# OKANOGAN COUNTY, WASHINGTON

# MULTI-HAZARD MITIGATION PLAN

2014

Prepared By

Northwest Management, Inc.

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# Foreword

"Hazard mitigation is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. Mitigation activities may be implemented prior to, during, or after an incident. However, it has been demonstrated that hazard mitigation is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs."[1]

The **Okanogan County, Washington Multi - Hazard Mitigation Plan** was updated in 2013 by the Okanogan County MHMP planning committee in cooperation with Northwest Management, Inc. of Moscow, Idaho.

This Plan satisfies the requirements for a local multi-hazard mitigation plan and a flood mitigation plan under 44 CFR Part 201.6 and 79.6.

[1] Federal Emergency Management Agency. "Local Multi-Hazard Mitigation Planning Guidance." July 1, 2008.

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U.S. Department of Homeland Security
FEMA Region X
Federal Regional Center
130 228th Street, SW
Bothell, WA 98021-8627

FEMA

October 20, 2014

Honorable Ray Campbell
Chair, Okanogan County Commissioners
123 Fifth Avenue North, Room 150
Okanogan, Washington 98840

Dear Chair Campbell:

The U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) has approved the ***Okanogan County Multi-Hazard Mitigation Plan*** as a multi-jurisdictional local plan as outlined in 44 CFR Part 201. With approval of this plan, the following entities are now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through October 19, 2019:

| | | |
|---|---|---|
| **Okanogan County** | **City of Brewster** | **City of Okanogan** |
| **City of Omak** | **City of Oroville** | **City of Pateros** |
| **Town of Coulee Dam** | **Town of Elmer City** | **Town of Riverside** |
| **Town of Twisp** | **Town of Winthrop** | **Town of Nespelem** |

The plan's approval provides the above jurisdictions eligibility to apply for hazard mitigation projects through your State. All requests for funding will be evaluated individually according to the specific eligibility and other requirements of the particular program under which the application is submitted. For example, a specific mitigation activity or project identified in the plan may not meet the eligibility requirements for FEMA funding, and even eligible mitigation activities are not automatically approved for FEMA funding under any of the aforementioned programs. Approved mitigation plans may be eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Additional information regarding the CRS can be found at www.fema.gov/business/nfip/crs.shtm or through your local floodplain manager.

Over the next five years, we encourage your communities to follow the plan's schedule for its monitoring and updating, and to develop further mitigation actions. The plan must be reviewed, revised as appropriate, and resubmitted for approval within five years in order to continue project grant eligibility.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact our State counterpart, Washington Emergency Management Division, which coordinates and administers these efforts for local entities.

Sincerely,

Mark Carey, Director
Mitigation Division

Enclosure

cc: Peter Tassoni, Washington Emergency Management Division

BH:bb

# Table of Contents

# Chapter 1

## Plan Overview



IN THIS SECTION:

- Planning Participants
- Phase I Hazard Assessment
- Goals and Guiding Principles
- Integration with Other Planning Mechanisms

# Chapter 1 – Plan Overview

## Overview of this Plan and its Development

This regional Multi - Hazard Mitigation Plan is the result of analyses, professional cooperation and collaboration, assessments of hazard risks and other factors considered with the intent to reduce the potential for hazards to threaten people, structures, infrastructure, and unique ecosystems in Okanogan County, Washington. The planning team responsible for implementing this project was led by Okanogan County Emergency Management. Agencies and organizations that participated in the planning process included:

- Okanogan County Commissioners and County Departments
- City of Omak
- City of Okanogan
- City of Oroville
- City of Tonasket
- City of Brewster
- City of Pateros
- Town of Conconully
- Town of Nespelem
- Town of Elmer City
- Town of Coulee Dam
- Town of Riverside
- Town of Twisp
- Town of Winthrop
- Okanogan County Fire Districts
- City of Omak Fire Department
- City of Okanogan Fire Department
- Town of Conconully Fire Department
- Town of Coulee Dam Fire Department
- Washington Department of Natural Resources
- Confederated Tribes of the Colville Reservation
- Colville Agency, Bureau of Indian Affairs
- Okanogan County Public Utilities District
- Okanogan County Public Health
- Okanogan Communities Development Council
- Washington Military Department, Emergency Management Division
- Okanogan Conservation District
- USDA Forest Service
- Okanogan County Sheriff's Department and Emergency Management
- American Red Cross
- Northwest Management, Inc.

In September of 2012, Okanogan County Emergency Management solicited competitive bids from companies to provide the service of leading the assessment, updating the data, and writing the Okanogan

County, Washington Multi - Hazard Mitigation Plan. Northwest Management, Inc. (NMI) was selected to provide this service to the County. NMI is a natural resources consulting firm located in Moscow, Idaho.

## *Phase I Hazard Assessment*

The Multi - Hazard Mitigation Plan is developed in accordance with the Federal Emergency Management Agency's (FEMA) and Washington Military Department, Emergency Management Division requirements for a county level pre-disaster mitigation plan. The State of Washington Hazard Mitigation Plan identifies nine natural hazards affecting the State. In an effort to be consistent, the planning committee developed annexes for the same natural hazards. The hazards addressed in this Plan are:

- Flood
- Earthquake
- Landslide
- Severe Weather
- Wildland Fire
- Terrorism & Civil Unrest

Additional hazard annexes may be added to this Plan as funding allows. The highest priority hazards to be considered for future evaluation are:

- Hazardous Materials
- Crop Loss
- Dam Failure
- Pandemic

A Phase I Assessment was facilitated with the county planning committee to determine the relative frequency of a hazard's occurrence and the potential impact a hazard event will have on people, property, infrastructure, and the economy based on local knowledge of past occurrences. A matrix system with hazard magnitude on the x axis and frequency on the y axis was used to score each hazard.

