Mt. Hood National Forest
Burned Area Emergency Response Summary – Riverside Fire
November 5, 2020

On September 8, 2020 firefighters responded to the human-caused Riverside Fire on the Mt. Hood National Forest (Mt. Hood NF) when it was first reported near Ripplebrook. Driven by high winds, crews reported extreme fire growth including torching, running, and spotting fire behavior as it moved 17 miles west along the Clackamas River drainage over the course of the day. Erratic east winds and low humidity continued to drive the fire down the Clackamas River corridor and surrounding private lands. Fire crews reported the largest growth to the east and southeast of the fire causing a 10,000-foot smoke plumes from the Riverside and Beachie Creek Fires to merge. Heavy smoke prevented pilots from conducting air operations for several days until a weather system changed conditions on September 18. The fire burned a mosaic pattern of mixed conifer stands encompassing 138,126 acres of mixed ownership with 62% occurring on the Mt. Hood NF.

The Forest Service assembled a Burned Area Emergency Response (BAER) team on September 28, 2020. This team of experts in soils, geology, hydrology, engineering, botany, recreation, archaeology, fisheries, and GIS began assessing the post-fire effects to critical values on Forest Service lands. The team developed a Soil Burn Severity (SBS) map to document the degree to which soil properties had changed within the burned area. Fire damaged soils have low strength, high root mortality, and increased rates of water runoff and erosion. Using the SBS map, BAER team members ran models to estimate changes in stream flows (hydrology) and debris flow
(geology) potential. The models compared pre-fire conditions to predicted post-fire conditions to determine relative changes, which are then used to determine the relative risk to different critical values and recommendations to address those things determined to be an emergency. Below is a summary of the findings of each resource area.

SOILS and EROSION
Approximately 72,051 acres had moderate (40%) and high (12.3%) soil burn severity within Riverside Fire. The majority (66%) of these acres occur on the Mt. Hood N.F. Moderately burned soils lost up to 80% of the pre-fire ground cover but retained fine roots and soil structure. While high soil burn severity was characterized by almost complete organic ground cover consumption with charred roots below the soil’s surface and a loss of soil structure. Field observations, however, found native vegetation sprouting in these areas. This and the presence of unburned root structures observed in the field suggests the native seed bank found within the soil profile may not be totally lost and has a good chance of recovery with the right timing and amount of precipitation.

In most cases, moderate and high severity burn areas are located on convex to concave drainages and have a higher likelihood of moderate to substantial sediment movement during higher precipitation events. A three-day rain event of 4 inches occurred in late September prior to the BAER team’s arrival. Slight rill erosion was observed in high and moderate burn severity areas. However, no major erosion occurred and organic ash on the soil’s surface was intact suggesting water infiltrated the soil profile. Larger rainfall and rain-on-snow events are more likely to increase erosion and runoff as soils saturate.

Hillslope treatments to increase ground cover and reduce erosion in the first year were evaluated by the BAER team. These treatments were not pursued because many slopes are above 45% where straw/wood mulch and seeding are less effective at reducing erosion. Studies have also shown that at least 60% ground cover is needed to
measurably reduce soil erosion and it was not economically feasible to treat enough of the moderate and high severity acres to justify this treatment.

**GEOLOGY and DEBRIS FLOW RISK**

The burned area lies entirely within the Western Cascades Physiographic Province, characterized by older volcanic rocks, generally steep slopes, and large ancient landslide deposits (Peck, et al., 1964). There are four bedrock units that underlie the fire perimeter. The oldest and lowest in position are the Little Butte Volcanic Series located in the upper reaches of the Clackamas River, at the confluence of the Clackamas and Collawash Rivers. The entire valley bottom is situated on large scale earthflows that produce generally subdued topography as compared to the lower portion of the watershed. Geologic and climatic conditions within the Riverside Fire tend to produce geohazards that range from small isolated rockfalls to large scale earthflows that move entire mountains. Many significant pre-fire mass wasting has occurred within the fire perimeter throughout recorded history.

**Earthflows** - Increases in soil moisture due to a decrease of evapotranspiration from a loss of vegetation is likely to accelerate earthflows in the Upper Clackamas watershed, but this is anticipated to be minor over the course of a few years as vegetative cover increases. Streams traversing earthflows may erode earthflow deposits leading to increased sedimentation, which could negatively impact transportation infrastructure (roads, ditches, culverts). An increase in sedimentation would also have the potential to affect water quality and subsequently, municipal water supplies downstream.

**Rockfall and Debris Slides** - As observed after the 2014 36 Pit Fire, loss of vegetation is likely to destabilize talus slopes on benches as well on alluvial fans built at the base of the river. The increase in rockfall should be anticipated along the both sides of the Clackamas River from the Forest boundary on Highway 224 near the North Fork Reservoir to the bridge over the Clackamas River near Three Lynx Creek. This should also be expected for the South Fork Clackamas River and Memaloose Creek.

