## Appendix G: Post-Fire Response and Recovery

## Fire Intensity verses Fire Severity

Understanding post-fire stabilization and rehabilitation needs in part requires an understanding of the differences between fire intensity and fire severity. Although these terms may be used interchangeably on an informal basis, they are not synonyms. Fire intensity is the heat generated by the flaming front of the fire and often characterized by flame length. Fire severity is the amount of change to a given resource caused by the fire and is a function of both fire intensity and fire duration, including both flaming and smoldering combustion periods. Thus, the severity rating for a fire depends on what resource is assessed. Most commonly, fire severity is assessed for soils and vegetation and the severity rating for each can be very different. Fire severity in vegetation is affected primarily by fire intensity while fire severity in soils is affected primarily by fire duration, particularly by the duration of smoldering combustion.

## BLM and Forest Service Post-Fire Response Program Direction

Although there are many similarities, the post-fire response programs for BLM and the Forest Service have some differences. The differences arise in part due to differences in the legal authorities between the Department of the Interior (BLM) and the Department of Agriculture (Forest Service), differences in the primary types of ecosystems each agency manages (primarily rangelands verses primarily forests), and in part due to historical differences in the programs that continue.

For both agencies, the emergency stabilization programs, or burned area emergency response (BAER), funds emergency needs in the post fire environment. Both agencies are limited to completing emergency response actions within the first year after containment. Both programs include actions that protect human life and safety, infrastructure and natural resources. The main differences between the agencies arise in the post-fire rehabilitation programs. BLM can conduct post-fire rehabilitation for up to five years while the Forest Service is limited to three years. Post-fire rehabilitation funding for BLM comes from suppression-related funds, although BLM is competing with the other three Interior agencies for those funds. Post-fire rehabilitation funding in the Forest Service comes from normal operating funds such that funding used for rehabilitation is subsequently not available for use in another program such as forest or range management. Whether a given activity can occur under emergency stabilization or under post-fire rehabilitation sometimes differs between BLM and Forest Service. For example, BLM can conduct fence repair or replacement as part of either emergency stabilization or post-fire rehabilitation, but the Forest Service conducts this activity only as part of post-fire rehabilitation.

According to BLM Handbook H-1742-1, typical stabilization and rehabilitation activities include repair or improvement of BLM-managed lands unlikely to recover naturally; invasive plant control; planting native and desirable non-native species; planting trees to reestablish burned habitat, native trees, or prevent establishment of invasive plants; and repair or replacement of fire-damaged to minor operating facilities. These facilities can include fences, campgrounds, interpretative signs and exhibits, shade shelters, wildlife guzzlers and similar structures but does not include replacement of major facilities such as visitor centers, work centers, administrative offices, and residences. BLM can also close areas to livestock grazing during the recovery period, conduct emergency gathers of wild horses and burros, and stabilize cultural resource sites affected by fire. In forests, additional program activities typically include hazard tree removal, repairing or installing water diversion structures on roads and trails, and storm patrols.

According to Forest Service Manual 2500, Chapter 2520, typical emergency response and stabilization activities include actions needed to address potential post fire risks to human life and safety, property, cultural-heritage and critical natural resources such as installing hazard warning signs, improving road and trail drainage infrastructure, invasive plant treatments, and mulching for erosion control. The Forest Service can also administratively close areas where restricted access is deemed necessary to protect life and safety or where valid uses will interfere significantly with emergency stabilization or rehabilitation efforts or recovery.

## Fire Suppression Repair

Fire suppression repair is the first phase in recovery efforts that seek to repair damages resulting from fire suppression activities and to restore the area as close as possible to a “pre-event” state. Crews work to repair the hand and mechanical fire lines, roads, trails, staging areas, safety zones, and drop points constructed as part of the fire suppression efforts. The direction for what constitutes fire suppression repair is very similar for both the Forest Service and BLM.

## Emergency Assessment and Mitigations: Burned Area Emergency Response/Stabilization

The second phase of post-fire response and recovery is an assessment of natural and cultural resource damage and identification of rehabilitation and restoration needs. Both the Forest Service and BLM typically conduct this assessment using Burned Area Emergency Response (BAER) teams.

