Appendix A. A summary of the results of the field work and speed study can be found in Table 1 below.

## Measured Sight Distances and Standards

Per Multnomah County Design Standards, intersection sight distance shall be in accordance with the procedures stated in current AASHTO Standards. The following Table 1 summarizes the five sites' measured and required intersection sight distance per AASHTO *Table 9-6 Design Intersection Sight Distance – Case B1, Left Turn from Stop* and *Table 9-8 Design Intersection Sight Distance – Case B2, Right Turn from Stop, and Case B3, Crossing Maneuver*.

**Table 1: Intersection Sight Distances**

| Location  | Direction | 85 <sup>th</sup><br>Percentile<br>Speed | Intersection Sight Distance (ISD) |                        |                       |                               |
|---|-----------|---|-----------------------------------|------------------------|-----------------------|-------------------------------|
|   |           |   | Measured                          | AASHTO<br>Requirement  | Adequate?<br>(Yes/No) | Reasoning                     |
| Site #1<br>Burlington Creek Forest<br>(NW McNamee Rd) | NB        | 38 mph                                  | 290 ft                            | 365 ft<br>(right turn) | No                    | Hillside,<br>Horizontal Curve |
|   | SB        | 35 mph                                  | 330 ft                            | 390 ft<br>(left turn)  | No                    | Trees/Vegetation              |





**Table 1: Intersection Sight Distances (continued)**

| Location  | Direction | 85 <sup>th</sup><br>Percentile<br>Speed | Intersection Sight Distance (ISD) |                        |                       |  |
|---|-----------|---|-----------------------------------|------------------------|-----------------------|--|
|   |           |   | Measured                          | AASHTO<br>Requirement  | Adequate?<br>(Yes/No) | Reasoning                              |
| Site #2<br>Ennis Creek Forest<br>(NW Newberry Rd) | NB        | 46 mph                                  | 95 ft                             | 510 ft<br>(left turn)  | No                    | Hillside                               |
|   | SB        | 45 mph                                  | 70 ft                             | 430 ft<br>(right turn) | No                    | Hillside,<br>Vertical Curve            |
| Site #3<br>McCarthy Creek<br>(NW McNamee Rd)      | EB        | 36 mph                                  | 635 ft                            | 345 ft<br>(right turn) | Yes                   | None                                   |
|   | WB        | 37 mph                                  | 375 ft                            | 410 ft<br>(left turn)  | No                    | Trees                                  |
| Site #4<br>McCarthy Creek<br>(NW Skyline Blvd)    | EB        | 51 mph                                  | 470 ft                            | 565 ft<br>(left turn)  | No                    | Vegetation                             |
|   | WB        | 49 mph                                  | 260 ft                            | 470 ft<br>(right turn) | No                    | Hillside/Vegetation,<br>Vertical Curve |
| Site #5<br>North Abbey Creek<br>(NW Skyline Blvd) | EB        | 44 mph                                  | 20 ft                             | 425 ft<br>(right turn) | No                    | Minor vegetation                       |
|   | WB        | 44 mph                                  | 80 ft                             | 490 ft<br>(left turn)  | No                    | Minor vegetation                       |

The Multnomah County Design Standards and AASHTO Standards state that when minimum intersection sight distance cannot be met, the minimum sight distance should be no less than the stopping sight distance on the major street. The required stopping sight distances were calculated for the five sites and are summarized below in Table 2.

**Table 2: Stopping Sight Distances**

| Location  | Direction | 85 <sup>th</sup><br>Percentile<br>Speed | Measured Sight<br>Distance | Stopping Sight Distance (SSD) |                          |                       |
|---|-----------|---|----------------------------|-------------------------------|--------------------------|-----------------------|
|   |           |   |                            | Measured<br>Average<br>Slope  | AASHTO<br>Recommendation | Adequate?<br>(Yes/No) |
| Site #1<br>Burlington Creek Forest<br>(NW McNamee Rd) | NB        | 38 mph                                  | 290 ft                     | -12.5%                        | 360 ft                   | No                    |
|   | SB        | 35 mph                                  | 330 ft                     | 12.8%                         | 215 ft                   | Yes                   |
| Site #2<br>Ennis Creek Forest<br>(NW Newberry Rd)     | NB        | 46 mph                                  | 95 ft                      | -5.5%                         | 410 ft                   | No                    |
|   | SB        | 45 mph                                  | 70 ft                      | -1.2%                         | 370 ft                   | No                    |
| Site #3<br>McCarthy Creek<br>(NW McNamee Rd)          | EB        | 36 mph                                  | 635 ft                     | 1.5%                          | 255 ft                   | Yes                   |
|   | WB        | 37 mph                                  | 375 ft                     | 3.7%                          | 255 ft                   | Yes                   |
| Site #4<br>McCarthy Creek<br>(NW Skyline Blvd)        | EB        | 51 mph                                  | 470 ft                     | 5.5%                          | 405 ft                   | Yes                   |
|   | WB        | 49 mph                                  | 260 ft                     | -1.7%                         | 425 ft                   | No                    |
| Site #5<br>North Abbey Creek<br>(NW Skyline Blvd)     | EB        | 44 mph                                  | 20 ft                      | 3.6%                          | 330 ft                   | No                    |
|   | WB        | 44 mph                                  | 80 ft                      | -2.8%                         | 365 ft                   | No                    |



### Access Evaluation

As discussed previously, five existing driveway access points have been evaluated to determine what improvements are necessary to meet Multnomah County access standards. Maps for each site are provided in Appendix B. Conceptual cost estimates are provided in Appendix C. The estimated costs at each site include costs for addressing sight distance issues as well as upgrades to the existing access points which may include grading, paving and culvert installations where needed.

#### Site #1: Burlington Creek Forest (NW McNamee Road)

- A. Sight distance (measured at 15 feet from the eastern pavement edge of NW McNamee Road) is currently restricted to the south at approximately 290 feet due to a horizontal curve in the road and a hillside on the west side of the roadway. Sight distance is currently restricted to the north at approximately 330 feet due to roadside trees and vegetation on the east side of the roadway.



Site #1 Access looking south



Site #1 Access looking north



- B. Cutting the easterly hillside down, and recording a restrictive sight distance easement over a portion of what appears to be private property, leased or owned by the power line company, will improve available sight distance somewhat to the south.
- C. Removing the roadside trees and vegetation, and recording a restrictive sight distance easement over a portion of what appears to be Metro-owned property, will improve available sight distance somewhat to the north.
- D. By making these modifications, it is likely that the required intersection sight distance can be attained in either direction. See Table 3 for a summary of the measured and required sight distances.

**Table 3: Sight Distance (SD) Summary – Site #1**

| <b>Traffic Direction</b> | <b>Measured SD</b> | <b>Required ISD</b> | <b>Required SSD</b> | <b>SD with Improvements</b> | <b>Meets ISD? (Yes/No)</b> |
|--------------------------|--------------------|---------------------|---------------------|-----------------------------|----------------------------|
| <b>NB</b>                | <b>290 ft</b>      | <b>365 ft</b>       | <b>360 ft</b>       | <b>&gt;365 ft</b>           | <b>Yes</b>                 |
| <b>SB</b>                | <b>330 ft</b>      | <b>390 ft</b>       | <b>215 ft</b>       | <b>&gt;390 ft</b>           | <b>Yes</b>                 |

- E. The estimated construction costs to achieve the required intersection sight distance, in both directions, is approximately **\$87,000**. This cost includes clearing and grubbing, grading, aggregate base, asphalt paving and other miscellaneous items required to meet Multnomah County standards. This does not include costs associated with the acquisition of required easements. If Multnomah County allows, this cost can be reduced by approximately **\$5,000** if stopping sight distance is used to the north of the access.

**Site #2: Ennis Creek Forest (NW Newberry Road)**

- A. Sight distance (measured at 15 feet from the western pavement edge of NW Newberry Road) is currently restricted to the south at approximately 95 feet due to roadside vegetation and an embankment. Sight distance is currently restricted to the north at approximately 70 feet due to roadside vegetation, an embankment and the vertical curvature of the roadway.



Site #2 Access looking south



# EXHIBIT J



**Table 14 Planned Projects**

| Document  | Project Number | Project Name                                       | Project Description  |
|---|----------------|--|--|
| Sauvie Island/Multnomah Channel                 |                |  |  |
| Westside Rural<br>TSP                           | 1              | Sauvie Island Road                                 | Safety improvement – Add to shoulders (4 ft) and add guardrail from Gillihan Road to Reeder Road. Replace culverts. \$3,675,000  |
|   | 2              | US 30  | Commuter rail study – Conduct study to determine feasibility of commuter rail from Portland to Astoria. \$100,000  |
|   | 3              | Gillihan Road                                      | Safety improvement – Add to shoulders (4 ft). \$2,055,000  |
|   | 4              | Reeder Road  | Safety improvement – Add to shoulders (4 ft). \$5,925,000  |
|   | 5              | US 30  | Ride share parking – Provide parking for 100 spaces next to truck scale near county line. \$325,000  |
|   | 6              | US 30  | Speed zone study – Conduct speed zone study to determine safe speed zone from Linnton north. \$5,000   |
|   | 7              | US 30/Cornelius Pass Road                          | Public transportation – Provide commuter transit service from Columbia County over Cornelius Pass Road to Washington County. \$78,000/year   |
|   | 8              | Reeder Road  | Improve parking and intersection safety with Sauvie Island Road. \$250,000   |
|   | 9              | US 30  | RAZ service expansion – Expand assuming 20 hours of additional service per work day for one bus. \$78,000/year   |
|   | 10             | Sauvie Island Wildlife Refuge                      | Recreational bike path – Conduct study to determine feasibility of a bike path north of Reeder Road for recreational purposes only, followed by implementation of the findings. \$1,060,000  |
|   | 11             | Sauvie Island Road                                 | Improve park and ride – Delineate parking and traffic circulation. \$300,000   |
|   | 12             | US 30  | Exclusive car pool lane study – Conduct study to determine feasibility and cost of adding a reversible exclusive car pool lane on US 30. \$100,000   |
|   | 13             | US 30  | Harborton sign installation – Provide signing for Harborton. \$ 1,000  |
|   | 14             | US 30  | Scenic viewing opportunities – Access provided across railroad tracks adjacent to Burlington Bottoms using existing road approaches (per location). Exact locations to be determined. Providing pull outs of widening along US 30 will not be acceptable on the basis of safety. \$350,000 |
| Multnomah County<br>CIPP                        | 15             | Sauvie Island Road: Bridge to Reeder Road (PN 159) | Reconstruct road to rural collector standards with 2 travel lanes. Requires working on dike. \$8,275,636   |
|   | 16             | Sauvie Island Road: Gillihan Road to Reeder Road   | Bike path. \$2,114,214   |
|   | 17             | Sauvie Island: Reeder to Ferry Road                | Shoulder bikeway. \$535,851  |
| Sauvie Island/Multnomah Channel Rural Area Plan | 18             | Multnomah Channel/U.S. 30                          | <i>Ride share parking</i> – Provide parking for 100 spaces next to truck scale near county line. Project to be coordinated with ODOT, Multnomah, and Columbia Counties.  |
|   | 19             | U.S. 30/Cornelius Pass Road                        | <i>Public transportation</i> – Provide commuter van pool or transit service from Columbia County over Cornelius Pass   |



|                       |    |                     |  |
|-----------------------|----|---------------------|--|
|                       |    |                     | Road to Washington County.   |
|                       | 21 | U.S. 30             | <i>Scenic viewing opportunities</i> – Access provided across railroad tracks adjacent to Burlington Bottoms using existing road approaches (per location). Exact locations to be determined. Providing linear pull outs or widening adjacent to U.S. 30 will not be acceptable on the basis of safety and access management standards. |
|                       | 21 | Cornelius Pass Road | <i>U.S. 30 intersection improvements</i> – Include a northbound turn lane and shared northbound left-turn/right-turn lane.   |
|                       | 22 | Gillihan Loop Road  | <i>Safety improvement</i> – Add to 6.13 miles of shoulders (4 ft).   |
|                       | 23 | Reeder Road         | <i>Safety improvement</i> – Add to 4.33 miles of shoulders (4 ft).   |
|                       | 24 | Reeder Road         | <i>Safety improvements</i> – Improve intersection sight distance with Sauvie Island Road.  |
|                       | 25 | Sauvie Island Road  | <i>Safety improvement</i> – Add to 2.15 miles of shoulders (4 ft) and add guardrail from Gillihan Road to Reeder Road. Replace culverts.   |
|                       | 26 | Sauvie Island Road  | <i>Create park and ride</i> – Delineate parking and traffic circulation. <b>(Completed since 1998 TSP)</b>   |
| West Hills            |    |                     |  |
| Westside Rural<br>TSP | 27 | Cornelius Pass Road | Safety improvement – Find ways to enforce posted speed limits and safe travel speeds. Install photo radar. \$20,000  |
|                       | 28 | Cornelius Pass Road | Safety improvement – Install reflectors, delineators, and traffic striping. \$200,000  |
|                       | 29 | Newberry Road       | Safety spot improvement – Install guardrail ¼ mile south of US 30 and install speed hump 1.2 miles from US 30. \$450,000   |
|                       | 30 | Cornelius Pass Road | Speed Zone Study – Conduct speed zone study to determine average running speed, safe operating speed, and needs for enforcement. \$5,000   |
|                       | 31 | Germantown Road     | Safety improvement – Add to 2.22 miles of shoulders (4 ft). \$6,744,000  |
|                       | 32 | Skyline Boulevard   | Safety improvement – Add to shoulders from UGB to Cornelius Pass Road (1.49 miles). \$ 2,039,000   |
|                       | 33 | Skyline Boulevard   | Safety improvement – Add to shoulders from Cornelius Pass Road to Rocky Point Road (4 ft). \$ 11,153,000   |
|                       | 34 | Skyline Boulevard   | Cornelius Pass Road intersection improvements – install signal, provide westbound left-turn lane and through/right lane on Skyline Boulevard. \$695,000  |
|                       | 35 | Cornelius Pass Road | Safety and capacity needs – Study to look at climbing lanes, guardrail, drainage, addition of shoulders, and alternate routes. \$180,000   |
|                       | 36 | Germantown Road     | Safety spot improvements – Widen lanes on curves only, install center skip like reflective markers, and install mirror at intersection with Old Germantown Road. \$750,000   |
|                       | 37 | Cornelius Pass Road | Safety Improvement – contract with the City of Portland for speed enforcement. Assume 0.25 staff per year including equipment and overhead. \$50,000/year  |



|                       |    |  |   |
|-----------------------|----|--|---|
|                       | 38 | Skyline Boulevard                                  | Speed zone study – Conduct speed study to determine appropriate speed limit for Skyline Boulevard from Cornelius Pass Road east to city limits of Portland. \$5,000 |
|                       | 39 | Springville Road                                   | Safety improvement – Add to shoulders (4 ft). \$3,160,000   |
|                       | 40 | Laidlaw Road                                       | Safety improvement – Add to shoulders (4 ft). \$643,000   |
|                       | 41 | Thompson Road                                      | Safety improvement – Add to shoulders (4 ft). \$100,000   |
|                       | 42 | Cornelius Pass Road                                | Realignment – Reduce curvature and eliminate switchback while minimizing grade increase of 1,500-foot section (assume average cut of 60 feet). \$2,020,000          |
|                       | 43 | Skyline Boulevard                                  | Safety improvement – Install traffic calming devices such as speed humps to reduce speeds from UGB to Cornelius Pass Road. \$485,000                                |
|                       | 44 | Skyline Boulevard                                  | Scenic viewing opportunities – Acquire property through fee or donation for development of parking area adjacent to roadway. \$350,000                              |
|                       | 45 | Cornelius Pass Road                                | Safety improvement – Construct pullouts at a number of locations for the purposes of speed enforcement. \$750,000   |
|                       | 46 | Germantown Road                                    | Safety improvement – Install traffic calming devices such as speed humps to reduce speeds. \$887,000  |
| Multnomah County CIPP | 47 | Cornelius Pass Road: MP 3.0 to MP 3.5 (PN 103a)    | Realign and widen Cornelius Pass Road to provide southbound passing lane. \$35,135,976  |
|                       | 48 | Cornelius Pass Road: MUS 30 to MP 2 (PN 389)       | Reconstruct Cornelius Pass Road including passing lane, safety, shoulder and drainage improvements. \$54,159,714  |
|                       | 49 | Cornelius Pass Road: MP 2 to MP 3 (PN 103)         | Widen Cornelius Pass Road, including new box culvert and passing lane. \$21,893,536   |
|                       | 50 | Germantown Road/Old Germantown Road (PN 726)       | Widen Germantown Road to create left turn pocket and improve sight distance. \$780,835  |
|                       | 51 | Skyline Boulevard: McNamee to Cornelius Pass       | Shoulder bikeway. \$2,629,164   |
|                       | 52 | Skyline Boulevard: Cornelius Pass to Rocky Point   | Shoulder bikeway. \$15,153,851  |
|                       | 53 | Springville Road: Skyline Boulevard to County Line | Shoulder bikeway. \$4,254,950   |
|                       | 54 | Cornelius Pass Road: (old) St. Helens Road to MP 2 | Shoulder bikeway. \$3,684,602   |
| East of Sandy River   |    |  |   |
| Multnomah County CIPP | 55 | Ogden Road: Mershon to Woodard                     | Shoulder bikeway. \$463,789   |
|                       | 56 | Larch Mt. Road: HCRH to End of Road                | Shoulder bikeway. \$26,341,706  |
|                       | 57 | Knieriem Road: Littlepage Road to HCRH             | Shoulder bikeway. \$3,122,720   |
|                       | 58 | Hurlburt Road: HCRH to Littlepage Road             | Shoulder bikeway. \$4,344,240   |
|                       | 59 | Evan Road: Hurlburt Road to HCRH                   | Shoulder bikeway. \$4,463,908   |
|                       | 60 | Woodard Road: HCRH to Ogden Road                   | Shoulder bikeway. \$2,338,065   |