**Landslides and Debris Flows** - The USGS debris flow modelling indicate 18% of stream segments are at high risk and 38% are at moderate risk for debris flows. Subwatersheds with the greatest
risks for increased mass wasting include Fish Creek, Lower Eagle Creek, and the Lower North Fork Molalla River. The Fish Creek drainage may experience small translational landslides in headwaters streams on both sides of Fish Creek Mountain. Drainages in this area have high probability of developing debris flows capable of travelling to the mainstem of Fish Creek and pose a significant risk to existing infrastructure.

HYDROLOGY and RUNOFF

Hydrologic response may include reduced interception and infiltration of precipitation, increased runoff, higher stream flow volumes, and a more rapid rise of stream and river levels in areas with greater portions of moderate and high severity burn areas. The Water Erosion Prediction Project (WEPP) Post-Fire Erosion Predictor (PEP) model was run to evaluate the risks of upland erosion, sediment delivery and flood flows from watersheds. Thirty-seven pour points were modeled using WEPP-PEP for pre-fire and post-fire scenarios at road/stream crossings and watersheds less than 25,000 acres in size below large areas of moderate and high severity burn areas. Watersheds more than 25,000 acres were evaluated by calculating pre-fire Q5 peak flows using USGS regression equations (Cooper, 2005) in StreamStats.

Model results indicate that post-fire Q5 (five-year peak flow) in smaller watersheds may increase by 1 - 8 times their pre-fire levels, depending on basin size, burn severity, and other factors. Results in larger watersheds indicate that there is a risk of higher peak flows at all three modeled sites. However, increases on the largest poursheds (e.g. two Clackamas River sites) are moderated by largely unburned areas in the headwaters of those large basins, such as the Collawash and Oak Grove Fork of the Clackamas River.

WATER QUALITY

An initial flush of ash and fine sediment is likely during initial rainstorms that may impair water quality. Suspended sediment loading and turbidity levels in streams within and below the burned area will likely be elevated in response to rainfall and snowmelt in subsequent years, until groundcover becomes re-established. Even after groundcover stabilizes hillslopes in the burned area, eroded fine sediment that is
deposited in draws, stream and river channels, and floodplains in the next few years will continue to move through the system for many years to come. Additionally, nutrients will be elevated in concert with higher turbidity and suspended load. Changes in water quality may impact municipal water within and downstream of the burned area, as well as aquatic resources and habitat (Callery and Krezlok, 2020). Increased inputs of nitrates and phosphorous to North Fork reservoir could increase algal growth, which might increase levels of turbidity and biotoxins and decrease the effectiveness of water treatment.

**FISHERIES**

Federal ESA-listed Upper Willamette River Chinook, Lower Columbia River (LCR) Coho, and LCR Steelhead occur within the Riverside Fire. Of significance is the Clackamas River Coho salmon population that is one of the last wild late-run Coho stock remaining in the Columbia River basin (Nehlsen et al., 1991). Anadromous fish are also considered an “Outstandingly Remarkable Value” as described in the 1993 Clackamas River Wild and Scenic River Management Plan. Bull trout are present in the watershed due to a cooperative multi-agency reintroduction effort in 2011. Natural populations of bull trout are federally listed as threatened range-wide, but this reintroduced population is an exception to that listing. Regional Forester sensitive Pacific lamprey are also present and are considered a priority to protect.

Fish Creek, South Fork Clackamas River, and the mainstem Clackamas River below Fish Creek will be especially susceptible to landslides and debris flows for several years due to the high amount of moderate and high soil burn severity in these drainages. This episodic sediment source, once transported into streams, will likely fill pools and low velocity habitats required for juvenile rearing survival, and impact spawning gravels. Stream temperatures may also increase in Fish Creek and South Fork of the Clackamas River where streamside vegetation has been burned. Riparian shrub and hardwood vegetation will recover quickly shading smaller stream channels, but it will take decades for conifers to provide shade in portions of Fish Creek and the South Fork Clackamas River.

Although fish may be impacted from post-fire effects in portions of the Clackamas River drainage, they are expected to persist and in time recover since several watersheds (e.g. Collawash and Oak Springs Fork of the Clackamas River) did not burn or burned at lower intensities.

