Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Santa Fe and Carson National Forests | July 2022

Hermits Peak-Calf Canyon Phase 3 Burned Area Emergency Response (BAER) Assessment Report

EXECUTIVE SUMMARY

Figure 1: Overview of HPCC Phase 3 Assessment Area

Fire Background

The Hermits Peak fire started on April 6, 2022, from the Las Dispensas prescribed burn on the Pecos/Las Vegas Ranger District (PLVRD) of the Santa Fe National Forest (SNF). Southwest Area Incident Management Team 1 (Type 1) assumed command of the fire on April 15. The Calf Canyon fire started on April 19, 2022, from a winter PLVRD pile burn project, and SWIMT 1 assumed command of this fire as well. The two fires merged on April 22 during high wind events. The fires were then managed as a single incident called the Hermits Peak-Calf Canyon (HPCC) Fire, eventually burning onto the Carson National Forest (CAF). The HPCC Fire initially divided into three zones, each under management of a Type 1 team. On May 15, and on May 27, the fire transitioned back to two zones and was managed by two Type 1 incident management teams (IMTs). As of July 29, 2022, the fire has burned 341,735 acres and is 94% contained and is managed by one Incident Management Team (SWIMT 5).

BAER Assessment

The Forest Service assembled a Burned Area Emergency Response (BAER) team on April 20, 2022, as HPCC fire managers increased its containment. The extreme wind events in late April resulted in rapid fire growth and the team was forced to delay its analysis. By mid-May, some areas of the fire were safe for BAER team's field analysis. The team was reestablished on May 17, 2022, to begin assessment on the HPCC fires. Due to the fire's size and continuing active fire behavior, the BAER team divided the burned area into separate phases for analysis. The initial phase (Phase 1) examined the southern half of the burned area and included the headwaters of the Gallinas River Watershed and the Tecolote Creek Watershed. The burned area assessed in Phase 1 covers 115,542 acres and includes 48,581 acres (42%) of National Forest System (NFS) lands, 66,216 acres (57%) of private property, and 745 acres (1%) of New Mexico (NM) state lands. Approximately 13,558 acres of the Phase 1 assessment area is in the Pecos Wilderness.

The second phase (Phase 2) was conducted from June 4- 17 and examined the northern half of the burned area and included Sapello River Watershed, Upper Mora Watershed, and portions of Embudo Creek and Coyote Creek Watersheds. The burned area assessed in Phase 2 covers 190,026 acres, including 57,093 acres of NFS lands (14,333 acres in the Pecos Wilderness) and 132,933 acres of private property. The total Phase 2 assessed burned area includes 81,830 acres (43%) of unburned/very low or low soil burn severity, 62,804 acres (33%) of moderate burn severity and 45,392 acres (24%) of high burn severity.

Phase 3 of the Hermits Peak & Calf Canyon (HPCC3) BAER assessment was initiated on June 26, 2022, and covers 40,150 acres, including 39,743 acres of NFS lands (27,982 Pecos Wilderness) and 407 acres of private property. HPCC3 BAER team efforts focused on assessing the fire footprint within the top five sub-watersheds identified in *Table 2*. Downstream sub-watersheds (HUC 6th) located within the Headwaters Pecos River Watershed 5th not impacted by the fire footprint were also assessed to evaluate post-fire flow risks associated with the Pecos River (Indian Creek Creek-Pecos River, Dry Gulch-Pecos River, Alamitos Canyon-Pecos River sub-watersheds).

BAER team assessments consist of rapid evaluations of post-fire conditions of the burned landscape to determine the level of risk from potential flooding and debris-flows to values on NFS lands. The team identifies 'BAER critical values' such as human life and safety, infrastructure, property, and critical natural and cultural resources. BAER teams also share information with local and federal agencies to identify risks to off-Forest resources (such as private property). Risks to BAER critical values are identified with the BAER risk assessment (Table 1), and the BAER team evaluates emergency stabilization treatments to reduce the risk to NFS values. Treatment actions must be evaluated based on: (1) the ability to be implemented in a timely manner, (2) effectiveness in reducing risk, (3) practical and technical feasibility, and (4) cost. BAER assessments are conducted quickly because treatments (including all phases of bidding, contracting, and implementation) must be completed before the first damaging storm. In New Mexico (NM) these storms typically will start in early to mid-July and run through mid-September with the monsoon rainstorm cycle. Due to scattered distribution of convective events not all burned areas may experience a damaging storm in the first year. The final soil burn severity (SBS) map was used to model changes in precipitation runoff and debris flow potential and identify risks to critical NFS values via the BAER risk assessment process (Table 1). This document summarizes the formal assessment in the FS-2500-8, Burned Area Report.