|  |    |   |   |
|--|----|---|---|
|  | 61 | Mershon Road: Ogden to HCRH   | Shoulder bikeway. \$4,009,646   |
| East of Sandy River Rural Area Plan  |    |   |   |
| No major capital improvement improvements are proposed within the study area |    |   |   |
| West of Sandy River  |    |   |   |
| West of Sandy River Rural Area Plan  | 62 | Orient Road/Dodge Park Boulevard Realignment  | Realign the intersection to create a more perpendicular angle. Driveway modifications would be required to serve the autobody shop in the northwest quadrant of the intersection.   |
|  | 63 | Division Drive/Troutdale Road Realignment   | Eliminate the northeast leg of the intersection between SE Division Drive and SE Troutdale Road to create one intersection. Realign each end of the segment proposed for closure. While projected 2020 PM peak hour traffic volumes satisfy signal warrants, signalization is not recommended until additional warrants are satisfied. All-way stop control would provide LOS D with projected 2020 PM peak hour traffic volumes, while adding an eastbound right turn lane would provide LOS C.  |
|  | 64 | 302 <sup>nd</sup> Avenue/Orient Drive/Bluff Road Realignment                              | Potential options include realigning SE Orient Drive to intersect SE Bluff at a more perpendicular angle or creating a left turn lane for eastbound traffic on SE Orient Drive. Either option may require realignment of SE Teton Drive. Further engineering analysis will be necessary to determine a preferred alignment. Signalize realigned intersection when warranted.  |
|  | 65 | Oxbow Drive/327 <sup>th</sup> Avenue Realignment  | Channelizing the broad paved area on SE 327 <sup>th</sup> Avenue at the approach to SE Oxbow Drive to create a more perpendicular intersection is recommended to improve sight distance and reduce the potential for conflict between westbound left turns and northbound left turns.   |
|  | 66 | Lusted Road/302 <sup>nd</sup> Avenue/Pipeline Road Realignment/Intersection Consolidation | Further engineering analysis is recommended to determine if intersection consolidation is feasible given the surrounding vertical grades and the location of a sewage holding tank in the center of the intersection. Recent parking restrictions enacted by the County may be adequate for the near term.  |
|  | 67 | Lusted Road/Powell Valley Road/282 <sup>nd</sup> Avenue Consolidation                     | Realignment to connect SE Lusted Road directly with SE Powell Valley Road is included in the County's Capital Improvement Plan and Program. The project would require further engineering analysis and coordination with the City of Gresham to develop a recommend alignment. A traffic signal is warranted based on projected 2020 PM peak hour volumes, and would provide LOS B operations.  |
|  | 68 | 282 <sup>nd</sup> Avenue/Stone Road Turn Lanes  | The addition of turn lanes in the northbound and southbound direction on 282 <sup>nd</sup> would reduce the high incidence of rear end crashes at this location. Some roadway widening would be necessary.  |
|  | 69 | Shoulder Widening to Meet Updated Standards   | Prioritization for shoulder improvements within the West of Sandy River rural area should be given to roadways connecting to school sites, especially Barlow High School. Proposed shoulder widening should be evaluated based on potential impacts on drainage and adjacent productive lands. For shoulders wider than 1.8 meters, the adopted County standards require paved width of 1.5 meters. The remaining 0.3 meters may be unpaved. Shoulder widening should be incorporated into routine roadway maintenance wherever possible. |
| Multnomah County CIPP  | 70 | Cochran Drive: Troutdale Road to westerly 2175' (PN 145)                                  | Reconstruct to major collector standards: 2 travel lanes, center lane/median, sidewalks, bike lanes, and culvert replacement. \$7,442,765   |



|   |    |   |   |
|---|----|---|---|
|   | 71 | Troutdale Road: Stark St to Division Drive (PN TBD)   | Reconstruct with 2 travel lanes; construct center turn lane/median, sidewalks, bicycle lanes between Stark and Strebin. Reconstruct Troutdale Road/Division Drive intersection including new fish culverts. \$8,297,000 |
|   | 72 | Sweetbriar Road: Troutdale Road to E City Limit (PN 149)  | Widen to neighborhood collector standards with 2 travel lanes, sidewalk and bike lanes. \$2,740,748   |
|   | 73 | Orient Drive/Bluff Road (PN 706)  | Widen Orient Drive to create eastbound left turn lane to Bluff Road, realign Bluff and Teton to create perpendicular intersection. \$685,247  |
|   | 74 | Orient Drive/Dodge Park Boulevard (PN 703)  | Widen Orient Drive to create eastbound left turn lane. \$373,616  |
|   | 75 | Oxbow Drive/Altman Road (PN 707)  | Widen Oxbow Drive to create westbound left turn lane to Altman Road, realign intersection to a 5 perpendicular intersection. \$ 790,693   |
|   | 76 | 302 <sup>nd</sup> Avenue/Lusted Road (PN 704)   | Realign Lusted Road and Pipeline Road to create perpendicular intersection at 302 <sup>nd</sup> , add left turn lane to each leg of intersection. \$5,613,717   |
|   | 77 | Division Drive/Troutdale Road (Included in Collector project above) (PN 186)                          | Realign intersection, eliminating NE leg, producing a 4-way intersection. Replace 3 existing culverts identified as fish barriers. \$ -   |
|   | 78 | Dodge Park Boulevard: 302 <sup>nd</sup> to County Line  | Shoulder bikeway. \$7,592,686   |
|   | 79 | 302 <sup>nd</sup> Avenue: Division to Bluff   | Shoulder bikeway. \$3,878,852   |
|   | 80 | Orient Drive: Welch Road to Dodge Park Boulevard  | Shoulder bikeway. \$1,523,441   |
|   | 81 | Oxbow Park Road: Oxbow Drive to Road End  | Shoulder bikeway. \$1,834,695   |
|   | 82 | Oxbow Drive: Division Drive to Hosner Road  | Shoulder bikeway. \$5,393,681   |
|   | 83 | Oxbow Drive: Hosner Terrace to Oxbow Park Road SE   | Shoulder bikeway. \$1,259,838   |
|   | 84 | SE Division Drive: UGB to Troutdale Road  | Bike lanes. \$945,518   |
|   | 85 | Troutdale Road: Strebin Road to 282 Avenue  | Bike lanes. \$3,292,979   |
|   | 86 | SE Division Drive: Troutdale to Oxbow Parkway   | Bike lanes. \$3,371,407   |
| Pedestrian Master Plan                    | 87 | Stark St: Eavans Ave to 35th St   | Add sidewalk to south side  |
| Columbia River Gorge National Scenic Area |    |   |   |
| Multnomah County CIPP                     | 88 | Historic Columbia River Highway RR Overcrossing: Half miles east of 244 <sup>th</sup> Avenue (PN 199) | Reconstruct railroad bridge to accommodate wider travel lanes, sidewalks, and bike lanes. \$9,314,500   |
|   | 89 | Corbett Hill Road/Historic Columbia River Highway (PN 147)  | Improve intersection alignment by making stops at right angle. \$3,770,920  |
| Other Plans and Projects                  |    |   |   |



|                                |    |   |  |
|--------------------------------|----|---|--|
| East Metro<br>Connections Plan | 90 | Sandy River to<br>Springwater multi-modal<br>connection | Projects to provide multi-modal connections from<br>Downtown Troutdale to Mt. Hood Community College and<br>the Springwater Corridor Trail. CATALYST PROJECTS:<br>Master plan for new multi-modal corridor.  |
|                                | 91 | Pleasant Valley   | Projects develop the necessary public infrastructure for<br>development of Pleasant Valley Community Plan.<br>CATALYST PROJECTS: Improvements to 174 <sup>th</sup> and<br>Foster.  |
|                                | 92 | Catalyst for Springwater<br>District                    | Projects help develop the necessary public infrastructure<br>for private investment and jobs in this regionally significant<br>employment area. Projects include a new interchange on<br>US 26 and an extension of Rugg Road to connect US 26<br>and Hogan, as well as collector street improvements to<br>provide needed access for future jobs and employment.<br>CATALYST PROJECTS: New interchange on US 26 and<br>arterial connections. |
| Pedestrian Master<br>Plan      | 93 | Interlachen Lane: Marine<br>Dr to Blue Lake Rd          | Add sidewalks to both sides  |

## FUTURE CONDITIONS SUMMARY

The following highlights key information that can be used as part of future alternatives analyses tasks.

- Population and employment in the rural areas is expected to grow at approximately 3 – 3.5 percent per year. Although not projected to result in traffic congestion in the rural areas, this growth will continue to have impacts on safety and conflicts between different modes.
- Multnomah County has several different plans that identify transportation improvements in the County’s rural unincorporated areas. These projects will be evaluated in the Alternatives Analysis phase of this project to determine if they are still warranted, how they should be prioritized, and if there are additional needs that require additional projects, programs, or policies to address them.

## NEXT STEPS

The information in this memorandum will be reviewed by County staff and shared with the Transportation Subcommittee of the County’s Comprehensive Plan Update Project Advisory Committee. Input will be requested on the existing and future conditions and currently planned project list to provide direction for the alternatives analysis.

## REFERENCES

1. ODOT Analysis Procedures Manual
2. Highway Safety Manual
3. NCHRP Report 641 *Guidance for the Design and Application of Shoulder and Centerline Rumble Strips*



**SEC-H AND SEC-V PERMIT REPORT**

Proposed Trail System Development  
Burlington Creek Forest Natural Area  
Multnomah County, Oregon

**Prepared for:**

Metro  
Parks and Nature Department  
Portland, Oregon

**Prepared by:**

John Villella, Senior Botanist



Siskiyou BioSurvey  
324 Avery St.  
Ashland, OR 97520  
(541) 482-5039

September 25, 2017





**Land Use Planning Division**  
1600 SE 190<sup>th</sup> Ave, Ste 116  
Portland OR 97233  
Ph: 503-988-3043 Fax: 503-988-3389  
multco.us/landuse

**Significant  
Environmental  
Concern for Wildlife  
Habitat Worksheet  
(Type I)**

**PROPERTY ID**

|          |  |       |    |         |               |             |                     |
|----------|--|-------|----|---------|---------------|-------------|---------------------|
| Address: | Metro, 600 NE Grand Ave., Portland, OR 97232 |       |    |         | Property ID#: | R See below |                     |
| Township | 2N   | Range | 1W | Section | 20            | Tax lot(s): | W/NW St. Helens Rd. |

**PROPOSED DEVELOPMENT:** Please provide a description of your proposal. This should, at a minimum, include the size and use of any structures you are proposing. Also include a description of any land clearing you will be doing including tree removal, area to be graded or excavated and the slope of the development area.

**Response:** In order to enhance and maintain public recreation on public land, Metro is proposing to develop approximately five miles of trails with associated stream crossings and a trailhead with parking and a restroom structure at Burlington Creek Forest Natural Area. All proposed development would occur on land owned by Metro and wholly contained within the Burlington Creek Forest Natural Area. Although this area is a contiguous block, there are several properties involved. The Property ID numbers are as follows: R124323, R124324, R124325, R124329, R124331, R124332, R124333, R124334, R124337, R124338, R124341, R124342, R124343, R124346, R124347 and R491652.

The trailhead area will include an information kiosk, picnic table, and a vault toilet. The restroom will have a footprint of 150 square feet, approximately 10 feet by 15 feet and approximately 12 feet tall. The kiosk will have a footprint of 30 square feet and be 9 feet by 5 feet and stand approximately 8 feet tall.

The trail system will be natural surface trails designated for uses including shared hiking/off-road cycling or hiking only. Six stream crossings will be constructed along various trails, including one bridge structure and five drainage crossings. The footprint for these structures is as follows: the bridge structure is 75 square feet, and there are two crossings of 100 square feet, two crossings at 60 square feet, and one at 90 square feet.

The majority of this development will take place in already cleared areas, such as the power line utility right of way and a cleared area near the existing road. Trail construction including bridges and other stream crossings in forested areas will not result in conversion from "forested areas" to "cleared areas" as defined by MCC Section 33.4570. Forested areas traversed by the proposed natural surface trails will maintain at least 75% crown closure and/or at least 80 square feet of basal area per acre of trees of 11 inch DBH or larger. According to MCC Section 33.4515, SEC permitting is not required for "Activities to protect, conserve, enhance, and maintain public recreational, scenic, historical, and natural uses on



public lands". It is the interpretation of the applicant that this development falls under this exception.

Total land clearance within currently forested areas would be approximately .05 acres and associated with the trailhead area. This will include the removal of approximately nine trees and some existing vegetation. An additional eighteen trees will be removed within the public road right-of-way in order to meet sight distance requirements. Grading and excavating activities will occur to install the new vault toilet and the parking facilities. This site is moderately sloping with all trailhead development occurring in areas with less than 10% slope. The trails have been aligned to avoid steep slopes but some trail segments will be in areas of >25% slope. Required grading along McNamee to meet sight distance requirements will also occur on land in the 10-25% slope range. Please see Area Map (figure 1) for locations of proposed development.

**EXISTING DEVELOPMENT: Please list the existing buildings, structures and improvements on your property, including a description of the use of these buildings, and identify them on your site plan.**

**Response:** Burlington Creek Forest Natural Area currently does not have any buildings. There is a gated road system that is accessed from McNamee road. These are shown on the Area Map (figure 1.)

#### **DEVELOPMENT STANDARDS**

**(1) Where a parcel contains any non-forested "cleared" areas, development shall only occur in these areas, except as necessary to provide access and to meet minimum clearance standards for fire safety.**

**Does your property contain any non-forested "cleared" areas?**

**Response:** Yes, the only currently cleared area that is available for development on the property is at the location where the development is proposed. Other currently cleared areas include the area within the utility corridor and can not be planted in trees or otherwise developed.

**If yes, will your proposed development be contained in the existing cleared area?**

**Response:** No

**If your development will not be contained in the existing cleared area, explain what portions of your development will be outside the existing cleared area.**

**Response:** The trailhead area will be developed with a bathroom facility and a twenty-five car parking area. This area will be located almost completely within an existing cleared area. After considering areas required to be cleared for fire and sight distance requirements, there is an additional area of approximately .05 acres that will need to be cleared. In order to meet fire safety standards some of the trees to be cleared will be removed as per MCC 35.2256. Regarding the primary fire safety zone



around the bathroom building (30 feet), the clearing of one tree falls within the primary fire safety zone. For the secondary fire safety zone (100 ft.) in order to maintain the required distance of greater than 15 feet between tree crowns four additional trees would be removed. This leaves an additional nine trees that will need to be removed within the area designated for the parking lot and road improvements.

Additionally, areas along NW McNamee Road will be graded and trees will be cleared or pruned to achieve sight distance requirements at our park access point. This area is within the sight distance easement of the road right of way. According to MCC 33.4515(2) timber cleared for public safety is exempt from SEC permitting. It is the interpretation of the applicant that the area occupied by these trees falls under this exemption.

**Explain why any new land clearing is the minimum needed to site the proposed buildings, provide access, and meet fire safety standards.**

**Response:** Burlington Creek Forest Natural Area is heavily forested, with only small cleared areas. In consideration of SEC-h requirements the development activities resulting in land clearing are concentrated within already cleared areas as much as possible, the location of the trailhead development is sited with this consideration in mind. The area to be cleared is the minimum required to site the proposed development without having to clear more area or conduct extensive grading activities that would further impact the site. The site location also takes into consideration SEC-v and SEC-s development standards. The proposed trailhead development will be mostly within already cleared areas associated with the road but will also include a small area of forest adjacent to the currently cleared area. Aside from the area to be cleared for fire safety and sight distance regulations the area to be cleared is approximately .05 acres. Proposed development would result in the removal of all vegetation and twelve trees with DBH ranging from 10-15 inches. The proposed improvements will have only a very minor impact on the forest canopy within Burlington Creek Forest Natural Area and will enhance public recreation opportunities at this public site. Site planning documents have been drafted in such a way as to provide access, and meet fire safety and sight distance standards while also minimizing the number of trees removed to accomplish the proposed development.

