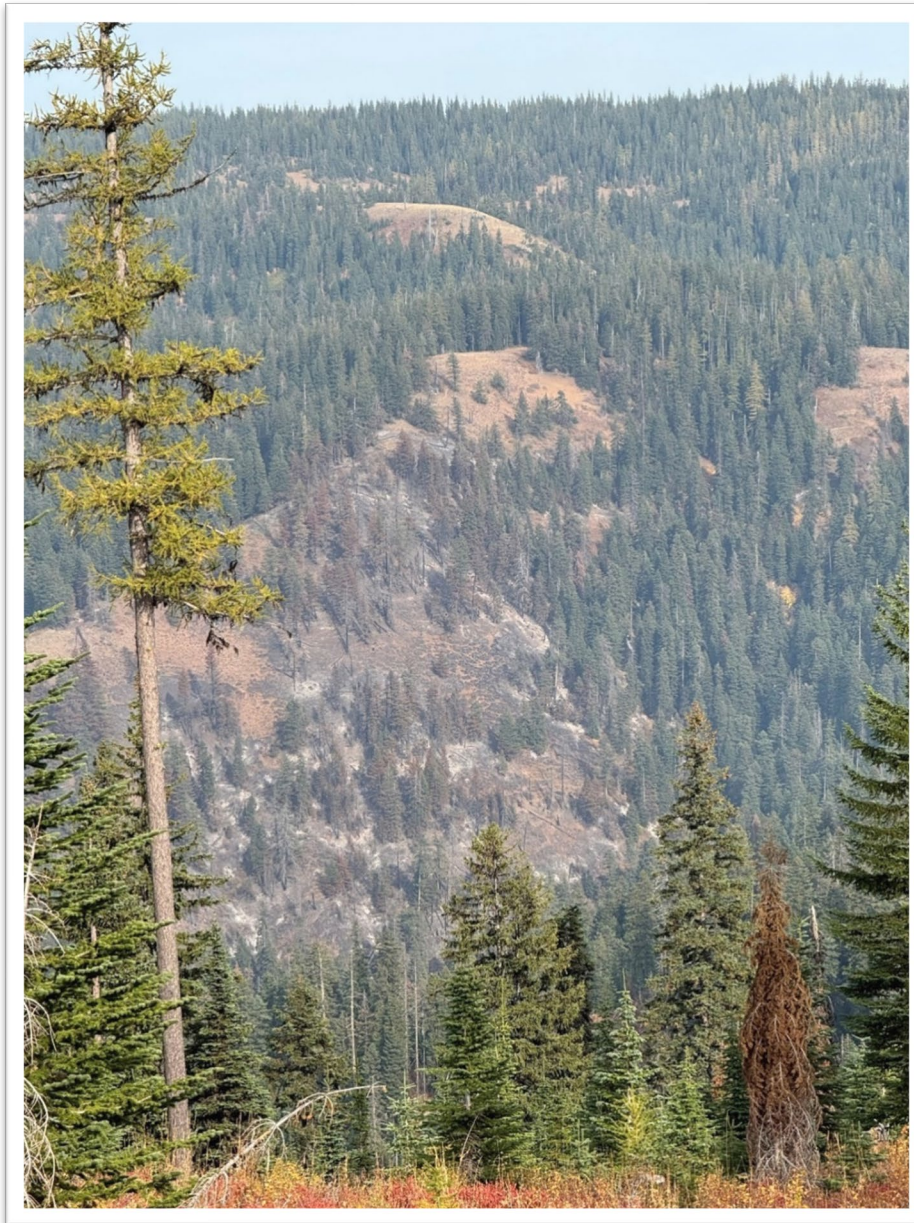


Tiger Creek Burned Area Emergency Response Hydrology Report

Umatilla National Forest



Prepared by:

**Rory Corrigan, Umatilla National Forest
October 2024**

Cover Photo: Moderate burn severity mid-slope at a southeast aspect within the Low Creek Drainage at the origin of the Low Creek spot fire.

REPORT SUMMARY (SECTION G OF THE 2500-8)

The Tiger Creek Fire burned within 3 different 12-digit Hydrologic Unit Code (HUC12) watersheds (Middle Mill Creek, Upper Mill Creek, and South Fork Walla Walla) with a mosaic of primarily very low and low soil burn severity and small pockets of moderate and high burn severity.

Post-fire peak flow analysis was conducted for 2 drainage areas (poursheds) to determine estimated changes in response to a storm event. A 5-year 24-hr storm (20% annual exceedance probability) was selected as the design storm to mimic the most likely damaging storm, a late fall or early spring localized long duration storm, within the 3-year recovery window. The intensity of a 5-year return interval storm was derived using local data from an NRCS SNOTEL site at the top of the Mill Creek watershed with a period of record beginning in 2007. Modeling efforts consisted of Wildcat5 runs for the Tiger Creek and Low Creek drainages using methods from field verified studies to modify curve numbers to adequately represent post-fire conditions (Higginson and Jarnecke, 2007).

Modeling results indicated marginal increases in peak flows for each pourshed 1.01 times pre-fire peak flow for Tiger Creek and 1.02 times pre-fire peak flow for Low Creek. These minute increases in the magnitude of post-fire discharge values indicate that while runoff will increase at some small ephemeral draws and drainages, there is not a significant anticipated change even at the micro-watershed scale and thus significant negative geomorphic changes are not expected. Any initial flushes of ash and sediment from burned areas positioned on mid to upper slopes are anticipated to be small and mostly buffered by intact riparian vegetation while vegetative recovery of burned areas occurs. The USGS Post-fire Debris Flow Hazard Model estimates a moderate to low risk for elevated debris flow hazard throughout most of the fire. Elevated likelihood is present in small areas of very steep drainages in between the 65 road and ridge delineating the Mill Creek Municipal Watershed, though combined hazard analysis ranks these areas low.

Peak flow and watershed responses are highly dependent on storm occurrence and are at greatest risk of elevated response in the first year or two after the fire, with emphasis on initial storm events. Post-fire hydrologic impacts will become less evident as vegetation is re-established, providing ground cover that reduces erosion, increases surface roughness to slow flow accumulation, and increases infiltration. Vegetative recovery is anticipated within approximately three years. Currently, most riparian vegetation remains intact, with robust needle cast observed on burned upland slopes greatly reducing risk of significant erosion and transport of eroded material to waterways.

OBJECTIVES

- Describe potential for increased runoff and related hydrologic impacts and determine if the post-fire environment has led to an emergency watershed condition.
- Identify critical values with risk of damage from post-fire flooding within and downstream of the burned area and estimate the location and magnitude of possible effects.
- Develop treatment recommendations intended to mitigate threats to BAER critical values.

CRITICAL VALUES

BAER hydrologists, alongside the BAER interdisciplinary team, assessed critical values with elevated risk of damage from post-fire erosion, flooding, and debris flows within and downstream of the Tiger Creek Fire on NFS land. The BAER focused first on the potential risk to human life and safety from flooding-related impacts, then shifted to primarily evaluating critical values including transportation infrastructure (e.g., roads and culverts), habitat for ESA-listed Middle Columbia River Steelhead and Bull

Trout,, watershed function, and water quality, with special attention to the Mill Creek Municipal Supply Watershed.

RESOURCE CONDITION

Resource Setting: The Tiger Creek Fire began as a prescribed burn Monday October 1st, 2024 on a unit between Forest Service Road 65, Indian Ridge Trail, and Tiger Creek roughly 15 miles southeast of Walla Walla, Washington. It was declared a wildfire in the late afternoon October 2nd, after demonstrating extreme fire behavior and spotting beyond containment lines into the Mill Creek Watershed. As of October 21st the fire has burned 534 acres, 492 of which are on NFS lands on the Walla Walla Ranger District of the Umatilla National Forest. The footprint of the Tiger Creek Fire is not within any known previous fire perimeters.

The fire burned across three HUC-12 subwatersheds: 221 acres burned in the Middle Mill Creek Watershed, 312 acres burned in the Upper Mill Creek subwatershed, and 0.2 acres burned in the Upper South Fork Walla Walla subwatershed. Within these subwatersheds, Low Creek (Upper Mill Creek subwatershed) and Tiger Creek (Middle Mill Creek subwatershed) encompass drainages that include burned areas, and have designated critical habitat for Middle Columbia Steelhead and Bull Trout. Additionally, Low Creek is part of the Mill Creek Municipal Supply Watershed that is the primary source of drinking water for the City of Walla Walla. The confluence of Low Creek and Mill Creek is roughly half a mile from the Lower Intake for the City of Walla Walla's drinking water system.

Primary drivers of notable hydrologic events are runoff and occasional rain-on-snow events during the winter or early spring with infrequent but longer duration, intense, localized precipitation cells. Using the simple definition of the transient snow zone as the zone in which snow accumulates and melts entirely within a winter the entirety of the burn perimeter falls within this zone – with minimum elevations near Tiger Creek at 3,200 ft and the summit of Low Ridge reaching 5200 ft (Wu et al. 1990). Within the transient snow zone precipitation readily falls as snow and rain throughout the winter and given the topographic relief within watersheds, rain-on-snow events are expected to occur with increased regularity moving forward (Fig. 2). Rain-on-snow events can enhance the magnitude of a flood by combining runoff from rain driven runoff and snow melt driven by precipitation. SNOTEL data from the top of the Mill Creek Watershed, just northwest of the northern burn boundary and roughly 400 feet higher than the highest points within the burned area, indicates that snow water equivalent typically peaks mid-April across the period of record (1991-2023) with a median value of 45.4 inches. Snow water equivalent decreases rapidly past this peak and is zero by mid-June on average across the period of record, pointing to a prolonged runoff period with snow persisting through the spring at higher elevations and protected aspects. There is data to suggest that snowpack development and longevity is hampered by increased solar radiation, but this was not accounted for as part of the modeling and analysis effort (Stevens, 2017). Therefore, the first hydrologic event considered to be significantly geomorphically active in the burned area for the purpose of this report would be a spring rain-on-snow event where snow remains at higher elevation, but snow melt has exposed lower or south facing portions of the burn scar.

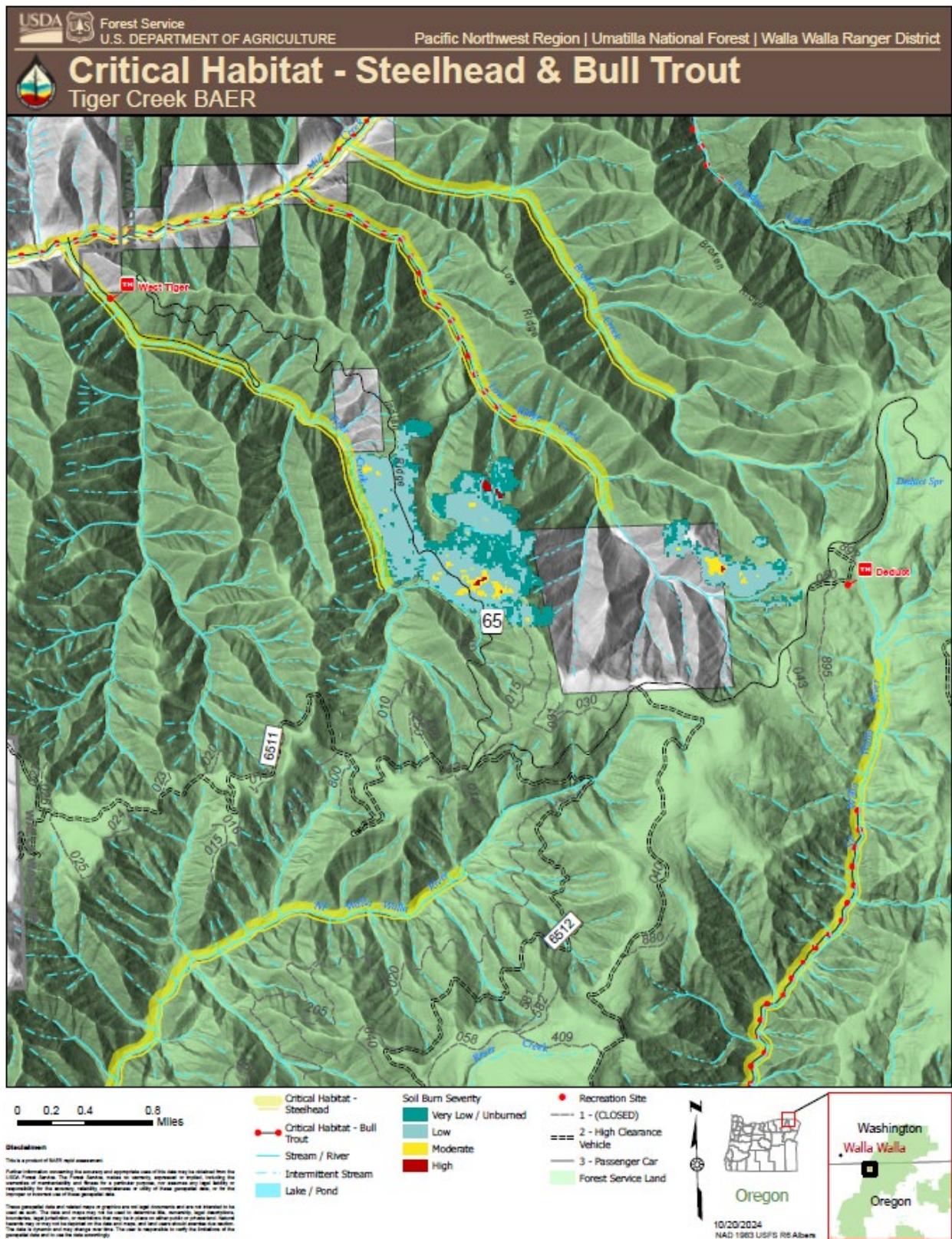


Figure 1. Stream network including designated MCR Steelhead critical habitat with fire perimeter.

