Oregon Post-Wildfire Flood Playbook

September 30, 2018

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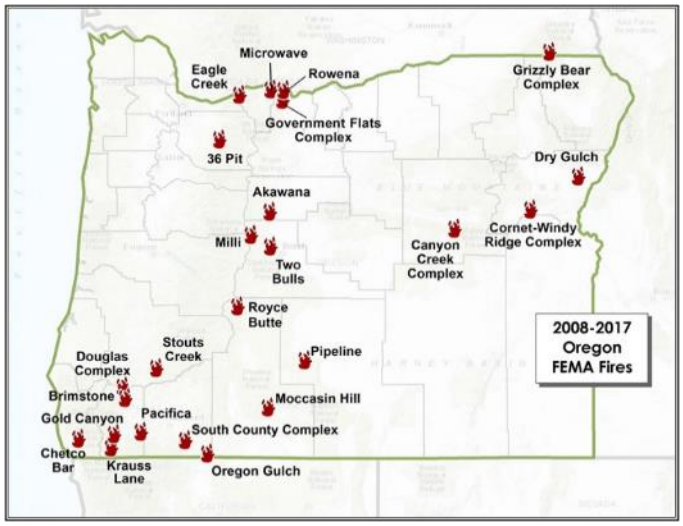
What is in this guide?

This guide contains resources for local governments to address increased flood risk and debris flows that can occur after large wildfires. **This guide is a resource to communities affected by a wildfire that need to navigate the complex web of federal and state programs and agencies.**



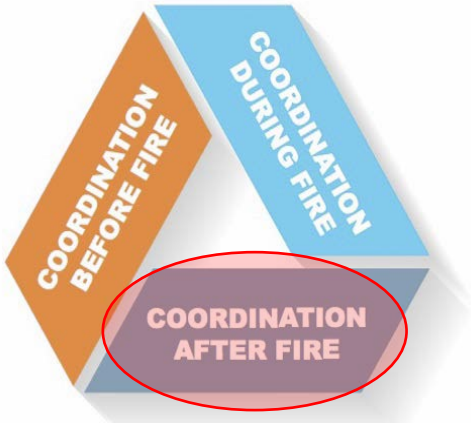
Fires with a FEMA Fire Management Assistance Declaration, 2008-2017

While wildfires generate many hazards, this guide focuses on two topics: increased flood hazard, and increased debris flow hazard. This does not minimize other concerns after a fire, such as public safety on transportation and recreation, ecosystem restoration, and economic recovery.

The main body of this guide is relatively short, with much more detail in the appendices. This guide first explains post-fire risks for flooding and debris flows, followed by general principles on how to address these risks. It explains agency roles and gives real examples using case studies. Appendix A has case studies about responses to post-fire threats. The case studies are from the Eagle Creek, Canyon Creek, Stouts Creek, and Carlton Complex Fires. Appendix B has agency summaries of the agencies that assist with post-fire flood risk. Appendix C lists the possible assistance for local governments, with eligibility information.

Who is this guide for?

The handbook is primarily for city and county community officials after a fire. **Emergency managers, floodplain managers, and hazard mitigation planners will find it most useful**. Local officials can use components of the playbook to respond to the increased flooding threat after a fire. This guide provides a boost to coordination of mitigation efforts after a fire. Strong working relationships built during one phase of the cycle provide a foundation for continued coordination and cooperation during other phases of the cycle.



While the primary audience is local community officials, others may use the playbook. It can be an educational tool for private landowners and local law enforcement. Soil and water conservation districts, state officials, and federal officials can use the playbook to understand other agencies' roles and responsibilities.

Why is there a higher risk of flooding after a fire?

Wildfires dramatically change the landscape and ground conditions, which can lead to a higher risk of flooding. **When a wildfire burns a portion of a watershed, the resulting burn scar increases the potential for flooding until vegetation is re-established**. Natural, unburned vegetation and soil normally act as a sponge during a rainfall event. However, the heat from a fire can bake the ground, creating a surface that will not absorb water and can increase the speed with which water flows off the slope. When a wildfire compromises or eliminates these normal protective functions, the potential for significant flooding and debris flows increases. The infographic illustrates this below:

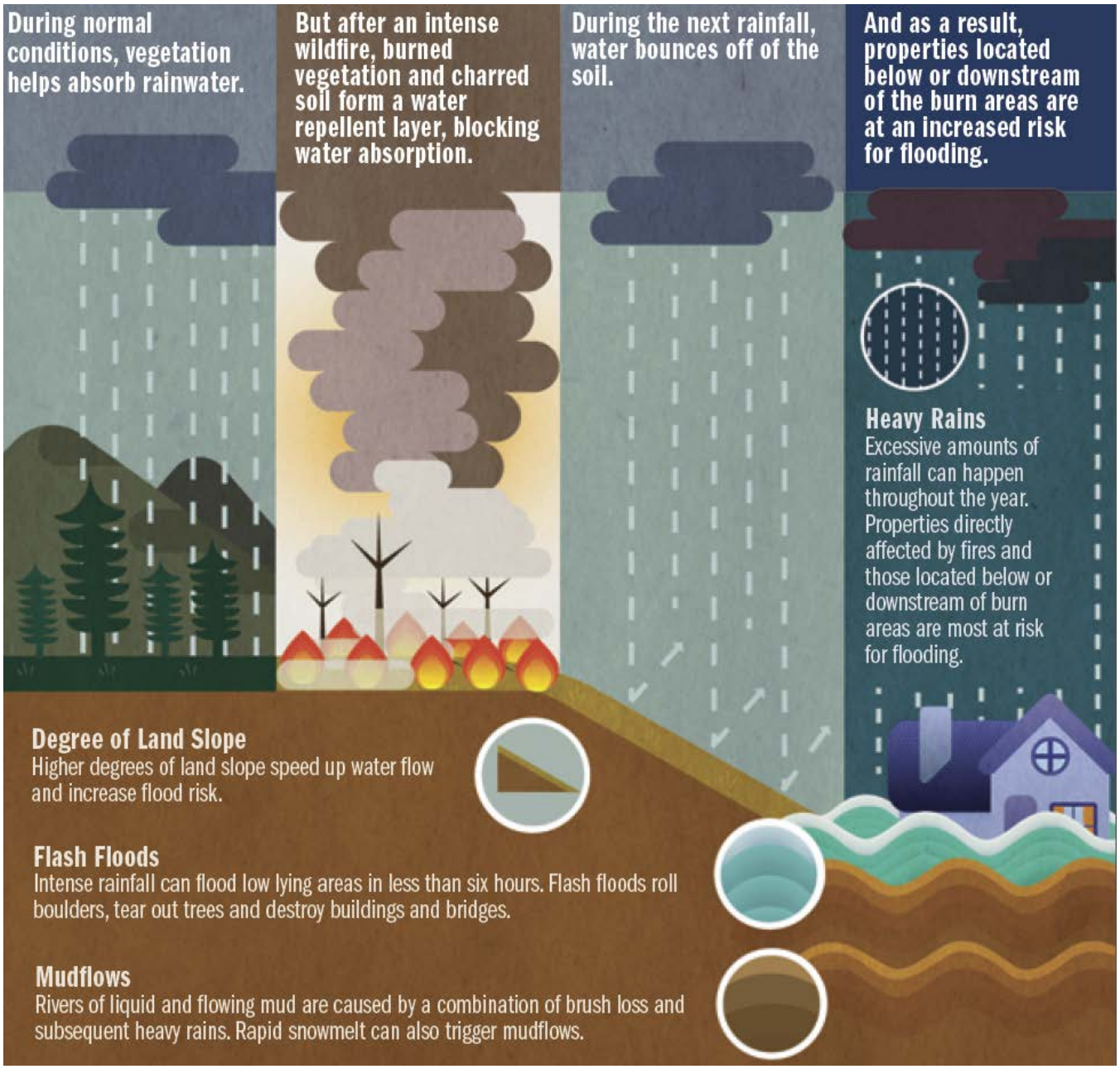


Image adapted from FEMA Flood After Fire Toolkit

Two distinct types of hazards exist when a heavy rainstorm occurs on a burned watershed: flooding and debris flows.

Water does not easily infiltrate burned soils

Flash Flooding

Flash floods are a concern even without a burned watershed. The most deadly disaster in Oregon history was the flash flood in Heppner in 1903, which resulted in 247 fatalities. **The odds of a flash flood increase dramatically when a fire has burned the area upstream.** Destructive flash flooding occurred in 2014 near Wenatchee, Washington just a few months after the Carlton Complex fire burned the watershed upstream of the area.

2013 Flash flood in Colorado

For any burn area, it takes much less rainfall to result in flash flooding than before the wildfire. Even modest rainstorms or heavy rain for a short time over a burned area can cause flash flooding downstream. Thunderstorms that develop quickly over burn areas can produce flash flooding and debris flows nearly as fast as National Weather Service radar can detect the rainfall, providing only a short time for warnings. These floods are typically much larger for a given sized storm than they were before the wildfire, so flooding is likely to be much more extensive following wildfire, endangering properties previously considered safe from flooding. A general rule of thumb is that half an inch of rainfall in less than an hour is sufficient to cause flash flooding in a burn area (NOAA). Likelihood of flooding can depend on the terrain, how much time the ground has had to heal, vegetation regrowth and the severity of the fire on the landscape. These floodwaters typically transport surface debris such as downed trees and gravel, but still behave like water.

Debris Flows (Mudflows)

As water runs downhill through burned areas, it can create major erosion and pick up large amounts of ash, rocks, boulders, and burned trees, generating a debris flow (also commonly termed "mudflow")[1]. **Fast-moving, highly destructive debris flows are one of the most dangerous post-fire hazards, since they occur with little warning**. High rainfall rates are the trigger for debris flows, rather than the total amount of rain. Their mass and speed make them particularly destructive. Debris flows can strip vegetation, block drainages, damage structures, and endanger human life. The force of the rushing water and debris can threaten life and property miles away from the burned area. Survivors of debris flows describe sounds of cracking, breaking, roaring, or a freight train. Refer to Appendix D for videos of debris flows.

[1] "Debris Flow" and "Mudflow" are used interchangeably in this document. The National Flood Insurance Program covers damages from both flooding and mudflows, and a debris flow qualifies as a mudflow. For more detailed definitions, refer to Lancaster et al (2015), "Alluvial Fan Flooding Hazards: An Engineering Geologic Approach", California Geologic Service.

Debris flows result in major devastation, as evidenced in January 2018 in Southern California and September 2014 near Wenatchee, WA. In December 2017, the Thomas fire burned many areas upslope of Montecito. Less than a month later, heavy rain on the burn scar led to severe debris flows that caused 21 fatalities and destroyed over 100 homes. In 2014, debris flows following the Carlton Complex fires resulted in severe property damage and a near-fatality.

How long do post-wildfire risks last?

In areas that have been severely burned, post-wildfire risks of floods or debris flows may last for **two to five years**. After two or three years, the regrowth of vegetation and reduced water repellency of the soil should lower the risk considerably.

What actions will reduce risk?

Communities cannot entirely eliminate the risk of flooding or debris flows after a fire, but they can take steps can reduce risk. Risk is a function of:

1. The probability of an event occurring
2. The negative consequences created by the event.

Strategies to mitigate risk include measures to address both components of risk. While nothing can control the weather, some measures can reduce the chances of an event on the ground. For instance, smaller culverts can clog easily with debris, which can cause water to back up and overtop roadways, potentially eroding away the slope and suddenly releasing a large amount of water. Debris control structures can be installed upstream of culverts, or they can be replaced with larger structures to reduce the chances of this situation occurring. This type of mitigation addresses the probability component of risk. Measures that mitigate the consequence component of risk include creating warning systems and purchasing flood insurance.

While “all disasters are local”, state and federal government agencies have a role to play in preparing for flooding hazards. When all levels of government take action, the response is more effective. Activities to respond to the post-fire threat are broken down into three categories:

1. **Independent State/Federal Government Actions**: Actions occur with limited community input.
2. **Direct State/Federal Government Assistance**: Support potentially available by community request.
3. **Community-Driven Activities**: Risk mitigation activities with a more limited state/federal role.

1. Independent State/Federal Government Actions

The actions in this category will occur regardless of how proactive local communities are in asking for support. The community can inform these actions, but they will usually occur with no formal request. Some examples include:

1. **Incident Management Team**. State or federal agencies typically lead the direct response and firefighting activities. This team dissolves once the immediate threat of the fire is over.
2. **Burned Area Emergency Response (BAER)**. BAER teams identify and manage potential risks to resources on all Federal lands and reduce these threats through appropriate emergency stabilization measures to

protect human life and safety, property, and critical natural or cultural resources. For more information, refer to Appendix C.

3. **Targeted forecasting**: Targeted forecasting of rainfall in a burned area begins while the fire is still ongoing. The National Weather Service further refines the post-fire forecasts by reviewing values at risk and placing greater focus on watches and warnings near the burned area.

2. State/Federal Government Assistance

The community must request most assistance programs from federal and state agencies. Proactive communities ask for this support so that the burden of reducing risk is not borne entirely locally. Assistance is not always available, and different programs become available depending on the size of the fire and on what lands it occurs. For a full list of all assistance programs with eligibility requirements, refer to Appendix C.

Emergency declarations often open the door to larger state and federal assistance. Local government provides initial response to the emergency or disaster. Neighboring communities and volunteer agencies supplement these efforts. If local governments are overwhelmed, the emergency management office requests the county commissioners declare a state of emergency and request state assistance. Once the state exceeds the amount of assistance it can provide, the Governor may make a request to the President, who may issue "major disaster" or "emergency" declarations before or after catastrophes occur. Emergency declarations trigger aid that protects property, public health and safety, and lessen or averts the threat of the incident becoming a catastrophic event. A major disaster declaration constitutes broader authority of federal agencies to provide supplemental assistance to help state and local governments, families and individuals, and certain nonprofit organizations recover from the incident.

State and federal assistance takes two general forms: direct services and financial grants. Direct services are those actions for which the agencies do the work themselves, with no transfer of funds to the community. Other assistance programs use a more grant-based approach that transfer financial resources to the community for them to manage. Grant funding is often uncertain: financial limitations, benefit-cost requirements, and competition sometimes prevent award of grants. The table below gives some examples of direct services and financial grants—see Appendix C for a full list:

Direct Services	Financial Grants
Rapid-deployment rain gauges	Emergency Watershed Protection Program
Flood and debris flow risk assessments	Hazard Mitigation Grant Program
Emergency Permitting	Technical Assistance Grant
	Environmental Quality Incentive Program (e.g. reseeding)

3. Community-Driven Activities

State and Federal assistance will not cover all the needs of a community. While state and federal agencies support risk mitigation activities, many actions require a stronger local lead. **Local governments are better suited to lead many activities, since they know the area and population much better than state and federal**

officials. Local governments should work with private landowners and soil and water conservation districts to accomplish these risk reduction measures. Some activities that the local community typically leads include:

1. **Risk communication to residents and landowners**: While state and federal agencies may hold occasional public meetings and emphasize risks via their public information offices, the most trusted voices to residents are local government agencies. Residents and businesses in areas downstream of a wildfire should be aware of the hazards they face, the steps they can take to reduce their risk, and resources that may be available to assist them. Ensuring that the community is well-informed and prepared for risks will help the community be more resilient if a flood occurs. At a minimum, residents should be encouraged to sign up for emergency alert services.

2. **Flood insurance**. Local governments can encourage residents to purchase flood insurance policies. **Homeowner's insurance does not cover flooding**. Homeowners must purchase separate policies to cover flood damage through the National Flood Insurance Program or from private insurers. Floods after wildfire are typically more extensive than before wildfires. Individuals and businesses downstream of the burned area need to reassess their flood risk and re-evaluate the need to purchase flood insurance even if they were previously outside the flood zone. There is normally a 30-day waiting period for new flood insurance policies to go into effect. FEMA may waive this requirement if a property is affected by flooding on burned federal land and the policy is purchased within 60 days of the fire containment date. To find out more about flood insurance, contact the Oregon Department of Land Conservation and Development or go to FEMA's webpage: https://www.fema.gov/national-flood-insurance-program/How-Buy-Flood-Insurance
3. **Flood warning systems**. One option to reduce risk is to install a flood warning system with sirens or other warning cues. While the National Weather Service may be able to assist in alert thresholds, it is up to the local government to operate the system.

Why coordinate after a fire?

In any large-scale event, it is critical to establish a framework for coordination among all parties involved in the response. **Unlike during the fire, a federal or state unified incident command does not generally manage response or recovery after a fire**. Instead, each agency and each level of government continues to act on its own authority. This creates an even greater need for coordination at the local level and sharing information among agencies to coordinate wildfire recovery efforts.

Who should lead the response effort?

