Tualatin Basin Quantitative Wildfire Risk Assessment and Recommendations

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QUANTITATIVE WILDFIRE RISK ASSESSMENT

OVERVIEW

PURPOSE OF THE ASSESSMENT

The purpose of the Tualatin Basin Wildfire Risk Assessment (TBRA) is to provide actionable information about wildfire hazard and risk to highly valued resources and assets within the Tualatin River Basin. Specifically, the Joint Water Commission (JWC), one of the primary drinking water suppliers in the Tualatin River basin, situated within Washington County, Oregon, along with the Tualatin Soil and Water Conservation District (Tualatin SWCD), Clean Water Services (CWS), the Tualatin River Watershed Council (TRWC), and other partners are seeking to assess risk to surface drinking water and water delivery infrastructure. This risk assessment is the first of a two-part project; first, to assess wildfire risk within the 146,000-acre drinking water source area (DWSA), then to use those results to inform a pre-wildfire preparedness and mitigation plan. A wildfire risk assessment is a quantitative analysis of the assets and resources across a specific landscape and how they are potentially impacted by wildfire. The TBRA considers several different components, each resolved spatially across the study area, including:

- likelihood of a fire burning,
- the intensity of a fire if one should occur,
- the exposure of assets and resources based on their locations, and
- the susceptibility of those assets and resources to wildfire.

Assets are human-made features, such as commercial structures, critical facilities, housing, etc., that have a specific importance or value. Resources are natural features, such as wildlife habitat, federally threatened and endangered plant or animal species, etc. These also have a specific importance or value.

Generally, the term "values at risk" has previously been used to describe both assets and resources. For the TBRA, the term Highly Valued Resources and Assets (HVRA) is used to describe what has previously been labeled values at risk. There are two reasons for this change in terminology. First, resources and assets are not themselves "values" in any way that term is conventionally defined—they have value (importance). Second, while resources and assets may be exposed to wildfire, they are not necessarily "at risk"—that is the purpose of the assessment.

To manage and prepare for wildfires in the Tualatin River basin, it is essential that accurate wildfire risk data, to the greatest degree possible, is available to drive preparedness and mitigation strategies. These risk outputs can be used to drive the planning, prioritization, and implementation of specific activities, such as mechanical fuel treatments, retrofitting existing infrastructure to be more fire resilient, and where to engage partners and neighbors in larger multi-ownership cross boundary projects. In addition, the risk data can be used to support fire operations in response to wildfire incidents by identifying those assets and resources most susceptible to fire or suppression actions. For example, an incident management team (IMT) managing a nearby wildfire could use location information for vulnerable buildings, above-ground elements of water transmission lines (e.g. intakes, control valves), or chlorine storage. This could also aid in decision making for prioritizing and positioning of firefighting resources.

Past risk assessments covering the Tualatin River basin have been broad in scope, using historical fire occurrence and weather as a guide, like the Pacific Northwest Quantitative Wildfire Risk Assessment (PNRA, 2018). This assessment will focus, instead, on a worst-case, low probability/high consequence outcome. Because of the way burn probability is applied on a relative scale across a large landscape in the PNRA, more site-specific granular data was missing for the Tualatin River Basin, an area of low wildfire risk, relative to the rest of Washington and Oregon.

By focusing on a single weather scenario for a single long (12-hour) burn period we are able to use the new QWRA module recently added to the Interagency Fuels Treatment Decision Support System (IFTDSS). 12 hours is the maximum time interval allowed in the IFTDSS burn probability model. It stands as a surrogate for the 2-3 day wind events witnessed during the 2020 fire season in Oregon. This web-based application was designed to make fuels treatment planning and analysis more efficient and effective. This platform provides access to data and models through one simple user interface and is available to all interested users, regardless of agency or organizational affiliation. IFTDSS was started as a Joint Fire Science project in the mid-2000s to assist fuels specialists and fire managers to optimize fuel treatments using best available science (Drury, et. al. 2016)

LANDSCAPE ZONES

The overall Analysis Area (AA) for the TBRA was defined by merging the Tualatin River watershed, the JWC Drinking Water Source Area (DWSA), and the Washington County boundary. All subsequent project boundaries (discussed below) were built from this initial extent. The TBRA AA is 516,620 acres in size and encompasses six incorporated communities larger than 25,000 in population according to the 2021 census: Hillsboro (110,982), Beaverton (99,561), Tigard (57,238), Aloha (54,287), and Tualatin (28,287), and Forest Grove (26,835). These communities lie just west of the Portland Metro Area and include several other suburban communities bringing the entire population of the AA to over a half million people.

To ensure valid Burn Probability (BP) it is necessary to allow the burn model to start fires outside of the AA and burn into it and allow fires near the edge to burn unhindered. This larger area where simulated fires are started is called the Fire Occurrence Area (FOA). We established the FOA extent as a 1-mile buffer on the AA and DWSA analyses. This buffer allows fires starting within the FOA to grow unhindered by the edge of the fuelscape. The buffer also provides a sufficient area to ensure that all fires that could reach the AA are simulated, though many burn out of the AA to the west, due to the high east wind scenario. The TBRA Fire Occurrence Area covers roughly 619,860 acres characterized by diverse topographic and vegetation conditions. To model this large area where fuels and topography are highly variable, we divided the overall AA FOA into eleven smaller FOAs, including the DWSA itself and the ten key HUC 12 level watersheds that make up the DWSA. Only a quarter-mile buffer was used for the individual DWSA HUC-12 watershed FOAs. A map of the AA and ten DWSA watershed extents are presented in Figure 1.

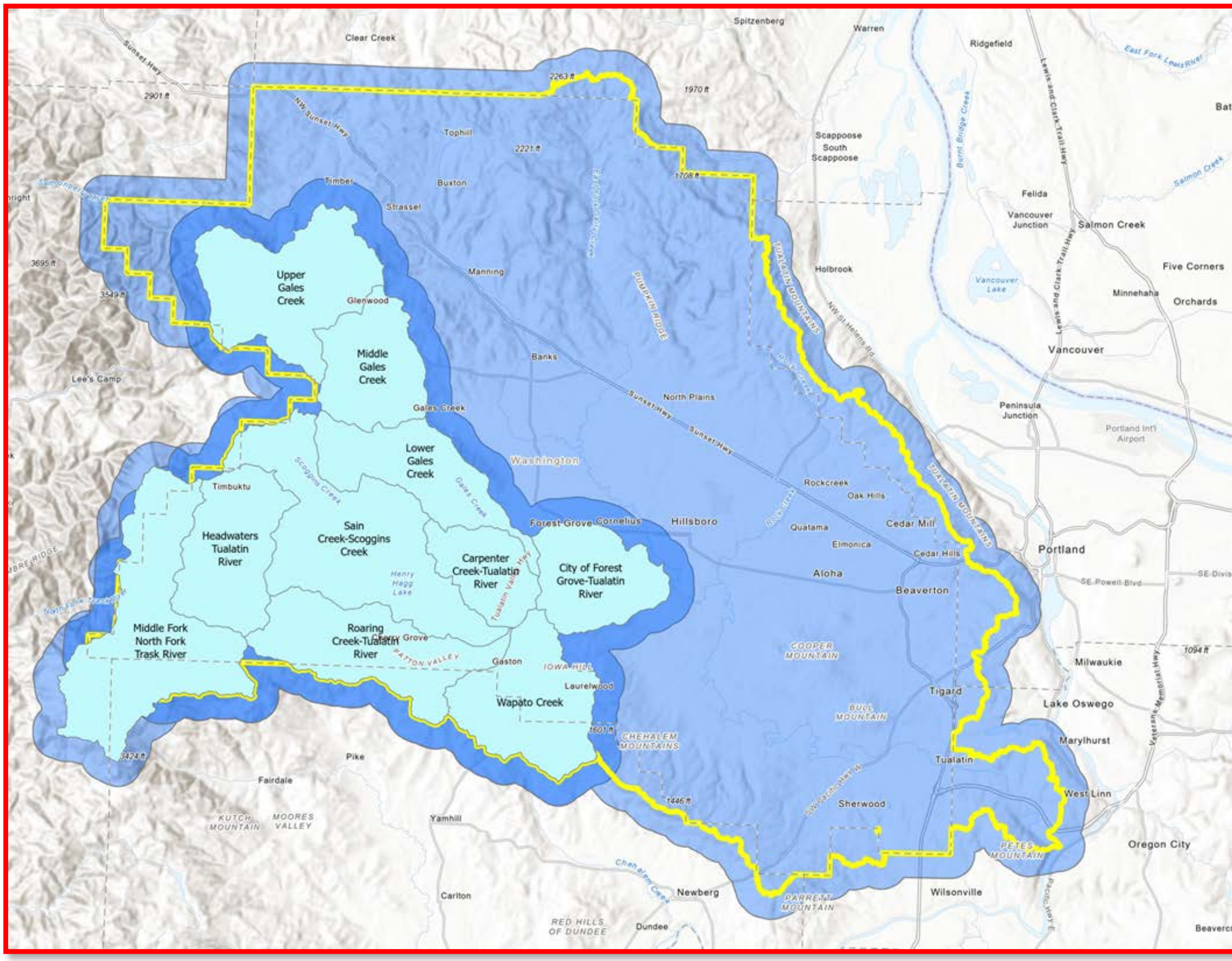


Figure 1. Overview of FOAs used for the TBRA. The project produces burn probability results within the AA and a one-mile buffer at 90m resolution, within the DWSA and a one-mile buffer at 60m, and with a 1/4-mile buffer for each HUC12 DWSA watershed.

QUANTITATIVE RISK MODELING FRAMEWORK

The basis for a quantitative framework for assessing wildfire risk to highly valued resources and assets (HVRAs) has been established for many years (Finney, 2005; Scott, 2006). The framework has been implemented across a variety of scales, from the continental United States (Calkin et al., 2010), to individual states (Buckley et al., 2014), to a portion of a national forest (Thompson et al., 2013b), to an individual county. In this framework, wildfire risk is a function of two main factors: 1) wildfire hazard and 2) HVRA vulnerability (Figure 2).

Wildfire hazard is a physical situation with potential for causing damage to vulnerable resources or assets. Quantitatively, wildfire hazard is measured by two main factors: 1) burn probability (or likelihood or burning), and; 2) fire intensity (measured as flame length, fireline intensity, or other similar measure).

For this analysis, we used FlamMap Minimum Travel Time (MTT) algorithms (Finney 2002) within IFTDSS to quantify wildfire potential across the aa at a pixel size of 90 m (approximately 2 acres per pixel). We will also analyze the entire DWSA at 60m (approximately 0.9 acres/pixel), as well as each of the ten DWSA watersheds at 30m (approximately ¼ acre per pixel) resolution, the finest resolution available from LANDFIRE.

IFTDSS landscape burn probability (LBP) calculates burn probability and conditional flame length for a fixed set of weather conditions for a single burn period. The Large Fire Simulation Model (FSim, Finney and others 2011) used in many national, regional, and unit level assessments, calculates results based on variable weather inputs for fires burning multiple days throughout an entire fire season.

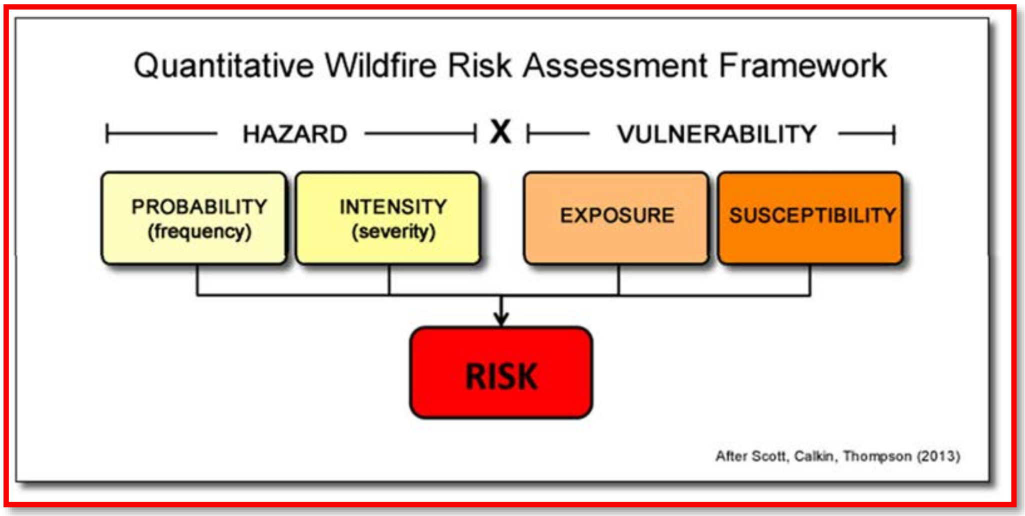


Figure 2. The components of the Quantitative Wildfire Risk Assessment Framework used for the TBRA.

HVRA vulnerability is also composed of two factors: 1) exposure and 2) susceptibility. Exposure is the placement (or coincidental location) of an HVRA in a hazardous environment—for example, building a home within a flammable landscape. Some HVRAs, like critical wildlife habitat or endangered plants, are not movable; they are not "placed" in hazardous locations. Still, their exposure to wildfire is the wildfire hazard where the habitat exists. Finally, the susceptibility of an HVRA to wildfire is how easily it is damaged by wildfire of different types and intensities. Some assets are fire-hardened and can withstand very intense fires without damage, whereas others are easily damaged by even low-intensity fire.

ANALYSIS METHODS and INPUT DATA

The IFTDSS FlamMap module was used to quantify wildfire hazard across the AA at a pixel size of 90m. The IFTDSS LBP module simulates burn probability potentials across a user-defined landscape using the MTT algorithms run numerous times across the landscape of interest (Finney 2002). Burn probability is produced by simulating a number of randomly located ignitions within the area of interest and recording the number of pixels that burn for each ignition. The probability that a pixel is burned, given a random ignition within the landscape, is calculated by dividing the number of times an individual pixel burns by the number of random ignitions. IFTDSS optimizes by generating enough random ignitions to burn every burnable pixel, at least once.

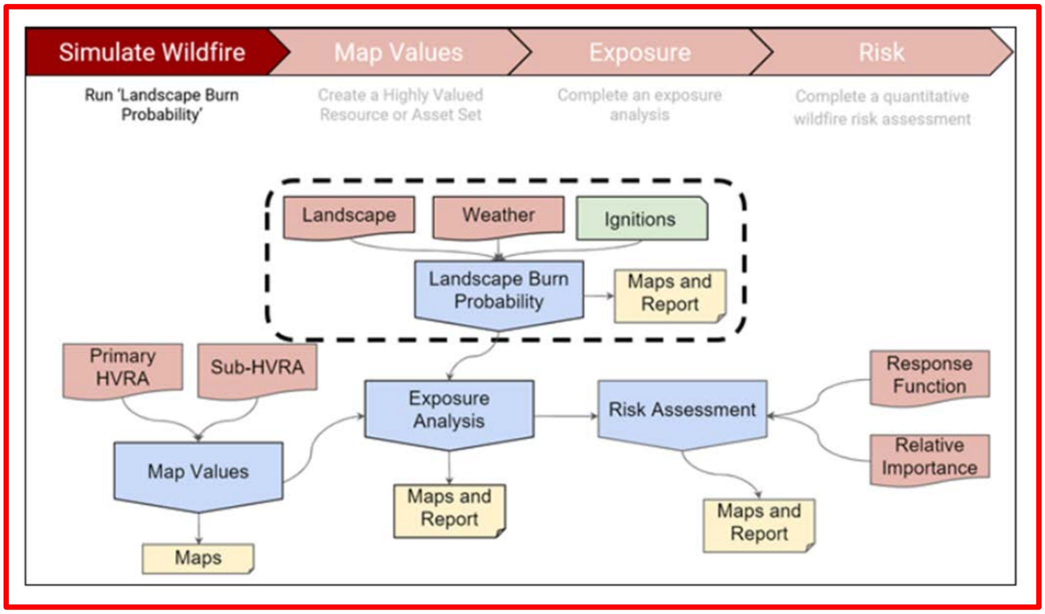


Figure 3. IFTDSS model process showing LBP as the first step in developing a risk assessment.

FUELSCAPE

A fuelscape is a quantitative raster representation of the fuels and topography of a landscape. The fuelscape must cover the entire FOA. The fuelscape consists of geospatial datasets representing surface fuel model (FM40), canopy cover (CC), canopy height (CH), canopy bulk density (CBD), canopy base height (CBH), and topography characteristics (slope, aspect, elevation). These datasets can be combined into a single landscape (LCP) file and used as a fuelscape input in fire modeling programs.

Our vegetation and disturbance inputs for the TBRA were derived from the newly released LANDFIRE Remap 2016 (LF2016) 30-m raster data. This new release had significant changes from previous versions of LANDFIRE, including the use of new imagery and continuous vegetation cover and height classifications .

To accurately estimate a landscape's fire behavior and appropriately assign a surface fuel model, we need an informed estimation of the surface fuel load and potential ladder fuels. To obtain this, we must know the current site characteristics for undisturbed areas and the pre-disturbance site characteristics for disturbed areas. LF2016 determined these site characteristics using newly remotely sensed imagery to model non-disturbed areas and relied on previous vintages of LANDFIRE for disturbed areas.

LF2016 canopy fuels datasets (CC, CH, CBH and CBD) are created in conjunction with surface fuels. The inputs used to generate canopy datasets include vegetation type, vegetation cover, and vegetation height. In the default LF2016 process, the vegetation cover and height datasets are binned to appropriate classes and midpoint values are used to calculate canopy fuel characteristics.

The resulting fuelscape by fuel model is shown in Figure 3. Of note is the high percentage of non-burnable coverage within the FOA. Over 150,000 acres or 17% of the landscape is coded as either urban (light grey) or agriculture maintained in an "unburnable state" (dark grey).

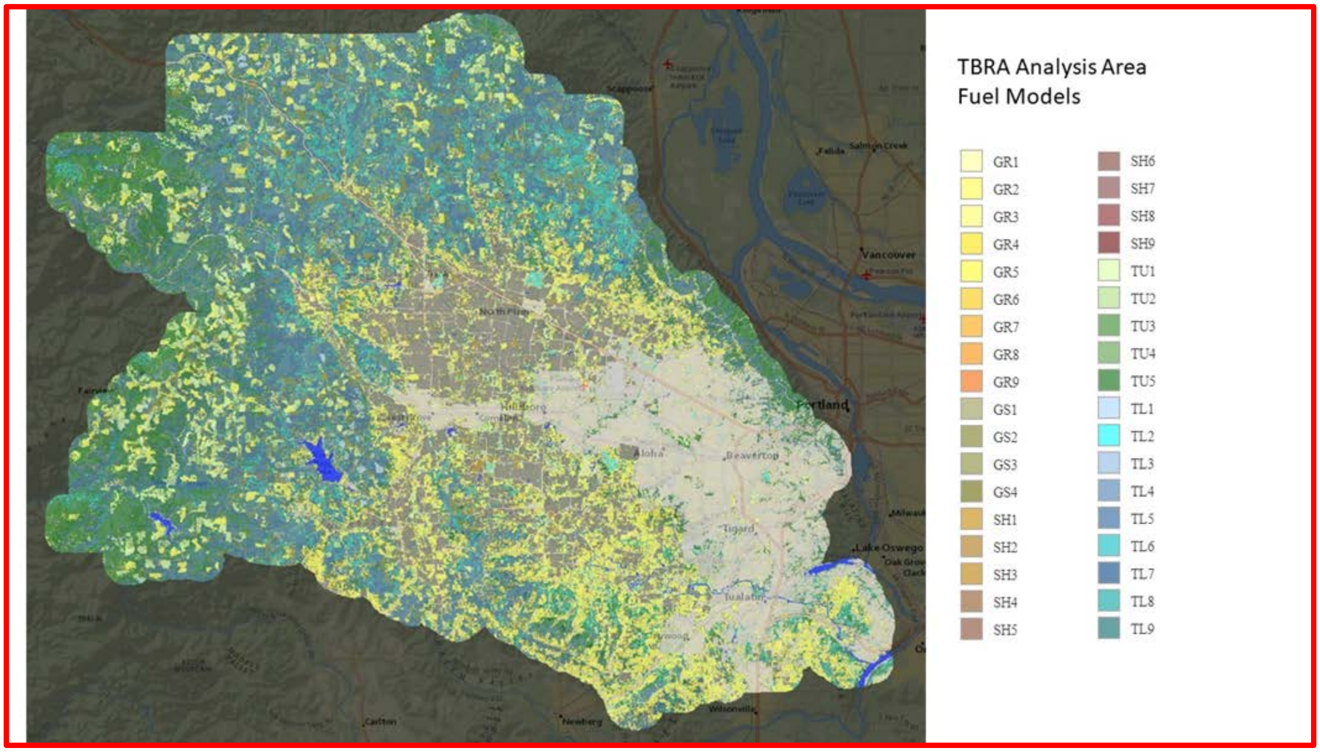


Figure 4. Map of fuel models across the TBRA analysis area. GR represents a grass models, GS/SH represent shrub models, and TU/TL are timber models

The fuelscape was edited both to mitigate underprediction of crown fire potential inherent in the native LF 2016 fuelscape, where canopy base height values were too high to produce crown fire behavior under any modeled weather conditions, and to prevent overprediction of crown fire, specifically in the Timber-understory (TU5) fuel model. We evaluated the most commonly occurring combinations of existing vegetation type (EVT), fuel model, and canopy base height (CBH) within the AA to determine where edits were needed to accurately reflect fire behavior potential. Our edits mimic those developed by Regional Fire and Fuels personnel at the fuels review workshop that took place November 2-3, 2016 in Portland, OR, for the 2018 PNRA. A summary of the edits made is outlined in Table 1.

Since there were no large fire occurrences between 2017 and 2021 within the AA, no fuelscape edits for fire disturbances were necessary in the LF2016 data. Potential edits to include disturbances like recent timber harvest and burnable crop lands should continue to be evaluated.

Order	Mask	Applied Landscape Edit Rule
1	bigsquare_erase	Change (Fuel Model set to 99)
2		Where (Fuel Model is equal to 162) change (Canopy Base Height multiply by 0.5 AND Fuel Model set to 161)
3		Where (Canopy Base Height is greater than 2 meters AND Fuel Model is equal to 165) change (Canopy Base Height multiply by 0.33)
4		Where (Fuel Model is equal to 165) change (Fuel Model set to 161)
5		Where (Canopy Base Height is less than or equal to 4 meters AND Fuel Model is equal to 185) change (Canopy Base Height multiply by 0.5)
6		Where (Canopy Base Height is greater than 2 meters AND Fuel Model is equal to 185) change (Canopy Base Height set to 2 meters)
7		Where (Fuel Model is equal to 102) change (Fuel Model set to 101)

Table 1. Table of applied edits to LANDFIRE landscape files.

HISTORICAL WILDFIRE OCCURRENCE

Historical wildfire occurrence data was not used to develop IFTDSS model inputs, unlike FSim which was used for the PNRA. FSim uses historical occurrence as a guide to where modeled ignitions occur, as well as for model calibration. In that assessment, the Fire Occurrence Area containing the TBRA study area had the least frequent rate of occurrence with an annual average of 0.05 large wildfires per million acres. For the TBRA, instead of attempting to mimic historical burn frequency and distribution, we wished to examine a worst-case scenario in excess of the 99th percentile, in an attempt to simulate a strong east wind event with dry, receptive fuels. Using random locations IFTDSS uses as many ignitions as necessary to burn every burnable pixel in at least one modeled fire.

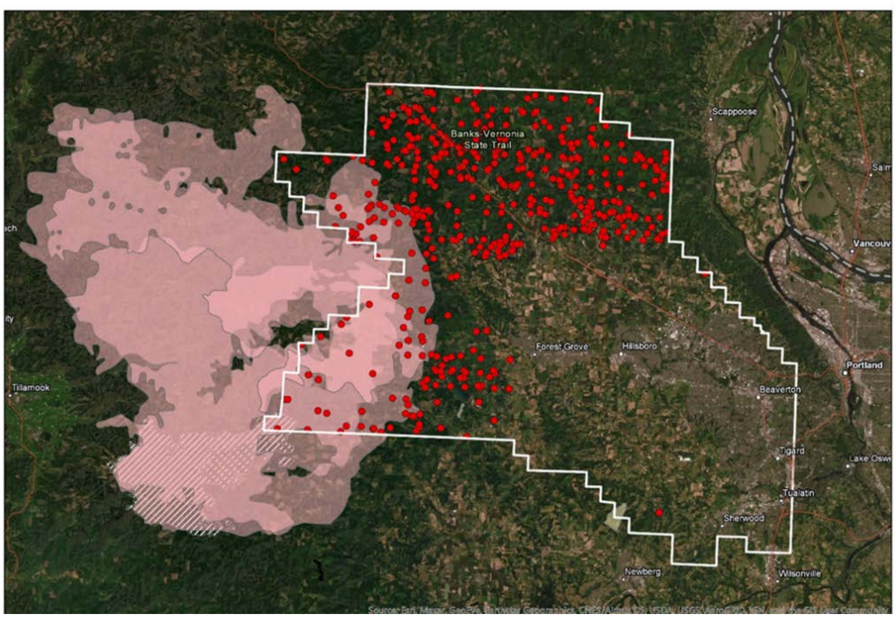


Figure 5. Oregon Dept. of Forestry fire history in Washington County (including fire start points 1961-2020 and perimeter areas 1933-2020).

In 2020 the devastating east wind event in early September caused many ignitions within communities from powerline failures. Using random ignitions in this analysis helps simulate those ignitions in receptive wildland fuels in the urban/suburban core not represented in the historic occurrence shown below (Figure 5) that may offer a flammable pathway through that suburban landscape.

WEATHER SCENARIO

The weather scenario selected for the TBRA reflects the recent events of a prolonged dry east wind that occurred on September 7-9, 2020. This was considered a rare event; however it is instructive for developing a single burn period weather and fuel moisture scenario required by IFTDSS. Furthermore, events such as these may become more common as our climate continues to warm and increase in turbulence. An informal review of Remote Automated Weather Station (RAWS) data for the period revealed a multi-day period of east winds averaging in excess of 30-40 mph. Using a single wind speed and direction allows IFTDSS to develop “gridded” winds using WindNinja (Wagenbrenner, et. al. 2016). This is useful especially at a finer resolution, as these gridded winds use topographic features to vary speed and channel winds used in the fire behavior modeling.

> *Timelag:* Time needed under specified conditions for a fuel particle to lose about 63 percent of the difference between its initial moisture content and its equilibrium moisture content. If conditions remain unchanged, a fuel will reach 95 percent of its equilibrium moisture content after 4 timelag periods.
>
> *Fuel Moisture Content*: The quantity of moisture in fuel expressed as a percentage of the weight when thoroughly dried at 212 degrees F.

For the TBRA 50 mph east winds were used with live and dead fuel moistures exceeding the 97% percentile values for the area (the threshold considered to represent *extreme* fire danger). The following initial dead (three timelag size classes) and live fuel moistures were applied to all fuel models:

1-hr (0-1/4” diameter) Fuel Moisture: 3%
10-hr (1/4-1” diameter) Fuel Moisture 4%
100-hr (1-3” diameter) Fuel Moisture 5%
Live Herbaceous FM: 30% (min – fully cured)
Live Woody FM: 60% (also used for foliar moisture input with the Scott/Reinhardt crown fire potential calculation method).

Fire behavior modeling systems all utilize fuel moistures in their calculations. Fuel moisture input values are of critical importance as the model outputs are sensitive to them. Conditioning can be used as a way to “correct” or “adjust” initial dead fuel moisture values to capture variation in local site conditions before a model run. This can be especially important for landscapes with a lot of topographic or canopy variation resulting in a diversity of fine fuel moistures due to slope, aspect, canopy cover, and their subsequent impacts on solar radiation, wind, and precipitation penetration through the canopy. We used the automated IFTDSS conditioning period of 1 – 7 days to alter the universal initial values above.

Conditioning adjusts dead fuel moistures across a landscape based on the factors described above. Elevation impacts on fuel moisture are also applied, taking into account cell or pixel location in relation to RAWS station or weather observation location. Portions of the landscape at higher elevation than the observations may see slightly increased fine fuel moistures whereas portions of the landscape below may adjust to slightly lower fine fuel moistures. Conditioning fuels in IFTDSS is done at the pixel or cell level and each cell is calculated independently. Live fuels are not conditioned. IFTDSS conditions dead fuel moistures using a classified weather stream. Currently, the only classified weather stream available represents near-maximum or "extreme" conditions. Our simulation was assigned the "extreme" Marine Northwest Coast Forest weather stream.

WILDFIRE SIMULATION

IFTDSS was used to develop LBPs, conditional flame lengths and integrated hazard for each FOA. As discussed in the introduction, hazard is a term used by the wildland fire community to define a variety of conditions or situations where damage to assets by fire is being evaluated. Hazard is quantified and categorized in IFTDSS using the LBP model evaluating:

- The probability of a fire occurring at a specific point under a specified set of conditions, and
- The intensity at a specific point given a fire occurs.

Integrated Hazard in IFTDSS combines two important measures —burn probability and conditional flame length—into a single characteristic that can be mapped. Within IFTDSS, the classified values of Burn Probability and Conditional Flame Length (CFL) are used to determine and map Integrated Hazard. Like Burn Probability, Integrated Hazard in IFTDSS is dynamic based on the extent at which it is mapped or reported.

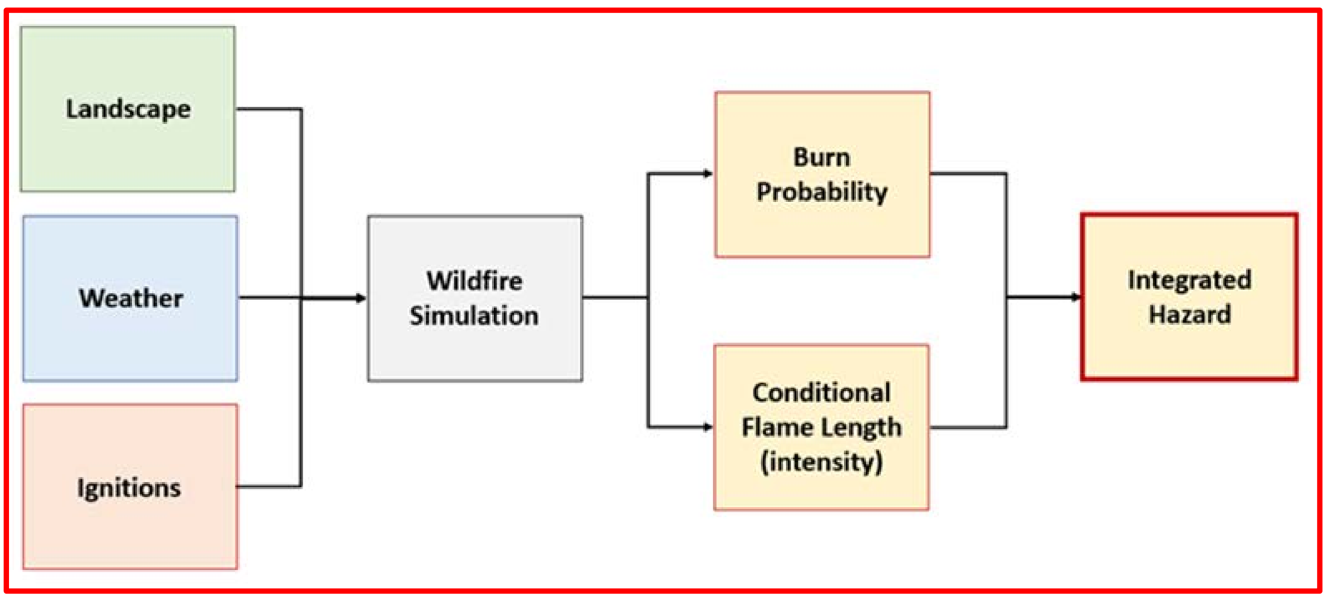


Figure 6. Decision Tree showing IFTDSS pathway to Integrated Hazard.

For each pixel, an Integrated Hazard value is assigned based on the Burn Probability and Conditional Flame Length Class using the following table:

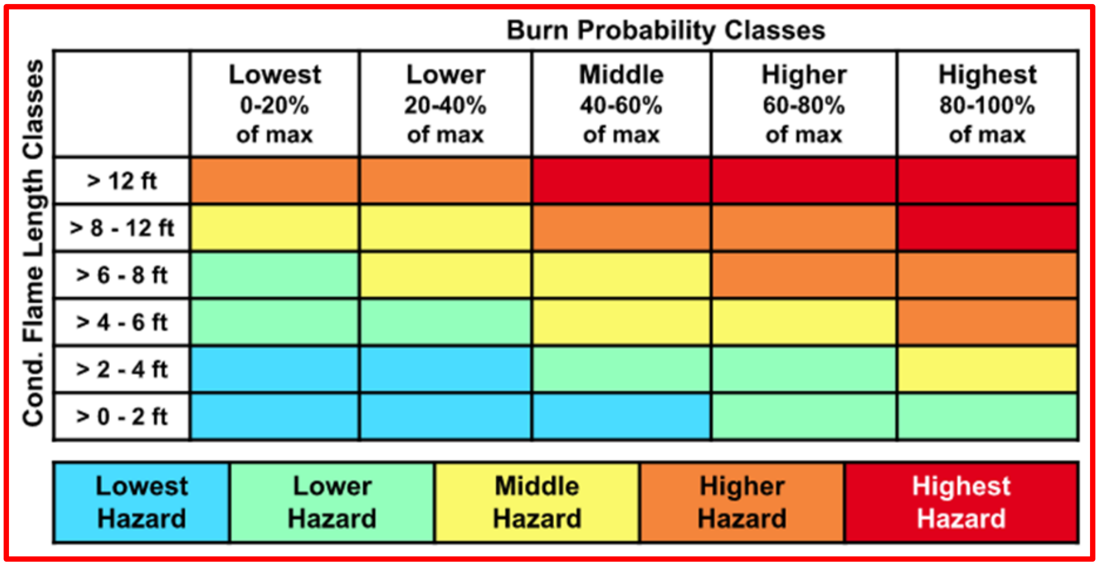


Figure 7. Integrated hazard determination matrix.

For example, a pixel with a burn probability of "Highest", and conditional flame length of >8-12-ft would have an integrated hazard of "Highest".

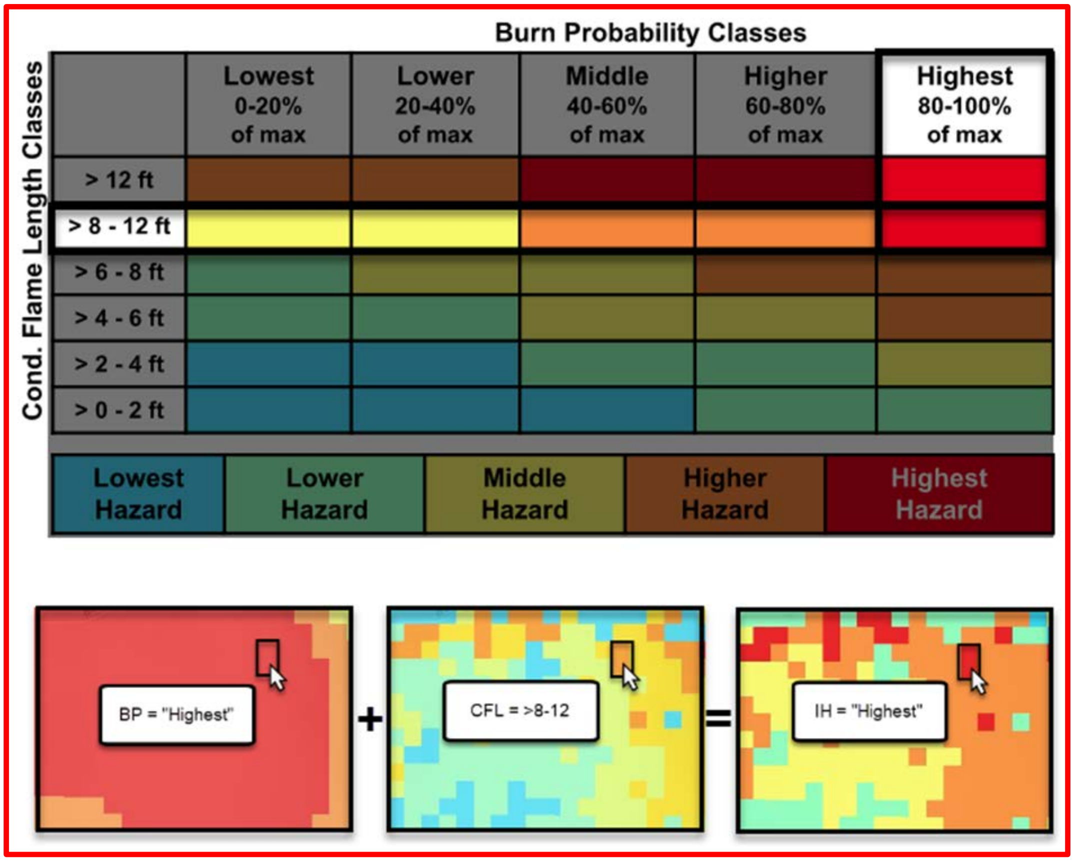


Figure 8. Illustration of burn probability and conditional flame length leading to an integrated hazard rating using the matrix (above) and the corresponding map output (below).

IFTDSS Integrated Hazard is categorized with seven distinct classes. The first two are for pixels that did not burn and the remaining five classes are dynamic based on the integrated hazard matrix above. They include:

- Non-burnable
- Burnable but not burned
- Lowest hazard
- Lower hazard
- Middle Hazard
- Higher Hazard
- Highest Hazard

In many cases, the Integrated Hazard value, combining both CFL and LBP, offers the best visual example, in the case of building sites and narrow linear assets like transmission lines, to the most likely sites to experience higher flame lengths. This can better guide steps to protect such sites and are included in Appendix B for each HUC12 DWSA watershed. The need for adaptation on these sites can be lost, once all the other HVRAs are considered together.