| Magnitude of Hazards | | | | | | |
|---|---|---|---|---|---|---|
| **Value** | **Reconstruction Assistance From** | **Geography (Area) Affected** | **Expected Bodily Harm** | **Loss Estimate Range** | **Population Sheltering Required** | **Warning Lead Times** |
| **1** | Family | Parcel | Little to No Injury / No Death | $1000s | No Sheltering | Months |
| **2** | City | Block or Group of Parcels | Multiple Injuries with Little to No Medical Care / No Death | $10,000s | Little Sheltering | Weeks |
| **2** | County | Section or Numerous Parcels | Major Medical Care Required / Minimal Death | $100,000s | Sheltering Required Neighboring Counties Help | Days |
| **4** | State | Multiple Sections | Major Injuries / Requires Help from Outside County / A Few Deaths | $1,000,000s | Long Term Sheltering Effort | Hours |
| **8** | Federal | Countywide | Massive Casualties / Catastrophic | $10,000,000s | Relocation Required | Minutes |

A scoring system (shown above) was used to categorize the relative magnitude each hazard may have on the community. Frequency was rated as "High" for hazards occurring multiple times per year of 5 year period, "Medium" for hazards occurring every 5 to 25 years, or "Low" for hazards occurring more than 25 years apart.[2]

The following table summarizes the results of the Phase I Hazard Assessments for Okanogan County.

| | | **Magnitude** | | |
|---|---|---|---|---|
| | | Low | Medium | High |
| **Frequency** | Low | | **Terrorism/Civil Unrest** | |
| | Medium | | **Landslide** | **Earthquake** |
| | High | | **Flood** | **Wildland Fire Severe Weather** |

The inclusion of additional hazards was considered; however, due to funding limitations, participating jurisdictions chose not to assess technological, man-caused, or other hazards until additional funding becomes available. At such a time, the Multi - Hazard Mitigation Plan will be revised to include hazards such as hazardous materials, dam failure, and pandemic.

[2] Custer County, Idaho. Scoring system partially adapted from the Custer County Multi-Jurisdiction All Hazard Mitigation Plan. 2008. Pp 165-168.

# Goals and Guiding Principles

## Federal Emergency Management Agency Philosophy

Effective November 1, 2004, a Multi - Hazard Mitigation Plan approved by the Federal Emergency Management Agency (FEMA) is required for Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation Program (PDM) eligibility. The HMGP and PDM program provide funding, through state emergency management agencies, to support local mitigation planning and projects to reduce potential disaster damages.

The new local Multi - Hazard Mitigation Plan requirements for HMGP and PDM eligibility is based on the Disaster Mitigation Act of 2000, which amended the Stafford Disaster Relief Act to promote an integrated, cost effective approach to mitigation. Local Multi - Hazard Mitigation Plans must meet the minimum requirements of the Stafford Act-Section 322, as outlined in the criteria contained in 44 CFR Part 201. The plan criteria cover the planning process, risk assessment, mitigation strategy, plan maintenance, and adoption requirements.

In order to be eligible for project funds under the Flood Mitigation Assistance (FMA) program, communities are required under 44 CFR Part 79.6(d)(1) to have a mitigation plan that addresses flood hazards. On October 31st, 2007, FEMA published amendments to the 44 CFR Part 201 at 72 Federal Reg. 61720 to incorporated mitigation planning requirements for the FMA program (44 CFR Part 201.6). The revised Local Mitigation Plan Review Crosswalk (July 2008) used by FEMA to evaluate local hazard mitigation plans is consistent with the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended by Section 322 of the Disaster Mitigation Act of 2000, the National Flood Insurance Act of 1968, as amended by the National Flood Insurance Reform Act of 2004 and 44 Code of Federal Regulations (CFR) Part 201 – Mitigation Planning, inclusive of all amendments through October 31, 2007 was used as the official guide for development of a FEMA-compatible Okanogan County, Washington Multi-Hazard Mitigation Plan. [3]

FEMA will only review a local Multi - Hazard Mitigation Plan submitted through the appropriate State Hazard Mitigation Officer (SHMO). Draft versions of local Multi - Hazard Mitigation Plans will not be reviewed by FEMA. FEMA will review the final version of a plan prior to local adoption to determine if the plan meets the criteria, but FEMA will be unable to approve it prior to adoption.

In Washington the SHMO is:

Mark Stewart
Washington Military Department
Emergency Management Division
Building 20, M/S: TA-20
Camp Murray, WA 98430-5122

A FEMA designed plan will be evaluated on its adherence to a variety of criteria.

[3] Federal Emergency Management Agency. "Local Multi-Hazard Mitigation Planning Guidance." July 1, 2008.

- Adoption by the Local Governing Body
- Multi-jurisdictional Plan Adoption
- Multi-jurisdictional Planning Participation
- Documentation of Planning Process
- Identifying Hazards
- Profiling Hazard Events
- Assessing Vulnerability: Identifying Assets
- Assessing Vulnerability: Estimating Potential Losses
- Assessing Vulnerability: Analyzing Development Trends
- Multi-jurisdictional Risk Assessment
- Local Hazard Mitigation Goals
- Identification and Analysis of Mitigation Measures
- Implementation of Mitigation Measures
- Multi-jurisdictional Mitigation Strategy
- Monitoring, Evaluating, and Updating the Plan
- Implementation Through Existing Programs
- Continued Public Involvement

## *Planning Philosophy and Goals*

### Okanogan County Planning Philosophy

This effort will utilize the best and most appropriate science from all partners, the integration of local and regional knowledge about man-made and natural hazards, while meeting the needs of local citizens, the regional economy, the significance of this region to the rest of Washington and the Inland West.

**Mission Statement**

To make residents, communities, state agencies, local governments, and businesses less vulnerable to the effects of hazards through the effective administration of hazard mitigation grant programs, hazard risk assessments, wise and efficient infrastructure hardening, and a coordinated approach to mitigation policy through federal, state, regional, and local planning efforts. Our combined priorities will be the protection of people, structures, infrastructure, and unique ecosystems that contribute to our way of life and the sustainability of the local and regional economy.

**Vision Statement**

Promote a countywide hazard mitigation ethic through leadership, professionalism, and excellence, leading the way to a safe, sustainable Okanogan County.

