Date of Report: 07/21/2016

BURNED-AREA REPORT
(Reference FSH 2509.13)

PART I - TYPE OF REQUEST

A. Type of Report

[x] 1. Funding request for estimated emergency stabilization funds
[ ] 2. Accomplishment Report
[ ] 3. No Treatment Recommendation

B. Type of Action

[x] 1. Initial Request (Best estimate of funds needed to complete eligible stabilization measures)

[ ] 2. Interim Report #____
[ ] Updating the initial funding request based on more accurate site data or design analysis
[ ] Status of accomplishments to date

[ ] 3. Final Report (Following completion of work)

PART II - BURNED-AREA DESCRIPTION

A. Fire Name: Bert

B. Fire Number: AZ-KNF-000327

C. State: AZ

D. County: Coconino

E. Region: 3

F. Forest: Coconino

G. District: Flagstaff

H. Fire Incident Job Code: P3J9NZ

I. Date Fire Started: 05/28/2016

J. Date Fire Contained: 07/01/2016

K. Suppression Cost: $375,000

L. Fire Suppression Damages Repaired with Suppression Funds
1. Fireline waterbarred (miles): 0
2. Fireline seeded (miles): 0
3. Other (identify):

M. Watershed Number: Big Hole Tank (150100040402) (3,840 ac.), Miller Wash Headwaters (150100040403) (1,428 ac.), Dent and Sawyer Tank (150200160601) (485 ac.)

N. Total Acres Burned: 5,753
NFS Acres (5,753) Other Federal ( ) State ( ) Private ( )

O. Vegetation Types: Pinyon pine-Juniper (5,249 ac.), blue grama-Pinyon pine (322 ac.), Fourwing saltbush-needle and thread (89 ac.), ponderosa pine (25 ac.), rabbitbrush-blue grama-western wheatgrass (68 ac.)

P. Dominant Soils: Typic Argiustolls (3,006 ac.), Typic Calciustolls (647 ac.), Typic Haplustalfs (1,919 ac.), Petrocalcic Calciustolls (89 ac.), Vertic Argiustolls (54 ac.), Mollic Eutroboralfs (23 ac.), Pachic Argiustolls (15 ac.),

Q. Geologic Types: Holocene to middle Pliocene basaltic rocks of the San Francisco Volcanic Field (trachyte, dacite, rhyolite, theolite, and sedimentary breccia)

R. Miles of Stream Channels by Order or Class: 1st order (14.3 mi.), 2nd order (1.8 mi.)

S. Transportation System

Trails: 0 miles Roads: 10.9 miles

PART III - WATERSHED CONDITION

A. Burn Severity (acres): 1,681 (very low/unburned) 2,769 (low) 329 (moderate) 974 (high)

B. Water-Repellent Soil (acres): 1,039

C. Soil Erosion Hazard Rating (acres): 4,636 (slight) 861 (moderate) 253 (severe)

D. Erosion Potential: 12.65 tons/acre

E. Sediment Potential: 1,226 cubic yards / square mile

PART IV - HYDROLOGIC DESIGN FACTORS

A. Estimated Vegetative Recovery Period, (years):	5-7 yrs.
B. Design Chance of Success, (percent):	70
C. Equivalent Design Recurrence Interval, (years):	10
D. Design Storm Duration, (hours):	1
E. Design Storm Magnitude, (inches):	1.48
F. Design Flow, (cubic feet / second/ square mile):	27
G. Estimated Reduction in Infiltration, (percent):	60
H. Adjusted Design Flow, (cfs per square mile):	41

PART V - SUMMARY OF ANALYSIS

A. Describe Critical Values/Resources and Threats:

Soil Productivity:

Soil productivity is considered a critical value under Forest Service BAER policy. Draft guidance for determining when risks to soil productivity can be considered unacceptable are in review by the agency personnel. This guidance identifies conditions which may trigger the need for BAER treatments (Draft BAER Guidance Paper, Unacceptable Risks to Soil Productivity (June 2016).