HVRA CHARACTERIZATION

Highly Valued Resources and Assets (HVRA) are the resources and assets on the landscape most likely to be protected from or enhanced by wildfire. The key criterion is that they must be of high value to warrant inclusion in this type of assessment, both for the sake of keeping the assessment tightly focused on water resources and to avoid valuing everything to the point nothing is truly highly valued.

HVRA IDENTIFICATION

A set of HVRA was identified through collaboration with the partners sponsoring this risk assessment. Subject matter experts identified five primary HVRAs in total: three assets and two resources. The complete list of HVRAs and their associated data sources are listed in Table 2. To the greatest extent possible, the HVRA set was constrained to values having the most to do with the delivery of clean drinking water to nearby communities. HVRAs were mapped to the extent of the Analysis Area boundary (Figure 1).

RESPONSE FUNCTIONS

Each HVRA selected for the assessment must also have an associated response to fire, whether it is positive or negative. This is called the response function (RF). RFs are a measure of the susceptibility or resilience of a Sub-HVRA to wildfire based on fire intensity (flame length class). A positive value in a response function indicates a benefit, or increase in value; a negative value indicates a loss, or decrease in value. Response function values ranged from -100 (greatest possible loss of resource value) to +100 (greatest possible increase in value). RF values require specialist input and consensus. We relied on input from JWC, the Tualatin SWCD, CWS, TRWC and other partner SMEs to develop response functions for a range of HVRAs, focusing on drinking water distribution infrastructure. We also used response functions from other QWRAs, where workshops were held with local resource specialists. In these workshops and with the risk assessment partners, stakeholders discussed how each resource or asset responded to fires of different intensity levels. The flame length values derived from the burn model are binned and correspond to the fire intensity levels (FIL) shown in Table 3. The response functions used to calculate expected net value change (eNVC) are shown in Table 4 through Table 9 below.

RELATIVE IMPORTANCE

The relative importance (RI) assignments are needed to integrate results across all HVRAs. Partner subject matter experts (SMEs) involved in the risk assessment established a weekly meeting scheduled to establish the importance and ranking of the primary HVRAs relative to each other. The Infrastructure HVRA received the greatest share of RI at 100, followed by the Surface Drinking Water HVRA at an RI of 90. This was followed by the Wildlife (fish habitat) and Communities (population density) HVRAs, both receiving an RI of 50. The relative extent of these coverages determines the final overall importance. Overall importance for the entire AA is shown as a pie chart (Figure 9). These importance percentages reflect the relative importance of all primary HVRAs. For each of the three scales the analyses were conducted; entire AA, DWSA, and DWSA HUC 12 watersheds; the RI was held constant between these primary HVRAs. The exception was the most remote DWSA HUC12 watersheds, which had no Communities extent coverage, at all (North/Middle Fk of the Trask River and the Tualatin Headwaters). In those two cases, only three pieces of pie were represented, changing the percentages. Overall relative importance of sub-HVRAs varied from analysis to analysis, due to different HVRA extents.

Sub-HVRA relative importance was determined by the same group of SMEs. Sub-RIs are based on both the relative importance per unit area and mapped extent of the Sub-HVRA layers within the primary HVRA category. In Table 6 through Table 10, we provide the share of HVRA relative importance within the primary HVRA.

Relative importance values were generally developed by first ranking the Sub-HVRAs then assigning an RI value to each. The most important Sub-HVRA was assigned RI = 100. Each remaining Sub-HVRA was then assigned an RI value indicating its importance relative to that most important Sub-HVRA.

The RI values apply to the overall HVRA on the assessment landscape as a whole. The calculations need to account for the relative extent of each HVRA to avoid overemphasizing HVRAs that cover many acres. This was accomplished by normalizing the calculations by the relative extent (RE) of each HVRA in the assessment area. Here, relative extent refers to the number of 30-m pixels mapped to each HVRA. In using this method, the relative importance of each HVRA is spread out over the HVRA's extent. An HVRA with few pixels can have a high importance per pixel; and an HVRA with a great many pixels can have a low importance per pixel. A weighting factor (called Relative Importance Per Pixel [RIPP]) representing the relative importance per unit area was calculated for each HVRA.

Table 2. HVRAs and sub-HVRAs identified for the TBRA with associated data sources.

HVRA & Sub-HVRA	**Data source**
Infrastructure	
Electric Transmission Lines	Low- and high- voltage from Homeland Security GIS database
High Priority Water transmission lines	City of Hillsboro transmission lines GIS: **COH_Transmission_Lines**; JWC Fernhill Transmission Line (JWC Critical Assets); **Trask_pipe**; Forest Grove transmission lines GIS: **FG_RW_TL, FG24_FW_TL, FG72_FW_TL** (100 m buffer)
Roads	Interstates and State Highways from Homeland Security GIS database. Roads on ODF managed land GIS: **ODF_Roads**; Roads to upper system infrastructure GIS**: Upper_System_Roads** (100 m buffer)
Flumes, Intakes & Control Valves	Tualatin Flume; Deep Creek, Smith Creek, Thomas Creek, Roaring Creek, Clear Creek, and Haines Falls Intakes; Patton Valley TL Control Valve, Upper System Sample Stations GIS: **JWC_CriticalAssets**
Reservoirs (tanks)	Dilley Reservoir, Fernhill Reservoirs #1 & 2 GIS: **JWC_CriticalAssets**
Low/Moderate Priority Water Transmission Lines	Upper System Distribution Mains and Service Lines GIS: **Upper_System_Service_Lines, Upper_System_Water_Mains**
High-Investment Buildings	JWC Water Treatment Plant, Slow Sand Filter Plant (SSFP), Scoggins Dam, Barney Dam (Block House, Valve), Soda Ash Plant, Spring Hill Pump Plant, Patton Valley Pump Plant, Quonset Hut, Wapato

	pumphouse, Blind Cabin (telecommunications) GIS: **JWC_CriticalAssets**
Communities	
Population by density class	Communities is part of the Highly Valued Resource or Asset (HVRA) data used in the National Wildfire Risk Assessment for Forest Service Lands (NaWRA, Dillon 2020). Community density classes are used as Sub-HVRAs within the Map Values, Exposure Analysis and Quantitative Wildfire Risk Assessment functionality within the Interagency Fuel Treatment Decision Support System (IFTDSS, https://iftdss.firenet.gov).
Surface Drinking Water	
Lakes, Wetlands & River Adjacency	Barney Reservoir GIS: **Barney_Reservoir**; Hagg Lake reservoir and Scoggins Dam boundary GIS: **Hagg_Scoggins** (1/4 mi. buffer); Fernhill wetlands GIS: **Fernhill_Wetlands**; Wapato wetlands boundary GIS: **Wapato** (1/4 mi. buffer); Tualatin River GIS: **Tualatin** (1/4 mi. buffer) includes SSFP Settling Pond.
Landslide Potential	Uses data depicted as landslide susceptibility at a 10-meter resolution, across the state of Oregon. The data was created using Oregon Lidar Consortium (OLC) data, and USGS NED data where OLC data was not present. This elevation data was converted into slopes, and a multi-pronged analysis process used these slopes, geology and mapped existing landslides. We will reclassify the 4 classes of landslide susceptibility: Low, Moderate, High and Very High into three classes as shown in the response function.
Wildlife	
Coho salmon	Tualatin River Rapid Bio-Assessment 2013 & 2014 Final Report, Bio-Surveys LLC
Winter Steelhead trout	Tualatin River Rapid Bio-Assessment 2013 & 2014 Final Report, Bio-Surveys LLC
Coastal cutthroat trout	Tualatin River Rapid Bio-Assessment 2013 & 2014 Final Report, Bio-Surveys LLC

Table 3. Flame length values corresponding to Fire Intensity Levels used in assigning response functions.

Fire Intensity Level (FIL)	1	2	3	4	5	6
Flame Length Range (feet)	0-2	2-4	4-6	6-8	8-12	12+

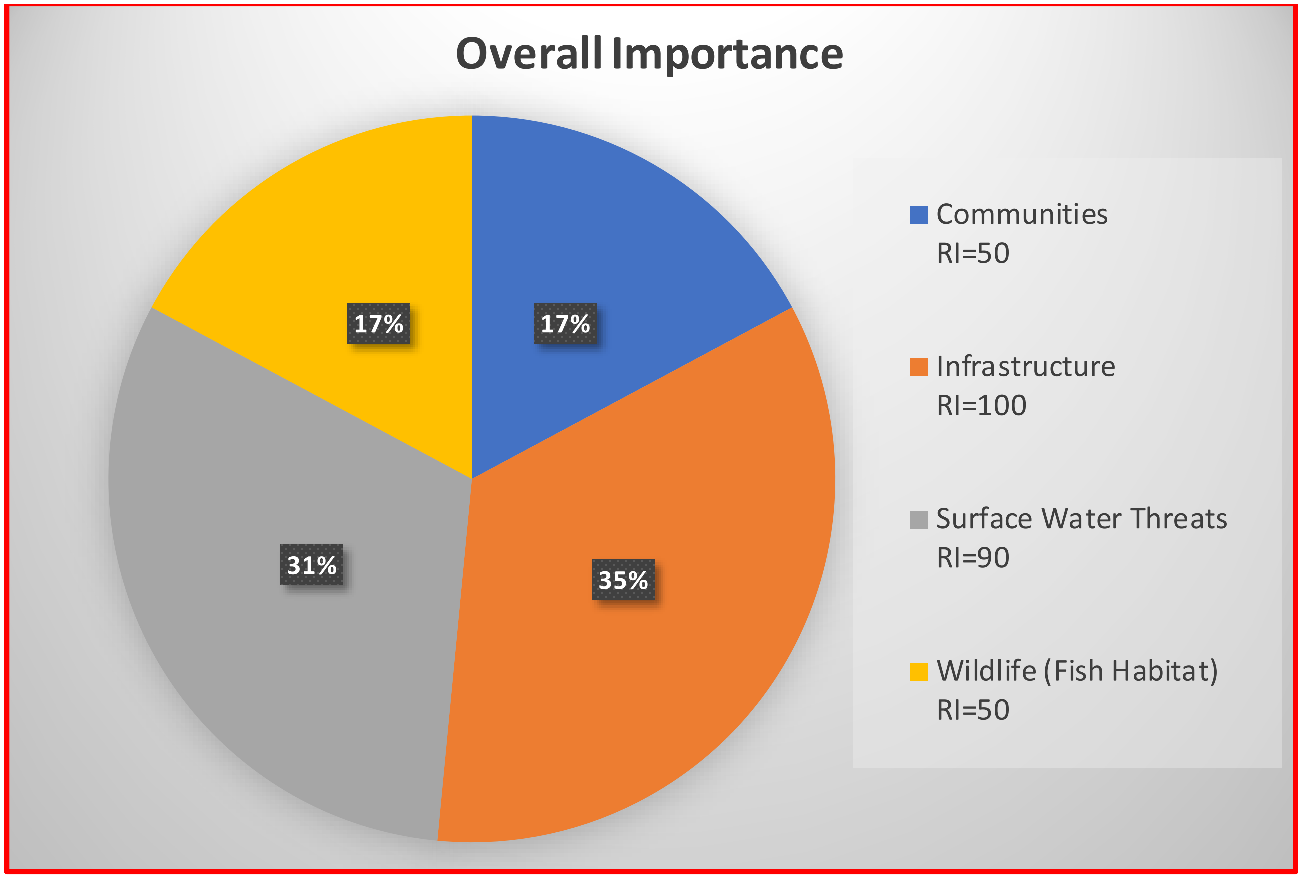


Figure 9. Overall HVRA Relative Importance for the Primary HVRAs used for all TBRA analyses.

HVRA CHARACTERIZATION RESULTS

Each HVRA was characterized by one or more data layers of sub-HVRA and, where necessary, further categorized by an appropriate covariate. Covariates include data such as infrastructure type and specific wildlife species. The main HVRAs in the TBRA are shown below along with a table with the set of response functions assigned. The overall share of relative importance, and total acres for each sub-HVRA listed on the following pages are for the DWSA assessment. RI values were held constant for all analyses, so relative importance of primary HVRAs was the same for the larger AA analysis and the individual DWSA HUC12 watershed analyses. In many similar regional analyses, the Communities HVRA is often assigned the highest rating (100). This analysis seeks specifically to address threats to clean water delivery and treatment, so water distribution infrastructure was given the highest rating.

The only significant difference among primary HVRAs overall importance was in the Headwaters and Middle Fk/North Fk Trask HUC12 watersheds, where no Communities HVRA coverage existed. That is reflected in their having the lowest Sum eNVC values in Table 10. The relative importance of sub-HVRAs within the entire AA are shown in Appendix A. These components are used along with fire behavior results from IFTDSS in the wildfire effects analysis described on Pg. 31.

Infrastructure

Communication Sites and Cell Towers

Communication Sites is part of the Highly Valued Resource or Asset (HVRA) data used in the National Wildfire Risk Assessment for Forest Service Lands (NaWRA, Dillon 2020). Communication Sites are used as a Sub-HVRA within the Map Values, Exposure Analysis and Quantitative Wildfire Risk Assessment functionality within IFTDSS. Communication Sites was created using the following data sources:

Federal Communications Commission (FCC) communication sites data was downloaded from the Wildland Fire Decision Support System (WFDSS, https://wfdss.usgs.gov/wfdss/WFDSS_Data_Downloads.shtml) with a date of March 12, 2013. The points are a merged dataset containing the following files from the FCC GIS page:

AM
Antenna Structure Registration
BRS/EBS
Cellular
FM
Land Mobile - Commercial
Land Mobile – Private
Land Mobile - Broadcast
Microwave
Paging
TV-NTSC
TV-Digital

Communication sites and cell towers mapped for TBRA are shown in Figure 12. We also included the telecommunications site on Blind Cabin Ridge utilized by the JWC. These points were converted to 100-m circular polygons. In this assessment, communication sites have a slightly negative response to FIL1 but respond more negatively with each increasing intensity level (Table 4).

Communication sites and cell towers received < 1 percent of overall relative importance, due to their small footprint on a large landscape. The share of HVRA importance is based on relative importance per unit area and mapped extent.

Electric Transmission Lines

Electrical transmission lines mapped for TBRA are shown in Figure 12. We selected transmission lines from the Homeland Infrastructure Foundation-Level Data (HIFLD) and buffered the line out 100 feet on either side to capture the area impacted by wildfire. High voltage (≥230 kV) electric transmission lines respond favorably to fire in FIL 1, where low intensity fires are thought to have a fuel treatment effect. High voltage lines have a neutral response in FILs 2-3, but an increasingly negative response in FILs 4-

6 (Table 6). Low voltage lines (230 kV) are thought to be mostly wooden poles, and therefore, respond negatively to fires of increasing intensity.

Due to the number of acres mapped on the landscape and their importance to infrastructure, electric transmission lines received 7 percent of the share of overall importance. The only high voltage line was outside the DWSA but was considered in the overall TBRA AA. The share of HVRA importance is based on relative importance per unit area and mapped extent.

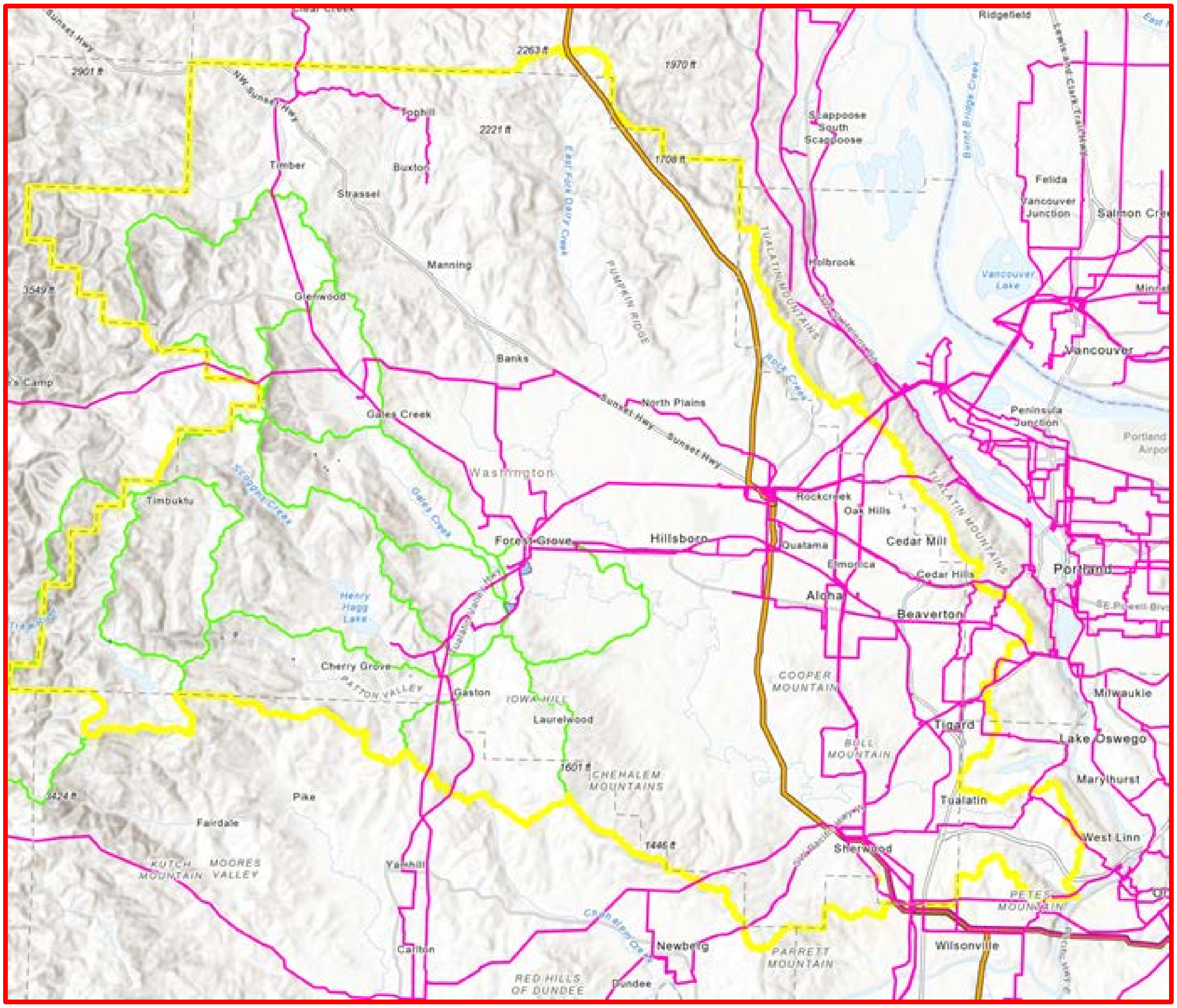


Figure 10. Map of electric transmission lines. TBRA boundary (yellow); low voltage lines (magenta); high voltage lines (orange). DWSA HUC12 watersheds shown in green.

Roads

Interstates and state highways mapped for TBRA are shown in Figure 10. We selected all interstates and state highways represented in the Homeland Security database within the assessment area. We also used local roads used to maintain the water distribution infrastructure, provided by Tualatin SWCD. These lines were buffered out 100 feet on either side to capture the area impacted by wildfire. In this assessment, roads are said to have a neutral response to FIL1 and a slightly more negative response with each increasing intensity level (Table 8). The RF shows mild susceptibility of roadways to wildfire, primarily to capture the temporal nature of road closures due to wildfire.

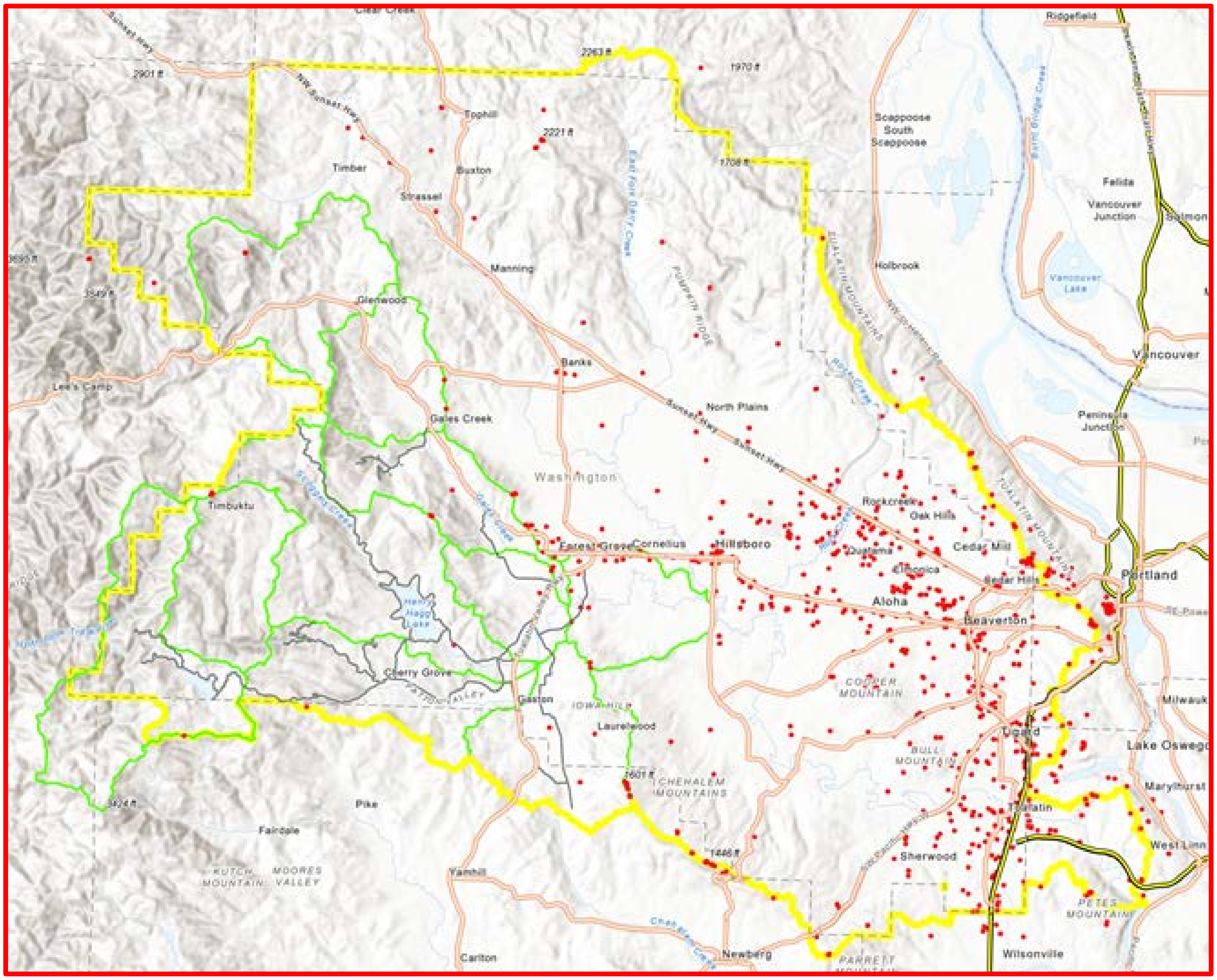


Figure 11. Map of communication sites and highways. TBRA boundary (yellow); communication sites (red point data); state highways (red outline); interstates (yellow/black outline); and local roads important to water delivery infrastructure (grey). DWSA HUC12 watersheds shown in green.

Water Transmission Lines

Water transmission lines mapped for TBRA are shown in Figure 11. Tualatin SWCD provided GIS line files for their locations. Both a high-priority and a low/moderate-priority set of water transmission lines were identified. These lines were buffered out 100 feet on either side to capture the area impacted by wildfire. In this assessment, water transmission lines are said to have a neutral response up to FIL3 and a slightly more negative response with each increasing intensity level (Table 4).

Other Water Delivery & Treatment Infrastructure

All other water distribution infrastructure items (buildings, reservoirs, flumes, intakes and control valves) are shown in Figure 12. Tualatin SWCD provided GIS point files for their location. The facilities in question were identified on aerial imagery then a polygon around those facility boundaries were photo interpreted from that imagery. Then these polygons were buffered out 100 feet on either side to capture the area impacted by wildfire, often called the "home ignition zone." In this assessment, the non-buildings are said to have a neutral response up to FIL3 and a slightly more negative response with each increasing intensity level, while the buildings begin to experience impacts at a much lower FIL (Table 6).

Together, water delivery infrastructure (excluding water transmission lines) only received 4 percent of the total HVRA relative importance. This is due to the small area represented by this HVRA, despite Infrastructure being rated highest, relative to other HVRAs.

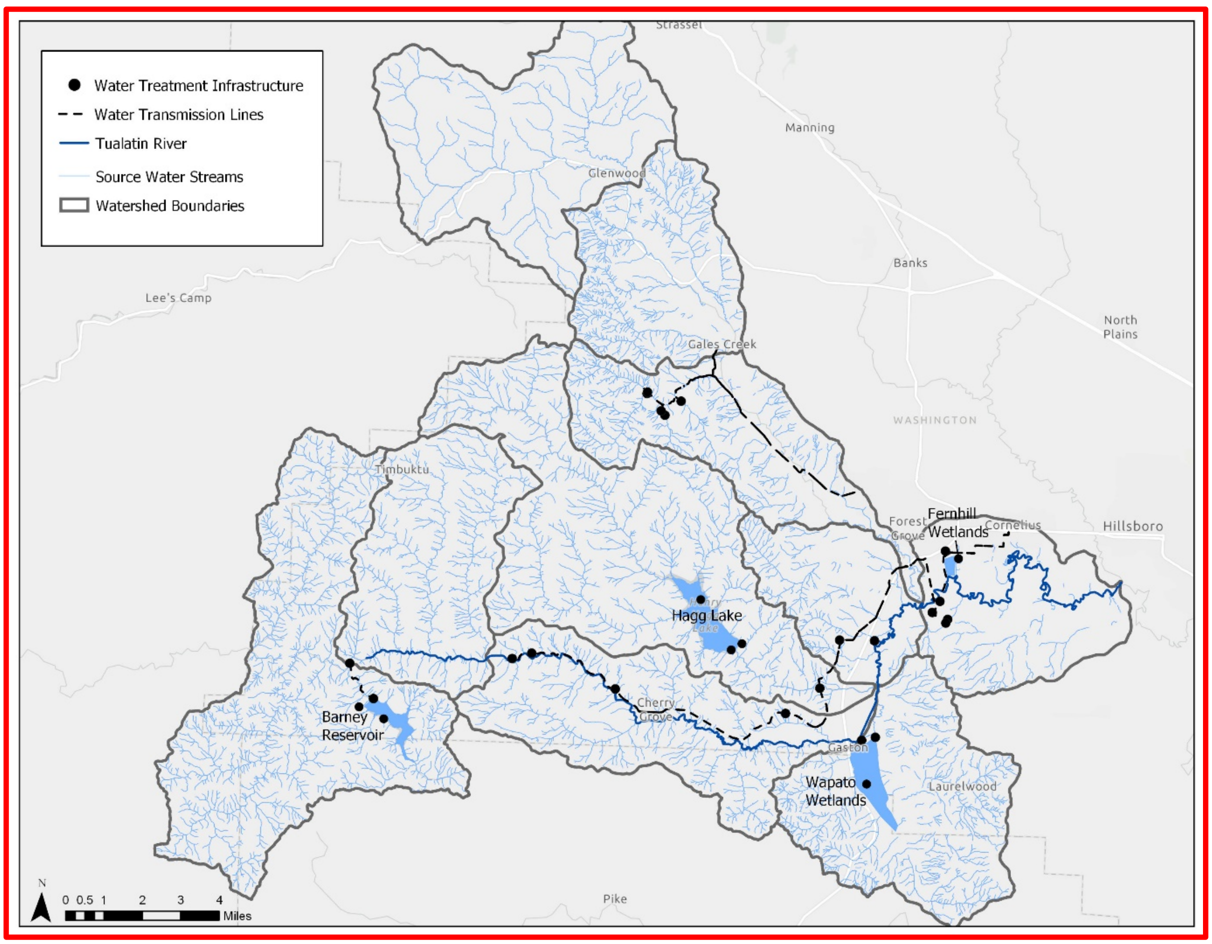


Figure 12. Water delivery and treatment infrastructure within the DWSA. Treatment infrastructure includes flumes, intakes, control valves, dams, reservoirs, treatment facilities, and other structures.

Table 4. Response functions for the TBRA Infrastructure sub-HVRAs

Sub-HVRA	FIL1	FIL2	FIL3	FIL4	FIL5	FIL6	RIPP[1]	Acres.
Electrical Trans-Line- High voltage	10	0	0	-10	-50	-70	74.56	0
Electrical Trans-Line- Low voltage	-10	-20	-50	-70	-80	-90	74.56	582
Communication Sites	-10	-30	-60	-80	-100	-100	74.56	14
Roads	0	-5	-10	-15	-20	-30	74.56	1,698
Water Transmission Lines, High	0	0	-5	-30	-40	-50	93.2	415
Water Transmission Lines, Low/Mod	0	0	-5	-30	-40	-50	74.56	364
Flumes, Intakes and Control Valves	0	0	-5	-30	-40	-50	93.2	10
Reservoirs (tanks)	0	0	-5	-30	-40	-50	93.2	24
High Investment Building	-10	-30	-60	-80	-100	-100	93.2	373

[1] Relative Importance per Pixel.

Communities

Communities is part of the Highly Valued Resource or Asset (HVRA) data used in the National Wildfire Risk Assessment for Forest Service Lands (NaWRA, Dillon 2020). Community density classes can be used as Sub-HVRAs within the Map Values, Exposure Analysis and Quantitative Wildfire Risk Assessment functionality within the Interagency Fuel Treatment Decision Support System (IFTDSS, https://iftdss.firenet.gov).

Communities represents population density classes based on Residentially Developed Populated Areas (RDPA, Haas et al. 2013). RDPA was developed using the LandScan USATM population data (Oak Ridge National Laboratory, 2008) with some additional smoothing to conservatively identify pixels that were most likely to have people and residential structures located within them (Haas et al. 2013). RDPA was summarized into three population density classes for use in IFTDSS. Classification used similar population density ranges to the Federal Register Wildland Urban Interface categorization:

- Low density: >0-28 people per square mile
- Medium density: >28-250 people per square mile
- High density: > 250 people per square mile

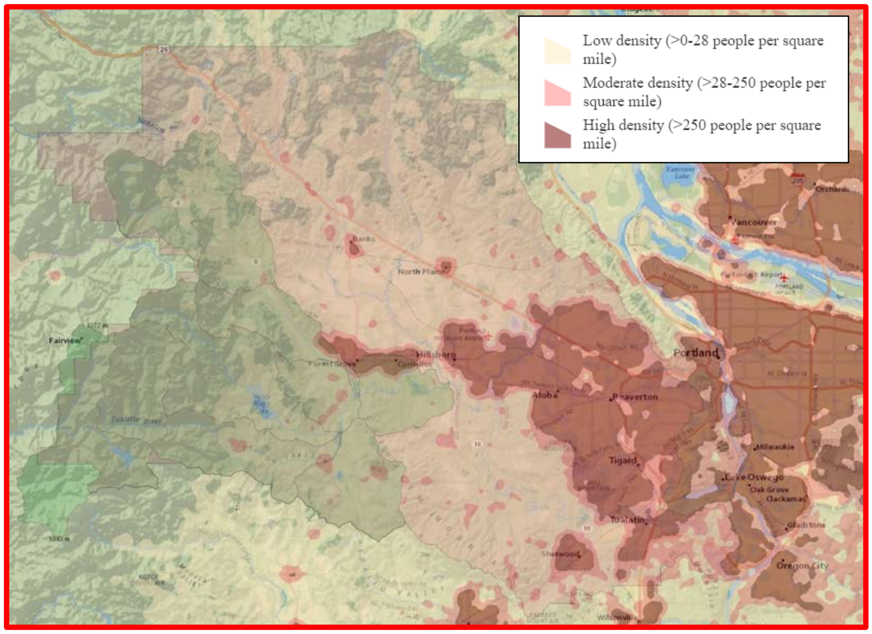


Figure 13. TBRA Population Density.

Response functions were increasingly negative for all housing densities across FILs 1-6 (Table 5), with slightly more loss assigned to the highest density class due to the impact to more houses and possibly overwhelmed suppression resources with high population exposure. Since low density housing was found in over a third of the study area, this sub-HVRA was lessened in importance, so it does not dominate the overall risk across the landscape.

Table 5. Response functions for the Communities HVRA

Sub-HVRA	FIL1	FIL2	FIL3	FIL4	FIL5	FIL6	RIPP[1]	Acres
Where People Live; >0-28 people per square mile	-10	-20	-40	-60	-80	-90	1.13	51,335
Where People Live; >28-250 people per square mile	-10	-20	-40	-60	-80	-90	16.99	2,109
Where People Live; >250 people per square mile	-10	-20	-40	-80	-100	-100	22.65	254

Surface Water Threats

Landslide Hazard Class

Geologists define landslides as the downslope movement of rock, soil, or related debris. Different types of landslides are composed of different materials, such as rock, sand, clay, and water and the proportions of these materials will dictate how fast a landslide moves and how much area it will cover.

Although landslides are propelled by gravity, they can be triggered by other natural geologic events or human activity. Volcanic eruptions and earthquakes can initiate earth movement on a grand scale. A variety of debris flows called “lahars”—a mixture of volcanic ash and water— are specific to volcanic activity and are often the major hazard experienced in a volcanic episode. Although earthquakes can initiate debris flows, the major causes of landslides in the northwest are continuous rains that saturate soils.

Landslides can also be the direct consequence of human activity. Seemingly insignificant modifications of surface flow and drainage may induce landslides. In an urban setting, improper drainage is most often the factor when a landslide occurs.

Many unstable, landslide prone areas can be recognized. Tip-offs include scarps, tilted and bent (“gun-stocked”) trees, wetlands and standing water, irregular and hummocky ground topography, and over steepened slopes with a thick soil cover. The technology of spotting landslides by use of aerial photography and new laser-based terrain mapping called lidar is helping State of Oregon Department of Geology and Mineral Industries (DOGAMI) develop much more accurate and detailed maps of areas with existing landslides allowing them to create landslide susceptibility maps, that is, maps that that show where we think different types of landslides may occur in the future.

Expert-based response functions can be designed to account for not only fire behavior characteristics but also landscape variables that could influence watershed susceptibility. Landslide potential was used as a significant variable influencing likely post-fire sedimentation and water quality degradation. As a proxy for erosion potential, we incorporated the GIS layer created using Oregon Lidar Consortium (OLC) data, and USGS NED data where OLC data was not present. This elevation data was converted into slopes, and a multi-pronged analysis process used these slopes, geology and mapped existing landslides. The rating system yields four qualitative categories (low, moderate, high, and very high) as a function of soil type and slope steepness.

The response functions shown in Table 6 are for three landscape hazard classes: moderate, high, and very high. The low category was dropped and did not receive a response function (Figure 16).

Landslide hazard class received 26 percent of the total HVRA relative importance. This is due to the large coverage represented by this HVRA, despite Infrastructure being rated highest, relative to other HVRAs.

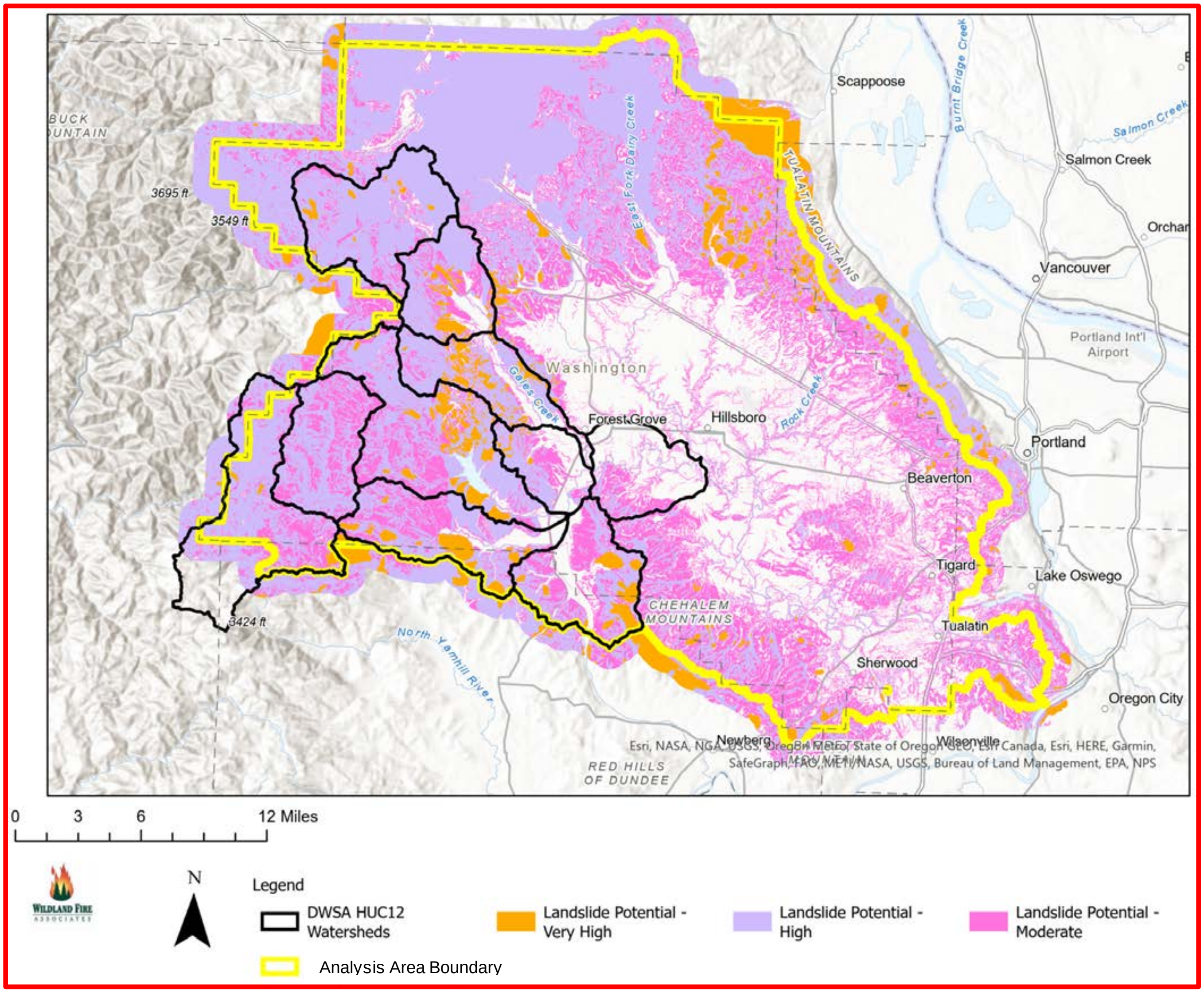


Figure 14. Map of erosion potential by landslide hazard class within the TBRA analysis area.