### Jurisdictional Planning and Mitigation Goals

Each participating jurisdiction in Okanogan County assisted in developing the County's Mission, Vision, and Goals Statements with each jurisdiction's respective interests in mind. Therefore, it was determined the County's statements suited the needs of each jurisdiction. This paragraph serves as each jurisdiction's

acceptance of the County's Mission, Vision, and Goals Statements. The following section outlines the goals submitted by each jurisdiction.

### *Okanogan County:*

1. *Planning* – This planning process will involve planning for the hazards of Wildland Fire, Flood, Earthquake, Landslides, Severe Weather, and Terrorism & Civil Unrest.
2. *Mitigation* – Prioritize the protection of people, structures, infrastructure, and unique ecosystems that contribute to our way of life and the sustainability of the local and regional economy.
3. *Mitigation* – Educate communities about the unique challenges of natural hazard preparedness in the county.
4. *Planning* – Additional hazards will be added to this plan as pre-mitigation planning is completed in the future.
5. *Planning* – Establish mitigation priorities and develop mitigation strategies in Okanogan County.
6. *Mitigation* – Strategically locate and plan infrastructure projects that take into consideration the impacts of natural hazards.
7. *Mitigation*– Identify and implement an integrated schedule of treatments targeted at achieving an elimination of lives lost, reduction in structures destroyed, infrastructure compromised, and unique ecosystems damaged that serve to sustain the way-of-life and economy of Okanogan County and the region.
8. *Planning* – Meet or exceed the requirements of a FEMA All Hazard Mitigation Plan.

## Integration with Other Local Planning Mechanisms

During the development of this Multi - Hazard Mitigation Plan several planning and management documents were reviewed in order to avoid conflicting goals and objectives. Existing programs and policies were reviewed in order to identify those that may weaken or enhance the hazard mitigation objectives outlined in this document. The following narratives help identify and briefly describe some of the existing planning documents and ordinances considered during the development of this plan. This list does not necessarily reflect every plan, ordinance, or other guidance document within each jurisdiction; however, this is a summary of the guidance documents known to and recommended for review by members of the planning committee.

### *Okanogan County Local Hazard Mitigation Plan – 2013*

In the 2013 Draft of the Local Hazard Mitigation Plan, the Task Force was developing ways to raise the community awareness of the natural hazards that threaten the public health and safety, the economic vitality of businesses, and the operational capability of important facilities and institutions. The draft plan identified the hazards threatening Okanogan County and provided an assessment of the risks posed. It also detailed the specific vulnerabilities of Okanogan County and many of the facilities that are important to the community's daily life. The plan included proposals to avoid or minimize those vulnerabilities. This information assisted individuals in understanding how the community could become safer from the impacts of future disasters. The work done and community supported garnered during the 2012-13 planning process has been incorporated in this Multi-Hazard Mitigation Plan.

### *Okanogan County Comprehensive Plan*

The Okanogan County Comprehensive Plan (Plan) is a 20-year guide for the future of Okanogan County. The Plan provides a framework to support growth, development, and public decision-making in the County. It provides the vision of how residents want the County to grow and evolve over time. It establishes the goals, policies, priorities, and actions that the County will pursue to allow maintenance and enhancement of the quality of life, preservation of the rural character, sustainability of agricultural and natural resource industries, provision of recreational opportunities for residents and visitors, and protection of environmentally sensitive areas.

A comprehensive plan is a document that can benefit private property owners, local businesses, County staff, cities and towns in the County, state and federal agencies, Tribes, community organizations and other interested parties. It is an effective management tool for elected officials, empowers community members to help define the future vision and character of the County, guide development patterns of the County, and provide predictability to property owners regarding the future use and enjoyment of their land.

The Okanogan County Comprehensive Plan was adopted in 1964 and was updated in 2005 with adoption of a revised plan scheduled for the fall of 2013. The Okanogan County All Hazard Mitigation Plan will be incorporated as a tool for decision makers to further their knowledge of specific hazard risk areas in order to make more informed decisions on how development should occur in those areas. Although land use designations are expected to be revised, specific recommendations regarding the vulnerability or potential dollar losses of future buildings, infrastructure, and critical facilities is not possible at this time.

### *Okanogan County Hazard Identification and Vulnerability Assessment*

The Hazard Identification and Vulnerability Assessment (HIVA) dated February 2004, describes natural and technological (human-made) hazards, which can potentially impact the people, economy, environment, and property of Okanogan County. It serves as a basis for county-level emergency management programs. It is the foundation of effective emergency management and identifies the hazards that organizations must mitigate against, prepare for, respond to, and recover from in order to minimize the effects of disasters and emergencies. The HIVA is not a detailed study, but rather a general overview of hazards that can cause emergencies and disasters. The Okanogan County All Hazards Mitigation Plan is a much more comprehensive approach, is more detailed, and provides specific plans to approach the county's problem areas.

### *Okanogan County Comprehensive Emergency Management Plan (CEMP)*

The Comprehensive Emergency Management Plan (CEMP) dated January 2011 considers the emergencies and disasters likely to occur, as described in the Okanogan County Hazard Identification and Vulnerability Assessment, and describes functions and activities necessary to implement the four phases of Emergency Management – mitigation, preparedness, response and recovery. The plan utilizes Emergency Support Functions, which identify primary and support agencies responsibilities/activities that county and local jurisdictions may need in order to implement all-hazard mitigation. It provides policies, information, recommendations and guidance to assist responsible officials making operational decisions. This plan is more the "who, what, when, where and why" activities in the event of an emergency. Emergency Support Functions (ESFs) = Transportation; Emergency Communications; Public Works & Engineering; Fire Protection; Information Analysis & Planning; Mass Care; Resource Management; Health & Medical Services; Search & Rescue; Hazardous Materials; Food & Water; Energy & Utilities; Military Support; Recovery & Restoration; Law Enforcement; and Damage Assessment**.** This plan does not conflict in any way with the All Hazards Mitigation Plan. CEMP updates will include support of initiatives and action items outlined in the Okanogan County All Hazards Mitigation Plan.