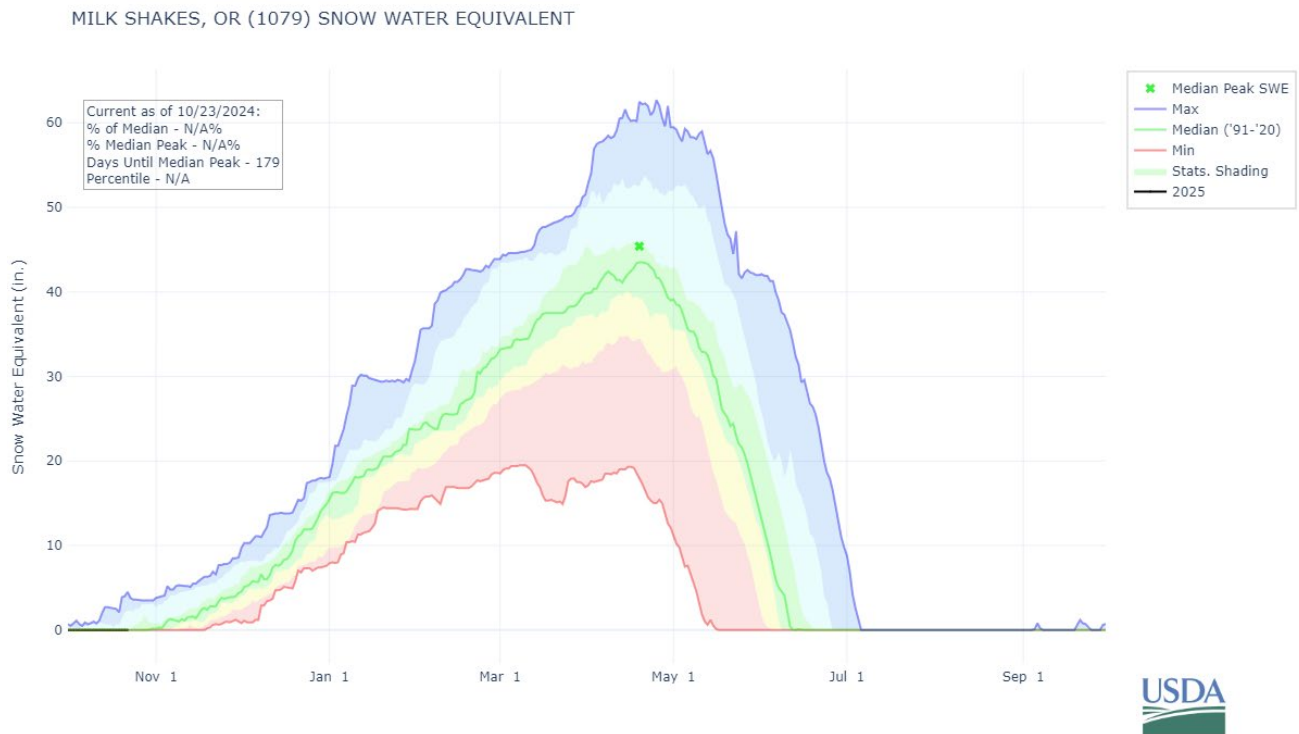


Figure 2: NRCS SNOTEL Data from Madison Butte Period of Record. (NRCS, 2024).

Assessment Methodology: The initial BARC map was created by comparing information from pre- and post-fire sentinel-2 satellite flights, with consideration given to seasonality influencing the satellite data. Field verification occurred October 18th by BAER Soil Scientists to inform a final SBS map, delivered October 19th, following the Field Guide for Mapping Post-Fire Soil Burn Severity (Parsons, et al. 2010). Resource conditions were reviewed by conducting on-the-ground inspections within the burn area from October 14st to October 16th with a focus on at-risk critical values. A variety of information was used to inform the hydrologic analysis, including BAER field data, local stream and weather stations, regional climate data and predictions, watershed analyses using Wildcat5, and information from Resource Advisors assigned to the Tiger Creek Incident.

Pre- and post-fire runoff was estimated at specific ‘pour points’ tied to BAER critical values (see Appendix C). Pour points are points within the drainage network, within or downstream of the burned area, where BAER specialists have identified critical values at risk. BAER hydrologists worked with other resource specialists (engineers, recreation specialists, fish biologists, archeologists, etc.) to identify a total of 2 pour points for pre- and post-fire streamflow modelling. Modelling focuses included impacts to the Mill Creek Municipal Watershed, designated critical habitat for ESA listed species, and overall hydrologic function, for the two primary drainages (Tiger Creek and Low Creek) impacted by the fire within the larger sub watersheds. Detailed streamflow analysis methods are provided in Appendix D.

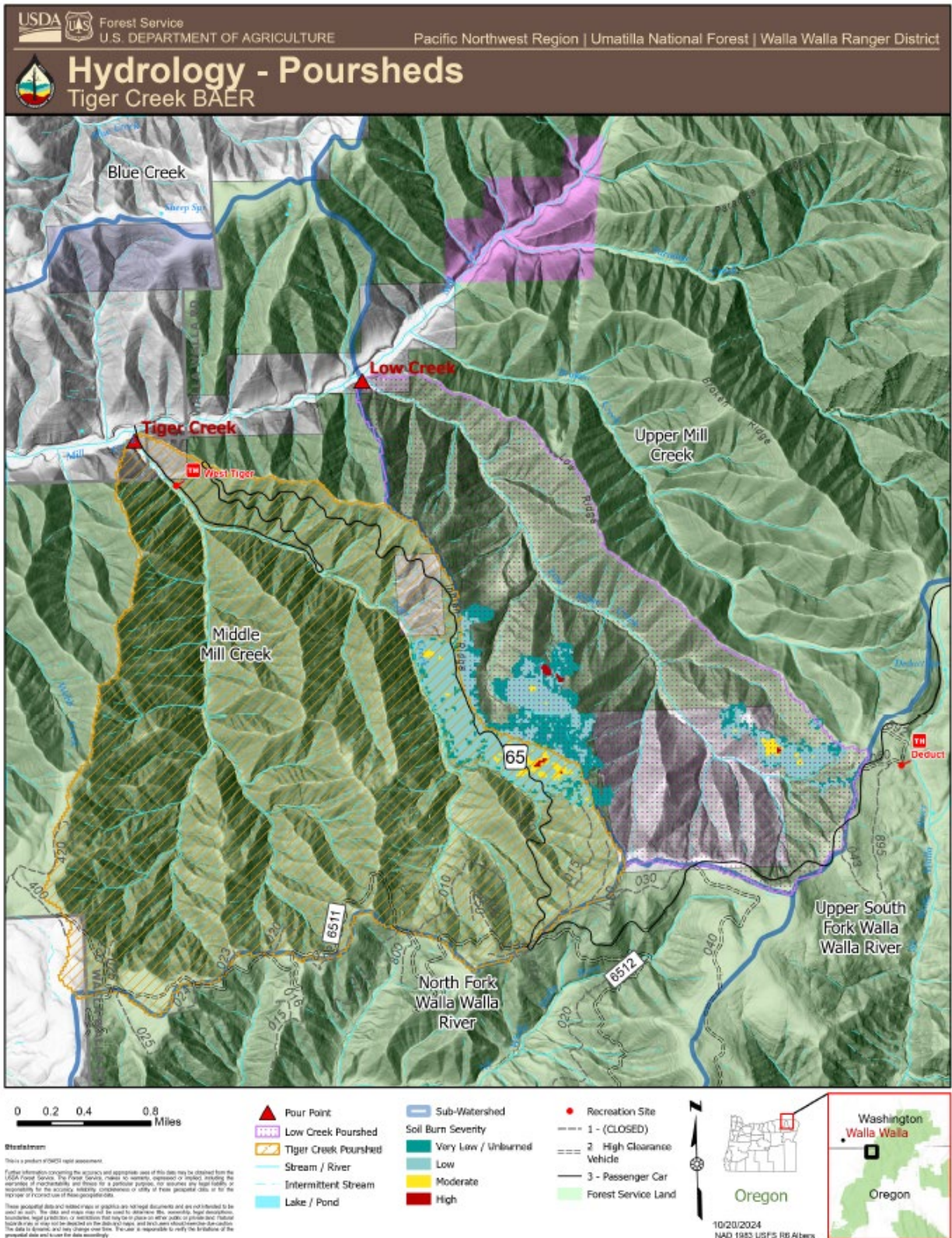
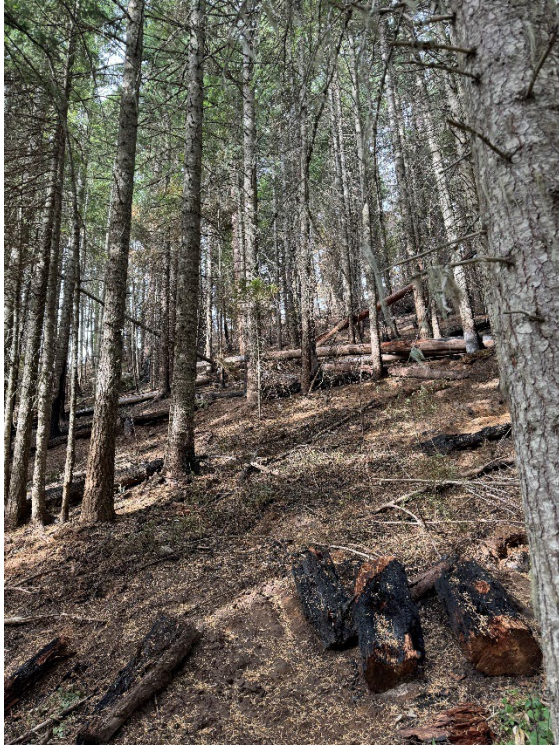


Figure 4. Map of fire perimeter with Pour Point watersheds and Soil Burn Severity.

Field Observations: The portion of the fire between Tiger Creek and Forest Service Road 65 burned primarily on the mid to upper portions of the slopes and effects were aligned with expectations from prescribed fire. Basal area mortality is anticipated to be more moderate overall with pockets of higher mortality on the steeper portions of the slopes closer to the road. Fire appeared to have backed into the riparian area stopping at the toe of the valley slope. There were two spots noted where burns extended into the riparian valley floor in the footprint of fallen trees and burned to roughly 25 feet from the ordinary high-water line. Ground cover on the burned upland area was moderate with needlecast present and potential for more, as well as pockets of shrubs remaining unburned. No hydrophobic soils or significant stretches of ash pockets were observed. Riparian vegetation and canopy cover was almost entirely intact.



Burn looking upslope from Tiger Creek; dominant condition on the right; area of burn in riparian area on left



Mid-slope burn area condition in Tiger Creek drainage, timber stringer left, exposed grass and shrub dominated slope right.

The Low Creek portion of the burn primarily features a northern aspect so the vegetation on the both the upland valley slopes and riparian areas is thicker both in canopy coverage and structure as well as undergrowth shrubs and ferns. Valley slopes are extremely steep 65% to 75% measured throughout the western portion of the burn in the Low Creek drainage. No burning in riparian areas was observed and robust vegetative buffers were observed between burned hillslopes and drainages connecting to low creek, including its perennial headwaters. Though canopy density and cover did not appear changed, higher basal area mortality is expected which could lead to canopy changes over the next few years, however, these high basal area mortality regions are primarily mid-slope.

These observations helped inform the overall assessment of hydrologic resilience and function, and modifications to models to represent post-fire conditions.

Results and Interpretation of Analysis: Major runoff producing events occur primarily in the winter months. These winter storms are longer in duration and cover a larger spatial extent than convective summer thunderstorms and given the possibility of winter storms triggering rain-on-snow events, a winter storm scenario was the focus of this analysis. A 5-year 24-hour precipitation event was selected as the design storm to represent this. A 5-year (20% annual exceedance probability) was selected over a more likely 2-year (50% annual exceedance probability) to err on the side of a larger storm to try to capture, in a rudimentary fashion, the magnitude of a rain-on-event given the possibility of occurrence.

Runoff modelling estimates for a Q5 storm event are included in Appendix B. These results should be interpreted with caution as numerous assumptions and simplifications of physical processes are embodied in the output. While absolute flow numbers may contain considerable uncertainty, relative increases in peak flow (comparing pre-fire to post-fire) are intended to provide a more useful guide for understanding the general extent of alteration of a drainages soil hydrologic function. Modelling efforts indicate that peak flows have the potential to increase 1.01 or 1.02 times the pre-fire condition, (Figures 4-8). In addition to marginally higher peak flows, other watershed responses may include: 1) an initial small flush of ash, 2) slight geomorphic changes driven by larger flows, and 3) minor sediment deposition downstream from hillslope soil loss. However, modelling and field observations suggest that the

likelihood of detrimental watershed responses occurring in either drainage is low, and no significant impacts to Mill Creek water quality and drinking water infrastructure, or designated critical habitat are anticipated at this time.