Typically, the community establishes a locally-led post-fire coordination group to lead and direct the response to the wildfire and any subsequent natural hazards, and help determine post-fire treatment options. **The local emergency management office is usually best suited to coordinate this group**. State and federal partners contribute to the team, but it is more important to ensure that local groups are part of the team. Particularly key

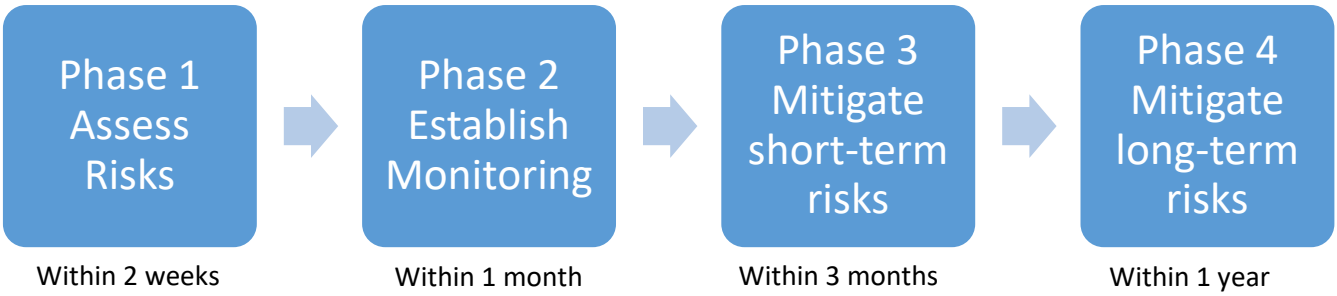
partners are the local Soil and Water Conservation Districts (SWCDs), as they provide a link to private landowners who will be directly affected by the increased hazard. If local emergency management is not staffed to lead the response, SWCDs can often fill the gap. The primary functions of the group include:

- Coordinating the risk assessment and the exchange of information among agencies and landowners
- Assembling and exchanging geospatial data
- Matching risks to the agency best able to mitigate the risk
- Supporting public communications
- Coordinating with elected officials

The flood and debris flow risks typically comprise just one component of the larger team. Often, sub-teams address specific hazards or risk communication. For an example of how this occurred in the Eagle Creek fire, refer to Appendix A.

How does post-fire response to the flood hazard come together?

There is no one-size-fits-all approach to addressing the post-fire risk. It differs based on the location, scale of destruction, and the land owners of the burned areas. After establishing a coordination team to address the risk of flooding and debris flows, some best practices apply. The figure below gives a helpful framework for thinking about responses after the fire. This process should begin before the fire is completely contained. While the figure shows a linear process, it is likely that additional risks will emerge through the course of the post-fire response. For an example of a real-world application of this process, refer to the Canyon Creek case study in Appendix A.



Phase 1-Assess Risks

Before beginning a concerted response effort, the coordination team should assess the severity of the risks. The coordination team should begin by sharing all known analysis on flood risk that existed before the fire. Potential steps to take in this phase include:

1. **Retrieve existing information**. This typically includes retrieving FEMA floodplain maps, hydraulic models of the rivers and creeks in the area, rainfall-runoff models, the BAER team reports and maps, and any other relevant existing work.
2. **Conduct a field visit**. This should involve all agencies participating in the coordination to see the areas of the community at risk. This field visit does not need to involve traveling inside the fire perimeter, but should include areas at risk downstream or downslope of the fire.

3. **Establish a risk register**. A working database of risks identified and potential mitigation measures is critical to a coordinated effort.
4. **Connect private landowners with support**. This includes ODF Stewardship foresters, NRCS District Conservationist, or Soil and Water Conservation Districts that can assist with replanting efforts and erosion management (see Appendix C). The Emergency Watershed Protection Program is one resource for private lands to assist with streambank protection, debris clearing from channels, and other protective measures.
5. **Apply for advance measures from USACE**. If the risk is severe enough and the emergency has depleted local and state resources, USACE may be able to provide support in risk assessments through the Advance Measures program (see Appendix C).

Phase 2-Establish Monitoring

Monitoring activities provide no reduction in probability of an event occurring, but they can give advanced warning of hazards. Monitoring provides a mechanism for the coordination team to stay up-to-date with the situation on the ground and adapt to an evolving risk landscape. Potential activities include:

1. Request a rapid-deployment stream gauge from OWRD or USGS (see Appendix C)
2. Request a rapid-deployment rain gauge from NWS (see Appendix C)
3. Work with NWS, USGS, and USACE to set up emergency alert thresholds based on rainfall rates.
4. Contact NRCS to see if targeted snowpack forecasting is available (see Appendix C)
5. Visit the creeks in the area periodically to document changes in channel conditions (e.g. sedimentation and debris).

Rain Gauging Station

Phase 3-Mitigate short-term risks

After identifying a significant risk, the team should explore options for mitigation of that risk. Short-term risks are defined here as those that can be addressed within 3 months of the fire. Many of the mitigation measures in this phase are temporary, just to get the community through the winter. Potential mitigation measures for risks include:

1. Coordinate emergency response preparation. This could involve developing an Incident Action Plan to respond to a flood/debris flow.
2. Procure a source for sandbags and Hesco barriers and notify residents of distribution procedures so they can protect their property.
3. Elevate critical equipment and records that may be lost if a flood occurs.
4. Install debris control structures upstream of culverts.
5. Construct temporary berms to reduce risk of flooding, with proper permits (see Appendix C for emergency permit procedures).
6. Clear debris and downed trees from the channel (without excavation of the creek bed).

Phase 4-Mitigate long-term risks

Risks from fire can last several years, and short-term solutions are only a temporary fix to the problem. There often exists an opportunity to reduce risk in the long-term after the fire. The actions in this section generally take more time to coordinate, but result in more significant risk reduction. Potential mitigation activities include:

1. Apply for mitigation projects through OEM using Hazard Mitigation Grant funds, if applicable (see Appendix C). Mitigation projects can be very diverse, but can include buyouts of especially risky properties, replacing or relocating vulnerable infrastructure, restoring the landscape post-fire, and installing a flood warning system.
2. Apply for a Technical Assistance Grant from DLCD if the community natural hazard mitigation plan needs an update (see Appendix C).
3. Apply for a flood risk reduction study from USACE. This can take the form of a planning study only, or a small flood risk management construction project managed by USACE.
4. Replace undersized culverts with larger structures (culverts or bridges)

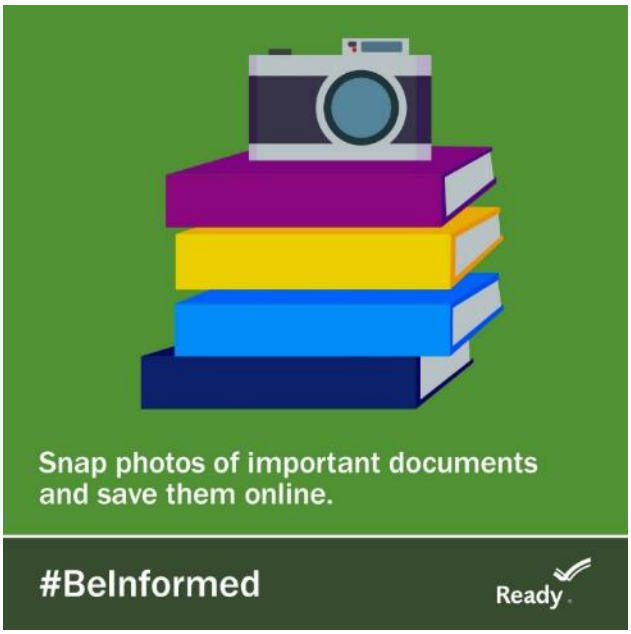
What should I tell residents?

Maintaining a steady flow of communication is critical to ensure that residents do not forget the continuing risk after the fire is over. FEMA has developed an extensive media toolset to assist with communications on flood risk that occurs after fire. The Flood After Fire toolkit contains templates for social media posts, infographics, and ideas for press releases. The toolkit is free of charge, and a link is in Appendix D. Appendix E offers a compilation of other suggested language for social media posts. Below are some tips to assist individuals, families, and businesses at this difficult time.

Document, document, document: Take pictures of your property from multiple angles (and provide "before" images if they are available). Taking pictures is one of the most important things you can do to help yourself.

Keep all of your receipts from restoration and recovery projects.

Consider purchasing flood insurance: A top priority after a wildfire is flood preparedness; flood insurance reduces financial exposure to flood damages. To find out more about flood insurance, contact the Oregon Department of Land Conservation and Development or go to FEMA's informational webpage on how to buy flood insurance (https://www.fema.gov/national-flood-insurance-program/How-Buy-Flood-Insurance).



Do not assume FEMA is all you need. A Presidential Disaster Declaration is required for a community to become eligible for FEMA funding. FEMA assistance, when provided, provides minimum assistance to get people on their feet after a disaster.

Who made this guide?

The Oregon Silver Jackets team is a partnership of state and federal agencies with a role in assessing and managing flood risk across the state. The Oregon Silver Jackets created this guide to increase preparedness for flooding and debris flow concerns after wildfires and provide a singular picture of state and federal assistance, rather than reaching out to each agency individually. Primary authors to this guide included: Angie Lane (OEM), Nick Henneman (ODF), David Lentzner (DLCD), Cara Farr (USFS), Spencer Higginson (NWS), Ryan Cahill (USACE), and Marc Stewart (USGS). For more information on the Oregon Silver Jackets, see our website: https://silverjackets.nfrmp.us/State-Teams/Oregon

Appendix A: Case Studies

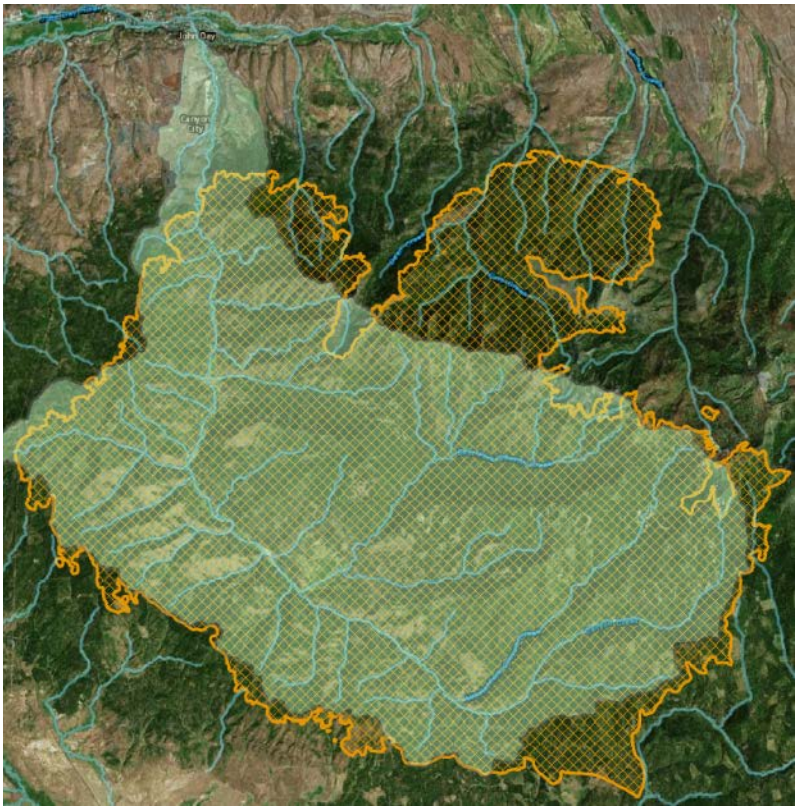
This guide is applicable throughout Oregon, but each individual fire presents a unique challenge. This appendix provides real-world case studies that show coordination and mitigation measures for four separate incidents. The 2015 Canyon Creek fire is perhaps the most applicable case study showing how a community addressed the increased risk of flooding. The 2015 Stouts Creek fire provides an example on a smaller scale. The 2017 Eagle Creek Fire response included extensive coordination and preparation for land movement and debris flows, though there was not significant flood risk from this fire. The 2014 Carlton Complex Fire occurred in Washington, and serious flooding and debris flows resulted.

2015 Canyon Creek Fire

Background

The Canyon Creek fire of 2015 is a comprehensive case study of interagency responses to the risk of increased flooding following a wildfire. In late summer of 2015, a large wildfire developed in Grant County. The fire burned over 110,000 acres, including nearly the entire drainage area of Canyon Creek. Canyon Creek flows through Canyon City to the John Day River. The increased risk of flooding to Canyon City from a burned watershed was identified early, and mitigation measures were taken to reduce the risk of potential flooding. No major storm events tested the Canyon Creek watershed since the fire, so no major flood events have occurred as of July 2018. Even so, the mitigation measures taken here provide examples of taking action against a serious risk. The temporary berm and sandbags had the unanticipated effect of preventing flooding due to ice jams in the creek.

https://inciweb.nwcg.gov/incident/4495/



Canyon Creek Fire perimeter in orange, watershed boundary in blue

Timeline

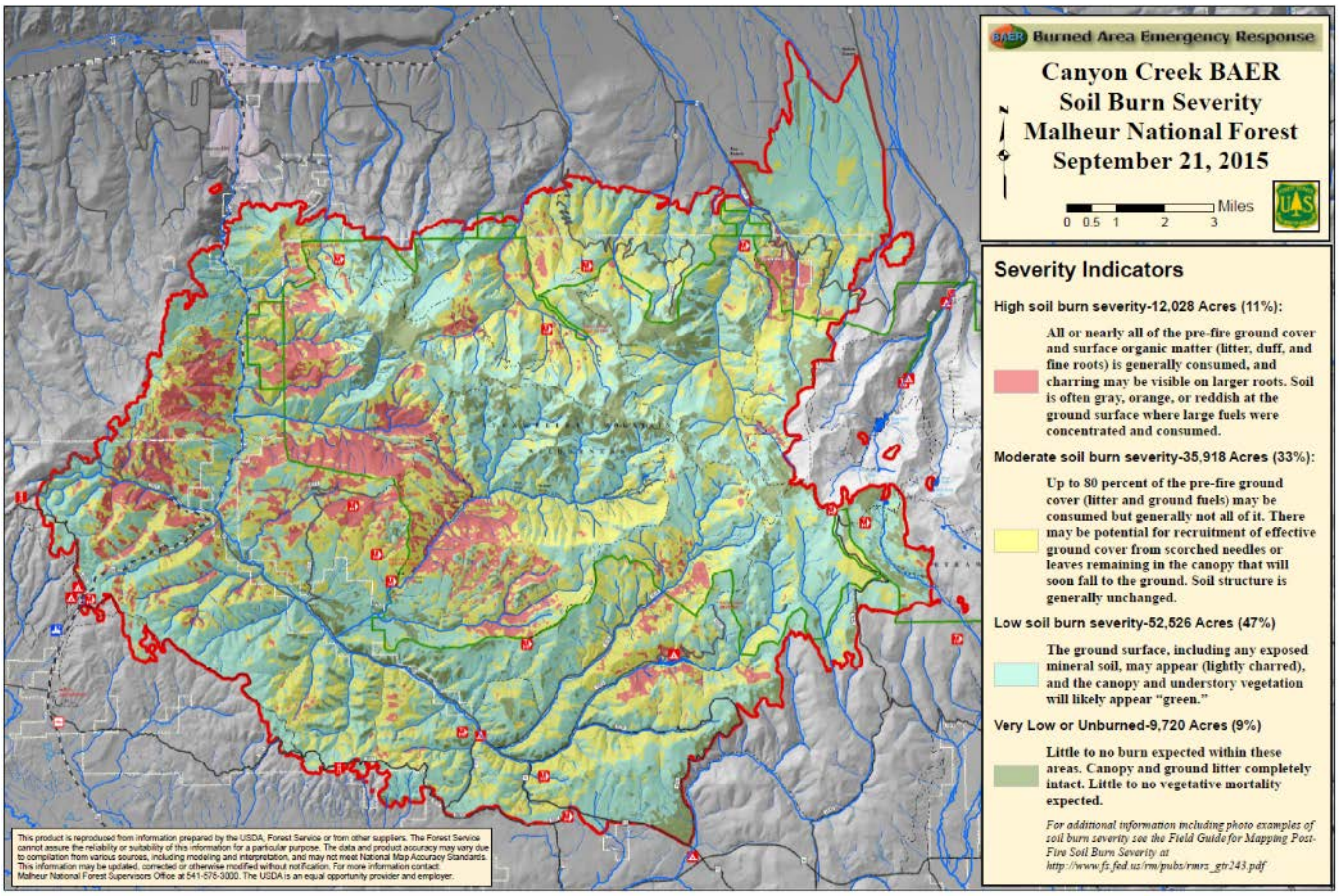
- August 12, 2015: Fire starts
- August 15, 2015: Federal Fire Management Assistance (FMA) Declaration (https://www.fema.gov/disaster/5102)
- September 20, 2015: Fire largely contained
- October 15, 2015: BAER Report produced by USFS.
    - USACE sent models and technical information to USFS to aid in report preparation
- October 26, 2015: Initial Silver Jackets outreach to community
    - Ad hoc public meetings organized by State Hazard Mitigation Officer. USACE, DLCD, and OEM attended from Silver Jackets team.
    - Field visit component identified risks and solutions outside the domain of the BAER report. For instance, a recommendation was to move historic documents out of the Courthouse basement, where they could be flooded.
- November 2015: Immediate mitigation
    - OWRD added two stream gauges and a rain gauge.
    - Two rain gauges were added by NWS
    - Placed sand bags and Hesco baskets around vulnerable properties.
- January 2016: Temporary berms constructed by community
- January 26, 2016: Emergency Management Tabletop exercise (OEM, FEMA, USACE, DLCD, OWRD, NWS present)
- February 2, 2016: State requests Advance Measures from USACE (letter from governor).
- March 2016:
    - USACE communicated value of temporary berms in reducing flood risk from hydraulic model results
    - Community expresses desire for "big dig"—to clear the channel and deepen it to increase conveyance. Silver Jackets team advises against this approach, instead recommending the removal of debris and hazard logs.