### *Okanogan County Emergency Response Plan– HazMat Plan*

The purpose of the Hazardous Materials Emergency Response Plan is to establish common guidelines for responding to hazardous materials incidents anywhere within Okanogan County and to protect life, property and the environment from risks associated with the discharge, release, or misuse of hazardous materials. The HazMat Plan is an operational plan as well as a reference document. It may be used for pre-emergency planning and recovery as well as emergency response. The plan is different from the county CEMP in that it is focused on the multi-jurisdictional response to a hazardous materials spill with the Washington State Patrol as the lead agency. This plan endeavors to include contingencies for all these types of hazardous events, except *oil spills.* This plan does not conflict in any way with the All Hazards Mitigation Plan.

### *Critical Area Ordinance*

This ordinance identifies protected and hazardous areas. Protected areas are fish and wildlife habitat conservation areas, aquifer recharge areas, and wetlands. Hazardous areas are frequently flooded areas, geologically hazardous areas, erosion hazard areas, landslide hazard areas, mine hazard areas, seismic hazard areas, and volcanic hazard areas.

### *Okanogan County Zoning Ordinance*

This ordinance does not identify hazard areas in great detail although there are a few zoning districts in the Methow Valley that prohibit new residences within the floodplain. These zones are the "Methow Review District", the "Rural Residential District", and the "Low Density Residential District".

### *Open Space Timber/Open Space Open Space Plans*

The Open Space Timber (OST) and Open Space Open Space (OSOS) Plans could be affected by some fuel reduction practices. The effects are more beneficial than hazardous, if handled appropriately. OST requires the sustenance of healthy commercial-grade timber. Fuels reduction has been shown to increase timber health. OSOS requires the sustenance of priority resources, other than timber. Landowners must ensure that fire-safety practices do not damage priority resources that keep them in the program in which they receive a property tax reduction.

### *Master Program for Okanogan County Shoreline Management*

The Master Program for Shoreline Management outlines allowed/prohibited uses within specific shoreline zoning designations. All shoreline designations allow forest practices within shoreline areas. Non-forestry related mitigation actions would be looked at individually, hopefully either allowed or allowed by permit. Most of the identified action items would have no effect on the shoreline areas such as road signs, evacuation plan, public education, fire-safe building materials etc. The shoreline ordinance is currently being revised and will conform to all existing regulations and plans. Upon approval of the Okanogan County Multi - Hazard Mitigation and Community Wildfire Protection Plans, the revised shoreline plan will acknowledge and support their adoption.

# Chapter 2

## Planning Process

IN THIS SECTION:

- Description of the Planning Process
- The Planning Team
- Planning Committee Meetings
- Public Involvement

# Chapter 2 – Planning Process

## Documenting the Planning Process

Documentation of the planning process, including public involvement, is required to meet FEMA's DMA 2000 (44CFR§201.6(b) and §201.6(c)(1)). This section includes a description of the planning process used to develop this plan, including how it was prepared, who was involved in the process, and how all of the involved agencies participated.

### *The Planning Team*

The Okanogan County Emergency Manager, Scott Miller, led the planning committee efforts. Northwest Management, Inc. Project Co-Managers were Tera R. King and Brad Tucker. These individuals led a team of resource professionals that included county and city elected officials and staff, fire protection districts, law enforcement, hospital and school district representatives, public health districts, and local interest groups.

The planning committee met with many residents of the County during the community risk assessments and at the public meeting. Additionally, the press releases encouraged interested citizens to contact their county emergency manager or attend planning committee meetings to ensure that all issues, potential solutions, and ongoing efforts were thoroughly discussed and considered by the committee. When the public meeting was held, many of the committee members were in attendance and shared their support and experiences with the planning process and their interpretations of the results.

The planning philosophy employed in this project included the open and free sharing of information with interested parties. Information from federal and state agencies was integrated into the database of knowledge used in this project. One meeting with the committee was held during the planning process to facilitate a sharing of information between cooperators.

### *Description of the Planning Process*

The Okanogan County Multi - Hazard Mitigation Plan was developed through a collaborative process involving all of the organizations and agencies detailed in Chapter 1 of this document. The planning effort began by organizing and convening a countywide planning committee.

Okanogan County Emergency Manager, Scott Miller, began organizing the planning committee in October of 2012 by sending out a project invitation letter to a wide variety of local officials, experts, specialists, and citizen groups. The original mailing list for the invitation to participate in the Multi-Hazard Mitigation Plan process included:

**Table 2.1. List of Initial Planning Committee Invitees.**

| | |
|---|---|
| Bill Vallance Cities of Brewster and Pateros, and Okanogan County Fire District #15 | Mark Vine Okanogan County Fire District #12 |
| Brad Armstrong Town of Riverside and Okanogan County Fire District #7 | Dave Hilton Okanogan County Public Health |