Table 1: BAER Risk Assessment[1]

Probability of Damage or Loss	Magnitude of Consequence		
	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**

Soil Burn Severity Mapping

The BAER assessment focuses on NFS critical values to determine where post-fire precipitation events could increase water runoff, flooding, erosion, and sediment delivery, where post-fire effects could impact critical threatened and endangered wildlife habitat, and where high-risk areas exist for the spread of invasive weeds. Post-fire water runoff changes with the severity of the fire – more severe fire conditions (i.e., hotter fire conditions) will alter the landscape in ways that enable more water runoff (increased flooding) and sediment mobilization (to include potential debris flows). The BAER team analyzed satellite reflectance images and collected field data from June 17-30, 2022, to produce a Phase 3 SBS map (Figure 3), which categorizes the burned area as High, Moderate, Low, or Very Low SBS (Table 3). Field validation of SBS was completed on June 30, 2022. Within the HPCC Phase 3 burned area, 50% of the acres are either unburned/very low or low SBS, while 16% are moderate SBS and 34% are high SBS.

Table 2: Acres Burned by Watershed

HUC #	Watershed Name	Total Acres	Acres Burned	% of Watershed Burned
130600010203	Rio Mora	34,420	22,922	66.6
130600010204	Winsor Creek-Pecos River	37,140	5,037	13.6
130600010104	Apache Canyon	14,079	3,302	24.5
130600010104	Bull Creek	17,603	3,524	20.0
130600010402	El Rito	28,241	4,678	16.6
130600010104	Headwaters Cow Creek	27,643	674	2.4
130600010205	Indian Creek-Pecos River	29,042	13	Trace

Figure 2: Foreground overlooking Gascon 239 trail with mosaic of high soil burn severity seen in some spruce fir vegetation and unburned in subalpine grasslands. Hamilton Mesa in the background on the left-hand side

[1] Threats to resources are based on the likelihood and consequence of an event. Threats that result in low or intermediate (white and yellow) risks are typically not considered for potential treatments. Treatments may be considered where threats that result in high or very high risks (red) are identified.