Table 6. Response functions for the Landslide Hazard Class sub-HVRA.

Sub-HVRA	FIL1	FIL2	FIL3	FIL4	FIL5	FIL6	RIPP[1]	Acres
Landslide Hazard – very high	20	0	-40	-60	-100	-100	1.93	11,101
Landslide Hazard – high	20	10	-20	-40	-60	-80	1.35	84,693
Landslide Hazard – moderate	20	20	0	-20	-40	-60	0.58	46,960

[1] Relative Importance per Pixel.

Potential Contamination Sources

The Potential Contaminant Sources (PCS) coverage comes from the 2013 JWC Source Water Assessment prepared by GSI Water Solutions, Inc. This category represents the locations that contamination may occur through a point source discharge. This layer is a combination of eleven individual layers from the Oregon Department of Environmental Quality (DEQ) and the Oregon Department of Agriculture (ODA):

- DEQ_Dry_Cleaner_Sites
- DEQ_ECSI_Site_Permits (permit locations from the Environmental Cleanup Site
- Information database)
- DEQ_State_Fire_Marshall_HSIS_Facilities (hazardous material storage locations from
- the Hazardous Substance Information Survey database)
- DEQ_Leaking_USTs (known leaking underground storage tanks)
- DEQ_USTs (underground storage tank locations)
- DEQ_UICs (underground injection control system locations)
- DEQ_NPDES_and_WPCF_Site_Permits (National Pollutant Discharge Elimination
- System and Water Pollution Control Facility permit locations)
- DEQ_WQ_Outfalls (other water quality outfall locations)
- DEQ_PCSs (a variety of potential contamination sources identified in DEQ’s 2003
- source water assessment for the JWC)
- DEQ_Solid_Waste_Site_Permits
- ODA_CAFOs (confined animal feedlot operations)

GSI and the JWC reviewed the 11 layers for duplicate occurrences and removed them from the data set. Then a list of the specific activities/potential contaminant sources was created to assign a relative risk score of “High” or “Low/Medium” to each location. Potential contaminant source locations with a relative risk score of “High” were assigned a numeric risk ranking of 7 and those with a relative risk score of “Low/Medium” were assigned a numeric risk ranking of 3. Specific activities/contaminant sources that were given a relative risk score of “High” included:

- Automobile Machine Shops
- Boarding Stables
- Confined Animal Feeding Operations
- Current and Historic Gas Stations
- Grazing Animals
- Hazardous Materials Storage
- Historic Drug Labs
- Irrigated Crops
- Junk/Salvage Yards
- Known Contaminant Site/Plume/Spill Locations
- Land Application Sites
- Metal Plating/Finishing/Fabrication
- Permitted Stormwater Discharge Site or Outfall

- Railroad Yards
- Rock Quarries
- Utility Stations and/or Powerplants
- Waste Landfills or Transfer/Recycling Stations
- Wastewater/Stormwater Lagoon or Disposal Sites
- Wastewater Treatment Plants
- Wood Processing Sites

Specific activities/contaminant sources that were given a relative risk score of “Low/Medium” included:

- Above Ground Storage Tank Locations
- Airport Maintenance and/or Fueling Areas
- Automobile Body Shops
- Automobile Repair Shops
- Automobile/Machinery Repair and/or Maintenance for Farms or Rural Homesteads
- Campground/Park Locations
- Cemeteries
- Dry Cleaners
- Fire Stations
- Fire Training Facilities
- Fish Hatcheries
- Food Processing Locations
- Certain Hazardous Materials Storage (specifically for Schools, Fire Departments, Food
- Processing Sites, Aquatic Centers, and Drinking Water Treatment Plants)
- Lawn Care – Highly Maintained Areas
- Leaking Underground Storage Tank Locations
- RV and/or Mini Storage Locations
- Motor Pools/Fleet Terminals/Parking Lots
- Reservoir or Dam Locations
- School Locations
- Underground Storage Tank Locations
- Drinking Water Treatment Plants

Once the final list of potential contaminant source locations and their associated risk rankings were determined, each location was buffered by 1,000 feet to represent the single points as areas and the appropriate risk ranking was assigned to each resulting polygon. Using a buffer distance of 1,000 feet was determined to be the best option to adequately show the potential contaminant sources without over-emphasizing their influence in the overall risk analysis. Any polygon that was identified as part of a cluster had its risk ranking increased by 3. The final ratings used (shown in Figure 15) are:

- High risk (risk rankings from 7 to 10),
- Medium risk (risk ranking of 6). and
- Low risk (risk rankings from 0 to 3).

GSI noted that this analysis includes very little actual contaminant release information, only potential for a release based on the type of activity. In this case that release would be because of a wildfire impacting that site. Also this data is only for the DWSA and does not cover potential contamination sources from the remainder of the overall TBRA AA.

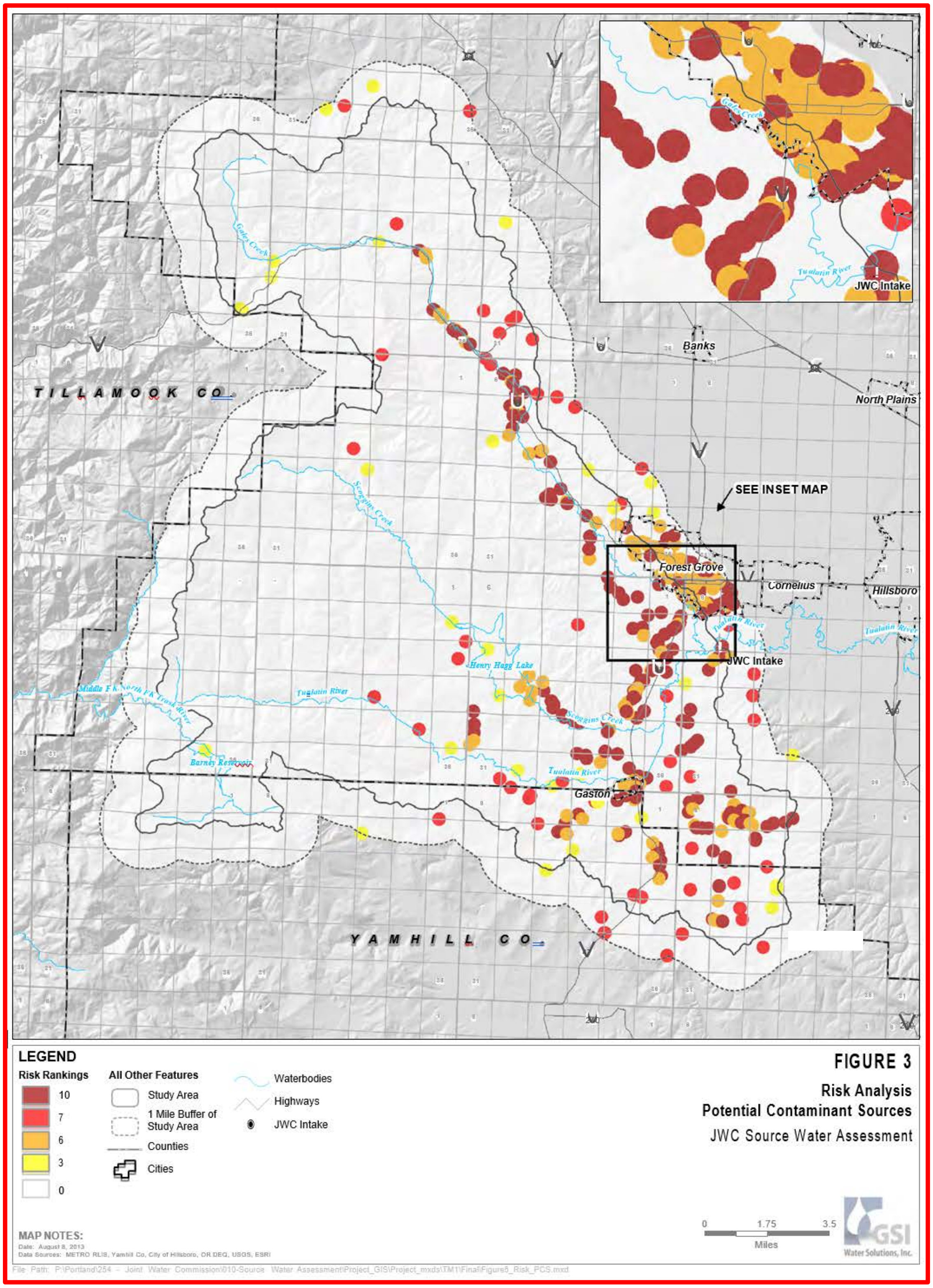


Figure 15. Map of potential contamination sources used in the TBRA (covers DWSA only).

Table 7. Response functions for the Potential Contamination Source (PCS) sub-HVRA.

Sub-HVRA	FIL1	FIL2	FIL3	FIL4	FIL5	FIL6	RIPP[1]	Acres
PCS – high	0	-30	-60	-80	-100	-100	1.93	11,101
PCS – medium	0	0	-40	-60	-80	-100	1.35	84,693
PCS – low	0	0	0	-30	-60	-90	0.58	46,960

[1] Relative Importance per Pixel.

Surface Drinking Water Adjacency

The Tualatin River as well as lakes and wetlands identified by the Tualatin SWCD were assigned a ¼-mile buffer for this sub-HVRA. This sub-HVRA represents the increased risk to water resources when a wildland fire burns adjacent or nearly adjacent to important SDW resources. The 1/4 -mile buffer also coincides with the boundary of the proposed Wild and Scenic River designation (*Wild & Scenic Rivers Suitability Report, Northwest Oregon.* 2015.), so this sub-HVRA also acts as a surrogate for recreation values, since using recreation as a primary HVRA was rejected for this analysis. 40 miles of the Tualatin River was designated as a National Water Trail in October of 2020. Surface water adjacency class received 3 percent of the total HVRA relative importance.

Table 8. Response functions for the Surface Drinking Water Adjacency sub-HVRA.

Sub-HVRA	FIL1	FIL2	FIL3	FIL4	FIL5	FIL6	Share of RI[1]	Acres
Surface Drinking Water Adjacency	0	0	0	-40	-60	-80	1.54	9,248

Fish Habitat

Oregon coastal coho salmon, winter steelhead trout, and coastal cutthroat trout critical habitat for the TBRA analysis area is shown in Figure 16. Coho salmon and steelhead critical habitat was included in the assessment due to the species' listed status and economic importance to the Region. Coastal cutthroat trout were included in the assessment because of concern over species isolation and ability to recolonize following a severe wildfire.

The original critical habitat map (inset Fig. 12) was obtained from NOAA Fisheries species distribution maps and was clipped to the analysis area boundary. Newer information was received from the 2013 & 2014 Tualatin River Rapid Bio-Assessment Final Report by Bio-Surveys, LLC. CWS, a partner in that inventory effort, developed a GIS layer of fish distribution for the inventoried subbasins. Stream segments showing the presence of each species were buffered for 100 feet on either side to capture the area impacted by wildfire. This was an improvement from the NOAA data, which showed species present above Henry Hagg Lake. This more recent survey showed no presence of these species above Hagg Lake. The GIS data provided was for the Tualatin watershed only and did not cover the Trask River drainage. For that single HUC12 DWSA watershed risk analysis, we used the NOAA data and clipped any extents above Barney Reservoir.

All fish habitat response functions are characterized as slightly beneficial for FILs 1-3 but show an increasingly negative response in FILs 4-6 – flame lengths greater than 6ft. (Table 9). These response functions were taken directly from the 2018 Pacific Northwest Quantitative Wildfire Risk Assessment.

Coho habitat received 2 percent, winter steelhead received 3 percent, and coastal cutthroat trout received 12 percent of the overall HVRA relative importance. The share of HVRA importance is based on relative importance per unit area and mapped extent.

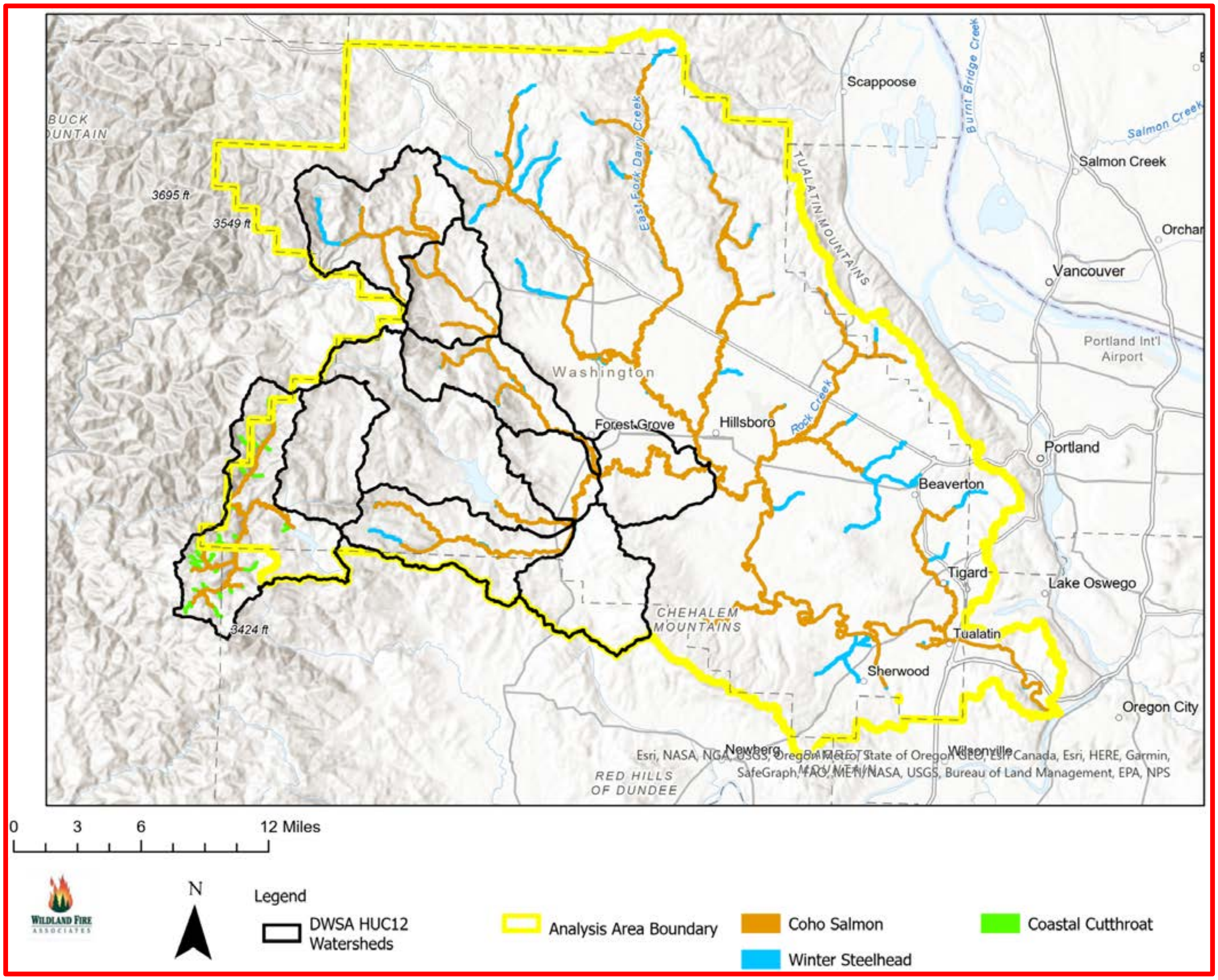


Figure 16. Fish habitat sub-HVRAs by species within the TBRA.

Table 9. Response functions for the Fish Habitat HVRA

Sub-HVRA	FIL1	FIL2	FIL3	FIL4	FIL5	FIL6	RIPP[1]	Acres
Coho salmon	20	20	10	-10	-20	-50	10.11	1,942
Winter Steelhead trout	20	20	10	-10	-30	-60	12.64	2,280
Coastal cutthroat trout	20	20	10	-10	-20	-50	10.11	10,372

[1] Relative Importance per Pixel.

EFFECTS ANALYSIS METHODS

An effects analysis quantifies wildfire risk as the expected value of net response (Finney, 2005; Scott et al., 2013b) also known as expected net value change (eNVC). This approach has been applied at a national scale (Calkin et al., 2010), in regional and sub-regional assessments (Thompson et al., 2015; Thompson et al., 2016) and several forest-level assessments of wildfire risk (Scott and Helmbrecht, 2010; Scott et al., 2013a). Effects analysis relies on input from resource specialists to produce a tabular response function for each HVRA occurring in the analysis area. A response function is a tabulation of the relative change in value of an HVRA if it were to burn in each of six flame-length classes. A positive value in a response function indicates a benefit or increase in value; a negative value indicates a loss, or decrease in value. Response function values ranged from -100 (greatest possible loss of resource value) to +100 (greatest possible increase in value).

Effects Analysis Calculations

Integrating HVRAs with differing units of measure (for example, habitat vs. homes) requires relative importance (RI) values for each HVRA/sub-HVRA. These values were identified by a pool of specialists, as discussed in the HVRA Characterization Section. The final importance weight used in the risk calculations is a function of overall HVRA importance, sub-HVRA importance, and relative extent (pixel count) of each sub-HVRA. This value is therefore called relative importance per pixel (RIPP). For more discussion on how IFTDSS calculates RIPP and the other outputs described below, see the *QWRA Technical Documentation* on the IFTDSS website.

The RF and RIPP values were combined with estimates of the flame-length probability (FLP) in each of the six flame-length classes to estimate conditional NVC (cNVC) as the sum-product of flame-length probability (FLP) and response function value (RF) over all the six flame-length classes, with a weighting factor adjustment for the relative importance per unit area of each HVRA, as follows:

$$cNVC_j = \sum_{i}^{n} FLP_i * RF_{ij} * RIPP_j$$

where i refers to flame length class (n = 6), j refers to each HVRA, and RIPP is the weighting factor based on the relative importance and relative extent (number of pixels) of each HVRA. The cNVC calculation shown above places each pixel of each resource on a common scale (relative importance), allowing them to be summed across all resources to produce the total cNVC at a given pixel:

$$cNVC = \sum_{j}^{m} cNVC_j$$

where cNVC is calculated for each pixel in the analysis area. Finally, eNVC for each pixel is calculated as the product of cNVC and BP:

$$eNVC = cNVC * BP$$

ANALYSIS RESULTS

IFTDSS RESULTS

IFTDSS burn probability and conditional flame length model results are presented for the TBRA in the following pages. The entire analysis area at 90m cell-size resolution is shown in Figs. 17 & 19, while the DWSA analysis at 60m resolution is shown in Figs. 18 & 20. The difference in burn probabilities can be explained by the larger landscape of the AA. The entire AA more pathways for fire spread under our extreme conditions outside of the DWSA. When constrained to the DWSA the many modeled fires had to find other pathways to obtain the maximum burn probability.

Of note, the area of maximum LBP for the AA lies squarely on the L.L. “Stub” Stewart Memorial State Park north of Buxton. This is well outside the DWSA, which is the focus of this study. This area of higher LBP also stands out as, unlike many subsequent analyses, the area of highest LBP is not the western edge of the landscape, indicating that many modeled fires burned out of the FOA to the west. For our high wind scenario, high LBP values occurred where fires could find fuel in an elongated ellipse, characteristic of wind-driven fires. With the strong gridded east wind scenario, the same pattern of fires becoming entrained in drainages running upslope from east to west and running out of the western edge of the FOA was repeated in the DWSA and many of the HUC12 DWSA watershed analyses. Within the DWSA, the area around Tillamook State Forest also saw higher LBP.

IFTDSS produced wildfire hazard results for each FOA, including burn probability and conditional flame length probability. Due to the highly varied nature of weather and fire occurrence across the large landscape, and to take advantage of LANDFIRE’s 30-m data, we then ran IFTDSS for each of the ten HUC12 DWSA watersheds independently, using the same set of weighed HVRAs and sub-HVRAs.

Landscape Burn Probability

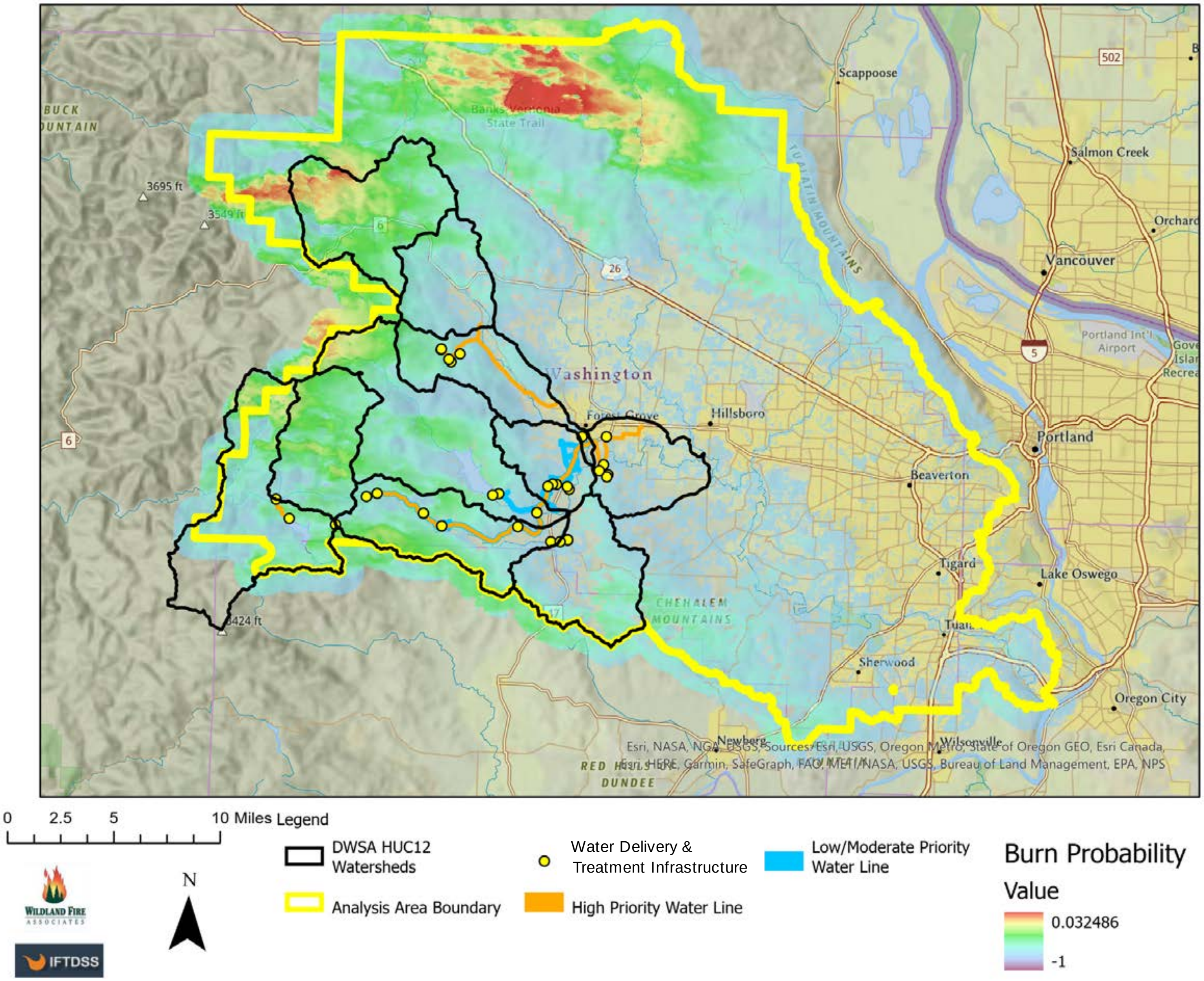


Figure 17. Map of IFTDSS burn probability results for the TBRA

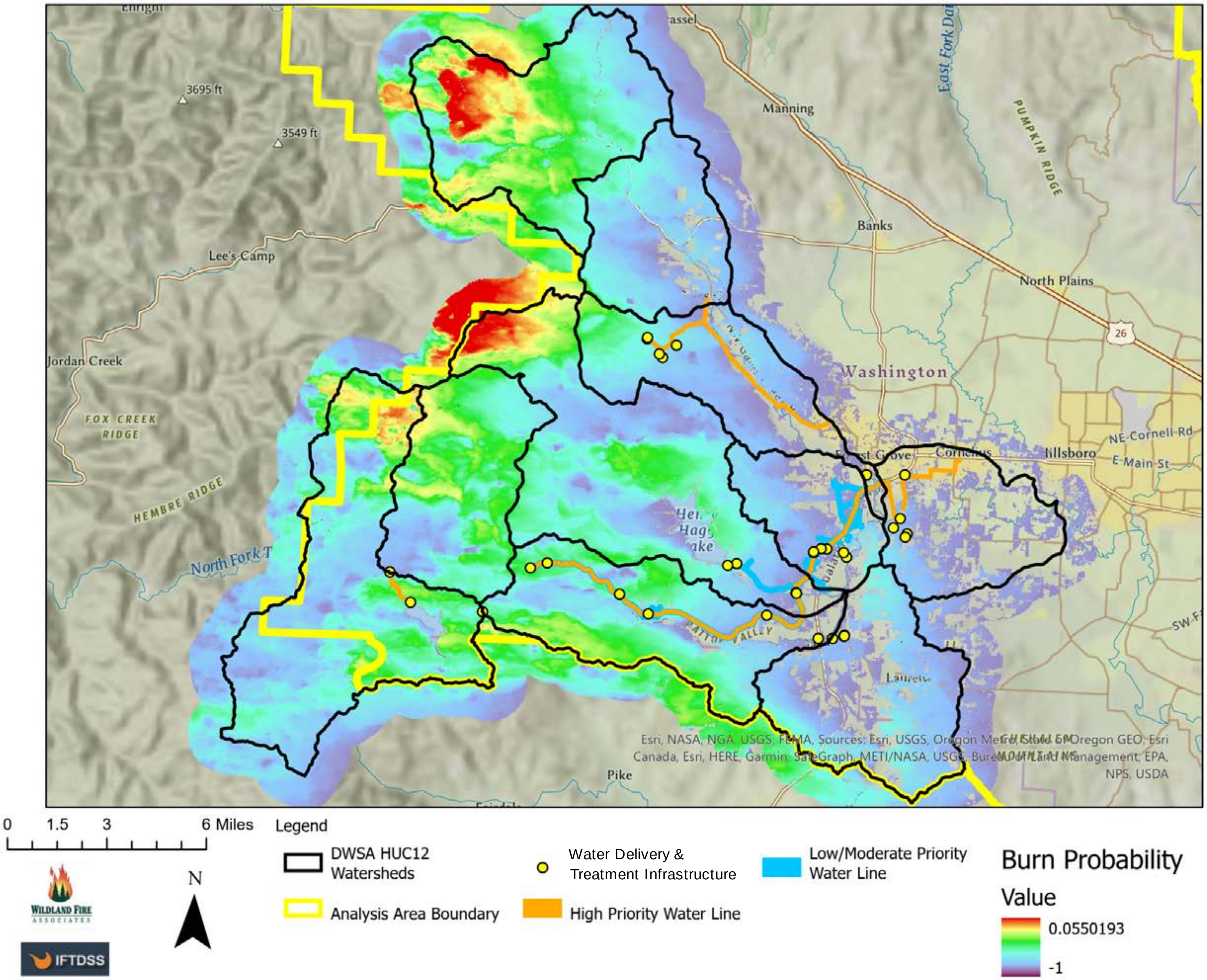


Figure 18. Map of IFTDSS burn probability results

Conditional Flame Length

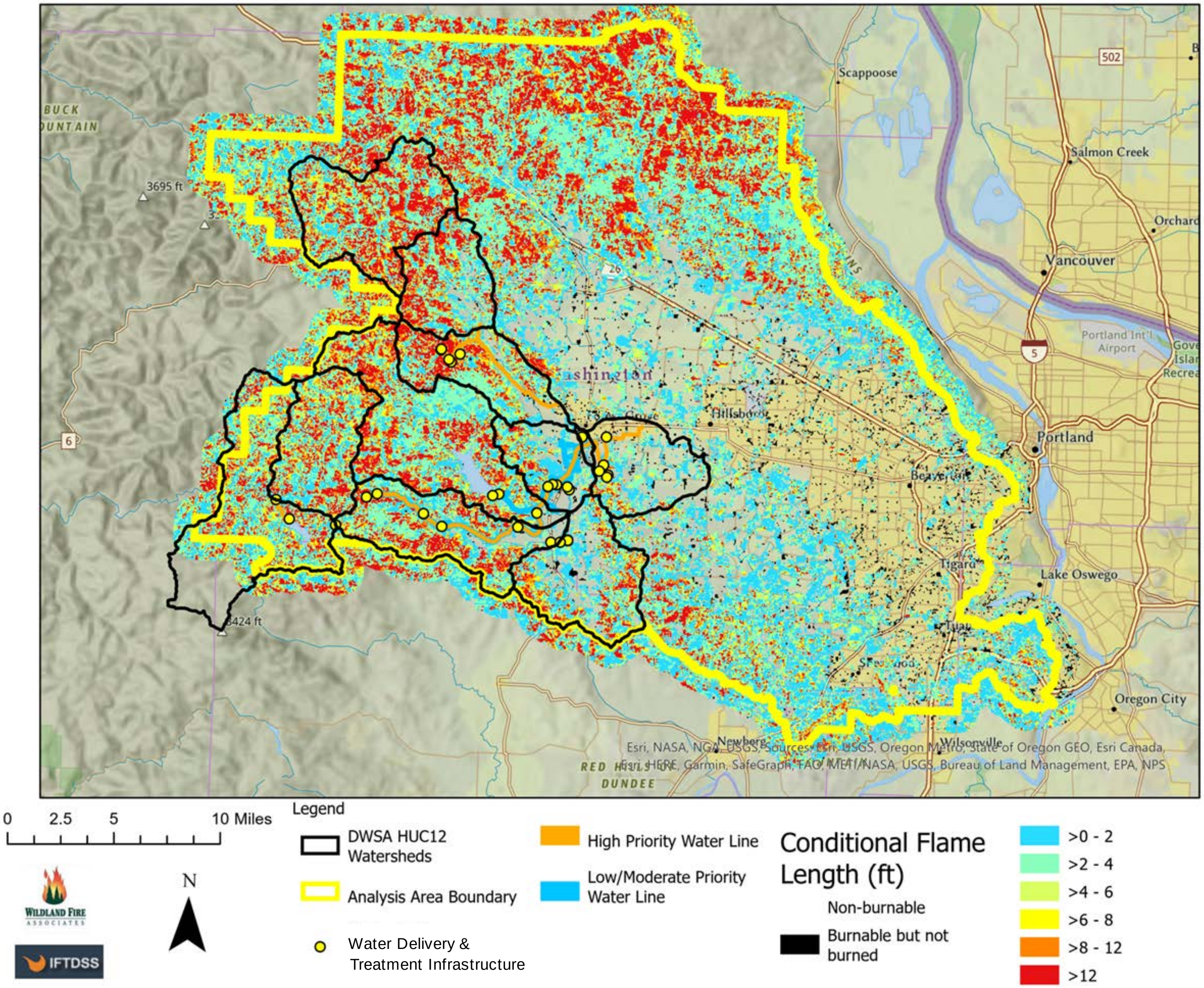


Figure 19. Map of IFTDSS conditional flame length for the TBRA

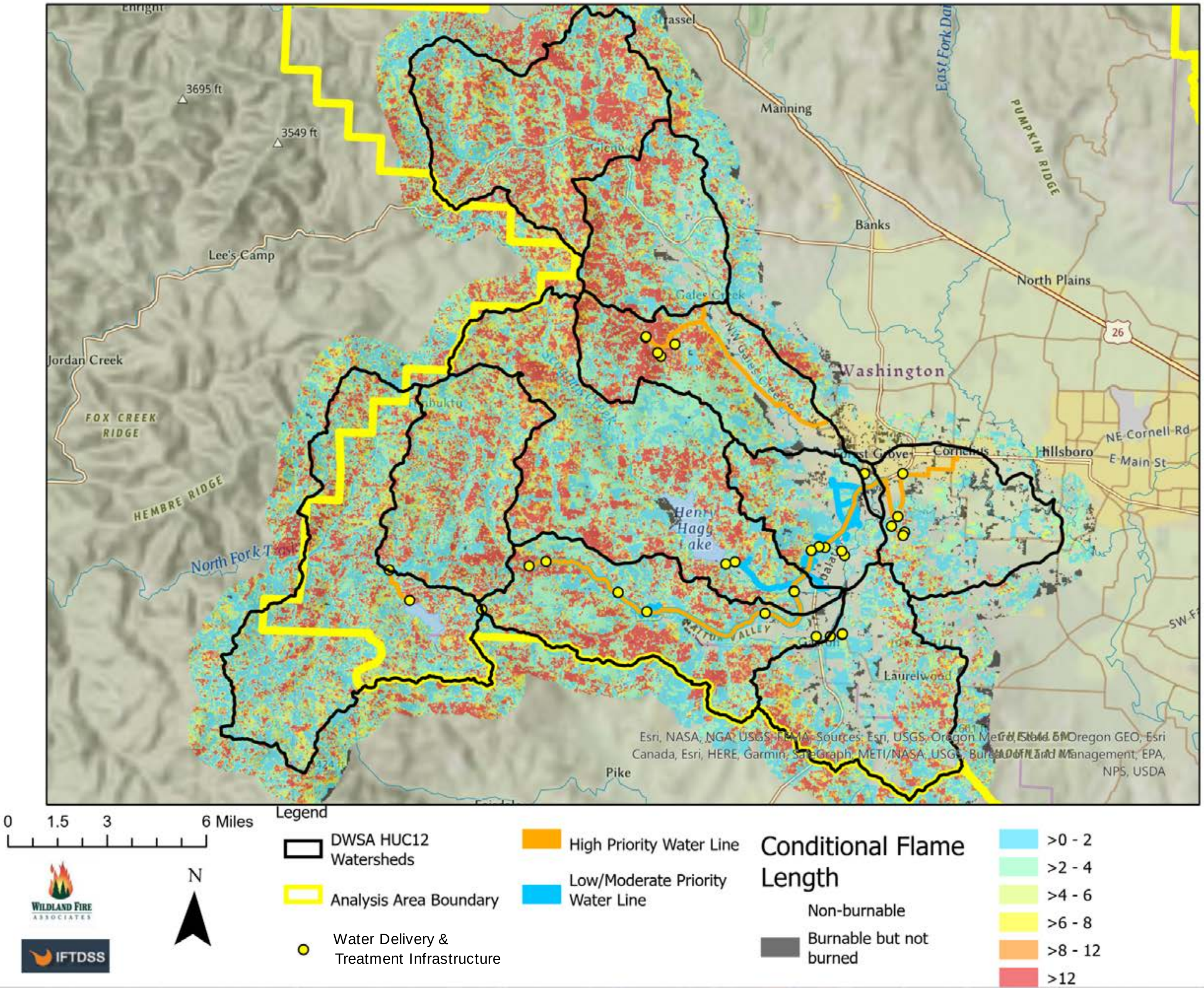


Figure 20. Map of IFTDSS conditional flame length for

EFFECTS ANALYSIS

The cumulative results of the wildfire risk calculations described on Pg. 31 are the spatial grids of cNVC and eNVC, representing both the conditional and expected change in value from wildfire disturbance to all HVRAs included in the analysis. Results are therefore limited to those pixels that have at least one HVRA and a non-zero burn probability. Both cNVC and eNVC reflect an HVRAs' response to fire and their relative importance within the context of the assessment, while eNVC additionally captures the relative likelihood of wildfire disturbance.

Cumulative effects of wildfire vary by HVRA within the DWSA with a net positive eNVC for Fish Habitat, a relatively moderate net negative eNVC for Infrastructure (except for roads, buildings, and low voltage electric lines, which were more significant), and an increasingly negative eNVC for Communities (especially low density) and with Landslide Susceptibility acting as a proxy for erosion showing the most negative net eNVC result, as one would expect for wildfires exhibiting higher severity. Figure 21 shows cNVC results across the DWSA analysis area, with beneficial effects shown in light blue and negative effects shown in orange. Adjusting cNVC by fire likelihood (i.e., burn probability) narrows the range of values for both negative and positive outcomes. cNVC and eNVC values for the DWSA are shown in Figures 22 & 23). cNVC and eNVC coverages will also be provided at the 90m AA scale and for each of the 10 HUC12 DWSA watersheds at the 30m scale in the digital report documentation.