**ROADS**

The Riverside Fire includes 264.04 miles of National Forest System roads and another 504.22 miles of other roads within the fire perimeter. Most roads occur outside of moderate and high severity burn areas. However, portions of the 4500 (Hillock Burn and Memaloose), 4620 (Sandstone), 5400 (Fish Creek) 4600, and 5410 roads are at higher risk from increased fire induced rock fall, runoff, and debris flows that may plug culverts, damage road infrastructure, and wash heavy debris and sediment into the surrounding drainages. Fire weakened trees occur on these and many other roads through the fire area, posing a risk to
public safety and access. In particular access could be blocked on the 5410 and 5411 that lead to critical communication sites at Whalehead and Memaloose that provide 911 and law enforcement services in the Clackamas River drainage.

Emergency treatments implemented to address increased risks to public safety and roads include:

- Road drainage stabilization (e.g. ditch and culvert clearing, culvert replacement, etc.) on 26.91 miles of road.
- Install K-Rail (Jersey Barriers) to catch debris and minimize obstruction a highly used paved road (4600) near Austin Point that can’t be temporarily closed.
- Storm patrols on 40.98 miles of road to identify problems such as debris caught on the debris racks, plugged or partially plugged culverts, and washed out roads and to clear, clean, and/or block roads that have received damage.
- Warning signs will be placed at road entry points that lead into the fire.
- Road gates to limit access to high hazard roads and prevent the public from entering hazmat sites at Ripplebrook, Oak Grove, Three Lynx, and Lazy Bend.
- Falling of hazard trees along the 5410 and 5411 roads to ensure there is access to the Whalehead and Memaloose communication sites.

RECREATION

The Riverside Fire includes 32.87 miles of National Forest System trails, numerous campgrounds, boat access, and day use areas along the Clackamas River. The Clackamas River is designated as a Wild and Scenic River. The river’s Outstanding Remarkable Values were identified as the superb fishery, scenery, and recreation. In addition, the river was designated as a State Scenic Waterway. Subsequent Wild and Scenic River designations include the major Clackamas River tributaries of the Collawash River, Roaring River, Fish Creek, and South Fork Clackamas River. These numerous protections highlight the outstanding remarkable scenic and recreational values of the Clackamas River watershed.

Section of Fish Creek and the Clackamas River below the Fish Creek confluence may see increased wood from adjacent dead and dying trees and debris flows. The Clackamas River is large and wide enough it may move trees downstream and into slower pockets of water. Trees that fall partially into the river could get lodged against the bank or standing trees to create river obstacles where more woody debris collects. Although increased in-channel large wood is a positive long-term benefit to fish habitat, changes could
create hazards for recreational floaters and have the potential to alter the recreational values of the Clackamas River.

Field reviews found that eight trails (Dry Ridge #518, Riverside #723, Alder Flat #574, Clackamas River #715, Memaloose Lake #515, Hillockburn #516, Cripple Creek #703, and Fish Creek Mountain #541) and seven trailheads (Clackamas River, Alder Flat, Riverside, Dry Ridge, Cripple Creek, Fish Creek, and Hillockburn) that require emergency treatments in order to stabilize and minimize anticipated impacts of post-fire storm events. Field reviews also found extensive fire damage at the Indian Henry, Lazy Bend, Rainbow, Fish Creek, Carter Bridge, and Sunstrip campgrounds with the loss of many facilities as well has numerous fire-killed hazard trees at many of recreation facilities.

Emergency treatments implemented to address increased risks to public safety, trails, and recreation facilities include:

- Pumping and capping of burned vault toilets that may overtop and spill raw sewage into nearby areas.
- Dropping of select hazard trees that pose an unacceptable risk to public safety or property at recreation facilities.
- Installing and repairing drainage (rolling grade dips, water bars, cleaning out existing water bars, etc.) along 20 miles of trail.
- Warning signs will be placed at campgrounds and trailheads where trails lead into the fire.
- Installation of gates at select trailheads and at the Indian Henry Campground to protect the public from post-fire hazards.

HAZARDOUS MATERIALS
Multiple facilities on the Clackamas River Ranger District burned during the 2020 Riverside Fire, resulting in a total loss of some structures. Additionally, some of the facilities contained hazardous materials (hazmat) that pose significant risk to water quality and human life and safety.

**Lazy Bend** - The Lazy Bend Concession site completely burned. The site contains petroleum products, toxic metals, asbestos and lead based paint, contaminated soil from petroleum products, and other unknown hazardous materials. Because the site is gated at the access road entrance and upper compound, administrative closure of the site would prevent access and preclude contact with hazmat.
**Timber Lake Job Corp** - The Timber Lake Job Corp has numerous facilities that were not fully inspected due to time constraints. Multiple facilities in the compound burned. One facility appeared to have been used to store hazmat including petroleum products as well as some unknown substances presumed to be hazardous which is adjacent to Timber Lake and could potentially impact water quality.