Hermits Peak / Calf Canyon BAER - Phase III

Soil Burn Severity - 6/30/2022

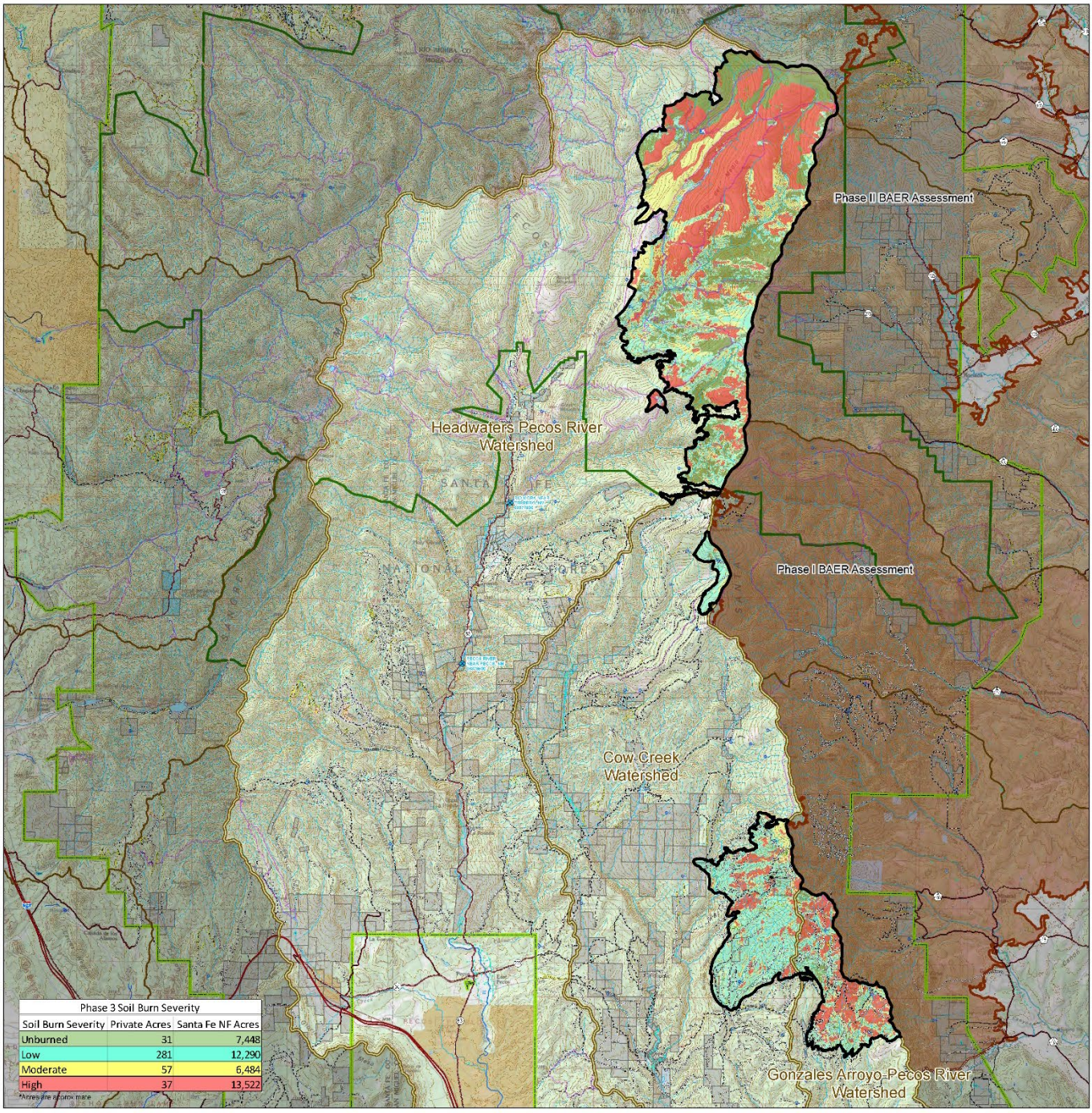

Figure 3: Soil Burn Severity Map for the northern area (BAER Phase 3) of the Hermits Peak-Calf Canyon Fire.

Table 3: Burn Severity Acres by Ownership

Soil Burn Severity	NFS	Other Federal (List Agency)	State	Private	Total	% within the Fire Perimeter
Unburned	7,479	0	0	31	7,479	19
Low	12,290	0	0	281	12,571	31
Moderate	6,484	0	0	57	6,541	16
High	13,522	0	0	37	13,559	34
Total	39,744	0	0	406	40,150	

Figure 4: Examples of low (top left), moderate (top right), and high (lower left) soil burn severity in the burned area. These burn conditions, including remaining ground cover, soil integrity, hydrophobicity, remaining root structure, and surviving vegetation, assist to estimate the likelihood and intensity of future flooding, erosion, and debris- flows.

Watershed Response

Soils

Soil productivity, or how well soil supports plant growth, is a non-renewable resource due to the exceptionally slow soil formation rate in the southwest. Post-fire soil erosion poses a significant threat to soil productivity. Moderate and high soil burn severities increase the potential for erosion and debris flows due to fire induced hydrophobicity (Figure 4), the loss of protective soil cover, the loss of soil porosity, the weakening or loss of soil structure, and the loss of soil stability due to root consumption. About half (20,100 acres) of the burned area within the BAER Phase 3 assessment had high or moderate SBS. Approximately 9,112 acres (23%) of fire induced water repellent soils occur on NFS lands in the HPCC Phase 3 assessed burned area. 1,886 acres have low repellency, 2,616 acres are considered moderately repellent, and 4,610 acres have high repellency. Water repellent soils were estimated to occur over 15% of the low SBS, 40% of the moderate SBS, and 65% of the high SBS.

Figure 5: Strong hydrophobic soil conditions caused by moderate soil burn severity in mixed conifer forest. Note 2 cm diameter water drop that persists on soil surface.

Accelerated runoff and erosion are to be expected throughout much of the Phase 3 analysis area, depending on burn severity, slope, post-fire soil characteristics, and the intensity and duration of precipitation that occurs within a given watershed. Debris-flows and flooding are strong possibilities. Baseline (pre-fire) erosion rates for soil types in the analysis area average less than one ton per acre per year. Modeling indicates the Phase 3 burned area will now average 16.3 tons per acre on NFS lands. Average sediment potential across moderate and high SBS on NFS lands is approximately 14,605 cubic yards per square mile.

Hydrology

Post-fire watershed conditions such as loss of groundcover and stabilizing vegetation, decreased soil porosity, and fire induced water repellency in soils are all factors that can increase the magnitude, frequency, and volume of stormwater runoff and produce debris-flows. Post-fire water flows have greater energy with which to damage resources within and downstream of the burn area and threaten life and property than do regular rainfall runoff events that occur over unburned areas. Additionally, high flows with increased concentrations of sediment and ash (bulking effect) can produce geomorphic changes such as aggradation, downcutting, and/or widening of stream channels that can significantly alter hydrologic function.

