Date of Report: September 12th, 2013

DUGAN FIRE
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

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

[X] 2. Interim Report
[X] 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: Dugan

B. Fire Number: MT- MCD - 171

C. State: Montana

D. County: Carter

E. Region: Northern (1)

F. Forest: Custer

G. District: Sioux

H. Fire Incident Job Code: PDG8DC

I. Date Fire Started: 09/14/2012

J. Date Fire Contained: 9/19/2012

K. Suppression Cost: TOTAL: $684,300

L. Fire Suppression Damages Repaired with Suppression Funds
1. Fireline waterbarred (miles): Handline 0; Dozerline 25 Total Miles of which 6.5 is on NFS lands
2. Fireline seeded (miles): 0
3. Other (identify): 0

M. Watershed Numbers: Sixth Level Watershed Acres by Ownership and Severity

6th Code HUCs / Burn Severity	Montana State Trust Lands	Private Land	US Bureau of Land Management	US Forest Service	Grand Total
Big Ramme Creek - 101102020503					
Unburned / Unclassified		12	1	24	37
Low		276	108	180	564
Moderate		40	97	210	346
High		0	50	35	86
Subtotal		328	255	449	1033

6th Code HUCs / Burn Severity	Montana State Trust Lands	Private Land	US Bureau of Land Management	US Forest Service	Grand Total
Fresh Water Draw - 101102020401					
Unburned / Unclassified	1	165	1	7	174
Low	34	492	47	189	761
Moderate	1	62	57	195	315
High		10	1	15	26
Subtotal	36	729	106	405	1276
Headwaters Little Beaver Creek - 101102011002					
Unburned / Unclassified	86	177	0	15	277
Low	550	859	15	1448	2872
Moderate	3	211		1764	1979
High		78		665	743
Subtotal	639	1325	15	3892	5871
Little Beaver Creek-Dugan Draw - 101102011003					
Unburned / Unclassified	0	21	1	33	55
Low	0	276	59	455	790
Moderate		39	15	702	757
High				122	122
Subtotal	0	336	75	1312	1724
Russell Creek - 101102011004					
Unburned / Unclassified	0	0	0	9	9
Low	0	0	0	331	331
Moderate				152	152
High				6	6
Subtotal	0	0	0	498	498
Grand Total	675	2718	452	6557	10401

N. Burned Acres by Ownership

Ownership within Dugan Fire Perimeter	Total Acres	Percentage
Montana State Trust Lands	676	6%
Private Land	2777	27%
US Bureau of Land Management	452	4%
US Forest Service	6569	63%
Grand Total	**10474**	

Note: Due to a difference between data types used to generate ownership and burned area acreage totals, acreage varies between tables. This difference equates to less than one percent of the fire acreage.

O. VegetationTypes: Grass, shrubs & ponderosa pine timber in rough and steep coulees

P. Dominant Soils: Dominant parent materials are slope alluvium and colluvium over residuum derived from semiconsolidated sedimentary beds. Majority soil series (Dast-Vebar complex, 15-35% slopes) is classified as coarse-loamy, mixed, frigid Typic Ustochrepts. Other soils with significant representation within the fire perimeter include fine-loamy, mixed, superactive, frigid Typic Argiustolls/Haplustolls/Haplustalfs.

Q. Geologic Types: The Ekalaka Hills consists of a series of sedimentary and volcanic strata forming a butte above the surrounding prairie. Bedrock geology consists of the Arikaree formation overlaying several members of the Fort Union Formation.

R. Miles of Stream Channels by flow regime:

Stream Channel Type	Miles
Perennial	0.07
Ephemeral	36.12
Grand Total	**36.19**

S. Transportation System:

Roads within Fire Perimeter, Summarized by Jurisdiction	Miles
COUNTY	**2.27**
No Maintenance level assigned	2.27
FOREST SERVICE	**26.55**
Closed	1.42
High Clearance Vehicles	16.92
Suitable for Passenger Cars	6.13
No Maintenance level assigned	2.08
PRIVATE	**2.35**
High Clearance Vehicles	2.31
No Maintenance Level assigned	0.04
Grand Total	**31.17**

PART III - WATERSHED CONDITION

A. Burn Severity (Acres):

Burn Severity	Montana State Trust Lands	Private Land	US Bureau of Land Management	US Forest Service	Grand Total
Unburned / Unclassified	87	375	3	88	552
Low	584	1903	228	2603	5318
Moderate	4	352	169	3024	3549
High	0	88	52	843	983
Grand Total	675	2718	452	6557	10401

*59% NFS lands in the High and Moderate categories.

B. Water-Repellent Soil (acres): 3,867 (FS acres, assuming acreage in moderate to high burn severity all displays moderate to strong hydrophobicity)

C. Soil Erosion Hazard Rating (acres)

Erosion Hazard Rating	Acres	Percentage
Slight	3854.5148	36.5
Moderate	3983.8533	37.8
Severe	2550.5302	24.2
Very severe	162.4870	1.5

D. Erosion Potential: 4.5 tons/ac (ERMiT results for representative hillslope in Dugan Draw, moderate burn severity 1 year post-fire)

