SHEEP CREEK BURNOVER

08-18-2018

Facilitated Learning Analysis

EXECUTIVE SUMMARY

The Sheep Creek Fire occurred on August 18, 2018. A helicopter crash in a remote area near Battle Mountain, Nevada ignited a wildfire, resulting in a burnover of a Type 4 engine on a Search and Rescue mission responding to the helicopter crash.

The helicopter was on a reconnaissance mission conducting a chukar survey. With a pilot and two biologists on board, the helicopter crashed in a draw, igniting the wildfire and injuring two of the passengers. They self-extricated from the helicopter and climbed up on a rock outcropping to take refuge from the rapidly spreading fire.

Location of Truck Prior to Burnover

Firefighting and rescue resources were dispatched from Lander County Dispatch, including Battle Mountain Volunteer Fire Depart, local EMS services and a medical helicopter.

Meanwhile, Elko Interagency Dispatch Center was coordinating with Central Nevada Interagency Dispatch Center on a response to the rapidly spreading wildfire

Two firefighters responding to the helicopter crash in a Typ-4 engine were burned over soon after the occupants of the crashed helicopter were evacuated.

The Facilitated Learning Analysis Team worked to make sense of the event focusing on command, communication and accountability; qualifications, equipment and training standards; communication between dispatch centers; and key decision points along the way. Through facilitated dialogue with those involved, the Team shared lessons learned and recommendations.

CONTENTS

Site of the origin of the fire and the helicopter crash.

Sheep Creek Burnover

FACILITATED LEARNING ANALYSIS

INTRODUCTION

"I was burning and screaming and hunkered down underneath the rear tires," said the Pumper-2 firefighter.

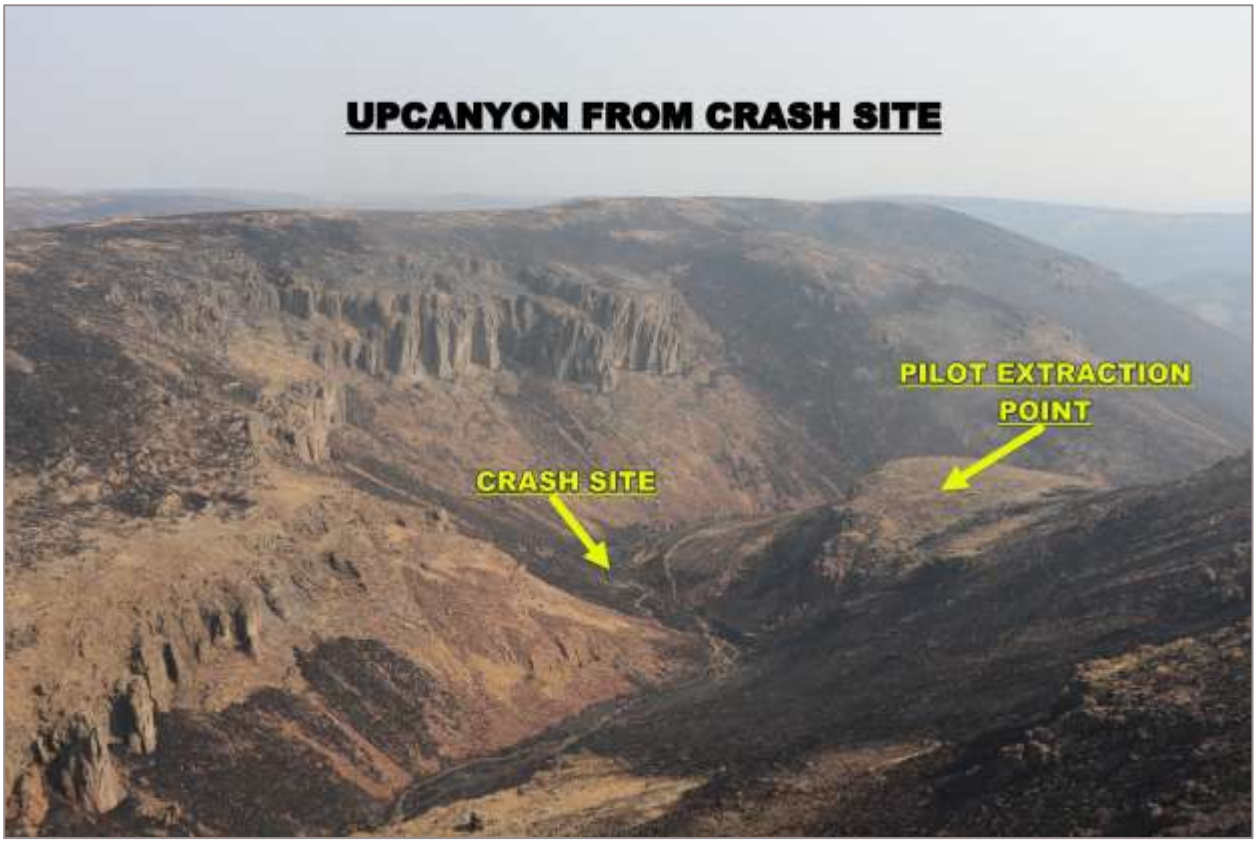
"You're going to have to get a helicopter," Lander County Dispatched. "It's the only way to get in here."

A team was delegated to conduct a Facilitated Learning Analysis (FLA) of the Sheep Creek Fire. The complexity level of this FLA responds to the environment in which the decisions, actions and events took place.

Through the FLA process, we can better understand and learn from the decisions, actions and events in context to their environment. In any complex environment where uncertainty persists, unexpected events happen, despite our best efforts. This analysis is not intended as a critique of our ability or performance; rather, it should be viewed as a reflection of the fundamental character of the unique complex systems in which the event occurred.

Our traditional response to unexpected outcomes typically tries to discover the errors that were made so they are not repeated in the future. Over time, this approach has proven to be limited, primarily because complex systems rarely deliver the same conditions and outcomes. Succeeding in complex systems should not be viewed as an error free system, but rather an *error tolerant system*. Error tolerant systems provide room for error and uncertainty to exist without the undesired consequence.

Learning from an event like the Sheep Creek Fire provides us an opportunity to learn both how to perform better and to build a more error tolerant organizational environment. This FLA is designed with goal that in mind.



THE STORY

On August 18, 2018, Lander County Dispatch received a 911 call at **1357** from a biologist reporting a helicopter crash in the remote Sheep Creek Range about 10 miles north of Battle Mountain, Nevada. The helicopter was on a mission conducting a chukar survey with a pilot and two biologists on board.

When the helicopter crashed, it ignited a wildland fire and injured two of its three passengers. The two biologists and pilot extricated themselves from the helicopter and moved their way to a rocky knob escaping the growing fire. A Fuels and Fire Behavior Advisory was issued for August 13-27, 2018 for the Northern Great Basin below 7000' (see Appendix A).