The large contiguous areas of moderate and high SBS are contributing to the elevated watershed response. Phase 3 assessment areas includes 11 sub-watersheds (12-digit Hydrologic Unit Codes). Four sub-watersheds have more than 15% of the watershed area burned and one has more than 50% of the total

watershed area burned (36% as high and moderate soil burn severity). Rio Mora sub-watershed is the one watershed with greater than 50% burned area is nearly entirely within the Pecos Wilderness on NFS lands.

In addition to Rio Mora, the William Creek – Pecos River sub-watershed is also primarily in the Pecos Wilderness boundary. This watershed contains the only Wild and Scenic River designation, the Pecos River, along with several other Outstanding Natural Resource Waters (ONRWs).

Clear water flow (not ash or sediment laden) models were created to reflect both average (Antecedent Runoff Condition II (ARC II)) conditions when annual flooding occurs and saturated soil moisture conditions (ARC III). Model runs for ARC III were created to reflect the multiple single storm events that frequently occur during the monsoon season. The 50% (i.e., 2-year – 1.12 to 1.35 inches in an hour) chance storm has an 88% likelihood over the next three years and is considered a *very likely* probability event and the 20% (i.e., 5-year – 1.49 to 1.79 inches in an hour) chance storm has a 49% probability over the next three years and is considered a *likely* event. Risk is based on a scale of minimal, significant, very significant, and extreme based on the degree of change in peak flows from pre-fire to post-fire.

For most basins and reaches within the burned area (63%), assuming average water runoff conditions (ARC II) without bulking, the *very likely* single storm event is modeled to have increases that are minimal to significant. The exceptions are six basins within the Pecos Wilderness and two basins within the Apache Canyon sub-watershed that are modeled to have extreme changes in peak flows. An additional five basins across all modeled sub-watersheds have very significant increases in peak flows for the *very likely* single storm event. For the *very likely* multiple storm event, 24% of basins and reaches within the burned area have modeled peak flow increases of very significant to extreme. For the *likely* single storm event, most (56%) of basins and reaches have a minimal to significant increase; and for the *likely* multiple storm event 22% have a very significant to extreme modeled change in peak flows. In summary, the increased risk is minimal for most basins in the *very likely* and *likely* storm events and the greatest increase in post-fire flows is from the 5-year (20% chance) storm event (54%). The outlets of all modeled watersheds have very significant to extreme changes in clear water peak flows for the very likely (50% chance) single storm event.

Hyper-concentrated flows, flows that contain entrained ash and sediment that typically occur during the first 2-3 post-fire storm events, were estimated by “bulking” clear water flows by 25%. This change does not increase the estimated risk for most basins for the very likely (50% chance) single or multiple storm events (only changing risks for 5-6 basins respectively). The outlets of all modeled watersheds have very significant to extreme changes hyper-concentrated peak flows for the very likely (50% chance) single storm event.

Debris-Flow Hazard Assessment

The US Geological Survey (USGS) estimated the probability and magnitude of debris flows within and from the burned area. They developed debris flow hazard ratings for both watersheds and stream channels for storms with a peak 15-minute (I_{15}) intensity ranging from 24 mm/hour (.94 inch per hour) to 40 mm/hour (approximately 1.6 inch per hour). The 40 mm/hour estimates were used for this analysis, as they are most representative of the intensity of New Mexico monsoonal storms and provide the most conservative estimate of potential risk. The 40 mm/hour estimate is approximately equivalent to the 50% chance storm based on NOAA Atlas 14 data for this phase of the HPCC Fire.

Critical Values

Critical Values (CVs) identified during the BAER assessment that have potential to be at-risk as defined in Forest Service (FS) Manual 2523.1 include human life and safety of employees and public, FS property (roads, trails, administrative and recreation infrastructure), cultural resources, natural resources including Threatened and Endangered Species (TES) habitat, native plant communities, soil, and water resources. The BAER team evaluated the risk to these critical values in accordance with the critical value matrix table (Table 1) by using the BAER risk assessment. The HPCC Fire critical value table is in the project record.

Primary BAER CVs that were assessedby the BAER team, but not limited too, included:

- High elevation trails within the Pecos wilderness that are affiliated with Rio Mora and Winsor Creek-Pecos River Subwatersheds.