E. Sediment Potential: 7.7 cubic yards / square mile

PART IV - HYDROLOGIC DESIGN FACTORS

A. Estimated Vegetative Recovery Period, (years): 1-5

B. Design Chance of Success, (percent): 80

C. Equivalent Design Recurrence Interval, (years): 5

D. Design Storm Duration, (hours/minutes): 6 hour/30 minutes

E. Design Storm Magnitude, (inches): 1.8 inches/.7 inches

F. Design Flow, (cubic feet / second/ square mile): 27 cfs/mi^2

G. Estimated Reduction in Infiltration, (percent): 36

H. Adjusted Design Flow, (cfs per square mile): 132 cfs/mi^2[1]

PART V - SUMMARY OF ANALYSIS

A. Critical Values/Resources and Threats:

Summary of Watershed Response

The Dugan Fire, whose cause is as yet undetermined, started near the north end of the Ekalaka Hills in the vicinity of the JP Smith Road where it crosses BLM land. The fire burned in a generally clockwise fashion in the Ekalaka Hills south approximately three miles south of Ekalaka. The fire initially burned north under low to moderate burn intensity and severity conditions, then turned south and burned toward the Stagville Road. Following this generally southerly run that ended south of the Ekalaka Park Campground, the fire turned west and burned through the Smith Creek drainage prior to settling down. Widespread crown fire and torching was observed during this final burn window. Site review following fire found numerous down large logs that had nearly completely burned and left lines of oxidized soil across hillslopes.

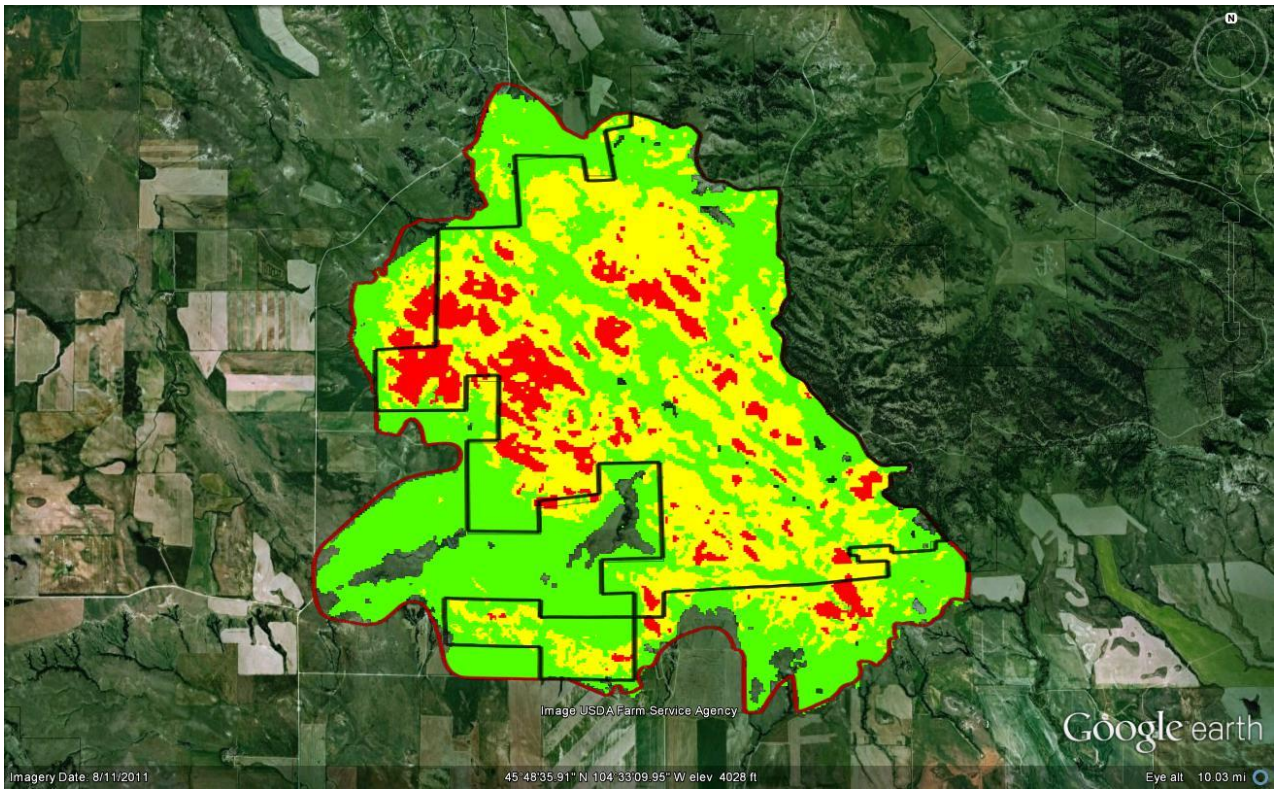

Figure 1. Dugan Fire Burn Severity Map (Red=High; Yellow=Moderate; Green=Low)

[1] Average for all watershed areas modeled for road/stream crossing structures. Maximum modeled value was 284 cfs/mi^2.

The Dugan Fire had substantial areas of high severity burn on the National Forest portion of the fire within the Sioux District boundary. Ponderosa pine stands, with their higher fuel loadings, generally burned much hotter than adjacent grasslands, particularly on north facing slopes. These areas have the majority of the post fire values at risk that can be addressed by the Burned Area Emergency Response (BAER) authorities. Downslope and downstream areas of concern on private land were judged by the NRCS staff as minimal.

With the loss of ground cover from burning, loss of overstory vegetation, and water repellent (hydrophobic) conditions found within the fire area there is a risk of post-fire erosion from a short duration-high intensity rainstorm in the next several years. Areas within the moderate intensity burn are of greatest extent and could have up to 4.5 tons ac^{-1} of potential erosion, a four-fold increase over background erosion rates. The lack of canopy cover and exposure of bare soil could exaggerate the potential erosion in these areas. Grasslands comprise a substantial area within fire perimeters, particularly on private land. While most grassland vegetation (grass, forbs, sagebrush) was consumed, fires in these areas burned quickly and did minimal soil heating. Burned severity across grasslands was determined to be low with only a few scattered areas of moderate or high severity where pockets of heavy fuel were present.