Once at the rocky nob, they called 911, which was routed through Lander County Dispatch. "We just got into a helicopter crash…three occupants, all of us are alive and managed to get out…started a big fire, fire is burning all around us right now…one of the guys hit his head pretty hard…you're gonna have to get a helicopter, it's the only way to get in here." Universal

Transverse Mercator (UTM) coordinates were provided by the biologist, but the medical helicopter could not utilize UTM.

Lander County received the information and passed it on to Central Nevada Interagency Dispatch Center (IDC). While on the phone with Lander County, Central Nevada IDC contacted Elko IDC, passing on the information and initiating their fire response plan. Initially, it was unclear to the Interagency Dispatch Centers whether the helicopter was a fire resource.

Even though the crash and subsequent fire were located just 10 miles northeast of Battle Mountain, the incident was jurisdictionally within the Elko IDC mutual response district. Because it was eventually determined to be a non-fire resource, Elko IDC did not have jurisdiction and could not take the lead on the response to the accident. Under this scenario:

1. Elko was the dispatch center responsible for the fire;
2. Central Nevada IDC in Winnemucca was supporting the response to the fire with Federal and State resources from their District; and
3. Lander County was the lead dispatch center for the search and rescue mission.

The Elko IDC Manager stressed that they would "do all they could to help, but it was not ours to lead." This dynamic added complexity and novelty to an already emergent situation. Resources, including a fire helicopter from Elko, were "directed to go size-up the fire and give us intel on the passengers from the helo crash." – Elko IDC Log.

1411 - 1416

Ground and air resources were dispatched from Winnemucca and Elko districts to the fire. Radio frequencies were assigned and communicated to all fire resources as part of the "tone out". Lander County dispatched Sheriff's Deputies and an engine with two firefighters from the Battle Mountain Volunteer Fire Department (VFD) to the helicopter Search and Rescue. The Battle Mountain VFD responded on Pumper-2. Staffing on the engine was the Fire Chief and a rookie firefighter. Pumper-2 is a Type 4 engine, with 750 gallons of water and limited suppression equipment on board. Both individuals grabbed their wildland personal protective equipment (PPE) and placed them in the back of the cab of Pumper-2.

Resources en-route to the rescue endeavored to find the best way to locate and access the crash site. They saw a smoke column forming on the northern end of the range, so they determined the best access to the site would be from the south end of the mountain via the apple orchards (see Appendix B).

Lander County Dispatch notified air medical resources of the crash, requesting the medical ship to respond and stage in the area of Battle Mountain because of unknown fire conditions and exact location of the crash site.

1425 – 1450

At 1425, BLM helicopter 5GH lifted from Elko en-route to the fire with direction to size up the fire and assume command. BLM ground resources were en-route from Elko, Winnemucca and Battle Mountain.

Post Fire Ingress Point

Lander County Dispatch called the biologist for a status update and requested a Lat/Long. The biologist provided an updated location with Lat/Long of their position, gave a patient update and indicated that all passengers were in an area to be extracted. The information was relayed to the medical aircraft dispatch, and the medical ship was directed to respond to the scene.

At about 1450, the medical helicopter advised Lander County Dispatch they are about 4 minutes out from the scene.

1450 - 1505

Over the fire, BLM 5GH provided a size-up and indicated the fire was around 300 acres and growing. 5GH advised there was no road access in the area and that the fire had extreme spread potential. They put in a resource order for the fire, including multiple air resources.

The Deputies proceeded to the NOAA tower to gain a better visual of the fire area, noting two distinct smoke columns. They believed that with the fire and road access issues there was no good option to get to the crash site area from their location (see Appendix B). Leaving the tower, the Deputies met Pumper-2 at the crossroads, where they had a discussion (see Appendix B). From the discussion, the Deputies perceived there was agreement that because of the conditions, they would leave the top of the mountain range back down the road towards the apple orchard. At **1505** the Deputies began to head off the mountain, but the route of travel and intent of Pumper-2 was difficult to track because there was no communication between Dispatch and Pumper-2 during the time period from **1505–1646**.

Helicopter Crew Extraction Point

At **1509** the medical helicopter advised Lander County Dispatch they were unable to access to the extraction site because of fire activity and would be staging out of the area.

Then at **1519** a 911 call was received from the biologist stating that the fire had moved out of the area and there was no fire where they were located. He identified the area as a large, flat, open bench above the crash site. Lander Country Dispatch contacted Central Nevada IDC to impress on them the severity of the situation, who until this point, through conversation with the helicopter owner, believed that the passengers were OK. Lander County Dispatch transferred the biologist's 911 call to Central Nevada IDC. The biologist repeated that the area was clear and the helicopter could land. "…I promise you can land now… I'm seriously concerned about the other passenger…we need to get them out of here as soon as possible." Central Nevada IDC replied, "I'll pass this info on and get a helicopter headed your way".

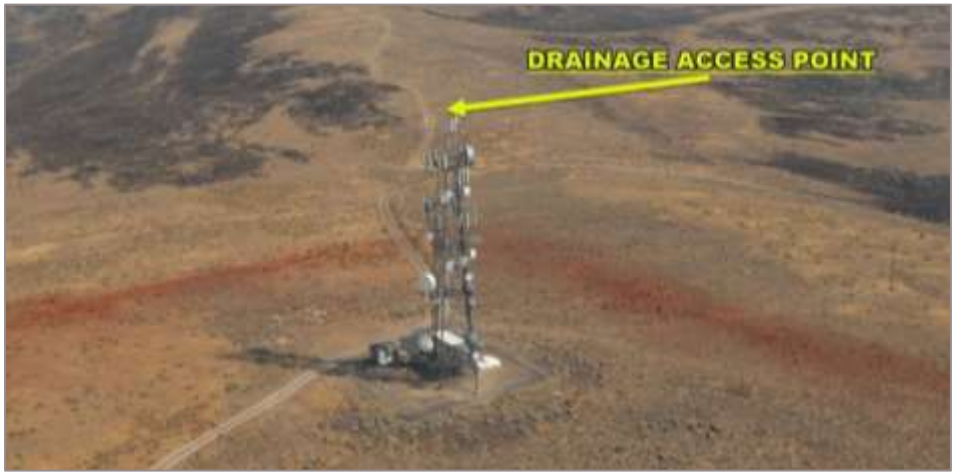
Both individuals got out of the vehicle and proceeded to hike up the steep ridge until they got on top of the ridge to establish communications.

Central Nevada IDC then called Elko IDC and discussed the use of the fire ship to assist in the extraction of the injured passengers. 5GH requested and was granted permission to assist in the extraction. The helicopters came up with a plan for the extraction. At approximately **1600**, all crash victims were removed from the crash site area.