The table below is used for determining magnitude of consequences and probability of damage to soil productivity. The table is used in the context of soil resilience and burn severity/soil development under *natural disturbance regimes* and is used only to evaluate risks associated with effects that are outside of natural range of variability. **Unacceptable risks to soil productivity are those associated with very high risks only.**

BAER Soil Productivity Risk Assessment

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

Probability of Damage or Loss: The following descriptions provide a framework to estimate the relative probability that damage would occur within 3 years:

- Very likely. Nearly certain occurrence (90% - 100%)
- Likely. Likely occurrence (50% - 89%)
- Possible. Possible occurrence (10% - 49%)
- Unlikely. Unlikely occurrence (0% - 9%)

Magnitude of Consequences:

- Major - Predicted post-fire erosion rates will result in significant changes in soil functions such that the area:
  A. Will not support potential natural vegetation, pre-fire vegetation or will result in a state change as described in an Ecological Site Description or;
  B. Will no longer provide the soil-dependent ecosystem services established in a Forest Plan (e.g. timber production, big-game winter range).

  Significant= across large contiguous areas and >15% of soil map unit

Probability of permanent damage or loss of soil pedogenic processes and productivity

The probability of loss of soil productivity in high soil burn severity areas is likely and the magnitude of consequences is high. Terrestrial Ecosystems represent the combined influences of climate, soil and vegetation, and correlates these factors with soil temperature and moisture along environmental gradients (Terrestrial Ecosystem Survey of the Kaibab National Forest, 1991). The dominant soil order throughout the Bert Fire consists of Mollisols, which are defined as soils of high inherent fertility that form in grassland ecosystems. They are characterized as having a thick, dark, humus-rich surface horizon. This fertile surface horizon, known as a mollic epipedon, results from the long-term addition of organic materials derived from plant roots. They often contain high concentrations of calcium and magnesium. The mollic epipedon forms in the presence of bivalent cations, particularly calcium. The base saturation is required to be 50 percent or more throughout the epipedon, meaning they are very fertile soils. These soils are very important terrestrial carbon sinks and sequester very large amounts of atmospheric CO_2. The importance of judicious management of Mollsols cannot be overstated in the context of global climate change mitigation or adaptation strategies. These soils do not form in dense forested or persistent woodland environments.

Grassland soils in the Bert Fire had been severely encroached upon by pinyon and juniper trees. Significant ingrowth had occurred, nearing the point of crown closure in many areas. Investations of beetles had resulted in significant tree mortality and decadent pinyon pine forest conditions, increasing woody detrital inputs to soil surfaces. The ingrown conditions of the invaded pinyon and juniper and woody fuel loads led to high severity, stand replacement fire that will ultimately result in a vegetation type conversion from woodland invasion back to grassland since pinyon and juniper mortality was 100 percent in moderate and high burn severities. High burn severity has also resulted in complete consumption of vegetative ground cover and soil organic matter to depths of 6 to 10 cm., so there is now insufficient ground cover and fine root biomass to protect soil surfaces from accelerated erosion and the seed bank (which was becoming sparse due to the high density of pinyon and juniper trees) has been severely degraded or destroyed entirely. In the absence of treatments to reestablish herbaceous vegetative ground cover, the type conversion back to grasslands would not occur at a rate sufficient to maintain the mollic epipedon. The loss of effective ground cover means that the soils have lost the ability to dissipate rainfall, prevent soil particle detachment (rainsplash) and entrainment, and regulate surface runoff. Even with average monsoon precipitation, erosion rates will be accelerated as a result of higher surface runoff efficiencies in these areas. The lack of adequate vegetative cover, litter, and fine root biomass will contribute to chronic erosion and soil creep resulting in loss of the mollic epipedon and associated nutrients. These soils will become a source of atmospheric CO_2 (a known greenhouse gas) rather than a sink and will therefore have potential to contribute to global climate change, albeit on a somewhat limited scale. The probability of permanent damage or loss of soil pedogenic processes, soil productivity, and ecosystem services is therefore ***very likely***.