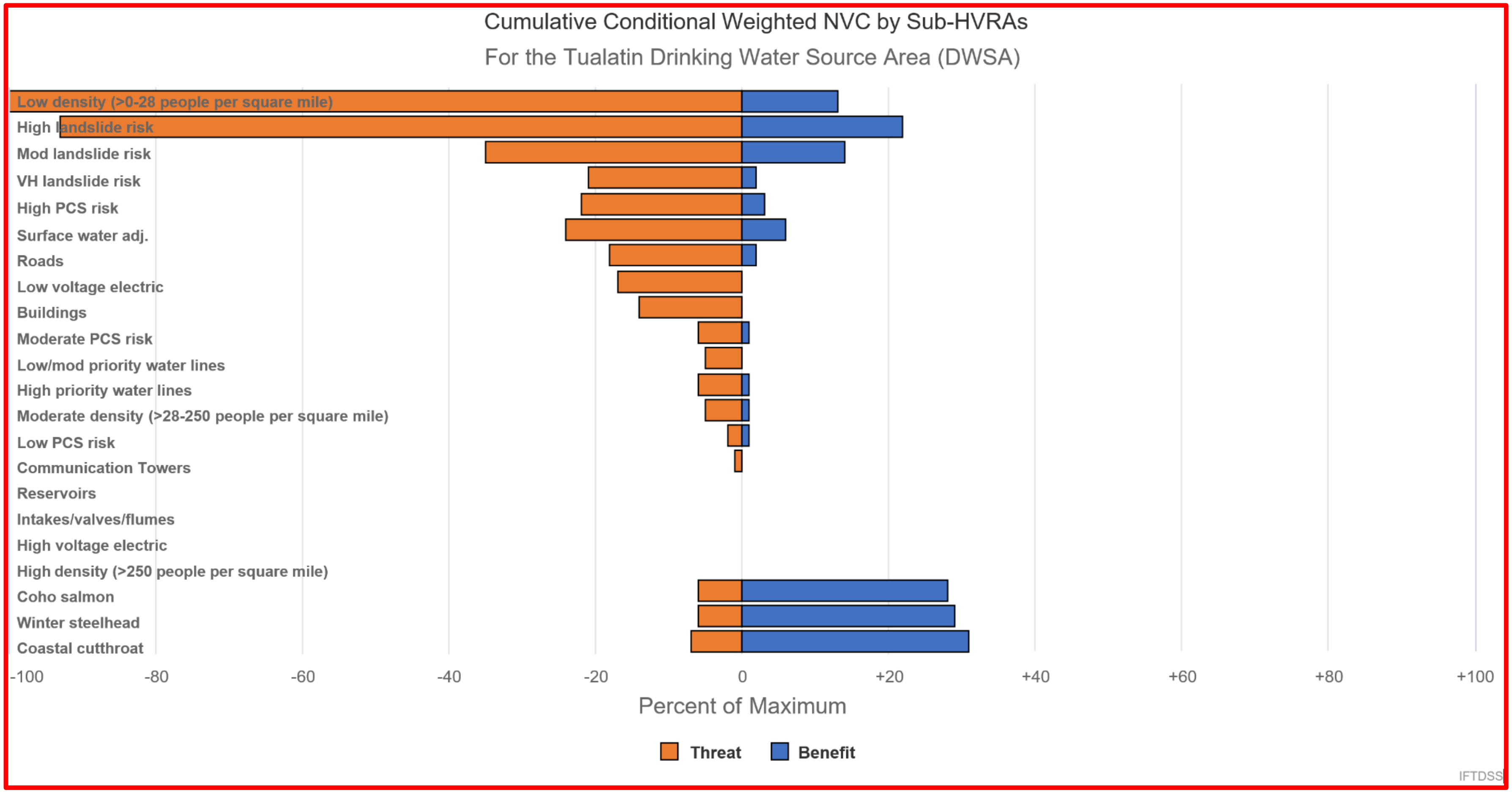


Figure 21. Weighted net response over all highly valued resources and assets (HVRAs) in the DWSA. HVRAs show positive net value change (response) on the right and negative net value change to the left.

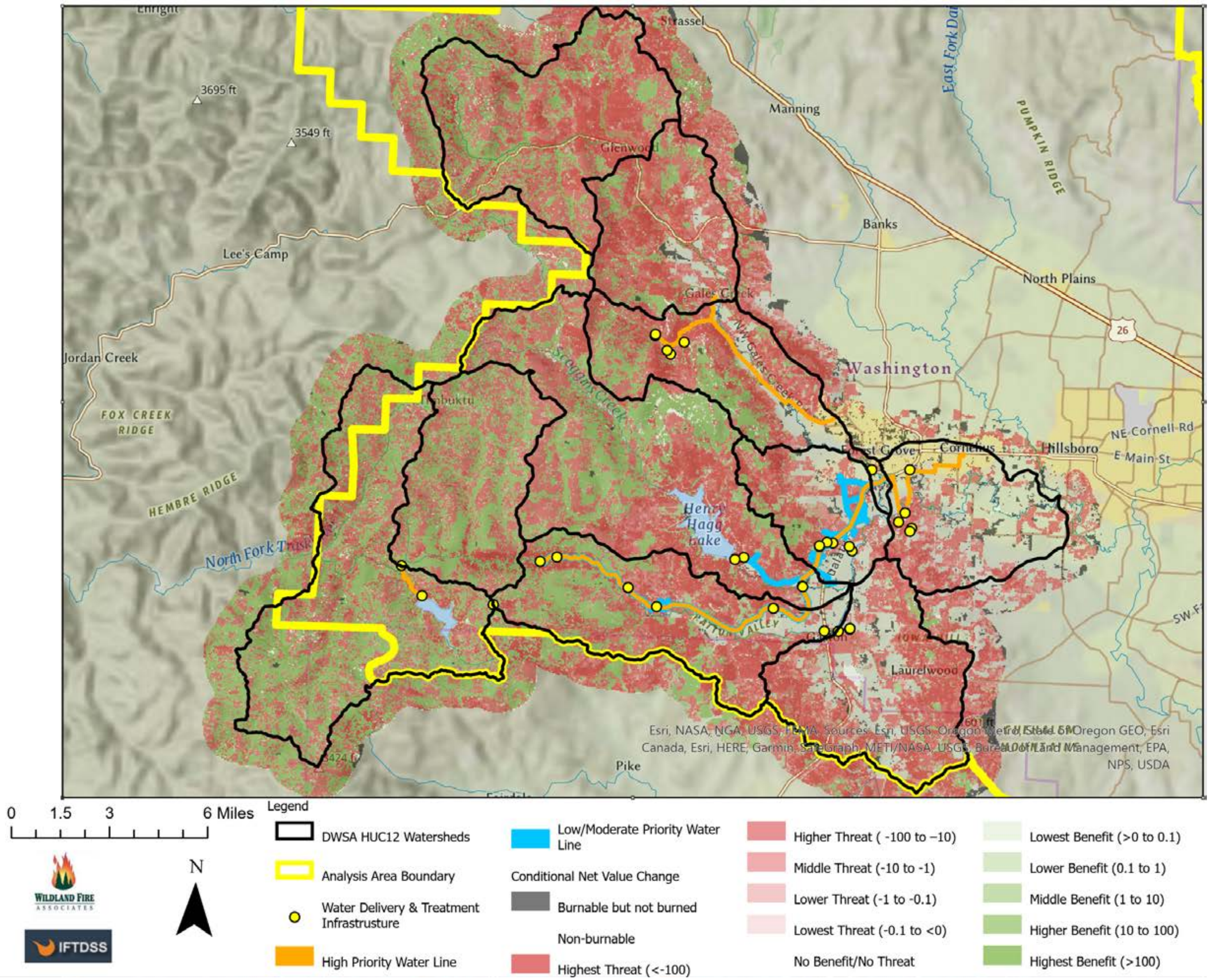


Figure 22. Map of Conditional Net Value Change (cNVC) for the DWSA.

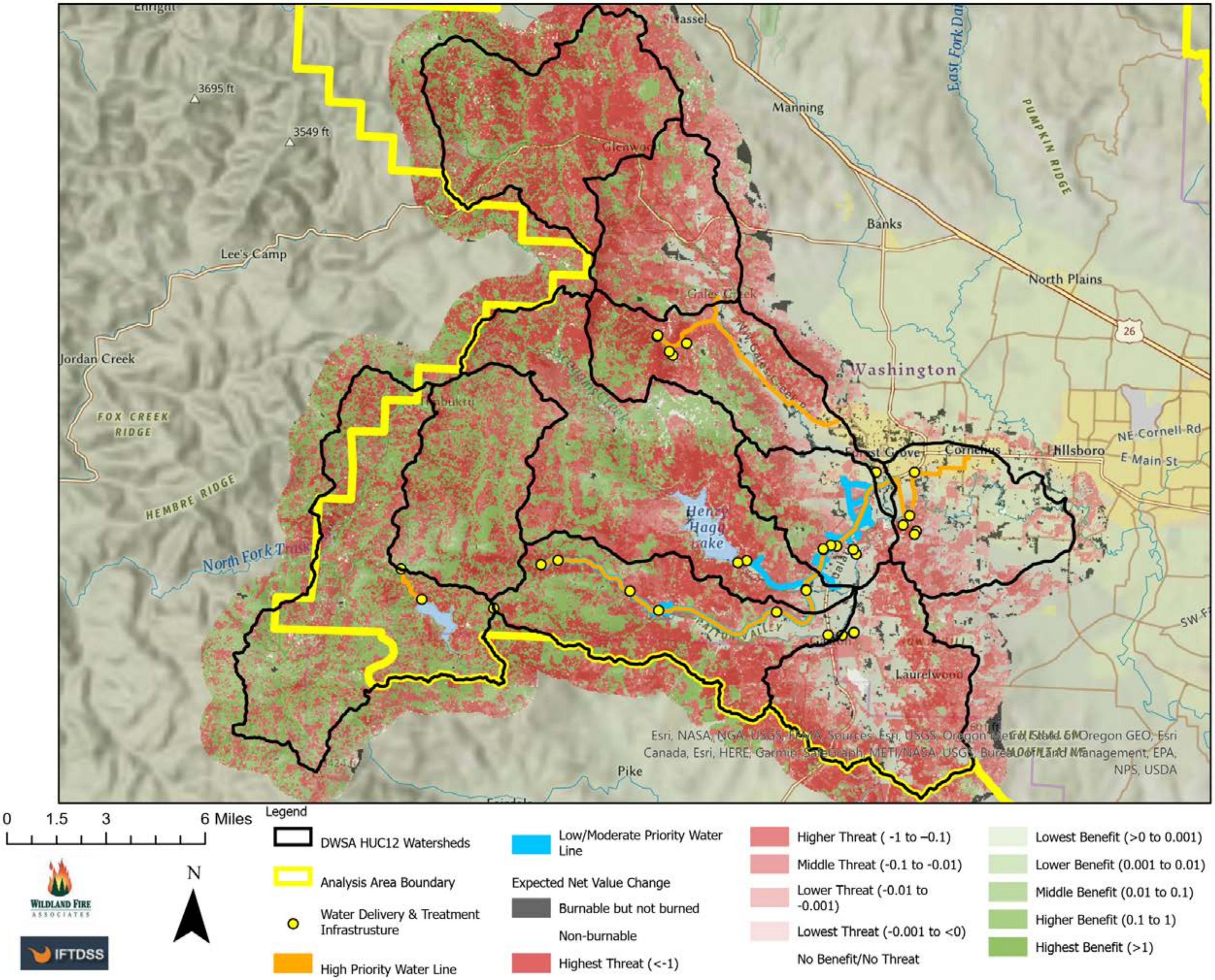


Figure 23. Map of Expected Net Value Change (eNVC) for the DWSA.

Looking at each individual watershed within the DWSA, they are listed below in order of decreasing eNVC (Table 10). The eNVC sum column reflects the expected loss to all HVRAs after considering burn probability. In other words, the watersheds are listed in order of greatest to least expected losses. The major importance HVRA column reflects the sub-HVRA in that watershed with the overall greatest importance, recognizing that by holding the primary HVRA relative importance at the same levels in each analysis, no sub-HVRA overall importance can exceed the relative importance of the primary HVRA overall importance shown in Figure 10. The overall importance of roads and low voltage powerlines generally exceeded the overall importance of water delivery infrastructure due to the former's greater extent. LBP and CFL are shown in Appendix B for each of the 10 HUC12 DWSA watersheds, along with the Integrated Hazard coverage. LBP and CFL maps in Appendix B are report outputs directly from IFTDSS, but those GIS coverages along with the cNVC and eNVC coverages for each watershed are available in the digital data accompanying this report.

DWSA Watershed	Area (ac)	% NB1[1]	% NB3[2]	% GR1[3]	Max LBP	Sum Weighed eNVC	Maj Importance HVRA	% Ovrl Import
Middle Gales Creek	12,609	2	7	9	0.3616	-1,607,412	Low Voltage Electric	26
Upper Gales Creek	21,207	1	0	2	0.372	-1,173,083	High Landslide Susceptibility	26%
Lower Gales Creek	14,150 ac.	4%	12%	4%	0.376	-1,086,719	Roads	20%
Roaring Creek / Tualatin River	17,947	3	8	12	0.3387	-1,025,275	Roads	19
Wapato Creek	16,776	5	20	27	0.2197	-872,157	Low Voltage Electric	18
Sain / Scoggins Creek	28,545	1	2	6	0.2032	-801,029	Roads	20
Carpenter Creek	8,691	7	25	24	0.3289	-648,106	High Landslide Susceptibility	16
Forest Grove	12,334	18	39	15	0.2598	-605,932	Buildings	19
Tualatin Headwaters	15,182	0	0	4	0.3177	-403,000	Roads	32
Middle Fork/ North Fork Trask River	27,649	0	0	3	0.1384	-98,364	Roads	33

Table 10. Statistics from the individual watersheds within the DWSA listed in order of decreasing maximum LBP.

[1] Non-burnable, urban
[2] Non-burnable, agriculture
[3] Grass

ANALYSIS SUMMARY

The Tualatin Basin QWRA provides foundational information about wildfire hazard and risk to highly valued resources and assets associated with delivery of fresh water. The results represent the best available science across a range of disciplines. While this report was generated by Wildland Fire Associates and Oregon State University Extension Service, the overall analysis was developed as a collaborative effort with Tualatin SWCD and the JWC, along with Clean Water Services (CWS) and the Tualatin River Watershed Council (TRWC) Resource Specialists, Geospatial Analysts, and Information Specialists. This analysis can provide great utility in a range of applications including: resource planning, prioritization and implementation of prevention and mitigation activities and wildfire incident response planning. Lastly, this analysis should be viewed as a living document. The landscape file should be periodically revisited and updated to account for future forest disturbances and other land use changes. Additionally, the HVRA mapping may also need to be updated to account for forthcoming resource challenges and needs within the Tualatin Basin.

PART 2
PREPAREDNESS and MITIGATION RECOMMENDATIONS

OVERVIEW

PURPOSE OF THE PREPAREDNESS AND MITIGATION RECOMMENDATIONS

The purpose of the preparedness and mitigation recommendations is to provide options for and prioritization of actions to reduce wildfire hazard and risk to highly valued resources and assets within the Tualatin River Basin. Specifically, the JWC, Tualatin SWCD, CWS, Tualatin River WC, and partners are seeking recommendations about mitigating risk to surface drinking water and water delivery infrastructure. The goal of this report is to:

- Provide guidance on delineation and mapping of geographic focus areas for mitigation projects
- Prescribe mitigation actions within the delineated geographic focus areas including improvement of access, hazardous fuels reduction, creation of defensible space, and coordination with local fire districts
- Identify subject matter experts to assist with project development

The recommendations in this section of the assessment are informed by the quantitative wildfire risk assessment in the previous section and observations on site visits to ground-truth conditions. Many recommendations will require additional research and collaboration with public entities, private landowners, and partner organizations to develop a more detailed action plan.

GENERAL RECOMMENDATIONS FOR HVRAs

INFRASTRUCTURE

Electric Transmission Lines

Preparedness and hazard mitigation actions include fuels treatments to reduce fuelbed depth including mowing and maintenance of vegetation below 6" and/or breaking up horizontal fuel continuity twice the height of the vegetation where a 6" height cannot reasonably be maintained. This will reduce fire intensity, as well as provide access for fire suppression resources to respond more effectively.

Roads

Preparedness and hazard mitigation actions include fuels reduction work in the form of mowing, thinning, piling, and pile burning as needed. Mowing and maintenance of vegetation below 6" and/or breaking up horizontal fuel continuity where a 6" height cannot reasonably be maintained is recommended 25-50 ft. on either side of roads intended for access to HVRAs. This will reduce fire intensity, as well as provide access for fire suppression resources to respond more effectively.

Communication Sites and Cell Towers

Preparedness and mitigation actions include mechanical fuels reduction treatments commensurate with defensible space for structure survivability around these sites. Nothing burnable should fall within 5 ft. of any communication site or cell tower and vegetation should be less than 6 in. within 5-30 ft.

Water Transmission Lines

Preparedness and mitigation actions include fuels reduction to maintain flame lengths at or below 4-6 ft., which translates to an average fuelbed depth of <1 ft. within the 30 ft. buffer on either side of transmission lines

Other Water Delivery and Treatment Infrastructure

Preparedness and mitigation actions include fuels reduction treatments commensurate with defensible space for structure survivability around most sites. Nothing burnable should fall within 5 ft. of any communication site or cell tower and vegetation should be less than 6 in. within 5-30 ft. Additional reduction of ladder fuels and wide spacing between plants is recommended out to 100 ft. Trees not being removed should be pruned to 8-10 ft. height above the ground.

SURFACE WATER THREATS

Landslide Hazard

A major cause of landslides in the northwest is continuous rains that saturate soil. Landslides can also be the direct consequence of human activity. Seemingly insignificant modifications of surface flow and drainage may induce landslides. In an urban setting, improper drainage is most often the factor when a landslide occurs. In the TBRA, landslide potential was used as a significant variable influencing likely post-fire sedimentation and water quality degradation.

Soil type and slope steepness are not generally readily modifiable, and preparedness and mitigation measures to address landslide hazard must focus on post-fire measures. Watersheds recently burned by wildfires are prone to debris flow occurrence, particularly within the first 2 years following wildfires (De Graff 2018). Debris flows are less likely over time due to recovery of vegetative cover and soil infiltration associated with restored hydrological function (De Graff 2018). Burned drainage basins with forest cover represent an exception, where a secondary period of increased susceptibility to debris flows due to fire-induced tree mortality and root decay leading to infiltration-triggered landslides 3-10 years or more after the fire (De Graff 2018). Recommended post-fire mitigation measures in forested terrain include stabilization measures to address the primary risks within the first two years posed by debris flows caused by progressive entrainment, such as seeding, mulching, directional felling, wattles, and haybales. Subsequent and simultaneous mitigation for later debris flows in forested terrain involves timely reforestation of areas where fire damage and decaying roots compromise soil strength (De Graff 2018).

Potential Contamination Sources

As described in the quantitative wildfire risk assessment, potential contaminated sources are locations where contamination may occur through a point source discharge. Preparedness and mitigation actions include mechanical fuels reduction treatments commensurate with defensible space for structure survivability around these sites. Nothing burnable should fall within 5 ft. of any communication site or cell tower and vegetation should be less than 6 in. within 5-30 ft. Additional reduction of ladder fuels and wide spacing between plants is recommended out to 100 ft.

Surface Drinking Water Adjacency

Rivers, lakes, and wetlands were assigned a ¼-mile buffer for this sub-HVRA. This sub-HVRA represents the increased risk to water resources when a wildland fire burns adjacent or nearly adjacent to important surface drink water resources. Surface water adjacency class received 3 percent of the total HVRA relative importance.

Preparedness and hazard mitigation actions for surface water include fuels treatments within the ¼ mile buffer to reduce fuelbed depth, including mowing and maintenance of vegetation below 6” and/or breaking up horizontal fuel continuity where a 6” height cannot reasonably be maintained. This will reduce fire intensity as well as provide access for fire suppression resources to respond more effectively. This may or may not be feasible in natural areas adjacent to water bodies with legally required and ecologically necessary buffers.

LANDSCAPE VEGETATION AND FUELS TREATMENTS

Landslide Hazard Adjacency to Surface Drinking Water

Areas of high fire hazard on slopes with high landslide or erosion risk where source streams are adjacent to those slopes should be prioritized for retention of mature conifer and hardwood forest. Mature Douglas-fir and Ponderosa pine trees native to the Willamette Valley are considered fire-resistant compared with other fire-sensitive conifer species such as Western red cedar and Western hemlock. Hardwoods such as oaks, maple, cottonwood, and alder tend to resist combustion and resprout both epicormically as well as from the base of the tree when they do burn. Thinning where possible for retention of healthier larger trees should be implemented with consideration for limitations inherent to forestry operations on steep slopes that characterize areas with high landslide potential. Tree planting projects should consider species adapted to both fire and hotter drier conditions, which favor Ponderosa pine and hardwoods over Douglas fir.

Pre-fire fuels mitigation strategies for landslide hazard mitigation are less numerous than what can be done post-fire. Establishment and promotion of hardwoods, particularly in riparian areas, is a good strategy for positive post-fire tree response. Alder, maple, oak, and cottonwood that were impacted by the 2020 Holiday Farm Fire along the McKenzie River responded with new green leaves within weeks of the fire after rain was received. A similar response was observed in Oregon white oak after a wildfire at Mt. Pisgah in 2019. The secondary form of landslide hazard associated with loss of root structure merits consideration of this strategy for the sake of maintaining forest structure.

Upper Gales Creek and Carpenter Creek are the DWSAs of primary concern in order of priority for retention of mature conifer and hardwood overstory to buffer against canopy loss during wildfire leading to an increase of existing high hazard for landslide potential. Introduction of low intensity prescribed fire in forests where tree maturation is sufficient to include thickened bark that resists cambial injury from fire is recommended with acknowledgement of the challenges of reintroducing fire on steep slopes in forests that have not burned frequently in recent history. Planting or promoting fire-dependent and/or adapted conifer species such as Ponderosa pine and redwoods could enhance post-fire regeneration and/or survivability respectively. Reducing and interrupting surface and ladder fuels where possible will help reduce both crown and surface fire potential.

Forest Health and Fire Hazard Reduction

Tools to help re-establish ecosystem health include thinning of dense trees to favor larger and more mature trees; managing for species and structural diversity and resilience including planting for climate adaptation; and invasive species management using early detection and rapid response to prevent new infestations of species that tend to contribute to higher rates of fire spread including Himalayan blackberry and various species of pasture grasses. Wider spacing to give plants and trees more resources and selecting species that tolerate hotter and drier conditions provides the additional benefit of maintaining reduced fuels.

Shaded fuel breaks concentrated near roads can provide opportunities to manage wildfires more effectively for positive net value change on the landscape. These can be created by reducing dead fuels in the form of branches and small logs by burning, including creation of biochar, and chipping. Reintroduction of fire where feasible will provide the most benefit overall in terms of hazard reduction. Breaking up the horizontal and vertical continuity of fuels includes pruning trees up to 8-10 ft., ensuring brush and small trees are limited to individuals and small isolated clumps.

Upper Gales, Middle Gales, Tualatin River, Roaring Creek, Scoggins Creek, Elkhorn Creek, and Dilley Creek all show fire hazard that merits prioritization of projects aimed toward forest health, achieved through both fire hazard reduction and climate change adaptation. In some cases, forests are too dense and need to be thinned, whereas in others, such as along the Tualatin River, a combination of thinning needs to occur alongside revegetation of areas recently commercially harvested for timber.

FLOODPLAIN DYNAMICS

Increasing stream complexity and restoring historic floodplain dynamics by adding large wood to streams helps mitigate wildfire hazard by creating larger and more complex riparian areas which are generally less susceptible to fire than uplands. Large woody debris is not associated with fire spread given its large diameter, particularly when it is partially submerged. Broadleaf species with higher live fuel moisture content due to adjacency to water are generally both less susceptible and more resilient to wildfire.

Beaver-dammed riparian corridors are comparably unaffected by wildfire when evaluated relative to similar riparian corridors lacking beaver dams (Fairfax and Whittle, 2021). Beaver habitat on the 2021 Bootleg Fire in southern Oregon slowed fire growth and burned less intensely. Building beaver dam analogs (BDAs) and supporting beaver dam complexes promotes water retention and groundwater recharge which has been shown to mitigate fire damage. It is recommended that where appropriate, beaver habitat be restored and analogs created where beaver activity is a nuisance.

GEOGRAPHIC FOCUS AREAS

The DWSA watersheds are listed in Table 11 in order of priority for hazard mitigation and preparedness. The Priority, or Major Importance, HVRA column reflects the sub-HVRA in that watershed with the overall greatest importance (see Effects Analysis results in quantitate wildfire risk assessment for an explanation of the ranking criteria).

DWSA Watershed	Geographic Focus Area Priority	Area (acres)	Priority (or Major Importance) HVRA
Middle Gales Creek	1	12,609	Low Voltage Electric
Upper Gales Creek	2	21,207	High Landslide Susceptibility
Lower Gales Creek	3	14,150	Roads
Roaring Creek / Tualatin	4	17,947	Roads
Wapato Creek	5	16,776	Low Voltage Electric
Sain Creek / Scoggins Creek	6	28,545	Roads
Carpenter Creek	7	8,691	High Landslide Susceptibility
Forest Grove	8	12,334	Buildings
Tualatin Headwaters	9	15,182	Roads
Middle Fork / North Fork Trask	10	27,649	Roads

Table 11. DWSA Watersheds in order of priority for wildfire risk mitigation actions with acreage and priority (or major importance) HVRA

The following sections describe priority mitigation actions in each DWSA watershed, in order of watershed priority. Table 12 provides a summary of the HVRA protection actions prioritized for each watershed (see guidelines in General Recommendations for HVRAs, and/or priority mitigation actions for each watershed). The integrated hazard map for each watershed (see Appendix B) shows each HVRA in relation to wildfire hazard on the landscape. It is important to note that not every hazard can be mitigated, particularly where steep slopes limit treatment options and landslide susceptibility is based on soil type and slope steepness.

DWSA Watershed	Geographic Focus Area Priority	Electric Transmission Lines	Roads	Communication Sites & Cell Towers	Water Transmission Lines	Other Water Delivery & Treatment Infrastructure	Landslide Hazard	Potential Contamination Sources	Surface Drinking Water Adjacency	Landscape Vegetation & Fuel Treatments	Floodplain Dynamics
Middle Gales Creek	1	X	X					X		X	X
Upper Gales Creek	2	X	X				X			X	X
Lower Gales Creek	3		X		X			X			X
Roaring Creek / Tualatin	4		X	X	X	X	X	X	X	X	X
Wapato Creek	5	X	X			X		X	X		X
Sain Creek / Scoggins Creek	6		X				X	X	X	X	X
Carpenter Creek	7				X	X	X	X		X	X
Forest Grove	8		X		X	X					X
Tualatin Headwaters	9		X			X				X	X
Middle Fork / North Fork Trask	10		X			X			X		X

Table 12. Summary table of HVRA protection actions prioritized for each watershed. Guidelines for each HVRA are listed in General Recommendations for HVRAs and priority mitigation actions for each watershed.

MIDDLE GALES CREEK

Low Voltage Electric (Priority HVRA)

Low voltage electrical transmission lines represent the HVRA with the highest level of importance in Middle Gales Creek. Lines located within highest hazard areas such as the western part of the watershed should be prioritized. Preparedness and hazard mitigation actions include fuels treatments to reduce fuelbed depth, such as mowing and maintenance of vegetation below 6" and/or breaking up horizontal fuel continuity twice the height of the vegetation where a 6" height cannot reasonably be maintained. This will reduce fire intensity, as well as provide access for fire suppression resources to respond more effectively.

Potential Contamination Sources

Many of the potential contamination sources (PCS) rank as high risk and are co-located with roads. Preparedness and mitigation actions include mechanical fuels reduction treatments to create defensible space for structure survivability around these sites. Nothing burnable should fall within 5 ft. of any communication site or cell tower and vegetation should be less than 6 in. within 5-30 ft. Additional reduction of ladder fuels and wide spacing between plants is recommended out to 100 ft.

Roads

Treatment of roads can function to aid in fire management operations on multiple levels. In Middle Gales, the orientation of the road north-south makes it potentially valuable as a control line given winds of concern are easterly (i.e., winds predominately arrive from the east). Where roads and transmission lines align, such as in the eastern portion of Middle Gales, consider prioritizing fuels treatments for multiple benefits from a single or expanded treatment to encompass both. Preparedness and hazard mitigation actions include fuels reduction work in the form of mowing, thinning, piling cut and gathered fuels, and burning piles as needed. Mowing and maintenance of vegetation below 6" and/or breaking up horizontal fuel continuity where a 6" height cannot reasonably be maintained is recommended 25-50 ft. on either side of roads intended for access to HVRAs. This will reduce fire intensity as well as provide access for fire suppression resources to respond more effectively.

UPPER GALES CREEK

High Landslide Susceptibility (Priority HVRA)

Recommended post-fire mitigation measures in forested terrain include stabilization measures to address the primary risks within the first two years posed by debris flows caused by progressive entrainment, such as seeding, mulching, directional felling, wattles, and use of hay bales to reduce surface runoff. Subsequent and simultaneous mitigation for later debris flows in forested terrain involves timely reforestation of areas where fire damage and decaying roots compromise soil strength (De Graff 2018).

Roads

Preparedness and hazard mitigation actions include fuels reduction work in the form of mowing, thinning, piling, and pile burning as needed. Mowing and maintenance of vegetation below 6" and/or breaking up horizontal fuel continuity where a 6" height cannot reasonably be maintained is recommended 25-50 ft. on either side of roads intended for access to HVRAs. This will reduce fire intensity, as well as provide access for fire suppression resources to respond more effectively.

Low Voltage Electric

Lines located within highest hazard areas such as the western portion of Upper Gales should be prioritized. Preparedness and hazard mitigation actions include fuels treatments to reduce fuelbed depth such as mowing and maintenance of vegetation below 6” and/or breaking up horizontal fuel continuity twice the height of the vegetation where a 6” height cannot reasonably be maintained. This will reduce fire intensity, as well as provide access for fire suppression resources to respond more effectively.

Potential Contamination Sources

A small number of PCS occur within Upper Gales. Preparedness and mitigation actions include mechanical fuels reduction treatments commensurate with defensible space for structure survivability around these sites. Nothing burnable should fall within 5 ft. of any communication site or cell tower and vegetation should be less than 6 in. within 5-30 ft. Additional reduction of ladder fuels and wide spacing between plants is recommended out to 100 ft.

LOWER GALES CREEK

Roads (Priority HVRA)

Preparedness and hazard mitigation actions include fuels reduction work in the form of mowing, thinning, piling, and pile burning as needed. Mowing and maintenance of vegetation below 6” and/or breaking up horizontal fuel continuity where a 6” height cannot reasonably be maintained is recommended 25-50 ft. on either side of roads intended for access to HVRAs. This will reduce fire intensity as well as provide access for fire suppression resources to respond more effectively.

High Priority Water Line

Preparedness and mitigation actions include fuels reduction to maintain flame lengths at or below 4-6 ft., which translates to an average fuelbed depth of <1 ft. within the 30 ft. on either side of transmission lines.

Potential Contamination Sources

Preparedness and mitigation actions include mechanical fuels reduction treatments commensurate with defensible space for structure survivability around these sites. Nothing burnable should fall within 5 ft. of any communication site or cell tower and vegetation should be less than 6 in. within 5-30 ft. Additional reduction of ladder fuels and wide spacing between plants is recommended out to 100 ft. Consider connecting treatments to create strategic fuelbreaks where roads, PCS buffers, and water transmission lines overlap.

ROARING CREEK / TUALATIN RIVER

Roads (Priority HVRA)

Access to Haines Intake, Slow Sand Filter Plant, and Soda Ash Facility should be prioritized, followed by access to Blind Cabin. Preparedness and hazard mitigation actions include fuels reduction work in the form of mowing, thinning, piling, and pile burning as needed. Mowing and maintenance of vegetation below 6” and/or breaking up horizontal fuel continuity where a 6” height cannot reasonably be maintained is recommended 25-50 ft. on either side of roads intended for access to HVRAs. This will reduce fire intensity, as well as provide access for fire suppression resources to respond more effectively.

Soda Ash Facility

Buildings

Preparedness and mitigation actions include mechanical fuels reduction treatments commensurate with defensible space for structure survivability around this sites. Nothing burnable should fall within 5 ft. of any communication site or cell tower and vegetation should be less than 6 in. within 5-30 ft. Additional reduction of ladder fuels and wide spacing between plants is recommended out to 100 ft. Trees not being removed should be pruned to 8-10 ft. height above the ground. Buildings such as the Soda Ash Facility would fare better during an extreme wildfire event and be more likely to be defended by firefighters if they received such treatments in advance, particularly within the fenced area surrounding the building.

High Priority Water Line

Fuels reduction to maintain flame lengths at or below 4-6 ft., which translates to an average fuelbed depth of <1 ft. within the 30 ft. on either side of below-ground water transmission lines, would mitigate wildfire hazard and prepare the area for safe and successful fire response.

Telecommunications Site

Fuels reduction treatments commensurate with defensible space for structure survivability should be conducted for preparedness and mitigation of potential wildfire impacts around these sites. Nothing burnable should fall within 5 ft. of any communication site or cell tower and vegetation should be less than 6 in. within 5-30 ft. Consider expanding and improving defensible space at Blind Cabin.

Blind Cabin Telecommunication Site

Water Infrastructure

Preparedness and mitigation actions include fuels reduction to maintain flame lengths at or below 4-6 ft., which translates to an average fuelbed depth of <1 ft. within 30 ft. of infrastructure, preferably including 5 ft. of unburnable directly adjacent. Examples of features in need of this type of hazardous fuels reduction are the Patton Valley Control Valve and Haines Intake. It is recommended that broader defensible space be created at Slow Sand Filtration Plant where a crown fire in the trees adjacent would likely create conditions under which the chlorine gas stored there could ignite. Creation and maintenance of fuels treatments for road access to Haines Intake and Slow Sand Filtration in the event of a wildfire is also recommended. Consider replacing the wooden outflow at the Slow Sand Filtration Settling Pond with some non-combustible.

Patton Valley Control Valve

High Landslide Susceptibility

Numerous clearcuts on steep slopes on private land on both sides of the Tualatin River pose near-term threats in terms of both wildfire and landslide susceptibility. The Slow Sand Settling Pond is a vulnerable feature on the landscape, for which there are few pre-fire mitigations due to adjacent slope steepness.

Recommended post-fire mitigation measures in forested terrain include stabilization measures to address the primary risks within the first two years posed by debris flows caused by progressive entrainment, such as seeding, mulching, directional felling, wattles, and use of hay bales to reduce surface runoff. Subsequent and simultaneous mitigation for later debris flows in forested terrain involves timely reforestation of areas where fire damage and decaying roots compromise soil strength (De Graff 2018).

Surface Drinking Water Adjacency

Numerous clearcuts along the Tualatin River pose increased wildfire hazard to adjacent surface drinking water. These areas should be revegetated as quickly as possible to reduce this threat. Where feasible, and where clearcuts have not recently occurred, preparedness and hazard mitigation actions could include fuels treatments within the ¼ mile buffer to reduce fuelbed depth including brushing, mowing and maintenance of vegetation below 6” and/or breaking up horizontal fuel continuity where a 6” height cannot reasonably be maintained. This will reduce fire intensity as well as provide access for fire suppression resources to respond more effectively. This may or may not be feasible in areas adjacent to water bodies considered wetlands, riparian, etc. and would also be constrained by restrictions along fish-bearing streams.

Potential Contamination Sources

Preparedness and mitigation actions include mechanical fuels reduction treatments commensurate with defensible space for structure survivability around these sites. Nothing burnable should fall within 5 ft. of any communication site or cell tower and vegetation should be less than 6 in. within 5-30 ft. Additional reduction of ladder fuels and wide spacing between plants is recommended out to 100 ft.

WAPATO CREEK

Low Voltage Electric (Priority HVRA)

Low voltage electrical transmission lines running north-south in the western portion of the Wapato focus area represent the HVRA with the highest level of importance and should be prioritized over other HVRAs based upon the TBRA. Preparedness and hazard mitigation actions include fuels treatments to reduce fuelbed depth, such as mowing and maintenance of vegetation below 6” and/or breaking up horizontal fuel continuity twice the height of the vegetation where a 6”height cannot reasonably be maintained. This will reduce fire intensity as well as provide access for fire suppression resources to respond more effectively.

Water Infrastructure

Preparedness and mitigation actions to protect features, such as the Wapato Pumphouse, include fuels reduction to maintain flame lengths at or below 4-6 ft., which translates to an average fuelbed depth of <1 ft. within 30 ft. This could include mowing, thinning, piling, and pile burning as needed.

Roads

Preparedness and hazard mitigation actions include fuels reduction work in the form of mowing, thinning, piling, and pile burning as needed. Mowing and maintenance of vegetation below 6" and/or breaking up horizontal fuel continuity where a 6" height cannot reasonably be maintained is recommended 25-50 ft. on either side of roads intended for access to HVRAs. This will reduce fire intensity as well as provide access for fire suppression resources to respond more effectively. Limitations in the use of this approach will vary considerably based on land ownership.

Potential Contamination Sources

Preparedness and mitigation actions include mechanical fuels reduction treatments commensurate with defensible space for structure survivability around these sites. Nothing burnable should fall within 5 ft. of any communication site or cell tower and vegetation should be less than 6 in. within 5-30 ft. Additional reduction of ladder fuels and wide spacing between plants is recommended out to 100 ft.

Surface Drinking Water Adjacency

Preparedness and hazard mitigation actions could include fuels treatments within the ¼ mile buffer to reduce fuelbed depth including brushing, mowing and maintenance of vegetation below 6" and/or breaking up horizontal fuel continuity where a 6" height cannot reasonably be maintained. This will reduce fire intensity as well as provide access for fire suppression resources to respond more effectively. This may or may not be feasible in areas adjacent to water bodies considered wetlands, riparian, etc. and would also be constrained by restrictions along fish-bearing streams.

SAIN / SCOGGINS CREEK

Roads (Priority HVRA)

Preparedness and hazard mitigation actions include fuels reduction work in the form of mowing, thinning, piling, and pile burning as needed. Mowing and maintenance of vegetation below 6" and/or breaking up horizontal fuel continuity where a 6" height cannot reasonably be maintained is recommended 25-50 ft. on either side of roads intended for access to HVRAs. This will reduce fire intensity as well as provide access for fire suppression resources to respond more effectively.

Patton Valley Pump Plant

Water Infrastructure

Preparedness and mitigation actions include fuels reduction to maintain flame lengths at or below 4-6 ft., which translates to an average fuelbed depth of <1 ft. within 30 ft. of infrastructure and facilities. Priority should be given to Patton Valley Pump Plant.

Potential Contamination Sources

Preparedness and mitigation actions include mechanical fuels reduction treatments commensurate with defensible space for structure survivability around these sites. Nothing burnable should fall within 5 ft. of any communication site or cell tower and vegetation should be less than 6 in. within 5-30 ft. Additional reduction of ladder fuels and wide spacing between plants is recommended out to 100 ft.