**(2) Development shall occur within 200 feet of a public road capable of providing reasonable practical access to the developable portion of the site. What is the distance between your proposed development and the nearest public road?**

**Response:** The development of the trailhead and information kiosk is adjacent to the current access road and approximately 325 ft. from McNamee road. The locations of the proposed trailhead/parking facility is the closest location to the roadway that is available to physically and practicably construct the facilities with the least impact.

**(3) The access road/driveway and service corridor serving the development shall not exceed 500 feet in length. What is the length of the driveway serving your development?**



**Response:** As shown on Figure 2, the access road is the existing road through the property. This access way is currently in use and no new roads are proposed. The distance from McNamee road to the development is approximately 325 feet. This is the minimum length needed to connect the public road to the proposed development.

**(4) For the purpose of clustering access road/driveway approaches near one another, one of the following two standards shall be met:**

**(a) The access road/driveway approach onto a public road shall be located within 100 feet of a side property line if adjacent property on the same side of the road has an existing access road or driveway approach within 200 feet of that side property line; or**

**(b) The access road/driveway approach onto a public road shall be located within 50 feet of either side of an existing driveway on the opposite side of the road.**

**Response:** Applicant is proposing to improve the existing access drive; the improvements are to promote safe and efficient access to the site. There is no existing access road or driveway within proximity to the access road where improvements are proposed.

**(5) The development shall be within 300 feet of a side property line if adjacent property has structures and developed areas within 200 feet of that common side property line.**

**Are there structures and developed areas on the neighboring properties within 200 feet of the common side property lines?**

**Response:** Yes, neighboring properties have developments including electrical transmission towers and a train track that are within 200 feet of the common property lines. The proposed development is less than 300 feet from both of these developments.

**(6) Fencing within a required setback from a public road shall meet the following criteria:**

**(a) Fences shall have a maximum height of 42 inches and a minimum 17-inch gap between the ground and the bottom of the fence.**

**(b) Wood and wire fences are permitted. The bottom strand of a wire fence shall be barbless. Fences may be electrified, except as prohibited by County Code.**

**(c) Cyclone, woven wire, and chain link fences are prohibited.**

**(d) Fences with a ratio of solids to voids greater than 2:1 are prohibited.**

**(e) Fencing standards do not apply in an area on the property bounded by a line along the public road serving the development, two lines each drawn perpendicular to the principal structure from a point 100 feet from the end of the structure on a line perpendicular to and meeting with the public road serving the development,**



and the front yard setback line parallel to the public road serving the development.

**Does your proposal include the installation of any fencing?**

**Response:** No new fencing is proposed with this development.

**(7) The nuisance plants listed in the table attached to the end of this form shall not be planted on the subject property and shall be removed from cleared areas of the subject property.**

**Are any of the listed nuisance plants present on your property? Show the location of the nuisance species on your site plan.**

**Response:** Yes. Because of the rural nature of the site in close proximity to urban densities, and the presence of a cleared right of way for the powerlines, Burlington Creek Forest Natural Area is heavily infested with nuisance plant species. The heaviest concentrations of infestation are along the powerline right of way and along the roadside edges. Also there is a general trend towards higher concentrations of nuisance plants in the northwest section of the property near the access from McNamee road. Nuisance plants located at the trailhead location are: Himalayan blackberry (*Rubus armeniacus*), Scotch broom (*Cytisus scoparius*), Canada thistle (*Cirsium arvense*), English ivy (*Hedera helix*), Tansy ragwort (*Senecio jacobaea*) and Robert geranium (*Geranium robertianum*). See figure 4 for nuisance plant infestations located near the proposed development.

**Do you acknowledge that you cannot plant any of the listed nuisance species on your property as landscaping or for any other reason?**

**Response:** Yes, Metro is actively working to minimize nuisance plants in Burlington Creek Forest Natural Area and strives to plant native species for mitigation, restoration or landscaping purposes.

**Describe how the listed nuisance plant species will be controlled in the cleared areas on your property.**

**Response:** When nuisance plants are detected they are removed as soon as possible using best management practices. Hand removal is preferred with herbicides only used as a last resort for larger infestations.

**Have you met ALL of the above criteria?**

**Response:** No, the applicant cannot meet development standards 1 because of physical characteristics unique to the property, specifically the lack of previously cleared areas. According to MCC Section 33.4515, SEC permitting is not required for "Activities to protect, conserve, enhance, and maintain public recreational, scenic, historical, and natural uses on public lands". It is the interpretation of the applicant that this development falls under this exception. Because of this a formal wildlife conservation plan has not been proposed for this project. That being said, Metro is actively restoring the site. Metro currently has a plan in place to restore 50 acres in the fall of 2017 by thinning and planting. 7,000 native plants will be planted in 2017 as



part of this effort. To date, restoration activities at Metro's North Tualatin Mountains properties have included 1.3 miles of stream restoration, 700 acres of forest thinning and the planting of 85,000 trees and shrubs.

## **WILDLIFE CONSERVATION PLAN**

**(1) The proposed development cannot meet the development standards because of physical characteristics unique to the property. The applicant must show that the wildlife conservation plan results in the minimum departure from the standards required in order to allow the use;**

**Can you meet all of the development standards? If no, please explain which development standard(s) you cannot meet and why.**

Response: No, the applicant cannot meet development standards 1 regarding the restriction of development to already cleared areas because of physical characteristics unique to the property including the current forest cover of the site. It is the opinion of the applicant that the proposed development is exempt from SEC permitting as per MCC Section 33.4515.

**Explain how your proposal results in the minimum departure from the development standards that will still allow your proposed use.**

**Response:** Burlington Creek Forest Natural Area is heavily forested, with only small cleared areas. In consideration of SEC-h requirements the development activities resulting in land clearing are concentrated within already cleared areas as much as possible. The site location of the development also takes into consideration SEC-v and SEC-s development standards. The location of the trailhead development is sited with all of these considerations in mind. The area to be cleared is the minimum required to site the proposed development without having to clear more area or conduct extensive grading activities that would further impact the site. The proposed trailhead development will be mostly within already cleared areas associated with the road but because of characteristics unique to the site a small area of forest adjacent to the currently cleared area will have to be cleared of twelve trees. The area to be cleared is approximately .05 acres. The proposed improvements will have only a very minor impact on the forest canopy and wildlife habitat within Burlington Creek Natural Area. Site planning documents have been drafted in such a way as to provide access and meet fire safety standards while absolutely minimizing the number of trees removed to accomplish the proposed development.

## **STANDARDS FOR REVIEW OF A WILDLIFE CONSERVATION PLAN**

**(3) The wildlife conservation plan must demonstrate the following:**

**(a) That measures are included in order to reduce impacts to forested areas to the minimum necessary to serve the proposed development by restricting the amount of clearance and length/width of cleared areas and disturbing the least amount of forest canopy cover.**

**(b) That any newly cleared area associated with the development is not greater than**



**one acre, excluding from this total the area of the minimum necessary access way required for fire safety purposes.**

**How much land clearance are you proposing? Show the area proposed for clearance on your site plan. You cannot exceed 1 acre of clearing (43,560 square feet).**

**Response:** .05 acres.

**Explain why this amount of land clearance is the minimum necessary to serve your proposal. Attach additional sheets if necessary.**

**Response:** The amount of land proposed for clearance is the minimum necessary to allow for the proposed development. The placement of the development site has been carefully selected and sited in a way that minimizes tree removal. As much as possible the development is in already cleared areas. By fully utilizing the already cleared area for the development sites the impacts on the forested areas is minimized.

**(c) That no fencing will be built and that existing fencing will be removed outside of areas cleared for the site development except for existing cleared areas used for agricultural purposes.**

**Does your proposal include any new fencing?**

**Response:** No, there is no fencing included in this proposal. There may be some areas such as viewpoints and steep edges where short sections of split cedar guardrails are installed to exclude people from certain areas.

**Is there existing fencing outside the cleared areas on the property?**

**Response:** No

**(d) That revegetation of existing cleared areas on the property at a 2:1 ratio with newly cleared areas occurs if such cleared areas exist on the property.**

**Do you have any existing cleared areas on the site?**

**Response:** Burlington Creek Forest Natural Area is heavily forested. Besides the area where the trailhead is proposed to be located, the cleared areas within the property are restricted to the right-of-way for the powerlines, and cannot be replanted as part of a mitigation plan. It is the opinion of the applicant that the proposed development is exempt from SEC permitting as per MCC Section 33.4515.

**Are you proposing new land clearance? If yes, how much land clearing are you proposing?**

**Response:** The area to be cleared for the trailhead area is approximately 2,178 square feet or .05 acres.

**If you have an existing cleared area but are proposing to clear new land, then you must replant the existing clearing. The amount of newly planted area must be double the amount of land you are clearing. Show the areas to be replanted on your**



site plan.

**How much land are you proposing to replant?**

**Response:** Because of the heavily forested nature of Burlington Creek Natural Area there is a lack of previously cleared areas on the site. That being said Metro is actively restoring the site. There is a plan in place to restore 50 acres in the fall of 2017 by thinning and planting in areas with currently closed canopy. 7,000 native plants will be planted in 2017 as part of this effort. To date restoration activities have included 1.3 miles of stream restoration, 700 acres of forest thinning and the planting of 85,000 trees and shrubs. It is the opinion of the applicant that the proposed development is exempt from SEC permitting as per MCC Section 33.4515.

**Describe your plan to revegetate the existing cleared areas. This should, at minimum, discuss the number and type of species you will plant, where the planting will occur, when the planting will occur, and how you plan on ensuring the survival of the new plants. Attach additional sheets if necessary.**

**Response:** Only drought tolerant native vegetation will be planted on site as deemed necessary. Species include plants such as dwarf Oregon grape, Salal or Western sword fern. Park facilities staff or site contractor will monitor any newly installed plants. Best management practices will be used and implemented. Regular monitoring and watering will ensure their survival. Planting will occur in the cleared area to the south of the proposed development. Metro typically overplants its restoration and mitigation areas to ensure an acceptable survival rate.

**(e) That revegetation and enhancement of disturbed stream riparian areas occurs along drainages and streams located on the property.**

**Do you have any streams or drainages on your property?**

**Response:** Burlington Creek and several unnamed streams pass through the property. Trails have been aligned as practicable to avoid the need for new stream crossings or cross at existing stream crossings (culverts under existing roadways). Where new stream or drainage crossings are proposed, abutments shall be located outside of the 10-year flood zone. Any disturbed vegetation that occurs as a result of trails or crossing structures in riparian corridors will be replanted. Trail placement has been done to minimize going into SEC-s overlay areas.

**(4) For Protected Aggregate and Mineral (PAM) resources within a PAM subdistrict, the applicant shall submit a Wildlife Conservation Plan which must comply only with measures identified in the Goal 5 protection program that has been adopted by Multnomah County for the site as part of the program to achieve the goal.**

**If your property is in the PAM overlay, ask staff to provide you a copy of the Goal 5 protection program for the specific aggregate and mineral site that affects your property.**

**Response:** This project is not located in a PAM overlay.









**MULTNOMAH COUNTY**  
LAND USE & TRANSPORTATION PROGRAM  
1600 SE 190<sup>TH</sup> Ave, Suite 116  
Portland OR 97233  
Ph 503.988.3043 Fax 503.988.3389  
<http://www.multco.us/landuse>

**Significant Environmental  
Concern for Views (SEC-v)  
Permit Worksheet**

**Address:** \_\_ Metro, 600 NE Grand, Portland OR, 97232 \_\_ **Site Size:** \_\_ 350 acres \_\_

**Township:** \_\_ 2N \_\_ **Range:** \_\_ 1W \_\_ **Section:** \_\_ 20 \_\_ **Tax Lot(s):** \_\_ See below \_\_

**PROPOSED DEVELOPMENT:** Please provide a description of your proposal. This should, at a minimum, include the size and use of any structures you are proposing. Also include a description of any land clearing you will be doing including tree removal, area to be graded or excavated and the slope of the development area.

**Response:** The proposal is to develop approximately five miles of trails with associated stream crossings and a trailhead. Proposed trail and trailhead construction would occur on land owned by Metro and wholly contained within the Burlington Creek Forest Natural Area. Although this area is a contiguous block, there are several properties involved. The Property ID numbers are as follows: R124323, R124324, R124325, R124329, R124331, R124332, R124333, R124334, R124337, R124338, R124341, R124342, R124343, R124346, R124347 and R491652.

The trailhead area will include an information kiosk, picnic table, and a restroom structure. The restroom will have a footprint of 150 square feet, approximately 10 feet by 15 feet and approximately 12 feet tall. The kiosk will have a footprint of 30 square feet and be 9 feet by 5 feet and stand approximately 8 feet tall. Grading activities will be restricted to the area around the proposed trailhead development and near McNamee road to meet sight distance requirements. Grading and vegetation removal within the public road right-of-way and on property owned by PGE is proposed to meet sight distance requirements. Eighteen trees within the right of way and sight distance easement will be pruned or removed in order to meet sight distance requirements.

There are four areas that will require fills or grading. A sixty by twenty foot area will be graded near the beginning of the access road, this will be south of the road. This grading activity will be in order to smooth out a steep slope and to construct a ditch along the road. Three additional areas will be associated with the parking lot and will include an area of forty by fifteen foot area to the northwest of the bathroom, an area of forty by fifteen feet at the northeast corner of the parking lot, and an area of approximately one hundred by twenty feet along the southern edge of the parking area. The final area to be graded is thirty feet by two



hundred feet, located along McNamee Road. The slope ranges from 1.5% to 10% within this area.

The trail system will be natural surface trails designated for uses such as shared hiking/off-road cycling, or hiking only. Six bridges will be constructed along various trails at drainage crossings to minimize impacts. The footprint for these structures is as follows: the bridge structure is seventy five square feet, and there are two crossings of one hundred square feet, two crossings at sixty square feet and one at ninety square feet.

The vast majority of this development will take place in already cleared areas, such as the powerline right of way and a cleared area near the existing road. Trail construction including bridges and other stream crossings in forested areas will not result in conversion from "forested areas" to "cleared areas" as defined by Multnomah County Code Section 33.4570. Forested areas traversed by the proposed natural surface trails will maintain at least 75% crown closure and/or at least 80 square feet of basal area per acre of trees of 11 inch DBH or larger. Total land clearance within currently forested areas would be approximately .05 acres. Eighteen trees within the site distance easement will be pruned or cut in order to meet sight distance requirements. This site is moderately sloping with all development occurring in some areas with greater than 25% slope.

Please see Area Map (figure 1) for locations of proposed development.

**EXISTING DEVELOPMENT: Please list the existing buildings, structures and improvements on your property, including a description of the use of these buildings, and identify them on your site plan.**

Burlington Creek Forest Natural Area currently does not have any buildings. There is a gated road system that is accessed from McNamee road. These are shown on the Area Map (figure 1.)

**REQUIRED DRAWINGS FOR SEC-V PERMIT** The checklist below lists all of the drawings that are required when making an SEC-v application. You will need to provide 2 copies of each of the drawings listed below, preferably on 8 ½ x 11 inch or 11 x 17 inch paper. Make sure the size of paper is appropriate to the scale of the drawing. All required drawings must be drawn to an even and measurable scale such as 1 inch = 20 feet, or ¼ inch = 1 foot.



- ☐ A **map of the property** drawn to scale showing:
  - Boundaries, dimensions, and size of the subject parcel (if zoned Farm or Forest use, include all contiguous properties in your ownership);
  - Location and size of existing and proposed structures;
  - Contour lines and topographic features such as ravines or ridges with the direction of the slope; or provide slope percent;
  - Location of natural streams, drainageways, springs, seeps, and wetlands on the site;
  - Proposed fill, grading, site contouring or other landform changes;
  - Location and predominant species of existing vegetation on the parcel, areas where vegetation will be removed, and location and species of vegetation to be planted, including landscaped areas;
  - Location and width of existing and proposed roads, driveways, parking and maneuvering areas, and service corridors and utilities such as wells, underground wires, septic and storm water systems;
  - Septic system location;
- ☐ Elevation drawings (side views) showing the appearance of proposed structures when build and surrounding final ground grades;
- ☐ Details on the height, shape, colors, outdoor lighting, and exterior building materials of any proposed structure; and
- ☐ A landscape screening plan, showing information on the type, height and location of any vegetation or other materials which will be used to screen the development from the view from identified significant viewing areas.

### **CRITERIA FOR APPROVAL OF SEC-v PERMIT**

The purpose of the SEC-v permit is to ensure that new development is "visually subordinate" to the landscape. *Visually subordinate* means development does not noticeably contrast with the surrounding landscape, as viewed from an Identified Viewing Area (see below). Development that is visually subordinate may be visible, but is not visually dominant in relation to its surroundings. In other words, your eyes are not drawn towards it. Please note that for most development, this means that you may have a view, but that it will likely be through trees that provide screening for the building.