| Table 2.1. List of Initial Planning Committee Invitees. | |
|---|---|
| Brad Tucker Northwest Management, Inc. | Phil Dart Okanogan County Fire District #11 |
| Ray Campbell Okanogan County Commissioner | Robert Jackson Town of Coulee Dam |
| Chris Branch Cities of Oroville and Tonasket, North Central WA RC&D | Rod Noel City of Oroville and Okanogan County Fire District #1 |
| David Dalstrom Marshall Town of Winthrop | Darryl Peery Okanogan County Fire District #10 |
| Ken Bajema Deputy Marshall Town of Winthrop | Ron Wonch Washington DNR |
| Chuck Johnson Washington DNR | Roy Schwilke Okanogan County Public Utilities District |
| Dale Swedberg Washington DF&W and Okanogan County Fire District #10 | Scott Miller Okanogan County Emergency Management |
| Rob Burks Chief of Police City of Tonasket and Okanogan County Fire District #4 | Ted Murray Okanogan County GIS |
| Don Waller Okanogan County Fire District #6 | Tera King Northwest Management, Inc. |
| Glenda Beauregard Okanogan County Emergency Management | Tim Vugteveen Washington DNR |
| Gordon Hennigs City of Okanogan and Okanogan County Fire District #3 | Mel Peterson Okanogan County Fire District #9 |
| Greg Roberts Washington DNR | Barbara Peterson Okanogan County Fire District #9 |
| Zac Claussen Town of Conconully | Mike Solheim BLM Fuels |
| Bob Bauer Okanogan County Fire District #16 | Richard Parrish AFMO Fuels |
| Mike Woelke Commissioner Fire District #16 | Paul Budrow Chief of Police Town of Twisp |
| Renee Tillman Town of Elmer City and Okanogan County Fire District #2 | Perry Huston Okanogan County Planning Department |
| John Foster Fanning Okanogan County Fire District #14 and DNR | Nobel Kelly Chiliwist Citizen |
| Kevan Roberts Washington DNR | Peggy Kelly Chiliwist Citizen |
| Kevin Bowling City of Omak and Okanogan County Fire District #3 | Steve Cook DNR |
| Kirsten Cook Okanogan Conservation District | Kathy Busee USFS MV |
| Donny Smith DNR South | Ed Townsend Okanogan Fire District #8 |
| Greg Saltsman DNR South | Sarah Wilkinson US Army Corps of Engineers Chief Joseph Dam |
| Cody Accord Okanogan Fire District #6 | Jen Croft USFS Tonasket Ranger District |
| Tim Tugaw Okanogan Fire District #9 | Jeff Ayers USAF Tonasket Ranger District |
| Bob Parten Okanogan County Public Works | Steve Harris DNR NWR |
| Ron Morris Citizen | Monika Nicholson USFS Methow Valley |
| Sandy Morris Citizen | Lynn Schilling Town of Nespelem |

These individuals attended the planning committee meeting personally or sent a representative from their office or organization. If they did not attend the meeting, these individuals provided information via email regarding their jurisdictions.

The planning process included seven distinct phases which were in some cases sequential (step 1 then step 2) and in some cases intermixed (step 5 completed throughout the process):

1. **Organization of Resources** – Okanogan County and NMI worked together to develop a comprehensive list of potential participants as well as a project timeline and work plan.

2. **Collection of Data –** NMI coordinated with the planning team to gather any available data and information about the extent and periodicity of hazards in Okanogan County to ensure a robust dataset for making inferences about hazards.

3. **Field Observations and Estimations –** NMI and the planning team developed risk models and identified problem areas in order to better understand risks, juxtaposition of structures and infrastructure to risk areas, access, and potential mitigation projects.

4. **Mapping –** NMI developed a comprehensive database and map files relevant to pre-disaster mitigation control and mitigation, structures, resource values, infrastructure, risk assessments, and other related data.

5. **Public Involvement –** NMI and Okanogan County developed a plan to involve the public from the formation of the planning committee to news releases, public meetings, public review of draft documents, and acknowledgement of the final plan by the signatory representatives.

6. **Strategies and Prioritization** – NMI and the planning team representatives worked together to review the risk analyses and develop realistic mitigation strategies.

7. **Drafting of the Report – NMI drafted a final report** integrating the results of the planning process and worked with members of the planning team to review each section, incorporated public comments, proceed with the state and federal review processes, and finally adopt the final document.

## *Multi Jurisdictional Participation*

CFR requirement §201.6(a)(4) calls for multi-jurisdictional planning in the development of Hazard Mitigation Plans that impact multiple jurisdictions. To be included as an adopting jurisdiction in the Okanogan County Multi-Hazard Mitigation Plan jurisdictions were required to participate in at least one planning committee meeting or meet with planning team leadership individually, provide a goals statement, submit at least one mitigation strategy, and adopt the final Plan by resolution.

The following is a list of jurisdictions that have met the requirements for an adopting jurisdiction and are thereby included in the Multi - Hazard Mitigation Plan:

Okanogan County

- Okanogan County, Washington
- City of Brewster
- City of Okanogan
- City of Omak
- City of Oroville
- City of Pateros
- City of Tonasket
- Town of Conconully
- Town of Coulee Dam
- Town of Elmer City
- Town of Nespelem
- Town of Riverside
- Town of Twisp
- Town of Winthrop

These jurisdictions were represented on the planning committee and at the public meeting and participated in the development of hazard profiles, risk assessments, and mitigation measures.

The planning committee meeting was the primary venue for authenticating the planning record. However, additional input was gathered from each jurisdiction in a combination of the following ways:

- Planning committee leadership visits to local government meetings where planning updates were provided and information was exchanged – regular updates were provided by the County Emergency Manager at County Board of Commissioners meetings. Additionally, representatives on the planning committee periodically attended municipality meetings to provide council members with updates on the project and request reviews of draft material.
- One-on-one correspondence between the planning committee leadership and the representatives of the municipalities and special districts. Planning committee leadership contacted each participating jurisdiction directly to provide updates, take comments, and answer questions on three separate occasions during the planning process. The first occurred via a direct letter to the head of the jurisdiction explaining the purpose of the planning process and inviting them to participate on the committee. The second occurrence was a phone call to each municipality explaining the importance of their continued participation on the planning committee as well as an explanation of the public review process. The third occurrence was also a direct letter to each participating jurisdiction explaining the State and FEMA review process for the All Hazard Mitigation Plan as well as their role in the adoption process.
- Public meeting was hosted by the County of Okanogan. The meeting was attended by involved county and municipality representatives, local volunteers, and local citizenry.

- Written correspondence was provided at least monthly between the planning committee leadership and each participating jurisdictions updating the cooperators on the document's progress, making requests for information, and facilitating feedback. Okanogan County Department of Emergency Management representatives used an email distribution list of all the stakeholders to announce meetings, distribute meeting minutes, provide draft sections for review, and request information. All of the participating jurisdictions provided comments to the draft document during the data gathering phase as well as during the various committee and public review processes.