- National Forest System (NFS) Roads (NFSR) directly impacted by high/moderate burn severity within the El Rito Subwatershed.
- Mexican Spotted Owl (MSO) Critical Habitat and native aquatic species communities primarily within the Rio Mora & Winsor Creek-Pecos River Subwatersheds.
- Recreation sites/infrastructure and NFSR roads along the Upper Pecos River corridor within the Winsor Creek-Pecos Subwatershed.
- A low-risk determination of contaminated soil release onto NFS lands from a historic hard rock mine remediation within the Indian Creek-Pecos River Subwatershed.
- A low-risk determination of recreation sites located below the fire footprint within the Pecos River corridor because of disipated post-fire flows (Dry Gulch-Pecos River Subwatershed).
- Evaluation of Elgible Historic Places within flood-prone water corridors and the fire footprint of the uplands.

Human Life and Safety

There is a very high risk to human life and safety on NFS lands within and immediately and downstream of the fire areas along the Pecos River. The post-fire environment poses increased hazards to the public and FS employees who travel, work, or recreate on NFS lands. Threats to human life and safety of forest visitors and employees traveling on NFS roads and trails include falling trees and limbs, falling rocks, flash floods, debris-flows, road/trail failure at multiple locations and other burned area hazards such as burned stump holes in the prism of the road/trail. Threats downstream of the burned area on NFS lands include flash floods and debris-flows. For the Pecos River corridor, downstream of the fire burned area, post-fire flows are predicted to increase up to 200% from pre-fire flows based on a 25-year event. These elevated flows and affiliated post-fire floatable debris would pose a risk to human life and public safety due to recreational activity within and adjacent to the Pecos River. Downstream risks within the Pecos River corridor have been identified to the Dry Gulch-Pecos River sub-watershed especially in the Dalton recreation area.

Human-Waste discharge associated with vaulted toilets of the Cowles Pond infrastructure and Windy Bridge Recreation site pose a high risk, with downstream post-fire flooding within the Pecos River likely. Effluent discharge into the Pecos River would pose a major magnitude of consequence to public health and safety.

Property--Roads and Bridges

The watersheds burned in the HPCC Fire will experience increased water runoff, sediment/ash laden runoff, and debris-flows creating a future concern for roads, bridges, culverts, and the associated channels along the drainage paths of the burned watersheds. Increased water flows may cause the capacity of crossings and drainage features (culverts) to be exceeded, and the transported sediment and debris may cause culverts, bridges, and other drainage features to become overwhelmed and ultimately fail (Figure 6). These impacts may cause uncontrolled flow to overtop the road and damage the road prism with potential for structural failure of roads within the affected watersheds.

Figure 6. Burned area above culvert where increased erosion and sedimentation can plug culverts leading to a road being overtopped by flood waters.

The road prism may become impassible to vehicles and in extreme cases may be completely washed out due to fill slope failure. Road prisms may also be damaged due to falling rock and debris making the road impassible. Public safety hazards are significantly increased due to flash flooding, where road segments lie within the floodplain, fallen trees, destabilized rock slopes, damage to traffic safety structures and signs.

Common BAER emergency treatments could include signs warning travelers of the increased danger, closures of some Forest Service roads during monsoon season, storm inspection and response, creating armored dips, clean ditches to handle increased flows, and removing debris from stream channel.

There are approximately 95 miles of Forest Service roads (NFSR) within the HPCC Phase 3 assessment area. There is risk of road loss and damage, or loss of access to recreational sites that could occur to the following surveyed NFSR roads.

Approximately 5.5 miles of NFS (NFSR 83, 83Y, 200L, 66F) road prism segments are in a very high risk of being lost due to soil instability (all level 2 maintenance roads). This includes the Barillas Lookout administrative road (NFSR 83Z) which is also a level 2 maintenance road. These road sections occur within or below moderate and high SBS with a moderate erosion hazard rate.

The NFSR 555 (level 4 maintenance) road is located within the Winsor Creek-Pecos River sub-watershed and adjacent to the Upper Pecos River corridor. Post-fire damage risk from upstream flooding is very low. The road is located outside the 100-year floodplain and the probability of this type of event to occur is unlikely.

NFSR 121 (level 4 maintenance) road segments leading onto the 121 Bridge from the NFSR 555 road and to the 121 junction (.15 miles) are at an intermediate risk of being damaged. Modeled changes in flows near these road intersections are minimal, but still some increases in post-fire flows are possible for a 2-year storm event. There is not a burned area above Winsor Creek, so most of the change will come from the Pecos River associated with the bridge.

NFSR 66F (level 2 maintenance) drainage crossings with Commissary Creek and NFSR 203 at Rio Rudiso have a high risk of losing the road crossing infrastructure. The crossings are downstream of sub-basins subjected to a high proportion of high SBS of likely post-fire flow events.