Guidelines to help you attain visual sub ordinance for your project are presented below. In no case should the proposed structure be taller than the surrounding forest canopy level. You will need to provide detailed information about the height, shape, colors, outdoor lighting, and exterior building materials you are proposing to use. Chosen colors should be dark natural or earth-tone colors and building materials should be selected to minimize reflectivity. Topography and vegetation may be used to screen the building, but primary emphasis is placed on the building's location, design and construction materials. Please be aware that many of your neighbors have buildings that were constructed before the current standards went into effect. It may not be possible for the County to approve a



house that is similar in size, color, visibility, and placement as other structures in the vicinity of your property.

The entries in bold text below are the standards for approval. The questions below each standard are intended to help you address the standards. Staff will use your responses to determine whether or not your proposal meets each specific standard. Please respond to each standard as fully as you can. When responding to the questions, remember to address the 'how' and 'why' each standard is met. Attach additional sheets if necessary.

**Any portion of a proposed development (including access roads, cleared areas and structures) that will be visible from an Identified Viewing Area shall be *visually subordinate*.**

Check all of the Identified Viewing Areas from which your property is visible. *Identified Viewing Areas* are public areas that provide important views of a significant scenic resource, and include both sites and linear corridors.

Identified Viewing Areas are:

|   |   |
|---|---|
| <input type="checkbox"/> Bybee-Howell House                       | <input checked="" type="checkbox"/> Highway 30                    |
| <input type="checkbox"/> Virginia Lakes                           | <input checked="" type="checkbox"/> The Multnomah Channel         |
| <input checked="" type="checkbox"/> Sauvie Island Wildlife Refuge | <input checked="" type="checkbox"/> The Willamette River          |
| <input type="checkbox"/> Kelley Point Park                        | <input checked="" type="checkbox"/> Public Roads on Sauvie Island |
| <input type="checkbox"/> Smith and Bybee Lakes                    |   |

If your property is topographically screened from view from all Identified Viewing Areas, then your proposal does not have to achieve visual subordination. "Topographically screened" means that a hill, ravine, or other natural land feature prevents your property from being seen from any of the listed Identified Viewing Areas. If you feel your property is not visible from any of the identified viewing areas, please explain why.

Keep in mind that screening from the tree canopy does not equate to topographic screening. It is possible that your property could be hidden from view by trees but would not be topographically screened from all Identified Viewing Areas if the trees were removed in the future through logging, fire, disease etc.

**Response:** The property is not topographically screened from the Identified Viewing Areas indicated above.

**If your property can be topographically seen from any identified viewing area, regardless of how remote the possibility, complete the remainder of this questionnaire. The questions below are intended to assist you in explaining why your proposal will be visually subordinate.**

**Guidelines which may be used to attain visual subordination, and which shall be considered in making the determination of visual subordination include:**



**(1) The development must be sited on portions of the property where topography and existing vegetation will screen the development from the view of identified viewing areas.**

Explain how existing topography will block the development from view from identified viewing areas. (Topography means ground terrain only.)

Explain how existing vegetation that is located only on your property will screen the development from view of identified viewing areas. You cannot include any vegetation that is not on your property since your neighbors could log their properties at any time. Please note that any vegetation you plan to use to screen the development must be permanently retained on the site to keep the new structure visually subordinate.

**Response:** The proposed development includes one small building, a single stall bathroom facility associated with the trailhead development and a retaining for the access road. This retaining wall will have a maximum exposed height of eight feet and will be earth toned in color. The building will be on the north side of the access road. North of the proposed development in the direction of the Identified Viewing Areas, there is 250 feet to the property line. This area is heavily forested with conifer trees. In order to achieve visual subordination and comply with SEC-V permitting requirements this forest will be left in place in perpetuity. Some tree thinning will occur in this area to bring the former commercial tree stand to a natural forest density as well as meet fire safety requirements associated with the restroom. The current height of the tree canopy in this area is approximately 50 feet and as the trees continue to grow this height will increase. This will completely obscure the proposed development from view from the Identified Viewing Areas. Please see Figure 3 for where the existing vegetation will be retained.

**(2) Nonreflective or low reflective building materials and dark natural or earthtone colors must be used.**

What materials are you proposing for the exterior of the structure including the roofing material? Examples of non-reflective or low reflective building materials include wood and composition shingles. An example of reflective material which will not meet this standard is metal roofing.

What colors are you proposing to use on the exterior of the structure? This information should include the name of the manufacturer and the name or number of the color(s) you propose. Dark earth tone colors should be proposed. These are colors such as dark brown and forest green that will blend into the surrounding forest landscape. Example colors are available for viewing at the land use planning office.

**Response:** The bathroom facility will have exterior coloration of earth tones such as brown or grey. Roofing materials will be non-reflective and made of concrete. The bathroom facility is a prefabricated facility manufactured by CXT, model name Rocky Mountain. See figure 5 for the schematic of the bathroom building.



**(3) Any exterior lighting must be directed downward and sited, hooded and shielded so that it is not highly visible from identified viewing areas. Shielding and hooding materials should be composed of nonreflective, opaque materials.**

Will there be any new exterior lighting installed as part of your project? ☒ Yes ☐ No

**Response:** We are proposing to include one exterior light near the bathroom structure. This light will be orientated downward and hooding material will be composed of opaque non reflective material.

**(4) Screening vegetation or earth berms may be used to block and/or disrupt views of the development from Identified Viewing Areas. Priority should be given to retaining existing vegetation over other screening methods. Planting new trees or building new berms should only be considered if you cannot design a development that can be screened from view using existing topography and vegetation. Trees planted for screening purposes should be coniferous to provide winter screening. The applicant is responsible for the proper maintenance and survival of any vegetation used for screening.**

Will existing on-site vegetation provide screening for your project? Yes ☒ No ☐

**If yes, describe how the vegetation will screen your project. This should include information on the size, height, species, and location of the vegetation. Please note that any vegetation you plan to use to screen the development must be permanently retained on site.**

**Response:** The proposed development includes only one small building, a bathroom facility associated with the trailhead development. This building will be on the north side of the access drive. North of the proposed development in the direction of the Identified Viewing Areas, there is 250 feet to the property line. This area is heavily forested with trees including Douglas-fir, Western hemlock, Western red cedar and Red alder. The forest canopy in this area is a minimum of forty feet with some trees reaching sixty feet. In order to achieve visual subordination and comply with SEC-V permitting requirements the forest will be left in place in perpetuity. This will completely obscure the proposed development from view from the Identified Viewing Areas. Please see Figure 3 for where the existing vegetation will be retained.

**Are you proposing to plant any new vegetation to screen your project? Yes ☐ No ☒**

**If yes, describe how the new vegetation will screen your project. This should include information on the number, size, height, species and location of the proposed vegetation**



as well as a timeline for planting that vegetation. Please note that any vegetation you plan to use to screen the development must be permanently retained on site.

Will any earth berms provide screening for your project? Yes\_\_\_ No\_X\_

If yes, describe how the berms will screen your project. This should include info size, height, and location of the berms.

**(5) Proposed developments or land uses shall be aligned, designed and sited to fit the natural topography and to take advantage of vegetation and land form screening, and to minimize visible grading or other modifications of landforms, vegetation cover, and natural characteristics.**

Examples of how to minimize grading and take advantage of existing topography are given on the last page of this application.

Will your proposal require any grading? Yes\_X\_ No\_\_\_

If yes, describe how your proposed project is designed to fit with the natural topography. This should include a discussion of why any proposed grading is minimizing the amount of land modification needed to install your project.

**Response:** The site location of the development takes into consideration SEC development standards. The location of the trailhead development is sited with SEC-h, SEC-v and SEC-s standards in mind. The parking lot and trailhead development is orientated on the landscape perpendicular to the slope in order to take advantage of the grade provided by the existing road. Given the unique topographic constraints of the property, the proposed area to be graded is the minimum required to site the proposed development without having to clear more area or conduct extensive grading activities that would further impact the site. The proposed trailhead development will be mostly within an already cleared; mostly flat area associated with the road and will have only a very minor impact on the forest canopy and wildlife habitat within Burlington Creek Natural Area. Site planning documents have been drafted in such a way as to provide access and meet fire safety standards while minimizing the amount of grading to accomplish the proposed development.

**Describe what grading activities will be needed in order to construct your project. This should include information such as the location, size, and % slope of the grading area, and the length, width and depth of any cuts or fills.**

**Response:** Grading activities will be restricted to the area around the proposed trailhead development and access road. There are five areas that will require fills or grading. A sixty by twenty foot area will be graded near the beginning of the access road, this will south of the road. This grading activity will be in order smooth out a steep slope and to construct a ditch along the road. There are three area that will be graded associated with the parking lot and will include an area of forty by fifteen foot



area to the northwest of the bathroom, an area of forty by fifteen feet at the northeast corner of the parking lot, and an area of approximately one hundred by twenty feet along the southern edge of the parking area. The final area to be graded is thirty feet by two hundred feet, located along McNamee Road. The slope ranges from 1.5% to 5.25% within this area.

**(6) Limit structure height to remain below the surrounding forest canopy level**

**How tall is the forest canopy surrounding your project from existing grade on the downslope side?**

50 Ft.

**How tall is your proposed structure (grade to tallest part of the structure)?**

15 Ft.

Your proposed structure must be shorter than the surrounding forest canopy measured from existing grade on the downslope side.

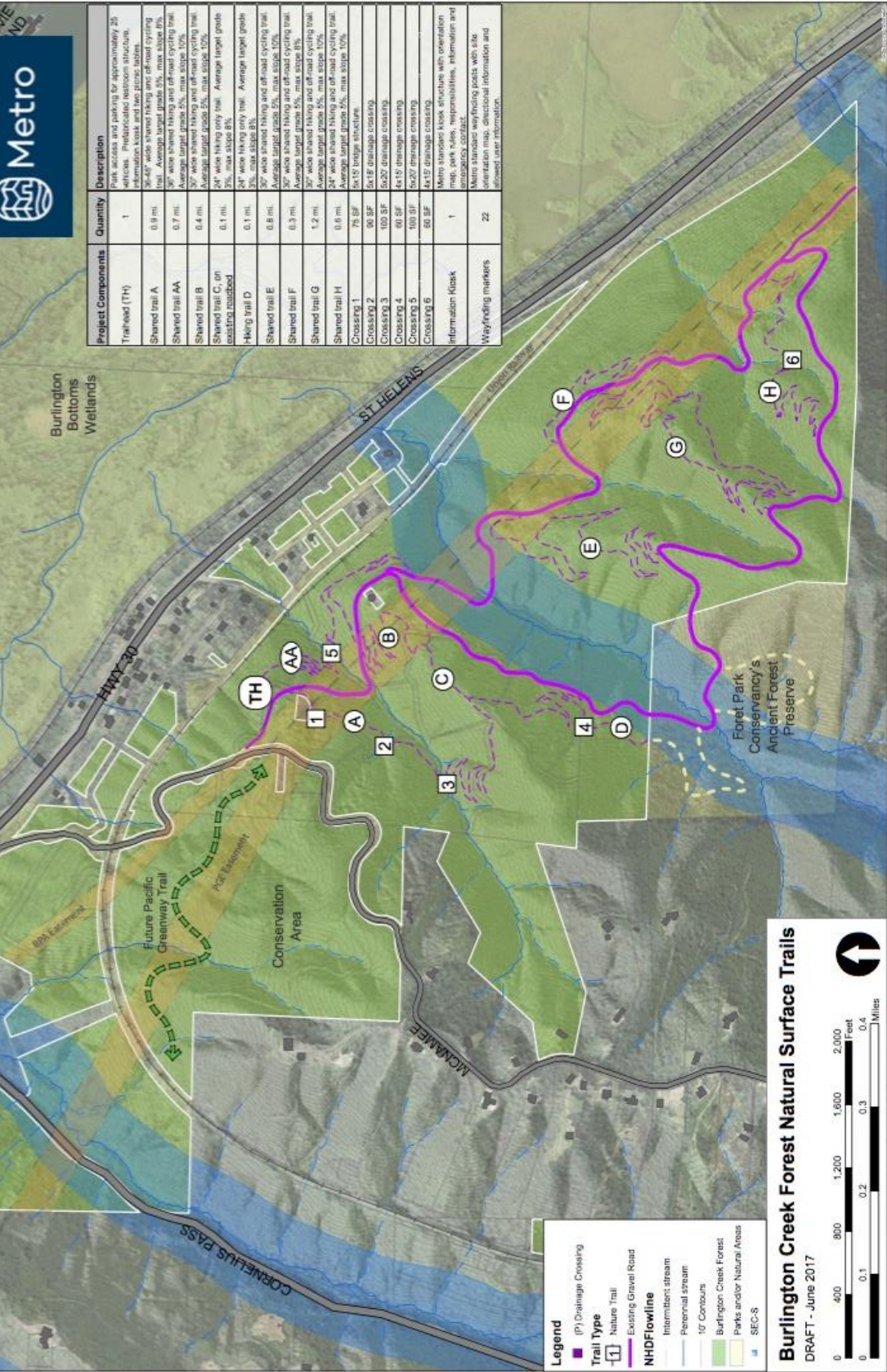
**(7) The silhouette of buildings and other structures must remain below the skyline of bluffs or ridges as seen from identified viewing areas. This may require modifying the building or structure height and design as well as location on the property. Some exemptions apply to new communications facilities as explained below.**

**Will your proposed structure break the skyline or ridgeline as seen from any Identified Viewing Area?**

☐ Yes ☒ No

**If yes, you must modify your proposal so that the structure does not break the skyline or ridgeline unless your project is a new communications facility.**