Post-fire watershed response will be greatest after initial storm events when rain particles are most likely to interact with hill slopes with reduced ground cover. However, based on field observation and SBS mapping, there are no riparian areas with moderate or high burn severity, and areas of high burn severity are understood to be highly localized making up no more than 0.2% of the burn severity of any of poursheds. The presence of intact riparian vegetation, and scant moderate and high soil burn severity is expected to mute the response across the system as even in areas where high and moderate SBS was observed there was a significant buffer of riparian and downslope vegetation intact. These expectations based on field work bared out in Soils specialists' erosion analysis using WEPP Cloud as a slightly elevated sediment response is expected, between 1-1.4 times baseline erosion, while hillslopes and stream banks revegetate. Additionally, this aligns with BAER soil scientists modeled and mapped areas of soil erosion risk with only 4.6 acres of high erosion risk rating. Areas of high and very high soil erosion risk are primarily between Forest Service Road 65 and the Indian Ridge trail, with a pocket on a ridgetop adjacent Low Creek.

Post-fire watershed response will become less evident as ground cover vegetation is reestablished over 0-3 years. Ground cover provides critical surface roughness that intercepts raindrops and dissipates energy, allowing soils to stabilize, infiltration to recover, and hillslope erosion to return towards pre-fire conditions. Ground cover, or lack thereof, has been shown to be more influential on post-fire runoff than hydrophobic qualities due to the added benefit of soil sealing (Larsen et al. 2009). With surviving vegetation and needle cast BAER Soil scientists estimated lower burn severity areas to be 50% or greater ground cover, a highly positive indicator of the possibility of lower sediment yield than was modeled and accelerated hydrologic recovery.

Additionally, The Tiger Creek Fire burned area has low potential for shallow debris slides and debris flows based on a 15-minute 24 mm/hr precipitation design storm (see Appendix C USGS Debris Flow Combined Hazard). Debris flows can deliver pulses of ash and sediment to the drainage network as well as complexity elements such as large wood and boulders, but the overall probability of a debris flow occurring and posing a risk to critical values is considered low.

It should be noted the ability of watersheds to capture sediment and mitigate flood pulse energy inputs appeared to be visually diminished in Tiger Creek due to the prevalence of incised reaches where the active channel was functionally disconnected from overbank areas and a lack of large wood and other elements of channel complexity and structure was observed. Spatially heterogenous stream reaches (i.e. multithread systems with structural complexity) have been noted as particularly important to post-fire resilience and recovery (Wohl et al. 2019). Natural wood recruitment of mobilized downed logs from areas of lower burn severity from post-fire storm events in systems is unlikely, but wind-driven falling previously weak trees in riparian areas being exposed to new wind loads, could occur and be beneficial in restoring ecosystem resilience.

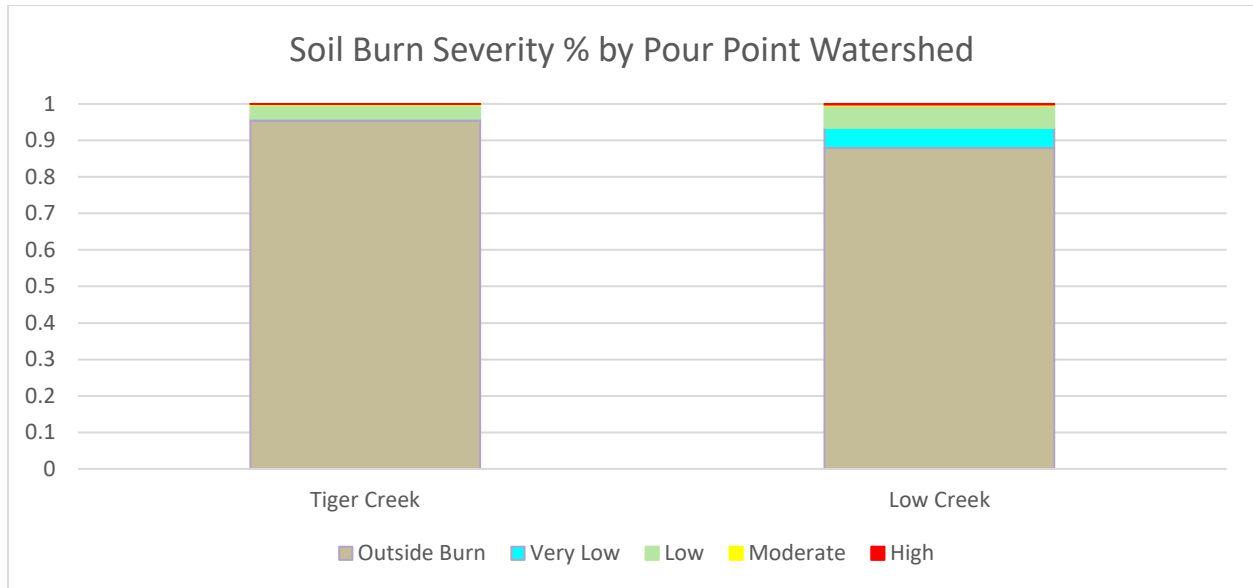


Figure 6: Soil Burn Severity by percentage for poursheds

Table 1: Modeled Watershed Peak Flow pre- and post- fire for poursheds

	Tiger Creek	Low Creek
Pre-Fire Q (cfs)	1548	861
Post-Fire Q (cfs)	1571	875
Percent Increase	1%	2%

RISK ASSESSMENT

The objective of the BAER risk assessment, as described in BAER manuals and policy, is to identify risk to BAER critical values identified by the Tiger Creek Fire BAER team. BAER hydrologists estimated post-fire runoff to help inform the BAER risk assessment at specific pour points, linked to BAER critical values. For example, post-fire watershed response on the Battle Mountain Complex may lead to plugged culverts on roads and trails, flow over road surfaces, rill and gully erosion of cut and fill slopes, erosion and deposition along road surfaces and relief ditches, loss of soil productivity, reduced water quality, and geomorphic changes that impact watershed function. For more information, see the Tiger Creek BAER risk assessment and 2500-8 form.

RECOMMENDED RESPONSE ACTIONS

No treatments are proposed based on hydrologic critical values at risk from post-fire watershed response, including elevated runoff and erosion. Additional details about any proposed treatments, objectives, and associated costs can be found in the 2500-8, the Tiger Creek BAER critical values risk assessment spreadsheet, and other specialist reports.

REFERENCES

- Higginson, B., Jarnecke, J., 2007, Salt Creek BAER-2007 Burned Area Emergency Response. Provo, UT: Uinta National Forest; Hydrology Specialist Report. 11 p.,
- Hawkins, R.H., Barreto-Munoz, A., 2016, *Wildcat5 for Windows, a rainfall-runoff hydrograph model: user manual and documentation*, USDA Forest Service Rocky Mountain Research Center, <http://dx.doi.org/10.2737/RMRS-GTR-334>.
- Larsen, I.J., MacDonald, L.H., Brown, E., Rough, D., Welsh, M.J., Pietraszek, J.H., Libohova, Z., Benavides-Solorio, J.D., Schaffrath, K., 2009, *Causes of Post-Fire Runoff and Erosion: Water Repellency, Cover, or Soil Sealing*, Soil Science Society of America Journal, Volume 73: Number 4.
- Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database for Mill Creek, Oregon. Available online. Accessed 10/19/2024
- United States, US Department of Agriculture, Natural Resource Conservation Service, National Water and Climate Center. Water and Climate Information System, *Air and Water Database*. <https://nwcc-apps.sc.egov.usda.gov/>, October 2024.
- Wohl, E., Marshall, A.E., Scamardo, J., White, D., Morrison, R.R., 2016, *Biogeomorphic influences on river corridor resilience to wildfire disturbances in a mountain stream of the Southern Rockies, USA*, Science of The Total Environment, Volume 820, 2022, 153321, ISSN 0048-9697, <https://doi.org/10.1016/j.scitotenv.2022.153321>.
- Wu, T.H., and Merry C.J., 1991, *Slope Stability in the Transient Snow Zone*, Timber-fish-Wildlife Sediment, Hydrology and Mass Wasting Committee Report.

LIST OF APPENDICES:

Appendix A: Methods

Appendix B: Modeling Results

Appendix C: Soil Erosion Hazard Map and USGS Debris Flow Combined Hazard Map

Appendix D: Basal Area Mortality

Appendix A: Methods

Pour Points

Pour points of interest were identified with consideration to critical values and field reconnaissance. The contributing drainage area upstream of a pour point (hereafter, poured) was delineated using USGS StreamStats v4.23.0. Locations of pour points are shown in Figure 4. Results of the increased discharge from the fire to these pour points can be seen in Appendix C.

HUC 12 watersheds that overlap with the burned area were also identified using GIS.

Wildcat5

The curve number approach is a widely used and efficient method for determining the approximate amount of direct runoff from a rainfall event in a particular area for smaller drainages. The runoff curve number is typically based on the area's hydrologic soil group, land use, treatment, and hydrologic condition. In this case, curve numbers for a given watershed are adjusted based on the amount of acres of unburned, low, moderate, and high soil burn severity found in each drainage. The WILDCAT5 software package, developed by the University of Arizona in cooperation with the U.S. Forest Service was used to simulate hydrographs and peak throughout the fire area (Hawkins and Barreto-Munoz 2016). Basin characteristics were extracted from GIS data. Curve numbers used in these model runs were selected based on overall soil hydrologic group from NRCS SSURGO data and landcover from USGS NLCD data, as well as utilizing input from other BAER hydrologists and soil scientists. Curve numbers used are shown in Table 6.

Table 1. Pre-Fire Landcover and Curve Numbers

Landcover Type and	Hydrologic Soil Group	Hydrologic Condition	CN
Grassland	Group D	Good	89
Brush	Group D	Good	77
Forest	Group D	Good	73

Post-fire increases in flow were estimated using the USGS Regression method for flood-frequency relations; increases in post-fire flows are estimated based on the proportion of unburned, low, moderate, and high soil burn severity within each poured. Post-fire regression multipliers were developed for the Tiger Creek Fire based on previous research, as well as professional experience, local geology, soils, and climate inputs

and are listed in Table 2 below. Discussion with soil scientists who evaluated the soil burn severity noted that a significant proportion of ground cover remained. Ground cover being highly influential in intercepting runoff and maintaining soil structure capable of infiltrating and storing precipitation, more modest modifiers were selected for curve numbers in alignment with BAER Soil scientists' ground cover observations and previous literature.

Table 2. Post-fire increases (Higginson and Jarnecke, 2007)

Soil Burn Severity	CN Adjustment
Unburned	None
Low	CN + 5
Moderate	CN + 10
High	CN +15

Post-fire runoff estimates do not include a bulking factor, which increases flow volume when waters are laden with sediment and debris. It was not deemed to be applicable given the magnitude of increase across all poursheds for the most likely event is well below 1.5x. Additionally, WEPPCloud modeling only indicated slight increases in sediment yield (up to 1.38x) across burned watersheds (Appendix C), and sediment pulses as a product of debris flows in drainages are considered unlikely due to low to moderate combined risk across the mapped area (Appendix D).

WEPPCloud

BAER soil scientists conducted erosion analysis using WEPPCloud to estimate pre- and post-fire sediment yield. Small and large poursheds were tested using the online interface at <https://wepp.cloud/weppcloud/>. For more information on this methodology, see the soils report

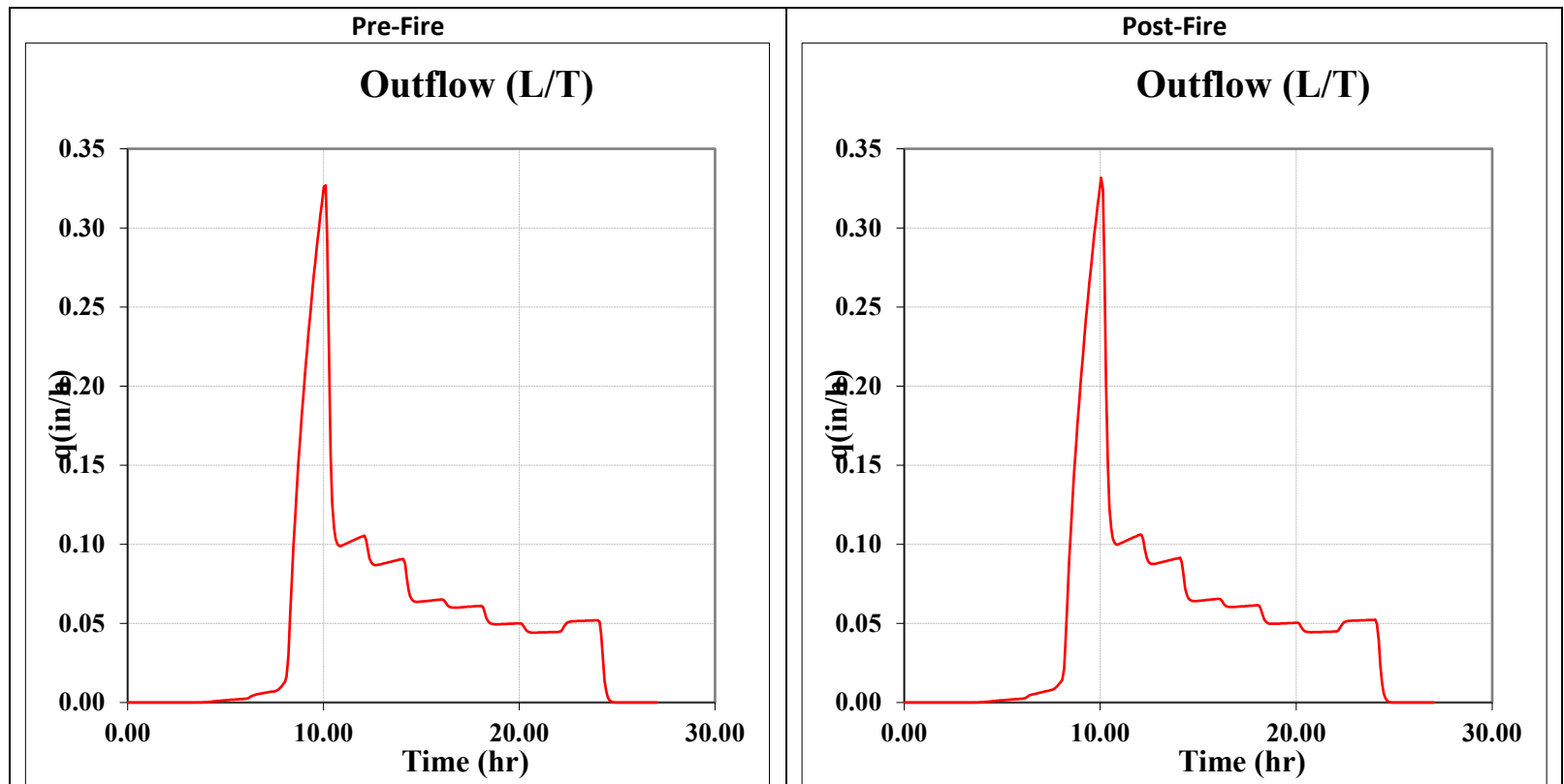
Appendix B: Pour Point Streamflow Modeling Results and Methods