Meanwhile……

From the interviews with the crew of Pumper-2, it appeared that Pumper-2 continued with the Search and Rescue mission of the helicopter crash. Pumper-2 traveled west from the crossroads towards the radio tower located on the southwest area of the Sheep Creek Range. A two-track road running south to north from the tower led Pumper-2 into the Sheep Creek drainage. As Pumper-2 commits off the top towards the drainage bottom, still able to receive radio communications, they heard the transmission from Lander County Dispatch at **1602** advising the responding resources that the medivac ships had extracted the crash victims and were now en-route to appropriate care facilities. Sheriff advised to cancel Search and Rescue.

After hearing the radio communication, the Chief stated, "It's now to get the f*ck out of here mission." He indicated the fire was to the north and west of their location along the ridge. They continued down drainage towards the fire because they thought there was a road out at the bottom. As they proceeded, the fuel was transitioning from a lighter grass to a heavier grass and sage component. "The sage was 5 to 6 feet tall," the Chief said.



As Pumper-2 proceeded down the drainage, the firefighter driving stated, "I was told [by the Chief] to speed up, so we don't get trapped as the fire is coming down the hill." Pumper-2 continued down the road, which was transitioning into a 4x4 trail as they passed the Chukar Guzzler. The Chief stated, "As we rounded a corner, the road stopped; fire was on both sides of the road. The fire was heading up canyon with winds of 15-20 mph."

Within seconds, the fire was all around Pumper-2.

The two got out and started the pump to spray water from the booster reel on the back of Pumper-2. Within seconds, the fire was all around Pumper-2. Both individuals were caught outside of the vehicle while trying to spray water. Neither had on their personal protective equipment (PPE) when the burnover occurred. The Chief stated, "We were in a rescue mission, so we had no PPE on."

During the burnover, the firefighter jumped off the back of Pumper-2, started to run around the vehicle and then took refuge under Pumper-2. "I was burning and screaming and hunkered down underneath behind the rear tires." After the burnover, the Chief yelled for the firefighter, whom he could not see anywhere. He eventually located the firefighter under Pumper-2.

Location of Truck Prior to Burnover

After sustaining significant burns, both the Chief and firefighter got back into the vehicle, with the Chief driving, continuing down drainage. The fire was behind them as they continued driving through the black towards the bottom of the drainage. Pumper-2 drove through the bottom of the drainage over the rough terrain until getting stuck. Both individuals got out of the vehicle and proceeded to hike up the steep ridge until they got on top of the ridge to establish communications.

At **1646**, Lander County Dispatch received a 911 call from the firefighter, who said he and the Chief had been burned. "We need help." Dispatch was asking questions to establish a location, but the cell phone was breaking up. The firefighter said, "We might need a helicopter because we are on the ridge…in the black…wearing a red shirt and just uphill right of the engine."

Suppression resources were actively engaged on the wildland fire during the burnover of the Pumper-2. The Incident Commander of the wildland fire was unaware that Pumper-2 was on the fire until well after the burnover occurred.[1] The dispatch centers did not know the location of Pumper-2.

[1] At 1702 information was relayed from Lander County to Elko IDC via Central Nevada IDC.

At **1728,** the initial Incident Commander of the fire assumed command of the crash site and burnover incidents, and the control of the fire was transitioned to an incoming Incident Commander.

1737-1753, the injured firefighters were located and medivaced by the air medical and suppression helicopters to awaiting ground medical resources at Battle Mountain Airport. At about **1900,** fixed-wing transports flew the injured firefighters to the University of Utah Burn Center in Salt Lake City, Utah.

LESSONS ANALYSIS (DISCUSSION)

In this section we feature the decisions, actions and events that we believe were relevant to the unintended outcome, followed by a statement as to why we believe it was relevant. The bulleted statements below are the conditions we believed influenced the decision, action or event.

Command, Communication and Accountability

The Sheep Creek Incident was a multi-incident, multi-jurisdictional and complex event that was treated as two separate incidents with separate structures: Search and Rescue and Wildland Fire. This influenced the capacity for communications, accountability and command. For example, the resources committed to the fire did not know the County resources were responding or were near the fire and were not aware that Pumper-2 was near the fire until after the burnover happened[2].

- The trajectory of this event was established at the outset by the type of mission the downed helicopter was involved with. The helicopter company is contracted for a variety missions with both the State and Federal agencies, including wildland fire. Because it was not flying a fire mission, Elko IDC (an interagency wildland fire dispatch center) was not jurisdictionally responsible for the search and rescue mission; Lander County was. If, on the other hand, it was a fire helicopter that crashed, Elko would have jurisdiction over both, simplifying command and control of the event.

- The County resources have only tactical (line-of-sight) frequencies in their mobile and handheld radios. They do not have State or BLM command (repeater) frequencies. Their radios have a limited number of potential channels and are not field programmable. Terrain and distance significantly limited the effectiveness of line-of-sight communications in the evolution of this event, so even if common frequencies were established, radio communication would have been very strained.

- Because of the skill and improvisation of the three dispatch centers, it appeared as though command, communication and accountability were being maintained throughout the event, so the need to run it as a unified command was not evident.

- In conversation with volunteer fire department members, it was explained that in most cases when County resources respond to a wildland fire in which State and Federal resources are also responding, unified command is "established"[3] because it is clearly a single event with resources from multiple agencies and are within close proximity to one

[2] With the exception of the Sheriff's Deputies and the Battle Mountain VFD engine, all resources were committed to the Sheep Creek Ridge Fire and were being managed by the Elko IDC. The Deputies, Battle Mountain VFD and medical helicopters were communicating exclusively to Lander County Dispatch either by phone or radio. Lander County Dispatch initially communicated to Central Nevada IDC that they had dispatched the Battle Mountain VFD, but no further record exists of search and rescue resources or Lander County dispatch updating Elko IDC (via Central Nevada IDC) of the Battle Mountain VFD's status.

[3] It is worth noting that the term unified command seems to mean different things to different groups. This is why we believe it is important to establish standards (see "Qualifications, Equipment and Training Standards" below) for how the County and State/Federal resources define and operate in a unified command.

another. Neither of these conditions existed initially on this event. This, in combination with the limited ability for radio communication (see above) between the two incidents, opens up the possibility for out-of-sight-out-of-mind conditions.

- From the outset of the helicopter crash rescue response, it was communicated that the crash and extraction sites were inaccessible and that helicopters would be best suited.[4] Fire resources were communicating with medical helicopters and may have assumed they were the only resources engaged in the search and rescue.

- In the end, all of the incidents were brought under a unified command at 1728.

Deputies Leave, Pumper-2 Remains

The deputies believed the intent was to head back down the mountain after the meeting at the crossroads with the crew of Pumper- 2, yet Pumper-2 continued to proceed north towards the fire. This important moment uncovers a potential difference of perception of a conversation between the deputies and Pumper-2. It also highlights a difference of perception of mission between the deputies and Pumper-2.

- The deputies believed everyone had agreed to come off the hill. We do not know the intent of the crew of Pumper-2 for sure, but we know they continued towards the western tower and on into the Sheep Creek drainage.