Temporary Berm Constructed in Canyon City

- May 9, 2016: Advance Measures closeout
- October 2016: Technical Assistance Grant from DLCD awarded to develop Canyon City Natural Hazard Mitigation Plan to be eligible for FEMA Hazard Mitigation Grant Program funding
- December 16, 2016: First draft of Canyon City Natural Hazard Mitigation Plan
- January 2017: City submits application to OEM/FEMA to use HMGP post fire funds to buyout a property with high flood risk
- Fall 2017: Targeted buyout property is sold to another private citizen.

Programs Activated

USFS-BAER: A BAER (Burned Area Emergency Response) team evaluated risks to life, property, and critical natural and cultural resources resulting from the impact of recent wildfires. USFS evaluates all fires with over 500 acres of National Forest system lands for the need of a BAER team assessment. The Forest Supervisor of the Malheur National Forest convened the BAER team for the Canyon Creek fire in mid-September to assess the fire. The team determined that approximately 45% of the fire area was in moderate and high soil burn severity and there was an increased risk of flooding and debris flows within National Forest System lands. Partner agencies involved during the assessment included the NWS, USACE, and NRCS. The team released their findings to the public shortly after approval. Approximately $4.5 million dollars' worth of emergency stabilization treatments were approved for protection of critical values on National Forest system lands. All treatments were implemented within one year of fire containment. A link to the hydrology section of the BAER report is at the link below:
www.oregon.gov/owrd/SW/docs/dam_safety/Canyon_Creek/2015_09_20_Canyon_Creek_Post_Fire_BAER_Report_USFS.pdf&usg=AOvVaw3gJfQQVRU1tQ5ZWgXyJ2Pi



Soil burn severity map from BAER report

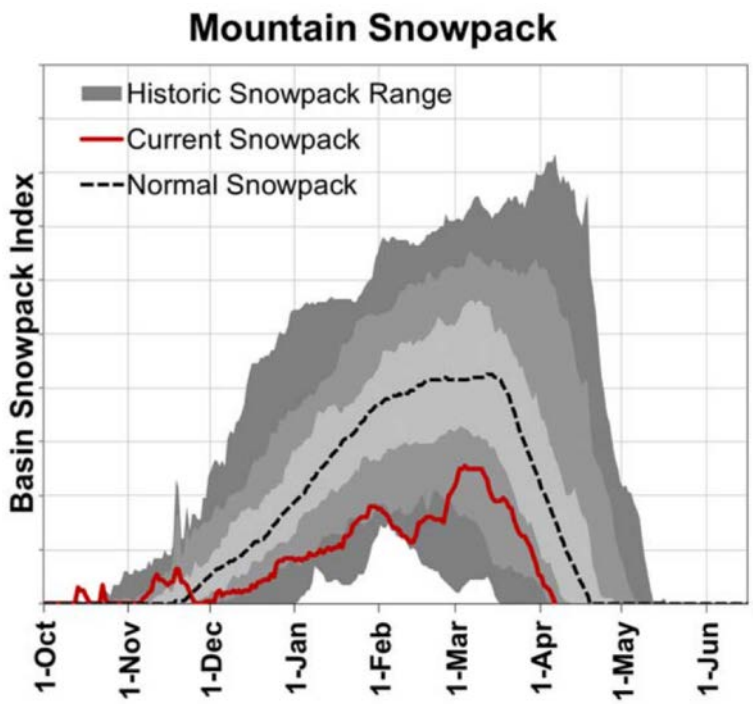
OEM/FEMA-HMGP: FEMA declared the FMAG (Fire Management Assistance Grant) Pilot for the Canyon Creek fire disaster, effective August 15, 2015. The opportunity to apply for hazard mitigation assistance under an FMA declaration was piloted in 2015. HMGP is available from FMA fires declared during Fire Season 2017-2018, though there are no guarantees it will be available in future years (subject to Congressional action). Typically, a wildfire disaster declaration only allows for fire suppression funding, but FMA declarations during Fire Season

2017-2018 allow for HMGP Post-fire funding. Grant County was allocated just over $441k for mitigation activities during the FMAG pilot of Fire Season 2015. Of this, approximately $20k was used to fund the OWRD stream gauges. The deadline for FMAG mitigation project applications was one year after the wildfire disaster declaration, but FEMA granted two extensions. Both FEMA and OEM had no streamlined process for rolling out the pilot, so there was delay in getting applications submitted that met the requirements for eligibility. Funds were intended to buyout a property on Inland Avenue at risk of flooding, but this did not occur. Grant County proposed no other mitigation projects that would have gained FEMA approval. The remaining funds transferred to Malheur County to restore state park lands affected by the Succor Creek fire that occurred in the same year. Under the 2015 pilot, adjacent counties can use funds.

ODF-Stewardship Foresters: ODF stewardship foresters provided technical assistance to operators after the fire. Technical assistance included providing: best management practices to help limit ground impacts during and after salvage harvests to reduce erosion; advice about replanting to help stabilize soil; and information about landowner assistance programs.

NRCS-Snow Survey Reports: Snow Survey staff worked with public affairs staff, local District Conservationists and other partners such as the National Weather Service to assemble weekly reports for the Canyon Creek fire. See the link below for an example:

http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/or/snow/?cid=nrcseprd854607



Example snowpack product from NRCS (April 2018 Canyon Creek forecast)

NRCS Environmental Quality Incentive Program (EQIP): NRCS worked with the Grant County Soil and Water Conservation District to implement post fire seeding of burned areas on private lands.

OWRD-Rapid Deployment Stream Gauging: OWRD installed two rapid deployment stream gauges upstream of Canyon City. There is no formal application process to receive this support—OWRD staff prioritizes placement of the rapid deployment gauges based on human safety concerns. HMGP grants (through OEM) were used to reimburse OWRD for the cost of the installation, but not for continuing operations and maintenance. OWRD removed these temporary gauges and installed permanent gauges around March 2016.

NWS-Rapid Deployment Rain Gauging: NWS installed temporary rain gauges in the burned area to get advance warning of large storm events. Canyon City informally requested these gauges. Internal NWS funds paid for these gauges once it was beyond the capacity of local and state efforts.

NWS Dry Soda Lookout Rain Gauge

NWS-Targeted Forecasting: NWS configured a pseudo-ALERT flash flood warning system. Warning threshold levels are set on the OWRD stream gauges. When river levels approach these thresholds, NWS will manually call Grant County Emergency to alert them that flash flooding is imminent. The ALERT system is still in place as of February 2018.

USACE-Advance Measures: Advance Measures were activated in February after receiving a request from the governor. The Advance Measures funding allowed USACE to model flooding scenarios with and without temporary berms and communicate these results to the community.

ODOT-Culvert replacement: ODOT replaced a culvert where Highway 395 crosses Vance Creek to reduce the risk of flash flooding if the original culvert were to become clogged with debris. ODOT replaced another culvert at Sheep Gulch.

Vance Creek culvert before replacement

DSL-Emergency Permitting: ODOT applied to replace two culverts at risk of clogging with debris, and DSL processed it as an emergency action. The permit number was 58527.

DLCD-Technical Assistance Grant: This funded the development of the Canyon City addendum to the Northeast Oregon Multi-jurisdictional Natural Hazards Mitigation Plan.

Lessons Learned

1. To access HMGP or FMAG funds, a community needs to have a FEMA-approved Hazard Mitigation Plan with the activities identified. While Grant County had a plan in place from 2014, Canyon City was not included in the plan. Canyon City had to scramble to get incorporated into the Northeast Oregon Multi-Jurisdictional Natural Hazards Mitigation Plan. The first draft of the Canyon City Addendum was released on December 16, 2016. FEMA approved it in August 2017.

2. Flood insurance is another option for residents to reduce their risk exposure after the fire, but it was not emphasized. There is typically a 30-day waiting period for new flood insurance policies to go into effect,

but this may be waived case-by-case if a property is affected by flooding on burned federal land and the policy is purchased within 60 days of the fire-containment date.

3. Post-fire property buyouts must occur rapidly to succeed. The City applied to buyout a flood-prone property on Inland Avenue in January 2017. The City planned to convert some of the property to open space and construct a protective berm on part of the property. While FEMA may have approved a simple application to convert to open space more readily, constructing a berm raised additional concerns. In July 2017, OEM and FEMA requested a more robust hydrologic study justifying the berm. By fall of 2017, the property owner sold the property to a private entity rather than wait for this process to conclude.

2017 Eagle Creek Fire

The 2017 Eagle Creek did not result in a major increase in flood risk to downstream communities. However, it posed major risks for debris flows, and is an excellent example of interagency coordination to prepare to respond to this threat. After giving a brief background on the fire and timeline, the formation of the post-fire response groups will be discussed.

Background

The fire began on September 2 in the Columbia River Gorge near Cascade Locks, and grew to 3,000 acres overnight. During the night of September 4th and 5th, east winds combined with excessive heat caused the fire to rapidly increase in size. By the morning of September 5th, the fire had grown to over 20,000 acres. The efforts of firefighters, cooler temperatures, and higher humidity helped slow fire growth in the days that followed, but the fire grew to the east and ultimately reached 48,861 acres. After the fire was fully contained in November, many recreation sites in the burn area were closed due to post-fire hazards such as fire-weakened trees and potential rockfall and landslides.

Overview of incident: https://inciweb.nwcg.gov/incident/5584/

Eagle Creek Fire Response Pages: https://www.fs.usda.gov/detail/crgnsa/fire/?cid=fseprd561692

https://www.fs.fed.us/eaglecreek

Timeline

- September 2, 2017: Fire starts
- September 3, 2017: Federal Wildfire Disaster Declaration (https://www.fema.gov/disaster/5203)
- September 20, 2017: Fire largely contained
- September 25, 2017: USFS BAER Team begins assessment.
- September 26, 2017: Interagency meeting to discuss recovery from fire. Lead for fire recovery transitions from USFS to County Emergency Management
- September 30, 2017: USGS completes debris-flow hazard assessment
- October 6, 2017: BAER Report produced by USFS.
- October 2017: Three subject matter expert groups form to ensure the region is prepared for land movement.
- October 31, 2017: NOAA installs a rain gauge in the burned area
- November 30, 2017: Fire 100% contained
- February 26, 2018: Table Top Emergency Management Exercise
- Spring 2018: DOGAMI, on behalf of Multnomah County, submits HMGP application to identify landslide risks. The application is currently being reviewed by the state and FEMA.

Post-fire coordination

After the immediate firefighting need is satisfied, emergencies typically move from response to a recovery process. With Eagle Creek (and other fires on Forest Service land), the Forest Service has a well-established mechanism to work through some aspects of recovery: the BAER process. The Forest Service issued the BAER report and began follow-up on the recommended actions after the fire. However, the Forest Service only operates within their lands, and it was unclear how much role other jurisdictions had in the recovery process. Local agencies had limited input into the BAER actions. In areas outside Forest Service jurisdiction, the Forest Service defers to local agencies for recovery and preparedness efforts.

The Multnomah County and Hood River County Emergency Management offices took the lead in coordinating groups concerned with the hazards that the fire created. Multnomah County Emergency Management invited large numbers of interested agencies to participate in this process. It largely consisted of entities focused on response to a potential disaster, since there was no clear lead for recovery. The coalition of agencies developed effective coordination to respond to a potential future emergency. Soon after the BAER report was issued, three sub-groups with all levels of government agencies and non-profits were created. A table-top emergency exercise was conducted in February 2018 that pulled the sub-groups together to discuss response to a land movement event, with about 40 people present.

1. **Geotechnical Working Group**: This ODOT-proposed group met twice a month for the first few months. Meetings tapered off to approximately monthly, which will continue through 2019 at least. These meetings allowed for coordination of more technical topics. Since Interstate 84 lies at the base of the burned areas, ODOT performed monthly flights to survey the risks of debris flows, rockfall, and landslides to infrastructure. These flights ceased in summer 2018 due to the lower risk of land movement, but will begin again in the winter/spring of 2019. Using this information, the group created a risk register of damaged culverts and roads and those with potential for more damage. The risk register was updated monthly and shared with other agencies in the geotechnical working group. Appropriate agencies have mitigated some of the risks. For instance, ODOT installed a rockfall fence above the Historic Columbia River Highway east and west of the Multnomah Falls Lodge.

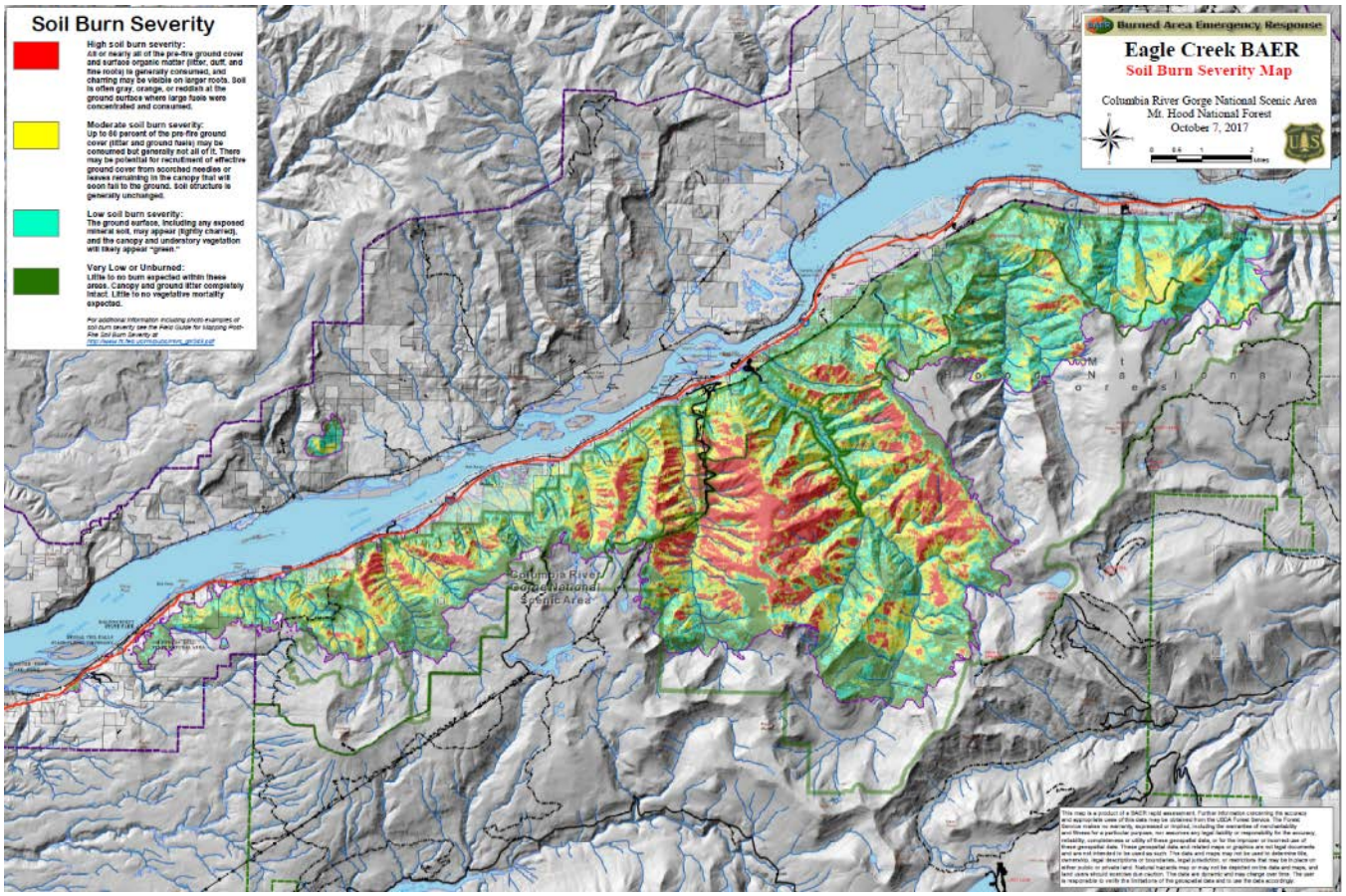
2. **Messaging Group**: This group crafted evacuation messages if debris flows or rockfalls became evident. They reviewed the evacuation messages given during the fire and worked toward creating messages in languages other than English and Spanish. They held focus groups across Multnomah County to explain emergency terms such as “shelter in place” and the difference between a forecast “watch” and “warning”.
3. **Operations Group**: This group consisted of police and fire, health and human services, and emergency management. They crafted an Incident Action Plan that focused on how to conduct response if any hazards materialized.

While Multnomah County took the primary lead on coordinating these post-fire activities, there was no formal chain of command or clear authority structure. Other groups also educated the public. For instance, the Trailkeepers of Oregon set up a recovery meeting in Corbett with a fire ecologist to talk about the duration of the burn and dangers still present on the closed recreation trails.

Programs Activated

USFS-BAER: A BAER (Burned Area Emergency Response) team evaluated risks to life, property, and critical natural and cultural resources resulting from the impact of recent wildfires. The team recommended mitigations on National Forest System lands to prevent further damage to values at risk. Specific concerns include falling trees, landslides, rockfall, and debris flow, which can be triggered by heavy rainfall or freeze/thaw cycles. One mitigation installed a rockfall system behind the Multnomah Falls Lodge. USFS also removed hazard trees and scaled loose rock from slopes above I-84 and the Historic Columbia River Highway. These mitigations are underway as of summer 2018. USFS treatments do not focus on preventing the causes of debris flow, but instead upgrade infrastructure so it can better withstand debris flows.