High Landslide Susceptibility

Recommended post-fire mitigation measures in forested terrain include stabilization measures to address the primary risks within the first two years posed by debris flows caused by progressive entrainment, such as seeding, mulching, directional felling, wattles, and use of hay bales to reduce surface runoff. Subsequent and simultaneous mitigation for later debris flows in forested terrain involves timely reforestation of areas where fire damage and decaying roots compromise soil strength (De Graff 2018).

Surface Drinking Water Adjacency

Preparedness and hazard mitigation actions could include fuels treatments within the ¼ mile buffer to reduce fuelbed depth including brushing, mowing and maintenance of vegetation below 6" and/or breaking up horizontal fuel continuity where a 6" height cannot reasonably be maintained. This will reduce fire intensity, as well as provide access for fire suppression resources to respond more effectively. This may or may not be feasible in areas adjacent to water bodies considered wetlands, riparian, etc. and would also be constrained by restrictions along fish-bearing streams.

CARPENTER CREEK

High Landslide Susceptibility (Priority HVRA)

Recommended post-fire mitigation measures in forested terrain include stabilization measures to address the primary risks within the first two years posed by debris flows caused by progressive entrainment, such as seeding, mulching, directional felling, wattles, and use of hay bales to reduce surface runoff. Subsequent and simultaneous mitigation for later debris flows in forested terrain involves timely reforestation of areas where fire damage and decaying roots compromise soil strength (De Graff 2018).

Water Infrastructure

Preparedness and mitigation actions include fuels reduction to maintain flame lengths at or below 4-6 ft., which translates to an average fuelbed depth of <1 ft. within 30 ft. Where fence inhibits access, such as at Dilley Reservoir, consider removing all burnable material between the fence and the reservoir.

Quonset Hut

Buildings

Mechanical fuels reduction treatments commensurate with defensible space for structure survivability are recommended for preparedness and hazard mitigation around these sites. Nothing burnable should fall within 5 ft. and vegetation should be less than 6 in. within 5-30 ft. Additional reduction of ladder fuels and wide spacing between plants is recommended out to 100 ft. Trees not being removed should be pruned to 8-10 ft. height above the ground.

Low/High Priority Water Line

Fuels reduction to maintain flame lengths at or below 4-6 ft., which translates to an average fuelbed depth of <1 ft. within the 30 ft. on either side of below-ground water transmission lines, would mitigation wildfire hazard and prepare the area for safe and successful fire response.

Potential Contamination Sources

Mitigation of fire hazard potential where PCS intersect with low/high priority water lines should be prioritized over other PCSs. Preparedness and mitigation actions include mechanical fuels reduction treatments commensurate with defensible space for structure survivability around these sites. Nothing burnable should fall within 5 ft. of any communication site or cell tower and vegetation should be less than 6 in. within 5-30 ft. Additional reduction of ladder fuels and wide spacing between plants is recommended out to 100 ft. Trees not being removed should be pruned to 8-10 ft. height above the ground.

FOREST GROVE

Buildings (Priority HVRA)

We recommend particular consideration be given to the on-site diesel gas storage area closest to Fern Hill Road at the Joint Water Commission Treatment Plant. Preparedness and mitigation actions include mechanical fuels reduction treatments commensurate with defensible space for structure survivability. Nothing burnable should fall within 5 ft. and vegetation should be less than 6 in. within 5-30 ft. Additional reduction of ladder fuels and wide spacing between plants is recommended out to 100 ft. Trees not being removed should be pruned to 8-10 ft. height above the ground.

Diesel tank at Joint Water Commission Treatment Plant

High Priority Water Line

Preparedness and mitigation actions include fuels reduction to maintain flame lengths at or below 4-6 ft., which translates to an average fuelbed depth of <1 ft. within 30 ft. of either side of transmission lines.

Fern Hill Reservoirs and Joint Water Commission Treatment Facility

Water Infrastructure

Preparedness and mitigation actions include fuels reduction to maintain flame lengths at or below 4-6 ft., which translates to an average fuelbed depth of <1 ft. within 30 ft. At Fern Hill Reservoirs and Treatment Facility, consider developing a defensible space plan that includes creation and maintenance of the above specifications. Working with Metro to reduce fuels on adjacent land to the west is also recommended. Due to the prevailing easterly winds associated with large fire events in this region, ensuring that fuels on the east side of the facility are managed will help mitigate potential wildfire impacts as well as provide firefighters with safer conditions and greater chances for success.

Roads

Preparedness and hazard mitigation actions include fuels reduction work in the form of mowing, thinning, piling, and pile burning as needed. Mowing and maintenance of vegetation below 6" and/or breaking up horizontal fuel continuity where a 6" height cannot reasonably be maintained is recommended 25-50 ft. on either side of roads intended for access to HVRAs. This will reduce fire intensity, as well as provide access for fire suppression resources to respond more effectively.

Western Property Boundary at Joint Water Commission Treatment Plant

TUALATIN HEADWATERS

Roads (Priority HVRA)

Preparedness and hazard mitigation actions include fuels reduction work in the form of mowing, thinning, piling, and pile burning as needed. Mowing and maintenance of vegetation below 6" and/or breaking up horizontal fuel continuity where a 6" height cannot reasonably be maintained is recommended 25-50 ft. on either side of roads intended for access to HVRAs. This will reduce fire intensity, as well as provide access for fire suppression resources to respond more effectively.

Water Infrastructure

Preparedness and mitigation actions include fuels reduction to maintain flame lengths at or below 4-6 ft., which translates to an average fuelbed depth of <1 ft. within 30 ft.

Where trees would post risks to the solar panel and other equipment at Tualatin Flume once on fire, consider removal within striking distance, or about 100 ft. around the fenced in portion of the flume.

MIDDLE FORK / NORTH FORK TRASK RIVER

Tualatin Flume

Roads (Priority HVRA)

Preparedness and hazard mitigation actions include fuels reduction work in the form of mowing, thinning, piling, and pile burning as needed. Mowing and maintenance of vegetation below 6" and/or breaking up horizontal fuel continuity where a 6" height cannot reasonably be maintained is recommended 25-50 ft. on either side of roads intended for access to HVRAs. This will reduce fire intensity, as well as provide access for fire suppression resources to respond more effectively.

Water Infrastructure

Preparedness and mitigation actions include fuels reduction to maintain flame lengths at or below 4-6 ft., which translates to an average fuelbed depth of <1 ft. within 30 ft. If a shaded fuelbreak is being used, consider the potential impacts of trees falling upon the Barney Spillway, and the need for their removal within striking distance.

Surface Drinking Water Adjacency

Numerous clearcuts surrounding Barney Reservoir pose increased wildfire hazard to adjacent surface drinking water. These areas should be revegetated as quickly as possible to reduce this threat. Where feasible, and where clearcuts have not recently occurred, preparedness and hazard mitigation actions could include fuels treatments within the ¼ mile buffer to reduce fuelbed depth including brushing, mowing and maintenance of vegetation below 6" and/or breaking up horizontal fuel continuity where a 6" height cannot reasonably be maintained. This will reduce fire intensity, as well as provide access for fire suppression resources to respond more effectively. This may or may not be feasible in areas adjacent to water bodies considered wetlands, riparian, etc. and would also be constrained by restrictions along fish-bearing streams.

Barney Spillway

LOCAL FIRE RESOURCES

Organization	Contact Name	Contact Info
Forest Grove Fire and Rescue - Gales Creek Station	Fire Chief – Michael Kinkade	503.629.0111
Oregon Department of Forestry – Forest Grove Unit	District Forester - Mike Cafferata	Mike.J.Cafferata@Oregon.gov
Clackamas County Fire Prevention Cooperative[4]	President - Kari Shanklin	503.742.2660 kari.shanklin@clackamasfire.com
Washington County Emergency Management	Manager – John Wheeler	503.846.7575
Banks Fire District No. 13	Brennan Nannenga – Volunteer Coordinator, Duty Officer	503.324.6262
Cornelius Fire District	Fire Chief - Michael Kinkade	503.357.3840
Gaston Rural Fire District	Fire Chief – Michael Kinkade	503.985.7575
Tualatin Valley Fire and Rescue		503.649.8577
Forest Grove Fire District (Rural)	Fire Chief – Michael Kinkade	503.992.3240
Oregon State University Extension Fire Program	Fire Specialists – Amanda Rau, Aaron Groth	amanda.rau@oregonstate.edu aaron.groth@oregonstate.edu
Oregon State Fire Marshal	Stephanie Stafford – Fire Risk Reduction Specialist, Washington County	503.990.5445 ssstaffo@osp.oregon.gov

[4] West Metro Fire Prevention Cooperative, which was hosted by the Forest Grove FD, merged with Clackamas County Fire Prevention Cooperative

RECOMMENDATIONS SUMMARY

The ultimate goal in preparing for and mitigating hazards associated with wildland fire are landscapes and communities that are resilient to fire. Many positive net value benefits occur as a result of fire on the landscape. Protection of HVRAs may include low intensity fire. Modification of fuels and enhancement of access represent opportunities to influence future wildfire events in favor of net positive benefits.

Some of the highest hazards and needs for mitigations represent substantial investments of time and resources. Where resources allow for mitigation of hazards where fewer resources are required, consider completing those projects while pursuing funding and partnerships for larger projects, including those at the landscape level.

A new statewide risk assessment including defining and mapping the wildland-urban interface is being produced under the Oregon Legislature's 2021 omnibus wildfire bill SB762. It is recommended that both the TBRA and RWTB be updated as needed based on the results of the new risk assessment.

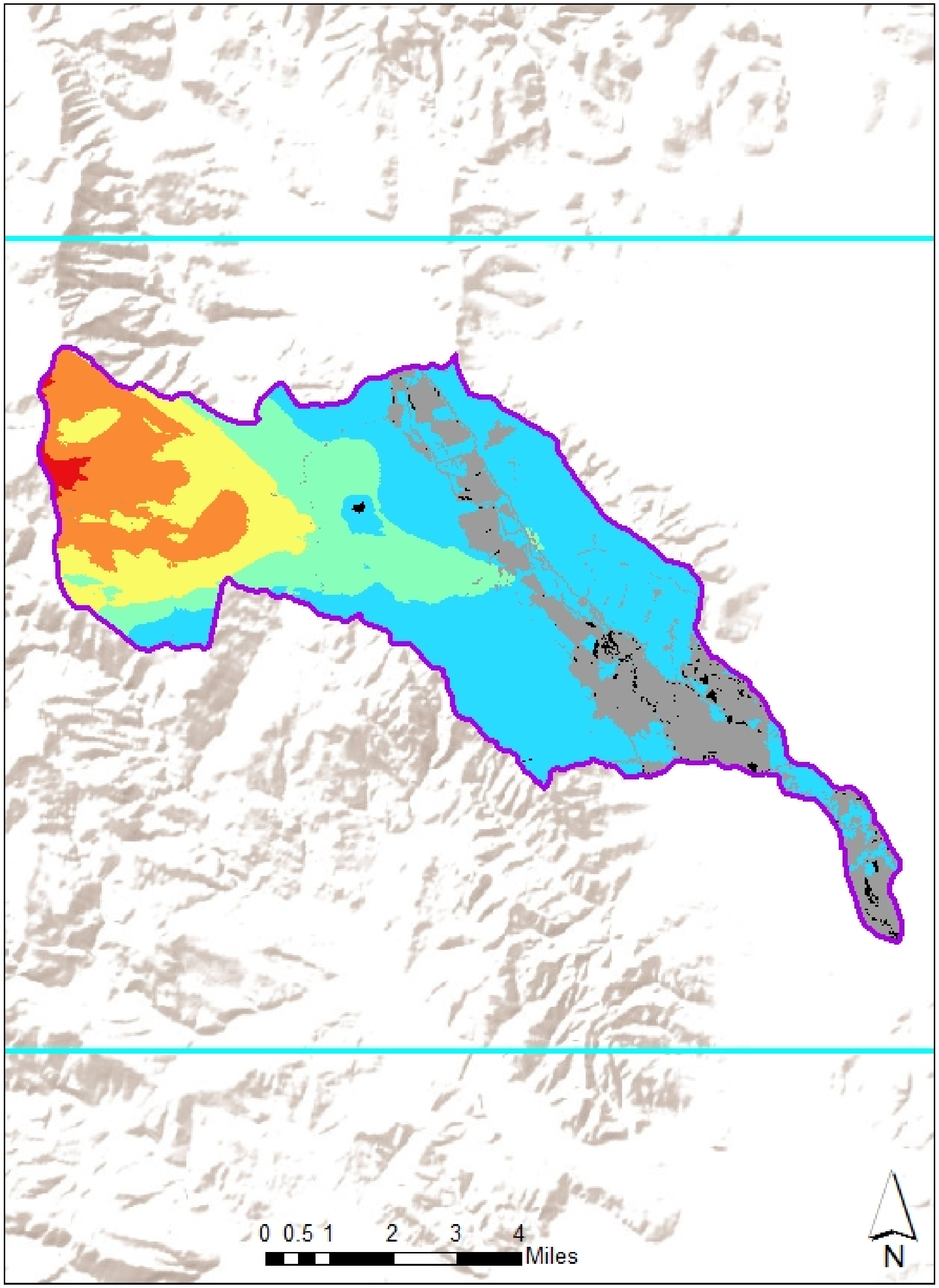
REFERENCES

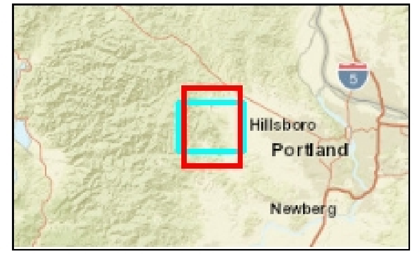
De Graff, J.V. A rationale for effective post-fire debris flow mitigation within forested terrain. *Geoenviron Disasters* **5,** 7 (2018). https://doi.org/10.1186/s40677-018-0099-z

Fairfax, Emily & Whittle, Andrew. (2021). Smokey the Beaver: Beaver-Dammed Riparian Corridors Stay Green During Wildfire Throughout the Western USA. The Bulletin of the Ecological Society of America. 102. 10.1002/bes2.1795.

Gilbertson-Day, J.; Stratton, R.D.; Scott, J.H.; Vogler, K.C.; Brough, A. Pacific Northwest Quantitative Wildfire Risk Assessment: Methods and Results; Pyrologix: Missoula, MT, USA, 2018.

Primary HVRA	Primary RI	Sub-HVRA	Sub-RI	Relative Extent (ac)	Relative Importance per Pixel	Overall Importance (%)
Communities	50	Low density (>0-28 people persquare mile)	50	175,941	1.28	13
Communities	50	Moderate density (>28-250 people per square mile)	75	19,099	1.91	2
Communities	50	High density (>250 people persquare mile)	100	10,620	2.55	2
Infrastructure	100	Communication Towers	80	320	91.59	2
Infrastructure	100	Buildings	100	368	114.48	2
Infrastructure	100	High Voltage Powerlines	80	564	91.59	3
Infrastructure	100	High Priority Water Lines	100	392	114.48	2
Infrastructure	100	Intakes, Valves & Flumes	100	8	114.48	0
Infrastructure	100	Low/Mod Priority Water Lines	80	322	91.59	1
Infrastructure	100	Low Voltage Powerlines	80	2,350	91.59	14
Infrastructure	100	Roads	80	2,040	91.59	10
Infrastructure	100	Reservoirs	100	24	114.48	0
Surface Drinking Water	90	Surface Water Adjacency	80	15,970	1.94	2
Surface Drinking Water	90	High Landslide Potential	70	172,966	1.70	19
Surface Drinking Water	90	High Potential Contamination Source (PCS) Risk	100	7,496	2.43	1
Surface Drinking Water	90	Low Potential Contamination Source (PCS) Risk	80	1,343	1.94	0
Surface Drinking Water	90	Moderate Landslide Potential	30	115,872	0.73	5
Surface Drinking Water	90	Moderate Potential Contamination Source (PCS) Risk	90	1,411	2.19	0
Surface Drinking Water	90	Very High Landslide Potential	100	21,681	2.43	4
Wildlife	50	Coho Salmon	80	5,036	17.37	4
Wildlife	50	Coastal Cutthroat	80	6,455	17.37	6
Wildlife	50	Winter Steelhead	100	6,321	21.71	7





Legend

- Unbuffered Extent
- Area of Interest

Burn Probability
(Analysis_maximum = 0.376)

- Non-burnable
- Burnable but not burned
- Lowest (0-20% of maximum)
- Lower (20-40% of maximum)
- Middle (40-60% of maximum)
- Higher (60-80% of maximum)
- Highest (80-100% of maximum)

Interagency Fuel Treatment
Decision Support System

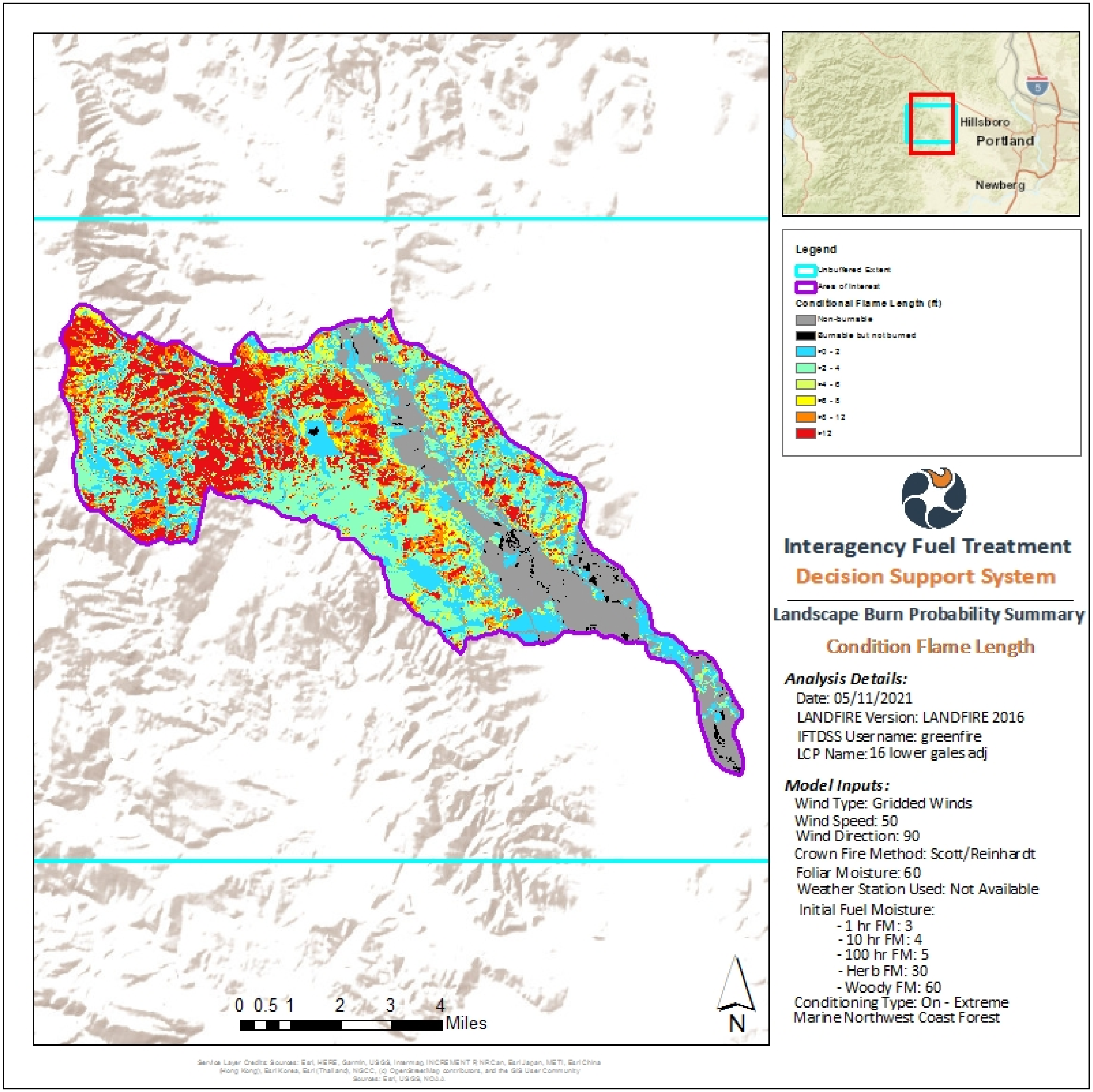
Landscape Burn Probability Summary

Burn Probability

Analysis Details:
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 lower gales adj

Model Inputs:
Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 60
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60

Conditioning Type: On - Extreme
Marine Northwest Coast Forest


Hillsboro
Portland
Newberg
5
Legend
Unbuffered Extent
Area of Interest
Conditional Flame Length (ft)
Non-burnable
Burnable but not burned
>0 - 2
>2 - 4
>4 - 6
>6 - 8
>8 - 12
>12
Interagency Fuel Treatment
Decision Support System
Landscape Burn Probability Summary
Condition Flame Length
Analysis Details:
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS User name: greenfire
LCP Name: 16 lower gales adj
Model Inputs:
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Wind Speed: 50
Wind Direction: 90
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Foliar Moisture: 60
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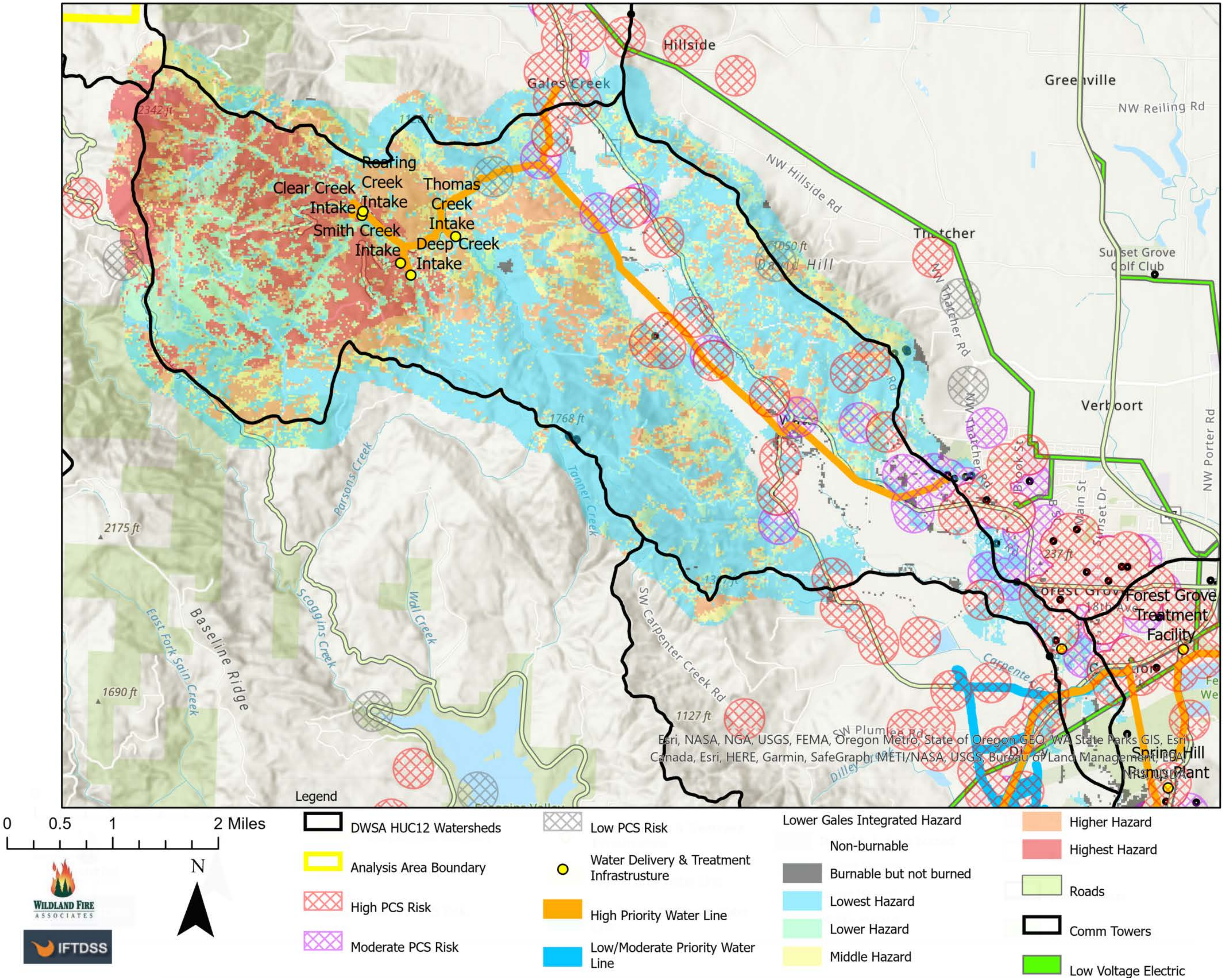
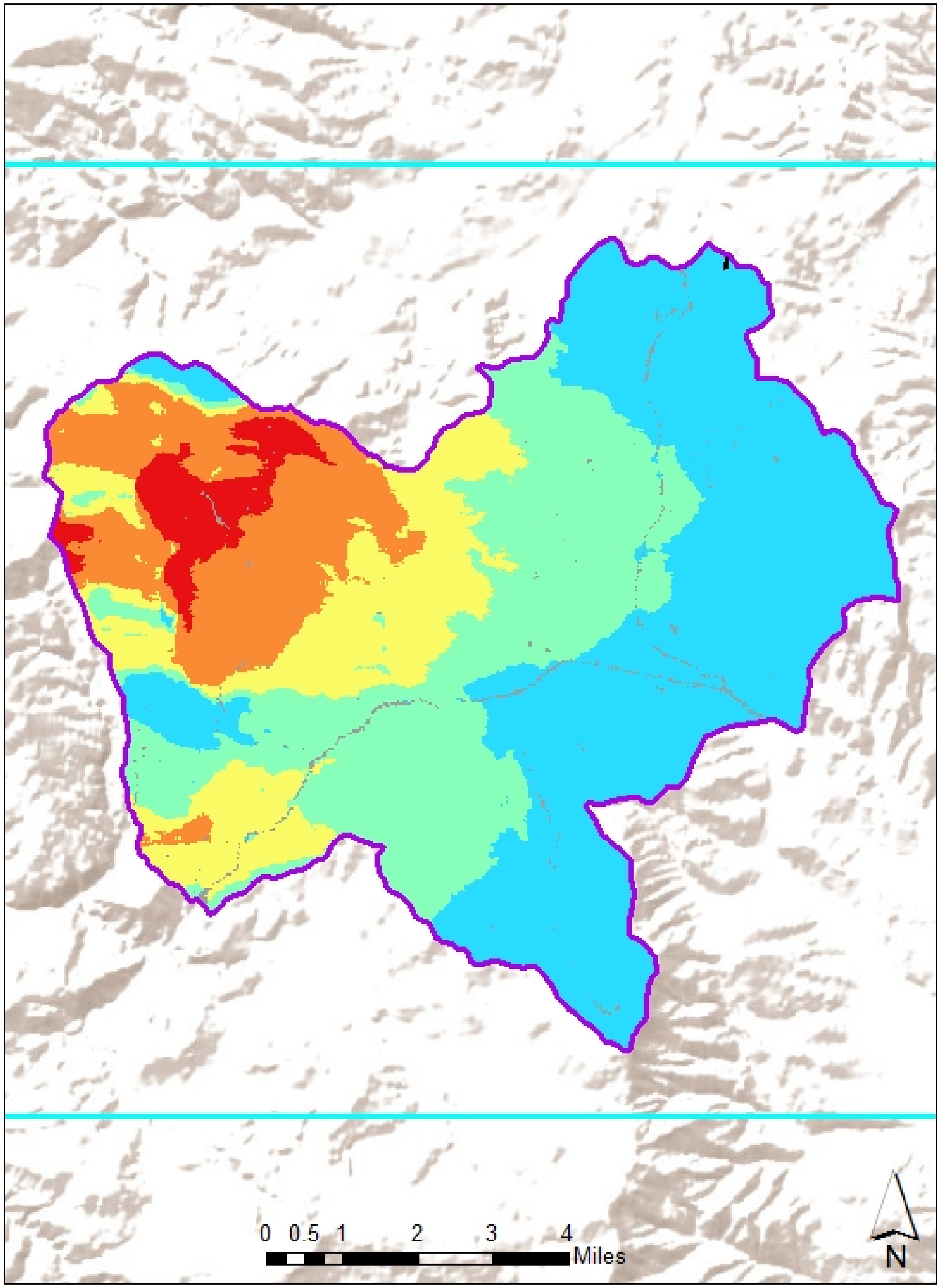
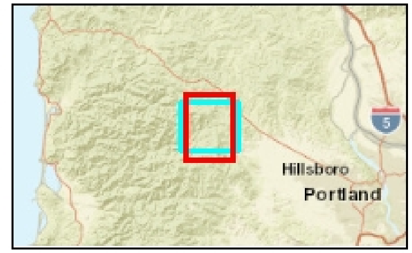
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60
Conditioning Type: On - Extreme
Marine Northwest Coast Forest
0 0.5 1 2 3 4
Miles
N
Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Sources: Esri, USGS, NOAA


Hillside
Gales Creek
Greenville
NW Reiling Rd
NW Hillside Rd
Roaring Creek Intake
Clear Creek Intake
Thomas Creek Intake
Smith Creek Intake
Deep Creek Intake
Thatcher
Sunset Grove Golf Club
NW Thatcher Rd
Verboort
NW Porter Rd
Forest Grove Treatment Facility
Parsons Creek
Tanner Creek
1768 ft
2342 ft
2175 ft
1690 ft
1127 ft
Baseline Ridge
East Fork Sain Creek
Scoggins Creek
Wall Creek
SW Carpenter Creek Rd
SW Plumlee Rd
Spring Hill Pump Plant
Esri, NASA, NGA, USGS, FEMA, Oregon Metro, State of Oregon GEO, WA State Parks GIS, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA
Legend
0 0.5 1 2 Miles
N
DWSA HUC12 Watersheds
Analysis Area Boundary
High PCS Risk
Moderate PCS Risk
Low PCS Risk
Water Delivery & Treatment Infrastructure
High Priority Water Line
Low/Moderate Priority Water Line
Lower Gales Integrated Hazard
Non-burnable
Burnable but not burned
Lowest Hazard
Lower Hazard
Middle Hazard
Higher Hazard
Highest Hazard
Roads
Comm Towers
Low Voltage Electric
Wildland Fire Associates
IFTDSS





Legend

- Unbuffered Extent
- Area of Interest

Burn Probability
(Analysis_maximum = 0.372)

- Non-burnable
- Burnable but not burned
- Lowest (0-20% of maximum)
- Lower (20-40% of maximum)
- Middle (40-60% of maximum)
- Higher (60-80% of maximum)
- Highest (80-100% of maximum)

Interagency Fuel Treatment
Decision Support System

Landscape Burn Probability Summary

Burn Probability

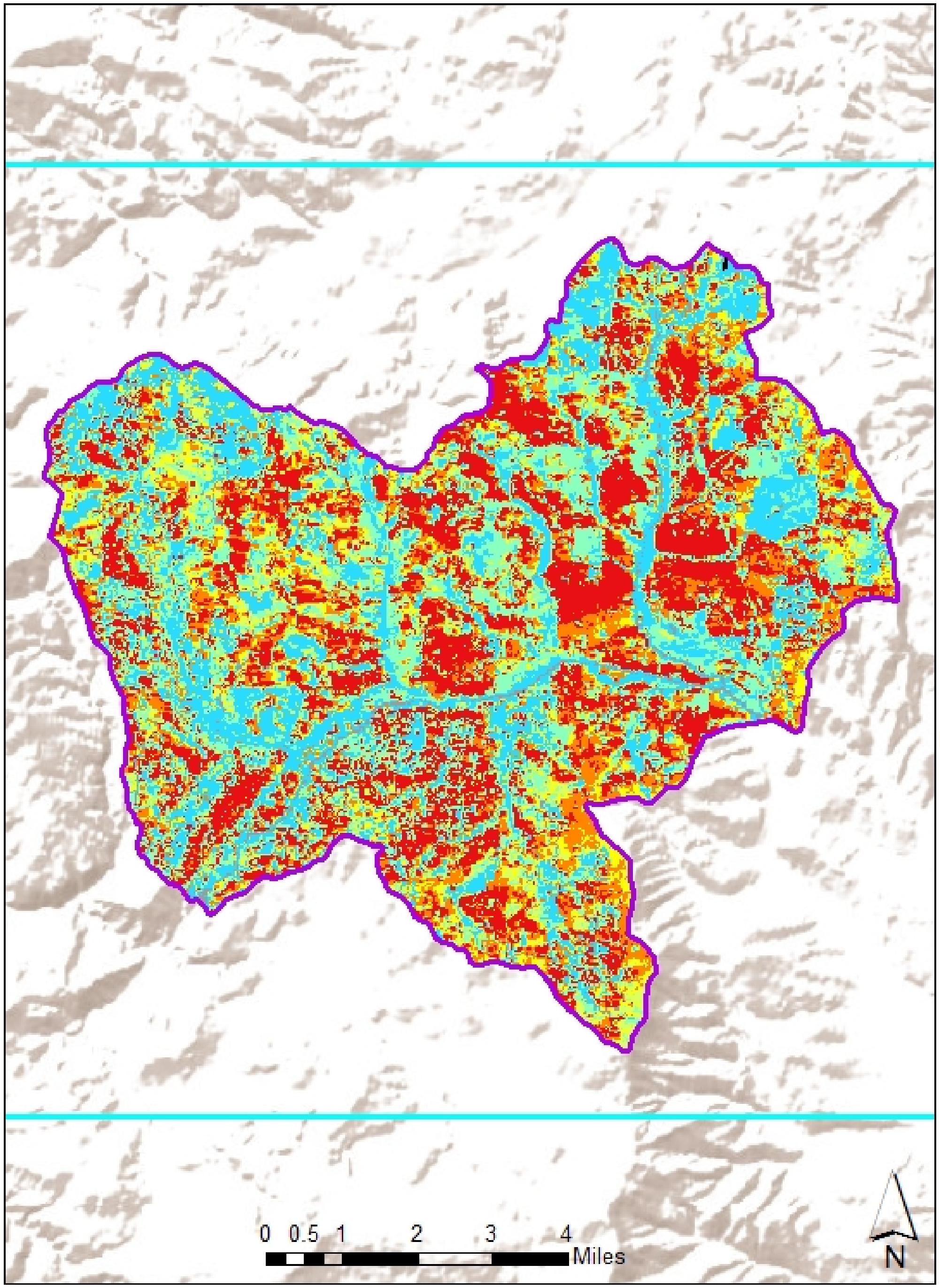
Analysis Details:

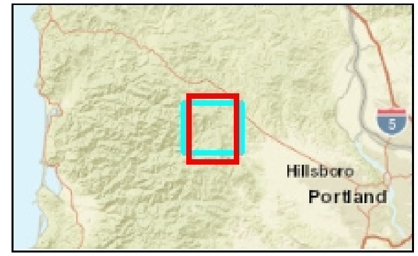
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 upper gales adj

Model Inputs:

Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 60
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60

Conditioning Type: On - Extreme Marine Northwest Coast Forest





Legend

- Unbuffered Extent
- Area of Interest

Conditional Flame Length (ft)

- Non-burnable
- Burnable but not burned
- >0 - 2
- >2 - 4
- >4 - 6
- >6 - 8
- >8 - 12
- >12

Interagency Fuel Treatment
Decision Support System

Landscape Burn Probability Summary

Condition Flame Length

Analysis Details:
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 upper gales adj