- Through conversations and the facilitated dialogue, it appears there is a distinction between the deputies "who fight crime, not fire," and the volunteer firefighters. It is possible the firefighters believed their mission and area of expertise did not necessitate them departing with the deputies.

Communications between Dispatch Centers

The chain of communication ran through three dispatch centers, with the path running between Lander County and Elko Dispatch Center via Central Nevada Dispatch Center. Lander County Dispatch Center communicated exclusively through the Central Nevada IDC, despite Elko IDC being the lead for the fire incident (and therefore the one managing the resources Lander was requesting). Central Nevada IDC suggested to Lander County Dispatch that they go direct with Elko IDC, but Lander continued to channel all communications with fire resources through Central Nevada IDC. Information had to then be passed onto Elko IDC for dissemination to the fire resources in the field. The Central Nevada IDC was happy to be the "big go between", and both Elko IDC and Central Nevada IDC believed the added layer was not detrimental to the response to either the helicopter crash or the burnover, recognizing it would have been more direct for Lander to go direct with Elko IDC.

[4] This is with the exception of the Sheriff, who received information that it may be possible to access the extraction site with UTV "side-by-sides".

- Lander County dispatch has made it standard protocol to make Central Nevada IDC the primary contact for all interactions with the BLM. It is believed that this enables timely contact with BLM resources without having to interpret the dispatch zoning maps first, especially for newer dispatch staff.

- Even after the facilitated dialogue, it was agreed that the initial contact for interactions with the Federal and State would be through Central Nevada IDC, with the option to redirect further communications to the appropriate dispatch centers once a location of the fire is determined. This demonstrates the utility of a single point of contact for a county dispatch center managing fire, EMS and law enforcement incidents.

Qualification, Equipment and Training Standards

NFPA 1977 wildland fire PPE and fire shelters were present at the burnover site, but they were not utilized by the burn victims. No training or qualification standards were identified for volunteer fire department wildland fire responses or emergency responses in general. It is important to note that we are *not* suggesting that if the VFD had a published standard for wildland fire qualification, equipment and training and/or the crew of Pumper-2 had been wearing the PPE, the outcome would have been any different. We are suggesting that establishing and communicating standards clearly defines expectations for VFD crewmembers and communicates how the VFD will interact with partner organizations and incident response.

- The Battle Mountain Volunteer Fire Department operates as the Authority Having Jurisdiction (AHJ)[5] that determines what policy, procedures and standards (nationally recognized or otherwise) are to be adopted for utilization within the response district. This means the department can set any standard for their qualifications, equipment and training, including no formal standard at all. The FLA Team could not identify any adopted standards for the Battle Mountain VFD.

- Pumper-2 was on a rescue mission. Conditions such as these are often difficult for readers and reviewers alike to rationalize. How can something seemingly insignificant like the difference between a rescue mission in the wildland environment and a wildland fire in the wildland environment enable an individual (or many individuals) to overlook what is now (with the benefit of a global perspective of the events and knowing the outcome) obvious. Two assumptions are import to discuss. First, both readers and reviewers think rationally about the situation because they are separated in both time and space from the event and they have lots of information and time (relative to those directly involved in the event) to rationally consider options. The assumption is that we always behave rationally, but that is false, especially in time-compressed or emotionally intense situations.[6] Similarly, the

[5] AHJ Definition: An entity that has the authority and responsibility for developing, implementing, maintaining and overseeing the qualification process within its organization or jurisdiction. This may be a State or Federal agency, training commission, NGO, private sector company, or a tribal or local agency such as a police, fire or public works department. In some cases, the AHJ may provide support to multiple disciplines that collaborate as a part of a team (e.g., an IMT). (From: FEMA.gov)

[6] For a quick lesson on this see "Thinking Fast and Slow" video on YouTube.

second assumption is that their perception of being a rescue resource on a rescue mission should have little influence on how they make sense of a situation. To the contrary, accident and human behavior science literature is full of examples and research demonstrating how such perceptions influence situational awareness.

LESSONS LEARNED AND RECOMMENDATIONS

Command, Communication and Accountability

The burnover occurred during an event that existed in the space between routine incidents for the agencies responding. It was not the fire nor the helicopter crash independently that generated the complexity; rather, it was the interaction of these events. This unveiled complexity is the keystone for the rest of the lessons learned and recommendations.

Action Item: Mutual Response Scenario

At the facilitated dialogue session it was agreed to develop and run a multi-incident, multi-agency scenario involving local, State and Federal partners. Resources are available at the Wildland Fire Lessons Learned Center as well as the local, State and Federal agencies.

Deputies Leave, Pumper-2 Remains

Humans are both the greatest asset and the worst enemy to any event. We have an incredible ability to foresee and predict, quickly react and constantly adapt to complex and dynamic situations; but because of how we do this and the inherent unpredictability of our environment, we are not as good as we think. We are, after all human, not superhuman. In recognition of this, the FLA Team recommends working towards a system that capitalizes on our human abilities and provides room for our inadequacies. This begins with the Action Item listed under the "Qualifications, Equipment and Training Standards" heading. The goal is building a system in which operators do not have to be superhuman in order to succeed and survive.

This event is also an opportunity to bring to the surface the assumptions about "how we do things around here." "How we do things around here" are the unspoken set of rules, expectations and perceptions about how the world works that drive a lot of our decisions and behaviors, mostly without our being aware of its influence. It is important to note that "how we do things around here" is so engrained because most of the time it works, often very well and for a long time. In bringing these assumptions to the surface, it is not to determine if they are good or bad, but simply to shed light on their influence and reflect on the opportunities and weakness they present. These are challenging and uncomfortable exercises, but ultimately central to creating a system in which people can reliably succeed.

Communications between Dispatch Centers

The three dispatch centers involved in this event felt good about how they operated during this event, but they expressed the desire for continued improvement. The dispatch centers reflected on opportunities to modify some protocols, keep others and establish new ones, including finding efficiencies during high volume times and increasing capacity for interagency coordination. They expressed a desire for more chances to interact casually and provide opportunities for training and cross-training in an effort to build relationships, cohesion and support networks throughout the response area. It is the FLA Team's recommendation that all these opportunities should be aggressively supported.

Qualification, Equipment and Training Standards

The FLA Team believes it is important to set a standard for minimum qualifications, equipment and training. This minimum standard communicates a common point of reference, firmly establishing expectations for both internal department membership and external partner groups. It is not necessary to adopt national standards in full, but rather adapt a standard that is appropriate for this department. The specifics of the standard matter less than the fact that a standard exists and is communicated internally to the department and externally to partners. The FLA Team recommends bringing a third party in as a consultant to help establish the standard.