Moderate severity with moderate to high intensity fire occurred across the majority of the burned timberlands. Tributary headwaters are generally steep to very steep. Significant hydrologic response from high intensity rain events is anticipated in all small tributary drainages that burned under these conditions. Excessive overland flow is likely with concentrated flow developing in these tributary channels. These small normally dry channels with ephemeral flow regimes when burned may produce flood flows with sufficient magnitude to down cut through colluvium and transport sediment to valley bottoms downslope. Because summer convectional thunderstorms generally are short duration and generally less than 5 miles in size, flood flows will diminish as burned tributary channels enter higher order channels downstream.

Fire intensity was generally high enough to scorch the entire crown of most trees that burned with high intensity. It is anticipated that high mortality will occur in the ponderosa pine timber stands. In these areas vegetative recovery will be slow and therefore post-fire hydrologic response is expected to last five or more years. Smaller tributary drainages that burned with moderate to high severity will be the most likely produce localized flood discharge levels that may exceed capacities of culverts located down gradient.

Figure 2. Example of high severity burn conditions within the Dugan Fire perimeter.

Values at Risk:
Risks were assigned based on Interim Directive No. **2520-2010-1**.

The BAER interdisciplinary team identified issues that result from fire effects within the Dugan fire. The primary watershed effects from the fires include a potential reduction in infiltration due to water repellency, with the resulting increase in potential runoff. Increased runoff, especially where the vegetation and surface duff layer has been burned will result in increased potential for higher peak flows, soil erosion, and sedimentation. Protection of life and property were given high priority. After examination of the fire area the BAER team, in consultation with other specialists, identified the following values at risk. The following post-fire effects and identified values at risk were identified and addressed where possible with BAER treatment proposals:

- **Road System:** The Dugan Fire contains 25 miles of system roads and administrative routes. These roads provide the transportation network needed to fulfill forest management objectives- including the Ridge Timber Sale, which will now be salvage logged- and sole access to private lands. Of those roads open to public access, 25% fall within areas burned under moderate to high severity. This does not account for total area in moderate to high burn severity draining to roads within and outside the burn perimeter. These roads are vulnerable to accelerated erosion due to increased overland flow from burn areas, excessive ditch erosion, loss of road fill, filling of drain structures, and damage or washing out of road culverts. Road segments were identified which have the most potential post-fire road surface drainage problems and/or under-sized culverts unable to handle post-fire stream flows as a result of the increased runoff. Proposed treatments are primarily for storm proofing techniques to handle the post-wildfire design storm flows.

- **Heritage/Cultural Resources:** Ten previously recorded cultural sites are located within the fire perimeter. Of these, eight are recommended for emergency protective treatments. The infrastructure concerns associated with the road system and the Ekalaka Park Campground are exacerbated because of the cultural significance of these sites. Those concerns will be addressed as discussed under Road System and Developed Recreation Sites. Hazard tree removal will be necessary to prevent further damage to two archaeological sites within the fire perimeter.

- **Developed Recreation Sites:** The Ekalaka Park Campground lies within a concave drainage surrounded by long, steep slopes. The fire burned with high intensity and severity across these slopes, creating conditions highly conducive to extreme runoff and sedimentation. Further exacerbating the issue is the fact that soils on the adjacent hillslopes have a severe erosion hazard rating under fully vegetated conditions. Hazard trees surrounding the campground are also of concern. A final compounding factor of concern is the heavily increased potential deposition of soil containing erionite, an asbestos-like fiber that can pose a significant health to FS personnel and the general public alike. To retain this historic campground setting and mitigate the health hazard posed by erionite deposition, action will be required.

- **Soil Productivity:** High intensity rainfall during the first several years following the fire will accelerate soil erosion. The loss of a major portion of the topsoil could significantly reduce soil productivity of those sites. In addition, pre-fire populations of noxious weeds are anticipated to significantly increase as a result of the fire and potentially impact soil productivity. While soil productivity is an important, it is not by itself a treatable BAER Value at Risk. Therefore, no specific treatments have been proposed to mitigate impacts to soil productivity from the fires.

- **Water Quality:** Increased sediment and nutrient yields are anticipated from portions of watersheds that burned at moderate or greater severity. While water quality is very important, due to a lack of downstream values likely to be adversely affected, no stand-alone treatments such as broad scale mulching and seeding have been proposed to mitigate impacts. However, many of the requested road treatments to protect infrastructure will reduce risks of erosion and impacts to water quality.

- **Potential Loss of Native Vegetation and Ecological Integrity due to Weed Infestation and Spread** For most noxious weed species identified in the fire complex, disturbed sites and dry potential vegetation types are the most at risk from invasion and spread. Disturbed areas would be roads, gravel pits, dispersed recreation sites, livestock spring developments and where ground disturbing fire suppression actions occurred (dozer lines, hand lines, helispots, safety zones, and drop points). Weed detection and treatment of fire induced weed spread is requested.

- **Potential Loss of Native Vegetation Recovery and Soil Stabilization without Livestock Deferment** Fires can be a devastating event, but at the same time, fire can provide many benefits to rangeland. Managing rangeland after fire can mean the difference between rangeland improvement or rangeland damage. The ability of rangelands to recover and produce forage following the fire depends on three factors – moisture conditions, time of burning, and management in the following years. One cannot control the first two factors, but permitted livestock will be deferred until after the first growing season in the 2013, at a minimum, to help rangelands recover and soil to stabilize.