Conditions outside the natural range of variability of natural disturbance regimes

Under natural conditions, wildfires in grasslands of the Kaibab National Forest tend to sweep across the landscape consuming only the tops of bunch grasses and forbs, and leaving lower portions of plants intact. Soil burn severities are typically very low to low and vegetative growth respose is usually positive and rapid following the first monsoon precipitation events. Wildfires typically increase organic carbon pools in grasslands by as much as 5-30 percent. Fire induced increases in soil organic matter in grasslands results in greater sequestered atmospheric CO_2 since is recalcitrant against decomposition due to lower nitrogen content that vegetative litter. Grassland fires also rarely result in complete removal of vegetative ground cover and associated litter, but instead create a mosaic of burned and unbured conditions, thereby limiting soil erosion potential. Often there is sufficient seed remaining in unburned areas to hasten vegetative recovery.

High soil burn severities in the encroached pinyon juniper grasslands has resulted in complete removal of all vegetative ground cover and litter. Fine roots of bunch grasses have been consumed to an average depth of 3 inches in high burn severities. Fire roots and most crowns of bunch grasses remain intact in low and moderate soil burn severities. High soil burn severities are therefore outside the natural range of variation for typical soil burn severities in natural grasslands.

With the forest canopy, protective vegetative ground cover, and seedbank consumed by the fire, there is little potential for revegetation of these soils in a reasonable timeframe (i.e., less than 7 years), rendering them susceptible to accelerated erosion for several years to come. If these soils are left to erode, significant loss of soil productivity for supporting the native grassland community will be lost in perpetuity as soil depth (i.e., rooting volume) will be reduced. Soils are considered a non renewable resource in that they will not redevelop *in situ* in the same manner as they had originally formed due to changes in climate, weather patterns, vegetative communities, and soil physical and chemical properties. Soil loss would therefore constitute an irreversible and irretrievable loss of forest resources.

Due to loss of native plant communities in areas of high burn severity, these areas and adjacent low and moderate burn severity areas are at risk of spread of invasive and noxious weeds, particularly cheatgrass (*Bromus tectorum*). Additionally, recreational use of the roads within and adjacent to the burned area increases the risk of introduction of invasive and noxious species.

In the absence of protective vegetative ground cover, soil erosion rates in moderate and high burn severities are expected to be above tolerance threshold levels for the next 3-5 years, and possibly longer. Erosion rates as high as 12.65 tons per acres could occur in moderate and high burn severity areas. Areas where sufficient rock and gravel cover exist will experience substantially lower erosion rates than the maximum predicted, and therefore require no emergency stabilization/revegetation treatment. If the average post-fire erosion rate in high burn severity areas is 8 tons per acre during the first year (two thirds of the predicted rate), and 4 tons per acre during the second year, the total value of soil loss over the first two years of recovery is $350,640.00 based on a commercial topsoil value of $30.00 per cu. yd. The magnitude of consequences of permanent damage or loss of soil pedogenic processes, soil productivity, and ecosystem services is *very high*.

Surface water quality:

The probability of short term surface water quality degradation is likely and the magnitude of consequences is moderate. Domestic livestock, wildlife ungulates, avifauna and other wildlife could experience animal health issues when ash, organic matter and sediment degrade water quality in livestock/wildlife waters. Ash flow and sediment delivery to streamcourses and livestock/wildlife waters that are proximal to high soil burn severity areas are common and well docmented phenonena on the Kaibab National Forest. The probability of damage or loss of surface water quality is *very likely* and the magnitude is *high*.

Livestock/wildlife waters:

The probability of damage to livestock/wildlife waters is possible and the magnitude is moderate. The following livestock/wildlife waters are at significant risk of sedimentation, dam breach, or spillway damage due to high burn severity in headwater areas: Ebert Tank, Hibben Tank, Miller Wash Tank, and Platten Tank. These livestock/wildlife waters are important infrastructure in this grazing allotment pasture for both livestock production and wildlife. The grasslands surrounding the fire are a very important migratory corridor of a very large herd of pronghorn antelope. If high levels of sediment and ash are delivered to these stock tanks, domestic livestock and wildlife ungulates could become mired in deep sediment/mud resulting in animal mortality. The probability that large amounts of sediment and ash cold be delivered to these livestock/wildlife waters is *very likely*. However, since these effects are of a limited scale (ie., a single allotment pasture), the magnitude of consequences is *minor*.