Action Item: Set a Standard

At the facilitated dialogue session, County and department representatives agreed a standard was needed and to move forward with establishing and communicating one. Standards to be considered were discussed as examples, but are by no means an exhaustive list:

- Check-in procedures and expectations between dispatch and fire/EMS resources, i.e., how often and what information should be conveyed upon check-ins.
- When/how will the department engage in wildland fires? Are there situations the department will not engage in suppression actions?
- What is a minimum level of training and/or experience required before firefighters will be allowed to go on wildland fire calls?
- How will training and experience records be managed to ensure firefighters engaging in wildland fire meet the established minimums standards?
- What radio frequencies will be in all the radios, and what are the expectations for their use?
- When dispatched to a wildland fire, what is the minimum equipment standard? How much hose is required? Will fire shelters be worn or be in the cab of the engine? What is the minimum tool complement to be on an engine responding to a wildland fire?

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APPENDIX A

FUELS AND FIRE BEHAVIOR

The Sheep Creek fire started on August 18, 2018 from a helicopter crash.

The Initial size-up of the fire was estimated at 300 acres, but by the time the crash victims were rescued, the fire was estimated at 1,500 acres and growing rapidly. The fire reached the confluence of the Sheep Creek drainage aligning topography, fuels and winds resulting in extreme fire behavior. The rapid growth moved up the drainage entrapping the engine and resulting in the two firefighter's being burned over.

The burnover site shows burn indicators of a rapidly moving fire, full consumption of one and ten-hour fuels that were not sheltered or protected.

Weather Summary

High pressure was in control of the weather across northern Lander and western Elko counties on 18 August 2018. Observational data taken from the Automated Weather Observing System (AWOS) at the Battle Mountain Airport (KBAM) indicates the weather was sunny during the timeframe between 1300-1800L. However, smoke and haze from area wildfires was causing a reduction in visibility to between 5 and 7 miles. No clouds were observed from the KBAM airport below 12,000 feet AGL. Winds were generally out of a northerly direction, varying from NW to NE, with sustained speeds up to 10 mph with no gusts reported. The air temperature was in the upper 80s to low 90s with a relative humidity reading in the single digits.

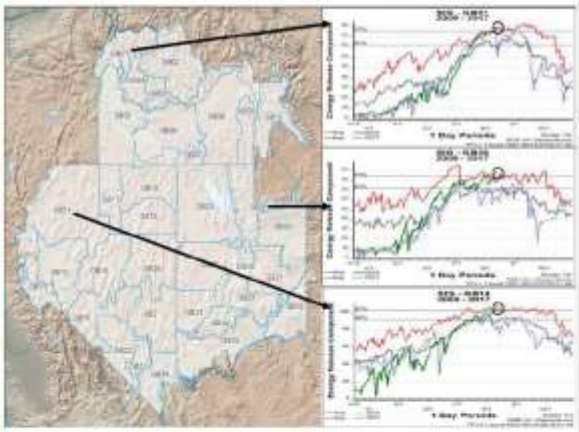
Clair E. Ketchum
Warning Coordination Meteorologist National Weather Service – Elko, NV

Fuels and Fire Behavior Advisory

Northern Great Basin – below 7000'

August 13, 2018 – August 27, 2018

Subject: Significant carryover fine fuels from the 2017 fire season exist over Western and Northern Nevada, southern Idaho and northwest Utah with multiple new crops of cheat grass from a wet 2018 spring. Continuous fine fuel loading 200-300% of average in many areas. These dry fine fuels, along with near record low 100-hr,1000-hr fuel moisture, record high ERC's and dry brush will drive advanced to extreme fire behavior over Western and Northern Nevada, northern Utah and across most of Southern and Central Idaho, mostly in areas below 7,000 feet.



Discussion: Extreme fire behavior has been observed on recent fires in these areas with several fires recently growing over 20,000 acres in a 24 hour burn period.

Difference from normal conditions: Fine fuel loading is 200-300% of normal in many low-mid elevations of northern Nevada, and only slightly less in Idaho and northern Utah. Across mid-high elevations, heavy fuels are critically dry and ERC levels are near or at new historical highs for the time of year for many parts across the advisory area. Sagebrush live fuel moisture is now below critical levels making sagebrush a significant contributor to fire spread in addition to the significant dead fine fuel load.

Concerns to Firefighters and the Public:

- Anticipate rapid rates-of-spread, even in the absence of slope and wind. You can't out run it!
- Anticipate flashy fine fuels and pinyon-juniper to ignite easily and exhibit advanced rates of spread, elongated flaming fronts and increasing fire brands; expect more long range spotting
- Short and mid-range spotting in fine fuels is possible with wind gusts, fire whirls, and frequent dust devils creating spotting potential greater than ½ mile in grass / sage fuel types with a probability of ignition generally over 90% based on current weather. Fine fuel loadings are dense and continuous and will support extreme rates of spread regardless of fuel heights.
- Under the right atmospheric conditions, fires in dense, heavier fuels can develop into large plume dominated fires.

Mitigation Measures:

- Direct attack may not be feasible in many circumstances and use of indirect attack measures may be necessary.
- Ensure you are planning well ahead of the fire.
- Choose the best ridge not the next ridge.
- Expect long-range spotting of up to a mile or more with well-developed columns.
- Retardant NOT effective unless immediately followed up with firefighters and/or bucket drops.

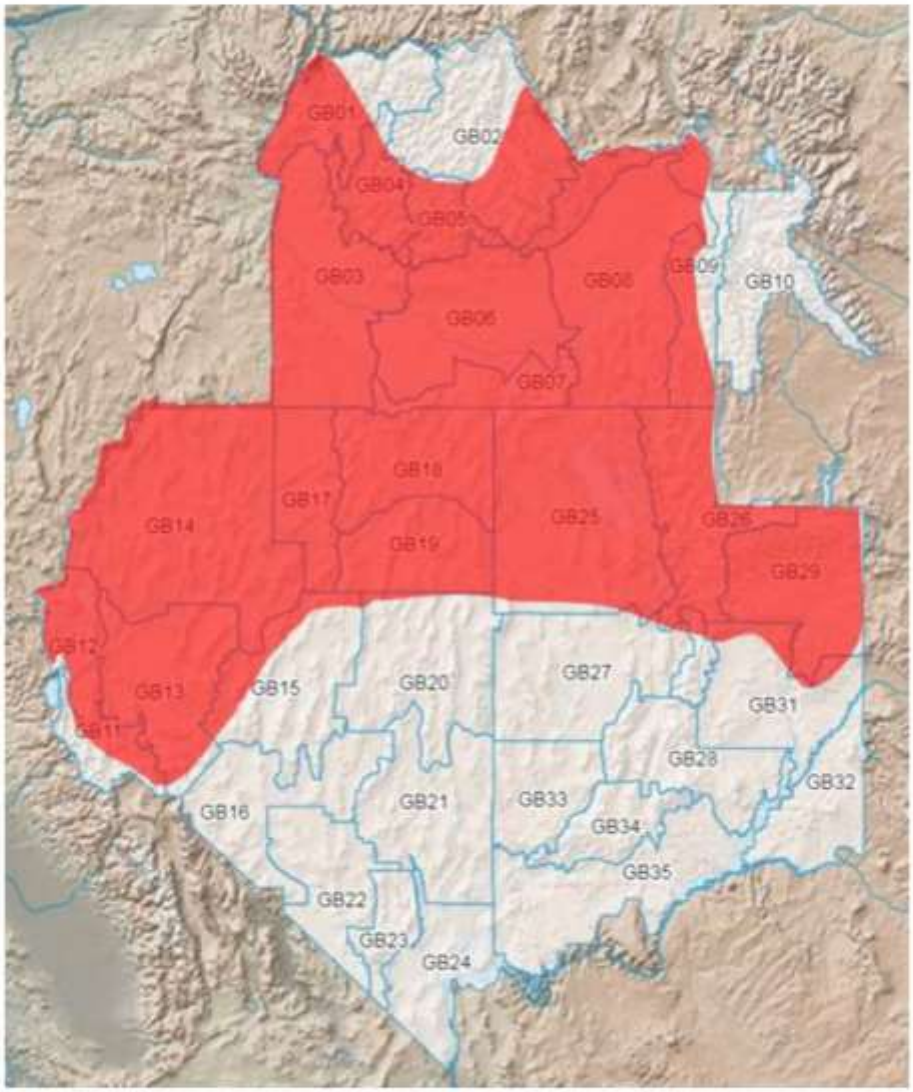
Issued By: GBCC Predictive Services, Basil Newmerzhycky, Shelby Law (Meteorologists)