BAER teams assemble very soon after a fire is contained, or even before a fire is contained on very long duration fires, to conduct a rapid assessment of burned watersheds. This team of specialists and experts evaluate and identify imminent post-wildfire threats to human life and safety, property, and critical natural or cultural resources. They identify emergency stabilization measures to take before the first major storms of the season arrive. High intensity fires can result in loss of vegetation, increased exposure of soil to erosion, and increased water runoff that may lead to flooding, increased sediment accumulation in rivers and streams, debris flows, spread of invasive plants, and damage to critical natural and cultural resources.

Teams develop 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 water repellant properties that increase water runoff and erosion. Using the SBS map, BAER team members run models to estimate changes in stream flows and debris flow potential. In general, the higher the soil burn severity, the larger the watershed response and the higher the risk of erosion and flooding. The findings provide the information needed to prepare and protect against serious post-fire threats. Emergency stabilization measures may include mulching, installation of erosion and water run-off control structures, temporary barriers to protect recovering areas, installation of warning signs. BAER work may replace fire-damaged facilities critical to public safety, such as guard rails; remove safety hazards; prevent permanent loss of habitat for threatened and endangered species; and prevent the spread of invasive plants, and protect critical cultural resources.

## Rapid Assessment and Long-Term Recovery

The third phase is the long-term recovery, or restoration, work, also referred to as burned area rehabilitation in BLM (the “R” in “ES&R”) and post-fire recovery in the Forest Service. Region 6 of the Forest Service uses a Rapid Assessment team process to evaluate these long-term recovery needs, including timber salvage. BLM uses the same team that identifies emergency stabilization needs. Rehabilitation work in both agencies consists of non-emergency actions to improve fire-damaged lands that are unlikely to recover naturally and to repair or replace facilities damaged by the fire that are not critical to life and safety. This phase may include restoring burned habitat, reforestation, other planting or seeding, monitoring fire effects, replacing burned fences, interpreting cultural sites exposed or damaged by the fire, treating invasive plants, and installing interpretive signs.

## BLM

### Burns District

The Cinder Butte, Coyote, and Upper Mine fires on Burns District have emergency stabilization and rehabilitation plans. Collectively, these fires affected 56,885 acres of BLM-managed lands. All three fires identified needs for seeding and invasive plant control. Cinder Butte and Upper Mine both identified cultural resource protection needs, and repair or replacement of damaged fences, gates or cattleguards. Cinder Butte also identified sagebrush planting as a need and Upper Mine requested funds for soil stabilization and water diversion structures. In addition, the Upper Mine plan includes closure of much of the fire area to livestock grazing. The post-fire work is intended to restore habitat for greater sage-grouse, pygmy rabbit, pronghorn, big game, and wild horses and burros. Major land allocations affected include sage-grouse general habitat management areas, priority habitat management areas (12 Mile/Paulina/Misery Flat Priority Area for Conservation (PAC)), wilderness study areas, and research natural areas.

### Lakeview District

Lakeview District prepared stabilization and rehabilitation plans for the Ana, Coglan, Macs Draw, McCarty, and Wildcat fires covering a total of 5,897 acres. The Ana Fire affected 3,977 acres of BLM-managed lands in the Picture Rocks PAC while the other fires affected sage-grouse general habitat management areas, a wilderness study area, and habitat for pronghorn and mule deer. Concerns were especially high for the Ana Fire since the Picture Rocks PAC had crossed an adaptive management threshold for sage-grouse populations contained in BLM’s 2015 Approved Resource Management Plan Amendment for management of sage-grouse, and for the Mac’s Draw Fire which affected an area that burned in 2001 and was rehabilitated then. Stabilization and rehabilitation needs for all fires included invasive plant control and closure to livestock grazing. Ana Fire identified seeding and both Coglan and McCarty Fires identified fence repair and replacement.

### Prineville District

Prineville District developed plans for the Hampton and Horn Butte fires, which collectively burned 4,020 acres. Hampton Fire affected a portion of the 12 Mile/Paulina/Misery Flat PAC, sage-grouse general habitat management area, and a wilderness study area. Horn Butte Fire burned a designated area of critical environmental concern for long-billed curlew nesting habitat. Both fires identified seeding and invasive plant control needs. Hampton Fire also included repair or replacement of fences while Horn Butte identified closure to livestock grazing.