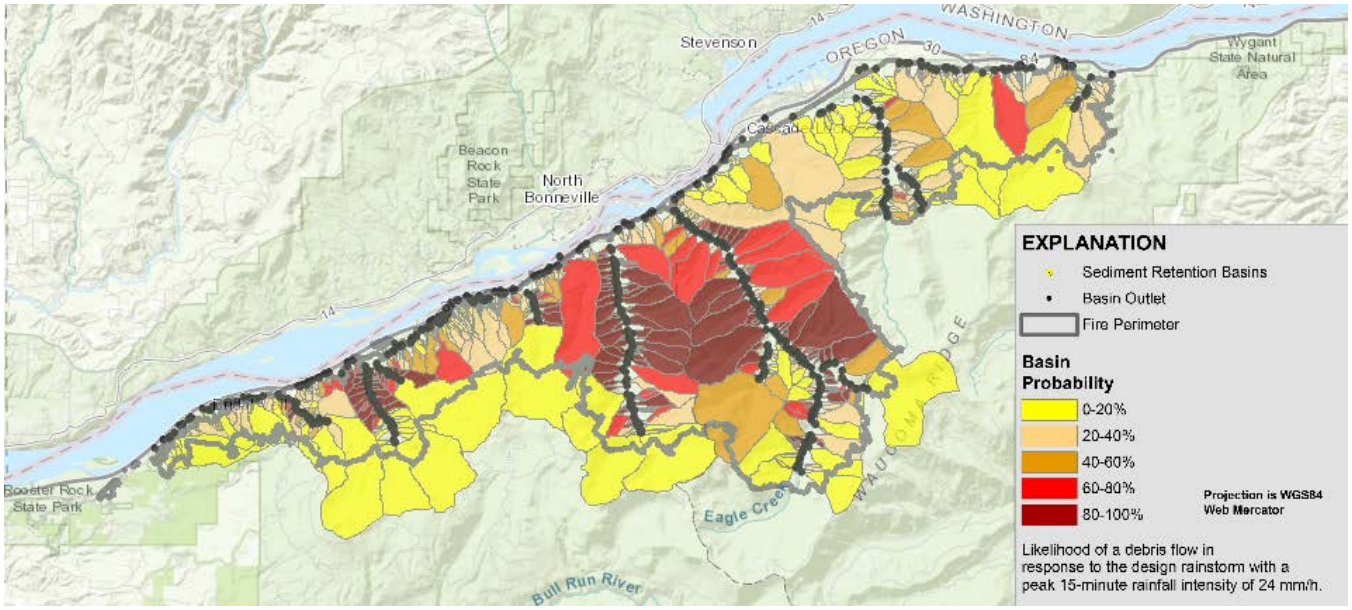
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd561697.pdf



Soil Burn Severity Map from BAER Report

USGS-Debris Hazard Mapping: USGS assessed a debris-flow hazards for the Eagle Creek Fire on September 30, 2017. A map can be found at the link below:

https://landslides.usgs.gov/hazards/postfire_debrisflow/detail.php?objectid=130



USACE-Sedimentation Study: The U.S. Army Corps of Engineers became concerned about increased sedimentation into Bonneville Dam. Sediment could potentially fill up the ship navigation channel, halting river commerce. They used the Engineer Research and Development Lab to assess the risk of sedimentation of the channel. Due to lack of data in locations similar to Eagle Creek, they adopted a "wait and see" approach to sedimentation of the shipping channel.

NWS-Rapid Deployment Rain Gauges: The National Weather Service installed a weather station in the burned area to ground-truth weather forecasts. The Forest Service worked quickly to give a permit for the weather station in the burned area via the BAER team.

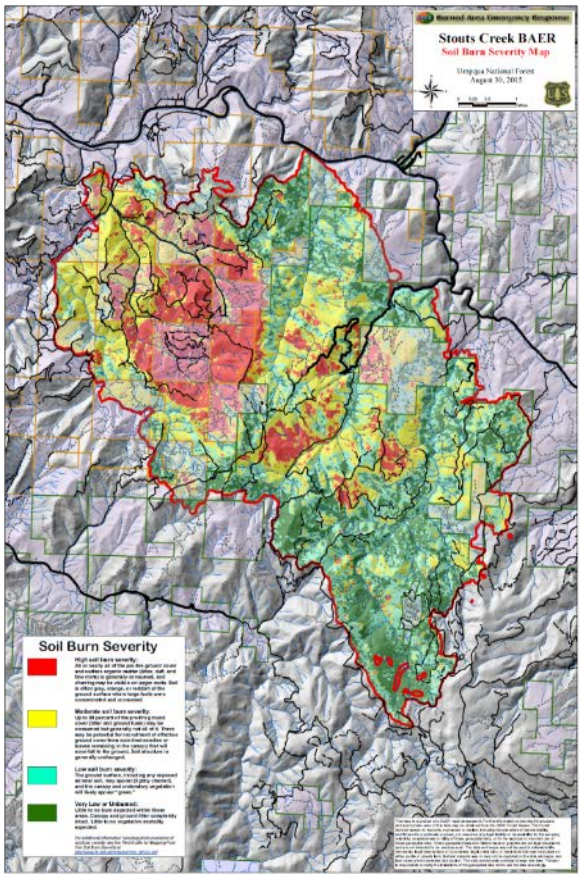
NOAA staff install a rain gauge in the burned area

Lessons Learned

1. The Forest Service does not become involved with local recovery efforts or preparing for emergency response after a fire. There is often not a clear local agency to take the lead after the immediate fire response is over. Emergency management offices are well-suited to fill this role. Federal agencies may sometimes overlook communication with all local agencies. Local agencies have to take the initiative to ensure they are involved.
2. Begin thinking about recovery while still in response mode. Multnomah County Emergency Management brought in Soil and Water Conservation Districts, River Keepers, and Salmon-Safe during response. The incident commander spoke to the increased risk of flooding and debris flows just before disbanding the Incident Command, which helped show that the risks weren't over once the fire was out.
3. Messaging is most effective when it comes from the local level. Residents are familiar with their local fire and law enforcement officials. Even if they are not subject matter experts on flood risk and landslides, their voice is trusted by the community. Messages from subject matter experts are most effective when local officials present them.

2015 Stouts Creek Fire

The Stouts Creek fire offers a case study for potential responses when the affected area is relatively small.



Background

The Stouts Creek Fire began on July 30, 2015, burning approximately 11 miles east of Canyonville near the community of Milo on forestlands protected by the Douglas Forest Protective Association (DFPA) before spreading onto the Umpqua National Forest. Incident Management Teams with members from the Oregon Department of Forestry and the Umpqua National Forest were deployed to the fire. The fire burned approximately 26,000 acres, and was fully contained on September 18, 2015.

https://inciweb.nwcg.gov/incident/4426/

https://www.fema.gov/disaster/5092

https://www.fs.usda.gov/detail/umpqua/landmanagement/projects/?cid=fseprd483021

Flood Risk Mitigation Measures

Only a few homes were downstream of the burned area in this fire, near the confluence of Stouts Creek and the Umpqua River. Since they were on private property outside of federal lands, no BAER treatments were used to mitigate their increased risk of flooding from the burned area. Douglas County Emergency Management took the lead in coordinating with the homeowners. NOAA Weather radios were given to the homeowners by Douglas County, and they were instructed how to interpret forecasts, watches, and warnings from the National Weather Service. The emphasis was that they have to be vigilant against the threat and take measures themselves to protect their lives and property.

NOAA Weather Radio

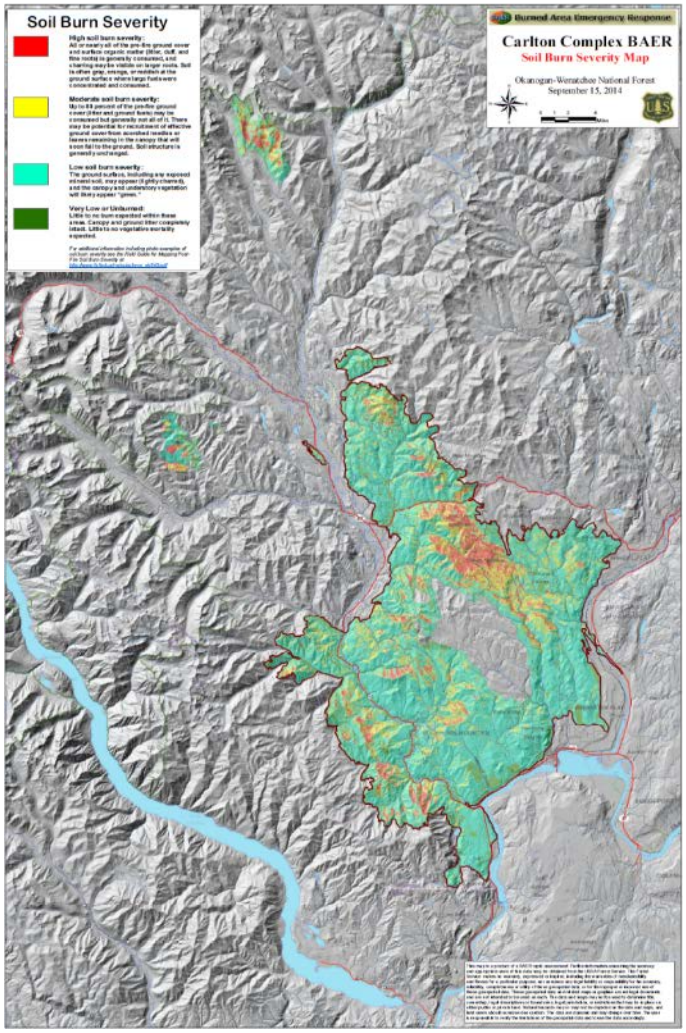
Douglas County received HMGP funding under the 2015 FMAG Pilot for a detection camera on Bland Mountain. The project cost more than the funding available ($22,000). It was done in partnership with Douglas Forest Protective Association, who incorporated the camera into their wildfire detection system operated in Roseburg.

Lessons Learned

For fires with relatively low populations at risk downstream, emphasizing extra preparedness and giving residents the tools to be ready for flooding may be sufficient.

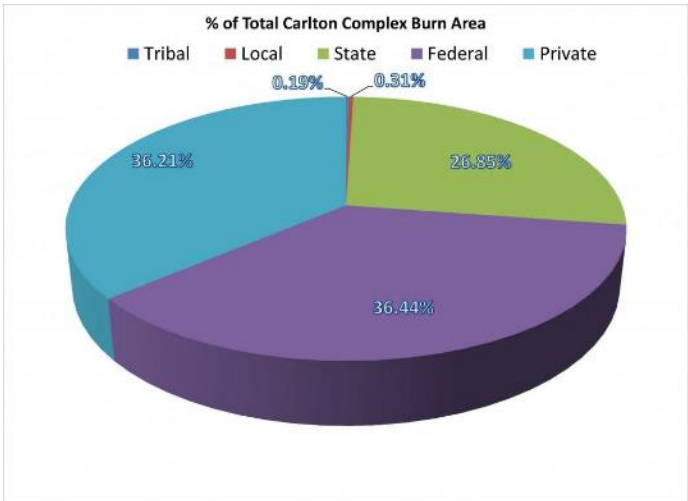
2014 Carlton Complex Fire

The previous three case studies show examples of coordination and risk mitigation in Oregon. In those cases, the mitigation measures were never seriously tested after the fire: no serious flooding or debris flows occurred. The 2014 Carlton Complex Fire shows what can happen when a severe storm strikes a burned area. While this fire was in Washington, not Oregon, it shows how a neighboring state responded to the post-fire threat.



Background

In the summer of 2014, the Carlton Complex Fire burned more than 250,000 acres of land in central Washington, the largest wildfire in state history. The fire began on July 14, and was fully contained on August 24. The President declared a major presidential disaster on August 11. The fire burned federal, private, and state lands, as shown in the pie chart.



Mitigation Activities

Since BAER team activities are limited to federal lands, much of the state and private lands did not have any pre-defined process for mitigation. FEMA formed the Erosion Threat Assessment Reduction Team (ETART), also known as interagency BAER (iBAER). This 17-agency team worked together to reduce erosion and flooding risks on non-federal lands. Treatments included debris racks, ditch protection, temporary berms, low-water crossings and sediment retention basins. In its final report, ETART also recommended better early warning systems, more warning signs on county roads and electronic message signs to aid residents evacuating via highways. Regional soil and water conservation districts were key links between state/federal agencies and landowners.

The National Weather Service placed fifteen portable rain gauges in September and October to monitor rainfall in the area.

Subsequent Floods and Debris Flows

One inch of rain fell within an hour in Finley Canyon on August 21st, generating debris flows. Three dams on Wenner Lakes failed, in part due to debris flows covering the spillways. A fire fighter was nearly killed in the resulting dam breach flood. The incident command post and fire camp experienced flooding as well. Miles of Highway 20 and Highway 153 were closed due to mudslides.

Appendix B: State and Federal Government Agencies

This appendix contains brief summaries of the roles of various state and federal agencies that are involved in managing flood risk after a wildfire. For more details on assistance programs offered by these agencies, refer to Appendix C.

Federal Emergency Management Agency (FEMA)

U. S. Department of Homeland Security

FEMA leads the effort to prepare the U.S. for all hazards and effectively manage federal response and recovery efforts following any national incident. FEMA also initiates proactive mitigation activities, trains first responders, and manages the National Flood Insurance Program. FEMA often works in partnership with other agencies and organizations that are part of the nation's emergency management system, including state and local emergency management agencies, other federal agencies, and the American Red Cross. FEMA's programs provide assistance in areas including multi-hazard mitigation planning, implementation of hazard mitigation projects, and training and capacity building for state and rural firefighting programs.

PROGRAMS

Note: Most FEMA programs, although funded by FEMA, are administered through the Oregon Emergency Management Office (see page 33), but the National Flood Insurance Program is administered through the Oregon Department of Land Conservation and Development (see page 36).

- FEMA National Flood Insurance Program (NFIP)
- FEMA Flood Mitigation Assistance (FMA)
- FEMA Hazard Mitigation Grant Program (HMGP)
- FEMA Pre-Disaster Mitigation Program (PDM)

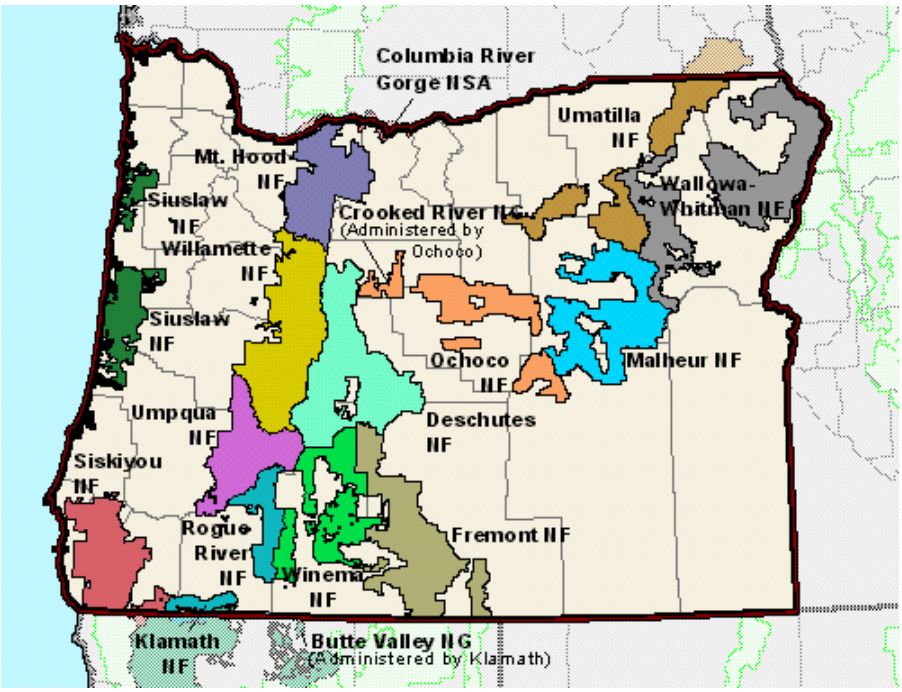
U.S. Forest Service (USFS)

U.S. Department of Agriculture

The U.S. Forest Service sustains the health, diversity, and productivity of national forests within Oregon. The USFS is one of five federal agencies with wildland firefighting responsibilities, and assists with establishing Fire Recovery Teams and Fire Recovery Assistance Centers.

The State and Private Forestry Program through the USFS offers a variety of assistance programs in areas including community planning for fire protection, hazardous fuel treatments, assistance to state and volunteer firefighting organizations, public education, economic action programs, forest health management, noxious weed treatment, and multi---resource stewardship.

Burned Area Emergency Response (BAER) teams evaluate risks to life, property, and critical natural and cultural resources resulting from the impact of recent wildfires. The teams provide recommendations for mitigations on National Forest System lands to prevent further damage to values at risk in the area. These BAER activities are generally limited to National Forest lands.