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Wind Direction: 90
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Weather Station Used: Not Available
Initial Fuel Moisture:
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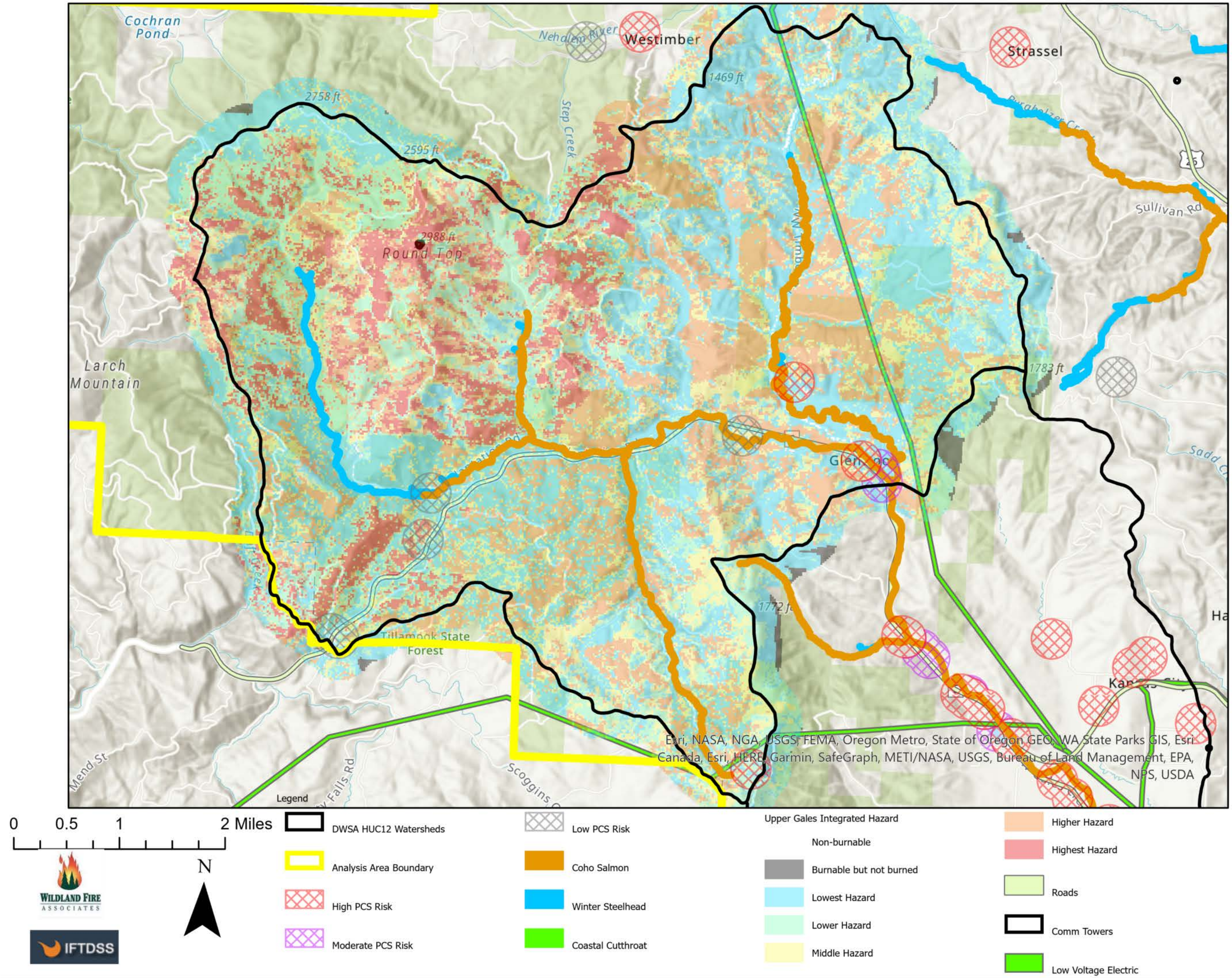
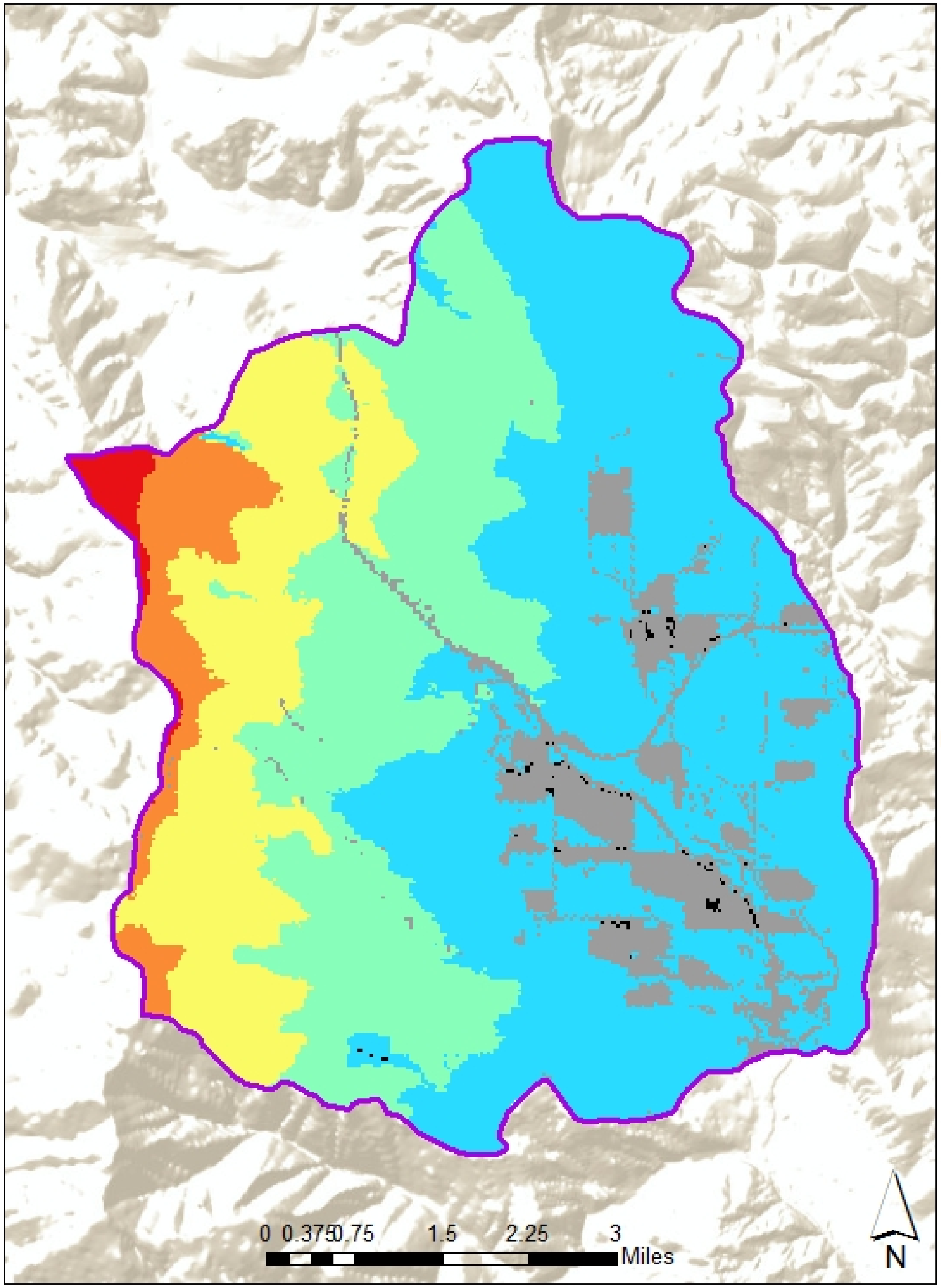
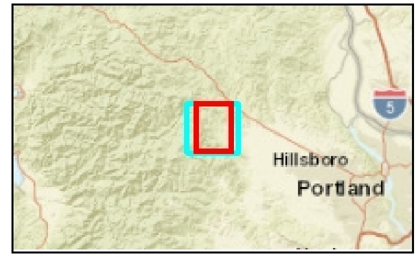
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60

Conditioning Type: On - Extreme Marine Northwest Coast Forest


Cochran Pond
Nehalem River
Westimber
Strassel
1469 ft
2758 ft
2595 ft
Step Creek
Round Top
2988 ft
Sullivan Rd
Larch Mountain
1783 ft
Glenwood
1772 ft
Tillamook State Forest
Scoggins
Esri, NASA, NGA, USGS, FEMA, Oregon Metro, State of Oregon GEO, WA State Parks GIS, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA
0 0.5 1 2 Miles
N
Legend
DWSA HUC12 Watersheds
Analysis Area Boundary
High PCS Risk
Moderate PCS Risk
Low PCS Risk
Coho Salmon
Winter Steelhead
Coastal Cutthroat
Upper Gales Integrated Hazard
Non-burnable
Burnable but not burned
Lowest Hazard
Lower Hazard
Middle Hazard
Higher Hazard
Highest Hazard
Roads
Comm Towers
Low Voltage Electric
WILDLAND FIRE ASSOCIATES
IFTDSS





Legend

- Unbuffered Extent
- Area of Interest

Burn Probability
(Analysis_maximum = 0.3816)

- Non-burnable
- Burnable but not burned
- Lowest (0-20% of maximum)
- Lower (20-40% of maximum)
- Middle (40-60% of maximum)
- Higher (60-80% of maximum)
- Highest (80-100% of maximum)

Interagency Fuel Treatment Decision Support System

Landscape Burn Probability Summary

Burn Probability

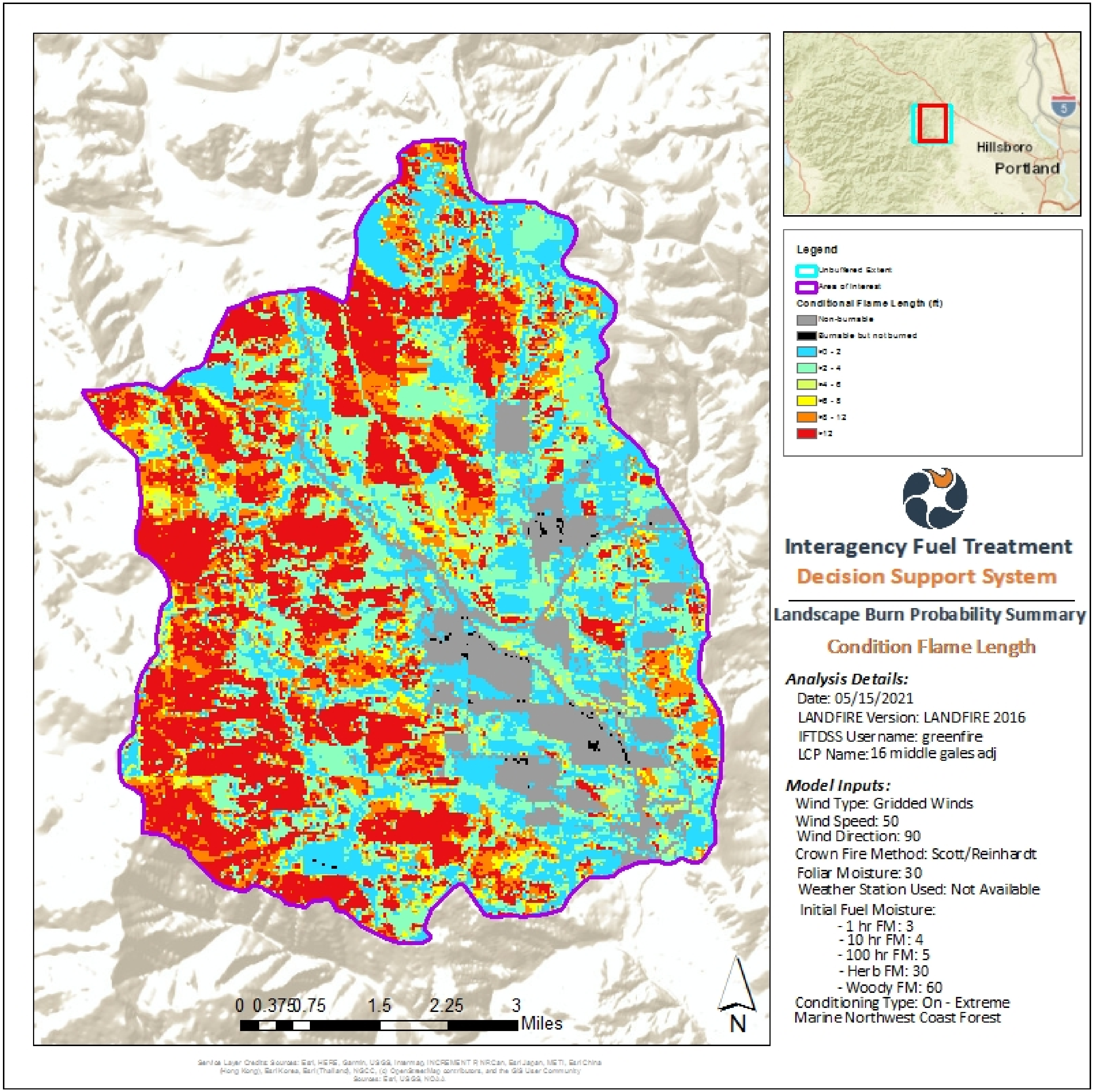
Analysis Details:

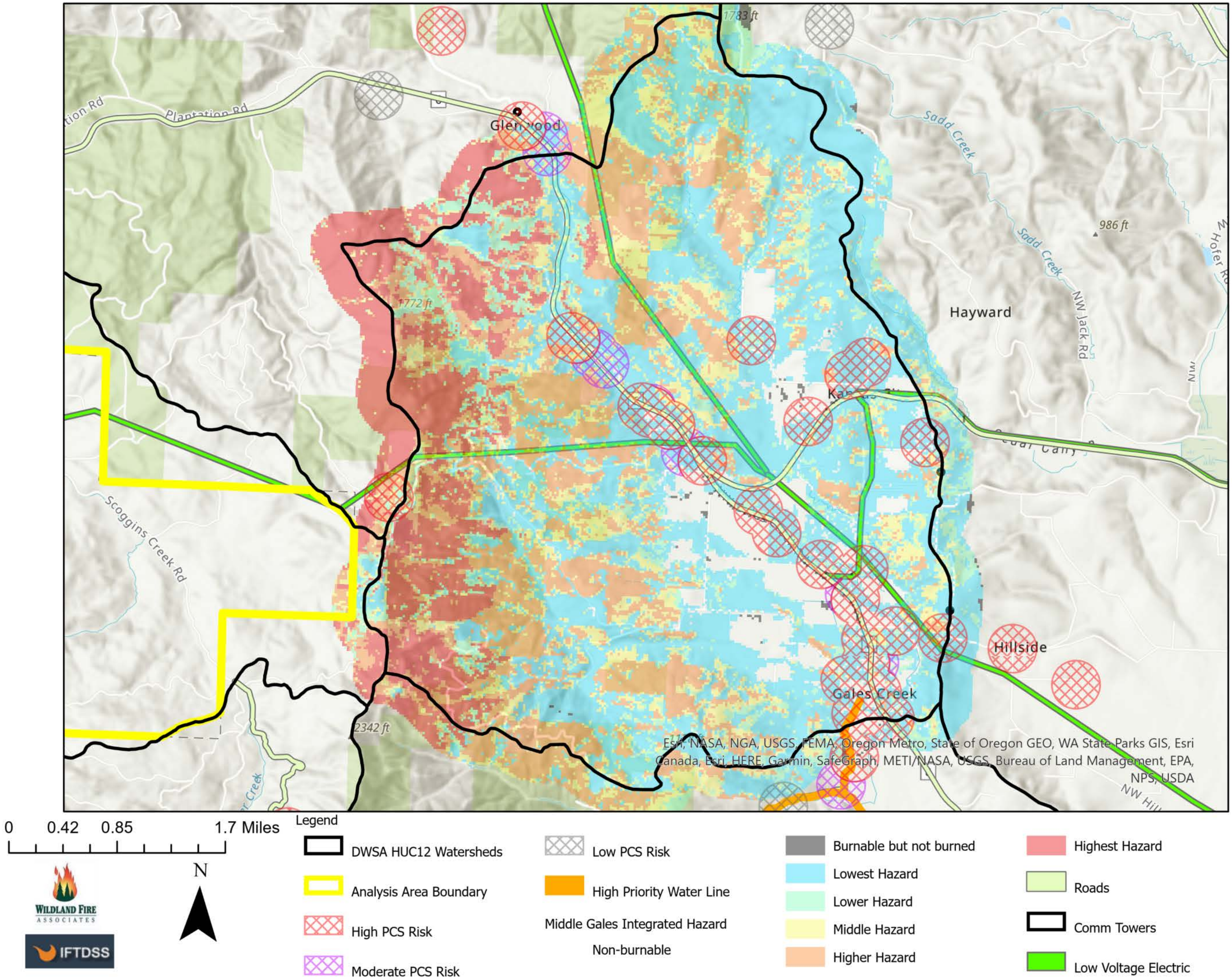
Date: 05/15/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 middle gales adj

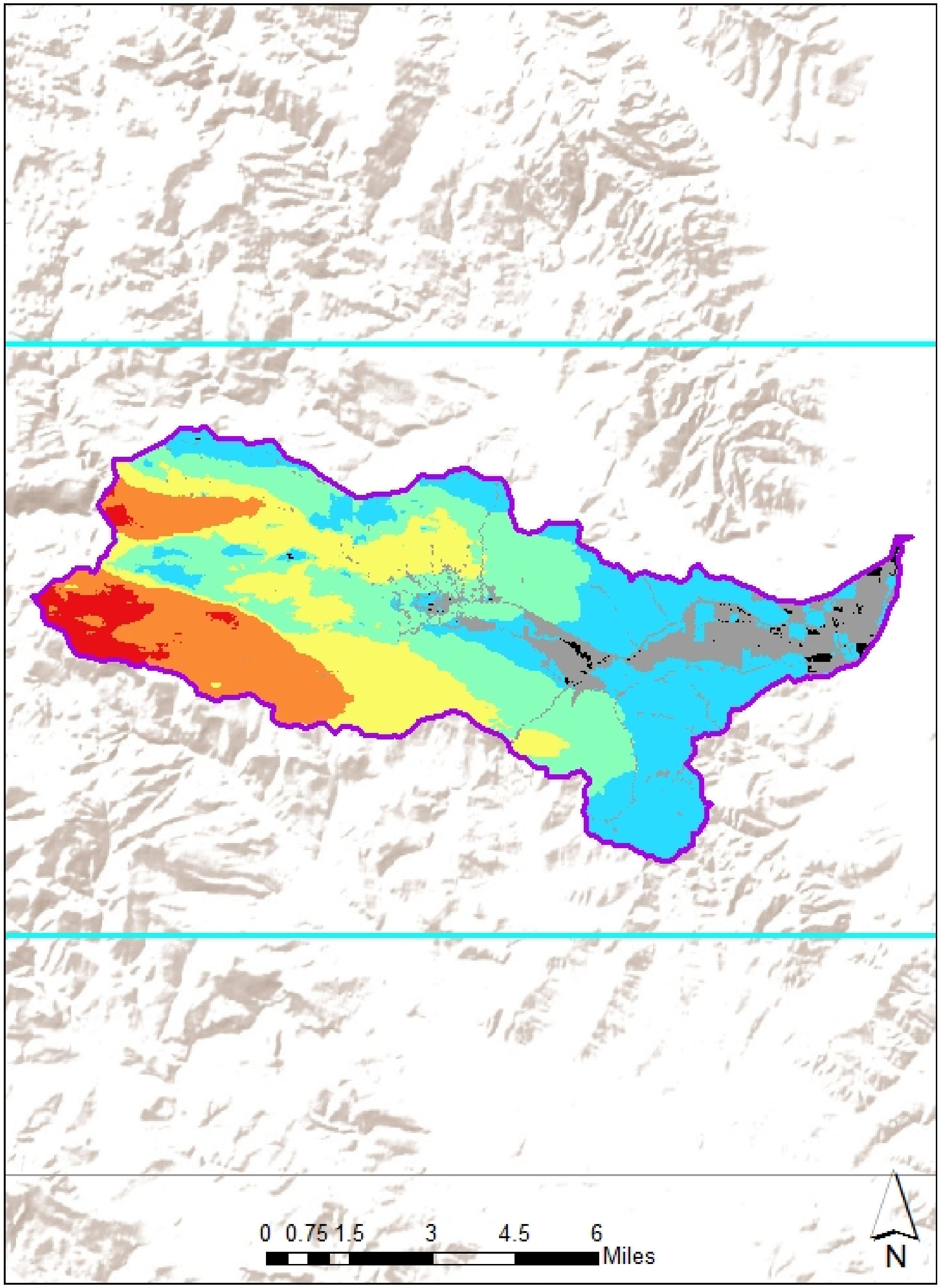
Model Inputs:

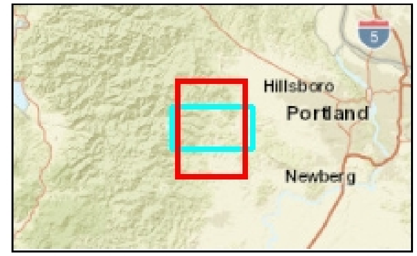
Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 30
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60

Conditioning Type: On - Extreme Marine Northwest Coast Forest


Hillsboro
Portland
5
Legend
Unbuffered Extent
Area of Interest
Conditional Flame Length (ft)
Non-burnable
Burnable but not burned
>0 - 2
>2 - 4
>4 - 6
>6 - 8
>8 - 12
>12
Interagency Fuel Treatment
Decision Support System
Landscape Burn Probability Summary
Condition Flame Length
Analysis Details:
Date: 05/15/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 middle gales adj
Model Inputs:
Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 30
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60
Conditioning Type: On - Extreme
Marine Northwest Coast Forest
0 0.375 0.75 1.5 2.25 3
Miles
N


Glenwood
Plantation Rd
Hayward
Sadd Creek
986 ft
1772 ft
1783 ft
2342 ft
Scoggins Creek Rd
Hillside
Gales Creek
Esri, NASA, NGA, USGS, FEMA, Oregon Metro, State of Oregon GEO, WA State Parks GIS, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA
0 0.42 0.85 1.7 Miles
N
Legend
DWSA HUC12 Watersheds
Analysis Area Boundary
High PCS Risk
Moderate PCS Risk
Low PCS Risk
High Priority Water Line
Middle Gales Integrated Hazard
Non-burnable
Burnable but not burned
Lowest Hazard
Lower Hazard
Middle Hazard
Higher Hazard
Highest Hazard
Roads
Comm Towers
Low Voltage Electric
WILDLAND FIRE ASSOCIATES
IFTDSS





Legend

- Unbuffered Extent
- Area of Interest

Burn Probability
(Analysis_maximum = 0.3387)

- Non-burnable
- Burnable but not burned
- Lowest (0-20% of maximum)
- Lower (20-40% of maximum)
- Middle (40-60% of maximum)
- Higher (60-80% of maximum)
- Highest (80-100% of maximum)

Interagency Fuel Treatment Decision Support System

Landscape Burn Probability Summary

Burn Probability

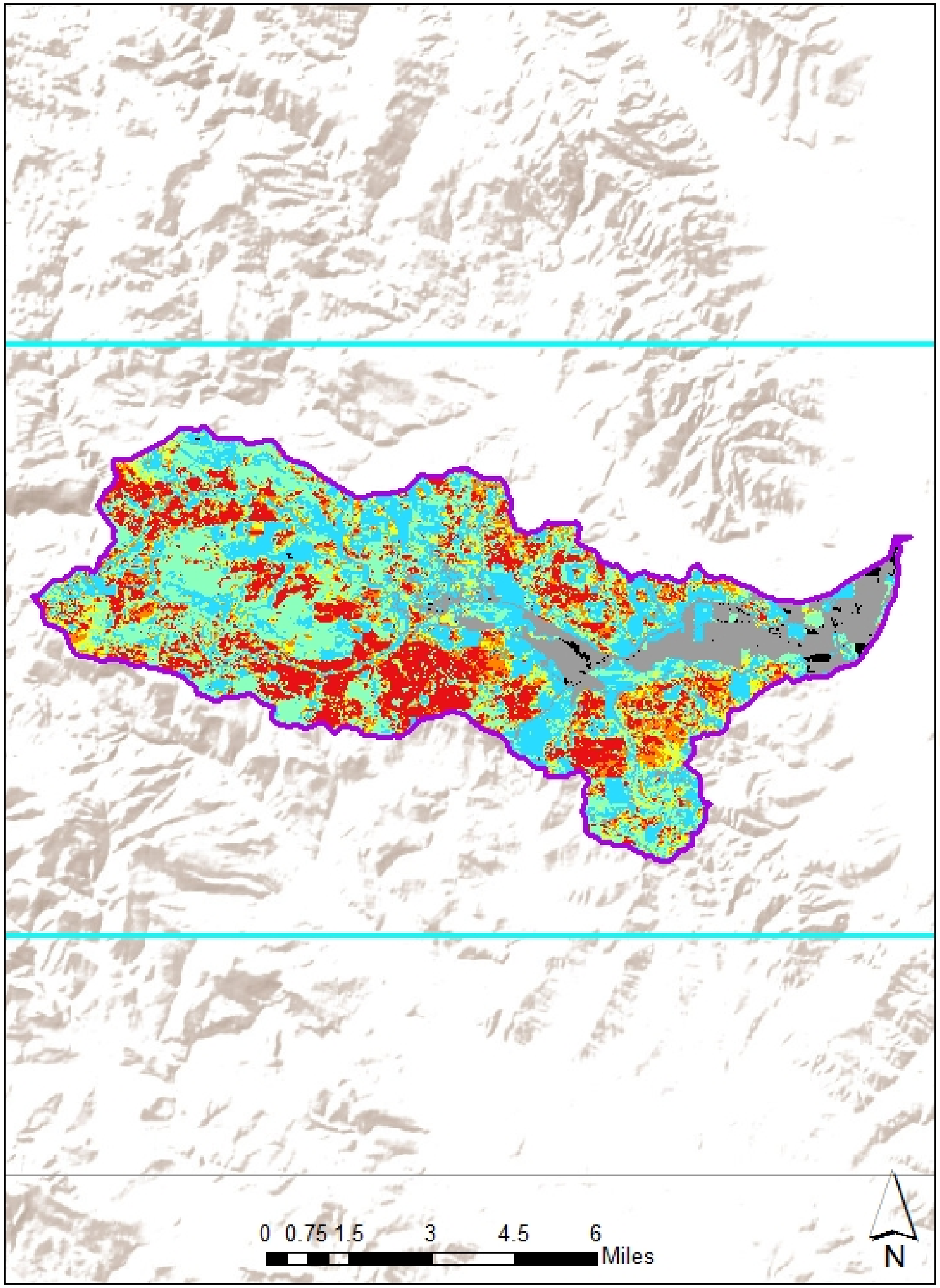
Analysis Details:

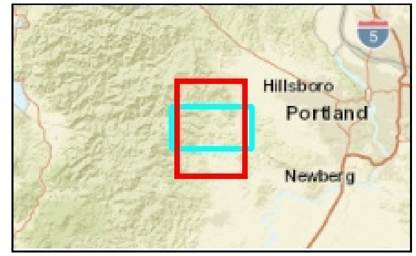
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 roaring ck tualatin adj

Model Inputs:

Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 60
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60

Conditioning Type: On - Extreme
Marine Northwest Coast Forest





Legend

- Unbuffered Extent
- Area of Interest

Conditional Flame Length (ft)

- Non-burnable
- Burnable but not burned
- >0 - 2
- >2 - 4
- >4 - 6
- >6 - 8
- >8 - 12
- >12

Interagency Fuel Treatment
Decision Support System

Landscape Burn Probability Summary

Condition Flame Length

Analysis Details:

Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 roaring ck tualatin adj

Model Inputs:

Wind Type: Gridded Winds
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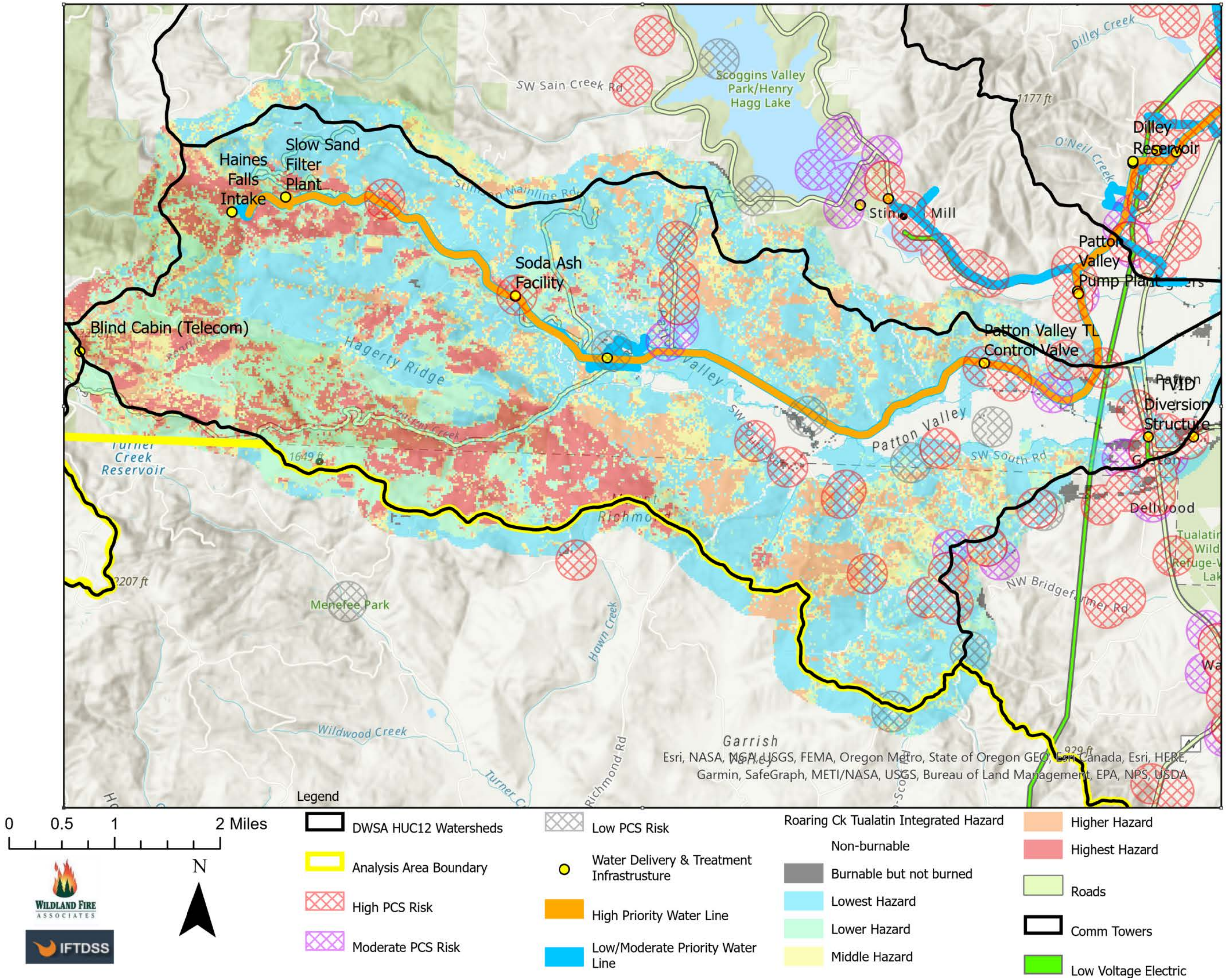
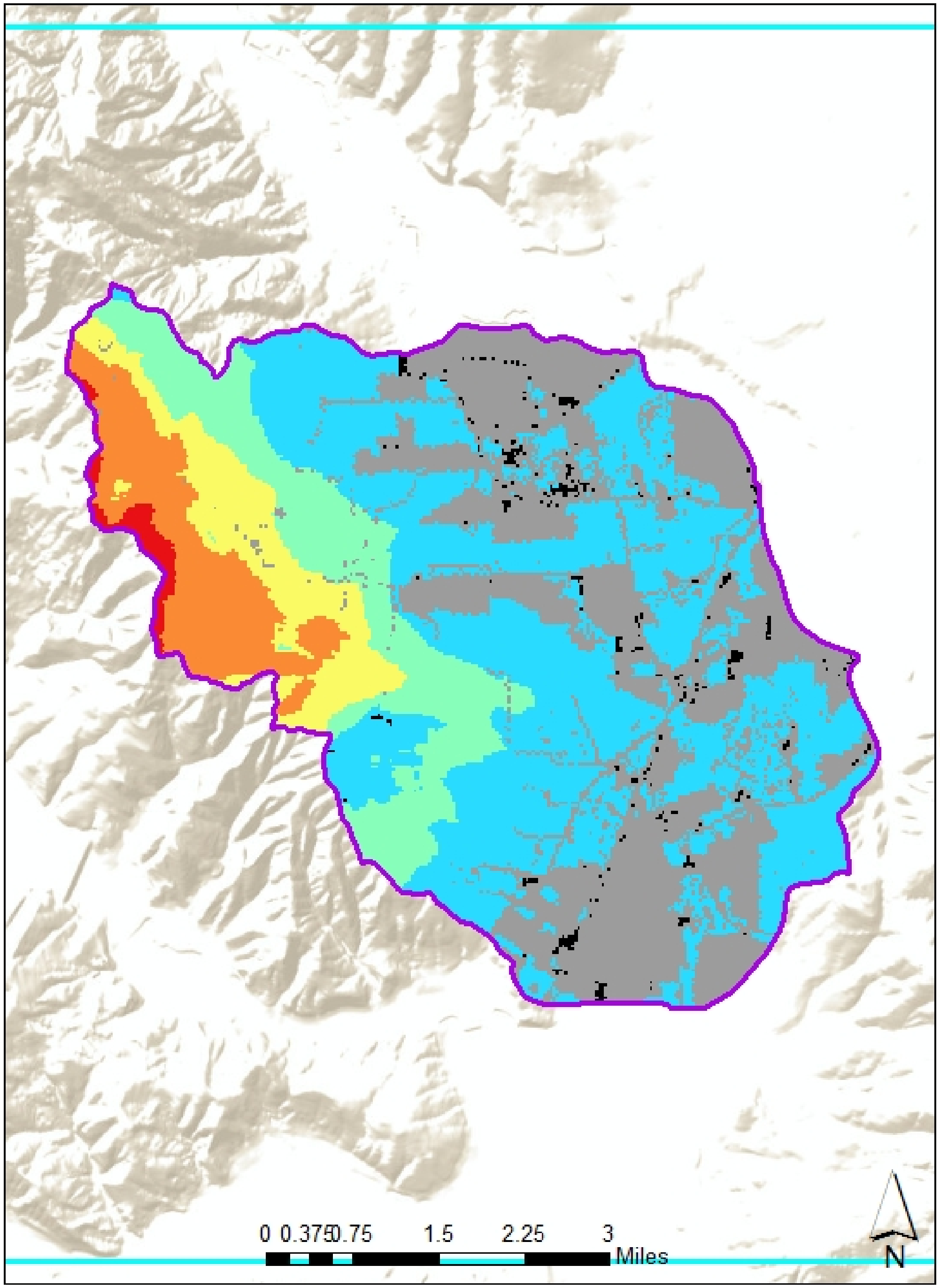
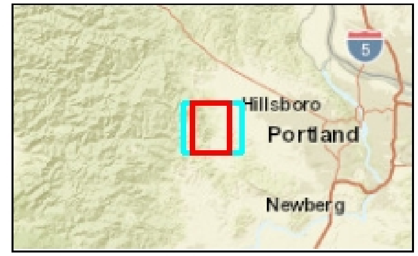
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60

Conditioning Type: On - Extreme
Marine Northwest Coast Forest

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Sources: Esri, USGS, NOAA


Slow Sand Filter Plant
Haines Falls Intake
Soda Ash Facility
Blind Cabin (Telecom)
Hagerty Ridge
Scoggins Valley Park/Henry Hagg Lake
SW Sain Creek Rd
Dilley Creek
Dilley Reservoir
O'Neil Creek
Mill
Patton Valley Pump Plant
Patton Valley TL Control Valve
TVID Diversion Structure
Patton Valley
SW South Rd
Dellwood
NW Bridgefarmer Rd
Turner Creek Reservoir
Menefee Park
Hawn Creek
Wildwood Creek
Garrish
Richmond Rd
1177 ft
1649 ft
2207 ft
929 ft
Esri, NASA, NGA, USGS, FEMA, Oregon Metro, State of Oregon GEO, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA
Legend
0 0.5 1 2 Miles
N
DWSA HUC12 Watersheds
Analysis Area Boundary
High PCS Risk
Moderate PCS Risk
Low PCS Risk
Water Delivery & Treatment Infrastructure
High Priority Water Line
Low/Moderate Priority Water Line
Roaring Ck Tualatin Integrated Hazard
Non-burnable
Burnable but not burned
Lowest Hazard
Lower Hazard
Middle Hazard
Higher Hazard
Highest Hazard
Roads
Comm Towers
Low Voltage Electric
WILDLAND FIRE ASSOCIATES
IFTDSS