- At the request of planning committee leadership, the County Courthouse hosted a copy of the draft Okanogan County Multi-Hazard Mitigation Plan and provided staff to be on hand to answer any questions during the public comment phase of the planning process.

- Once the draft Plan was completed, planning committee leadership emailed each participating jurisdiction to discuss the review process, note any additional revisions in the document, and ensure their understanding of the adoption process.

## *Planning Committee Meeting*

The following list of people participated in the planning committee meeting and volunteered time or responded to elements of the Multi - Hazard Mitigation Plan's preparation. A few participants served on the committee as dual representatives of more than one jurisdiction. A record of sign-in sheets is included in the Chapter 7 Appendices.

**Okanogan County Participants:** *Indicates Adopting Jurisdiction

| | |
|---|---|
| Noble Kelly, Chilwist Citizen | *Robert Bauer, F.D. 16 |
| *Steve DeCook, WA DNR | *Tim Tugaw, F.D. #9 |
| *Kevin Bowling, Omak Fire | *Bob Parten, Okanogan Co. Public Works |
| Robert Burks, Tonasket Police | Ron Morris, Citizen |
| *J. Foster Fanning, WA DNR/F.D. #14 | Sandy Morris, Citizen |
| Tera King, Northwest Management | *Ed Townsend, R.F.D. #8 |
| Vaiden Bloch, Northwest Management | Sarah Wilkinson, US Army Corp of Engineers |
| Brad Tucker, Northwest Management | Jen Croft, US Forest Service –Tonasket R.D |
| *Barbara Peterson, RFD #9 | Jeff Ayers, US Forest Service – Tonasket R.D. |
| *Mel Peterson, RFD #9 | *Kevan Roberts, WA DNR |
| *Chris Branch, City of Oroville Fire & EMS | *Steve Harris, WA DNR |
| *Gordon Hennigs, City of Okanogan | *Tim Vngteveen, WA DNR |

| | |
|---|---|
| *Mike Woelike, F.D. #11 | *Donny Smith, WA DNR |
| *Greg Saltsman, WA DNR | *Cody Acord, Okanogan County F.D. #6 |
| Monika Nicholson, US Forest Service – Methow Valley | Kathy Busse, US Forest Service – Methow Valley |
| *Don Waller, Okanogan Co. F.D. #6 | Kirsten Cook, Okanogan Conservation District |
| *David Dahlstom, Winthrop Marshals Office | *Ken Basema, Winthrop Marshals Office |
| *Perry Huston, Okanogan Co. Planning Department | *Ted Murray, Okanogan Co. GIS |
| Mike Solheim, Bureau of Land Management | Richard Parrish, Bureau of Land Management |
| *Ron Wonch, WA DNR | *Roy Schwilke, Okanogan Co. Public Utilities District |
| *Paul Budrow, Twisp Police Department | Peggy Kelly, Chiliwist Citizen |
| *Glenda Beauregard, Okanogan Co. Emergency Mgmt. | *Scott Miller, Okanogan Co. Emergency Management |
| *Greg Roberts, WA DNR | |

### *Committee Meeting Minutes*

The planning committee meeting was held January 16, 2013. The minutes and attendance records for the planning committee meeting is included in the Chapter 7 Appendices.

## *Public Involvement*

Public involvement in this plan was made a priority from the inception of the project. There were a number of ways that public involvement was sought and facilitated. In some cases, this led to members of the public providing information and seeking an active role in protecting their own homes and businesses, while in other cases it led to the public becoming more aware of the process without becoming directly involved in the planning.

### *News Releases*

Under the auspices of the Okanogan County planning committee, three formal news releases were submitted to the local newspapers and a few local radio stations. The first press release informed the public that the Multi-Hazard Mitigation Plan process was taking place, who was involved, why it was important to Okanogan County, and who to contact for more information. The second press release was in the form of a flyer announcing the public meeting dates and venues, which was submitted to the newspapers as well as distributed to local businesses by committee members. The third press release provided information regarding the public comment period including where hardcopies of the draft could be viewed, the availability of the draft on the Okanogan County website, and instructions on how to submit comments. A record of published articles regarding the Multi-Hazard Mitigation Plan is included in the Chapter 7 Appendices.

**Figure 2.1. Press Release #1 – Planning Process Announcement.**

# Okanogan County

## Media Release

From: Scott Miller, Okanogan County Emergency Manager
Date: Nov 6, 2012
RE: Okanogan County Multi-Hazard Mitigation Plan and Community Wildfire Protection Plan Updates.

## Okanogan County Set to Update Hazard Risk Plans

**Okanogan, WA.** Okanogan County has launched a project to update the Okanogan County Multi-Hazard Mitigation Plan and Community Wildfire Protection Plan. Local agencies and organizations in Okanogan County have created a committee to complete the required 5-year updates of these documents as part of the FEMA Pre-Disaster Mitigation program and National Fire Plan and Healthy Forests Restoration Act. The project is being funded through a grant from FEMA.

The planning update will include risk analyses, vulnerability assessments, and mitigation recommendations for the hazards of flood, landslide, earthquake, severe weather, wildland fire, terrorism/civil unrest, massive crop failure, and extended power outage.

Northwest Management, Inc. has been retained by Okanogan County to provide risk assessments, hazard mapping, field inspections, interviews, and to collaborate with the planning committee to update the Plans. The committee includes representatives from local communities, rural and wildland fire districts, Washington Department of Natural Resources, U.S Forest Service, Bureau of Land Management, highway districts, private landowners, area businesses, various Okanogan County departments, and others.