**Burlington Creek Forest Natural Surface Trails**  
DRAFT - June 2017

0 400 800 1,200 1,600 2,000 Feet  
0 0.1 0.2 0.3 0.4 Miles



Figure 1. Area Map showing location of proposed development including trails

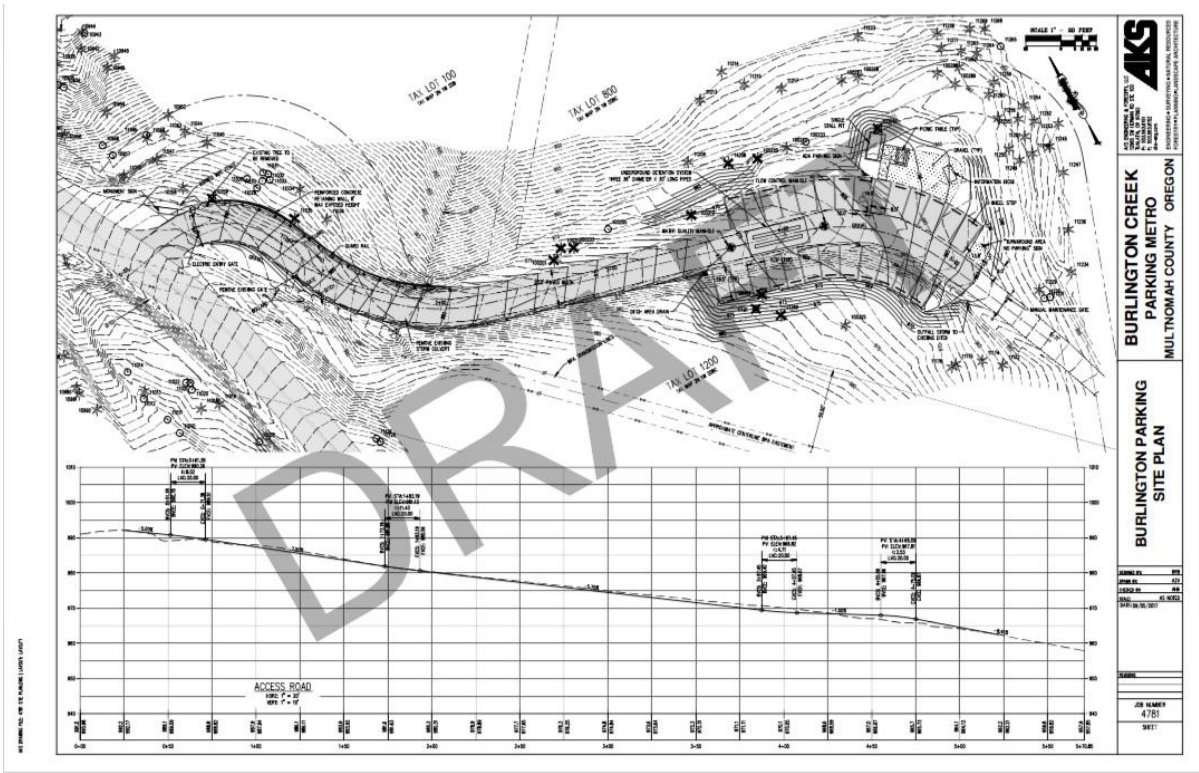


Figure 2. Site Plan showing proposed development and trees to be removed

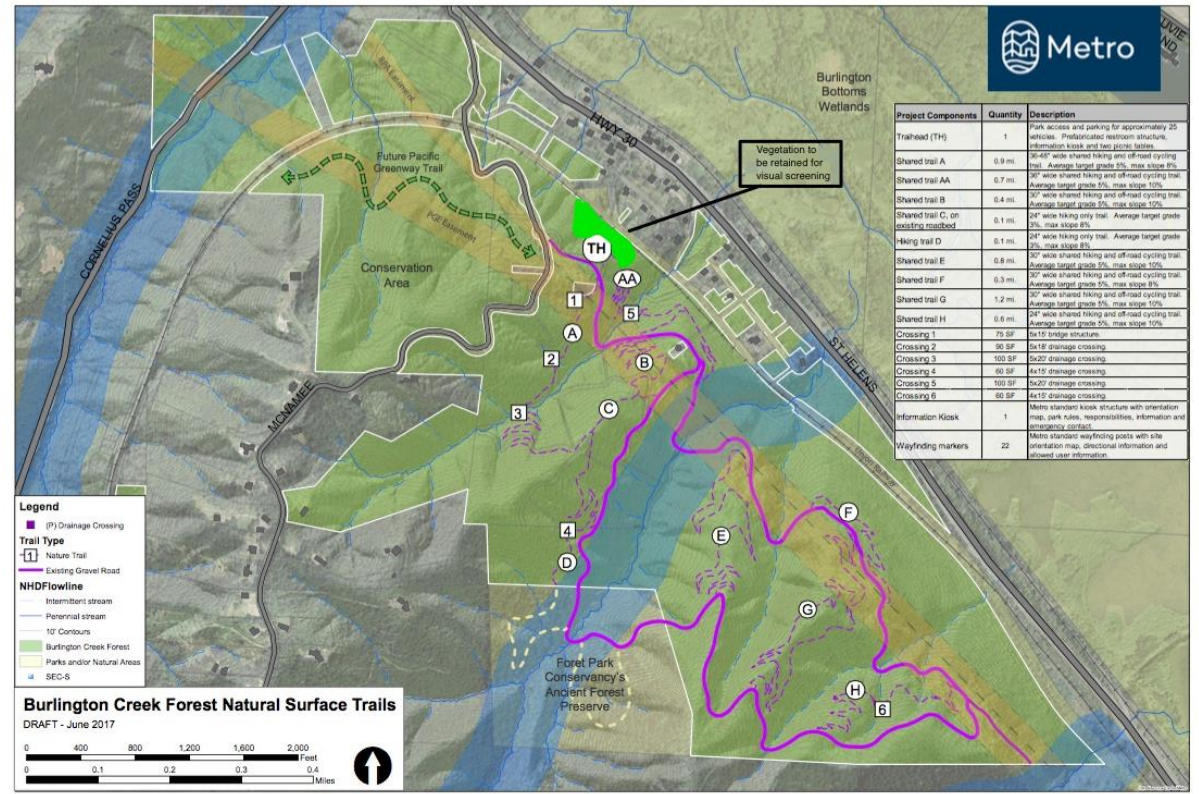




Figure 3. Vegetation to be retained for visual screening

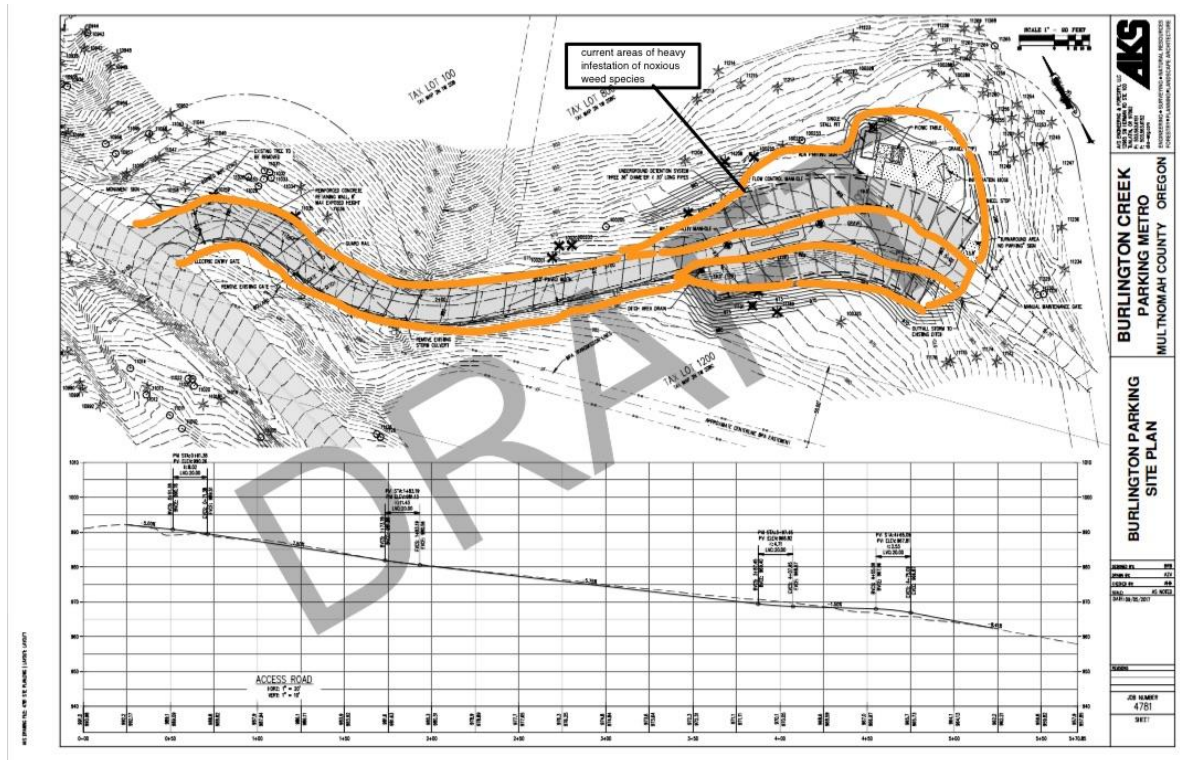


Figure 4. Current areas of noxious weed infestations around proposed development

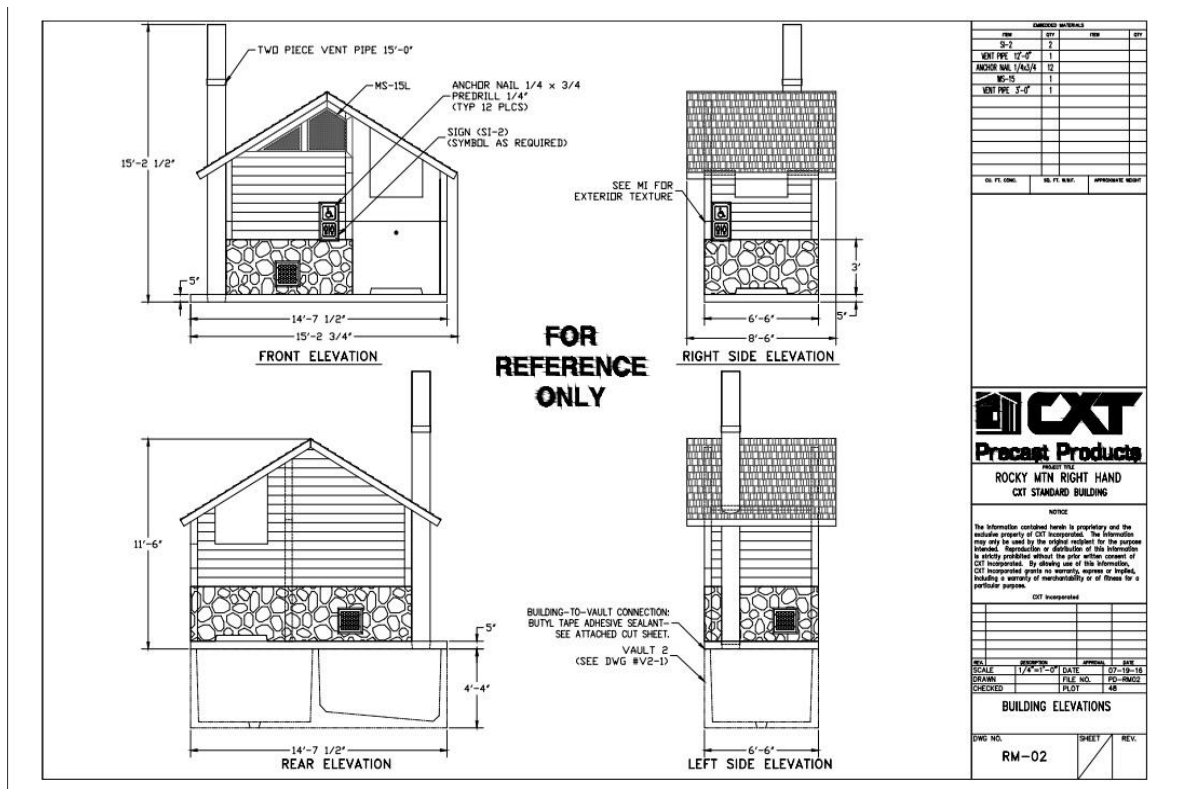
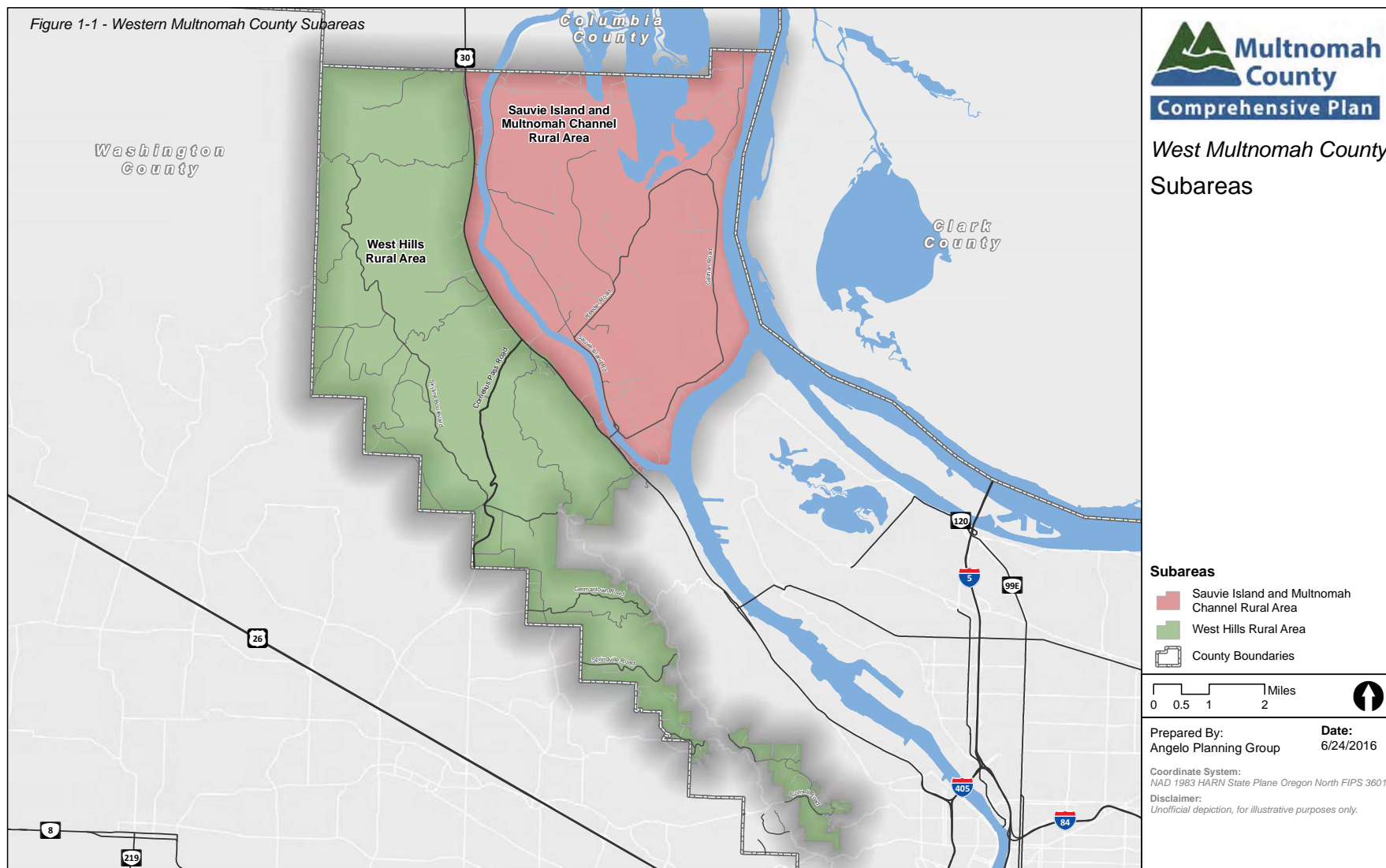


Figure 5. Schematic of bathroom structure



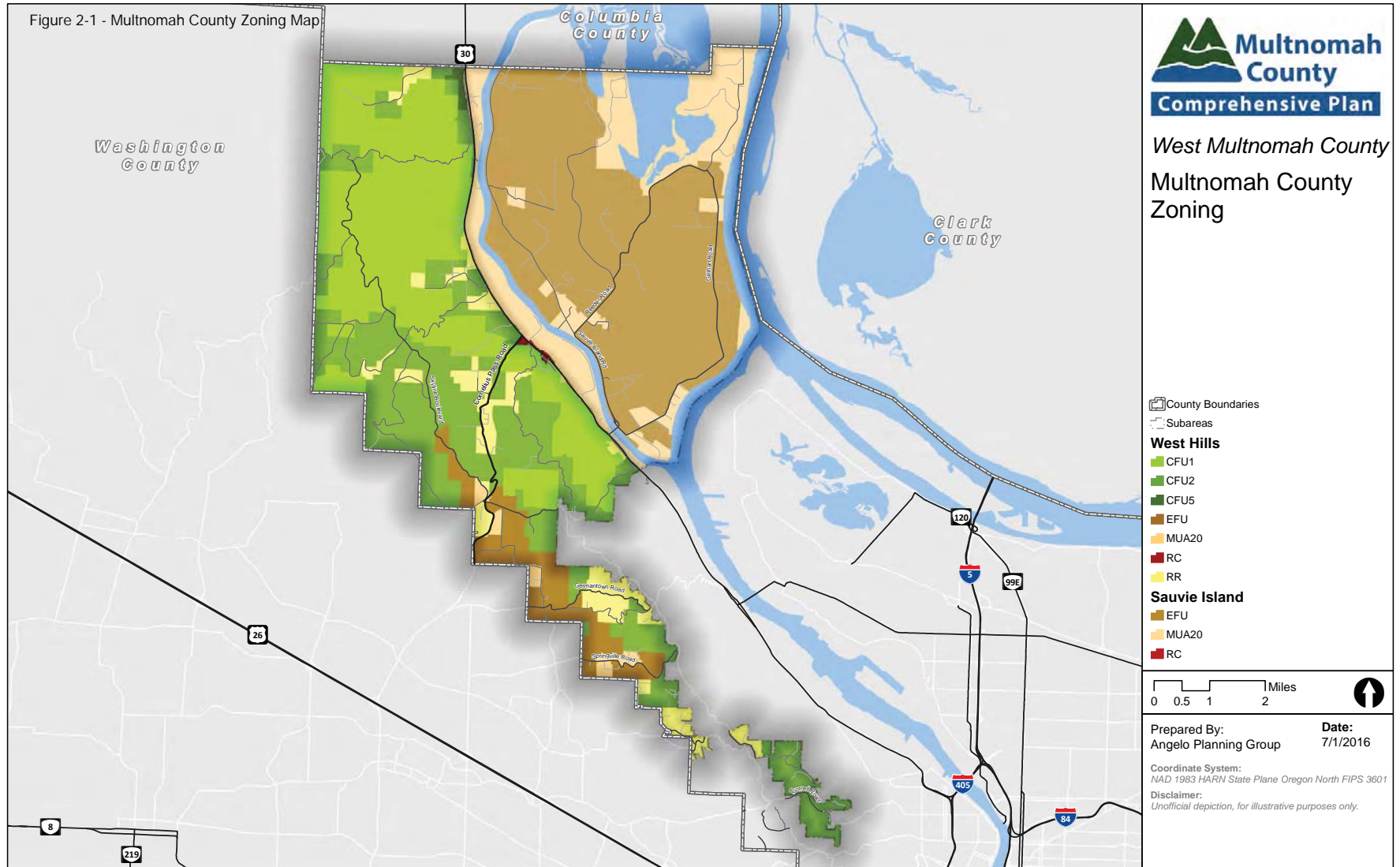
# EXHIBIT 7

## INTRODUCTION AND CITIZEN INVOLVEMENT





# EXHIBIT 8





1600 SE 190<sup>th</sup> Avenue, Portland OR 97233-5910 • PH. (503) 988-3043 • Fax (503) 988-3389

## **PRE-APPLICATION CONFERENCE NOTES**

**This is not a public hearing, it is an informational meeting.**

**Case File No.: PA-2017-7041 / EP-2017-6780**

### **MEETING TIME AND PLACE**

**March 30, 2017 at 2 p.m.**

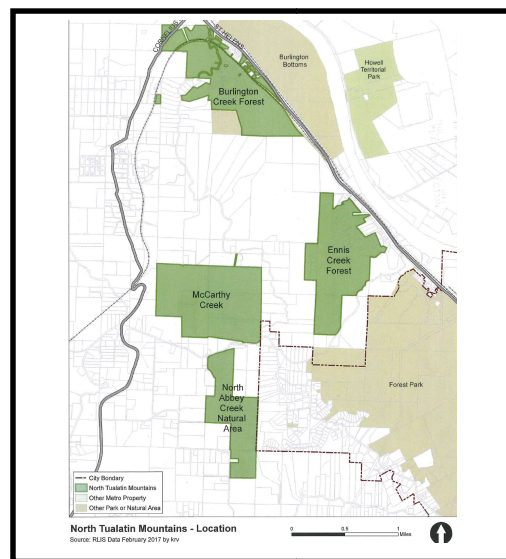
**Board Room 100, 501 SE Hawthorne Blvd., Portland, OR**

**PROPOSAL:** A Pre-Application meeting is to be held on the date above to discuss the applicable Multnomah County Land Use Code and County Transportation requirements and application for a Quasi-Judicial Revision to the Comprehensive Plan to adopt Metro's North Tualatin Mountains Access Master Plan – And for some or all of the following permits to develop park related parking, trails, restrooms and related amenities: Conditional Use, Community Service Use, Design Review, Significant Environmental Concern, Hillside Development, Protected Aggregate and Mineral Sites, and Grading & Erosion Control, Flood Development Permit, Lot of Record, Address Assignment, and Forest Development Standards.