- **Erionite:** The majority of the Dugan Fire is underlain by the Arikaree formation. Sampling conducted by the CNF within this geologic formation has identified the presence of erionite, a naturally occurring asbestos form mineral in concentrations ranging from trace to 20%. Recent investigations have identified potential human health and safety concerns associated with inhalation of erionite fibers, similar to concerns associated with asbestos. While presence has been established, extent to which individuals are inhaling erionite fibers when working in this area is unknown. Further, it is unknown how wildfire may affect erionite exposure risk to FS personnel working within the fire perimeter as well as potential for increased off-site travel. *Of note is that all project work proposed within this request will be contingent upon the results of sampling within the fire perimeter to ensure FS employee and contractor safety during implementation.*

- **Eolian Transport of Erionite:** High winds common to the area coupled with loss of vegetative cover on areas burned under high and moderate severity fire will be highly conducive to off-site ash and mineral soil transport until understory vegetation recovers. Off-site ash and soil transport may exacerbate erionite exposure for residents adjacent to the Ekalaka Hills. Aerial seeding was explored as an option to mitigate this potential hazard. This treatment was projected to cost between $800,000 and $900,000 and has had only marginal success in past applications on the CNF. Because the cost-effectiveness of this treatment is questionable, no request for seeding is being made at this time.

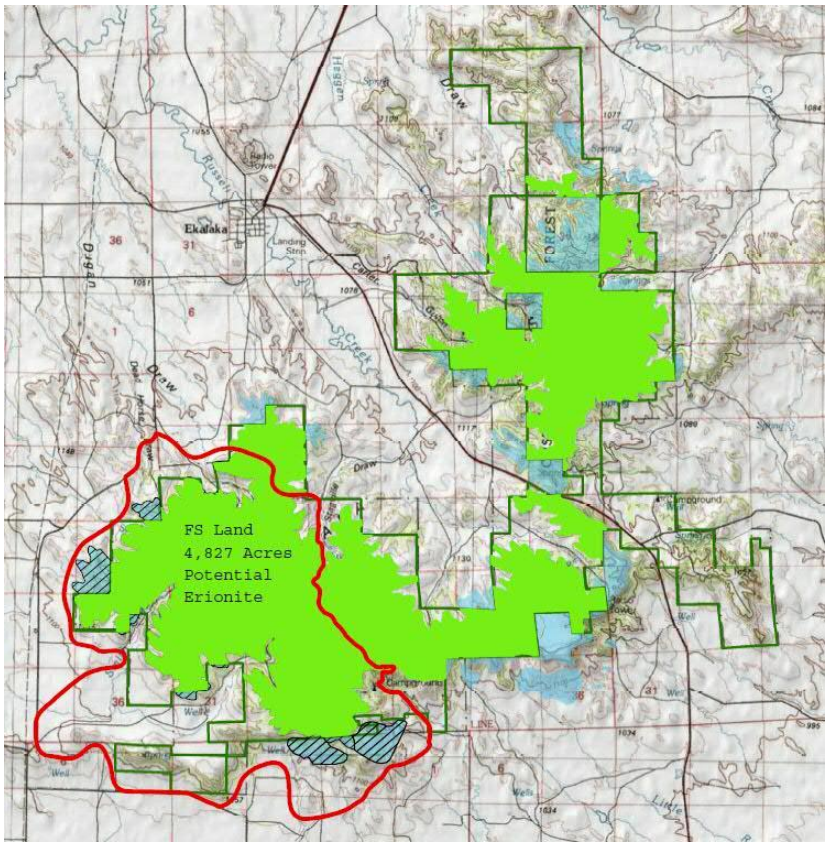

Figure 3. Map of the Dugan Fire perimeter relative to surficial bedrock geology containing erionite.

In accordance with the revised Forest Service manual, the risk matrix below, Exhibit 2 of Interim Directive No.: 2520-2010-1, was used to evaluate the Risk Level for each value identified during the Dugan Fire BAER assessment. Only treatments that had a risk of Intermediate or above are recommended for BAER authorized treatments.

The risk levels by resource included soils, roads, weeds, heritage, erionite, developed recreation sites, and water quality. Only roads, weeds, erionite, and developed recreation sites had risk levels of intermediate or greater and therefore are the only resources recommended for BAER funded treatments. Heritage concerns were accounted for within the matrix through their linkage with other values at risk. Administrative action will be taken for natural recovery by permitted livestock deferment and recreationist safety by campground closure; BAER funds are not requested for these actions.

Probability of Damage or Loss	Magnitude of Consequences		
	Major	Moderate	Minor
	RISK		
Very Likely	Very High erionite	Very High developed rec sites (heritage)	Low
Likely	Very High road system (heritage)	High weeds	Low
Possible	High	Intermediate soil productivity	Low
Unlikely	Intermediate	Low water quality	Very Low

B. Emergency Treatment Objectives:

- Roads - Mitigate effects of changed post-fire watershed responses (runoff,erosion, and deposition) by stormproofing selected road areas, and protect human life and safety at specific locations where Forest roads and stream crossings are at risk of damage or failure.
- Provide for safety and facility/resource protection from hazard trees in concentrated work areas for BAER treatments.
- Weeds and native vegetation recovery - Reduce the risk of expansion of existing weed seed beds and infestations of noxious weeks and allow burned plant communities to recover more rapidly.
- Address safety concerns associated with erionite through further sampling and development of mitigations.
- Mitigate effects of changed post-fire watershed response on cultural resources.
- Address increased hillslope erosion and potential for erionite deposition in Ekalaka Park Campground through implementation of hillslope stabilization measures.