PROGRAMS

- State and Private Forestry Programs
- Burned Area Emergency Response (BAER)

NOAA National Weather Service (NWS)

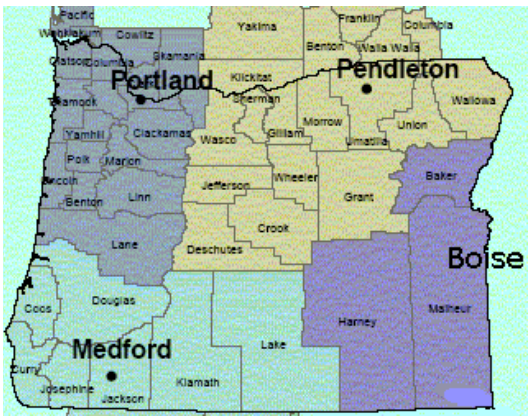
U.S. Department of Commerce

The forecasts, warnings, and watches by the NWS provide weather information before, during, and after wildfires. During fires, NWS Incident Meteorologists travel to fire sites when requested by the fire-management team and provide weather information essential to the firefighting effort. The NWS coordinates closely with other agencies such as the U.S. Forest Service and the U.S. Geological Survey during recovery efforts to help forecast flash flood and debris flow events, and with local law enforcement offices to help provide emergency notification to landowners in areas threatened by flash flooding or debris flows. The National Weather Service (NWS) has always been very active in the wildfire community, but only recently has the NWS begun to try to fill some of the post-wildfire needs. NWS has established a post-wildfire program that covers forecasts and watch/warning products specifically for burn scars. NWS also has a rapid-deployment rain gauge cache maintained by NWS Western Region.

Oregon is served by four Weather Forecast Offices, which are located in Portland, Medford, and Pendleton, Oregon and Boise, Idaho.

PROGRAMS

- Rapid Deployment Rain Gauges
- Targeted Forecasting



The National Weather Service issues watches and warnings based on confidence levels. NWS typically issues watches 12-48 hours in advance of when flooding may occur. The watch is issued when the confidence level for an event occurring is around 50 to 80%. Once a watch is issued, residents should prepare to take action.

NWS issues warnings when confidence is 80 to 100% that an event will occur (likely or occurring). Depending on the type of event, these may be issued anywhere from hours to days before an event. Residents should take action when warnings are issued.

When a flood event is slow to develop, generally anything greater than 6 hours, it is treated as a Flood event. When the event develops rapidly, generally anything under 6 hours, it is treated as a Flash Flood event.

- **Flash Flood Watch:** issued to indicate current or developing conditions that may result in flash flooding. The occurrence is neither certain nor imminent. A watch is typically issued within several hours to days ahead of the onset of possible flash flooding.

- **Flood Watch:** issued when conditions are favorable for a specific hazardous weather event to occur. A Flood Watch is also issued when conditions are favorable for flooding. It does not mean flooding will occur, but it is possible.

- **Flash Flood Warning:** issued when a flash flood is imminent or occurring. Residents in flood-prone areas should immediately move to high ground. A flash flood is a sudden violent flood that can take from minutes to hours to develop. It is even possible to experience a flash flood in areas not immediately receiving rain.

- **Flood Warning:** issued when the hazardous weather event or flooding is imminent or already occurring.

U.S. Army Corps of Engineers (USACE)

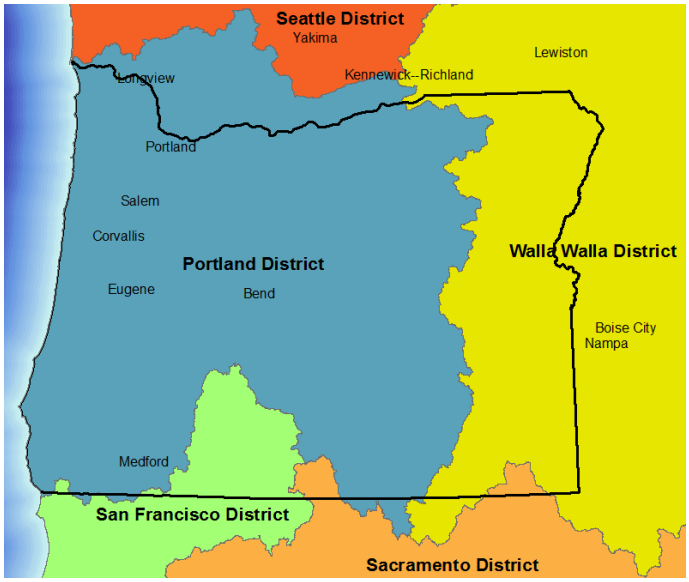
U.S. Department of Defense

The U.S. Army Corps of Engineers is the nation's primary water resources development agency. The Corps of Engineers has been involved in developing recreational and commercial navigation, reducing flood damage, and restoring ecosystems. The primary departments of USACE during a post-wildfire scenario are emergency management, regulatory (permitting), and floodplain management. USACE has expertise in hydrologic and hydraulic modeling of flood scenarios, and has capability to offer emergency services during major disasters. Post-flood response activities are intended to save lives and protect property (i.e., public facilities/services and residential/commercial developments) following a major flood event. USACE does not assist individual homeowners and businesses. USACE serves as the federal lead for the Oregon Silver Jackets team.

Four USACE Districts (Portland, Walla Walla, Sacramento and San Francisco) serve and support Oregon and its communities for the purposes of emergency management and floodplain management. For regulatory permitting, the Portland District is the primary point of contact for the state of Oregon.

PROGRAMS

- Advance Measures
- Emergency Permitting



U.S. Geological Survey (USGS)

U.S. Department of Interior

The U.S. Geological Survey (USGS) is a science organization that strives to provide information on the natural hazards that threaten us. The USGS Oregon Water Science Center (one of 28 nationwide USGS Water Science Centers) has headquarters in Portland. Field offices are located in Central Point, Klamath Falls, Kennewick WA, and Boise, ID. USGS data and research are essential for the protection of citizens of Oregon against floods and other natural disasters and for the preservation of the environment. USGS has expertise in modeling and mapping debris flow hazards following wildfires and can provide on-the-ground support for post-wildfire response assessments. Additionally, the stream gauging mission of USGS is relevant in a post-fire scenario to provide valuable information on how a burned watershed responds to storm events.

PROGRAMS

- Rapid Deployment Gauge Program
- Emergency Assessment of Post-Fire Debris Flow Debris Flow Hazards

Natural Resources Conservation Service (NRCS)

U.S. Department of Agriculture

The USDA Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve natural resources on private lands. NRCS works extensively with Soil and Water Conservation Districts and other partners across the state to manage natural resources on private lands. In the event of a wildfire or other disaster, local emergency managers can contact the NRCS District Conservationist for their county to request assistance. In some situations, NRCS may provide financial and/or technical assistance for re-seeding, grade and streambank stabilization, and vegetation recovery efforts through the Environmental Quality Incentive Program or the Emergency Watershed Protection Program. Refer to the following website for NRCS resources for a fire:
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/or/programs/financial/eqip/?cid=stelprdb1261654

The Environmental Quality Incentive Program (EQIP) can assist landowners in restoring areas impacted by wildfire. Post Fire Rehab EQIP projects target critical areas where there is a possibility of erosion and areas that have a high probability of conversion to invasive annuals due to burning. EQIP funding may be made available to counties impacted wildfire for conservation practices such as weed control, planting, seeding, prescribed grazing, obstruction removal, fire break, fuel break, and fencing. Funding opportunities are announced by NRCS through press releases and in cooperation with partners such as Soil and Water Conservation District, Oregon Department of Fish and Wildlife, Farm Service Agency, and Bureau of Land Management. Interested landowners complete an EQIP application at their local NRCS office. NRCS uses ranking questions to evaluable eligible applications and to prioritize funding.

The NRCS Snow Survey Program in Oregon measures snowpack and other pertinent data at about 300 mountain sites across Oregon and Washington. This data is available in near real-time online. Understanding the current snowpack conditions and the potential for rain-on-snow events can help local communities stay better informed and prepared to anticipate flash flooding after a wildfire. In a post-wildfire scenario, NRCS Snow Survey hydrologists work with the National Weather Service (NWS) to provide up-to-date snowpack forecasts to aid local communities in anticipating rain and flooding events. For instance, NRCS worked with NWS to assemble weekly reports for burned areas of the Windy Ridge, Canyon Creek, and Grizzly Bear fires. Check the website for the latest information: https://www.nrcs.usda.gov/wps/portal/nrcs/main/or/snow/

APPLICABLE PROGRAMS

- Environmental Quality Incentive Program (EQIP)
- Emergency Watershed Protection Program (EWP)
- Snow Survey

Oregon Military Department Office of Emergency Management (OEM)

OEM conducts and facilitates emergency preparedness, response, recovery, and mitigation activities with federal, state, local, and Tribal agencies and organizations. OEM administers grants relating to emergency program management and emergency services for the state. OEM also provides for and staffs a State Emergency Coordination Center, and establishes training and standards for local emergency program management personnel. OEM chairs and administers the State Interagency Hazard Mitigation Team (State IHMT), which seeks to understand losses arising from natural hazards, and implement strategies to mitigate loss of life, property, economic and natural resources by maintaining the Governor-adopted and FEMA-approved Oregon Natural Hazards Mitigation Plan. OEM manages several non-disaster hazard mitigation grant programs, serving as the primary liaison to FEMA. Overall coordination of local hazards mitigation planning in Oregon is led by OEM with considerable assistance from the Oregon Partnership for Disaster Resilience (OPDR) and the Department of Land Conservation and Development (DLCD). These local plans must be updated and FEMA re-approved a least once every five years to qualify for FEMA grant money.

PROGRAMS

- Management of Hazard Mitigation Grant Programs (see FEMA section)

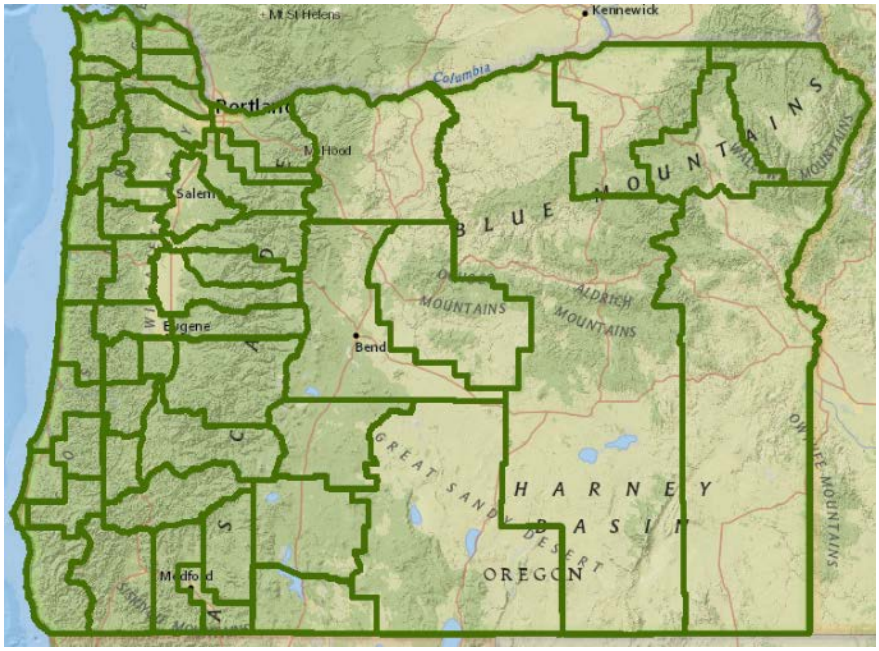
Oregon Department of Forestry (ODF)

The Oregon Department of Forestry protects, manages, and promotes stewardship of Oregon's forests to enhance environmental, economic, and community sustainability. Oregon’s largest fire department, ODF's Fire Protection program protects 16 million acres of forest. These lands consist of privately owned forests as well as some public lands, including state-owned forests and, by contract, US Bureau of Land Management forests in western Oregon. ODF Manages forests before a fire to keep them healthy and fire resilient. The department works aggressively to contain and stop wildfires. ODF is part of an extensive fire protection network that includes landowner resources, contract crews and aircraft, inmate crews, and agreements with public agencies across Oregon, the US and British Columbia. ODF also serves as a liaison between privately owned forests and federal agencies, such as NRCS.

A map of the ODF Stewardship Forester areas is below:
http://www.oregon.gov/ODF/Working/Pages/FindAForester.aspx

PROGRAMS

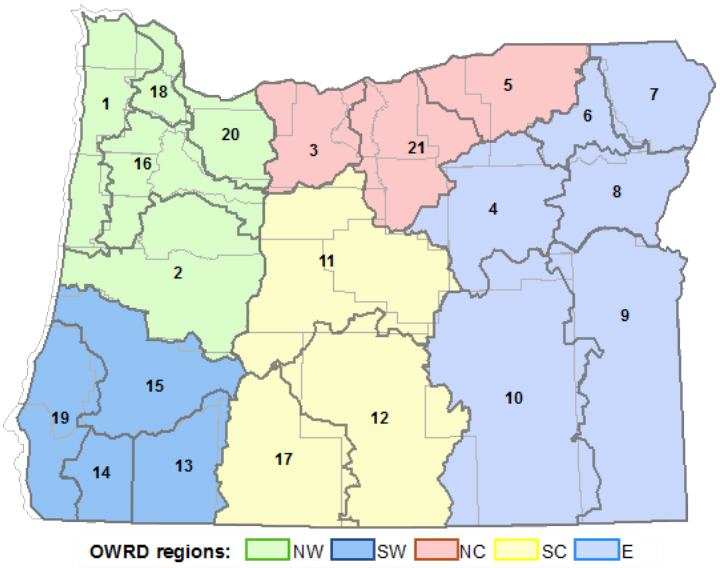
- Technical Assistance: Post-fire Harvesting, Replanting, Stream Health, Soil Stability, and Wildlife Habitat



Oregon Water Resources Department (OWRD)

By law, all surface and ground water in Oregon belongs to the public. The Oregon Water Resources Department (OWRD) is the state agency charged with administration of the laws governing surface and ground water resources. The Department's core functions are to protect existing water rights, facilitate voluntary streamflow restoration, increase the understanding of the demands on the state's water resources, provide accurate and accessible water resource data, and facilitate water supply solutions. OWRD manages over 250 surface water gauges, historical and real-time databases, and hydrologic tools. The stream-gauging function of OWRD is critical in post-wildfire situations to monitor how burned watersheds react to storm events. OWRD collects hydrologic information and provides access to water data, publications, and maps.

OWRD divides the state into five distinct regions, as shown in the map below.



PROGRAMS

- Rapid Deployment Gauge Program

Oregon Department of Land Conservation and Development (DLCD)

DLCD helps communities and citizens plan for, protect and improve the built and natural systems that provide a high quality of life. State law requires each city and county to adopt a comprehensive plan and the zoning and land-division ordinances needed to put the plan into effect. DLCD oversees Oregon´s 19 Statewide Planning Goals, which are achieved through local comprehensive planning. Goal 7 (Areas Subject to Natural Hazards) deals with development in places subject to natural hazards such as floods and landslides. It requires that jurisdictions apply "appropriate safeguards" (floodplain zoning, for example) when planning for development. DLCD serves as the state coordinator of the National Flood Insurance and Risk Mapping, Assessment, and Planning Programs (NFIP and Risk MAP, respectively), and can advise on post-wildfire recovery measures. DLCD offers natural hazards mitigation planning assistance to local governments and serves as the state lead for coordinating the update, maintenance, and implementation of the Oregon Natural Hazards Mitigation Plan (NHMP). DLCD also serves as the state lead for the Oregon Silver Jackets team. DLCD's Regional Representatives are also available to assist local governments with land use planning and the Technical Assistance Grant program.

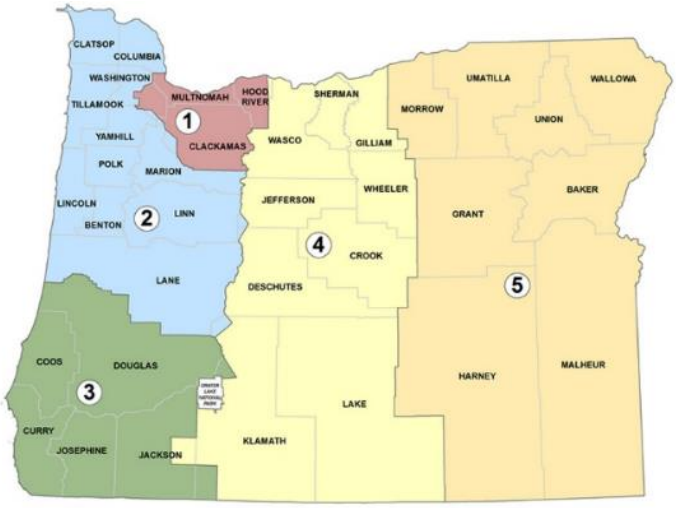
PROGRAMS

- Technical Assistance Grants
- National Flood Insurance Program (NFIP) Coordination
- Risk Mapping, Assessment, and Planning (Risk MAP) Coordination

Oregon Department of Transportation (ODOT)

ODOT provides a safe and reliable multimodal transportation system that connects people and helps Oregon's communities and economy thrive. During wildfires, ODOT may participate in emergency operations as the Highway Authority responsible for road closures on state highways. After a wildfire, ODOT is responsible for ensuring that transportation corridors are safe for the public. ODOT evaluates highways, culverts, and bridges after a wildfire to ensure they are structurally sound and are still capable of meeting their intended purpose. Roadway embankments are evaluated for slide, rockfall, and tree hazards.

ODOT divides Oregon into five distinct regions, as shown below.



ODOT is able to provide technical support in the design and delivery of culvert or bridge structures during a declared emergency or in partnership with other agencies providing funding. ODOT also participates in the Oregon Public Works Emergency Response Cooperative Assistance Program. ODOT Culvert Funding programs are dedicated to the replacement or rehabilitation of culverts in poor or critical structural condition.