### Spokane District

Spartan and Sutherland Canyon fires, which burned at the same time, needed plans from Spokane District. Both fires affected habitat for greater sage-grouse, with Sutherland Canyon Fire affecting the Moses Coulee PAC. Sutherland Canyon also burned within the recovery emphasis area for the endangered Columbia Basin pygmy rabbit, prompting efforts to retrieve several rabbits from the burned over landscape. Both fires also affected habitat for BLM special status species, including an area of critical environmental concern established for Whited’s milkvetch. Sutherland Canyon also burned 1,709 acres that had burned one or more times in recent years. Both stabilization and rehabilitation plans identified needs for invasive plant control, planting sagebrush, repair/replacement of fences, and closure to livestock grazing. The Spartan Fire plan also included seeding.

### Vale District

Vale District prepared plans for the Bowden, Hawk, Horse Cross, Little, and Morgan Creek Fires, covering 27,692 acres. Hawk Fire burned entirely within the Cow Lakes PAC, which has tripped a hard trigger for the combination of sage-grouse habitat and population. Horse Cross Fire affected the Folly Farm/Saddle Butte PAC and Little Fire burned in the Louse Canyon PAC, which is also a designated sagebrush focal area. Bowden Fire burned within the perimeter of the 2012 Long Draw Fire in a wilderness study area that was not rehabilitated at that time. Other resources affected by these fires included BLM special status plant species, bighorn sheep habitat, sage-grouse general habitat management areas, big game winter range, pygmy rabbit and golden eagle habitat, and around lava tubes used by western big-eared bat. All but the Little Fire stabilization and rehabilitation plan identified invasive plant control needs and all but Horse Cross Fire plan identified closure to livestock grazing. Both the Bowden Fire and Little Fire plans included fence repair or replacement and the Hawk and Little Fire plans included planting sagebrush. Only the Bowden Fire plan included seeding.

### Coos Bay District

At the time the emergency stabilization and rehabilitation plan for the Chetco Bar Fire was prepared, the fire had burned approximately 6,500 acres on lands managed by the Coos Bay District. Although the plan was prepared before the fire was fully contained, the fire was not expected to burn additional lands managed by BLM. Resource concerns within the burned area include infestation of noxious weeds and loss of habitat for federally threatened northern spotted owl, marbled murrelet, and Coho salmon. Pacific fisher, a species of concern, has also been documented in the area. Proposed treatments include warning signs, road drainage improvement, hazard tree removal, invasive plant control, and planting trees.

### Roseburg District

Horse Prairie Fire burned an estimated 7,630 acres of lands managed by Roseburg District. Soil Burn Severity (SBS) acres for identified 669 acres of high severity, 2070 acres of moderate, 1817 acres of low, and 3074 acres of very low or unburned. Resource concerns within the burned area include spread of invasive plants and loss of habitat for federally threatened northern spotted owl, marbled murrelet, and Coho salmon. Proposed treatments include warning signs, road drainage improvement, hazard tree removal, archaeological site protection, invasive plant control, and planting trees.

## Forest Service

### Eagle Creek Fire

A BAER team consisting of scientists and experts in soils, geology, hydrology, engineering, botany, recreation, archaeology, and fisheries, along with GIS support and public information officers responded to Eagle Creek Fire. The team conducted a rapid assessment emergency stabilization needs starting September 25. Only about 16 percent of the fire area had severely burned soil and over half the area was considered low severity, very low severity, or unburned (Figure x). About 30 percent of the fire area is the equivalent of high severity for vegetation, based on the definition of high severity used by LANDFIRE, with 75 percent or greater tree mortality (Figure x).

Treatments recommended and approved for immediate implementation within the fire include rockfall protections at Multnomah Lodge, trail stabilization and drainage improvement, limited removal of hazard trees along road edges and near facilities, emergency closure and hazard warning signs, and invasive plant treatments. There was no Rapid Assessment Team assigned for the Eagle Creek fire due to the land use allocations that the fire burned in (administratively withdrawn lands and wilderness) that do not permit timber salvage. Additional rehabilitation needs include trail reconstruction, trail bridge replacement, and repairs to the Eagle Creek water system.

Figure X. Soil burn severity ratings across all ownerships within the Eagle Creek Fire perimeter.