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

Land **90** % Channel **na** % Roads/Trails **90** % Protection/Safety **95** %

D. Probability of Treatment Success

Years after Treatment

	1	3	5
Land (weeds)	70	70	90
Land (slope stabilization)	95	95	95
Channel	na	na	na
Roads/Trails	95	85	75
Protection/Safety	na	na	na

E. Cost of No-Action (Including Loss): $646,391

It is estimated that without noxious weed treatment, cost would be about $43,200. This is based on the estimated cost for weed detection and treatment action is $42,000 due to 14% anticipated increase in weed expansion and a cost of $1,200 for loss of forage from vegetation type conversion from native forage to leafy spurge. Estimated engineering costs associated with replacing infrastructure post-failure would increase by 40%.

F. Cost of Selected Alternative: $437,008

A total of $24,200 will be needed for noxious weed detection ($4,900) and treatment ($19,300). NOTE: There is an acknowledgement that there is a cost of the selected alternative to Term Grazing Permit holders for deferring approximately 1159 AUMS which equates to about $21,000 to relocate livestock during that timeframe.

G. Skills Represented on Burned-Area Survey Team:

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

Team Leader: Andy Efta

Email: Andy Efta jefta@fs.fed.us Phone 406-255-1407 kreid@fs.fed.us Phone: 406-255-1413

Core Team Members:

- Andy Efta – Hydrology, Soils
- Kim Reid – Range/Botany/Noxious Weeds
- Dave Shimek – Engineering
- Andy Wilber – Engineering

- Andy Godtel – Hydrology Assist
- Buck Buchanan – Range/Weeds
- Meghan Reedy–Range/Weeds
- Nathan Baver – Range/Weeds
- Tawni Cordell – Recreation
- Bobby Cordell - Fuels
- Halcyon LaPoint – Heritage
- Mike Bergstrom – Heritage
- Pat Pierson- Geology
- Rebecca Wolentz and Wayne Yost – NRCS, Private lands Range/Weeds
- Kirk Anderson – BLM, Range/Weeds

H. Treatment Narrative:

Land Treatments

Ekalaka Park Campground Slope Stabilization: Under the standardized NRCS classification scheme for erosion hazard rating, soil series found on hillslopes adjacent to Ekalaka Park Campground fall within the category of "severe" erosion hazard (note that this rating applies under unburned conditions). The Dugan Fire burned under high severity on all slopes adjacent to the campground. Under these conditions, hillslope runoff and erosion modeling predicted an increase in runoff of four times that pre-fire and an increase in erosion of five times that of background rates if left untreated (Efta 2012)[2]. Primary areas of soil loss will be steep slopes near the top of the watershed, with lower slopes likely to experience deposition following shorter entrainment distances. Models show a high likelihood of erosion from above the boundary between the Arikaree formation (where erionite has been found) and deposition in close proximity to the campground if not directly within it (Figure 4).

To mitigate this issue, selective tree felling and broadcast seeding with native species is proposed. Tree falling will be conducted such that trees are fallen cross-slope where feasible. Increased slope roughness will shorten runoff flowpath lengths, which in turn will minimize sediment transport distance and prevent seed from leaving the site.

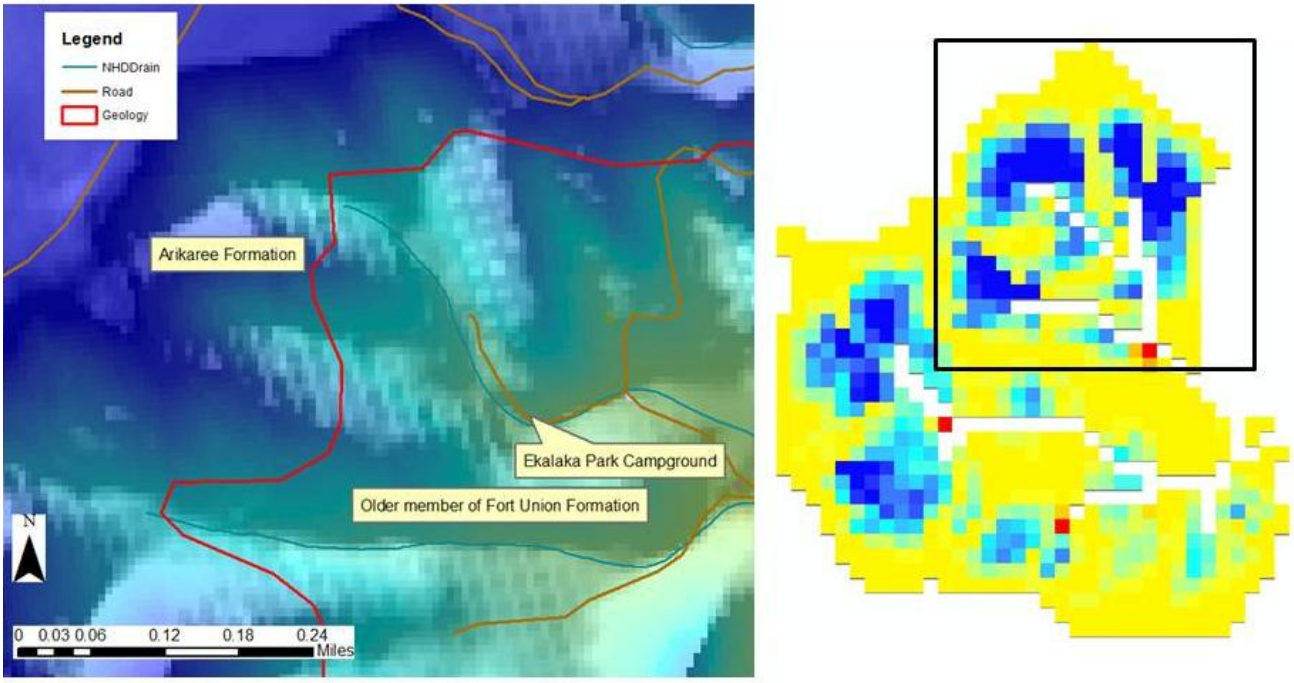

Figure 4. Map showing location of Ekalaka Park Campground as related to Arikaree formation (left) and WEPP predicted flowpath sediment loss (right). Blue indicates areas of erosion while yellow and red indicate areas of deposition. The black square on the right denotes the watershed area displayed within the left image (from Efta, 2012).