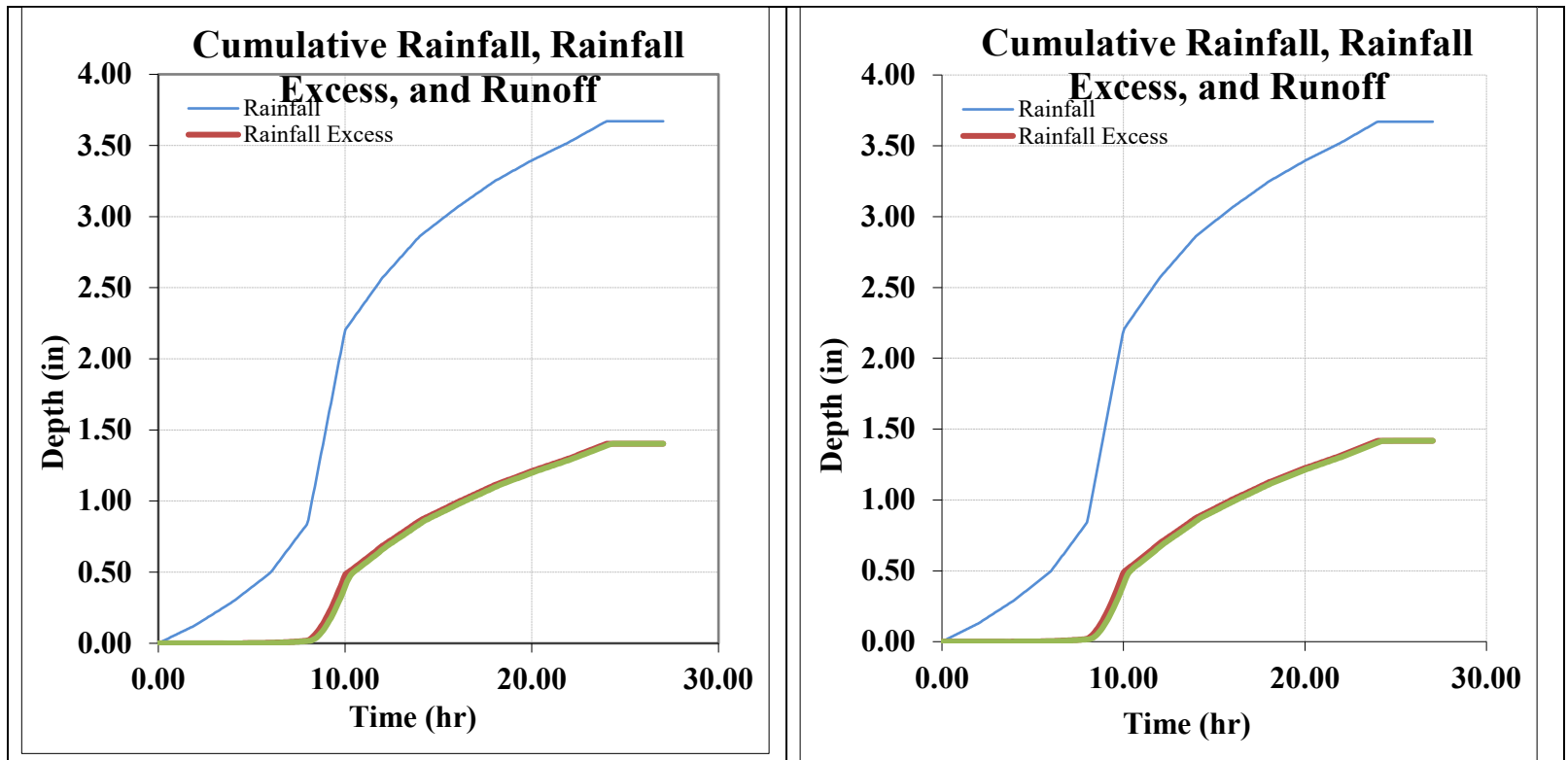
Table 1: SBS Percentage by PourShed

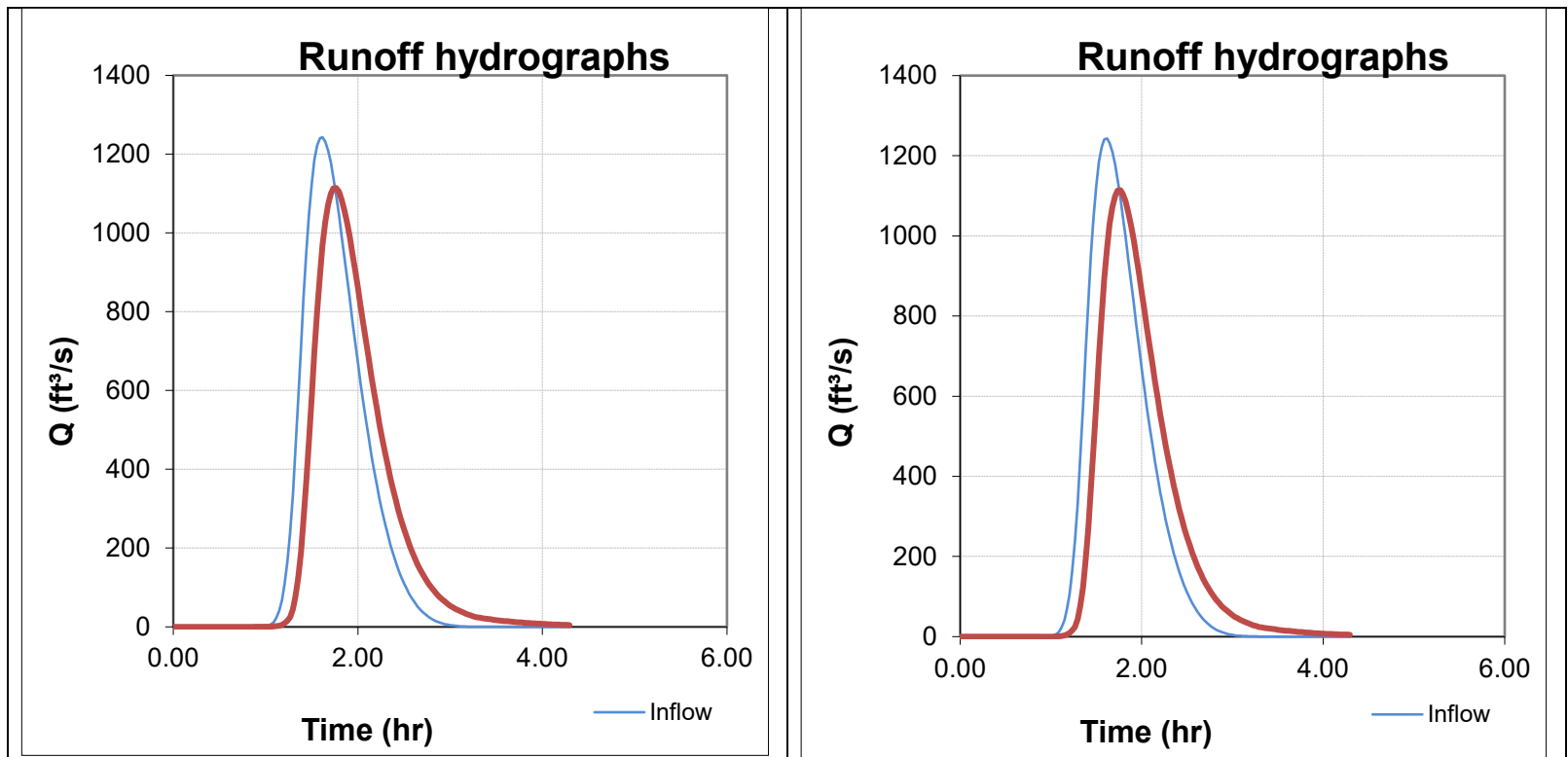
	Outside Burn	Very Low/Unburned	Low	Moderate	High
Tiger Creek	87.94%	5.49%	6.16%	0.28%	0.13%
Low Creek	95.40%	0.58%	3.66%	0.33%	0.03%