Interagency Fuel Treatment
Decision Support System

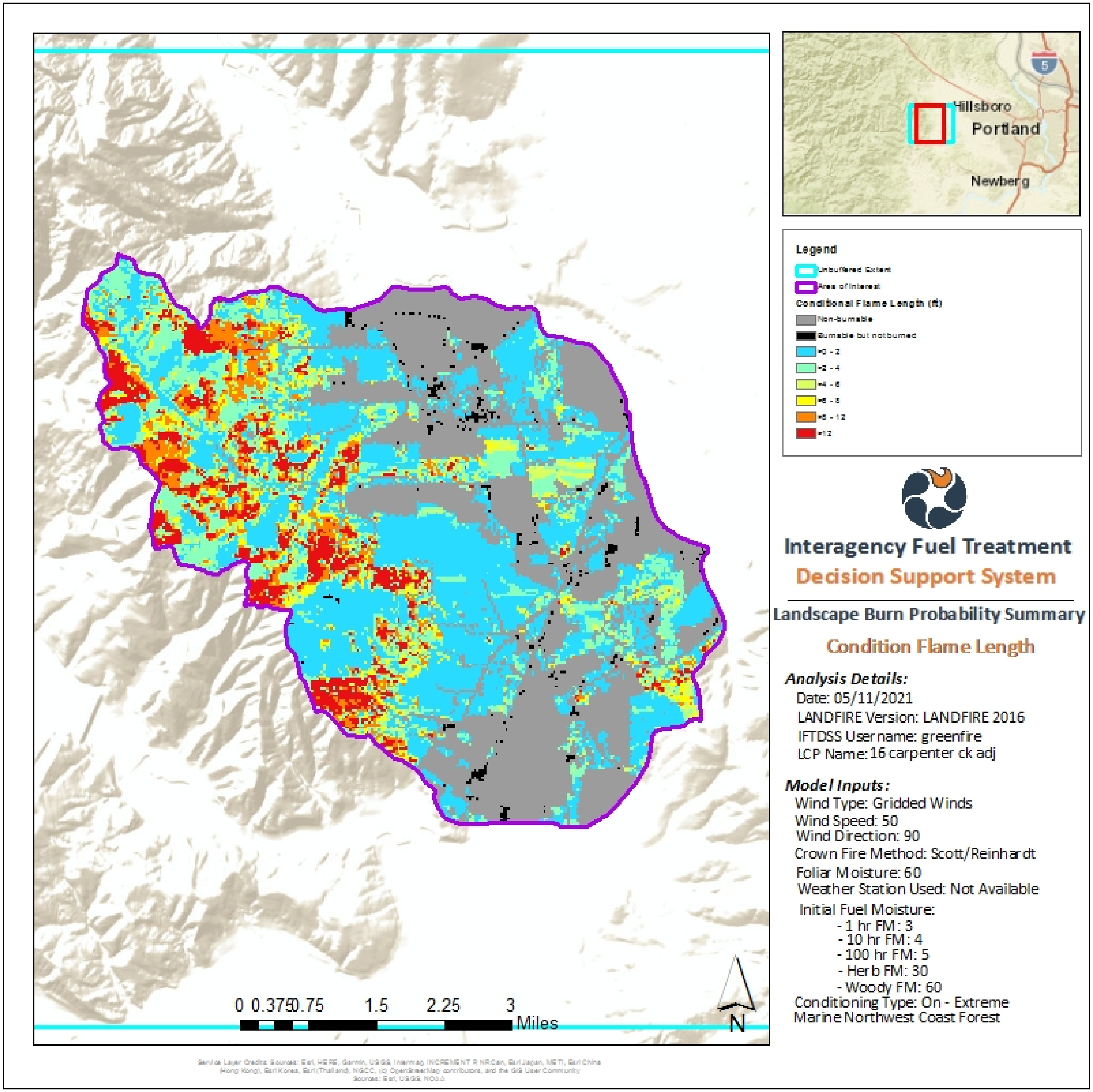
Landscape Burn Probability Summary

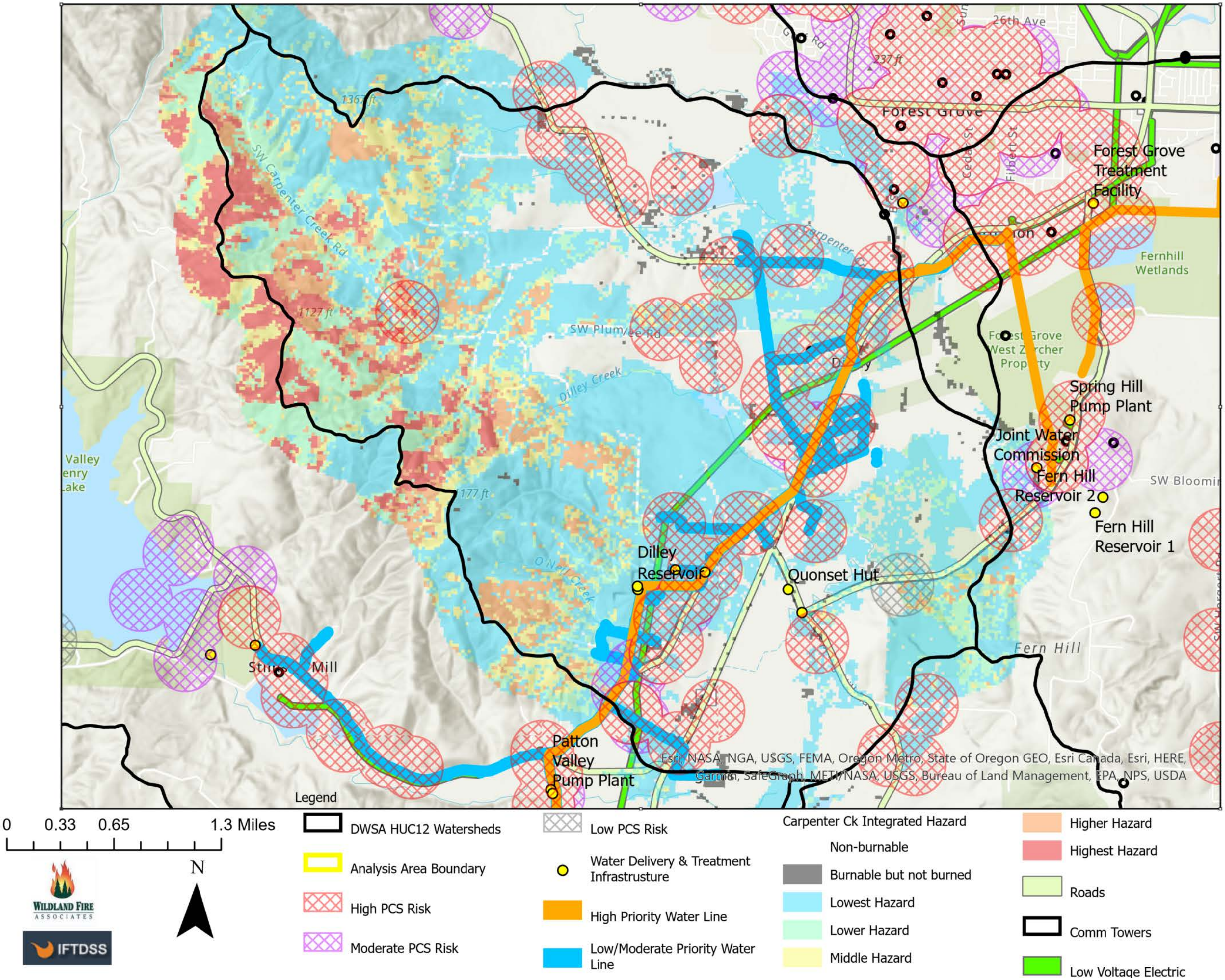
Burn Probability

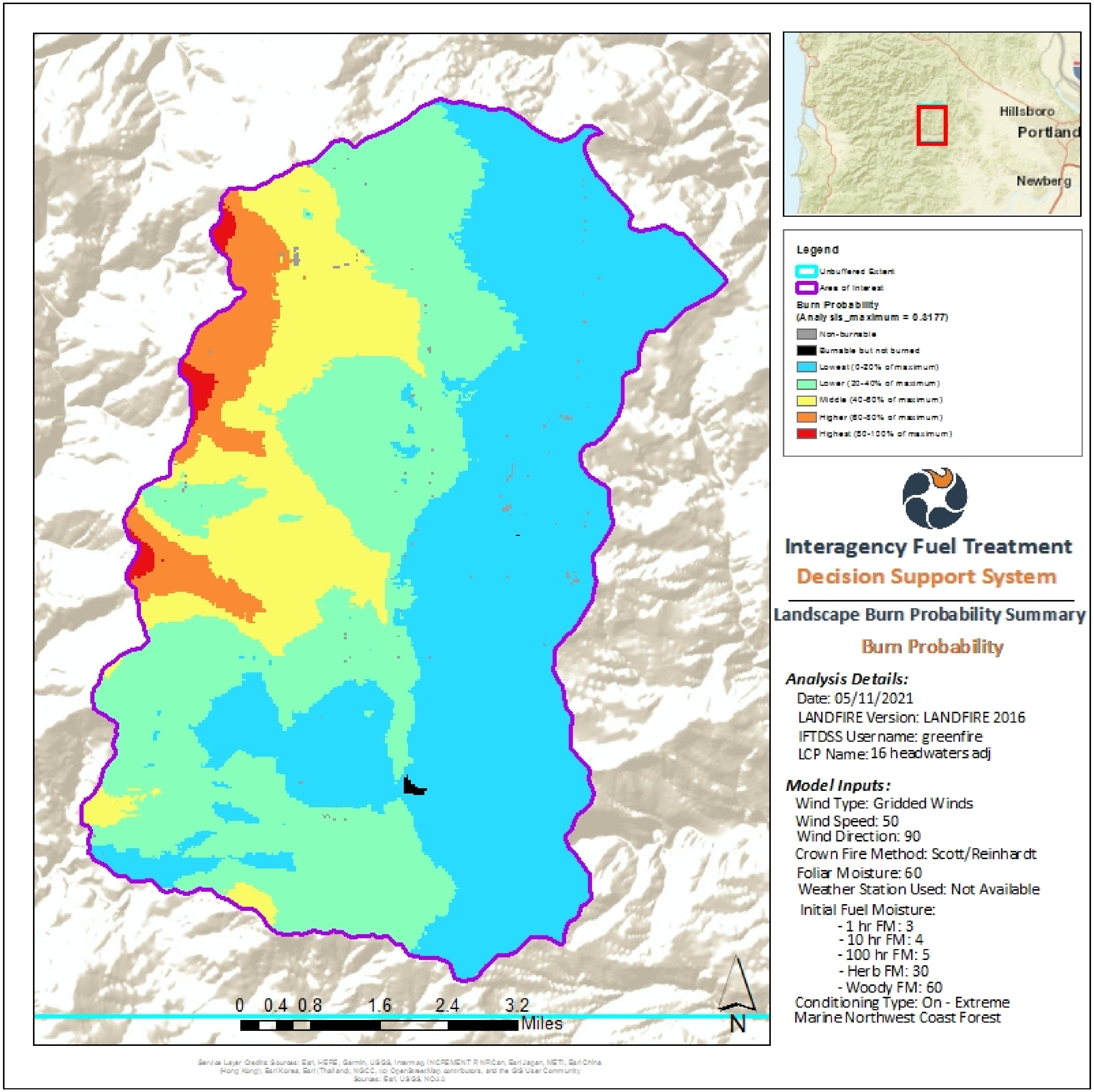
Analysis Details:
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 carpenter ck adj

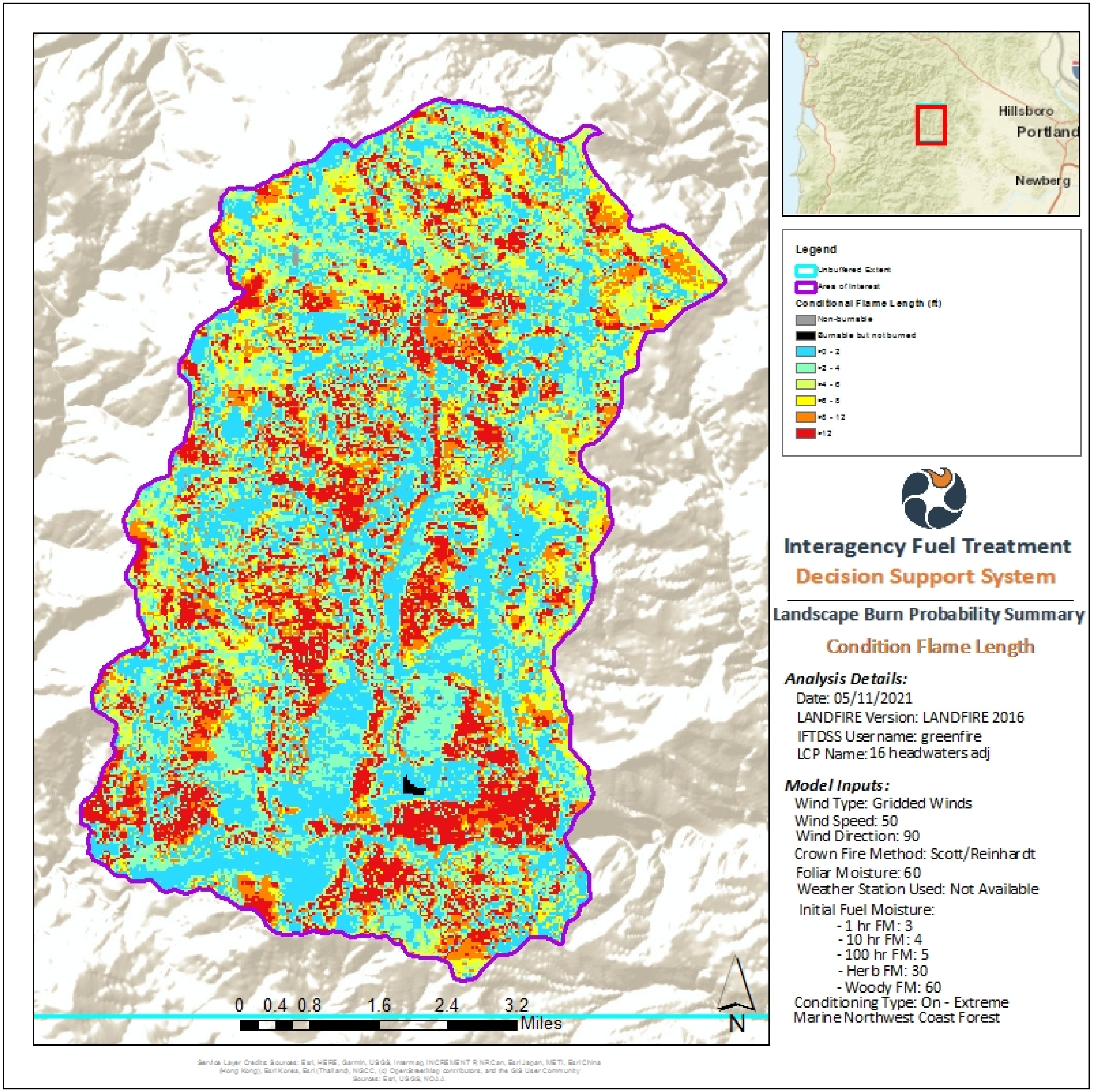
Model Inputs:
Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 60
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60

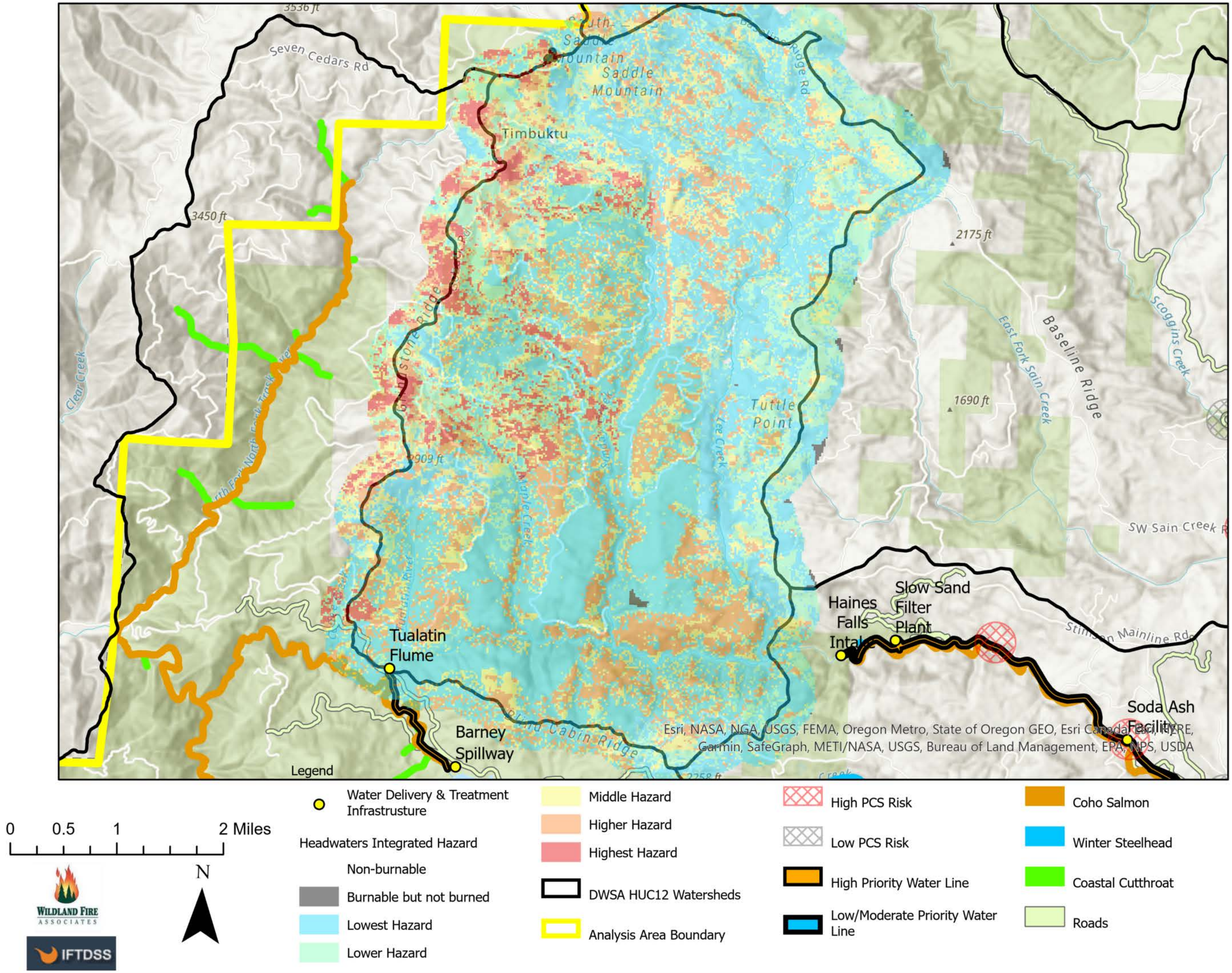
Conditioning Type: On - Extreme Marine Northwest Coast Forest

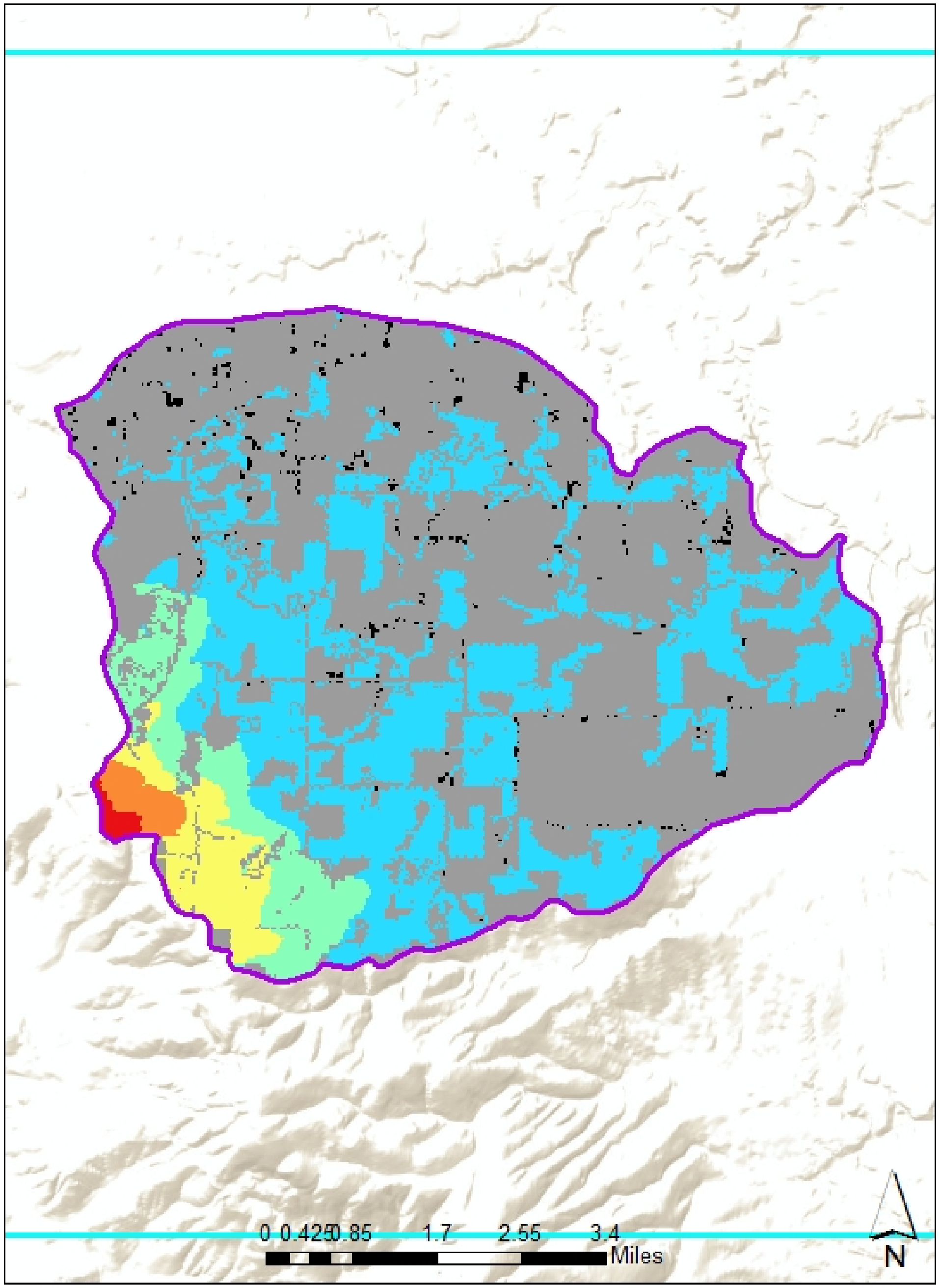

Hillsboro
Portland
Newberg
5
Legend
Unbuffered Extent
Area of Interest
Conditional Flame Length (ft)
Non-burnable
Burnable but not burned
0 - 2
2 - 4
4 - 6
6 - 8
8 - 12
12
Interagency Fuel Treatment
Decision Support System
Landscape Burn Probability Summary
Condition Flame Length
Analysis Details:
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 carpenter ck adj
Model Inputs:
Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 60
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60
Conditioning Type: On - Extreme
Marine Northwest Coast Forest
0 0.375 0.75 1.5 2.25 3
Miles
N


26th Ave
Forest Grove
SW Carpenter Creek Rd
SW Plumlee Rd
Dilley Creek
O'Neill Creek
Forest Grove Treatment Facility
Fernhill Wetlands
Forest Grove West Zurcher Property
Spring Hill Pump Plant
Joint Water Commission
Fern Hill Reservoir 2
Fern Hill Reservoir 1
SW Blooming
Dilley Reservoir
Quonset Hut
Fern Hill
Stimson Mill
Patton Valley Pump Plant
Esri, NASA, NGA, USGS, FEMA, Oregon Metro, State of Oregon GEO, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA
Legend
0 0.33 0.65 1.3 Miles
N
DWSA HUC12 Watersheds
Analysis Area Boundary
High PCS Risk
Moderate PCS Risk
Low PCS Risk
Water Delivery & Treatment Infrastructure
High Priority Water Line
Low/Moderate Priority Water Line
Carpenter Ck Integrated Hazard
Non-burnable
Burnable but not burned
Lowest Hazard
Lower Hazard
Middle Hazard
Higher Hazard
Highest Hazard
Roads
Comm Towers
Low Voltage Electric
WILDLAND FIRE ASSOCIATES
IFTDSS


Hillsboro
Portland
Newberg
Legend
Unbuffered Extent
Area of Interest
Burn Probability
(Analysis_maximum = 0.3177)
Non-burnable
Burnable but not burned
Lowest (0-20% of maximum)
Lower (20-40% of maximum)
Middle (40-60% of maximum)
Higher (60-80% of maximum)
Highest (80-100% of maximum)
Interagency Fuel Treatment
Decision Support System
Landscape Burn Probability Summary
Burn Probability
Analysis Details:
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 headwaters adj
Model Inputs:
Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 60
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60
Conditioning Type: On - Extreme
Marine Northwest Coast Forest
0 0.4 0.8 1.6 2.4 3.2
Miles
N
Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Sources: Esri, USGS, NOAA


Hillsboro
Portland
Newberg
Legend
Unbuffered Extent
Area of Interest
Conditional Flame Length (ft)
Non-burnable
Burnable but not burned
>0 - 2
>2 - 4
>4 - 6
>6 - 8
>8 - 12
>12
Interagency Fuel Treatment
Decision Support System
Landscape Burn Probability Summary
Condition Flame Length
Analysis Details:
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 headwaters adj
Model Inputs:
Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 60
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60
Conditioning Type: On - Extreme
Marine Northwest Coast Forest
0 0.4 0.8 1.6 2.4 3.2
Miles
N


Seven Cedars Rd
South Saddle Mountain
Saddle Mountain
Timbuktu
3536 ft
3450 ft
2175 ft
1690 ft
2909 ft
Clear Creek
Tuttle Point
Lee Creek
Maple Creek
East Fork Sain Creek
Baseline Ridge
Scoggins Creek
SW Sain Creek Rd
Stimson Mainline Rd
Tualatin Flume
Barney Spillway
Haines Falls Intake
Slow Sand Filter Plant
Soda Ash Facility
Esri, NASA, NGA, USGS, FEMA, Oregon Metro, State of Oregon GEO, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA
Legend
0 0.5 1 2 Miles
N
Water Delivery & Treatment Infrastructure
Headwaters Integrated Hazard
Non-burnable
Burnable but not burned
Lowest Hazard
Lower Hazard
Middle Hazard
Higher Hazard
Highest Hazard
DWSA HUC12 Watersheds
Analysis Area Boundary
High PCS Risk
Low PCS Risk
High Priority Water Line
Low/Moderate Priority Water Line
Coho Salmon
Winter Steelhead
Coastal Cutthroat
Roads
WILDLAND FIRE ASSOCIATES
IFTDSS



Legend

- Unbuffered Extent
- Area of Interest

Burn Probability
(Analysis_maximum = 0.2698)

- Non-burnable
- Burnable but not burned
- Lowest (0-20% of maximum)
- Lower (20-40% of maximum)
- Middle (40-60% of maximum)
- Higher (60-80% of maximum)
- Highest (80-100% of maximum)

Interagency Fuel Treatment
Decision Support System

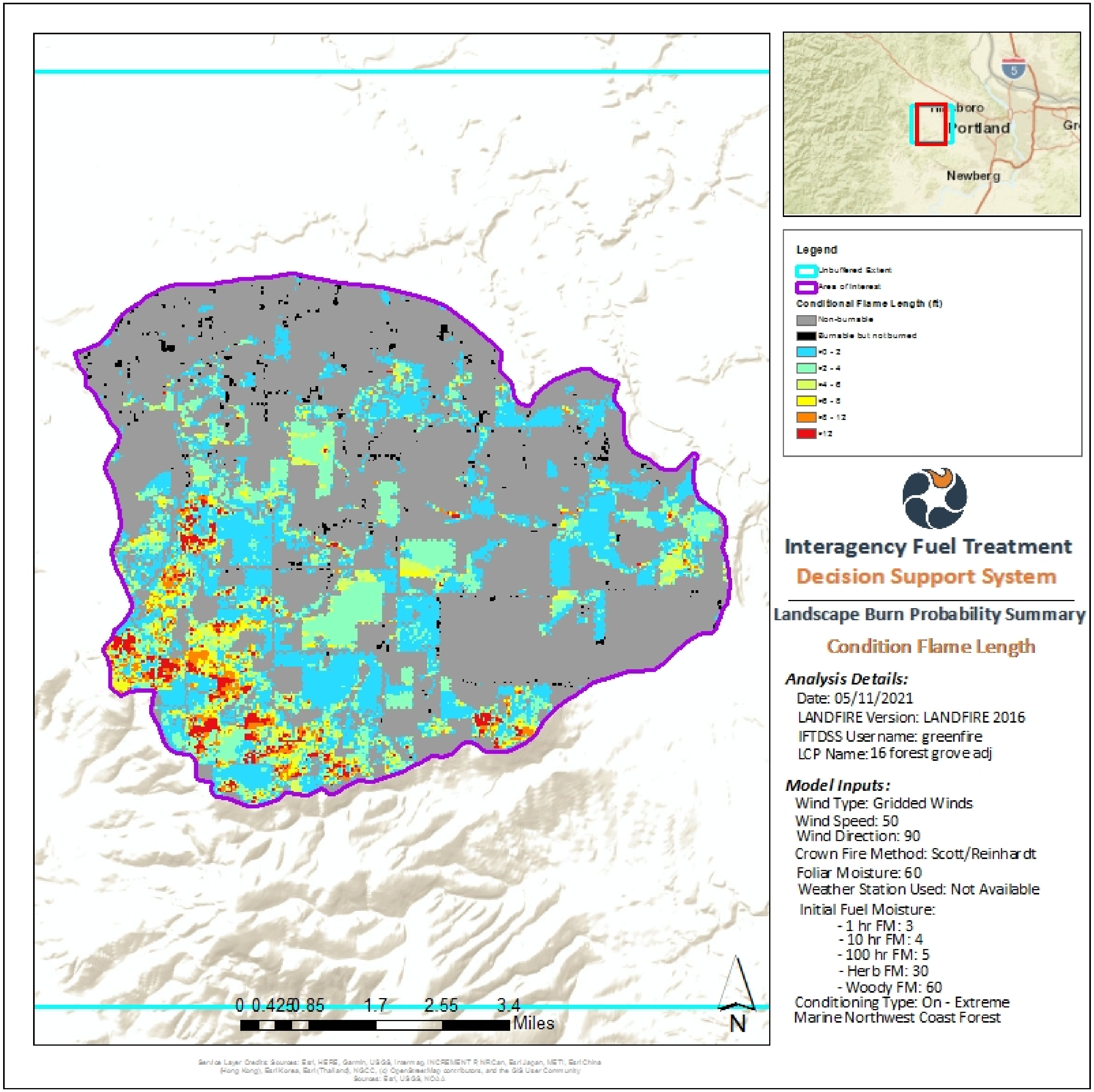
Landscape Burn Probability Summary

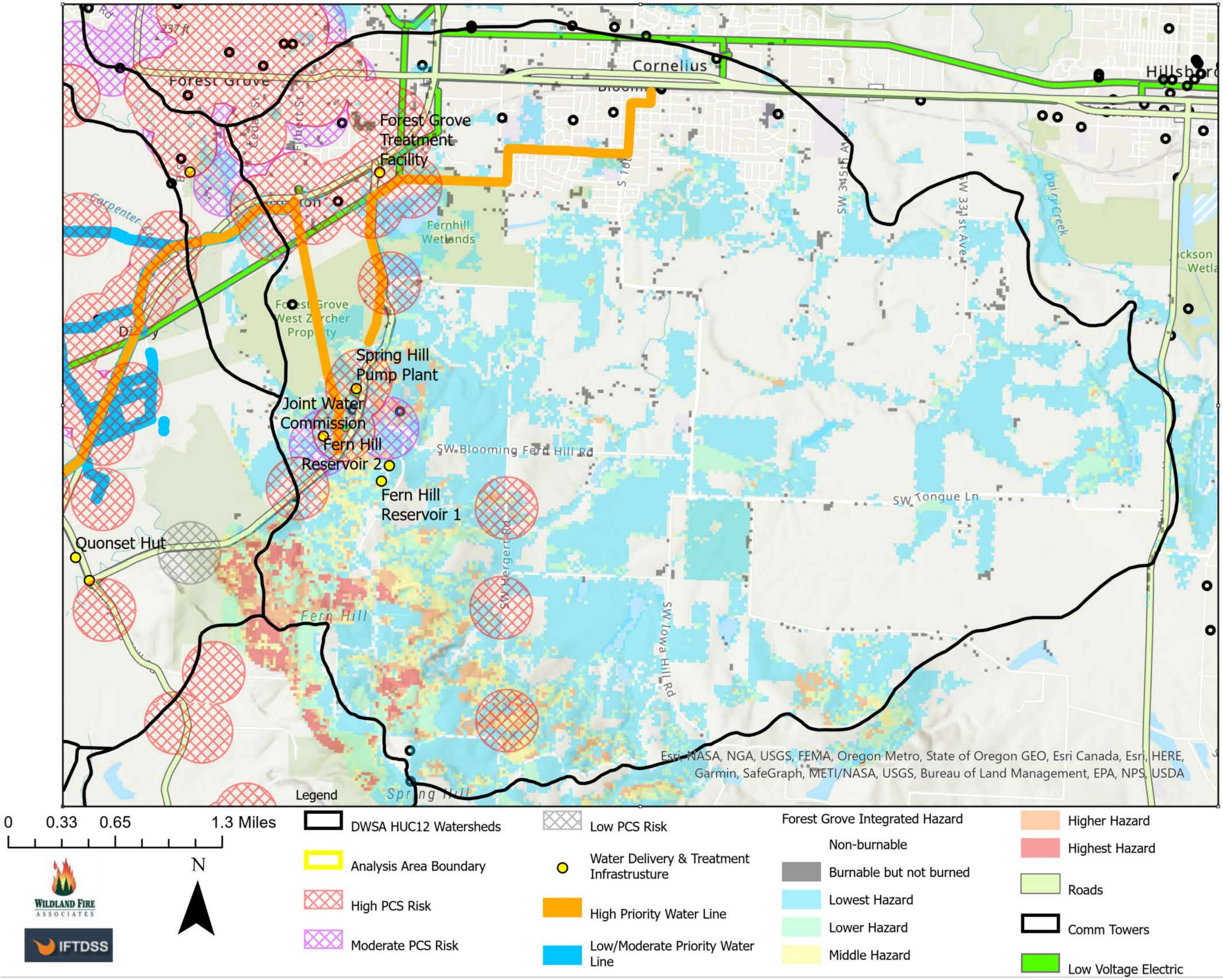
Burn Probability

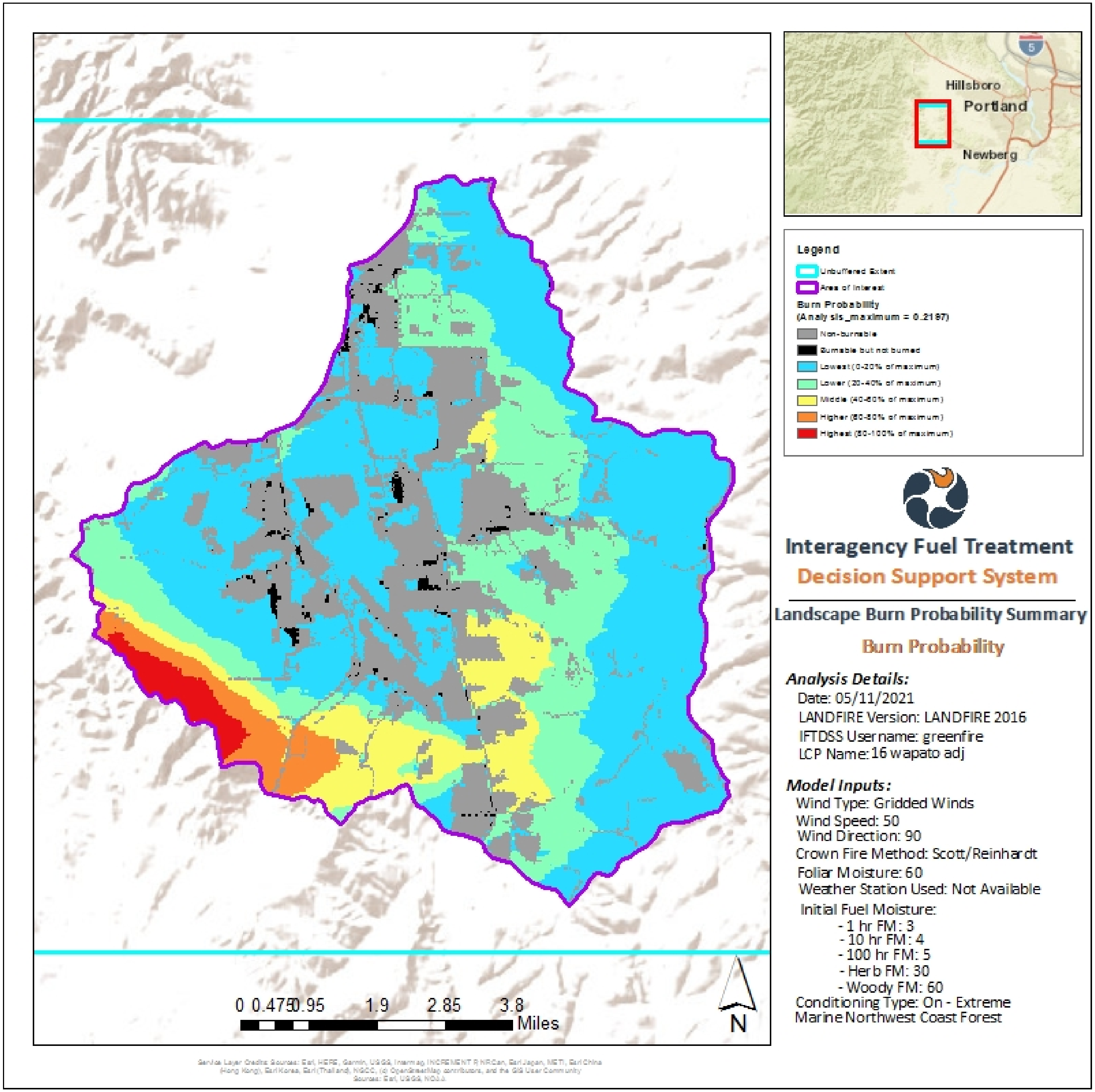
Analysis Details:
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 forest grove adj

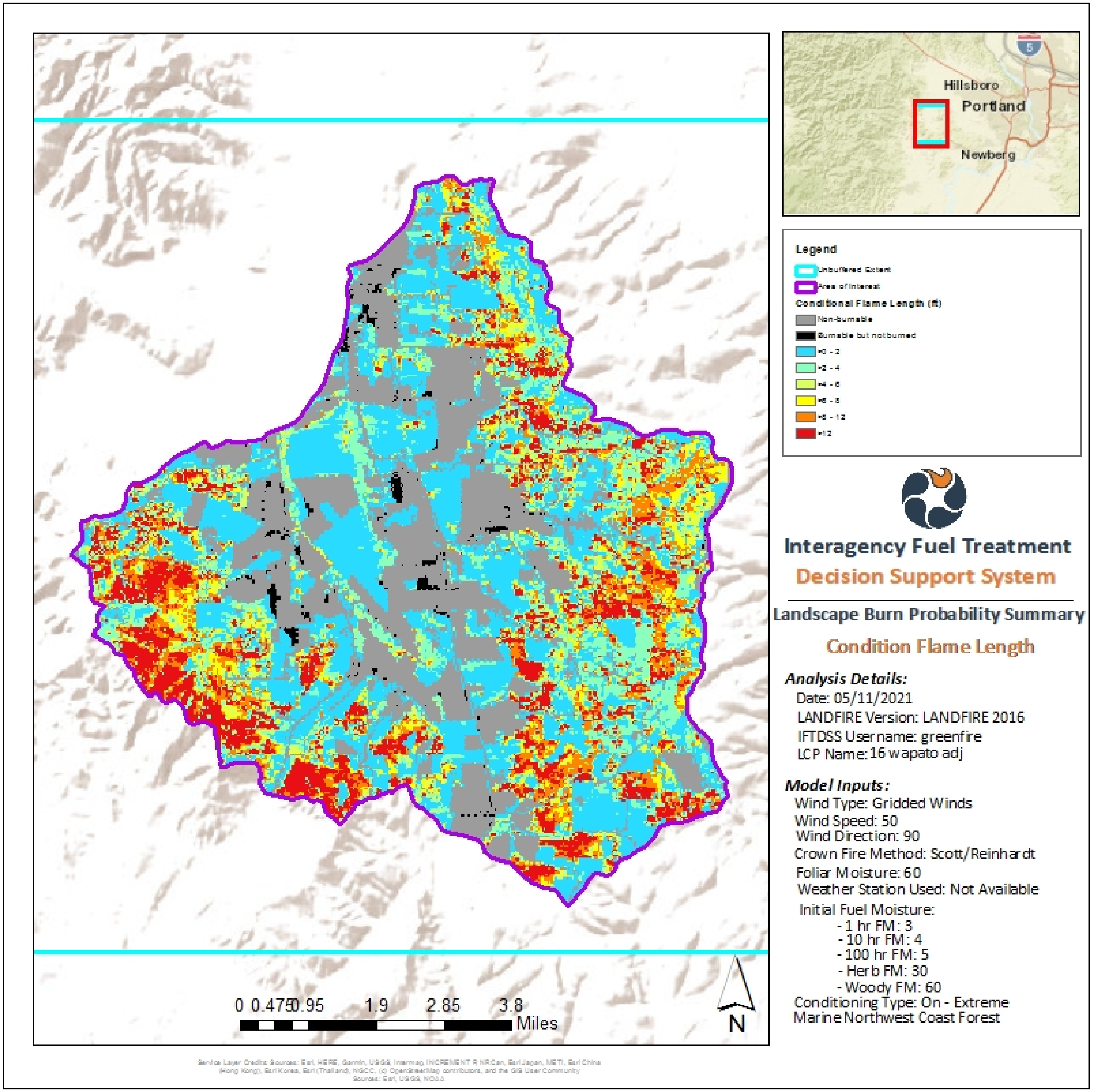
Model Inputs:
Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 60
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60