[2] Efta, A. 2012. Dugan Fire BAER Hydrology/Soils Report.

Weed Treatments: The fires burned grassland and forest land, and eliminated natural competition for invaders. The fire-caused disturbance created perfect habitat for noxious weed invasion and expansion. If emergency mitigation activities are not implemented, this problem will very likely expand exponentially and will require extensive future resources to manage.

The emergency to the resource caused by the fire is of a high priority, especially in those areas which have highly invasive species concentrations prior to the burn. About 868 gross acres (NFS) of the Dugan Fire is predominately infested with leafy spurge with isolated areas of spotted knapweed. Even though minor density weed infestations existed in pre-fire conditions, the seed banks in the soils associated with those infestations have long term viability aspects that will take advantage of post-fire conditions. Although the estimated net infested acreage is small (130 acres) in the context of the gross fire area, the entire ~6,500 NFS acre fire area provides a seed bed where weed seeds can become established from several spread vectors and remain viable in the soil for years. Weed seed viability can last up to 8 years for leafy spurge which produces up to 4000 pounds seed per acre and has a robust and substantial rhizomatous root system that sprouts vegetatively upon disturbance such as fire. Additionally, nearby infestations of houndstongue and white top may appear in this post-fire newly created seed bed. Weed seed viability can last up to 20 years for spotted knapweed which can produce up to 40,000 seeds per plant. Additionally, nearby infestations of houndstongue and whitetop may appear in this post-fire newly created seed bed.

Over 25 miles of dozer suppression lines were constructed. About 6.5 miles occurred on NFS lands and are considered prime weed beds, especially where there are known seed beds and infestations being in the area and suppression activities possibly moving seed source around suppression lines. 24 net acres of weed treatment are anticipated in the overall dozer line gross area of 158 acres. Weed wash stations were not established in Ekalaka at the incident command post so firefighting activities did not have this preventative measure which makes some of the fire area more vulnerable to new weed seed sources.

BAER team vegetation experts assessed areas at risk from invasion and potential seed sources into these areas. Locations were identified for continued assessment to determine where treatment within one year of fire containment will be needed to protect vulnerable vegetation resources. These areas will be the first priority for detection assessment and potential future noxious weed treatment. The second priority for detection assessment will be the remainder of the burned area.

Recommended land treatments to mitigate the emergency are weed detection, herbicide weed treatment, and livestock deferment from burned areas during recovery of native vegetation. Proposed assessments treatments where needed will follow Forest Service regulatory requirements and protocols in accordance with existing 1986 Custer Forest Plan and 2006 Custer National Forest Weed Management EIS NEPA decisions.

Cultural Resource Treatments: All significant (NRHP eligible), potentially eligible and unevaluated sites or portions of sites within the burned area were carried forward for the consideration of effects in the recommended BAER treatments. Beyond the heritage concerns associated with the road system and Ekalaka Park Campground, hazard tree removal under archaeological supervision will be critical to protect two cultural sites that were burned over by the fire. Costs for treatment are itemized in Appendix A.

Road Treatments: BAER funds are appropriate for treatment of anticipated fire erosion events on roads but not to improve roads to standards over pre-fire conditions. Road treatments will include FR 3814 (JP Smith Road), FR 3811 (Dugan Draw Road), and FR 3104 (Rimrock-Carter Road). The objectives of the road treatments are to stormproof the road investment from accelerated erosion, sediment transport, and sediment deposition on travel routes and reduce the sediment transfer from the routes while maintaining access to the Forest for administrative, private lands access, and public use. Wildfire accelerated surface flows down roads are probable and if not treated will cause significant surface erosion and failure in localized areas. In addition, the substantial projected increases in discharge are likely to overtop road fills should culverts not be upsized to accommodate post-fire discharges. Protection of these road investments- which are also of cultural significance- is of critical importance in order to maintain access for conducting forest management activities. In addition, FR 3104 is the lone access for a private inholding, further increasing the need to preserve this travel route.

The Dugan Fire BAER treatments for roads are focused on storm proofing the most important routes associated with the transportation system and in the priority watershed areas. Despite cost-saving measures, road system improvement costs are greater than normal as a result of the need to transport erionite-free gravel in from off-site as well as the critical need to wet down soil during construction so as to avoid excess liberation of erionite from soil.

Road treatment units and costs are listed in Appendix B. The treatments for the roads consist of a variety of storm proofing techniques including blading the roads and restoring drainage, constructing armored drainage dips and sags, hazard tree removal to provide for safety during BAER contract administration, and upsizing culverts. Armoring drainage dips and sags is essential due to the highly erodible nature of the soil in the fire. Armoring will be completed in selected segments with a local shale material that is inexpensive but provides protection against rutting and reduces sediment movement.

Treatment of hazard trees will provide for a safe working environment for the emergency response crews during contract administration and implementation. Hazard tree removal will be implemented along all of FR 3104 to ensure access for a private landowner whose only property access is through FS land. Only specific roads are targeted for hazard tree treatments and focused on erosion prevention not road standard improvement.

Road treatments will be conducted in consultation with the Custer NF heritage program to ensure that cultural concerns are being addressed.