**LOCATION:** North Tualatin Mountains, west of Forest Park, east of Cornelius Pass, south of U.S. Hwy 30 and north of Washington County. A complete list of the properties is included in this notice.

**APPLICANT:** Metro Parks and Nature  
600 NE Grand Avenue  
Portland, OR 97232

**BASE ZONE:** Commercial Forest Use – 1 (CFU-1),  
Commercial Forest Use – 2 (CFU-2),  
and Exclusive Farm Use.



**CONTACT:** The applicable County Code provisions, Comprehensive Plan Policies and County Transportation requirements will be discussed at the Pre-Application Meeting. For further information regarding the meeting, contact Kevin Cook, Senior Planner at Multnomah County's Land Use Planning Division at (503)-988-0188 or email: kevin.c.cook@multco.us  
The notes from this meeting can be obtained by attending the meeting or by contacting Multnomah County after March 30, 2017.



**The following is for informational purposes only. No approvals or conclusions have been drawn about this project. Until such time as the necessary Applications are submitted and reviewed, no decisions will be or have been made regarding the project's compliance with the land use regulations of Multnomah County.**

## **Outline of the Pre-Application Meeting's Purpose and Process**

### **I. Meeting Purpose:**

- (A) The Pre-Application meeting is to provide information to an applicant for a land use action or plan amendment that will assist them in completing the application.
- (B) The objectives of the meeting are to clarify the proposal, inform the applicant of the applicable procedures and approval criteria, and to identify all known issues.
- (C) A Pre-Application meeting is a standard requirement for all applications that require a public hearing.

### **II. Meeting Structure:**

- (A) This is not a public hearing and no decisions will be made. The meeting is meant to be informal in nature.
- (B) The Multnomah County planning staff will be responsible for conducting the meeting. Staff will begin the meeting by asking for introductions of those in attendance.
- (C) The applicant will be responsible for explaining their proposal. This explanation is especially helpful to the public who have not seen the application materials and is an opportunity to share relevant information with their neighbors.
- (D) Planning staff will be responsible for reviewing the applicable procedures and approval criteria and to identify all known issues.
- (E) Members of the public and other agency representatives will be provided the opportunity to ask questions about the proposal and will be asked to identify any relevant issues.

### **III. Other Opportunities for Review:**

- (A) If you are interested in the proposal and are unable to attend the Pre-Application meeting, you may review the Pre-Application case file at the offices of Multnomah County Land Use Planning, located at 1600 SE 190<sup>th</sup> Avenue, Portland, between 8:00 a.m. and 4:00 p.m., Tuesday through Friday, except holidays.
- (B) After the Pre-Application meeting, and after the application has been deemed “complete” by responding to each approval criteria, a notice announcing the date,



time, and place of the public notice will be sent. Failure to participate at the Pre-Application meeting will not preclude your involvement at the first scheduled hearing on the completed application.

## **MEETING PURPOSE**

This Pre-Application meeting and the following notes are provided to assist the applicant in preparing a land use application. Our objectives for the meeting are to clarify the proposal, to inform you of the applicable procedures and approval criteria, and to identify all known issues.

**Notwithstanding any representations by County staff at a Pre-Application meeting, staff is not authorized to waive any requirements of Multnomah County Code (MCC). Any omission or failure by staff to recite to an applicant all relevant applicable land use requirements shall not constitute a waiver by the County of any standard or requirement. [MCC 37.0570(C)]**

After the meeting, if you have any questions regarding the criteria, the process or the next steps, please contact the case planner, Kevin Cook at 503.988.0188.

## **PERMITS**

**Note 1: Certain components of future development may be exempt from one or more of the following permits.**

**Note 2: Additional permits may be required.**

| <b>Permit</b>                                  | <b>Description</b>   |
|--|--|
| <b>Comprehensive Plan Amendment Type IV</b>    | A Comprehensive Plan Amendment and/or zone change application involves specific parcels or tracts. These applications involve substantial discretion and evaluation of subjective approval criteria district. The Planning Commission shall render the initial decision on all Type IV permit applications. If the Planning Commission recommends approval of the application, that recommendation is forwarded to the Board of County Commissioners. The Board's decision is the county's final decision on a Type IV application and is appealable to the Oregon Land Use Board of Appeals (LUBA).           |
| <b>Permit</b>                                  | <b>Description</b>   |
| <b>Community Service &amp; Conditional Use</b> | The purpose of the Community Service and Conditional Use provides for the review and approval of the location and development of special uses which, by reason of their public convenience, necessity, unusual character, or effect on the neighborhood, may be appropriate as specified in each district.   |
| <b>Permit</b>                                  | <b>Description</b>   |
| <b>Design Review</b>                           | The purpose of a Design Review is to ensure site development occurs in a manner that is functional, safe, innovative, attractive and compatible with the natural and man-made environment. When evaluating Design Review applications, the County considers such things as vehicle circulation, needs of the handicapped, preservation of natural vegetation, drainage, buffering and screening of storage areas, utilities, and signage. You will need to provide a detailed site plan and building elevations with this type of application, along with narrative explaining how the criteria have been met. |



| Permit  | Description   |
|---|---|
| <b>Significant Environmental Concern for Wildlife Habitat</b> | The purpose of the Significant Environmental Concern for Wildlife Habitat overlay is to preserve corridors for wildlife movement and to protect natural areas in the greater Forest Park area. This is achieved through the application of fixed standards that seek to cluster development, direct it to cleared areas, and require it occur close to public roads. Certain types of fencing that obstruct wildlife movement are prohibited along road rights-of-way, and specific “nuisance plants” cannot be planted and must be removed from cleared areas. A Wildlife Conservation Plan can be submitted as an alternative to the fixed standards for properties that cannot meet them or in circumstances where the owner can demonstrate that alternative measures will better protect the resource. You will need to satisfy one of these approaches. |

| Permit   | Description   |
|--|---|
| <b>Significant Environmental Concern for Streams</b> | The purposes of the Significant Environmental Concern for Stream Permit is to protect, conserve, enhance, restore, and maintain streams which are of public value and to establish conditions and standards for the development to achieve these goals. Significant stream corridors are mapped. If you develop within the corridor you will need to prepare a mitigation plan and will be subject to design standards that restrict crossings to bridges or arched culverts, limit lighting and stormwater discharges, and require the replanting of trees that are removed. |

| Permit  | Description  |
|---|--|
| <b>Significant Environmental Concern for Scenic Views (SEC-v)</b> | The purpose of the Significant Environmental Concern Overlay for Scenic Views is to maintain a natural vista along the east side of the Tualatin Mountains as seen from Highway 30, Sauvie Island, Multnomah Channel, and the Willamette River. Detailed site plan and building elevations are required for this type of application, and the County will be looking at specific design details such as the location, orientation, color and materials of structures to ensure that they blend with the surrounding natural landscape. |

| Permit                             | Description   |
|------------------------------------|---|
| <b>Hillside Development Permit</b> | The purpose of Hillside Development Permit is to assure the building site is safe and stable, minimize grading (excavation) to the amount necessary for the proposed development, prevent erosion, control stormwater discharges and prevent damage to properties and streams from earth movements, erosion or stormwater runoff. At a minimum, you will need to hire a Certified Engineering Geologist or Geotechnical engineer to evaluate the property and confirm that the building site will be safe and stable. A site plan and narrative is needed explaining how the approval criteria have been met and, if adding more than 500 square feet of impervious surfaces, you will need to hire an engineer to evaluate how the stormwater will be managed. |



| Permit   | Description   |
|--|---|
| <b>Protected Aggregate And Mineral Sites - PAM</b> | <p>The purposes of the Protected Aggregate and Mineral Resources Overlay Subdistrict are:</p> <p>(A) To provide a mechanism to identify and, where appropriate, protect significant aggregate and mineral resource sites;</p> <p>(B) To allow surface mining subject to uniform operating standards; and</p> <p>(C) To regulate conflicts with surface mining activities.</p> |

| Permit                             | Description  |
|------------------------------------|--|
| <b>Grading and Erosion Control</b> | <p>The purpose of the Grading and Erosion Control Permit is to minimize grading (excavation/fill) to the amount necessary for the proposed development, prevent erosion, control stormwater discharges and prevent damage to properties and streams from erosion or stormwater runoff. You will need to provide a site plan showing where erosion control measures will be placed and, if adding more than 500 square feet of impervious surfaces, you will need to hire an engineer to evaluate how the stormwater will be managed.</p> |

| Permit                               | Description   |
|--------------------------------------|---|
| <b>Floodplain Development Permit</b> | <p>The purpose of the flood hazard overlay is to minimize public and private losses due to flood conditions in specific areas and to allow property owners to participate in the National Flood Insurance Program. You will need to provide a completed FEMA floodproofing or elevation certificate, as appropriate to the project. An engineer or architect can complete the floodproofing certificate. You will need to hire a surveyor to complete an elevation certificate. A site plan and building plans are also required, and there are specific construction standards for building in the floodplain. A \$1000 fee deposit for an as-built survey is required for elevation certificates that are based on construction drawings. If you do not believe that your property is within the floodplain you have the option of submitting a survey to establish that is the case.</p> |

| Permit                                     | Description  |
|--|--|
| <b>Forest Development Standards Review</b> | <p>The purpose of the Forest Development Standards Review is to ensure that the Forest Practice Act Setbacks are satisfied as well as the primary and secondary fire safety zones required of the CFU zoning district. Additionally, staff must review development in the CFU zones for compliance with the development standards found in each CFU zone. The review ensures that the minimum amount of forest land is used for a new structure or dwelling and that the access corridor is minimized. The standards will pull development towards an existing dwelling on the property or closer to the public road. You will need to provide a detailed site plan with this type of application along with narrative explaining how the criteria and/or standards have been met.</p> |



| Permit               | Description  |
|----------------------|--|
| <b>Lot of Record</b> | A Lot of Record is a piece of property that conformed to all zoning and land division laws when placed into its current configuration. The Multnomah County zoning code requires a property to be a Lot of Record in order for building or land use permits to be issued or approved (MCC 37.0560). You will need to provide deeds or sales contracts that were either recorded or in recordable form, dating back to when the property was created. The County will then compare those documents to the rules in effect at that time to confirm if the property is a Lot of Record and thus eligible for development. |

## GENERAL PROCESS

**Note 3:** Some permits may be reviewed separately, some permits may be reviewed concurrently, and some permits may be contingent on approval of a higher order permit.

- A. **Type IV** Comprehensive Plan Amendment. To incorporate the Metro Parks Master Plan in to County Comprehensive Plan requires a hearing by the Planning Commission followed by a hearing by the Board of County Commissioners.
- B. **Type III** Conditional Use and Community Service Use Permits. Review of certain park related uses requires a land use hearing by a County Hearings Officer.
- C. **Type II** permits, including Design Review, Significant Environmental Concern permits, Hillside Development, and Lot of Record may be included as part of the Conditional Use and Community Service reviews or may be reviewed separately depending on the scope of the particular review. Type II reviews that are reviewed concurrently with a Conditional Use or Community Service are considered at a hearing by a County Hearings Officer. Type II permits that are reviewed independently of a Conditional Use or Community Service are reviewed by the Planning Director.
- D. **Type I** permits are technical reviews for permits such as Grading and Erosion Control or Flood Development. Type I permits are issued by the Planning Director and are subject to allowed or approved uses on property.

## SUMMARY OF APPLICABLE PERMITS, CODES, POLICIES & FEES

These Multnomah County Code (MCC) sections (provided at meeting) can be found under the link titled *West Hills Rural Plan Area* on our webpage at: [web.multco.us/landuse](http://web.multco.us/landuse)

| Permits                      | Code Sections  | Fees            |
|------------------------------|--|-----------------|
| <b><i>Type IV</i></b>        |  |                 |
| Comprehensive Plan Amendment | 37.0705 [approval criteria]. Applicable Comprehensive Plan Policies including those applicable policies found in Chapters 1, 3, 4, 5, and 8. Relevant State Goals, Statutes and Rules including Goals 1, 3, 4, 5, and 8. | \$3,204 Deposit |
| <b><i>Type III</i></b>       |  |                 |
| Conditional Use              | 33.2030(A)(9)(b) [Conditional Uses in CFU-1],  | \$2,601         |



|   |  |   |
|---|--|---|
|   | 33.2230(A)(9)(b) [Conditional Uses in CFU-2], 33.2630(C) [Conditional Uses in EFU], 33.6300 – 33.6350 [Conditional Uses criteria]. |   |
| Community Service                                 | 33.6000 – 33.6020 [Standards for Community Services].  | \$2,601   |
| <b><i>Type II</i></b>                             |  |   |
| Design Review                                     | 33.7000 – 33.7060  | \$1,238   |
| Forest Development Standards                      | 33.2000 – 33.2110 [CFU-1], 33.2200 – 33.2310 [CFU-2].  | \$379   |
| Significant Environmental Concern                 | 33.4500 – 33.4575  | \$1,240   |
| Hillside Development                              | 33.5500 – 33.5525  | \$969   |
| Protected Aggregate and Mineral Sites             | 33.5700 – 33.5745  | \$1,457 or \$2,601 (processed as either an administrative decision by the Planning Director or as a Type III review). |
| Lot of Record                                     | 33.0005 [Definitions], 33.2075 [Lot of Record – CFU-1], 33.2275 [Lot of Record – CFU-2], 33.2675 [Lot of Record – EFU].            | \$1,088 and/or \$144 per hour research fee  |
| <b><i>Type I</i></b>                              |  |   |
| Flood Development                                 | 29.600 – 29.611  | \$409   |
| Grading and Erosion Control                       | 29.330 – 29.348  | \$392   |
| Address Assignment                                | 37.1500 – 37.1575  | \$219   |
| <b><i>Other Code Standards and Procedures</i></b> |  |   |
|   | 33.2600 – 33.2690 [Exclusive Farm Use], MCC Chapter 37 [Administration and Procedures].  |   |

## APPLICATION SUBMITTAL

Multnomah County Land Use Planning Office will not accept an application that is lacking fundamental components. The planner on counter duty will briefly review materials submitted using the checklist below to determine if the fundamental components have been submitted. This cursory review is not a completeness review, which will be conducted within 30-days of application submittal. Applications must comply with both the general submittal requirements of Chapter 37, and the specific submittal requires indicated for each type of permit review. **Please**



**note the following information will also be helpful in determining compliance with the approval criteria:**

1. The application materials include all details about the phases of development. For instance – whether phase I will include bathrooms and parking, and whether later phases will include trail development – This will be useful in considering the overall master plan.
2. It will be useful if your application will show generally, which areas are generally considered conservation / restoration areas versus those areas that may see future trails, parking and related facilities.
3. Some of the future trails are intended to connect with regional trail systems. Staff recognizes there is uncertainty regarding specific alignments of offsite portions of future trail systems; however, it will be useful to understand how trail systems will function in the larger context of regional trail systems.