Both the NFSR 555 and 121 Bridges that cross the Pecos River within the Winsor Creek-Pecos River areas have a high risk of being irreparably damaged due to concentrated post fire flows and debris transport/accumulation. A post-fire 25-year event would be similar to a 50 to100-year pre-fire event. Although the bridges have a good infrastructure and are predicted to sustain a moderate increase of flows, such a drastic increase of post-fire flows can cause substantial bridge damage. The physical obstruction of bridges and the concentration of flows due to alteration of the channel and the chokepoint from their infrastructure pose an additional hazard to debris accumulation. Debris accumulation can cause a physical hazard in themselves, and they also can dam-up flows that are prone to breaching and cause a pulse of flood waters that can amplify hazards to the bridge infrastructure and subsequent downstream resources. This debris dam accumulation phenomenon also poses a high risk to public safety.

Property--Trails

There are approximately 5 miles of NFS trails within the HPCC Phase 3 assessment area. The majority of the trails impacted by the fire are within the fire perimeter and concentrated within the Pecos Wilderness. There is a high risk to these trails since the probability of damage or loss related to post fire impacts in moderate or high SBS is likely. There is an intermediate risk to NFS trails in unburned or low SBS since the probability of damage or loss related to post fire impacts is likely.

Property—Recreation Infrastructure and Recreation Sites

The Cowles Pond and recreation site is located immediately adjacent to the outside bend of the Upper Pecos River within the Winsor Creek-Pecos River sub-watershed and downstream of the fire burned area. The day-use facilities include ponds utilized for sport fishery, outbuildings, a walk bridge, and an information kiosk. A post-fire 2-year event is predicted to be below a pre-fire 5-year flooding event. The risk is high because of the

proximity of ponds to the river, the potential of debris and sedimentation from post fire flows, and the higher risk of post-fire flows undermining the pond and impacting the dam integrity. Post-fire high sedimentation of the Pecos River is expected and subsequent impacts of the river's ability to transport sediment and bedload can alter the channels thalweg (depth) particularly on outside meander areas. The Cowles Pond area is more vulnerable to sediment deposition due to lower channel gradients, geomorphology, and watershed pour points.

The Windy Bridge, field tract, and Dalton recreation sites are located downstream of the fire burned area near the Pecos River in the Dry Gulch-Pecos River sub-watershed. There are minor risks from potential post-fire Pecos River flooding the recreation infrastructure located at a higher elevation adjacent to the river and some of these sites have minimal development investment. The sites are located within a sub-watershed that is below an unburned sub-watershed.

Natural Resources—Water Quality of Outstanding National Resource Waters

Outstanding National Resource Waters (ONRWs) are streams, lakes and wetlands that receive special protection against degradation under the State of New Mexico's Standards for Interstate and Intrastate Surface Waters (Water Quality Standards) and the federal Clean Water Act. ONRW water bodies are at risk of water quality loss due to post-fire effects. ONRWs themselves are not considered to be BAER critical values; however, the sections of ONRWs on Forest Service lands were evaluated for post-fire risks to their water quality which is a BAER critical value.

Several miles of stream ONRWs are within the Phase 3 assessment area including segments of Pecos River, Rio Valdez, Rio Mora, Jarosa Canyon, Rito del Oso, Rito de los Esteros, Rito las Trampas, Bear Creek, and South Fork Bear Creek.

The probability of damage for Bear Creek, Pecos River, Rio Valdez, and Rio Mora is very likely based on the very significant or extreme change for the 50% chance storm. The consequences are minor for Bear Creek and Pecos River because the change is minimal for the 20% chance multiple storm event (i.e., the types of flows that the reach will experience are relatively common). The consequence is moderate for Rio Valdez and Rio Mora because the increased peak flows are all extreme or very significant. Therefore, there is a high risk for Bear Creek and Pecos River and a very high risk for the Rio Valdez and Rio Mora to exceed the State's water quality standard.

Natural Resources—Eligible Wild and Scenic Rivers

Designated wild and scenic rivers (WSR) meet the basic criteria for inclusion in the National Wild and Scenic Rivers System. They are free-flowing and possess at least one value that is outstandingly remarkable, regionally or nationally. Within the HPCC Phase 3 BAER assessment there is one (1) designated WSR segment within the fire perimeter, the Pecos River. The Pecos River Outstandingly Remarkable Values (ORVs) are recreation, scenic, and cultural/historic.

The SBS map for Phase 3 depicts burn severity as moderate and high along the headwaters of the river corridor, with some low SBS adjacent to the riparian corridor of the WSR reach. The lower half of the river is unburned. The probability of damage to water quality is very likely based on changes in modeled peak flow values from pre- to post-fire and soil erosion modeling and expected sedimentation rates. The magnitude of consequence is minor because the change is minimal for the 20% chance multiple storm event (i.e., the types of flows that this reach will experience are relatively common) making the risk low. Some short-term water quality issues, such as sediment, total dissolved solids, and pH balance disruptions could be altered for a short period of time during flushing flood events.