Table 2: Tiger Creek Wildcat5 Results

Tiger Creek







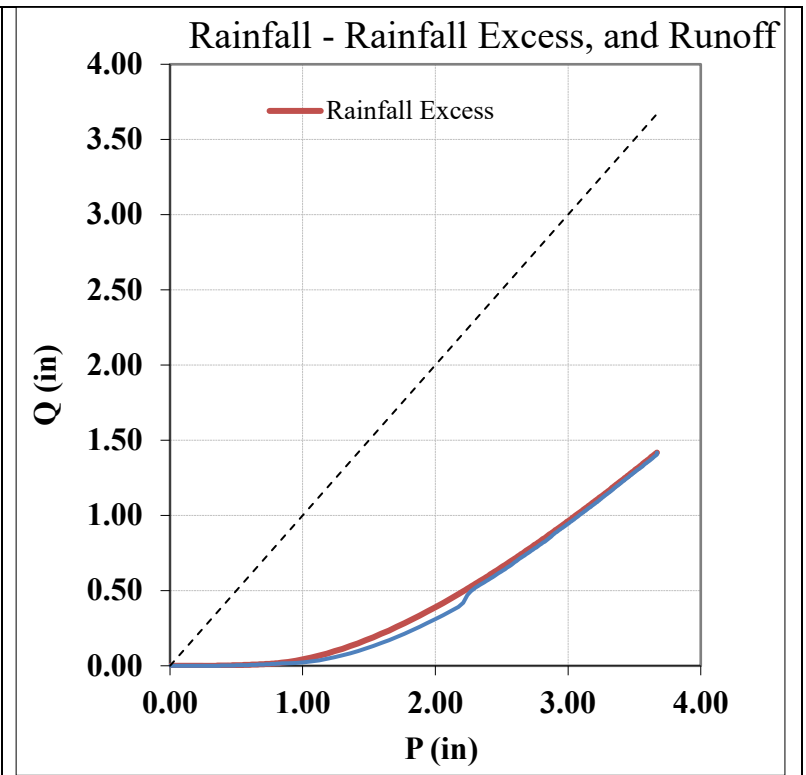
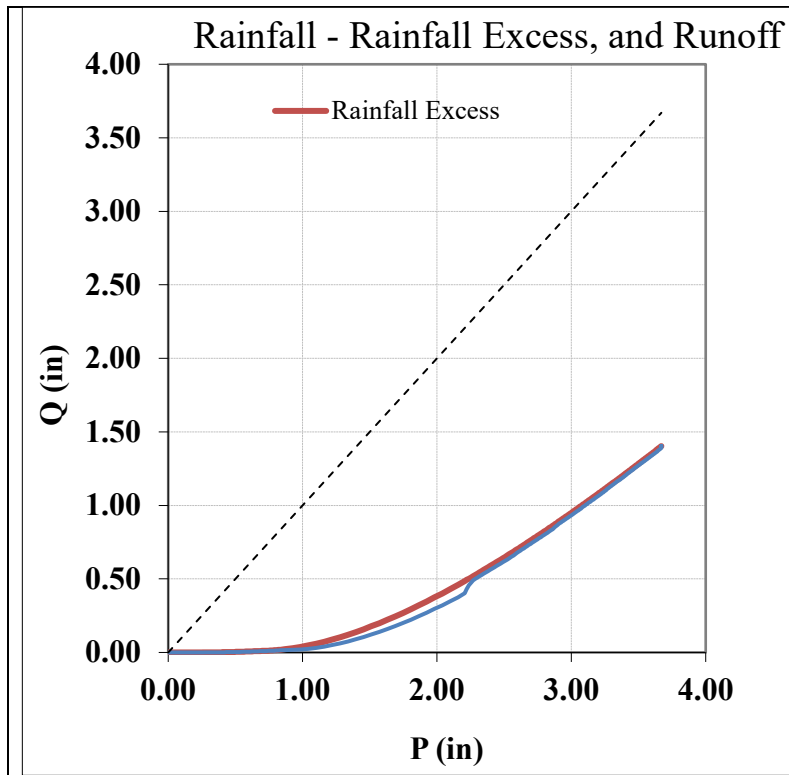
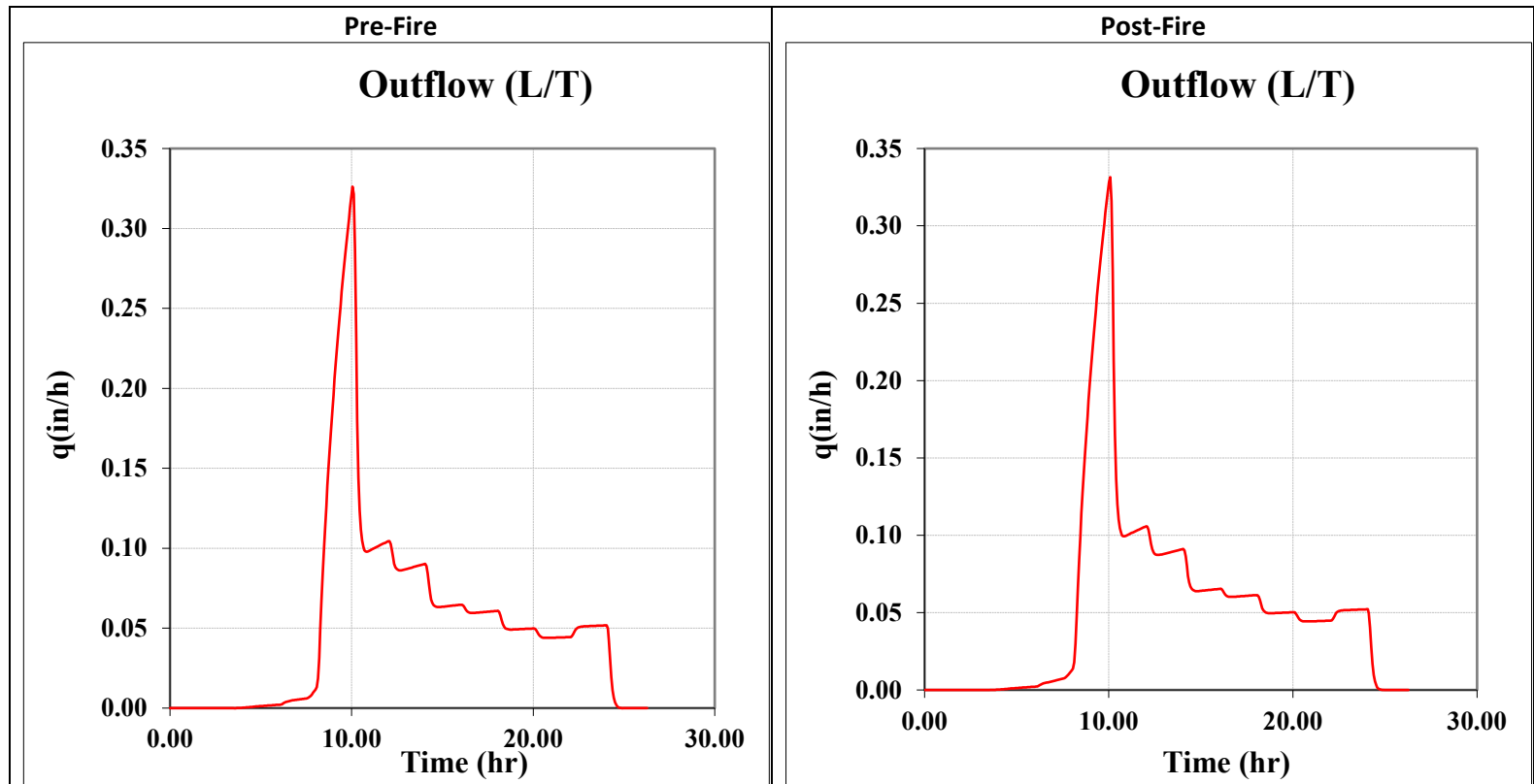
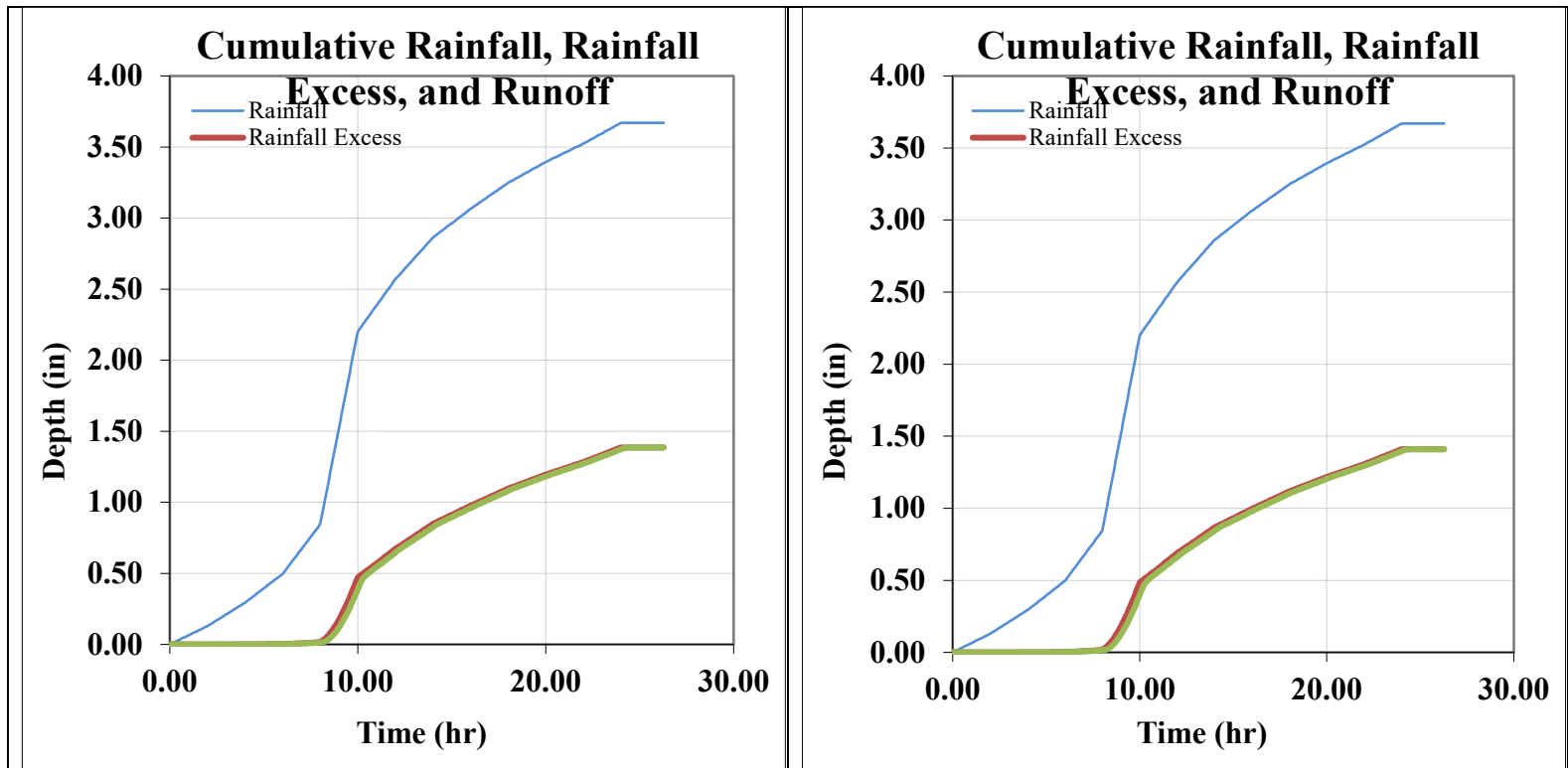
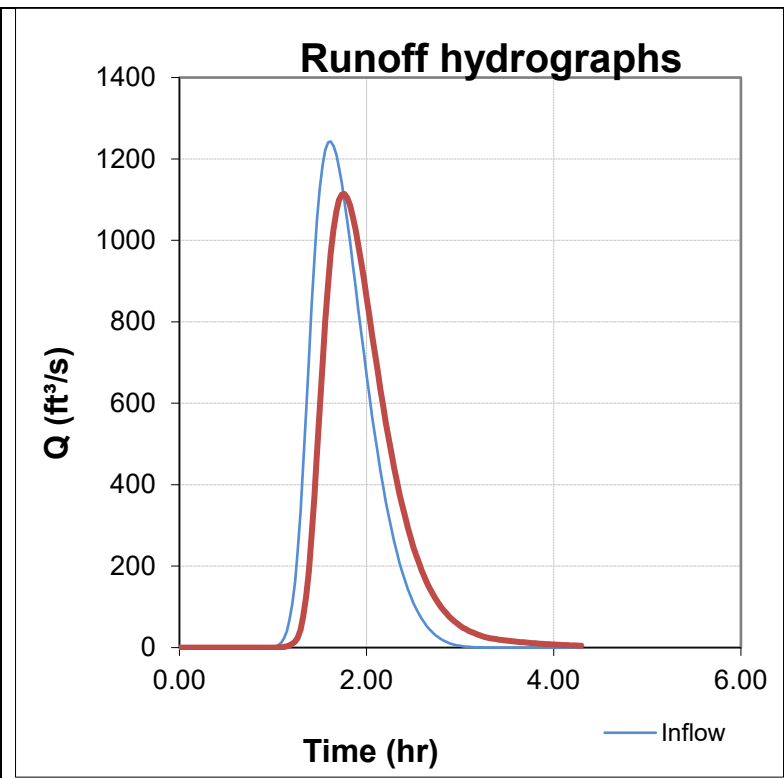
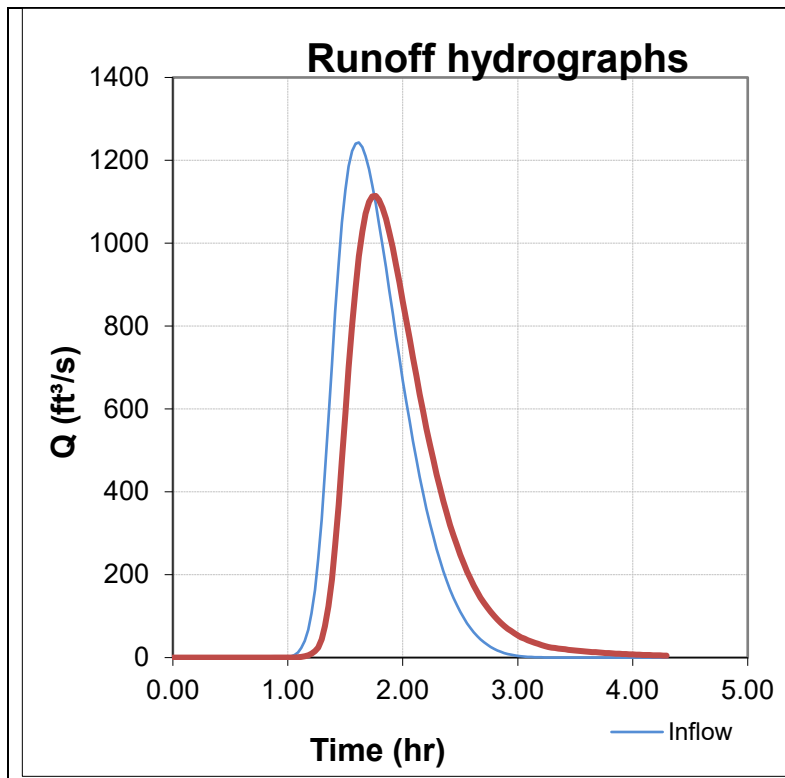