November 2012 interim discussion: This interim request is for funding to cover contract administration costs associated with Dugan BAER road work. Contract administration was not accounted for in the initial Dugan BAER request submitted to the Regional Office on October 19th, 2012. Parts E and F, Table VI, and Appendix B have been updated to reflect these changed costs.

Second interim update 8/7/2013: Following the November interim filing, the Custer NF was instructed to continue BAER implementation- including contract preparation and administration- under the original funding authorization and solicit formal interim authorization when funding from the initial request was fully obligated. Since that time, the Dugan Fire engineering contract has been successfully awarded for approximately $9,000 greater than the original engineer's estimate. High bids were a result of contract stipulations requiring erionite hazard mitigation as well as long travel distances for the IDIQ contractor. This has further exacerbated the need for those contract administration funds requested last November. In absence of interim funding, remaining contract administration will have to be paid either using the existing BAER authorization or force account funds, thereby preventing full completion of BAER project work and/or impacting forest personnel funding.

Table IV, Parts C and G and Appendix B have been updated to reflect these changes (November interim changes have been replaced).

Third interim update 9/12/2013: On September 7th and 8th, southeast Montana was impacted by a series of significant precipitation events. While the Ekalaka RAWS station reported 2.3" of rain in 24 hours (with 1.3" of that falling in less than 30 minutes, according to NWS Billings), according to Sioux District personnel approximately 3" of rain in approximately 24 hours was reported at a ranch adjacent to the Ekalaka Hills. This rain fell prior to the high intensity, short duration event, creating saturated antecedent conditions prior to the fire area being impacted by the high intensity, short duration event mentioned above. Given the higher elevation of the Ekalaka Hills it is possible that total storm precipitation and peak storm intensity impacting the burned area was higher than that observed at the Ekalaka RAWS station or the adjacent ranch. The 30-minute precipitation event observed at Ekalaka equates to a 25 year pre-fire recurrence interval and likely translated to a much higher recurrence interval post-fire runoff event.

From Parrett's research in the Ashland, MT area (2003), it is well known that very large, flashy discharges can result from high intensity precipitation events throughout this region both within and outside of burned areas.

Following this rainfall-runoff event, Sioux District personnel estimate water depths in the Smith Well Draw (through which the JP Smith Road runs, intersecting the draw in 12 locations) was up to 6 feet deep during peak discharge. Assuming conservatively that water continuously inundated the draw to a depth of three feet and using average draw dimensions and slope, discharge would have exceeded 700 cubic feet per second in this ephemeral draw with no defined channel. Some culverts conveyed all runoff and debris without overtopping, while in other locations (primarily where side draws intersected the main draw, conveying high velocity runoff to the main draw), runoff overtopped road fills. Backwater control on the culverts produced turbulence that displaced fill around them via piping. At these locations, culverts were found in place with partial or total fill removal around the culvert and an intact road bed bridging across the top of the culverts. Debris bulking did not appear to be an issue during this event.

This interim request is to perform maintenance on those road/draw crossings that were impacted by this runoff event. The existing culverts (undamaged) will be re-set and re-compacted in place and armored where appropriate. With a contractor already on site, maintenance costs will be minimized by avoiding further mobilization costs.

Figure 5. Culvert on JP Smith Road following September 7th-8th storm events.

Protection and Safety Treatments

Erionite: Erionite is a zeolite series mineral with similar physical characteristics to asbestos. The mineral is found throughout the Sioux District of the Custer NF within the Arikaree and White River formations. Though classified as a Class 1 respiratory carcinogen, it is currently unregulated by the EPA (Van Gosen et al 2012)[3]. The presence of erionite on the district has been recognized for several years but only recently has more information become available regarding the health risks associated with the fiber. In addition, this is the first major fire that has occurred since much of that information has become available.

There are numerous unknowns regarding erionite and the potential hazard to human health. To address these concerns, a statement of work has been drafted for soliciting contractors to begin a combination of activity-based and passive air sampling as well as soil sampling. Questions of interest that are pertinent to BAER efforts include:

- Exposure potential to personnel conducting routine field work or reasonably foreseeable project work within or adjacent to the fire perimeter

[3] Van Gosen, B.S., Blitz, T.A., Plumlee, G.S., Meeker, G.P., Pierson, M.P. 2012. Geologic occurrences of erionite in the United States: an emerging public health concern for respiratory disease. Environmental Geochemistry and Health. In press.

- Erionite fiber mobility entrained within employee clothing, equipment and vehicles
- Variation in volumetric content in geologic environments (Arikaree and Fort Union Formations) and media (bedrock and soil)
- Ambient or baseline exposure potential within and adjacent to the Dugan Fire perimeter
- Environmental conditions which potentially produce the highest degree of exposure- specifically, wind velocity and duration, soil moisture content, and amount of vegetative cover are of variables of interest.
- Extent to which risk of erionite exposure has changed as a result of the fire (e.g. have erionite fibers changed physical structure as a result of extreme heating, are personnel more or less susceptible to exposure as a result of the fire, is off-site transport potential via eolian transport significantly increased)

Funding is requested to contract with an industrial hygienist to conduct site sampling and monitoring. Cost of sampling will vary based on the amount of activity-based sampling requested. These funds are being requested to complement the BAER assessment.

Montana DEQ has been contacted regarding the potential environmental hazards posed by the fire. Where appropriate, the CNF will coordinate with Montana DEQ to accomplish sampling and design mitigations to ensure safe implementation of BAER work.