Fuels and Fire Behavior Advisory

Northern Great Basin

August 13, 2018 – August 27, 2018

Area of Concern: The area of concern includes western and northern Nevada, northern Utah and much of Idaho below 7000'.



Back to Main Page

Fire Weather Forecast for NVZ468

FNUS55 KLKN 180920
FWFLKN

Fire Weather Planning Forecast for Northern and Central Nevada
National Weather Service Elko NV
220 AM PDT Sat Aug 18 2018

.DISCUSSION...Sunny and warm this weekend. Winds increase across the region Monday afternoon which may approach critical levels in some zones. A mix of isolated wet and dry thunderstorms are possible Monday afternoon and early evening across mainly zones 470 and 455.

Note: See Fire Weather Discussion in the Area Forecast Discussion for more info
Note: Thunderstorms imply gusty and erratic winds
Note: CWR means precipitation totals will be more than 0.10 inches
Note: Winds in the extended forecast are average daytime winds

NVZ468-182315-
Eastern Humboldt County and Northwestern Elko County-
220 AM PDT Sat Aug 18 2018

.TODAY...
* Sky/weather.....Sunny. Patchy smoke.
* Max Temperature....
* Valleys.....85-95.
* Mid slope.....80-90.
* 24 hr trend.....Little change.
* Min humidity.....
* Valleys.....6-11%.
* Mid slope.....9-14%.
* 24 hr trend.....2% drier.
* 20-foot winds.....
* Valleys.....Upslope/up valley winds 4 to 8 mph.
* Ridge top.....West 10 to 15 mph.
* Haines Index.....5.
* LAL.....1.
* Mixing Height.....11000 ft agl.
* Transport winds....West 10 to 15 mph.
* Chc Wetting Rain...0%.

.TONIGHT...
* Sky/weather.....Clear. Patchy smoke.
* Min Temperature....
* Valleys.....48-58.
* Mid slope.....56-66.
* 24 hr trend.....2 degrees warmer.
* Max humidity.....
* Valleys.....32-42%.
* Mid slope.....21-31%.
* 24 hr trend.....4% drier.
* 20-foot winds.....
* Valleys.....Downslope/down valley winds 2 to 5 mph.
* Ridge top.....West 10 to 15 mph.
* Haines Index.....5.

* LAL.....1.
* Chc Wetting Rain...0%.

.SUNDAY...
* Sky/weather.....Mostly sunny. Patchy smoke.
* Max Temperature....
* Valleys.....88-98.
* Mid slope.....83-93.
* 24 hr trend.....3 degrees warmer.
* Min humidity.....
* Valleys.....4-9%.
* Mid slope.....8-13%.
* 24 hr trend.....Little change.
* 20-foot winds.....
* Valleys.....Upslope/up valley winds 4 to 8 mph.
* Ridge top.....Southwest 6 to 12 mph.
* Haines Index.....5.
* LAL.....1.
* Mixing Height.....11000 ft agl.
* Transport winds....Southwest 10 to 15 mph.
* Chc Wetting Rain...0%.

.Extended...
.SUNDAY NIGHT...Mostly clear. Patchy smoke. Lows 54-64. Downslope/down valley winds 2 to 5 mph.
.MONDAY...Mostly sunny with isolated dry thunderstorms. Highs 88-98. Southwest winds 10 to 20 mph.
.TUESDAY...Mostly clear. Lows 52-62. Highs 88-98.
.WEDNESDAY...Mostly clear. Lows 57-62. Highs 87-97.
.THURSDAY...Mostly clear. Lows 55-60. Highs 86-96.
.FRIDAY...Mostly clear. Lows 50-60. Highs 85-95.

.8 TO 14 DAY OUTLOOK FOR (SAT AUG 25 through FRI AUG 31)
Above normal temperatures and Near normal precipitation.