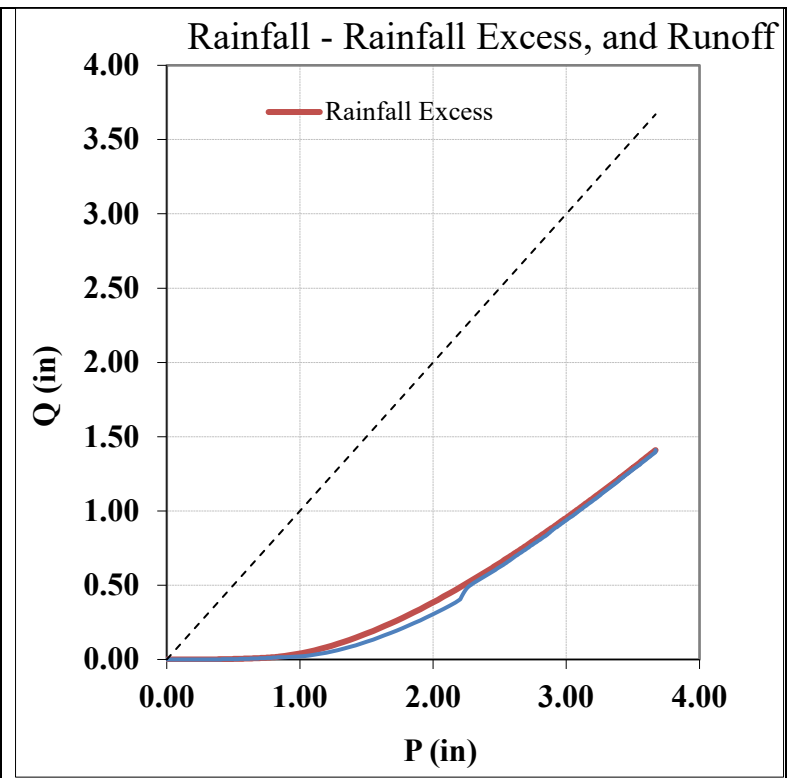
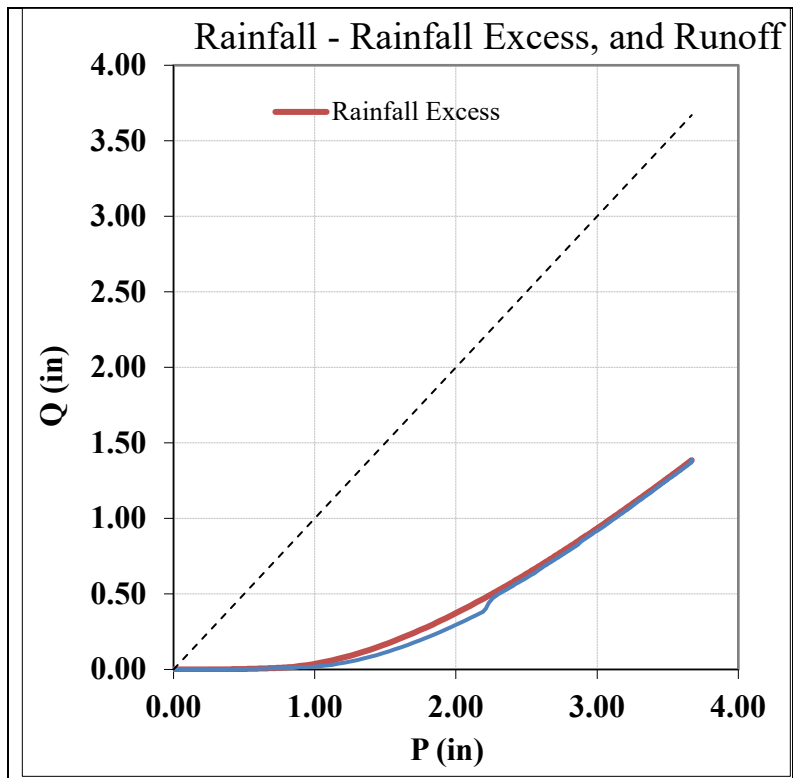
Table 3: Low Creek Wildcat5 Results

Low Creek



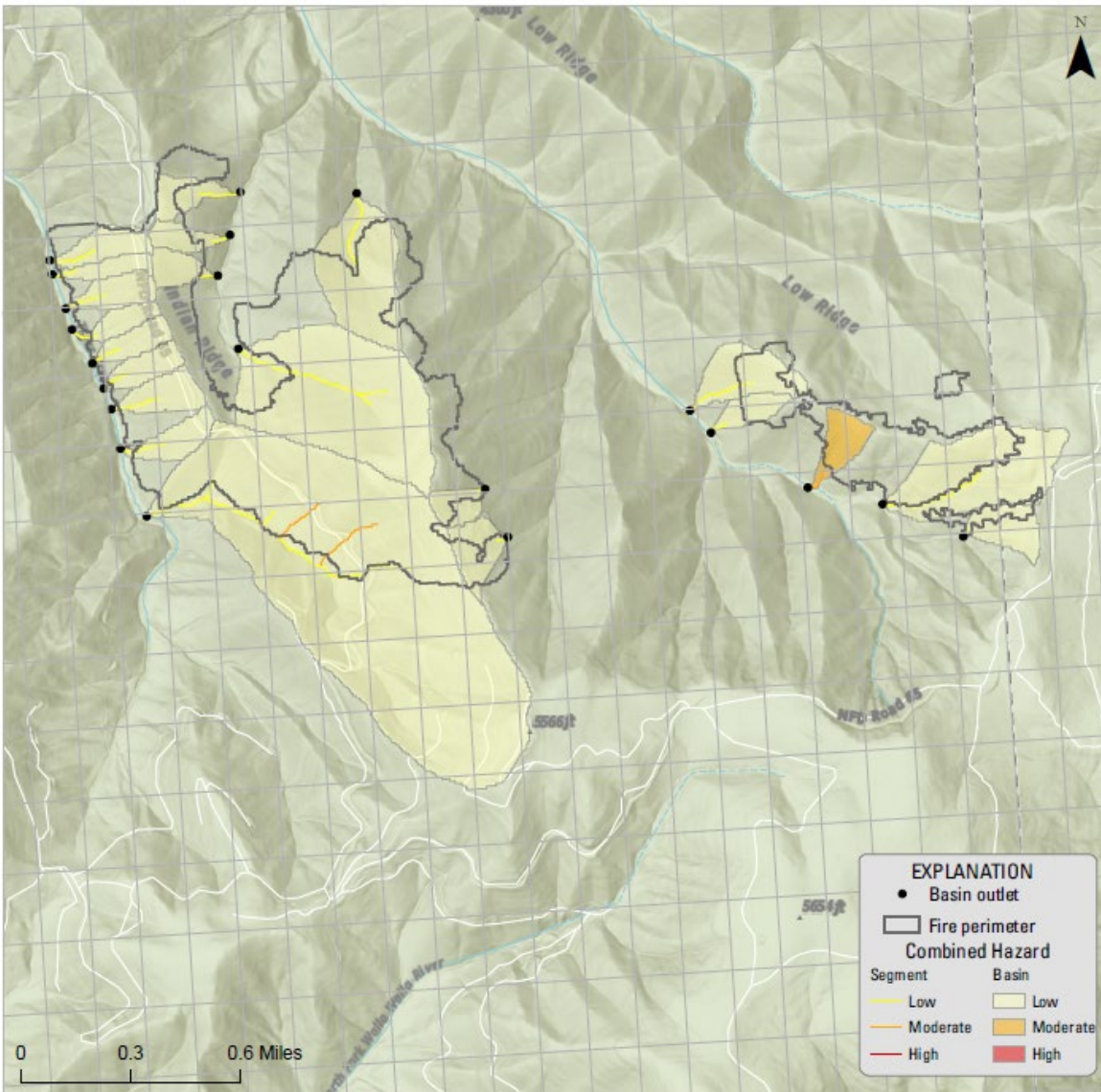






Appendix C: USGS Debris Flow Combined Hazard Map and Soil Erosion Hazard Map

Tiger Creek Fire, Umatilla National Forest, Oregon
Combined Hazard
Design storm: Peak 15-minute rainfall intensity 24 mm/h



Disclaimer - Limitations of Hazard Assessment

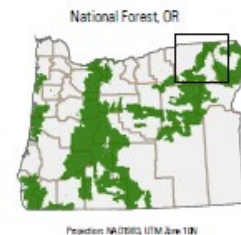
Hazard assessments use a design rainstorm with a given peak 15-minute rainfall intensity to predict the probability, volume, and combined relative hazard of debris flows in basins formed by the fire. Differences in model predictions and actual debris-flow occurrence will arise with differences in actual storm duration and intensity. The occurrence of higher rainfall intensities or longer storm durations may increase the probability or volume of potential debris flows.

The models were developed, calibrated, and tested using data from the western United States. The models have not yet been tested in burn areas in the eastern United States, western Oregon, or Washington (west of the Cascade Range). Currently, efforts are being made to validate model predictions in the eastern United States, western Oregon, and Washington.

In addition, the hazard assessment relies upon readily available geospatial data; the accuracy and precision of which may influence the estimated likelihood and magnitude of post-fire debris flows. However, local conditions (such as debris supply) certainly influence both the probability and volume of debris flows. Unfortunately, locally specific data are not presently available at the spatial scale of the post-fire debris-flow hazard assessment. As such, local conditions that are not controlled by the model may serve to dramatically increase or decrease the probability and/or volume of a debris flow at a basin outlet. The input geospatial data are also subject to error based upon mapping resolution, elevation interpolation technique, and mapping and/or classification methods. If any, this assessment is specific to debris-flow hazard hazards from flash-flooding are not described in this study and may be significant.

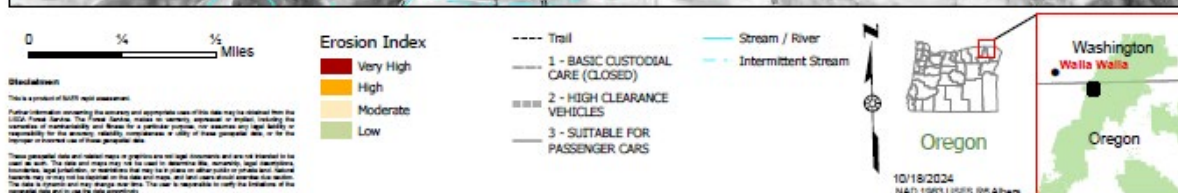
This assessment also characterizes potential debris-flow hazards at a static point in time in medially fullowing wildfire. Studies of post-fire debris flow in the western United States have indicated that debris-flow activity in recently burned areas typically occurs within 2 yr of wildfire. As vegetation cover and soil properties return to pre-fire conditions, the threat of debris-flow activity decreases with time elapsed since wildfire. Conversely, the hazards from flash-flooding may persist for several years after the wildfire.

Finally, this work is preliminary and is subject to revision. It is being provided due to the need for timely "best science" information. The assessment is provided on the condition that neither the U.S. Geological Survey nor the United States Government may be held liable for any damages resulting from the authorized or unauthorized use of the assessment.

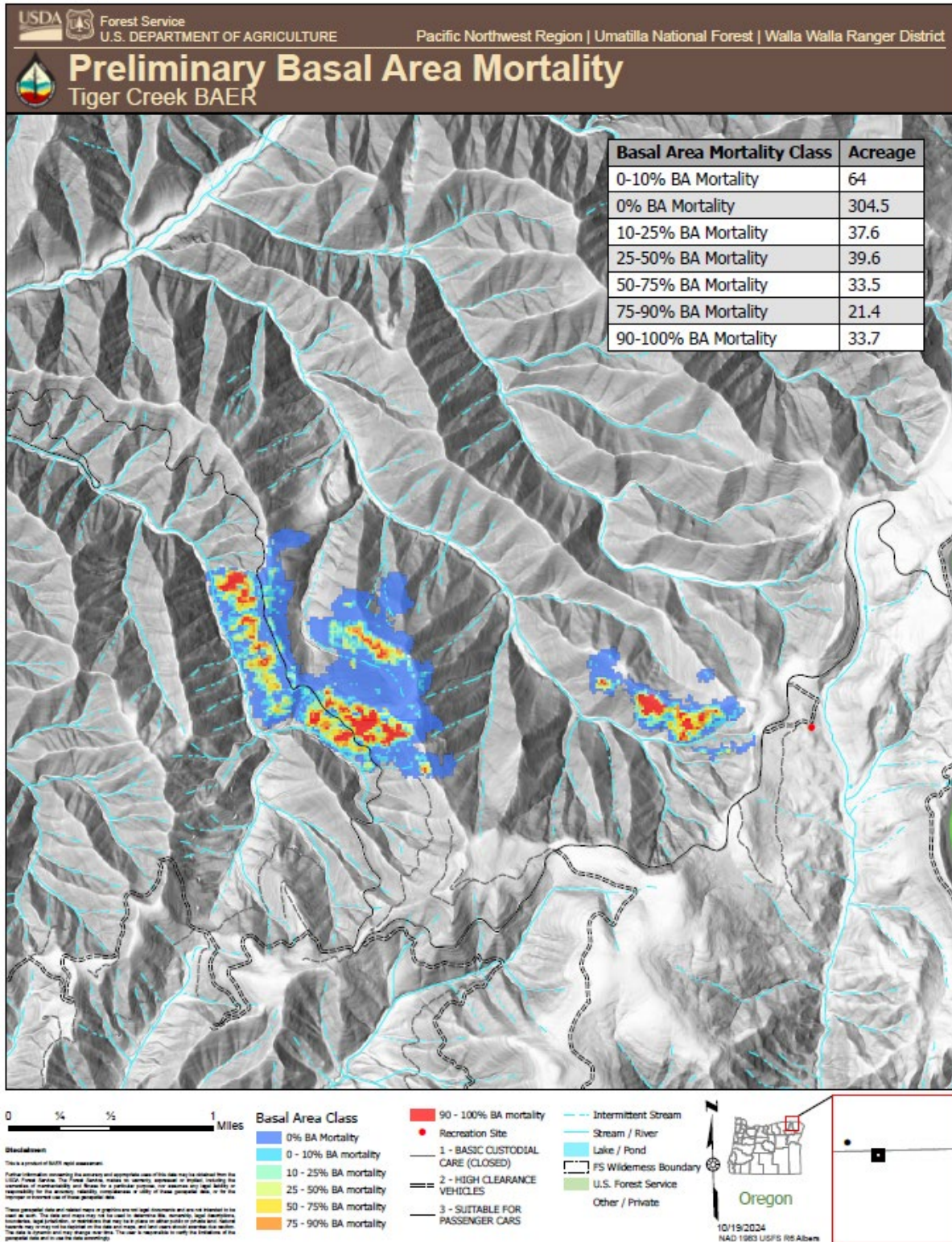


Erosion Risk	Acreage
Low	160.4
Moderate	327.3
High	23.1
Very High	4.6

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Low	160.4
Moderate	327.3
High	23.1
Very High	4.6