One of the goals of the planning process will be to increase the participating jurisdictions' eligibility for additional grants that will help minimize the risk and potential impact of disaster events. The planning team will be conducting public meetings to discuss preliminary findings and to seek public input on the Plans' recommendations. A notice of the dates and locations of these meetings will be posted in local newspapers. Once completed, the updated draft Plans will also be available for public review and comment. For more information on the Okanogan County Multi - Hazard Mitigation Plan and Community Wildfire Protection Plan updates, contact Scott Miller, Okanogan County Emergency Manager, at 509-422-7207 or smiller@co.okanogan.wa.us

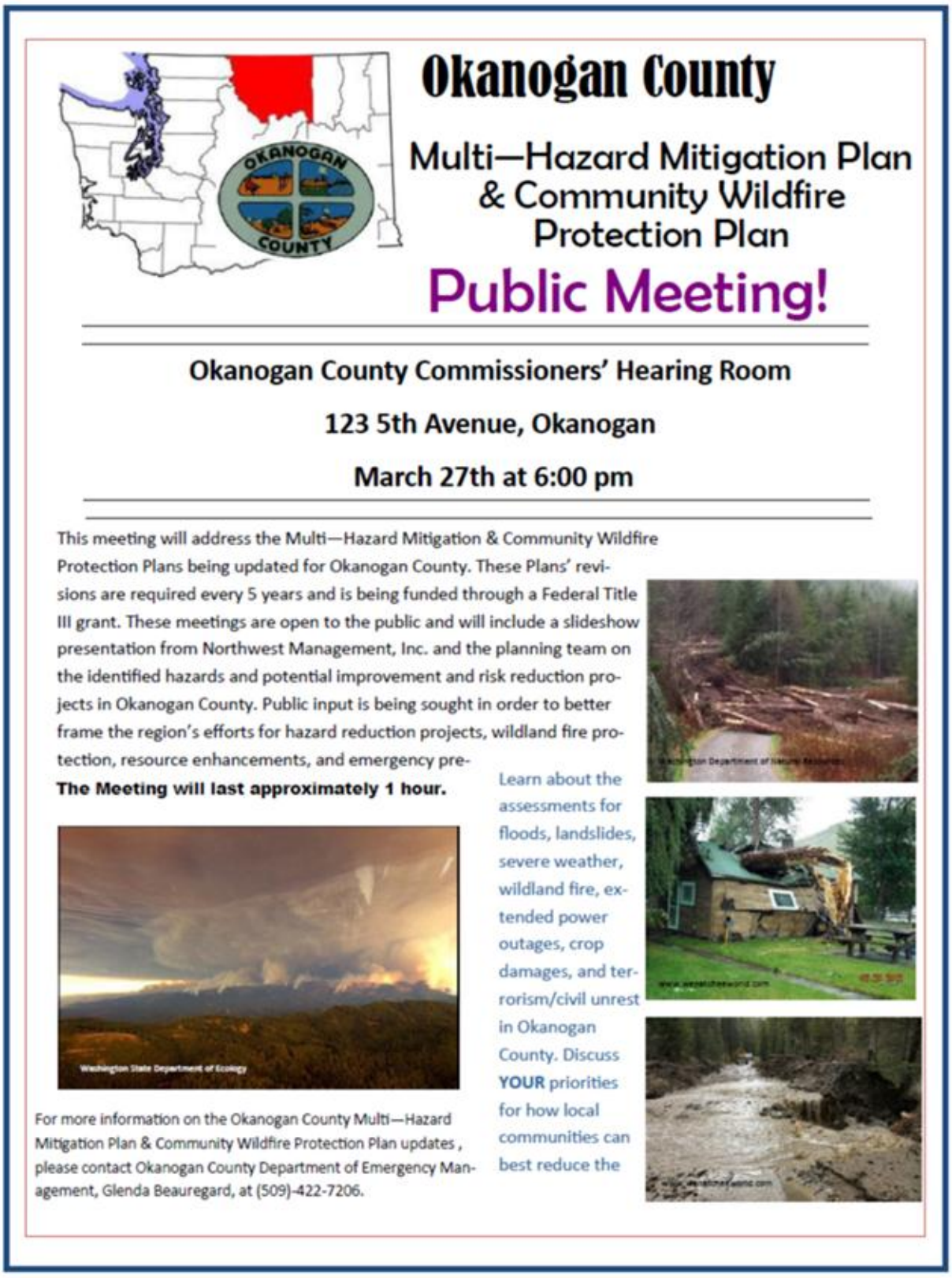
## *Public Meetings*

A public meeting was scheduled in a central part of the County during the hazard assessment phase of the planning process. The venue for the meeting was chosen by the planning team and located in a central geographical area in order to provide an adequate opportunity for members of every community to attend without considerable travel. The public meeting focused on sharing information regarding the planning process, presenting details of the preliminary risk and vulnerability assessments, and discussing potential mitigation strategies. Attendees at the public meetings were asked to give their impressions of the accuracy of the information generated, relate any previously unknown information such as historical accounts, provide their opinions of the proposed mitigation measures, and suggest any additional project objectives and/or mitigation strategies.

The public meeting was held in Okanogan. This meeting was attended by a number of individuals on the committee and from the general public. Attendance at the public meeting was low to moderate, but included eight individuals. A record of attendance at the public meeting is included in the Chapter 7 Appendices. The slideshow presentation used during the public meetings is also included in the Appendices.

The public meeting announcement was sent to the local newspapers and a flyer was distributed throughout each community by committee members. A record of published articles regarding the public meetings is included in the Chapter 7 Appendices. A sample of the flyer is included below in Figure 2.2.

**Figure 2.2. Press Release #2 - Public Meeting Flyer.**



## *Public Comment Period*

A public comment period was conducted from September 2 thru September 16, 2013 to allow members of the general public an opportunity to view the full draft plan and submit comments and any other input to the committee for consideration. A press release was submitted to the local media outlets announcing the comment period, the location of Plan for review, and instructions on how to submit comments. A Hardcopy draft was printed and made available at the Okanogan County Department of Emergency Management. The hardcopy was accompanied by a letter of instruction for submitting comments to the planning committee. A record of published articles regarding the public comment period is included in the Chapter 7 Appendices.

**Figure 2.3. Press Release #3 – Public Comment Period.**

# Okanogan County Hazard Plans Available for Public Review

The Okanogan County Multi-Hazard Mitigation Plan and Community Wildfire Protection Plan updates have been completed in draft form and are available to the public for review and comment at the locations listed below. Electronic copies may be viewed in pdf format at http://www.consulting-foresters.com/?id=clients. The public review phase of the planning process will be open from September 2nd, 2013 thru September 16th, 2013.