PROGRAMS

- **Emergency Operations Program**
  https://www.oregon.gov/ODOT/Maintenance/Pages/Emergency-Operations-Program.aspx
- **Culvert Inventory and Inspection Program**
  https://www.oregon.gov/ODOT/GeoEnvironmental/Pages/Culverts.aspx
- **Unstable Slopes Program**
  https://www.oregon.gov/ODOT/GeoEnvironmental/Pages/Unstable-Slopes.aspx

Oregon Department of Geology and Mineral Industries (DOGAMI)

DOGAMI provides earth science information and regulation to make Oregon safe and prosperous. DOGAMI assists in preparing for wildfire-related risks by developing maps, reports, and data of geologic hazards that are exacerbated by wildfires, such as landslides and debris flows. DOGAMI maintains a statewide, base-level landslide and debris flow inventory, produces landslide susceptibility maps, and are in the process of developing a debris-flow susceptibility mapping technique for Oregon. The landslide inventory is a fundamental dataset, because landslides tend to occur in the same general locations as past landslides. DOGAMI makes these datasets publicly available to better understand which areas are at greater risk after major wildfires.

In addition to geologic hazard mapping, DOGAMI has the capability to rapidly produce building footprint data in many locations throughout the state. DOGAMI has already produced building footprints for many areas in Oregon, which are available upon request. This data informs firefighting and evacuation efforts.

- **Landslide Home Page**
  http://www.oregongeology.org/Landslide/Landslidehome.htm
- **DOGAMI's Statewide Landslide Information Database of Oregon (SLIDO):**
  http://www.oregongeology.org/slido/index.htm
- **Lidar-Based Landslide Inventory**
  http://www.oregongeology.org/pubs/sp/p-SP-42.htm
- **Deep Landslide Susceptibility**
  http://www.oregongeology.org/pubs/sp/p-SP-48.htm
- **Shallow Landslide Susceptibility**
  http://www.oregongeology.org/pubs/sp/p-SP-45.htm
- **Example of recent landslide inventory in the 2017 Eagle Creek Fire area**
  http://www.oregongeology.org/pubs/ofr/p-O-17-03.htm

Appendix C: Assistance Program Inventory

This appendix contains a comprehensive inventory of assistance programs from state and federal agencies. A summary table of all programs is shown on the following page, with further details in the following sections.

Page #	Program Name	Agency	Owner of Wildfire-burned land: Privately-owned[1]	State-owned (State Forest, DSL)	Federal-owned	Tribal-owned	Type of Assistance[2]	Matching Funds required?	Emergency or Disaster Declaration Required?	How long will this take?[3]	Must be requested from local government?
41	Burned Area Emergency Response	USFS			X[4]		Direct	None	None	Medium	No
42	Emergency Stabilization and Rehabilitation	DOI			X[4]	X	Direct	None	None	Medium	No
44	Advance Measures	USACE		X	X	X	Direct	None	None	Fast	Yes
45	Rapid Deployment Rain Gauges	NWS		X	X	X	Direct	None	None	Fast	Sometimes
46	Rapid Deployment Stream Gauges	OWRD	X	X	X	X	Direct	None	None	Fast	Sometimes
47	Rapid Deployment Stream Gauges	USGS	X	X	X	X	Direct	None	None	Fast	Yes
48	Targeted Forecasting	NWS		X	X	X	Direct	None	None	Medium	Sometimes
49	Snowpack monitoring	NRCS		X	X	X	Direct	None	None	Medium	Sometimes
50	Emergency Watershed Protection Program	NRCS	X			X	Funding	25% of cost	None	Fast/ Medium	Yes
51	Emergency Permitting	USACE	X	X	X		Direct	Permit fee ($100)	USACE-defined	Fast	Yes
52	Emergency Permitting	DSL	X	X	X		Direct	Permit fee (variable)	DSL-defined	Fast	Yes
53	Technical Assistance	ODF	X				Direct	None	None	Medium	Yes
54	Debris Flow Hazard Mapping	USGS	X	X	X	X	Direct	None	None	Fast	Sometimes
55	Hazard Mitigation Grants (HMGP)	OEM		X	X	X	Funding	25% of cost	Presidential disaster[5]	Medium	Yes
57	Flood Mitigation Assistance	OEM		X	X	X	Funding	0%-25% of cost	None	Slow	Yes
59	Pre-Disaster Mitigation	OEM		X	X	X	Funding	25% of cost	None	Slow	Yes
61	Technical Assistance Grant	DLCD		X	X	X	Funding	None	None	Slow	Yes

Notes:

1. Private landowners should work with local governments or Soil and Water Conservation Districts rather than reaching out directly to state/federal agencies.
2. Direct assistance to local communities uses direct labor and materials from state/federal governments. Funding assistance comes to local governments by the form of funding, which is used by the local government.
3. "Fast" can be done within 30 days of the request. "Medium" can be done within 1 year, and "Slow" can be done within 3 years.
4. Burned Area Emergency Response (BAER) is used on National Forest lands, while Emergency Stabilization and Rehabilitation (ES&R) is used on National Park Service, Bureau of Land Management, and Fish and Wildlife Service lands
5. Normally, HMGP is only available after a major presidential disaster declaration. The Bipartisan Budget Act of 2018 unlocks HMGP for wildfires with a Fire Management Assistance declaration from October 2016 to September 2018.

Burned Area Emergency Response

US Forest Service

What is it? The Burned Area Emergency Response (BAER) program identifies and manages potential risks to resources on National Forest System lands and reduce these threats through appropriate emergency measures to protect human life and safety, property, and critical natural or cultural resources. BAER is an emergency program for stabilization work to complete time-critical activities before the first damaging storm event. All fires with over 500 acres of National Forest system lands are evaluated for the need of a BAER team assessment.

What type of assistance is available? Funding for National Forest System lands, technical information for partner agencies.

Who can apply? US Forest Service. Communities can suggest projects, but they do not formally apply.

Application deadline? Funding requests must be submitted within 7 days of fire containment.

What are the requirements to apply?

1. **State or Federal Declaration:** None required
2. **Burned land owner:** US Forest Service lands only.
3. **Matching funds:** N/A

How soon can this start? Because of the emergency nature of BAER, the Forest Supervisor submits initial requests for funding of proposed BAER treatments to the Regional Office after a BAER assessment, but within 7 days after total containment of the fire. The Regional Forester's approval authority for individual BAER projects is $500,000. Approval for BAER projects exceeding this limit is forwarded onto the Washington Office. Funding is available immediately upon authorization.

How long will the assistance last? All projects must be complete within one year of fire containment.

Contact Name: Regional BAER Coordinator

Contact Phone Number: (503) 808-2468

Contact Email: PNWRegionalForester@fs.fed.us

Website: https://www.fs.fed.us/biology/watershed/burnareas/index.html

Example of use in Oregon: Starting September 25, 2017, the Eagle Creek BAER team rapidly assessed potential imminent post-fire threats to critical values such as life and safety, property, natural resources, and cultural resources. Treatments recommended and approved for immediate implementation within the Eagle Creek Fire include rockfall protections at Multnomah Lodge, road and trail treatments, limited danger tree mitigations, emergency closure and hazard warning signage, and invasive species treatments. Information provided to partner agencies included the Soil Burn Severity map, hydrologic modeling of post-fire watershed response and debris flow potential mapping.

Emergency Stabilization and Rehabilitation

Department of the Interior Agencies (National Park Service, Bureau of Land Management, US Fish and Wildlife Service, Bureau of Indian Affairs)

What is it?

The primary purpose of the Department of Interior's (DOI) Post-Wildfire Recovery program is to reduce the risk of resource damage and restore landscapes affected by wildfire and to promote long-term restoration and recovery objectives. The Post-Wildfire Recovery program is comprised of two parts: Emergency Stabilization (ES) and Burned Area Rehabilitation (BAR). It is the counterpart to the US Forest Service BAER program, which only applies to US Forest Service lands.

The principal purpose of the ES program funding is to prevent further degradation of natural and cultural resources, and to protect life, property, and other values. ES activities reduce the risk of resource damage caused by floods, debris flows, erosion, or other fire-caused events. The ES program assesses and treats landscapes threatened from post-fire floods or other degradation. Funds are available for no more than one year plus 21 days after the ignition date of a wildfire, with an additional year available under special circumstances.

The principal purpose of the BAR program funding is to protect resources by repairing or improving landscapes unlikely to recover naturally to management approved conditions within an acceptable timeframe, and to repair or replace minor assets. The BAR program funding is to begin longer-term actions to repair damages caused by wildfire if natural recovery is unlikely to occur within an acceptable timeframe considering management objectives and to encourage the protection, conservation, and restoration of fire-impacted lands and resources consistent with land and resource management plan objectives. BAR funds are available for no longer than 5 years plus 21 days after fire ignition, with funding priorities based on bureau-identified criteria. All BAR treatments must show a link to long-term recovery and restoration.

What type of assistance is available? Funding for DOI-administered lands

Who can apply? Only federal DOI Units

Application deadline? Funding request must be submitted within 21 days of fire containment; however, an extension may be granted by the Washington Office (WO) program lead under certain circumstances.

What are the requirements to apply?

1. **State or Federal Declaration:** None required
2. **Burned land owner:** DOI-administered lands
3. **Matching funds:** None required.

How soon can this start? Funding is available immediately upon approval for treatments addressing Human Life and Safety, but typically funding is allocated at the beginning of the fiscal year (October 1).

How long will the assistance last? ES funding is available for up to 1 year plus 21 days after the ignition date of a wildfire, with an additional year available under special circumstances. BAR funding is available for no longer than 5 years plus 21 days after fire ignition.

Contact Name: Varies by Agency – contact local unit for more information

Example of use in Oregon: The Cinder Butte fire burned 52,000 acres managed by the Burns District BLM in July 2017. The entire burned area fell within designated habitat management areas for greater sage-grouse, pronghorn antelope, pygmy rabbits, mule deer and elk. In addition, hunters and campers regularly used the burned area. ES treatments following the burn included drill seeding to stabilize soils, promote wildlife habitat recovery and protect against annual grass invasion; stabilization and protection of cultural resource sites; and herbicide application to control noxious weeds and invasive annual grasses. BAR treatments include follow-up seeding and herbicide application to promote native species recovery and reduce the risk of invasive annual grass treatment. In addition, funding was requested to repair allotment fences used for managing livestock grazing and reconstruct wildlife guzzlers that serve as important water source to big game species.

Advance Measures

U.S. Army Corps of Engineers (USACE)

What is it? USACE can provide emergency assistance after a fire and before flooding. Advance Measures are technical assistance or construction. Advance Measures may prevent or reduce damages when there is an "imminent threat of unusual flooding."

USACE can provide technical assistance to tribes and states to mitigate risks for an imminent threat of unusual flooding. Technical assistance can include developing contingency plans and exercises.

USACE may also do projects that reduce flood damage. These are temporary projects intended to prevent or reduce flood impacts. The projects are typically ones that (1) reduce threats to life or improved property, and (2) are beyond the capacity of a tribe, state, or local government. These short-term projects must be feasible and buildable to mitigate the imminent threat.

What type of assistance is available? Direct Service

Who can apply? Communities apply through a State Emergency Management Agency or a Tribal government.

Application deadline? There is no formal deadline to apply for this program.

What are the requirements to apply?

1. **State or Federal Declaration:** A disaster declaration is not required, but a letter from the Governor is required stating that State, Tribal and local governments have exhausted all resources (i.e., workforce, supplies, equipment, funds, National Guard assets, etc.).
2. **Burned land owner:** Activities are limited to protecting life and public facilities/infrastructure in imminent danger of flooding. The law specifically excludes assistance to individual homeowners and businesses, including agricultural property.
3. **Matching funds:** None required.

How soon can this start? After submitting a request with a letter from the governor.

How long will the assistance last? Variable

Contact Phone Number: USACE Emergency Manager, 503-808-4402

Contact Email: cenwp-pa@usace.army.mil

Website: http://www.nwp.usace.army.mil/emergency/
http://www.nrcs.usda.gov/wps/portal/nrcs/main/nm/programs/financial/ewp/

Example of use in Oregon: Following the Canyon Creek fire in 2015, Oregon Emergency Management worked with Grant County to apply for Advance Measures. USACE activated the technical assistance component. USACE engineers analyzed alternatives for the placement of a temporary berm in Canyon City and advised on a path forward.

Authority: Public Law 84-99

Rapid-Deployment Rain Gauges

National Weather Service (NWS)

What is it? The Western Region of the NWS has a cache of rapid-deployment rain gauges for rainfall monitoring in and around new burn scars. The availability is limited, so the NWS expects other avenues for securing rain gauges to be explored first. One to two gauges may be requested for a fire, although extenuating circumstances could allow for more.

The rain gauges are setup to transmit data via cellular networks or over satellite. More and more gauges are being set up with the cellular capabilities.

Who can apply? Any government agency

What type of assistance is available? Direct Service

Application deadline? There is no formal deadline to apply for this program.

What are the requirements to apply?

1. **State or Federal Declaration:** No declaration required.
2. **Burned land owner:** No restriction.
3. **Matching funds:** None required.

How soon can this start? After the fire is out and a need-assessment is conducted, the NWS will help the land owner/manager make a case for procuring rain gauges. If other channels are exhausted, the NWS will request one or two gauges from their cache.

How long will the assistance last? Typically one year, but extenuating circumstances may allow for longer duration.

Contact: Service Hydrologist at the Portland, Pendleton, Medford, or Boise Weather Forecast Office (WFO)

Example of use in Oregon: NWS-Owned rain gauges were used on the 2017 Eagle Creek Fire (Hood River County), 2016 Rail Fire (Baker County), the 2015 Cornet-Windy Ridge Fire (Baker County), and the 2015 Canyon Creek Complex (Grant County)

Rapid-Deployment Stream Gauges (OWRD)

Oregon Water Resources Department (OWRD)

What is it? Oregon Water Resources Department has several rapid-deployment gauges for use in emergencies around the state. There are about five gauges around the state for various monitoring purposes prioritized by OWRD. These gauges can be installed downstream or within burned areas to monitor river levels. The gauges measure river height, not flow, and transmit data via satellite. USGS has a similar capability to install rapid-deployment gauges. OWRD prioritizes rapid-deployment gauges for situations where human safety is a concern. The gauges are not typically used for water quality purposes. Alert triggers and early warning messaging must be coordinated with the National Weather Service.

Who can apply? Any government agency

What type of assistance is available? Direct Service

Application deadline? There is no formal deadline to apply for this program.

What are the requirements to apply?

1. **State or Federal Declaration:** No declaration required.
2. **Burned land owner:** No restriction.
3. **Matching funds:** None required, but funding support increases likelihood of activation.

How soon can this start? As soon as commitment from OWRD is reached, typically one week.

How long will the assistance last? Typically six months or less.

Contact Name: Surface Water/Hydrology Program Manager

Contact Phone Number: (503) 986-0838

Websites: https://www.oregon.gov/owrd/Pages/index.aspx http://www.nwp.usace.army.mil/emergency/ www.oregon.gov/owrd http://www.nrcs.usda.gov/wps/portal/nrcs/main/nm/programs/financial/ewp/

Example of use in Oregon: After the Canyon Creek fire of 2015, one rapid deployment gauge was installed downstream of the burned area. After a few months, the gauge was transitioned from rapid deployment to permanent status. An additional gauge was installed on a tributary. Funding for the permanent installation was provided by a FEMA grant through Oregon Emergency Management.

Rapid-Deployment Stream Gauges (USGS)

United States Geologic Survey (USGS)

What is it? USGS Rapid Deployment Gauges (RDG) are fully functional stream gauges designed to deploy quickly and temporarily to measure and transmit stream stage data in emergencies. The short installation time allows the USGS to:

- Augment gauge networks during river flooding by adding temporary locations.
- Provide situational awareness and support to emergency managers.
- Maintain data flow when stream gauging equipment is damaged.

The USGS local office has a supply of rapid-deployment equipment for streamflow rainfall monitoring in and around new burn scars and a few supplemental rain gauges that could deploy at existing stream gauges when applicable. Cameras and other equipment can be added for rapid response monitoring. The Rapid Deployment Gauges are set up to transmit data via cellular networks or satellite.

Who can apply? Any government agency

What type of assistance is available? Direct Service

Application deadline? There is no formal deadline to apply for this program.

What are the requirements to apply?

1. **State or Federal Declaration:** No declaration required.
2. **Burned land owner:** No restriction.
3. **Matching funds:** Localities, States and Tribes

How soon can this start? Within 2 weeks of an agreement to work.

How long will the assistance last? Typically one year, but extenuating circumstances may allow longer.

Contact Name: Data Chief

Contact Phone Number: 503-251-3200 extension 3 for Information Specialist and 3 for Surface Water

Contact Email: gs-w-or_qaqc@usgs.gov

Website: http://www.nwp.usace.army.mil/emergency/ https://www.usgs.gov/centers/or-water http://www.nrcs.usda.gov/wps/portal/nrcs/main/nm/programs/financial/ewp/

Example of use in Oregon: https://waterdata.usgs.gov/or/nwis/rt

Legal Authority: The USGS partners with over 800 Federal, State, and local agencies through the Federal-State Cooperative Water Program (Water Coop Program). The Water Coop Program was formalized in appropriations law in 1929 and has been reaffirmed by the Congress every year since.

Targeted Forecasting

National Weather Service (NWS)

What is it? Following a wildfire, the hydrologist at each office determines potential values at risk and then sets rainfall-rate thresholds for recent burn scars. Ideally, land-management agencies/communities responsible for the burned area assist with these forecasts. BAER reports or other assessments provide information to determine the severity of the impacts from the fire.

Once these values at risk and thresholds are set, the NWS will set up their products for quickly issuing watches and warnings. Within the NWS warning software, polygons are created with pre-determined wording to get the products out quickly when there is an imminent threat to a value at risk.