Natural Resources—Hydrologic Function

Threats to the magnitude, timing, and volume of storm water runoff and changes in the condition of stream channels from significant post-fire runoff and sediment are expected. Increased water runoff accelerated sheet and rill erosion throughout the fire areas, as well as the potential for rock fall and debris slides can alter the hydrologic function of streams within and directly below the burned area. The probability of damage to this critical value is very likely based on the clear water flow and hyper concentrated flow model results. These impacts will have a considerable and long-term effects, which makes the risk very high.

Natural Resources—Soil Productivity

The probability of damage or loss for soil productivity in areas with high SBS and severe erosion hazard have a very high risk due to the severe erosion hazard and 1.5-year event modelled soil loss rates that indicated a very likely possibility with a major magnitude due to these rates significantly exceeding soil loss tolerance which can inhibit natural recovery and result in long term impacts.

In areas of moderate SBS and severe erosion hazard, the probability of damage or loss for soil productivity have a very high risk due to severe erosion hazard and the 1.5 year modelled soil loss rates that indicated a very likely possibility with a major magnitude due to a majority of the modelled soil loss rates exceeding at least three times soil loss tolerance levels which can inhibit natural recovery and result in potential long term impacts until effective ground cover is established.

The risk is very high for the probability of damage or loss for soil productivity within areas of high SBS with moderate erosion hazard due to a likely risk from 1.5-year modelled soil loss rates and a major magnitude due to these rates significantly exceeding soil loss tolerance which can inhibit natural recovery and result in long term impacts.

Areas with both moderate SBS and erosion hazard have a high risk for the probability of damage or loss for soil productivity with a likely possibility indicated from 1.5-year modelled soil loss rates and a moderate magnitude because modelled soil loss rates were just over tolerance overall indicating short term impacts to soil productivity.

Modelled soil loss in low SBS was likely due to 1.5-year event modelled soil loss rates but will not inhibit natural vegetation recovery in large areas and will continue to support short-term and long-term ecosystem services resulting in a minor magnitude and overall risk of low.

Natural Resources—Minerals (Mines)

Within the HPCC Phase 3 assessment area, no historical mines were documented on NFS lands. The reclaimed Terrero Mine is located on NM state land at the Pecos River and Willow Creek confluence. Historic mining was for the recovery of precious metals has led to concerns of heavy metals and related contaminants being released onto NFS lands and impacting downstream water quality from post-fire flooding. Under the Wyden Watershed Restoration and Enhancement Agreement authority (Pub. L. No. 105-277), Forest Service funding may be used to accomplish work on non-NFS lands if the work is essential to protect NFS lands or safety of NFS visitors (FSM 2532.53, 2020). The risk is low for the probability of damage or loss related to post fire impacts to water quality from mine spoils and is unlikely because a predicted post-fire event wouldn’t elevate to a 50/100-year pre-fire flow event.

Natural Resources—Rio Grande Cutthroat trout

The Rio Grande Cutthroat trout (RGCT) is a Forest Service region 3 sensitive species managed under a Species Conservation Agreement and is a candidate for federal-listing designation. The probability of damage and loss to the RGCT and their associated occupied designated core conservation streams is likely due to loss of overstory vegetation and slow recovery of conifer species in areas that have been burned at a moderate to high intensity, along with ash and sediment inputs to the streams and increased stream temperatures. These impacts would have considerable long-term effects with the displacement of native fish, impacts of the SBS decreasing soil productivity for native plant communities with an increased overland waterflow transporting sediment and ash to RGCT streams. The risk is therefore high for these native fish community critical values due to the loss of habitat.

Natural Resources—Mexican spotted owl (MSO)

The probability of loss for Mexican spotted owl (MSO) delineated habitats in the HPCC Phase 3 assessment area is likely with moderate consequences because these habitats have experienced loss from the fire, they may potentially experience loss from post-fire impacts of soil loss, prey forage loss, habit structure loss, and is not expected to recover; however, the risk is therefore high for MSO delineated habitats.