Forest Roads:

The probability of damage is possible and the magnitude of consequences is minor. Stream crossings and road surfaces below high burn severity areas are at risk of washing out at several locations on Forest Roads 710, 774, and 2004. These roads and their associated stream crossings are somewhat infrequently used and are of minimal construction standard (maintenance level 2). Stream crossings are ephemeral, so water is rarely present, limiting the potential to degrade surface water quality during roads use. The probability of damage or loss of forest roads resources is *possible* and the magnitude of consequences is *intermediate*.

B. Emergency Treatment Objectives:

Ground based seeding of selected high soil burn severity areas is intended mitigate soil loss and impaired soil hydrologic function. It will also help to mitigate adverse effects to surface water quality, particularly in livestock and wildlife waters. Elevated soil erosion, sedimentation, runoff, and stream flows could continue for 7 years or longer after the fire, until vegetation has sufficiently recovered to restore the surface soil-hydrologic function and processes of the watersheds that burned at moderate and high severity. This treatment will provide an opportunity for native grasses to germinate and establish to a point where they can compete with invasive species such as cheatgrass and other noxious weeds.

Seeding approximately 308 acres of moderately deep, loamy soils in high burn severity areas in headwater basins will provide protective ground cover, and reduce soil erosion and sediment delivery to drainages. This treatment will: a) prevent loss of long term soil productivity, b) prevent damage to forest road infrastructure within and immediately adjacent to the burned area, c) protect important livestock/wildlife waters from delivery of sediment and nutrient-laden ash, d) protect animal health through improved surface water quality in livestock/wildlife waters, and e) restore the seedbank in areas where vegetative recovery is expected to be slow (i.e., >7 years).

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

Land __75__ % Channel ___ % Roads/Trails ___ % Protection/Safety ___ %

D. Probability of Treatment Success

	Years after Treatment		
	1	3	5
Land	70	75	85
Channel	N/A	N/A	N/A
Roads/Trails	N/A	N/A	N/A
Protection/Safety	N/A	N/A	N/A

E. Cost of No-Action (Including Loss):

Based on an estimated cost of $30.00 per cu. yd. for commercial topsoil, the estimated value of soil loss from high soil burn severity areas in the absence seeding treatments (i.e., no-action) is approximately $350,640.00 during the first two years of recovery. Note: This cost does not include the value of soil loss in low and moderate soil burn severity areas, which are not proposed for treatment, nor does it include the value of soil loss that would occur after the second year of post-fire recovery.

The estimated cost of damage repair to livestock/wildlife waters (sediment removal and spillway repair to restore conservation pool level) is $9,000 per water body. Four water bodies are at risk of post-fire damage (Ebert Tank, Hibben Tank, Miller Wash Tank, and Platten Tank). The total post-fire damage cost to livestock/wildlife waters could exceed $36,000.

Road maintenance at ephemeral stream crossings would include blading and reestablishment of the traveled way. The cost of road repair is estimated to be approximately $1,800 per stream crossing and adjacent road segment. There are 6 stream crossings that are at risk of failure (i.e., washing out). The total one-time repair cost for all of these stream crossings is estimated to be approximately $10,800.00.

The total cost of No-Action is therefore estimated to be $397,440.

F. Cost of Selected Alternative (Including Loss):

The estimated cost of seeding 308 acres with a native cereal grain (western wheatgrass)(20 lbs. per acre, barley (8 lbs. per acre) and sideoats grama (2 lbs. per acre) using ground-based seeding (UTV with seed spreaders or seed drill is $98,000.00, or $318.00 per acre.

G. Skills Represented on Burned-Area Survey Team:

[x] Hydrology	[x] Soils	[ ] Geology	[x] Range	[ ]
[ ] Forestry	[x] Wildlife	[**x**] Fire Mgmt.	[ ] Engineering	[ ]
[ ] Contracting	[ ] Ecology	[ ] Botany	[ ] Archaeology	[ ]
[ ] Fisheries	[ ] Research	[ ] Landscape Arch	[x] GIS	

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H. **Treatment Narrative:**

(Describe the emergency treatments, where and how they will be applied, and what they are intended to do. This information helps to determine qualifying treatments for the appropriate funding authorities. For seeding treatments, include species, application rates and species selection rationale.)