Watches and warnings play on NOAA All Hazards Radio (Weather Radio) and, in special cases such as a Flash Flood Warning, activate EAS and WEA. EAS (Emergency Alert System) transmits the warning over TV and radio, notifying emergency services. WEA (Wireless Emergency Alert) pings cell towers in and around the warning area polygons. Any cellular user within range of these cell towers will receive the warning information.

Who can apply? Anybody

What type of assistance is available? Direct Service

Application deadline? There is no formal deadline to apply for this program.

What are the requirements to apply?

1. **State or Federal Declaration:** No declaration required.
2. **Burned land owner:** No restriction.
3. **Matching funds:** None required.

How soon can this start? The NWS pays special attention to weather affecting a fire due to safety concerns during the suppression efforts. Targeted forecasting begins while the fire is still burning. Once the fire is out, more will be learned about which areas of the burn scar need special attention and specific criteria will be created and rainfall thresholds will be set and refined.

How long will the assistance last? Targeted forecasting by the local weather office will continue until the burn scar is deemed to no longer be a threat. That decision will be made through discussion between the land owner/manager, emergency management officials, and the NWS.

Contact: Service Hydrologist at the Portland, Pendleton, Medford, or Boise Weather Forecast Office (WFO)

Example of use in Oregon: NWS WFOs have issued Flood Warnings/Watches or Flash Flood Warnings/Watches for several burn scars based on thresholds and criteria established specifically for them. Some examples of burn scars that have had these targeted forecasts are the 2017 Chetco Bar Burn Scar (Curry County), 2017 Eagle Creek Burn Scar (Hood River County), 2015 Stouts Creek Burn Scar (Douglas County), 2015 Cornet-Windy Ridge Burn Scar (Baker County), and the 2015 Canyon Creek Burn Scar (Grant County).

Snowpack Monitoring

USDA-Natural Resources Conservation Service

What is it? The NRCS Oregon Snow Survey Team can provide snowpack information to communities impacted by catastrophic wildfires. The information helped communities determine the potential for rain-on-snow events in burned areas, which can lead to debris slides and flooding.

What type of assistance is available? Weekly snowpack reports for burned areas that can be distributed to emergency management officials, landowners, and other partners.

Who can apply? Communities impacted by wildfires.

Application deadline? None.

What are the requirements to apply? None.

How soon can this start? Upon receipt of request for snowpack monitoring reports.

How long will the assistance last? As long as NRCS and the requesting entity feel it is needed to protect the public from runoff events on burned areas.

Contact Phone Number: NRCS Oregon Snow Survey Hydrologist, (503) 414-3271

Website: https://www.nrcs.usda.gov/wps/portal/nrcs/main/or/snow/

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/or/programs/financial/eqip/?cid=stelprdb1261654

Example of use in Oregon: In recent years, NRCS Snow Survey staff worked with Public Affairs Specialists and local District Conservationists and the National Weather Service to assemble weekly reports in Baker, Grant, and Wallowa counties.

Emergency Watershed Protection Program

USDA-Natural Resources Conservation Service

What is it? Through the Emergency Watershed Protection (EWP) Program, the Natural Resources Conservation Service provides financial and technical assistance to communities responding to natural disasters, such as floods, wildfires, and debris flows. Activities covered under the program include but are not limited to: debris removal from stream channels, culverts and bridges; streambank protection, channel and grade stabilization, vegetation establishment, and levee repair. Projects must reduce threats to life and property; be economically, environmentally and socially sound; and must meet NRCS engineering standards and specifications.

What type of assistance is available? Financial and Technical Assistance. NRCS can pay up to 75% of the cost for eligible emergency projects. Local Project Sponsors must provide the remaining 25% in cash or in-kind services.

Who can apply? Public and private landowners can apply for EWP assistance through a local Project Sponsor that is a legal subdivision of the State of Oregon. Eligible Project Sponsors include cities, counties, town, Soil and Water Conservation Districts, irrigation and water control districts, or any federally-recognized Native American Tribe or tribal organization. Project Sponsors must have a legal interest in, or responsibility for, the areas threatened by a watershed impairment resulting from a natural disaster.

Application deadline? For situations that are an imminent threat to life and property, a request for assistance must be submitted to NRCS within 10 days of the disaster. For situations that are <u>not</u> an imminent threat to life and property, a request for assistance must be submitted to NRCS within 60 days.

What are the requirements to apply? To apply, Project Sponsors submit a letter that includes information on the nature, location, and scope of the problem for which assistance is requested. The letter must be signed by an official of the requesting entity. NRCS staff is available to assist with letter preparation and offer addition info on EWP program eligibility. Project Sponsors must provide land rights and permits and must contribute 25% of the costs in cash or in-kind services.

How soon can this start? After receiving a request for assistance, NRCS staff will conduct site visits with potential Project Sponsors to determine eligibility and complete Damage Survey Reports. Project Sponsors must obtain all necessary permits for the installation of the projects.

How long will the assistance last? For eligible projects that are an imminent threat to life and property, work will be completed within 10 days from the time the site is accessible, and funding is approved. For eligible projects that are not an imminent threat to life and property, work will be completed within 220 calendar days from the date funding is approved.

Contact Info: NRCS State Conservation Engineer, (503) 414-3252
https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/landscape/ewpp/?cid=nrcseprd1381472

Example of use in Oregon: In 2016 and 2017, NRCS Oregon implemented EWP programs with three Project Sponsors in Western Oregon for natural disasters that had a Presidential disaster declaration. Projects included bioengineered streambank protection measures; sediment and debris removal from drainage and natural channels to restore conveyance capacity; rock abutment protection of private bridges; grade stabilization; and repair of breached levees.

Emergency Permitting (USACE)

U.S. Army Corps of Engineers (USACE)

What is it? USACE can approve special permitting procedures in emergencies. An "emergency" is a situation which would cause an unacceptable hazard to life, a significant loss of property, or an immediate, unforeseen, and significant economic hardship if corrective action requiring a permit is not undertaken within a period less than the normal time needed to process the application under standard procedures. The emergency work proposed under the permit should be the minimum to resolve the emergency. The Corps may not view an action as an emergency if the applicant has known of the deficient condition and the need for work, but has not attempted to secure permits and to conduct the work promptly.

For projects that do not qualify as emergencies, the Corps may initiate "expedited" (non-emergency) authorization procedures. In other cases, the proposed work will be subject to standard permit processing procedures appropriate for the nature and location of the work.

Who can apply? Any individual or agency considering an action that would require a Corps permit.

What type of assistance is available? Direct Service

Application deadline? You must immediately notify the Corps Regulatory Branch of the need for emergency work and obtain authorization, if applicable, before doing the work.

What are the requirements to apply?

1. **State or Federal Declaration:** No disaster declaration required. The Corps has sole responsibility to determine if the proposed work follows the Corps' definition of an emergency.
2. **Burned land owner:** No restriction.
3. **Matching funds:** Flat permit fee required ($100)

How soon can this start? The process may take from a few hours to up to a week. If the project does not qualify as an emergency and expedited authorization procedures take place, the process may take several weeks to complete. Work cannot begin until the Corps gives approval.

How long will the assistance last? Following the emergency, additional coordination with the Corps will likely be required to remove or modify the emergency work, to obtain authorization for additional proposed work to complete the final project, or for compensatory mitigation for unavoidable impacts to waters of the United States. A final permit approval may take over 6 months to obtain.

Contact Name: Contact information for the Regulatory Project Manager in your county can be found at: http://www.nwp.usace.army.mil/Missions/Regulatory/Contact.aspx

Contact Email: PortlandRegulatory@usace.army.mil

Website: http://www.nwp.usace.army.mil/notice/Article/1400671/emergency-permitting-application-procedures/ http://www.nrcs.usda.gov/wps/portal/nrcs/main/nm/programs/financial/ewp/

Example of use in Oregon: There have been no emergency permits issued in the past five years. After the 2015 Canyon Creek fire, an expedited process for ODOT-proposed culvert replacements was used.

Authority: Permitting authority comes from Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act. Emergency procedures are described in 33 CFR Part 325.2(e) (4).

Emergency Permitting (DSL)

Oregon Department of State Lands (DSL)

What is it? Oregon's Removal-Fill Law requires people who plan to remove or fill material in wetlands or waterways to obtain a permit from the Department of State Lands. This permit is broadly called the "Removal-Fill Permit." Usually both a Removal-Fill permit from DSL and a Section 404 permit from the Army Corps of Engineers are required.

Oregon DSL may grant an Emergency Permit (EP) when natural or human-caused circumstances pose an immediate threat to public health, safety or substantial property, including cropland. Actions must be limited to what is necessary to alleviate the emergency. In certain situations, emergency actions may be exempt from a DSL permit requirement, including emergency repairs to roads, bridges, transportation-related structures, and water control structures.

Who can apply? Any individual or agency considering an action that would require a permit.

What type of assistance is available? Direct Service

Application deadline? Oregon DSL should be contacted as soon as possible following the emergency.

What are the requirements to apply?

1. **State or Federal Declaration:** No disaster declaration is required.
2. **Burned land owner:** No restriction.
3. **Matching funds:** Permit application fee required, cost varies by amount of material moved.

How soon can this start? Documentation must justify the determination of an emergency, including a description of the emergency. There is no official timeline for the decision on whether to grant an emergency permit or not. Permits from Oregon DSL and the U.S. Army Corps of Engineers (if applicable) must be secured before beginning work.

How long will the assistance last? Emergency permits are typically valid for no more than 60 days. Follow-up actions after the emergency are often required.

Contact Name: Aquatic Resource Coordinator

Contact Phone Number: 503-986-5200 (west of the Cascades), 541-388-6112 (east of the Cascades)

Contact Email: Varies by county. See http://www.oregon.gov/dsl/WW/Pages/WWStaff.aspx
mailto:PortlandRegulatory@usace.army.mil

Website: http://www.oregon.gov/dsl/WW/Pages/Permits.aspx
http://www.nrcs.usda.gov/wps/portal/nrcs/main/nm/programs/financial/ewp/

Example of use in Oregon: The emergency permitting process was used following the Canyon Creek Fire in 2015. ODOT applied to replace two culverts at risk of clogging with debris, and DSL processed it as an emergency action. The permit number was 58527.

Legal Authority: ORS 196.795-990

Technical Assistance: Post-fire Harvesting, Replanting, Stream Health, Soil Stability, and Wildlife Habitat

Oregon Department of Forestry

What is it? Oregon Department of Forestry (ODF) Stewardship Foresters provide technical assistance to forest landowners before and after wildfires. After a fire, ODF can help landowners with salvage logging, reforestation, and other restoration work to minimize ground disturbance and stabilize soil. Nonindustrial private forest landowners may also be eligible for financial assistance through federal programs.

Type of Assistance? Oregon Department of Forestry Stewardship Foresters can provide technical assistance related to salvage logging, reforestation, and other restoration work. Stewardship Foresters may also help nonindustrial private forest landowners access financial assistance through federal programs. The Natural Resources Conservation Service (NRCS) may provide financial assistance to help landowners with practices to control erosion. The Farm Service Agency (FSA) may provide financial assistance through the Emergency Forest Restoration Program (EFRP) to help landowners reforest following natural disasters like wildfire. Other FSA programs may be available to help rebuild fences.

Who Can Apply? Forest landowners should contact ODF Stewardship Foresters for technical assistance. Stewardship Foresters may have information about federal programs that provide financial assistance, but landowners must contact these agencies (NRCS or FSA) directly to apply. Anyone performing forestry work or operating power driven machinery on privately owned forestland must submit a notification through E-Notification on ODF's website (https://ferns.odf.oregon.gov/e-notification).

Application Deadline? A private forestland owner should contact ODF when they expect forest management work after a fire. Application deadlines for federal programs vary – contact the local NRCS or FSA office for specific details of each program.

Eligibility Requirements? Landowners can always contact a local ODF Stewardship Forester for technical assistance (http://www.oregon.gov/ODF/Working/Pages/FindAForester.aspx). Eligibility for federal financial assistance varies by program – landowners should contact the appropriate federal agency.

How soon can this start? Planning can start immediately. If reading this before a wildfire, please work with the local stewardship forester, and encourage other private landowners to do the same. If during or after a wildfire, contact your local stewardship forester to plan what to do after the fire is contained.

How long will the assistance last? The Oregon Department of Forestry's technical support is continuous. Financial support from federal programs varies.

Website: https://www.oregon.gov/ODF/Documents/WorkingForests/AssistanceAftertheWildfire.pdf

Contact? Find your local stewardship forester http://www.oregon.gov/ODF/Working/Pages/FindAForester.aspx

Examples: 2015 Canyon Creek Fire; 2015 Cornet-Windy Fire; 2017 Chetco Bar Fire. After the Canyon Creek fire, technical assistance included providing: best management practices to help limit ground impacts during and after salvage harvests to reduce erosion; advice about replanting to help stabilize soil; and information about landowner assistance programs

Authority: Oregon Forest Practices Act

Emergency Assessment of Post-Fire Debris-Flow Hazards

United States Geologic Survey (USGS)

What is it? The United States Geologic Survey (USGS) delivers geospatial data describing post-fire debris-flow hazards for select wildfires in the Western U.S., including estimates of the probability and volume of debris flows that may occur in response to design storms. USGS makes the assessments at the scale of the drainage basin and individual stream segment. They are typically completed to support Burned Area Emergency Response (BAER) team efforts (see page 41), though BAER teams also have to option of using the Forest Service's "Debris Flow Potential Model", which was developed jointly with BLM. The assessments are specific to debris-flow hazards; hazards from flash-flooding are not described in this study and can be significant.

The models underlying the USGS debris-flow hazard assessments were developed, calibrated, and tested using data from the western United States. The models have not yet been tested in burn areas in the eastern United States, western Oregon, or Washington (west of the Cascade Range). As of 2018, USGS is validating model predictions in the eastern United States, western Oregon, and Washington.

Due to technical and resource limitations, the USGS may not be able to accommodate requests for assessments. Priority is placed on requests for hazard assessments for major wildfires on federally owned public lands for which a formal BAER process has been established. Case by case assessments are used for small wildfires, wildfires that occurred in prior fire seasons, and wildfires outside federally owned public lands. Debris-flows are typically not a threat in areas of low topographic relief.

Who can apply? Any government agency

What type of assistance is available? Direct Service

Application deadline? There is no formal deadline to apply for this program (see other considerations above).

What are the requirements to apply? The debris-flow hazard assessments rely on digital data describing differenced normalized burn ratio and field-validated estimates of soil burn severity. The request must include these data.

1. **State or Federal Declaration:** No declaration required.
2. **Burned land owner:** No restriction (see other considerations described above).
3. **Matching funds:** None required.

How soon can this start? Typically, within a week after the necessary data are provided to the USGS.

How long will the assistance last? Until the geospatial data are delivered, typically within in two weeks.

Application Link: https://landslides.usgs.gov/hazards/postfire_debrisflow/request.php

Website: https://landslides.usgs.gov/hazards/postfire_debrisflow/index.php
http://www.nwp.usace.army.mil/emergency/http://www.nrcs.usda.gov/wps/portal/nrcs/main/nm/programs/financial/ewp/

Example of use in Oregon: Debris-flow hazard maps are available for 26 fires in Oregon from 2013-2017, including: 2013 Government Flats Fire, 2015 Canyon Creek Fire, 2017 Chetco Bar Fire, and 2017 Eagle Creek Fire.

Hazard Mitigation Grant Program (HMGP)

Office of Emergency Management

What is it? The purpose of the HMGP is to help communities implement hazard mitigation measures following a Presidential major disaster declaration. Hazard mitigation is any action taken to reduce or eliminate **long-term** risk to people and property from natural hazards. Mitigation planning is a key process used to break the cycle of disaster damage, reconstruction and repeated damage.

FEMA pays a portion of project costs (75 percent) and successful sub-applicants provide a non-federal share (25 percent). Payment of funds comes to the successful applicant as a reimbursement of costs submitted at least quarterly throughout the life of the project.

Homeowners and business owners can also participate in this HMGP offering but must be represented by an eligible applicant. HMGP is available statewide after initial, priority consideration in the declared counties.

Who can apply? State agencies, local governments, Not-for-Profit entities, special districts, and Tribal governments.

What type of assistance is available? Grant funding via an application process.

Application deadline? The deadline to apply for this program occurs within the year following the declaration[2]. The application is sent to sub-applicants if the project proposed appears reasonable, beneficial, and appears to "fix" the problem.

What are the requirements to apply?

1. **Presidential Declaration:** A presidential disaster declaration is required[3]. After that time, a call for letters of interest will be announced.
2. **Must have a FEMA-approved Natural Hazard Mitigation Plan in place throughout the life of the project.** If you have no current, approved plan, please contact the State Hazard Mitigation Officer at Office of Emergency Management.
3. **Matching funds:** 25% of total project cost must be matched. This can be hard or soft match. Assurance that the match is available is a requirement of the grant.
4. **Other requirements:** Environmental, cultural and historic impacts must be explored. A Benefit-Cost Analysis, utilizing the latest FEMA BCA tool, is also required. Other elements are also required, and are described in the grant application packet.

How soon can this start? The State and FEMA review the applications. Those applications considered complete are considered for award. The State prioritizes projects submitted, and FEMA makes the award. Environmental Analysis or historic and cultural considerations can delay award, depending on difficulty of project and whether digging will occur.

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[2] The deadline is 6 months if HMGP is authorized as a result of a Fire Management Assistance declaration instead of a major presidential disaster declaration (October 2016-September 2018).