Figure XX. Percent of basal area mortality for the Eagle Creek Fire across all ownerships.

The Forest Service hosted Eagle Creek Fire Response partnership meetings in Cascade Locks on October 4 and November 1. Local organizations and partner agencies discussed the status of the Eagle Creek Fire and began an open conversation regarding the recovery efforts to come. At the first meeting attendees brainstormed ideas and major topics grouping these into six over-arching themes to be discussed in small groups at the next meeting. The six themes included trail maintenance and repair, ecological restoration and citizen science, environmental education, creative and emerging volunteer roles, coordination and communication, and funding. Eventually the creative and emerging volunteer discussion was integrated into each of the other topic areas, and ecological restoration and citizen science group narrowed their focus to invasive species. Small groups of engaged volunteers and partners continue to meet and develop collaborative action plans addressing each of these themes. The larger group of Eagle Creek Fire Response partners will reconvene in late January to report progress and solicit feedback on the individual action plans.

### Chetco Bar and other Rogue River-Siskiyou National Forest Fires

Rogue River-Siskiyou National Forest assembled four BAER teams over the course of the 2017 fire season. The BAER team for the Chetco Bar fire assembled in late September for two weeks to complete that assessment. Overall the soil burn severity for all fires on the forest were found to be much lower than originally anticipated (Figure x) but especially so for Chetco Bar with less than 6 percent rated as high severity (Figure x). Treatments authorized for the Rogue River-Siskiyou BAER include over 100 miles of road work, several miles of trail stabilization, limited hazard tree treatments, hazard signage, invasive plant treatments and cultural resource protections.

Figure x. Burn severity for all large fires assessed within the Rogue River-Siskiyou National Forest.

Figure x. Burn severity for all ownerships within the Chetco Bar fire perimeter.

Figure XX. Percent of basal area mortality for the Chetco Bar Fire across all ownerships.

Chetco Bar Fire on the Rogue River-Siskiyou burned across approximately 170,000 acres of National Forest System lands, with 48 percent of the fire occurring in wilderness, 33 percent in Late Successional Reserve and 17 percent in the matrix land use allocation. There were some larger patches of high severity crown fire runs, with 45 percent of the burned area experiencing 50 percent or greater overstory tree mortality and 37 percent experiencing high severity using LANDFIRE’s definition of high severity as 75 percent or greater vegetation mortality (Figure XX).

Forest managers are working to reopen around 300 miles of roads impacted by the fire by felling roadside danger trees within the Chetco Bar perimeter and about 100 miles of additional roadside danger tree removal within the perimeters of High Cascades and Miller complexes. Forest managers are also considering options for commercial timber salvage within the matrix lands of the Chetco Bar Fire along the private land boundaries in order to reduce fuel loadings along those boundaries, to assist in future fire management options, and to recoup some economic value from the burned trees. Additional rehabilitation needs include road stabilization, repair/replacement of road and trail structures, trail signage, repair/replacement of wildlife guzzlers and fish habitat structures, tree planting, fence replacement and repair of other damaged range improvements, and cultural resource protection.

### Umpqua National Forest Fires

Umpqua National Forest also convened multiple BAER teams over the course of the fire season to address the post-fire emergency needs. The majority of fires on the Umpqua showed high percentages (89 percent) of low to very low soil burn severities and therefore had a lesser need to post-fire emergency funding (Figure x). BAER treatments approved for the Umpqua include road and trail drainage upgrades, emergency hazard signage, cultural resource protections and invasive plant treatments.

Figure x. Soil burn severity for all large fires assessed within the Umpqua National Forest.

Figure XX. Percent of basal area mortality for all of the 2017 fires on the Umpqua National Forest.

Umpqua National Forest experienced fires scattered across three Ranger Districts totaling approximately 65,000 acres. These fires mostly burned at very low severities, with about 79 percent of the burned acres experiencing less than 25 percent overstory mortality (Figure XX). The Forest is working to reopen around 300 miles of roads impacted by the fires by felling roadside danger trees within the fire perimeters. Staff on the Umpqua are also considering options for commercial timber salvage on two fires that burned within matrix land allocations on the Tiller Ranger District. These salvage units are expected to be less than 250 acres each. Additional rehabilitation needs include stabilizing affected roads, repair/replacement of road and trail infrastructure, trail reconstruction, invasive plant control, repair of the Horseshoe Bend water system, replacing burned or damaged signs, tree planting, and cultural resource site protection.