USA.gov

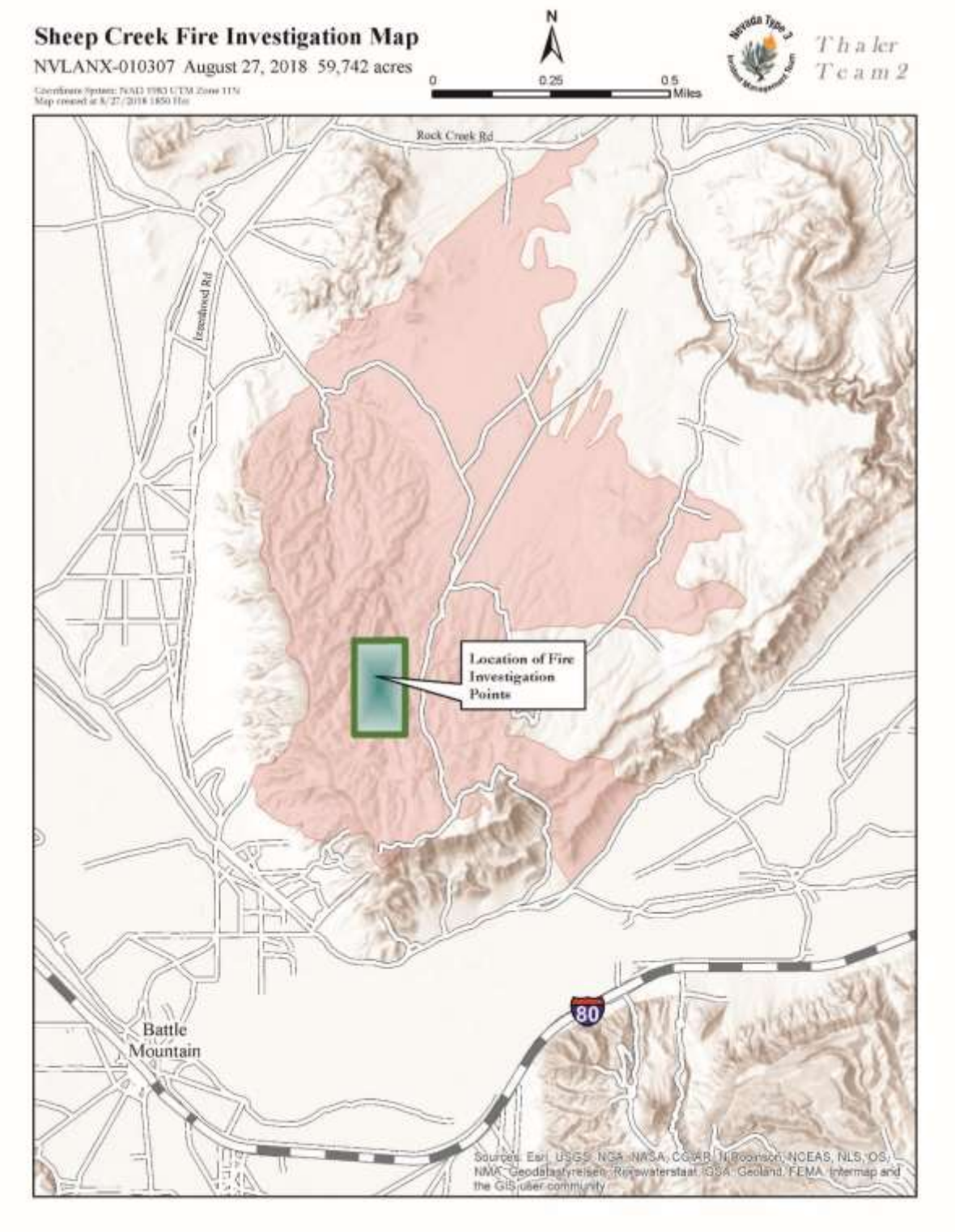
- US Dept of Commerce
- National Oceanic and Atmospheric Administration
- National Weather Service
- ,
- w-lkn.webmaster@noaa.gov

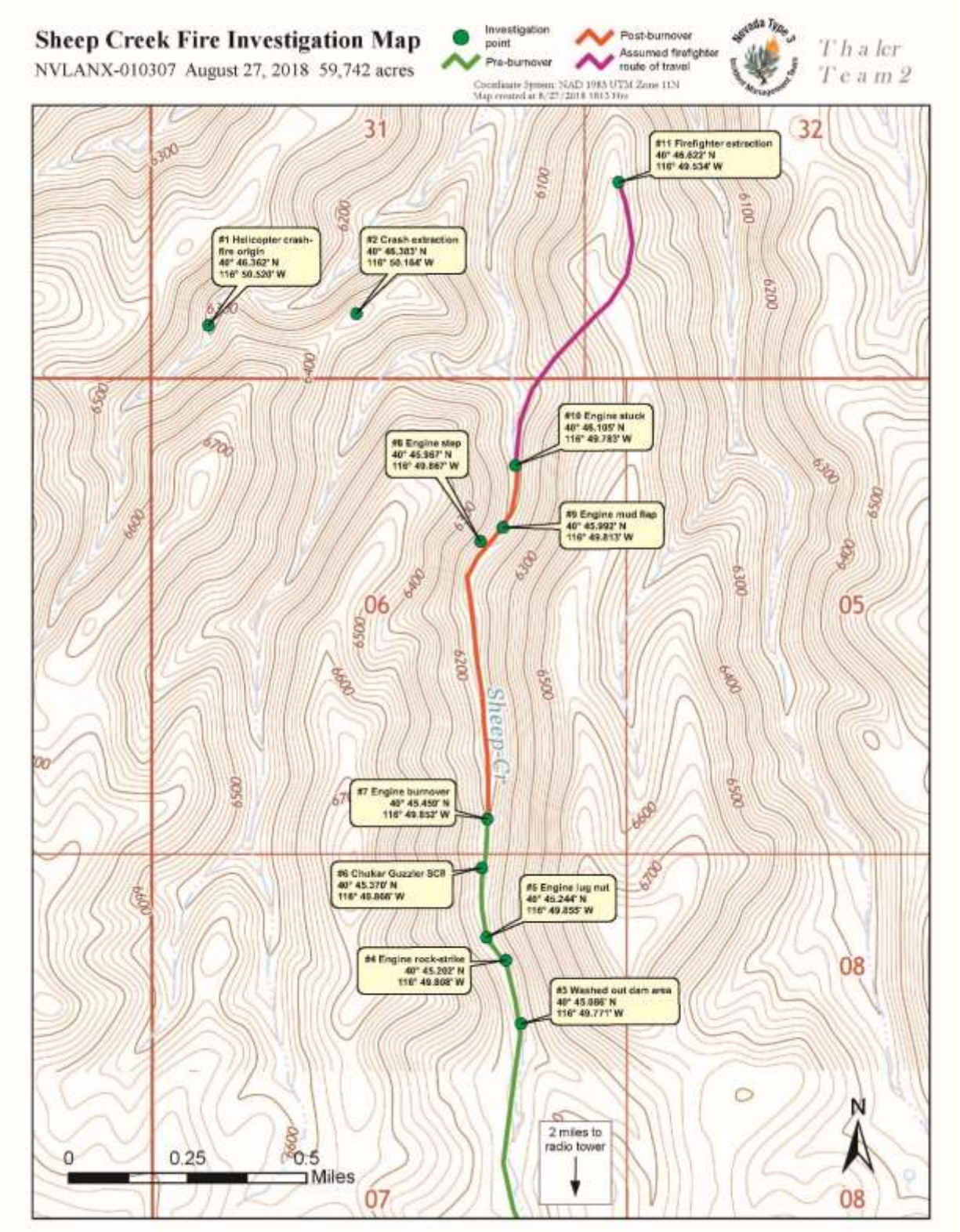
- Disclaimer
- Information Quality
- Help
- Glossary