Figure 7. Mexican Spotted Owl

Cultural Resources

Cultural resources or historic properties consist of archaeological sites, historic buildings, and traditional cultural properties (TCPs). Significant heritage sites are those listed, or are potentially eligible for listing, on the National Register of Historic Places (NRHP) and are considered nonrenewable and irreplaceable resources. Post-fire erosion threats to cultural resource sites in high to moderate severity burns have been well documented. Sites with surface vegetation removed by wildfire are vulnerable to erosion, slumping, trampling and, with increased ground visibility, artifact looting and theft. Storm runoff, particularly after severe summer monsoons, may wash away significant portions of heritage sites or bury them with mud and debris. Post fire erosion threats include: the development of gullying or riling that can expose and remove subsurface cultural deposits or burials; increased levels of sheet-wash eroding archaeological features and/or removes artifacts from site locations and fire-killed trees that fall, and up-end root systems can result in the destruction of archaeological features/architecture, displace artifacts, and contribute to the exposure of subsurface archaeological deposits including human remains.

There are two analysis areas identified for Phase 3 BAER assessment of the HPCC Fire: 1) the uplands (Pecos Wilderness and headwaters of the Pecos River/Barillas area); and 2) the Pecos River floodplain (Wilderness boundary and south to Dalton Canyon).

Within the uplands area (also entirely in the fire perimeter), there are 22 sites, 3 sites which are eligible for listing in the National Register of Historic Places (NRHP), 3 sites are not eligible, and 16 sites that are unevaluated, or potentially eligible. One of the eligible and three of the potentially eligible (unevaluated) sites fall within high SBS and sit on steep slopes with unstable soils. These resources represent historic cabins and a precontact lithic scatter. Post fire impacts to these critical cultural/heritage resources within the uplands range from a very high to high risk.

Post fire impacts to all other upland sites, regardless of site type, that are within low SBS areas and are on low-steep slopes have a low post-fire risk. No post-fire emergency risk has been identified that is applicable to recommend BAER treatments. Fully rerecording of sites identified as high risk will need to be conducted through regular Forest Service Ranger District work or other means. While the Barillas Lookout Tower is a not eligible archaeological site, debris removal and rebuilding of the tower can potentially be accomplished under BAER treatment funding.

Within the floodplain area of analysis there are 9 sites, 5 which are eligible, 1 is not eligible, and 3 are unevaluated, or potentially eligible. These resources represent historic homesteads, segments of the historic

Old Pecos Road, CCC-era campgrounds, historic acequias, and a multicomponent site consisting of a precontact lithic scatter and historic artifact scatter. Post-fire flooding impacts to these cultural/heritage resources within the 100-year floodplain depend on their location within the floodplain, and whether they are in the path of inundation. These floodplain cultural resources sites have a range of post-fire risk from high to very low.

The acequias are associated with historic Spanish Land Grant agricultural use. Some are still in use today for modern agricultural needs. Risks to these features are intermediate from predicted post-fire elevated flows of the Pecos River that could undermine acequia infrastructure/footprint. The acequias sites are downstream of the HPCC Phase 3 assessed burned area within the Indian Pecos River sub-watershed. A predicted 2-year post-fire flood event is equivalent to a slightly below 5-year pre-fire event resulting in a possible probability. It is not known if all three acequias within the floodplain are actively used or maintained but they are likely known by the community and can be utilized at any time for irrigation needs

Partner Efforts

In addition to identifying and recommending treatments to reduce post-wildfire effects to critical values on NFS lands, BAER team members met and communicated with other federal agencies such as US Geological Survey (USGS), Natural Resources Conservation Service (NRCS), and National Weather Service (NWS). Team members also met with non-federal partners such as the State of New Mexico Forestry Department-EMNRD and New Mexico Acequia Association to understand additional post-fire needs that are outside of the scope of the Forest Service BAER program and shared their analysis and data.

Conclusion

The BAER team identified threats to critical values on NFS lands based on a rapid Phase 3 assessment of the area burned by the HPCC Fire. The team's findings provide the information needed to recommend emergency treatments for managing unacceptable risk to these critical values: human life and safety, and Forest Service infrastructure.

BAER treatment recommendations must undergo an internal review at the local Forest Service Supervisor's Office, Regional Office, and Washington Office, depending upon total treatment funding amounts. The BAER team's recommended emergency treatment objectives for its Phase 3 assessment include:

- Posting area closure and hazard warning signs to control public access to trail and recreation areas, and to inform the public of post-wildfire hazards that exist within the burned area.
- Implementing closure barriers such as gates for public safety from post-fire flooding and debris-flows at key roads, trails, campsites, and trailheads.
- Protecting high value Forest Service roads, drainage crossings, and bridges through storm proofing, culvert cleaning, and strategic armoring to facilitate effective function of NFS investments during events with increased water flows, and sedimentation delivery; and conducting storm inspections and response after rainstorm events.
- Pumping vaulted toilets at NFS recreational facilities where unacceptable risk to human health and safety could occur to prevent effluent waste discharge due to post-fire flooding risk.