Appendix D: Basal Area Mortality Map



Date of Report: 10/27/2024**BURNED-AREA REPORT****PART I - TYPE OF REQUEST****A. Type of Report**

- ☒ 1. Funding request for estimated emergency stabilization funds
☐ 2. No Treatment Recommendation

B. Type of Action

- ☒ 1. Initial Request (Best estimate of funds needed to complete eligible stabilization measures)
☐ 2. Interim Request #_____
☐ Updating the initial funding request based on more accurate site data or design analysis

PART II - BURNED-AREA DESCRIPTION**A. Fire Name:** Tiger Creek Fire**B. Fire Number:** OR-UMA-000830**C. State:** Oregon**D. County:** Umatilla**E. Region:** R6**F. Forest:** Umatilla NF**G. District:** Walla Walla**H. Fire Incident Job Code:** P6R9AR**I. Date Fire Started:** Wildfire started 10/01/2024**J. Date Fire Contained:** 11/1/2024 estimated**K. Suppression Cost:** \$8,200,000**L. Fire Suppression Damages Repaired with Suppression Funds (estimates):**

1. Fireline repaired (miles):
2. Other (identify):

M. Watershed Numbers:*Table 1: Acres Burned by Watershed*

HUC #	Watershed Name	Total Acres	Acres Burned	% of Watershed Burned
170701020202	Middle Mill Creek	20,091	221	1.1%
170701020201	Upper Mill Creek	20,800	312	1.5%
170701020101	Upper South Fork Walla Walla River	17,569	0.2	0%

N. Total Acres Burned:*Table 2: Total Acres Burned by Ownership*

OWNERSHIP	ACRES
NFS	492
STATE/COUNTY	39
TOTAL	531

O. Vegetation Types: Moist upland forests, dry upland forests, cold upland forests, shrublands and grasslands comprise most of the vegetation groups within the burned area. Elevations range from 3,200

feet at the bottom of Tiger Creek, to 5,200 feet near the summit of Low Ridge. Bluebunch wheatgrass-dominated grasslands cover lower to mid-slopes of the western aspects, with ponderosa pine and Douglas fir stingers interspersed in the steep grasslands. Shrub components include Rocky Mountain maple, ninebark, and snowberry. Most of the burn occurred in moist forest, with grand or white fir and Douglas fir in the overstory, and queen's cup beadlily or twinflower in the understory. At higher elevations the forest type transitions to cold forest, with subalpine fir and Engelmann spruce dominating the overstory, and queen's cup beadlily the understory. Idaho fescue and Sandberg's bluegrass-dominated grasslands occur along open ridgetops, interspersed with shrublands of mountain sage.

P. Dominant Soils: There is a geomorphic and aspect driven mosaic of soils in the area ranging in depth from roughly 18cm to over 200cm, with a range of volcanic ash influence. Andisols generally have a thicker ash cap over a more skeletal, older subsoil (ashy or ashy-skeletal over loamy-skeletal particle size class) and are dominated by mixed conifer vegetation. These soils trend deeper, are known for their excellent water holding capacity afforded by the ash influence and are covered with O horizons. Other soils, to a lesser extent, are ash limited, bunch grass dominated loamy-skeletal lithic xerolls (with and without argillic horizons). There are also many intermediary type soils like loamy-skeletal vitrandic argixerolls. The area is very steep overall with lots of surface rock and rock outcrop.

Q. Geologic Types: Soils of the area are derived from residuum and colluvium of the Columbia River basalts and other extrusive volcanics with various amounts of loess and volcanic ash from the Mount Mazama eruption (~8,000 yrs. b.p.).

R. Miles of Stream Channels by Order or Class:

Soil Burn Severity by NHD Flowline F-Code

F-Code	Very Low / Unburned (mi)	Low (mi)	Moderate (mi)	High (mi)	Grand Total (mi)
46003	1.70	0.59	0.04	0.02	2.35
46006	1.39	0.27			1.66

S. Transportation System:

Trails: *National Forest:* 1.4 miles

Roads: *National Forest:* 1.22 miles

PART III - WATERSHED CONDITION

A. Burn Severity (acres):

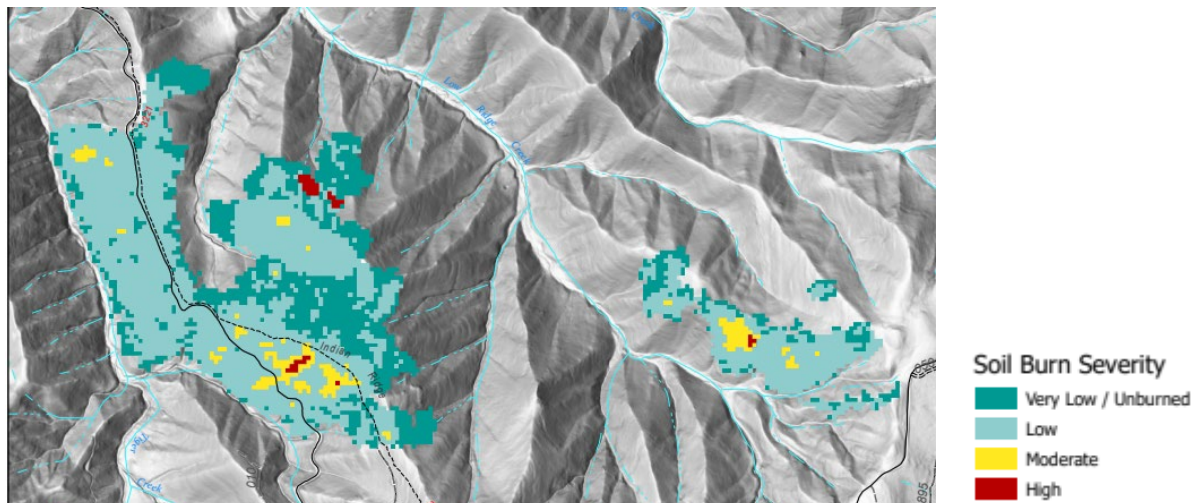
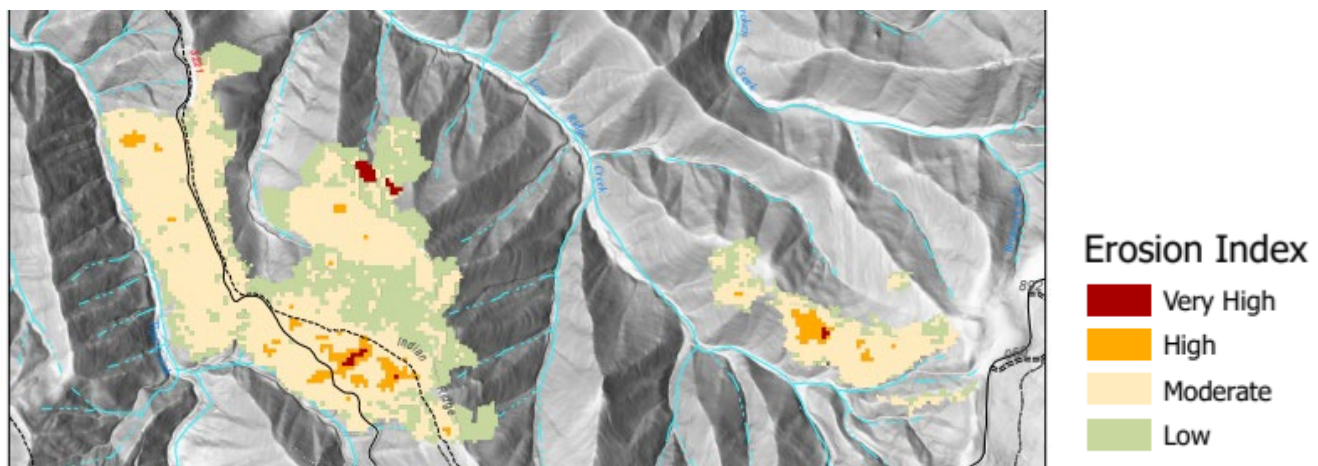


Table 3: Burn Severity Acres by Ownership

Soil Burn Severity	NFS	State/County	Total	% within the Fire Perimeter
Unburned	157	15	172	32%
Low	312	20	332	63%
Moderate	18	4	22	4%
High	5	0	5	1%
Total	492	39	531	

- B. Water-Repellent Soil (acres):** Soil hydrophobicity was tested at a selection of data points using a water drop method. While low to moderate hydrophobicity was observed in some areas, occurrence rates were low and only in higher soil burn severity. Due to the low number of areas with high SBS, fire related hydrophobicity is estimated to affect less than 1 acres of the NFS fire affected lands.
- C. Soil Erosion Hazard Rating:** A soil erosion index (SEI) was used to determine relative erosion hazard risk in the burned area (see inset of map and map in files). The SEI is based on slope and soil burn severity. Results were 160 acres of slight (low), 327 acres of moderate and 27 acres of severe (high/very high).



- D. Erosion Potential:** Little change in soil loss is expected from baseline in low SBS areas. As soil burn severity increases, erodibility will increase as well with less effective ground cover and at the very extreme of high SBS, conversion to single grain soil structure in the topsoil. Most of the fire, 95%, is very low / unburned or low SBS. This means that soil structure is intact at the soil surface and roots are present at the soil surface. Vegetative cover is present, or charred grass stubble is also present in the area. Moderate and high SBS, 5% of the area, is surrounded by stable soil at the surface. Most of the burned area is located on the upper backslope, shoulder, or summit of mountains with minimal or limited catchment above to shed or funnel surface flow onto barren surface of mineral soil leading to significant increased soil erosion.
- E. Sediment Potential:**

WEPPCloud - Disturbed modeling for Tiger Creek assessment

Run Name	Proportional Increase			Acres in Analysis
	Sediment Discharge	Channel Soil Loss	Stream Discharge	
Low Ridge Creek	1.05	1.06	1.01	620
Tiger Creek	1.38	1.05	1.08	1200
Left Drainage Low Ridge Creek	1	1	1	280

Of the three drainages affected by Tiger Creek fire, all of them are expected to have similar sediment yield as background or undisturbed areas. The slightest increase is expected for Tiger Creek likely due close moderate

SBS fire disturbance near the RHCA or stream channel. Fire disturbance above Lower Ridge Creek is around the summit and shoulder of mountains, more than a couple hundred feet from the RHCA. Distance and significant amounts of low SBS in the area result in negligible changes of sediment.

F. Estimated Vegetative Recovery Period (years): Grassland habitats should recover in 1-3 years, depending on SBS. Shrubland habitat should recover in 2-5 years, depending on SBS as well as forested habitat with low burn severity. Forested habitat that endured moderate and high burn severity will take more than 5 years to recover.

G. Estimated Hydrologic Response (brief description): The Tiger Creek Fire burned within 2 different 12-digit Hydrologic Unit Code (HUC12) watersheds (Middle Mill Creek and Upper Mill Creek). Post-fire peak flow analysis was conducted for 2 drainage areas (poursheds) to determine estimated changes in response to a storm event. A 5-year 24-hr storm (20% annual exceedance probability) was selected as the design storm to mimic the most likely damaging storm, a late fall or early spring localized long duration storm, within the 3-year recovery window. The intensity of a 5-year return interval storm was derived using local data from an NRCS SNOTEL site at the top of the Mill Creek watershed with a period of record beginning in 2007. Modeling efforts consisted of Wildcat5 runs for the Tiger Creek and Low Creek drainages. Modeling results indicated marginal increases in peak flows for each pouredshed:

- 1.01 times pre-fire peak flow for Tiger Creek
- 1.02 times pre-fire peak flow for Low Creek.

These minute increases in the magnitude of post-fire discharge values indicate that while runoff will increase at some small ephemeral draws and drainages, there is not a significant anticipated change even at the micro-watershed scale and thus significant negative geomorphic changes are not expected. Initial flushes of ash and sediment from burned areas positioned on mid to upper slopes are anticipated to be small and mostly buffered by intact riparian vegetation while vegetative recovery of burned areas occurs. The USGS Post-fire Debris Flow Hazard Model estimates a moderate to low risk for elevated debris flow hazard throughout most of the fire. Elevated likelihood is present in small areas of very steep drainages in between the 65 road and ridge delineating the Mill Creek Municipal Watershed, though combined hazard analysis ranks these areas low.

PART V - SUMMARY OF ANALYSIS

Introduction/Background

Tiger Creek fire started as a 335 acre controlled burn on 09/30/2024. During operations local weather shifted causing winds to push fire beyond the planned perimeter into other areas of future planned treatments. On 10/01/2024 the fire exceeded predetermined fire boundaries and was then classified as a wildland fire. The fire perimeter includes portions of Mill Creek Municipal Watershed for the city of Walla Walla, WA. Teams worked with cooling weather and increased humidity to maintain the current fire perimeter. The fire is expected to be contained on 11/01/2024.