| <b>Application Checklist</b> |  | <b>Required</b> | <b>Included</b> |
|------------------------------|--|-----------------|-----------------|
| 1.                           | <b>Completed Application Form:</b> signed by the all property owners and the applicant along with the required fee(s).   | <b>X</b>        |                 |
| 2.                           | <b>Narrative:</b> Written narrative providing a clear and complete description of your proposal and specifically addressing each applicable code section. List the code reference you are responding to in your narrative and your response to that criterion. Applicable criteria you must address in your narrative are previously listed in these notes. Reference in your narrative any supporting documents you are attaching (including required site map) to demonstrate how your proposal meets a particular code criterion.<br><input type="checkbox"/> Significant Environmental Concern for Wildlife Habitat Worksheet<br><input type="checkbox"/> Significant Environmental Concern for Scenic View Worksheet<br><input type="checkbox"/> Hillside Development Worksheet (may include HDP Form 1)<br><input type="checkbox"/> Commercial Forest Use Type I Worksheet | <b>X</b>        |                 |
| 3.                           | <b>Scaled Site Plans:</b> see Site Plan Checklist for items needed on the site plan  | <b>X</b>        |                 |
| 4.                           | <b>Certification of On-Site Sewage Disposal Form</b> and site plan signed by the Sanitarian (green form).  | <b>X</b>        |                 |
| 5.                           | <b>Fire District Review Form</b>   | <b>X</b>        |                 |
| 6.                           | <b>Certification of Water Service form</b>   | <b>X</b>        |                 |
| 7.                           | <b>Sheriff's Office Review</b>   | <b>X</b>        |                 |
| 8.                           | <b>School District Review Form</b>   |                 |                 |
| 9.                           | <b>Storm Water Disposal Form:</b> completed by a Oregon Registered Professional Engineer   | <b>X</b>        |                 |
| 10                           | <b>Lot of Record status:</b> Submit copy of current deed for the properties & first deed that described the subject property in its current configuration.   | <b>X</b>        |                 |
| 11.                          | <b>Habitable Dwelling:</b> Please provide recent photographs of the existing dwelling showing exterior walls and roof, indoor plumbing consisting of a kitchen sink, toilet and bathing facilities, septic tank lid, interior lights (turned on), and heating system.  |                 |                 |
| 12.                          | <b>Grading and Erosion Control Permit</b>  | <b>X</b>        |                 |
| 11.                          | <b>Flood Development Permit</b> – <input type="checkbox"/> One & Two Family Dwelling <input type="checkbox"/> other uses   | <b>X</b>        |                 |
| 14.                          | <b>Traffic Study</b>   | <b>X</b>        |                 |
| 15.                          | <b>Transportation Certification Form.</b> Please contact Jessica Berry at 503.988.3897   | <b>X</b>        |                 |



## **APPLICATION COMPLETENESS**

Once an application is submitted, it will be assigned to a planner. The planner has 30 days, by state law, to determine whether the application is complete. If an application is incomplete, the applicant has 180 days by state law to submit the requested additional information to make the application complete. If your application is found to be incomplete, we request that you submit the required additional information in one packet.

## **ADDITIONAL ASSISTANCE**

Please contact Kevin Cook, Senior Planner at (503) 988-0188 with any questions. Scheduling an appointment is necessary to see your case planner. In the event your case planner is unavailable, the planner on duty can also help answer questions at 503.988.3043. Hours for the planner on duty are Tuesday – Friday, 8:00 AM – 4:00 PM, except holidays. Please note that a building permit plan check fee and erosion control inspection fee may be required at building plan signoff after the conclusion of the land use review process. These fees do not need to be paid at the time of land use application submittal.

## **Issues Discussed at Pre-Application Meeting 3/30/2017**

The following summarizes issues raised at the Pre-application meeting and are not meant to be a detailed summary or transcript:

- There is a concern that wildlife travel and migration corridors have not been fully investigated. Some believe there need to be more detailed environmental study prior to finalizing both the extent and location of proposed trails. Many local residents are eager to share their own observations and knowledge of local wildlife.
- Concerns about erosion potential associated with building, using, and maintaining trails.
- Similar to the above concern over water quality and silt (turbidity). Climate change may further contribute to run-off and turbidity concerns.
- Concerns about impacts to the local road system including more cars and bikes.
- Concerns about red-legged frog migrating through the Burlington forest unit. Is there enough area set aside to accommodate frog migration?
- Concerns that about unlawful camping.
- Concerns that parking may be undersized for the demand and may lead to unlawful overflow parking onto the right of way.
- What is the anticipated number of visitors throughout the year? What about long-term projections?



- Differing opinions regarding the number of trails as well as whether there would be conflicts between types of trail users – pedestrian, bike, equestrian etc.
- Comments about the mountain bike facilities both pro and con with respect to overall availability near the Portland metro region and concerns about conflicts among trail users.
- Concerns regarding existing unimproved rights of way that may have different impacts in the future.
- Comments that some trails could provide connectivity to regional trail systems.



# EXHIBIT 10

## NATURAL RESOURCES



### West Multnomah County Riparian Areas

-  SEC Streams
-  Inventoried Riparian Wildlife Habitat Areas (Metro)
-  Fish Habitat (ODFW and StreamNet)
-  Subareas
-  County Boundaries

0 0.5 1 2 Miles

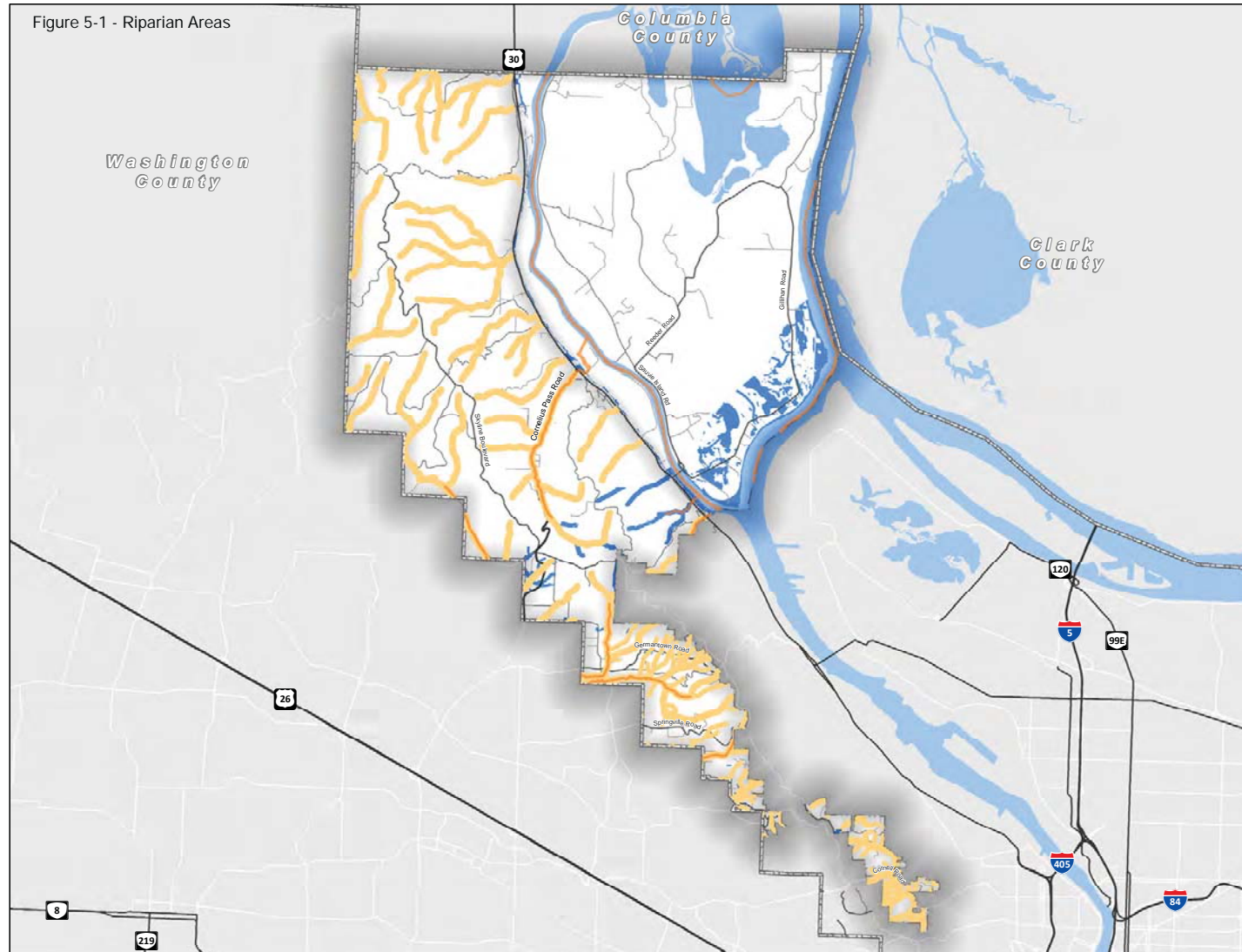


Prepared By:  
SWCA

Date:  
6/23/2016

Coordinate System:  
NAD 1983 HARN State Plane Oregon North FIPS 3601

Disclaimer:  
Unofficial depiction, for illustrative purposes only.





# EXHIBIT 11

## NATURAL HAZARDS



### West Multnomah County Steep Slopes

Historical Landslides

#### Steep Slopes

Slopes 20-25%

Slopes >25%

Subareas

County Boundaries

0 0.5 1 2 Miles



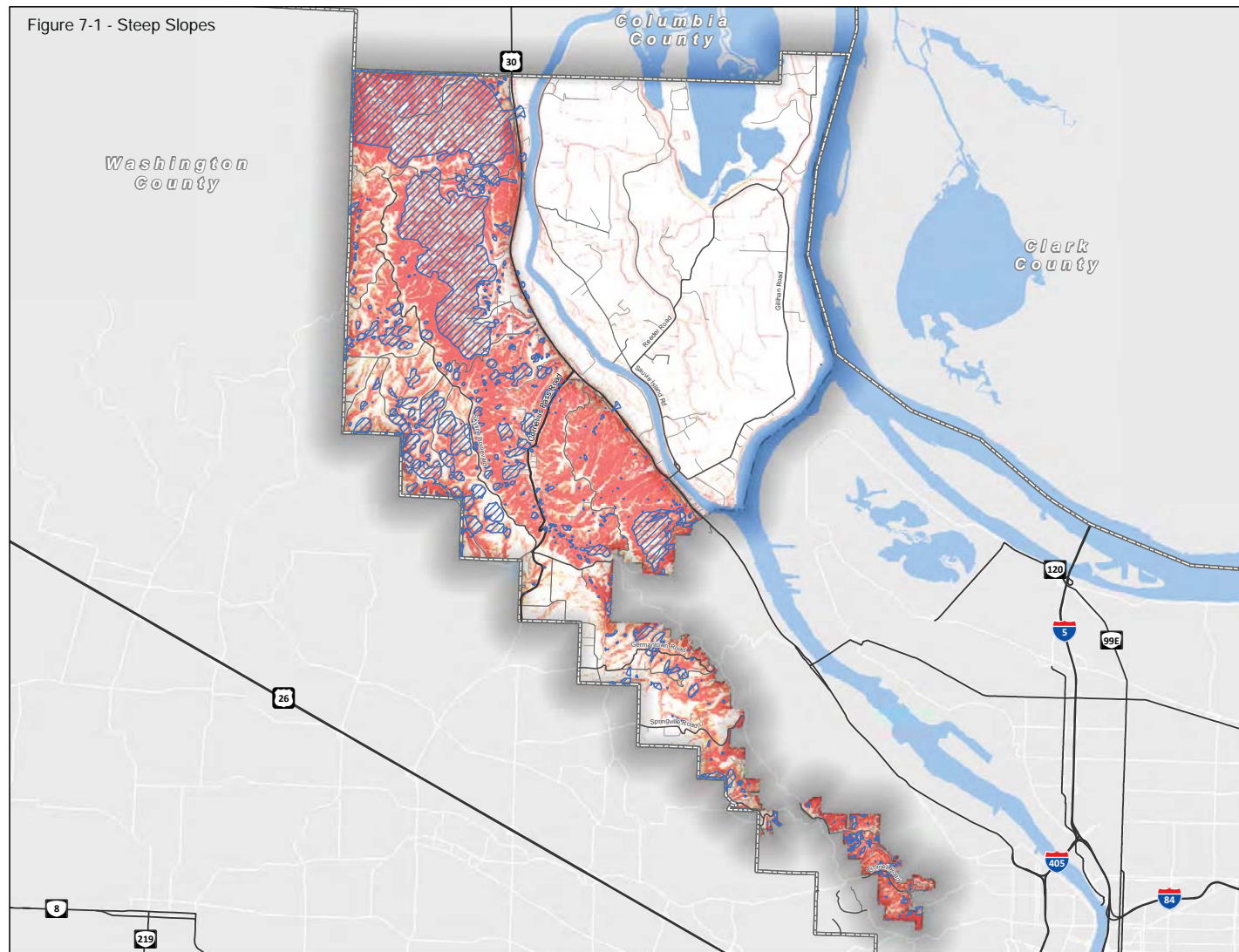
Prepared By:  
GeoEngineers and APG

Date:  
6/23/2016

Coordinate System:  
NAD 1983 HARN State Plane Oregon North FIPS 3601

Disclaimer:  
Unofficial depiction, for illustrative purposes only.

Figure 7-1 - Steep Slopes





# EXHIBIT 12

## NATURAL HAZARDS



### West Multnomah County Flood Hazards

#### FEMA Flood Hazard Zone

- A - 1% annual chance by approximate methods
- AE - 1% annual chance by detailed methods
- AH - 1% annual chance shallow flooding (ponding)

Subareas

County Boundaries

0 0.5 1 2 Miles



Prepared By:  
GeoEngineers and APG

Date:  
6/23/2016

Coordinate System:  
NAD 1983 HARN State Plane Oregon North FIPS 3601

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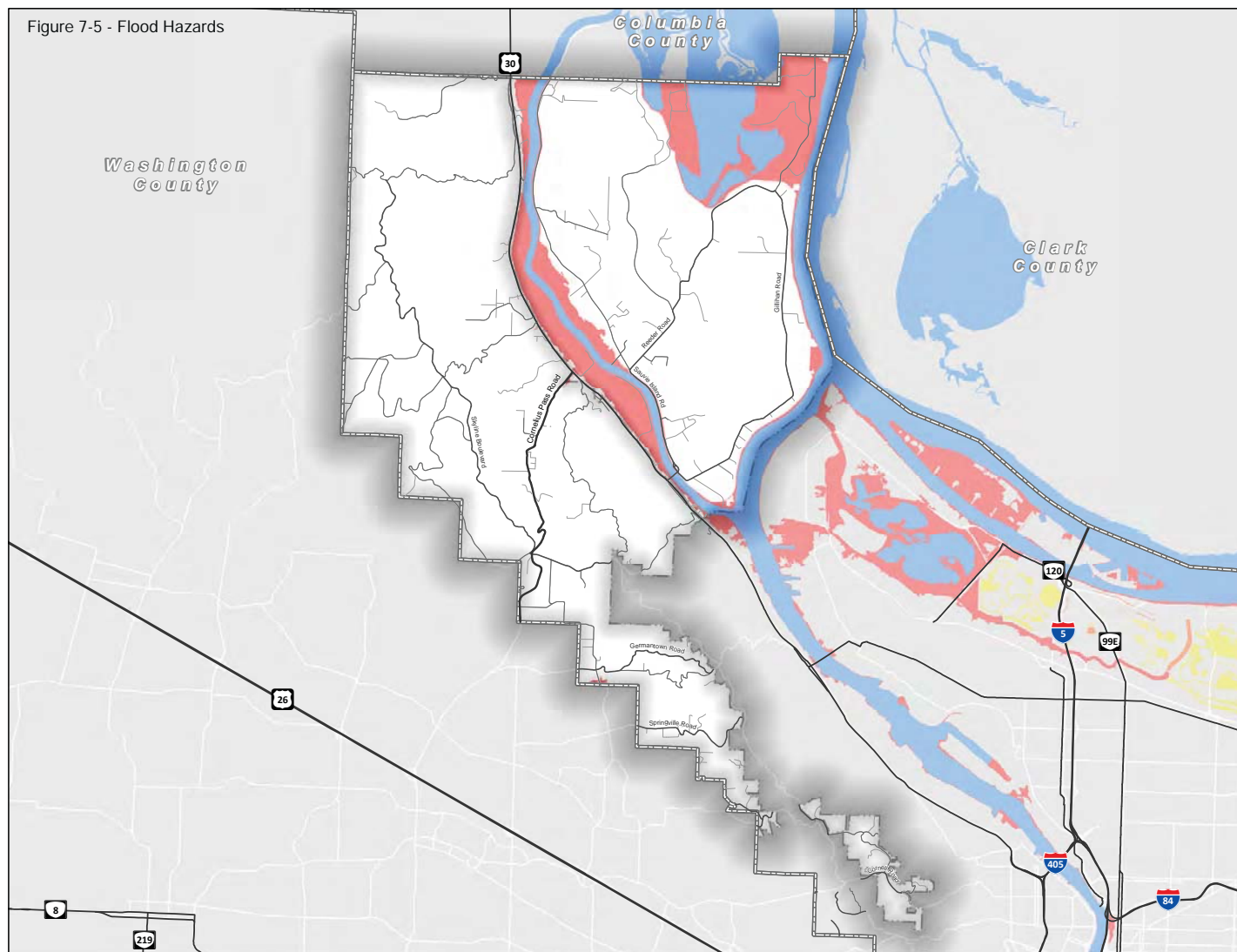