[3] Normally, HMGP is only available after a major presidential disaster declaration. Under the Bipartisan Budget Act of 2018, HMGP can be used after wildfires with a Fire Management Assistance declaration from October 2016 to September 2018. $425,000 is authorized for mitigation activities for each FMA declaration.

How long will the assistance last? The project must be completed within 3 years of the application due date. Projects can be phased, but need to be vetted with the State Hazard Mitigation Officer.

Contact Name: State Hazard Mitigation Officer

Contact Phone Number: 503-378-4660

Website: http://www.oregon.gov/OEM/emresources/Grants/Pages/HMA.aspx

Example of use in Oregon: Types of projects funded include mitigating flooding using structural and non-structural strategies, updating Natural Hazard Mitigation Plans, installing warning systems, installing generators for critical facilities, elevations of structures, retrofitting buildings for seismic and wildfire hazards, reducing hazardous fuels in wildland-urban interface areas, and moving buildings from tsunami inundation zones and landslide areas. Other types of projects are also eligible.

Authority: Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

Flood Mitigation Assistance (FMA)

Office of Emergency Management

What is it? FMA provides funding to states, U.S. territories, federally-recognized tribes and local communities for projects and flood planning that reduces or eliminates long-term risk of flood damage to structures insured under the NFIP. FMA funding is also available for management costs. Funding is appropriated by Congress annually.

Subapplicants submit flood mitigation planning and project subapplications to their state during the open application cycle. After reviewing project and planning applications to determine if they meet the program's requirements, Oregon Emergency Management or a federally-recognized tribal governments prioritize and forward the applications to their FEMA regional office.

Planning subapplications submitted for consideration for FMA funding must only be used to support the flood hazard portion of State, tribal, or local mitigation plans to meet the requirements outlined in 44 CFR Part 201 Mitigation Planning.

Projects submitted for consideration for FMA funding must be consistent with the goals and objectives identified in the current, FEMA-approved state or tribal (standard or enhanced) hazard mitigation plan along with the local or tribal hazard mitigation plan for the jurisdiction in which the activity is located.

Funding is limited and FEMA Headquarters must make difficult decisions as to the most effective use of grant funds. FEMA awards FMA funds to state, U.S. territory, and Federally-recognized tribal Applicants, who in-turn provide sub-awards to local government subapplicants.

Once FEMA reviews planning and project applications for eligibility and completeness, FEMA makes funding decisions based on the agency's priorities for the most effective use of grant funds and the availability of funds posted in the Notice of Funds Opportunity announcement on Grants.gov. **The FMA program is a highly competitive grant program.**

Who can apply? State agencies, local governments, special districts, and Tribal governments.

What type of assistance is available? Grant funding via an online application process; nationally competitive.

Application deadline? This is an online application through eGrants. The application period is 3 months, however, the State takes 1 month to conduct reviews and put the grant package together to submit for this funding opportunity. Sub-applicants need to be readily available to respond to requests for information within that 3 month period.

What are the requirements to apply?

1. **Notice of Funding Opportunity (NOFO):** When the funding opportunity is available, FEMA will announce approximately one month before the application period opens (usually in mid-summer, through early fall). At that time, sub-applicants are encouraged to request from the State Hazard Mitigation Officer a user profile for eGrants. Once the user profile is approved, the State will then allow the sub-applicant to start the application process.

2. **Must have a FEMA-approved Natural Hazard Mitigation Plan (NHMP) in place throughout the life of the project.** If you do not have a current, approved plan, please contact the State Hazard Mitigation Officer at Office of Emergency Management. Project proposals must be consistent with the goals and objectives identified in the NHMP in which the activity is located.
3. **Matching funds:** 0% - 25% of total project cost must be matched (depends on type of structures involved in project area). This can be hard or soft match. Assurance that the match is available is a requirement of the grant.
4. **Other requirements:** Hydraulic/Hydrologic processes, as well as environmental, cultural and historic impacts must be explored. A Benefit-Cost Analysis, utilizing the latest FEMA BCA tool, is also required. Other elements are also required, and the user will be prompted through all of the questions as they proceed through the screens associated with the online application. Communities must be participating in the National Flood Insurance Program (NFIP).

How soon can this start? After the application is submitted, the applications are sent to a National Review Team. Complete applications are considered for further review, and potential award. The State prioritizes projects submitted, and FEMA makes the award. Environmental Analysis or historic and cultural considerations that may result as a part of the project activities could delay award, depending on difficulty of project and whether or not digging will occur.

How long will the assistance last? The project must be completed within 3 years of the application due date.

Contact Name: State Hazard Mitigation Officer

Contact Phone Number: 503-378-4660

Website: http://www.oregon.gov/OEM/emresources/Grants/Pages/HMA.aspx

Example of use in Oregon: Types of projects that have been funded include property buy-outs within the Special Flood Hazard Area, elevations of structures, other structural and non-structural flood mitigation projects, and demolishing and relocating buildings from flood hazard zones. Other types of projects are also eligible.

Authority: Section 1366 of the National Flood Insurance Act of 1968.

Pre-Disaster Mitigation (PDM)

Office of Emergency Management

What is it? The PDM Program is designed to assist states, U.S. territories, federally-recognized tribes, and local communities in implementing a **sustained** pre-disaster natural hazard mitigation program. The goal is to reduce overall risk to the population and structures from future hazard events, while also reducing reliance on federal funding in future disasters. This program awards planning and project grants, and provides opportunities for raising public awareness about reducing future losses before disaster strikes. Mitigation planning is a key process used to break the cycle of disaster damage, reconstruction, and repeated damage. PDM grants are funded annually by Congressional appropriations and are awarded on a nationally competitive basis. However, there is a state set-aside amount allowed for certain project proposals.

Local governments are eligible Subapplicants and can sponsor applications on behalf of homeowners to submit to the applicant. Subapplicants (i.e., local governments) submit mitigation planning and project subapplications to their State during the open application cycle. After reviewing planning and project applications to determine if they meet the program's requirements, the Applicants (i.e., states, U.S. territories, or federally-recognized tribal governments) prioritize and forward the planning and project applications in a PDM grant application to FEMA.

Once FEMA reviews planning and project applications for eligibility and completeness, FEMA makes funding decisions based on the agency's priorities for the most effective use of grant funds and the availability of funds posted in the Notice of Funds Opportunity announcement on Grants.gov. **The PDM program is a highly competitive grant program.**

Who can apply? State agencies, local governments, special districts, and Tribal governments.

What type of assistance is available? Grant funding via an online application process; nationally competitive.

Application deadline? This is an online application through eGrants. The application period is 3 months, however, the State takes 1 month to conduct reviews and put the grant package together to submit for this funding opportunity. Sub-applicants need to be readily available to respond to requests for information within that 3 month period.

What are the requirements to apply?

1. **Notice of Funding Opportunity (NOFO):** When the funding opportunity is available, FEMA will announce approximately one month before the application period opens (usually in mid-summer, through early fall). Sub-applicants are encouraged to request from the State Hazard Mitigation Officer a user profile for eGrants. Once the user profile is approved, the State will then allow the sub-applicant to start the application process.
2. **Must have a FEMA-approved Natural Hazard Mitigation Plan (NHMP) in place throughout the life of the project.** If you have no current, approved plan, please contact the State Hazard Mitigation Officer at Office of Emergency Management. Project proposals must follow the goals and objectives identified in the NHMP in which the activity is located.
3. **Matching funds:** 25% of total project cost must be matched. This can be hard or soft match. Assurance that the match is available is a requirement of the grant.

4. **Other requirements:** Environmental, cultural and historic impacts must be explored. A Benefit-Cost Analysis, utilizing the latest FEMA BCA tool, is also required. Other elements are also required, and the user will be prompted through the questions as they proceed through the screens associated with the online application.

How soon can this start? After the application is submitted, the applications are sent to a National Review Team. Those applications considered complete are considered for further review, and potential award. The State prioritizes projects submitted, and FEMA makes the award. Environmental Analysis or historic and cultural considerations that may result as a part of the project activities could delay award, depending on difficulty of project and whether or not digging will occur.

How long will the assistance last? The project must be completed within 3 years of the application due date.

Contact Name: State Hazard Mitigation Officer

Contact Phone Number: 503-378-4660

Website: http://www.oregon.gov/OEM/emresources/Grants/Pages/HMA.aspx

Example of use in Oregon: Types of projects funded include mitigating flooding using structural and non-structural strategies, updating Natural Hazard Mitigation Plans, installing warning systems, installing generators for critical facilities, elevations of structures, retrofitting buildings for seismic and wildfire hazards, reducing hazardous fuels in wildland-urban interface areas, and moving buildings from tsunami inundation zones and landslide areas. Other types of projects are also eligible.

Authority: Section 203 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act

Technical Assistance Grant (TA Grant)

Oregon Department of Land Conservation and Development

What is it? The Department of Land Conservation and Development offers grants to local and tribal governments to complete projects that update and modernize comprehensive plans, land use ordinances, development codes and other planning regulations.

One defined priority for the grant is to plan for resilience to natural hazards. This priority is for grants that assist with creating local natural hazard mitigation plans and for incorporating new hazards data, and the response to the data, into comprehensive plans and zoning regulations.

What type of assistance is available? Funding

Who can apply? Oregon local and tribal governments, and some special districts and regional planning agencies, may apply directly.

Application deadline? Grants are accepted for Oregon legislative biennium periods. Applications for the 2017-2019 biennium were due in October 2017. Applications for the 2019-2021 biennium may be due in fall 2019, but procedures can change when a new grant period is established.

What are the requirements to apply? Communities can contact their DLCD Regional Representative for more information, and fill out and submit an application directly to DLCD. Web page with list of DLCD Regional Representatives - http://www.oregon.gov/lcd/pages/repslist.aspx.

How soon can this start? Only during open grant periods at the start of each Oregon legislative biennium.

How long will the assistance last? The funding is for a specific project that meets the planning goals outlined above.

Contact Phone Number: 503-934-0054

Website: http://www.oregon.gov/LCD/Pages/grants.aspx

Example of use in Oregon: Canyon City used a DLCD Technical Assistance Grant to fund the writing of its addendum to the Northeast Oregon Multi-Jurisdictional Natural Hazards Mitigation Plan in 2017. This need was spurred by the 2015 fires and subsequent concerns about flooding and landslides caused by post-fire soil conditions. The addendum provided an up-to-date basis for hazard mitigation in the post-disaster environment, and created a document that would enhance the City's competitiveness for multi-hazard FEMA mitigation grants.

Appendix D: Links to other resources

There are many resources aside from this playbook to learn more about post-fire hazards. This playbook only discussed risk of flooding and debris flow, but there are other post-fire hazards as well. Selected resources from different agencies are provided in this section.

Federal Agency Sites

USGS real-time geospatial database of fire perimeters: https://www.geomac.gov/
USGS post-fire debris flow emergency assessments: https://landslides.usgs.gov/hazards/postfire_debrisflow/
USGS post-fire water quality impacts: https://ca.water.usgs.gov/wildfires/wildfires-water-quality.html
USGS/NOAA Post Wildfire Flash Flood and Debris Flow Survival Guide (for individuals): https://www.wrh.noaa.gov/lox/hydrology/files/DebrisFlowSurvivalGuide.pdf
NWS post-fire debris flow and flash flood overview: https://www.weather.gov/riw/burn_scar_flooding
NWS post-fire burn scar map (experimental): https://www.wrh.noaa.gov/wrh/postwildfire/
NRCS Oregon After the Fire Resources (includes fact sheets on hazard trees, log erosion barrier, etc.): https://www.nrcs.usda.gov/wps/portal/nrcs/detail/or/programs/financial/eqip/?cid=stelprdb1261654
NRCS Oregon Snow Survey Program: https://www.nrcs.usda.gov/wps/portal/nrcs/main/or/snow/
FEMA Flood after Fire toolkit: https://www.fema.gov/media-library/assets/documents/159559
FEMA Flood after Fire (Spanish): https://fema.gov/es/inundacion-fuego
FEMA Hazard Mitigation Grant Program Post-fire: https://www.fema.gov/hazard-mitigation-grant-program-post-fire
FEMA Mitigation Ideas: https://www.fema.gov/media-library/assets/documents/30627
Rapid Response tools and datasets for hydrologic modeling: http://rred.mtri.org/rred/

Outside of Oregon Resources and Examples

New Mexico After Wildfire: http://afterwildfirenm.org/
Washington After Wildfire: http://afterthewildfirewa.org/
British Columbia Brochure on post-fire landslides and flooding risks: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/resource-roads/local-road-safety-information/landslide_flooding_risks_due_to_wildfires-brochure.pdf
University of Idaho. After the Burn: Assessing and managing your forestland after a wildfire (Barkley 2011). http://extensionweb.forestry.oregonstate.edu/sites/forestry-extension/files/after_the_burn_barkley.pdf

Videos

2018 Montecito, CA post-fire debris flow overview: https://www.youtube.com/watch?v=BUuyd9HRZ1A
2016 Fish Fire Post-fire debris flow footage: https://www.youtube.com/watch?v=OTuHQOHjC6Q
2014 Silverado Fire debris flow footage: https://www.youtube.com/watch?v=VwPnKCx2SNM
2003 Clear Creek County, Colorado debris Flow footage: https://www.youtube.com/watch?v=8mKC3eID074
2003 Grand Prix Fire, Devore, CA post-fire debris flow: https://www.youtube.com/watch?v=k3W-wDIR-Os
California Flooding after Fire Video: https://vimeo.com/188360924
NWS Local educational videos: https://www.youtube.com/playlist?list=PL4LXNOV7Vb5Q3BqjSi8y9IoALLwfeldrL
After the Wildfire Colorado-based webinar: https://www.youtube.com/watch?v=dF683m-KnNY

Appendix E: Social media risk messaging

Communicating the continuing risk of flood and debris flows after a fire can be challenging. This appendix contains some short messages that can be posted to social media accounts and messaged to residents to warn them of the risks. For images and infographics to support these communications, refer to the FEMA flood after fire toolkit: https://www.fema.gov/media-library/assets/documents/159559

- Flood risk is significantly higher up to five years after a large-scale wildfire event. Here's what you can do to protect the life you've built: fema.gov/flood-after-fire
- FACT: If you live in an area recently affected by wildfires, you are at risk of costly flooding. Most homeowner's insurance does not cover floods from natural disasters. Make sure your home is protected: fema.gov/flood-after-fire
- If you are living in an area that has experienced a wildfire you are at high risk of flash flooding and debris flows. Do you have flood insurance? Be prepared: fema.gov/flood-after-fire
- Debris flows are fast-moving, powerful mixtures of mud, rocks, boulders, and entire trees. They are most common during intense rain after wildfires. When a wildfire burns a slope, it increases the chance of debris flows for several years.
- A debris flow can start on a dry slope after only a few minutes of intense rain. "Intense" rain means a burst of rain at a fast rate, about half an inch in an hour.
- Get out of a debris flow danger area before the storm arrives. Debris flows can travel faster than 20 miles per hour. If you wait to be sure a debris flow is headed your way, it will be too late to leave safely.
- Follow all evacuation orders. If you stay behind, you can't protect your property and first responders won't be able to protect you. Never underestimate a debris flow.
- If you get caught in a debris flow danger area, get to the highest point that you can get to, safely, before the debris flow arrives. Go uphill or upstairs, get on a roof, climb a tree.
- Know the warning signs that a debris flow is about to arrive. Listen and watch for rushing water, mud, unusual sounds. Survivors describe sounds of cracking, breaking, roaring, or a freight train.
- If you are near a wildfire burn area, sign up for emergency alerts and pay attention to weather forecasts for the burn area. The weather in the burn area could be very different from where you are.
- Debris flows don't always stay in stream channels and they can flow sideways as well as downhill.
- You can't stop or change the path of a debris flow. However, you may be able to protect your property from floodwaters or mud by use of sandbags, retaining walls or k-rails (Jersey barriers).
- In the West, almost 200 people have been killed by debris flows. Most victims were sleeping in lower-floor bedrooms adjacent to drainages or steep slopes.

Appendix F: Acronym Glossary

BAER: Burned Area Emergency Response
BAR: Burned Area Rehabilitation
BLM: Bureau of Land Management
DLCD: Oregon Department of Land Conservation and Development
DOGAMI: Oregon Department of Geology and Mineral Industries
DOI: Department of Interior
DSL: Oregon Department of State Lands
EFRP: Emergency Forest Restoration Program
EM: Emergency Manager
EP: Emergency Permit
ES: Emergency Stabilization
EQIP: Environmental Quality Incentives Program
EWPP: Emergency Watershed Protection Program
FEMA: Federal Emergency Management Agency
FMA: Flood Mitigation Assistance
FMAG: Fire Management Assistance Grant (2015 pilot only)
FSA: Farm Service Agency
FWS: United States Fish and Wildlife Service
HMGP: Hazard Mitigation Grant Program
NOAA: National Oceanic and Atmospheric Administration
NOFO: Notice of Funding Opportunity
NHMP: Natural Hazards Mitigation Plan
NPS: National Park Service
NRCS: Natural Resources Conservation Service
NWS: National Weather Service
ODF: Oregon Department of Forestry
ODOT: Oregon Department of Transportation
OEM: Oregon Emergency Manager
OWRD: Oregon Water Resources Department
PDM: Pre-Disaster Mitigation
RDG: Rapid Deployment Gauge
SWCD: Soil and Water Conservation District
USACE: United States Army Corps of Engineers
USFS: United States Forest Service
USGS: United States Geological Survey