### Milli Fire

The BAER team for Milli Fire completed its assessment in mid-September. Milli Fire had one of the highest soil burn severities of the Oregon fires with 27 percent of the area rated as moderate and high severity (Figure x). BAER treatments in the Milli Fire included road and trail treatments, hazard signs, cultural site protections, and invasive plant treatments.

Figure x. Soil burn severity ratings within the Milli Fire perimeter.

Figure XX. Percent of basal area mortality for the Milli fire on the Deschutes National Forest.

Milli Fire on the Deschutes National Forest burned across approximately 24,000 acres of NFS lands, primarily in wilderness (39 percent) and late successional reserves (39 percent) with about 12 percent of the fire occurring in the matrix land allocation. Due to two days of rapid fire growth about 40 percent of the fire acres had greater than 50 percent overstory mortality (Figure XX). The Deschutes has focused on treating roadside danger trees to reopen roads to all safe public access. They are not pursuing area salvage at this time.

### Willamette National Forest Fires

Three BAER teams assessed fires on Willamette National Forest over the course of the fire season. Like the Umpqua fires, the majority of the soil burn severities were low to very low (Figure x). Several BAER treatments approved for these fires include road and trail work, including the Pacific Crest Trail; hazard warning signs; and invasive plant treatments.

Figure x. Soil burn severity for all large fires assessed on the Willamette National Forest.

Figure XX. Percent of basal area mortality for the Whitewater fire and then all other fires combined during the 2017 fire season on the Willamette National Forest.

Willamette National Forest had 17 fires for a total of approximately 70,000 acres. The Separation Fire was primarily in wilderness (91 percent), while the Whitewater fire (about 11,500 acres) burned in wilderness (56 percent) and late successional reserves (44 percent). The Whitewater fire had the highest amount of tree mortality with 37 percent of the total fire experiencing greater than 50 percent overstory mortality (Figure XX). The other fires across the Willamette primarily had low severity impacts to the overstory, with over 50 percent of the total burned area experiencing less than 10 percent mortality (Figure XX). The Willamette is reopening the approximately 88 miles of road affected by the 2017 fires by removing roadside danger trees. Additional rehabilitation needs include stabilizing affected roads, repair/replacement of trails and trail structures, invasive plant control, tree planting, and repairing damage to developed recreation sites.

### Okanogan Wenatchee National Forest Fires

Two BAER teams assessed multiple fires on the Okanogan-Wenatchee National Forest in October 2017. The BAER teams found a much higher soil burn severity on these fires, potentially a reflection of repeated fires on the landscape (Figure x). BAER treatments included hazard signage, road and trail treatments, recreation facility protections, and invasive plant treatments.

Figure x. Soil burn severity within all large fires assessed on the Okanogan-Wenatchee National Forests.

Figure XX. Percent of basal area mortality for the Norse Peak and Jolly Mountain Fires on the Okanogan Wenatchee National Forest.

The Okanogan Wenatchee National Forest had nine large fires which burned over 175,000 acres within the Forest. About 130,000 acres were within designated wilderness. Two of the largest fires with portions outside of wilderness were the Jolly Mountain and Norse Peak fires, and their overstory mortality is displayed in Figure XX. Since most of the wildfire acres on the Okanogan Wenatchee were in wilderness, the Forest is not planning large scale roadside danger tree treatments and they are not pursuing area salvage. They did not identify any post-fire recovery items beyond the emergency treatments funded in the BAER process.

### State Summaries

Collectively, fires that burned on National Forest System lands in Oregon saw only seven percent high burn severity in soils with 68 percent of soils experiencing low or very low severity (Figure xa). Impacts to soils in Washington were higher with 17 percent high severity and 52 percent low to very low severity (Figure xb). Washington also saw higher overstory mortality than Oregon for all categories from 10 percent overstory mortality and higher (Figure x)

Figure X. Overall burn soil burn severity for large fires on National Forest System lands in Oregon (A) and Washington (B).

Figure XX. Combined basal area mortality for all fires assessed in 2017 in Oregon and Washington.