I. Monitoring Narrative:

Part VI – Emergency Stabilization Treatments and Source of Funds

A. Land Treatments	Units	Unit Cost	# of Units	BAER $	Other$
Weed herbicide treatment	Ac	$125	154	$19,300	
Weed detection	Job	$4,900	1	$4,900	
Livestock Deferment – Adm. Action - No Request	Job	0	0	$0	
Ekalaka Park Campground Hazard Tree Removal/Slope Stabilization	Tree	$52.03	200	$10,406	
Ekalaka Park Campground hillslope seeding	Ac	212	25	$5,300	
Cultural Site Treatments		See Appendix A		$5,830	
Subtotal Land Treatments				$45,736	
B. Channel Treatments					
C. Roads and Trails					
Culverts, Road armoring & drainage etc.		See Appendix B		$360, 054	
Road hazard trees	Tree	$52.03	600	$31,218	
Subtotal Roads and Trails	Road treatment specific funding detail is included in Appendix B.			$391, 272	
D. Protection and Safety					
Subtotal Protection and Safety					
E. BAER Evaluation					
Assessment (person days)	Days	$350	30		$ 10,500
Travel costs	LS	$			
Subtotal Evaluation					$ 10,500
					$10,500
F. Monitoring					
		$		$	
Subtotal Monitoring				$	
G. Totals					
Previously approved				$0	
Total for this request				$437,008	

PART VII - APPROVALS

1. _____ 9/12/2013
Deputy Forest Supervisor Date

2. _____ 9/ /2013
Regional Forester Date

Appendix A. Dugan Fire Heritage Cost Summary*

Table 1. Cost Summary

Line Items	Units	Unit Cost	# of Units	BAER $
Cultural Site Treatments				
Cultural Resource Site Hazard Tree Removal – 2 sites treatments	Tree	50.00	20	$1000
Archaeologist Monitor for tree removal – two days per site	Cultural site	578.00	2	$1156
Archaeologist Monitor Post Treatment - 10 sites- 5 days	Cultural site	289.00	5	$1445
Forest Archaeologist Review and Consultation – 5 days	Cultural site			$2225
Cultural Site Treatments				**$5826**

****Does not include road treatments and consultation for Dugan, Rim-Rock Carter, Stagville Ekalaka, J.P. Smith or treatment and consultation for Ekalaka Park Campground***

Appendix B. Engineering cost detail (Interim modification 9/12/2013)

15101	Mobilization	LSQ	LS	All		$ 27,196.50
72501C	Water	LSQ	LS	All		$ 27,196.50

Item #1 Road #3814

Item Number	Description	Method of Measure	Pay Unit	Estimated Quantity	Unit Price	Total
30101	Drainage armoring	CQ	CY	350	$ 70.00	$ 24,500.00
60202A	Install Culvert CMP 18"	AQ	LF	80	$ 80.00	$ 6,400.00
60202B	Install Culvert CMP 36"	AQ	LF	80	$ 160.00	$ 12,800.00
60202C	Install Culvert CMP 42"	AQ	LF	146	$ 175.00	$ 25,550.00
60202D	Install Culvert CMP 48"	AQ	LF	36	$ 200.00	$ 7,200.00
60202E	Install Culvert CMP 54"	AQ	LF	162	$ 225.00	$ 36,450.00
30302B	Construct Grade Sag	AQ	EA	1.0	$ 1,400.00	$ 1,400.00
30302A	Construct Rolling Dip	AQ	EA	20.0	$ 1,400.00	$ 28,000.00
30301	Blading and ditch cleaning	CQ	LF	225.0	$ 25.00	$ 5,625.00
20304A	Remove Existing Culvert	CQ	LS	9	$ 500.00	$ 4,500.00
					Item #1	**$ 152,425.00**

Item #2 Road #3813

Item Number	Description	Method of Measure	Pay Unit	Estimated Quantity	Unit Price	Total
60701	Culvert Cleaning	AQ	EA	3.0	$ 200.00	$ 600.00
60202A	Install Culvert CMP 18"	AQ	LF	36	$ 80.00	$ 2,880.00
30101	Drainage armoring	CQ	CY	235	$ 70.00	$ 16,450.00
30301	Blading and ditch cleaning	CQ	LF	100.0	$ 25.00	$ 2,500.00
20304A	Remove Existing Culvert	CQ	LS	1	$ 500.00	$ 500.00
					Item #2	**$ 22,930.00**

Item #3 Road #3104

Item Number	Description	Method of Measure	Pay Unit	Estimated Quantity	Unit Price	Total
60701	Culvert Cleaning	AQ	EA	1.0	$ 200.00	$ 200.00
60202A	Install Culvert CMP 36"	AQ	LF	38	$ 160.00	$ 6,080.00
30101	Drainage armoring	CQ	CY	220	$ 70.00	$ 15,400.00
20304A	Remove Existing Culvert	CQ	LS	1	$ 500.00	$ 500.00
					Item #3	**$ 22,180.00**

Item #4 Road #3811

Item Number	Description	Method of Measure	Pay Unit	Estimated Quantity	Unit Price	Total
30101	Drainage armoring	CQ	CY	215	$ 70.00	$ 15,050.00
60202A	Install Culvert CMP 18"	AQ	LF	118	$ 80.00	$ 9,440.00
60202B	Install Culvert CMP 24"	AQ	LF	132	$ 100.00	$ 13,200.00
60202C	Install Culvert CMP 36"	AQ	LF	44	$ 160.00	$ 7,040.00
30302A	Construct Rolling Dip	AQ	EA	18.0	$ 1,400.00	$ 25,200.00
20304A	Remove Existing Culvert	CQ	LS	9	$ 500.00	$ 4,500.00
					Item #4	**$ 74,430.00**
					Item 1-4	**$ 271,965.00**
					Mob & Water	**$ 54,393.00**
					Contract administration	**$ 15,000**
					Post-storm culvert maintenance	**$ 18,696**
					Grand Total	**$ 360,054.00**