A. Describe Critical Values/Resources and Threats (narrative):

Table 4: Critical Value Matrix

Probability of Damage or Loss	Magnitude of Consequences		
	Major	Moderate	Minor
	RISK		
Very Likely	Very High	Very High	Low
Likely	Very High	High	Low
Possible	High	Intermediate	Low
Unlikely	Intermediate	Low	Very Low

1. Human Life and Safety (HLS): a.

- a. National Forest 65 road within the burn perimeter is located along the mountain backslope and shoulder. Damage to the road by runoff, falling trees, or rock fall is limited to one section of FS 65 rd below moderate and high SBS. Tree and rock fall in the steep sloped area has occurred and is expected to continue with the high number of standind dead trees. The

probability of negative effects to human life and safety is likely in this area with the magnitude of consequences major. **BAER treatment recommendation is for S1a. Road Hazard Signs**

- b. Indian Ridge trail traverses the fire. Standing dead and scorched trees along trails in low and moderate SBS areas is likely to pose serious threat to users (see inset of BARC map in CV table). The consequences of damage to life and safety is major. Closing trails is difficult and ineffective. Removal or dropping danger trees is costly. **BAER treatment recommendation is for S1b. Trail/Recreation Hazard Sign.**
2. **Property (P):** National Forest 65 Road within the burn perimeter is located along a mountain backslope and shoulder. The probability of damage or loss to the road prism is possible due to falling trees and small isolated areas of debris flow. The magnitude of consequences is minor based ease in removal of additional debris from road. The risk rating is low. **BAER treatments are not recommended.**
- b. Indian Ridge trail traverses the fire. Standing dead and scorched trees along trails in low and moderate SBS areas are likely to fall across the trail prism. Due to the trail position on the landscape, debris flow damage or excessive runoff causing erosion to the trail prism is not expected. The probability of loss or damage to the trail system is possible but the consequences are minor as trees can be cut and removed by trail crew with no anticipation to trail prism damage. The risk rating is low and **BAER treatments are not recommended.**
3. **Natural Resources (NR):** Soil productivity in the post fire environment is threatened by accelerated erosion and in localized areas of high SBS productivity may be impacted by fire induced effects on nutrient cycling and microbes in the soil ecosystem. The probability of damage to soil productivity over the NFS affected area is unlikely given Tiger Creek fire resulted in mostly low SBS (63%) and unburned or very low (32%). In high (1%) and moderate (4%) SBS areas there is very limited effective ground or canopy cover and little to no needle cast potential. Because the fire burned in a mosaic pattern with minimal areas of high SBS and limited areas of contiguous moderate SBS, the resulting effects are anticipated to be minimal, recoverable, and localized. The risk rating is low and **BAER treatments are not recommended.** Natural recovery is expected to maintain the current soil productivity state.
- b. Hydrologic function in the post fire environment is not threatened by increased stream flow during storm events or snowmelt runoff due to limited extent of high and moderate SBS within the fire on NFS lands. Post-fire flows are expected to increase by 1.01 to 1.02 during the first year and return to background levels during the second year from pre-fire flows. Few channels in the fire area experienced localized burning; mostly low SBS. Because these areas are not widespread and the small percentage of moderate to high SBS in the fire is on the mid and upper slopes, away from the stream channels, the probability of damage or loss is rated as "possible". Increased post-fire flows will be minimal and short-term (3 years). Majority of understory burned vegetation is expected to recovery rapidly. Increased potential of down burned and dead trees is likely but due to distance from most drainages is not likely to negatively impact stream channel morphology. Overall impacts will be localized and short term. Higher flows are not expected to impact the channel morphology or result in excess sedimentation or erosion of stream banks; therefore, the magnitude of consequence is minor. The risk rating is low and natural recovery is expected to occur and will quickly reduce accelerated streamflow. **No BAER treatments are recommended to mitigate any impacts due to increased streamflow.**
 - c. Water quality in the post fire environment may be minimally impacted by increased stream temperatures, ash, and small amounts of sediment deposition. The probability of damage or loss is possible because Tiger Creek may experience short term and localized increases of sediment and ash during the first year depending on the severity of rainstorms and/or snowmelt runoff. RHCAs adjacent to Tiger Creek and Lower Ridge Creek may see short-term pulses of ash and sediment contributions even in low SBS streams due to geomorphological processes and lack of vegetative buffer in areas of moderate and high SBS up slope. The magnitude is moderate due to fire perimeter located in Walla Walla municipal watershed. **No BAER treatments recommended due to the short-term effect that will resolve with natural processes.**

- d. Treatments to native plant communities on NFS lands are where invasive species or noxious weeds are absent or present in minor amounts due to soil disturbing fire suppression activities such as dozer lines, handlines, pushouts, and drop points into previously undisturbed areas. The probability of damage or loss to native or naturalized plant communities is very likely because suppression activities caused soil disturbances, removed vegetation, and created a receptive environment for invasive species establishment and spread. The magnitude of consequences is moderate because damage will cause considerable long-term effects to native plant community due to the ability of invasive species to outcompete native plants. The risk is very high. **BAER treatments are recommended for P1b. Invasives EDRR-Suppression Repair.**
- e. On Umatilla NFS lands Bull trout designated critical habitat is in Low Ridge Creek well below the fire perimeter. Mid-Columbia River Steelhead critical habitat is also located in Low Ridge Creek and Tiger Creek. The fire perimeter is along planed RHCA boundaries of Tiger Creek but not within the boundary. Tiger Creek was assessed for planned fire treatment and remains within assessed effects. Short-term pulses of sediment and ash are expected in both streams. However, based on the amount of unburned and low SBS above Lower Ridge Creek, effects will be localized and rapid recovery of grasses and shrubs in the first-year post-fire should provide decrease even more possible sediment into the stream channel. Due to the mosaic of SBS and distance from Lower Ridge Creek fire effects are not enough to cause a measurable change to bull trout or MCR steelhead habitat. **BAER treatments are not recommended for bull trout or MCR steelhead habitat.**

4. **Cultural and Heritage Resources:** There are no National Register of Historic Places listed resources within Tiger Creek Fire footprint. There are no historic properties of religious and cultural significance identified within Tiger Creek Fire footprint (Hunn et al. 2015). Post-fire threats to eligible for listing NRHP heritage resources exist from accelerate erosion, increased cattle activity, and exposure to looting/vandalism. The probability of damage or loss is possible given most of the fire area is unburned/very low or low SBS (95%). There is high needle cast potential in areas of low SBS, which can provide cover. The magnitude of consequences is minor given minimal or localized effects are predicted in vast majority of the fire due to low SBS (63%). Where sites are in high and moderate SBS (5% of fire area) there may be moderate erosion potential. There are no known NRHP eligible historic resources within the high or moderate SBS areas within Tiger Creek Fire footprint. The risk is low. BAER treatments are not recommended. However, as part of the FS Section 110 obligations, these sites will be monitored (i.e., site visits) to record site conditions. The recommended monitoring schedule would be 1 year and 3 years post-fire.

B. Emergency Treatment Objectives:

Proposed Land Treatments

Land treatment objectives:

1. Promote and protect native and naturalized vegetative recovery by reducing the spread of noxious weeds (**P1b**).
2. Note – No active land treatments are recommended for long-term soil productivity. Allowing for natural recovery is recommended.

Proposed Road and Trail Treatments

Road and trail objectives:

1. Note – No active road or trail treatments recommended for long-term stability because the road and trail are located towards the top of the mountain with limited upslope damage and input to erosive forces.

Proposed Protection/Safety Treatments

Protection/Safety objectives:

1. Protect human life and safety by raising awareness of potential dangers by posting hazard warning signs at road and trail access to the fire perimeter (**S1a and S1b**).

C. Probability of Completing Treatment Prior to Damaging Storm or Event:

Land: 75%

Channel: NA
 Roads/Trails: NA
 Protection/Safety: NA

D. Probability of Treatment Success

Table 5: Probability of Treatment Success

	1 year after treatment	3 years after treatment	5 years after treatment
Land	70%	75%	75%
Channel	NA	NA	NA
Roads/Trails	NA	NA	NA
Protection/Safety	85	95	95

E. Cost of No-Action (Including Loss): \$204,000, not including threat to human life and safety.

F. Cost of Selected Alternative (Including Loss): \$159,000, Not including threat to human life and safety.

G. Skills Represented on Burned-Area Survey Team:

☒ Soils ☒ Hydrology ☐ Engineering ☒ GIS ☒ Archaeology
☒ Weeds ☒ Recreation ☒ Fisheries ☒ Wildlife
☐ Other:

Team Leader: Brien Park

Email: brien.park@usda.gov

Phone(s) 541-969-3342

Forest BAER Coordinator: Brien Park

Email: brien.park@usda.gov

Phone(s): 541-969-3342

Team Members: Table 6: BAER Team Members by Skill

Skill	Team Member Name
Team Lead	Brien Park
Soils	Brien Park
Hydrology	Rory Corrigan
Engineering/Roads	John Manderscheid
GIS	Matthew Gondek
Archaeology	William Marquardt
Weeds/Botany	Kayla Saager
Recreation	Andrew Steel
Other	

H. Treatment Narrative:

The following narratives summarize the response actions recommended to decrease risks to BAER Critical Values. It is important to note that these treatments are not designed to eliminate risk. They are designed to reduce risk to an acceptable level, FSM 2523.1 - Exhibit 02. Detailed specifications, cost estimates, and maps identifying the spatial location of treatments are in the BAER Assessment project record. Documents can be obtained by contacting the Forest BAER Coordinator.

All treatment costs were conservatively estimated based on the assumptions that local unit Agency personnel would require overtime to complete implementation prior to damaging events and/or contract crews would be implementing the authorized treatments. If personnel from the local unit are identified for implementation, current BAER salary and expense guidance regarding the use of NFSE funds a BAER H-codes would be

adhered to (base time would be charged to NFSE). Project budgets represent a best estimate of the BAER assessment team and may be adjusted with interim funding authorization requests to reflect current market values at the time of contracting and implementation.

Land Treatments:

P1b- Invasives EDRR Suppression

EDRR for dozer lines (15-foot buffer), staging areas, drop points, and other ground disturbed areas caused by fire suppression activities is also proposed. The likelihood of off-forest personnel and equipment working on suppression activities carrying seed or spreading invasive seeds into new areas is very high. Early detection and treatment will help prevent new invasive species from establishing in newly disturbed areas.

Treatment	Units	# of Units	Unit Cost	Total Cost
P1b Invasives EDRR-Suppression	Acres	88	\$186	\$16,368

Channel Treatments: None Proposed

Roads and Trail Treatments: None Proposed

Protection/Safety Treatments:

S1a – Road Hazard Signs

Only 1 segment of NFS 65 RD is below high and moderate SBS. This section is very steep above and below the road prism. The lack of understory vegetation even in the small catchment area is likely to cause rock fall and some sedimentation on the road. The number of dead standing trees in this area is likely to resulting in tree fall onto the road prism. These effects will put road users in danger. Placement of road hazard signs informs users of fire dangers within the segment of road allowing them to make informed decisions prior to traveling the road segment.

S1b. Trail/Recreation Hazard Signs

Indian Ridge trail passes through low and moderate SBS with a high number of dead standing trees. This is a high use trail. Placement of hazard signs informs users of dangers in fire affected areas and allows them to make informed decisions prior to hiking the trail.

Treatment	Units	# of Units	Unit Cost	Total Cost
S1a- Road Hazard Signs	Sign	2	\$576	\$1,152
S1b- Trail/Recreation Hazard Signs	Sign	2	\$340	\$680

I. Monitoring Narrative: EDRR treatments will be monitored during follow up early detection surveys to ensure new weed infestation expansion is minimized as part of normal work. No funded monitoring is proposed with this BAER assessment.

PART VI – EMERGENCY STABILIZATION TREATMENTS AND SOURCE OF FUNDS

Line Items	Units	Unit Cost	NFS land # of Units	BAER \$	Other \$
A. Land Treatments					
P1b-Invasives EDRR Supp	Acre	186	88	\$16,368	\$0
	Acre			\$0	\$0
<i>Insert new items above this line!</i>				\$0	\$0
<i>Subtotal Land Treatments</i>				<i>\$16,368</i>	<i>\$0</i>
B. Channel Treatments					
NA				\$0	\$0
<i>Insert new items above this line!</i>				\$0	\$0
<i>Subtotal Channel Treatments</i>				<i>\$0</i>	<i>\$0</i>
C. Road and Trails					
NA	Mile			\$0	\$0
<i>Insert new items above this line!</i>				\$0	\$0
<i>Subtotal Road and Trails</i>				<i>\$0</i>	<i>\$0</i>
D. Protection/Safety					
S1a-Road Hazard Sign	Sign	576	2	\$1,152	\$0
S1b-Trail/Rec Hazard Sign	Sign	340	2	\$680	\$0
<i>Insert new items above this line!</i>				\$0	\$0
<i>Subtotal Protection/Safety</i>				<i>\$1,832</i>	<i>\$0</i>
E. BAER Evaluation					
Initial Assessment	Report			\$11,285	\$0
<i>Insert new items above this line!</i>				---	\$0
<i>Subtotal Evaluation</i>				<i>\$11,285</i>	<i>\$0</i>
F. Monitoring					
NA				\$0	\$0
<i>Insert new items above this line!</i>				\$0	\$0
<i>Subtotal Monitoring</i>				<i>\$0</i>	<i>\$0</i>
G. Totals					
Previously approved					
Total for this request				\$18,200	\$0

PART VII - APPROVALS

1. _____
 Deputy Forest Supervisor Date