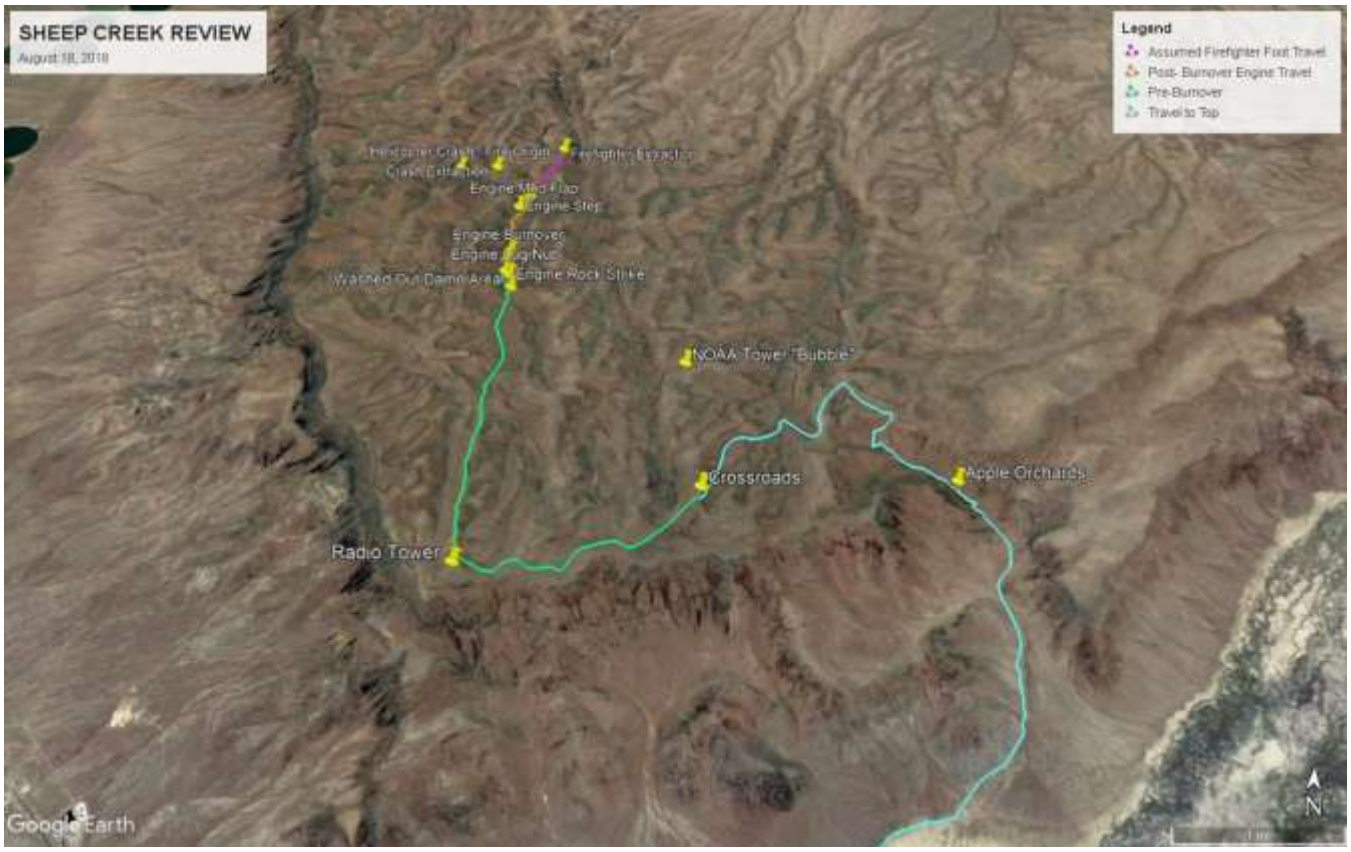
- Privacy Policy
- Freedom of Information Act (FOIA)
- About Us
- Career Opportunities

APPENDIX B

MAPS




Sheep Creek Fire Investigation Map
NVLANX-010307 August 27, 2018 59,742 acres
Investigation point
Pre-burnover
Post-burnover
Assumed firefighter route of travel
Nevada Type 3 Incident Management Team
Thaler Team 2
Coordinate System: NAD 1983 UTM Zone 11N
Map created at 8/27/2018 1813 Hrs
#11 Firefighter extraction
40° 46.622' N
116° 49.534' W
#1 Helicopter crash-fire origin
40° 46.362' N
116° 50.520' W
#2 Crash extraction
40° 46.383' N
116° 50.184' W
#10 Engine stuck
40° 46.105' N
116° 49.783' W
#8 Engine step
40° 45.967' N
116° 49.667' W
#9 Engine mud flap
40° 45.992' N
116° 49.813' W
#7 Engine burnover
40° 45.459' N
116° 49.852' W
#6 Chukar Guzzler SCB
40° 45.370' N
116° 49.866' W
#5 Engine lug nut
40° 45.244' N
116° 49.855' W
#4 Engine rock-strike
40° 45.202' N
116° 49.868' W
#3 Washed out dam area
40° 45.086' N
116° 49.771' W
Sheep Cr
2 miles to radio tower
0
0.25
0.5
Miles
N
31
32
06
05
07
08


SHEEP CREEK REVIEW
August 18, 2018
Legend
Assumed Firefighter Foot Travel
Post- Burnover Engine Travel
Pre-Burnover
Travel to Top
Engine Step
Engine Burnover
Engine Lug Nut
Engine Rock Strike
Washed Out Damn Area
NOAA Tower "Bubble"
Crossroads
Apple Orchards
Radio Tower
Google Earth
N


SHEEP CREEK REVIEW
August 18, 2018
Legend
Assumed Firefighter Foot Travel
Post- Burnover Engine Travel
Pre-Burnover
Travel to Top
Engine Step
Engine Burnover
Chukar Guzzler
Engine Lug Nut
Engine Rock Strike
Washed Out Damn Area
Google Earth
N

APPENDIX C

BURNOVER SITE

Aerial View of Incident within Incident

Burnover Site from Ground

APPENDIX D

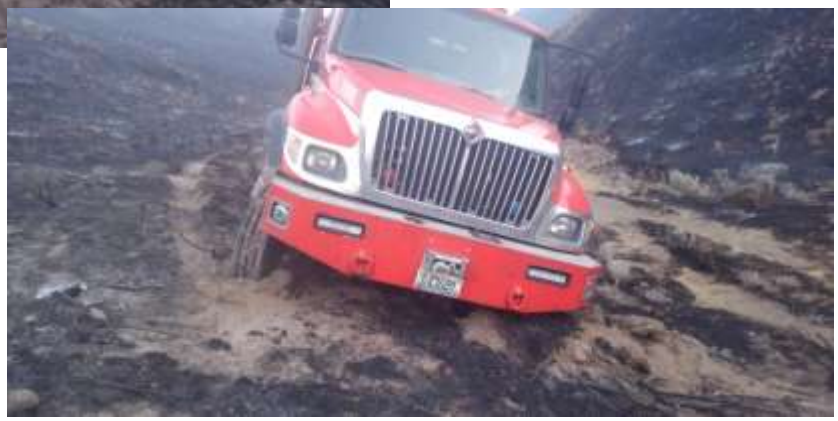
PRIOR TO THE BURNOVER


IMPACT ON BOLDER
CHUKAR GUZZLER
DIRECTION OF TRAVEL
LOG COVER AND STRIKE
DIRECTION OF TRAVEL
IMPACT TO DRIVER SIDE STEP PRIOR TO BURNOVER
DIRECTION OF TRAVEL

POST BURNOVER

APPENDIX E

PUMPER-2




BATTLE
F
D
MOUNTAIN


2008