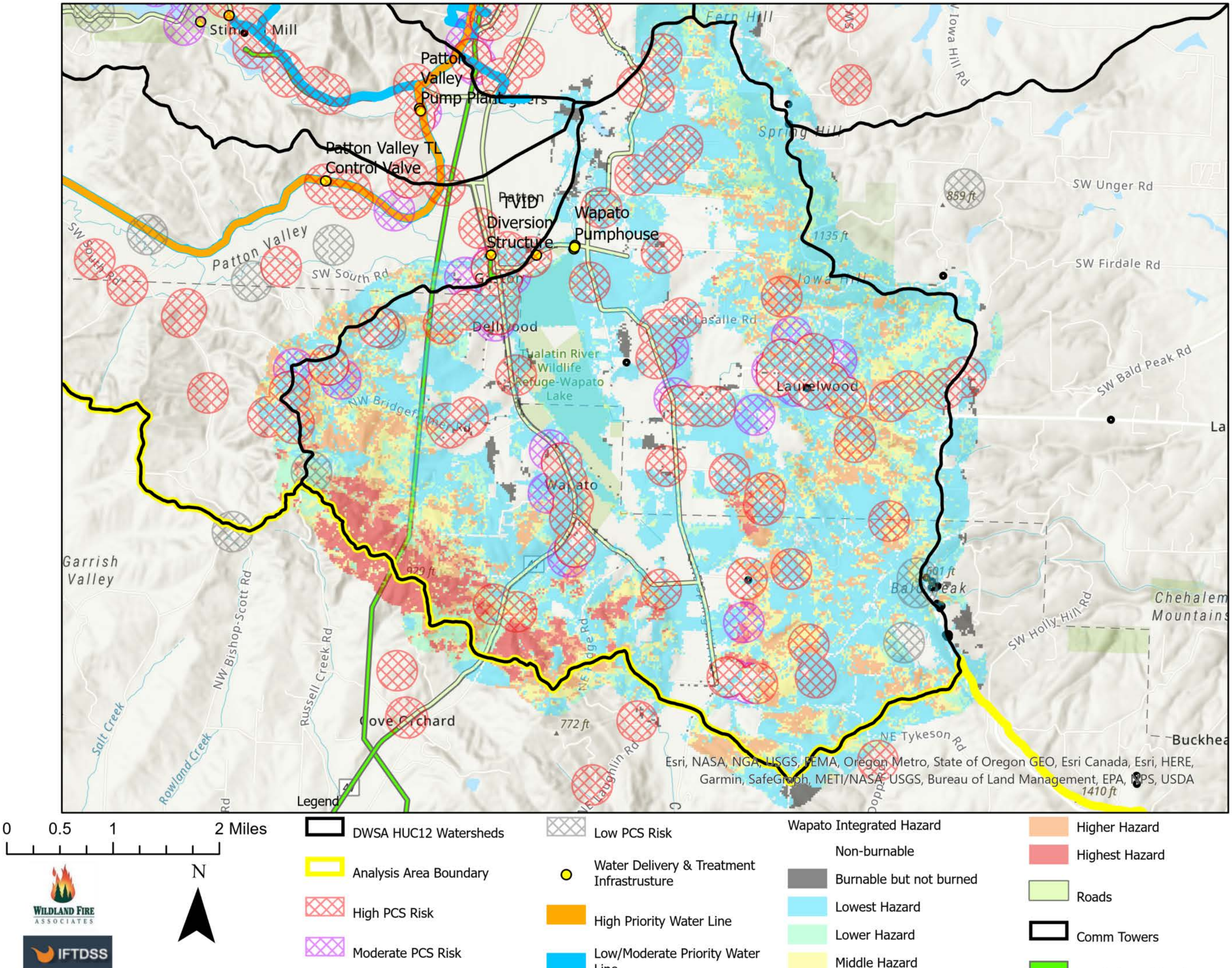
Conditioning Type: On - Extreme Marine Northwest Coast Forest

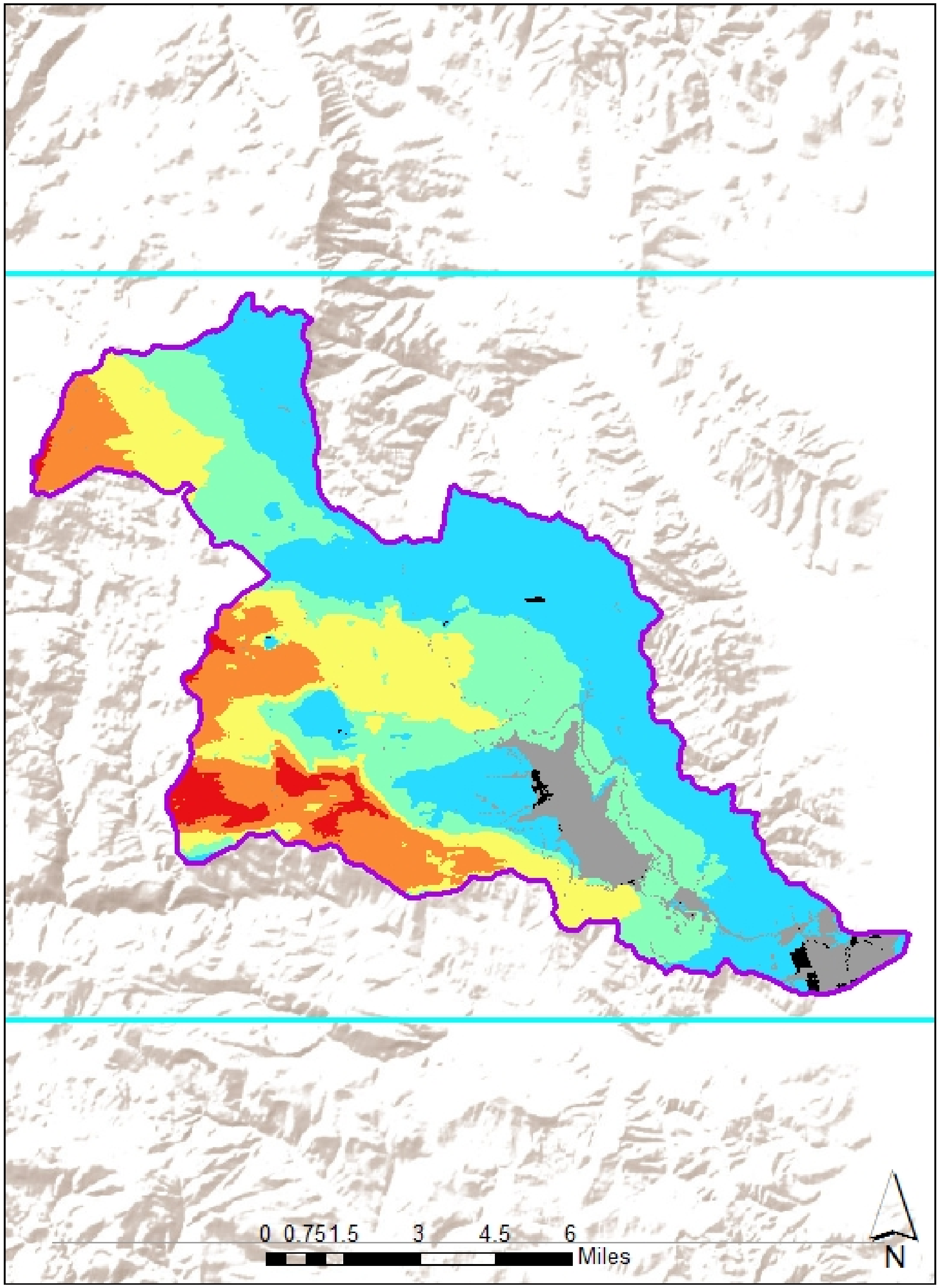

Portland
Newberg
Legend
Unbuffered Extent
Area of Interest
Conditional Flame Length (ft)
Non-burnable
Burnable but not burned
>0 - 2
>2 - 4
>4 - 6
>6 - 8
>8 - 12
>12
Interagency Fuel Treatment
Decision Support System
Landscape Burn Probability Summary
Condition Flame Length
Analysis Details:
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 forest grove adj
Model Inputs:
Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 60
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60
Conditioning Type: On - Extreme
Marine Northwest Coast Forest
0 0.425 0.85 1.7 2.55 3.4
Miles
N

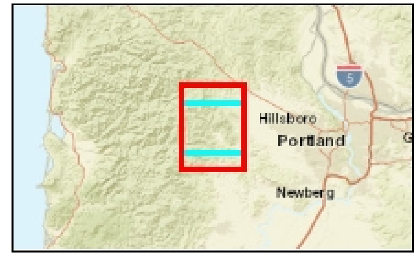

Cornelius
Forest Grove
Hillsboro
Forest Grove Treatment Facility
Fernhill Wetlands
Forest Grove West Zurcher Property
Spring Hill Pump Plant
Joint Water Commission
Fern Hill Reservoir 2
Fern Hill Reservoir 1
Quonset Hut
SW Blooming Fern Hill Rd
SW Tongue Ln
SW Iowa Hill Rd
SW 345th Ave
SW 331st Ave
Dairy Creek
Carpenter Cr
Fern Hill
Spring Hill
Esri, NASA, NGA, USGS, FEMA, Oregon Metro, State of Oregon GEO, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA
0 0.33 0.65 1.3 Miles
N
Legend
DWSA HUC12 Watersheds
Analysis Area Boundary
High PCS Risk
Moderate PCS Risk
Low PCS Risk
Water Delivery & Treatment Infrastruture
High Priority Water Line
Low/Moderate Priority Water Line
Forest Grove Integrated Hazard
Non-burnable
Burnable but not burned
Lowest Hazard
Lower Hazard
Middle Hazard
Higher Hazard
Highest Hazard
Roads
Comm Towers
Low Voltage Electric
WILDLAND FIRE ASSOCIATES
IFTDSS


5
Hillsboro
Portland
Newberg
Legend
Unbuffered Extent
Area of Interest
Burn Probability
(Analysis_maximum = 0.2187)
Non-burnable
Burnable but not burned
Lowest (0-20% of maximum)
Lower (20-40% of maximum)
Middle (40-60% of maximum)
Higher (60-80% of maximum)
Highest (80-100% of maximum)
Interagency Fuel Treatment
Decision Support System
Landscape Burn Probability Summary
Burn Probability
Analysis Details:
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 wapato adj
Model Inputs:
Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 60
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60
Conditioning Type: On - Extreme
Marine Northwest Coast Forest
0 0.475 0.95 1.9 2.85 3.8
Miles
N


Hillsboro
Portland
Newberg
5
Legend
Unbuffered Extent
Area of Interest
Conditional Flame Length (ft)
Non-burnable
Burnable but not burned
>0 - 2
>2 - 4
>4 - 6
>6 - 8
>8 - 12
>12
Interagency Fuel Treatment
Decision Support System
Landscape Burn Probability Summary
Condition Flame Length
Analysis Details:
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 wapato adj
Model Inputs:
Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 60
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60
Conditioning Type: On - Extreme
Marine Northwest Coast Forest
0 0.475 0.95 1.9 2.85 3.8
Miles
N
Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Sources: Esri, USGS, NOAA


Stimson Mill
Patton Valley Pump Plant
Patton Valley TL Control Valve
TVID Diversion Structure
Wapato Pumphouse
Patton Valley
SW South Rd
Dellwood
Tualatin River Wildlife Refuge-Wapato Lake
Laurelwood
Wapato
Fern Hill
Spring Hill
Iowa Hill
SW Unger Rd
SW Firdale Rd
SW Bald Peak Rd
SW Holly Hill Rd
Bald Peak
Chehalem Mountains
Garrish Valley
NW Bishop-Scott Rd
Russell Creek Rd
Gove Orchard
NE Tykeson Rd
Salt Creek
Rowland Creek
Esri, NASA, NGA, USGS, FEMA, Oregon Metro, State of Oregon GEO, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA
Legend
0 0.5 1 2 Miles
N
DWSA HUC12 Watersheds
Analysis Area Boundary
High PCS Risk
Moderate PCS Risk
Low PCS Risk
Water Delivery & Treatment Infrastructure
High Priority Water Line
Low/Moderate Priority Water Line
Wapato Integrated Hazard
Non-burnable
Burnable but not burned
Lowest Hazard
Lower Hazard
Middle Hazard
Higher Hazard
Highest Hazard
Roads
Comm Towers
Low Voltage Electric
WILDLAND FIRE ASSOCIATES
IFTDSS





Legend

- Unbuffered Extent
- Area of Interest

Burn Probability
(Analysis_maximum = 0.2032)

- Non-burnable
- Burnable but not burned
- Lowest (0-20% of maximum)
- Lower (20-40% of maximum)
- Middle (40-60% of maximum)
- Higher (60-80% of maximum)
- Highest (80-100% of maximum)

Interagency Fuel Treatment
Decision Support System

Landscape Burn Probability Summary

Burn Probability

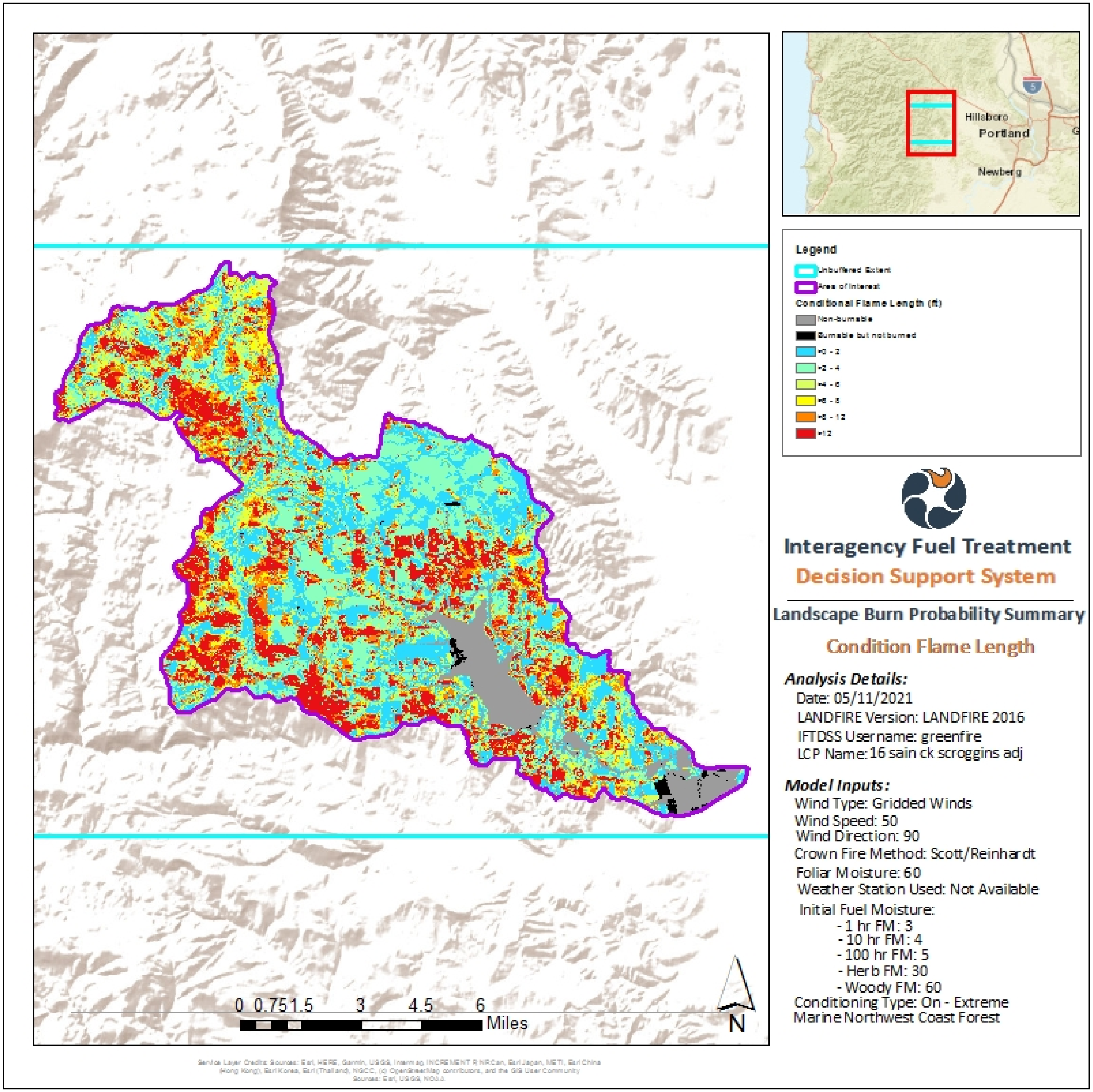
Analysis Details:

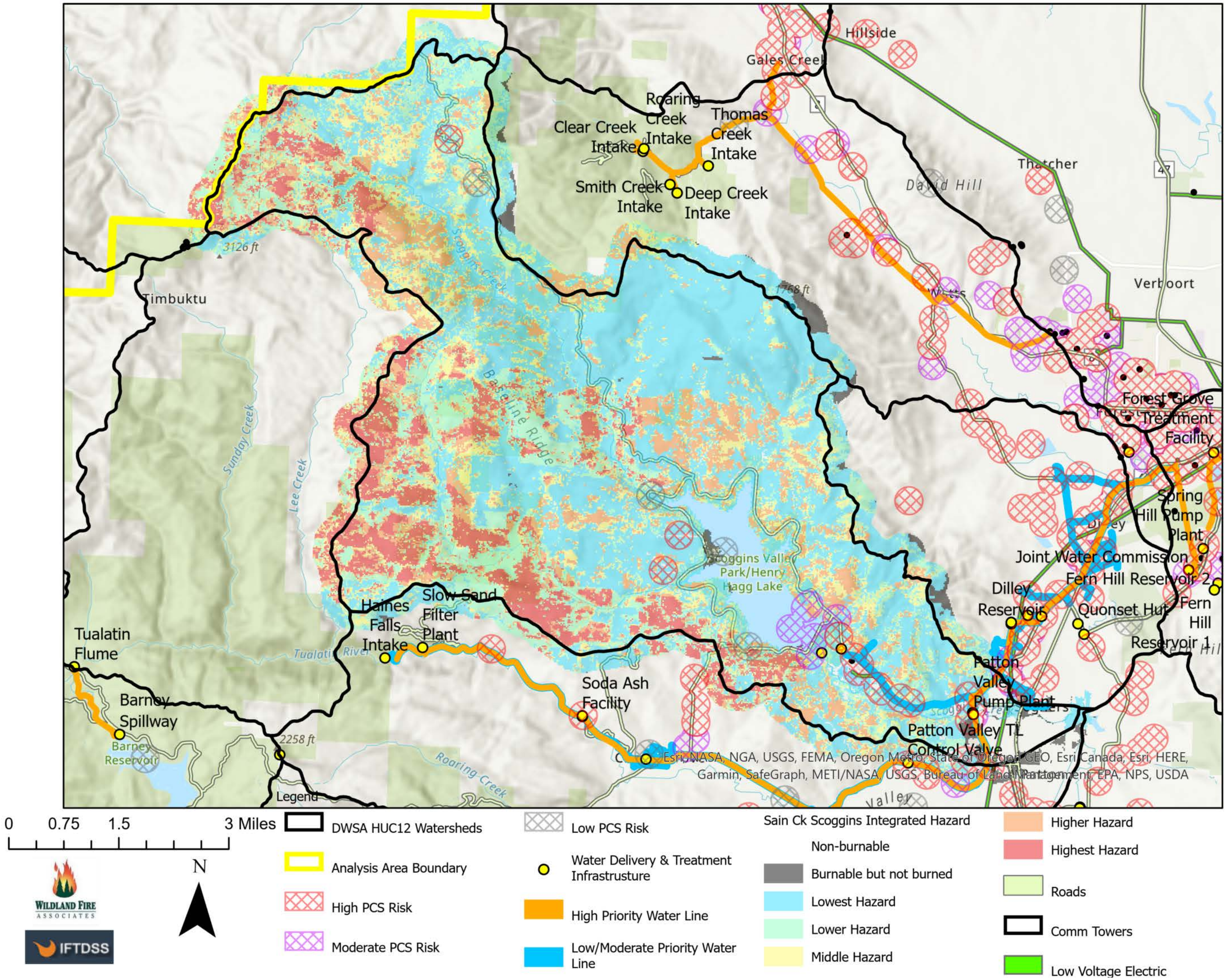
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 sain ck scroggins adj

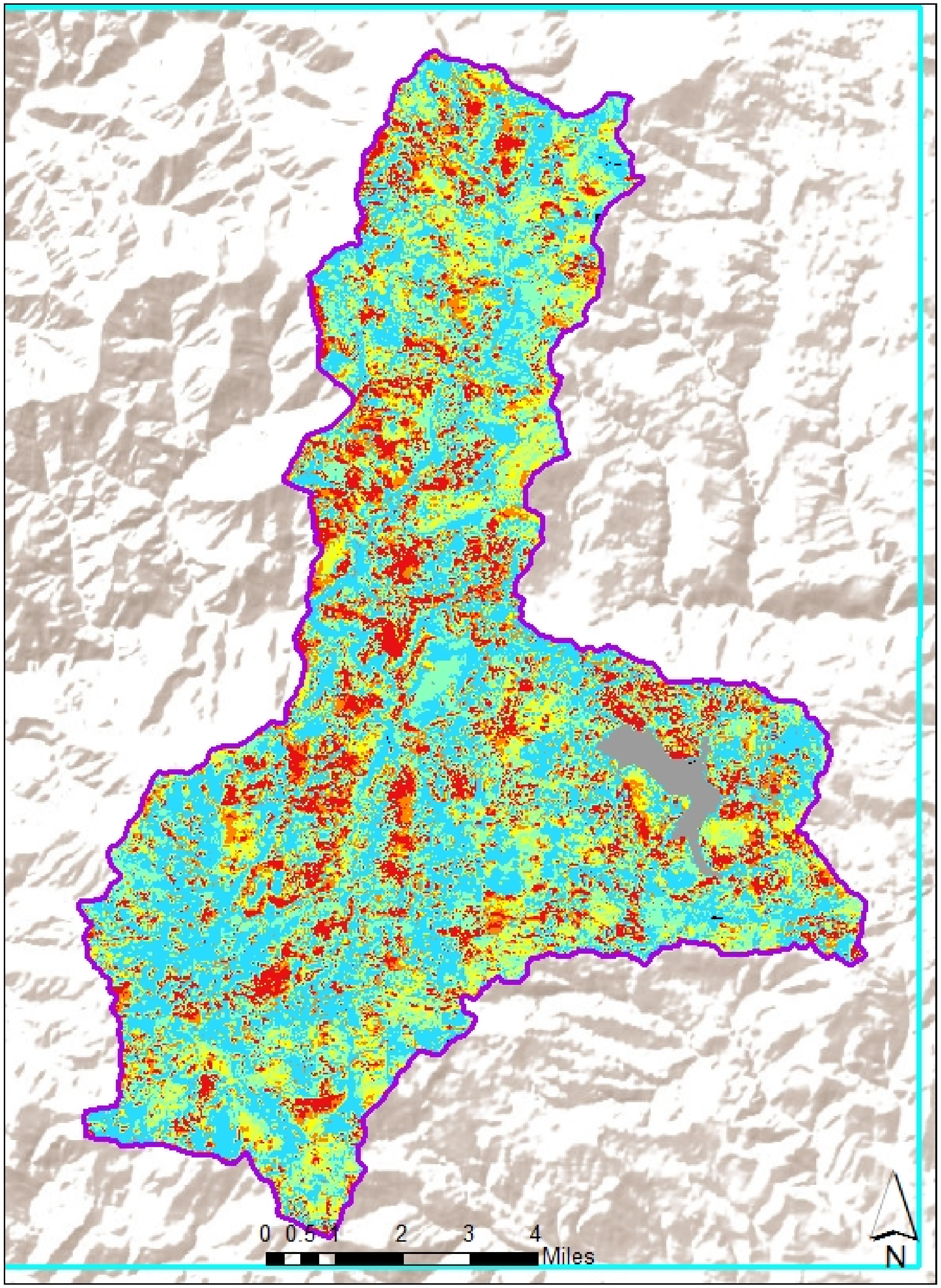
Model Inputs:

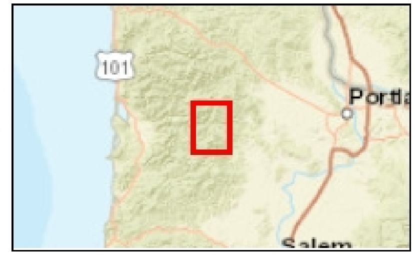
Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 60
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60

Conditioning Type: On - Extreme
Marine Northwest Coast Forest


Hillsboro
Portland
Newberg
Legend
Unbuffered Extent
Area of Interest
Conditional Flame Length (ft)
Non-burnable
Burnable but not burned
>0 - 2
>2 - 4
>4 - 6
>6 - 8
>8 - 12
>12
Interagency Fuel Treatment
Decision Support System
Landscape Burn Probability Summary
Condition Flame Length
Analysis Details:
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 sain ck scroggins adj
Model Inputs:
Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 60
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60
Conditioning Type: On - Extreme
Marine Northwest Coast Forest
0 0.75 1.5 3 4.5 6
Miles
N


Hillside
Gales Creek
Roaring Creek Intake
Thomas Creek Intake
Clear Creek Intake
Smith Creek Intake
Deep Creek Intake
Thatcher
David Hill
Verboort
Timbuktu
3126 ft
1768 ft
Scoggins Creek
Baseline Ridge
Sunday Creek
Lee Creek
Forest Grove Treatment Facility
Spring Hill Pump Plant
Joint Water Commission
Fern Hill Reservoir 2
Dilley Reservoir
Quonset Hut
Fern Hill Reservoir 1
Scoggins Valley Park/Henry Hagg Lake
Haines Falls Intake
Slow Sand Filter Plant
Tualatin Flume
Tualatin River
Barney Spillway
Barney Reservoir
Soda Ash Facility
Patton Valley Pump Plant
Patton Valley TL Control Valve
2258 ft
Roaring Creek
Esri, NASA, NGA, USGS, FEMA, Oregon Metro, State of Oregon GEO, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA
Legend
0 0.75 1.5 3 Miles
N
DWSA HUC12 Watersheds
Analysis Area Boundary
High PCS Risk
Moderate PCS Risk
Low PCS Risk
Water Delivery & Treatment Infrastructure
High Priority Water Line
Low/Moderate Priority Water Line
Sain Ck Scoggins Integrated Hazard
Non-burnable
Burnable but not burned
Lowest Hazard
Lower Hazard
Middle Hazard
Higher Hazard
Highest Hazard
Roads
Comm Towers
Low Voltage Electric
WILDLAND FIRE ASSOCIATES
IFTDSS





Legend

- Unbuffered Extent
- Area of Interest

Conditional Flame Length (ft)

- Non-burnable
- Burnable but not burned
- >0 - 2
- >2 - 4
- >4 - 6
- >6 - 8
- >8 - 12
- >12

Interagency Fuel Treatment
Decision Support System

Landscape Burn Probability Summary

Condition Flame Length

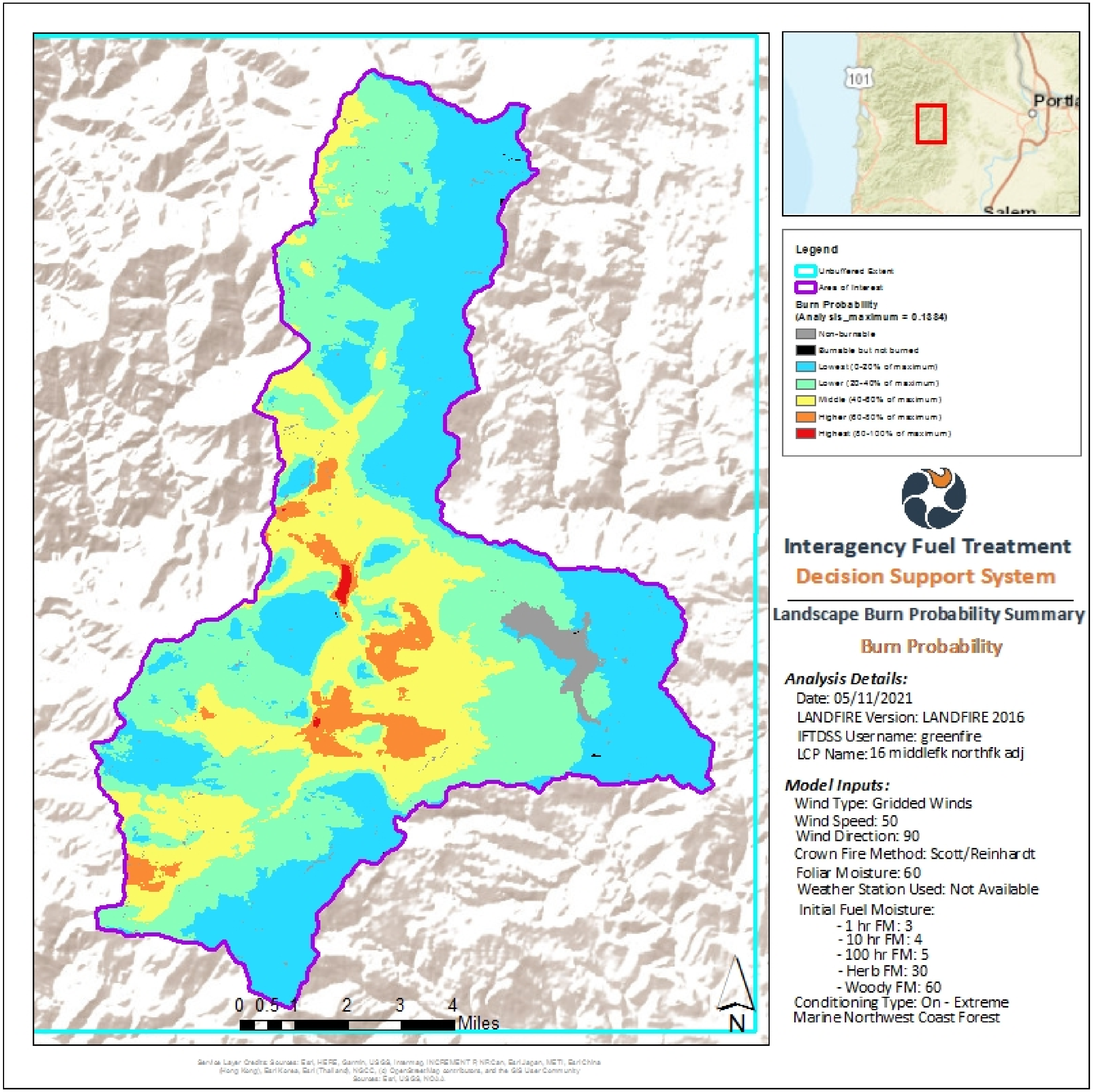
Analysis Details:

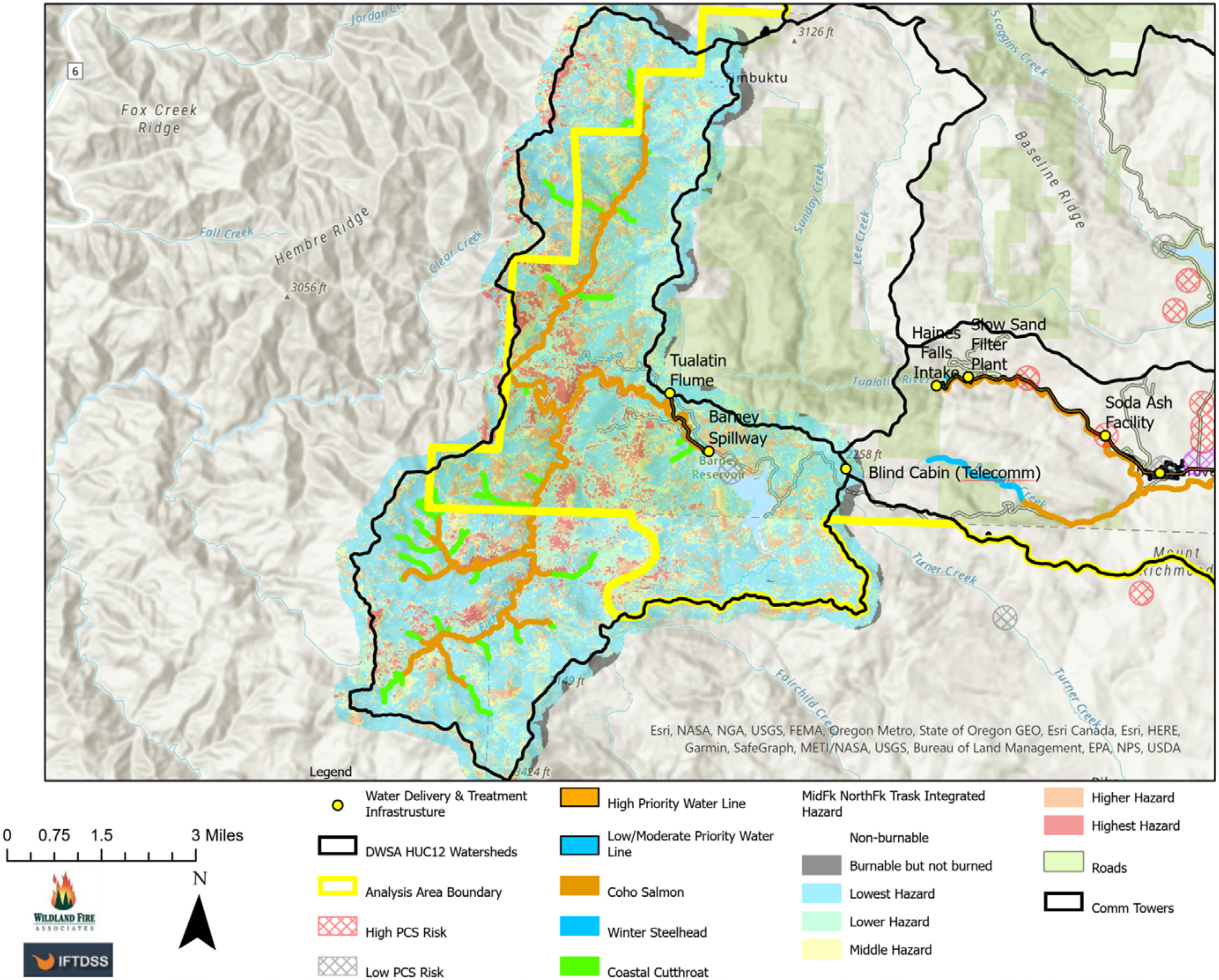
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 middlefk northfk adj

Model Inputs:

Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 60
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60

Conditioning Type: On - Extreme
Marine Northwest Coast Forest


101
Portl
Salem
Legend
Unbuffered Extent
Area of Interest
Burn Probability
(Analysis_maximum = 0.1384)
Non-burnable
Burnable but not burned
Lowest (0-20% of maximum)
Lower (20-40% of maximum)
Middle (40-60% of maximum)
Higher (60-80% of maximum)
Highest (80-100% of maximum)
Interagency Fuel Treatment
Decision Support System
Landscape Burn Probability Summary
Burn Probability
Analysis Details:
Date: 05/11/2021
LANDFIRE Version: LANDFIRE 2016
IFTDSS Username: greenfire
LCP Name: 16 middlefk northfk adj
Model Inputs:
Wind Type: Gridded Winds
Wind Speed: 50
Wind Direction: 90
Crown Fire Method: Scott/Reinhardt
Foliar Moisture: 60
Weather Station Used: Not Available
Initial Fuel Moisture:
- 1 hr FM: 3
- 10 hr FM: 4
- 100 hr FM: 5
- Herb FM: 30
- Woody FM: 60
Conditioning Type: On - Extreme
Marine Northwest Coast Forest
0 0.5 1 2 3 4
Miles
N


Fox Creek Ridge
Hembre Ridge
Fall Creek
Clear Creek
3056 ft
Timbuktu
3126 ft
Baseline Ridge
Sunday Creek
Lee Creek
Haines Falls Intake
Slow Sand Filter Plant
Tualatin Flume
Barney Spillway
Barney Reservoir
Soda Ash Facility
Blind Cabin (Telecomm)
Turner Creek
Fairchild Creek
Esri, NASA, NGA, USGS, FEMA, Oregon Metro, State of Oregon GEO, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA
Legend
Water Delivery & Treatment Infrastrusture
DWSA HUC12 Watersheds
Analysis Area Boundary
High PCS Risk
Low PCS Risk
High Priority Water Line
Low/Moderate Priority Water Line
Coho Salmon
Winter Steelhead
Coastal Cutthroat
MidFk NorthFk Trask Integrated Hazard
Non-burnable
Burnable but not burned
Lowest Hazard
Lower Hazard
Middle Hazard
Higher Hazard
Highest Hazard
Roads
Comm Towers
0 0.75 1.5 3 Miles
N
WILDLAND FIRE ASSOCIATES
IFTDSS