**Ripplebrook Maintenance Yard** - Multiple facilities in the Ripplebrook Maintenance Yard burned. These include a construction and maintenance shop (C&M) as well as a gas and oil house. Both facilities appear to have been used to store hazmat including petroleum products, as well as some unknown substances presumed to be hazardous. This facility is located adjacent to a wetland and topographic conditions promote the runoff of hazmat into it, potentially affecting water quality. Additionally, an office building in the vicinity of the C&M shop burned and may contain asbestos containing materials.

Because the two facilities at Ripplebrook and Timber Lake Job Corp posed immediate risks to water quality and drinking water critical values, emergency treatments were authorized during the BAER assessment. Protection was completed by “First Strike Environmental Company on 10-09-2020 since significant rain was predicted that could have washed material into nearby wetlands and waterbodies. Plastic sheeting was placed to cover burnt materials. Sheeting was partially extended outside of these areas and secured with sandbags to ensure it would stay in place, that rainfall/runoff would not penetrate each site and that runoff from each site would not reach adjacent water bodies.
Ripplebrook Residential Area – The Ripplebrook residences are approximately ½ mile from the Ripplebrook Maintenance Yard along FSR4631. Nine residences and one unidentified outbuilding were burned. Many of the residences stored petroleum products, unidentified hazardous substances, and a few appeared to have had underground heating oil tanks. Additionally, a few structures had basements that are now exposed and pose a fall hazard. A few of the residences are still currently utilized to house District staff. Concerns on site include easy access to the area, downed power lines, hazardous materials including petroleum products. There is no existing gate to maintain administrative closure of the site, which is further complicated by the fact that residents still reside there. There are also numerous hazard trees in the vicinity of the residences that pose a risk to residents as well as to workers reclaiming the sites. Select felling of these trees would be implemented to allow residents to go back and collect belongings from unburned homes.

Oak Grove Work Center - The Oak Grove Work Center is approximately 2 miles from the Ripplebrook Maintenance Yard along FSR4631. Six structures and one hay barn were burned. None of the structures appeared to be storing any hazmat. One structure, however, had a heating oil tank onsite (Figure 19). The hay barn had materials that were suspected asbestos containing material. There were also downed power lines on site.

BOTANY
During fire suppression activities, 105 points (including drop points, helistops, dozer pushes, log decks), .5 miles of dozer line and 2.6 miles of hand line were constructed totaling 688 acres. These may all serve as weed seed dispersal corridors. Dispersal of weeds from fire equipment movement poses a significant risk to native plant post-fire regeneration. Even though a weed washing station was brought in, seed may have been transported into the burn on suppression vehicles and equipment that arrived on the fire before the washing station was established. This increases the possibility of suppression equipment acting as weed seed vectors. In addition, localized invasive weed populations exist immediately adjacent to moderate and high severity burned areas and may spread into approximately 113 acres now that native vegetation has been removed. BAER treatments include the detection survey, treatment (manual removal, and chemical application), and monitoring of invasive species infestation in these suspectable acres.
CULTURAL RESOURCES
The Riverside Fire is part of the lands ceded to the Federal government through several of the seven ratified treaties of western Oregon. These lands include ancestral and ceded lands of Confederated Tribes of the Grand Ronde Community and the Confederated Tribes of Siletz Indians, and usual and accustomed lands of the Confederated Tribes of the Warm Springs Reservation of Oregon. Archaeological sites include 168 National Register of Historic Places (NRHP) Eligible or Unevaluated sites. Common property types include lithic scatters, bark peeled cedars, stacked rock features, habitation sites, rock shelters, Forest Service administrative sites, industrial sites related to timber harvest and hydroelectric infrastructure, and precontact/historic period trail systems. Many of these sites occur in moderate and high severity burn areas prone to post-fire erosion, which can expose and remove subsurface cultural deposits and/or remove artifacts from site locations; and fire-killed trees that fall up-end root systems resulting in the destruction of archaeological features and subsurface archaeological deposits. In addition, consumption of vegetative ground cover leads to increased site visibility, making cultural resources susceptible to looting.

Emergency treatments will be implemented in several lithic scatter sites associated with logistical camp-flintknapping task. Directional felling of designated trees will occur to ensure that additional blowdown doesn’t take place that could create mounds and depression microsite and redistributing cultural materials. The loss of site integrity in these instances is an irreversible loss. Lop and scatter of available slash within site boundary will also aid in erosion control and camouflage artifacts and features to prevent looting.

CONCLUSION
The BAER team has identified imminent threats to values at risk based on a rapid scientific of the area burned by the Riverside Fire. The findings provide the information needed to prepare and protect against post-fire threats. Emergency treatments will be implemented within one year of containment of the fire to minimize risk to critical BAER values.