Figure 7-5 - Flood Hazards



# EXHIBIT 13

## PARKS AND RECREATION



### Multnomah County Comprehensive Plan

#### West Multnomah County Parks and Open Space

- Parks and/or Natural Areas
- Cemeteries
- Golf Courses
- Subareas
- County Boundaries

0 0.5 1 2 Miles



Prepared By: Angelo Planning Group  
Date: 6/23/2016

Coordinate System:  
NAD 1983 HARN State Plane Oregon North FIPS 3601

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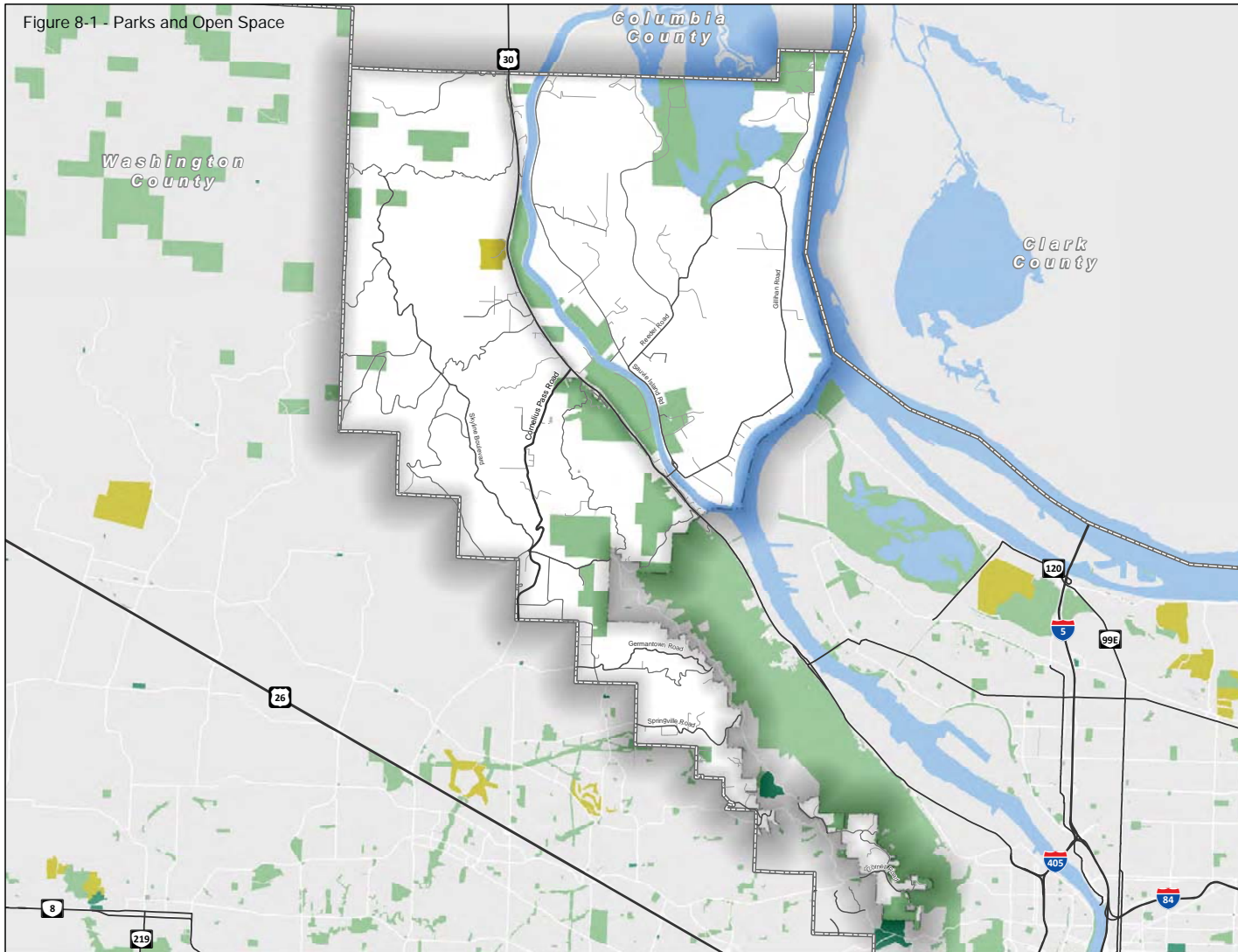
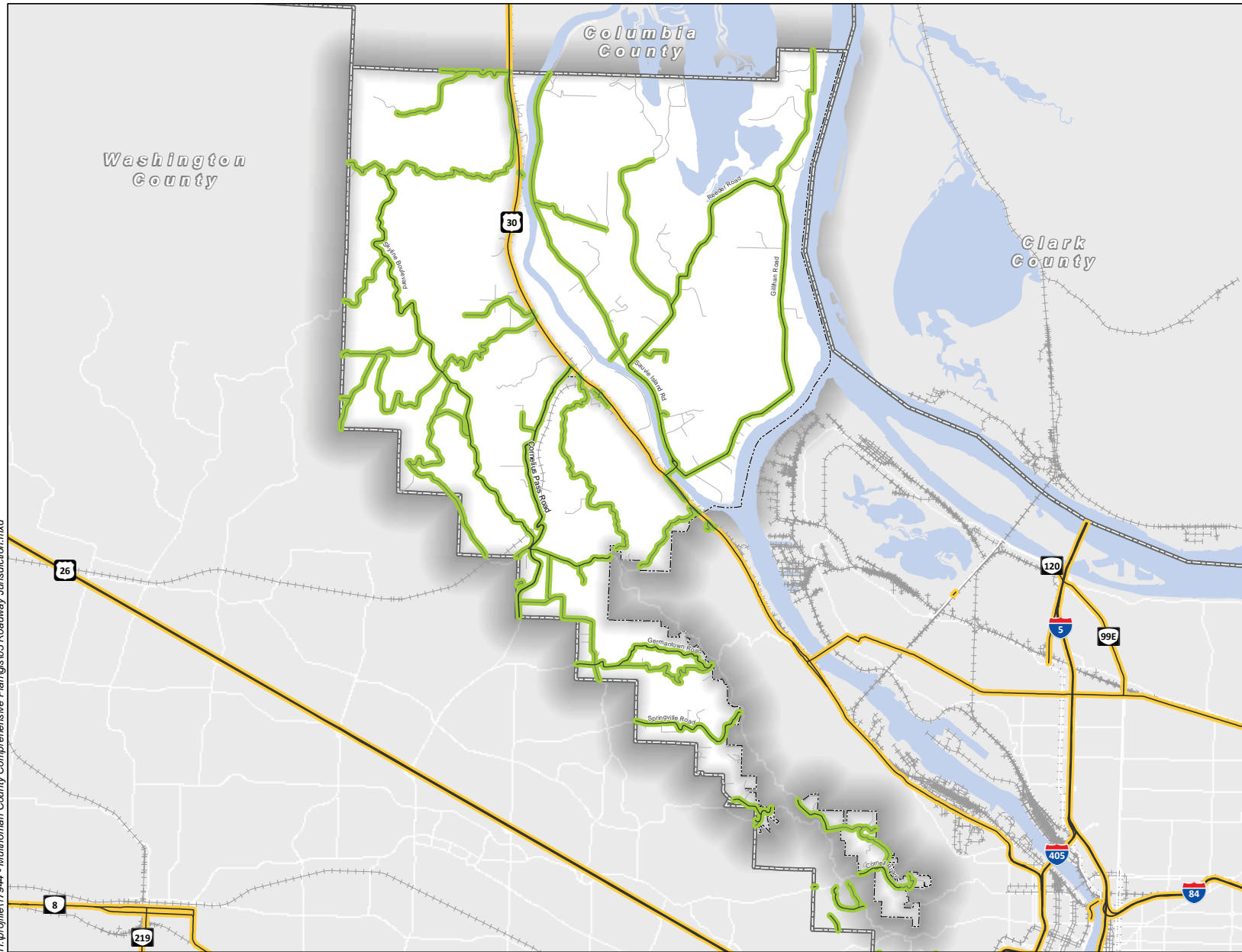


Figure 8-1 - Parks and Open Space

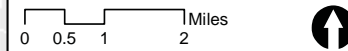




**Figure 3A**  
Roadway Jurisdiction



- Multnomah County Roadways
- ODOT Roadways
- Local Roads (not maintained by county)
- Plan Areas
- County Boundaries



Prepared By: Kattelison & Associates, Inc. Date: 5/16/2016

Coordinate System:  
NAD 1983 HARN State Plane Oregon North FIPS 3601

Disclaimer:  
This map is intended for informational purposes only. While this map represents the best data available at the time of publication, Multnomah County makes no claims, representations, or warranties as to its accuracy or completeness. Metadata available upon request.

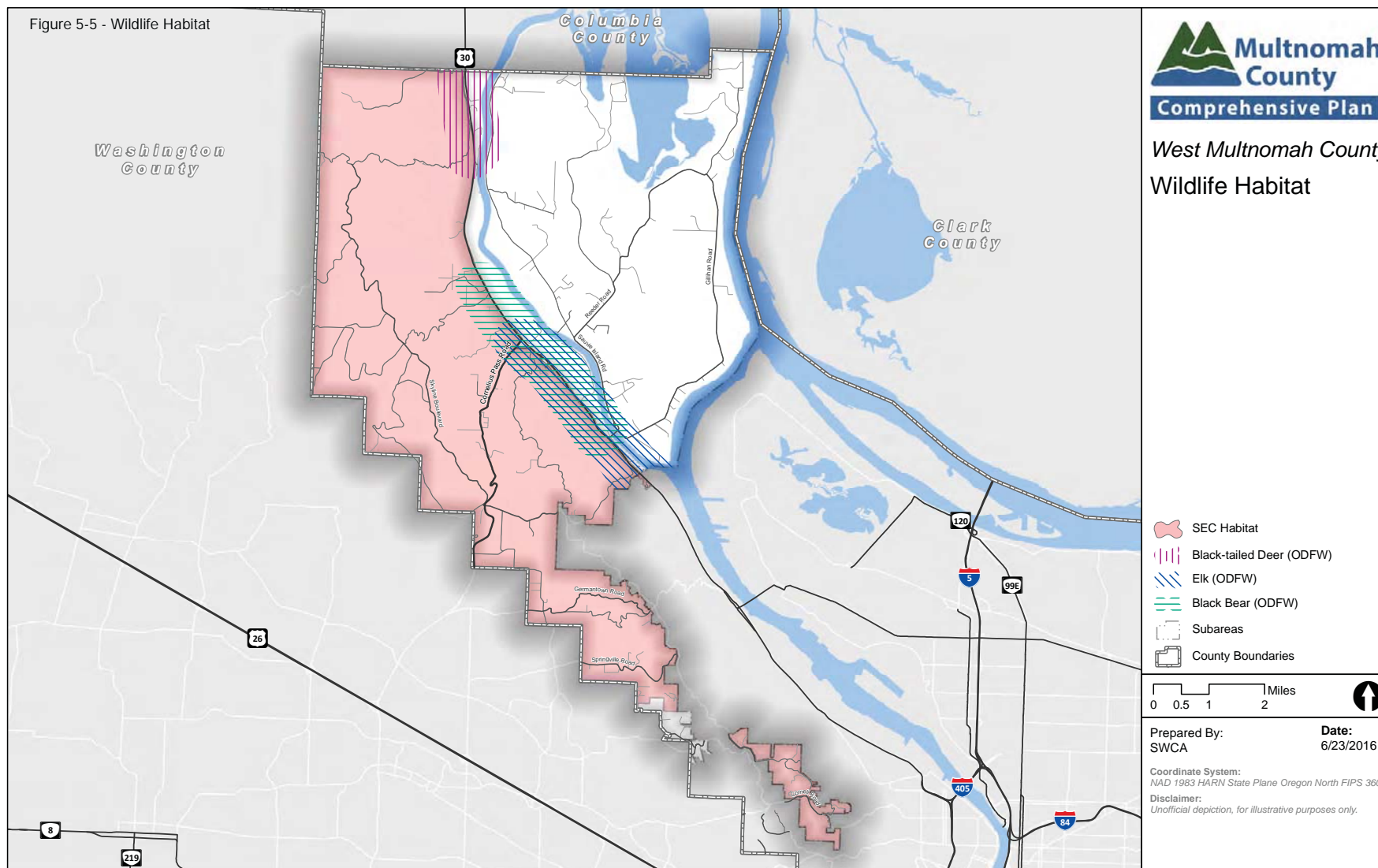


# EXHIBIT 15

## NATURAL RESOURCES



### West Multnomah County Wildlife Habitat





# EXHIBIT 16

## NATURAL RESOURCES



### West Multnomah County Scenic Areas

- SEC Scenic View
- Subareas
- County Boundaries

0 0.5 1 2 Miles



Prepared By:  
Angelo Planning Group

Date:  
7/1/2016

Coordinate System:  
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Disclaimer:  
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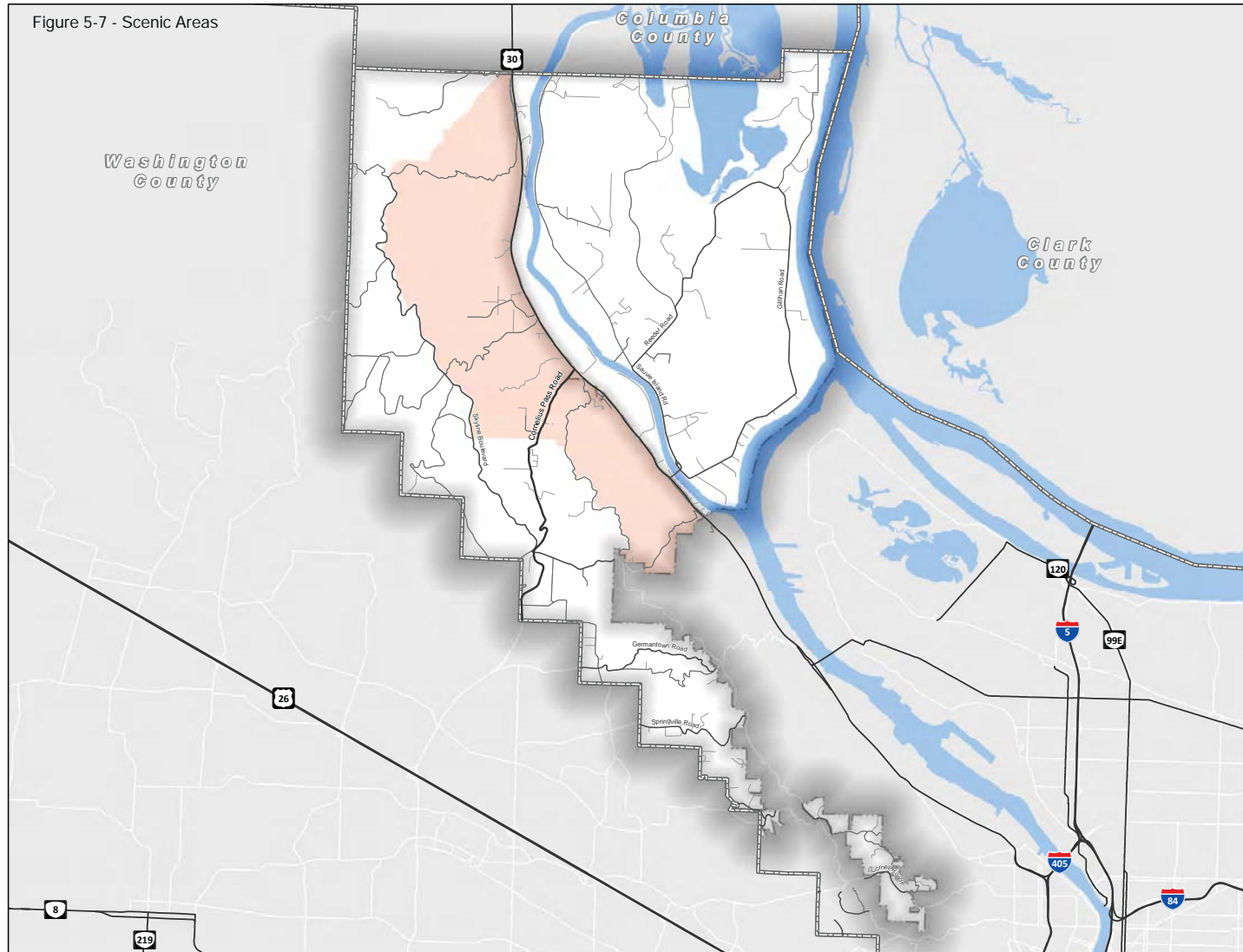


Figure 5-7 - Scenic Areas