Land Treatments: Ground-based seeding of 308 acres of high burn severity areas on steeper slopes in headwater areas using a certified weed-free cereal grain (western wheatgrass (*Pascopyrum smithii*). This treatment is intended to: a) minimize loss of soil pedogenic processes, b) minimize loss of long term soil productivity, c) reduce soil erosion and sediment delivery to ephemeral drainages, d) prevent damage to forest roads (FR710, FR774, FR2004) and e) minimize sediment delivery or spillway damage to Ebert Tank, Hibben Tank, Miller Wash Tank, and Platten Tank.

Seeding increases the likelihood of successful soil stabilization by reestablishing vegetation in high burn severity areas. Seeding applications are typically most effective beyond the first growing season. However, success has often been achieved within the first year in Northern Arizona when seeding is performed immediately before or during monsoon precipitation patterns or before winter snowfall occurs.

Recommended seed mix is as follows:

Common Name (species)	**Lbs. per acre**
Western wheatgrass (*Pascopyrum smithii*)	20
Barley (*Hordeum vulgare*)	8
Sideoats grama (*Bouteloua curtipendula*)	2

Invasives Early Detection and Rapid Response (EDRR):
Monitoring of seeding treatment would be necessary to evaluate treatment effectiveness (i.e., successful seed germination and stand establishment) and to ensure that there are no invasive or noxious weeds introduced with seed. Monitoring of seeded treatment areas during the early growth stage provides an opportunity to detect invasive and noxious weed species and implement mitigation measures to prevent population expansion. Monitoring helps determine if soil productivity objectives are being achieved.

Channel Treatments: N/A

Roads and Trail Treatments:

No roads or trails treatments are recommended. However, storm patrols should occur after major precipitation events to determine if there are risks to human life and safety as a result post-fire effects.

Protection/Safety Treatments: N/A

I. **Monitoring Narrative:**
(Describe the monitoring needs, what treatments will be monitored, how they will be monitored, and when monitoring will occur. A detailed monitoring plan must be submitted as a separate document to the Regional BAER coordinator.)

Part VI – Emergency Stabilization Treatments and Source of Funds **Interim # 1**

			NFS Lands			Other Lands				All
		Unit	# of		Other	# of	Fed	# of	Non Fed	Total
Line Items	**Units**	**Cost**	**Units**	**BAER $**	**$**	**units**	**$**	**Units**	**$**	**$**
A. Land Treatments										
Seeding (ground-based)	acre	280	308	$86,240	$0		$0		$0	$86,240
Invasives EDRR	days	600	8	$4,800	$0		$0		$0	$4,800
Subtotal Land Treatments				$91,040	$0		$0		$0	$86,240
B. Channel Treatments										
				$0	$0		$0		$0	$0
Subtotal Channel Treat.				$0	$0		$0		$0	$0
C. Road and Trails										
Storm Patrol	days	600	8	$4,800	$0		$0		$0	$4,800
Subtotal Road & Trails				$4,800	$0		$0		$0	$4,800
D. Protection/Safety										
				$0	$0		$0		$0	$0
Subtotal Structures				$0	$0		$0		$0	$0
E. BAER Evaluation										
Person Days	each	380	6		$2,280					
Mileage	miles	0.33	172	---	$57		$0		$0	$57
Subtotal Evaluation				---	$57		$0		$0	$57
F. Monitoring										
Subtotal Monitoring				$0	$0		$0		$0	$0
G. Totals				$95,840	$2,337		**$0**		**$0**	**$91,097**
Previously approved										
Total for this request				**$95,840**						

PART VII - APPROVALS

1. /s/ Jacqueline C. Banks (for) — 7/21/2016

Forest Supervisor (signature) — Date

2. ______________________ — ________

Regional Forester (signature) — Date