**Okanogan County Department of Emergency Management**

123 5th Ave N., Room 200

Okanogan, Washington

The purpose of the Okanogan County Multi-Hazard Mitigation Plan (MHMP) and Community Wildfire Protection Plan (CWPP) is to reduce the impact of hazards such as floods, landslides, severe weather, wildfire, extended power outage, crop loss, and terrorism/civil unrest on Okanogan County residents, landowners, businesses, communities, local governments, and state and federal agencies while maintaining appropriate emergency response capabilities and sustainable natural resource management policies. The MHMP and CWPP identify high risk areas as well as structures and infrastructure that may have an increased potential for loss due to a hazard event. The documents also recommend specific projects that may help prevent disasters from occurring altogether or, at the least, lessen their impact on residents and property. Both the MHMP and CWPP are being developed by a committee of city and county elected officials and departments, local and state emergency response representatives, land managers, highway district representatives, and others.

The Okanogan County MHMP and CWPP include risk analysis at the community level with predictive models for where disasters are likely to occur. These Plans will enable Okanogan County and its communities to be eligible for grant dollars to implement the projects and mitigation actions identified by the committee. Although not regulatory, the MHMP and CWPP will provide valuable information as we plan for the future.

Comments on the MHMP and/or CWPP must be submitted to the attention of Scott Miller, Okanogan County Emergency Management, at smiller@co.okanogan.wa.us or mailed to Okanogan County Department of Emergency Management, 123 5th Ave N., Room 200, Okanogan, Washington 98840 by close of business on September 16th, 2013. For more information on the Okanogan County MHMP and CWPP update process, contact Scott Miller at 509-422-7207.

**Web Posting**

The draft plan was also posted for public review on the Northwest Management, Inc. website at: http://www.consulting-foresters.com/?id=clients during and after the official public comment period. Instructions for submitting public input as well as local project contact numbers were also provided on the webpage.

### *Continued Public Involvement*

Okanogan County is dedicated to involving the public directly in review and updates of this Multi - Hazard Mitigation Plan. The County Emergency Manager, through the planning committee, is responsible for the annual review and update of the Plan as recommended in the Chapter 6, "Plan Monitoring and Maintenance" section of this document.

The public will have the opportunity to provide feedback about the Plan annually on the anniversary of the adoption at a meeting of the County Board of Commissioners. Copies of the Plan will be kept at the County Courthouse. The Plan also includes contact information for the Emergency Manager, who is responsible for keeping track of public comments.

A public meeting will also be held as part of each annual evaluation or when deemed necessary by the planning committee. The meetings will provide the public a forum for which they can express concerns, opinions, or ideas about the Plan. The County Commissioner's Office will be responsible for using County resources to publicize the annual meetings and maintain public involvement through the County's webpage and local newspapers.

## *Documented Review Process*

Review and comment on this Plan has been provided through a number of avenues for the committee members as well as for members of the general public. A record of the document's review process has been established through email correspondence, press releases, published articles, meeting minutes, and meeting sign-in sheets. Proof of these activities is recorded in the Chapter 7 Appendices.

During a scheduled committee meeting in 2013, the committee members met to discuss findings, review mapping and analysis, and provide written comments on draft sections of the document. During the public meeting attendees observed map analyses, and made recommendations on potential project areas.

The completed first draft of the document was presented to the committee during the August 2013 for full committee review. The committee spent a few weeks proofreading and editing sections of the draft. Many jurisdictions met individually to review and revise their specific risk assessment and mitigation strategy including the prioritization of action items. Once the committee's review was completed, the draft document was released for public review and comment. The public review period remained open from September 2nd thru September 16th, 2013.

# Plan Monitoring and Maintenance

As part of the policy of Okanogan County in relation to this planning document, this entire Multi - Hazard Mitigation Plan should be reviewed annually (from date of adoption) at a special meeting of a joint planning committee, open to the public and involving all jurisdictions, where action items, priorities, budgets, and modifications can be made or confirmed. Okanogan County Emergency Management (or an official designee of the joint committee) is responsible for the scheduling, publicizing, and leadership of the annual review meeting. During this meeting, participating jurisdictions will report on their respective projects and identify needed changes and updates to the existing Plan. Maintenance to the Plan should be detailed at this meeting, documented, and attached to the formal plan as an amendment to the Multi - Hazard Mitigation Plan. Re-evaluation of this plan should be made on the 5th anniversary of its acceptance, and every 5-year period following.

## Annual Review Agenda

The focus of the joint planning committee at the annual review meeting should include at least the following topics:

- Update historical events record based on any events in the past year.
- Review county profile and individual community assessments for each hazard and note any major changes or mitigation projects that have altered the vulnerability of each entity.
- Update the Emergency Resources information as necessary for each emergency response organization.
- Add a section to note accomplishments or current mitigation projects.
- All action items in Chapter 6 will need updated as projects are completed and as new needs or issues are identified.
- Address Emergency Operations Plans – how can we dovetail the two plans to make them work for each other? Specifically, how do we incorporate the County's EOP into the action items for the regional MHMP?
- Address Updated County Comprehensive Land Use Plans – how can we dovetail the two plans to make them work for each other?
- Incorporate additional hazard chapters as funding allows.

All meeting minutes, press releases, and other documentation of revisions should be kept on record by Okanogan County Emergency Management.

## Five Year Re-evaluation Agenda

The focus of the planning committee at the five year re-evaluation should include all of the topics suggested for the annual review in addition to the following items:

- Update County demographic and socioeconomic data.

- Address any new planning documents, ordinances, codes, etc. that have been developed by the County or cities.
- Review listed communication sites.
- Review municipal water sources, particularly those in the floodplain or landslide impact areas.
- Redo all risk analysis models incorporating new information such as an updated County parcel master database, new construction projects, development trends, population vulnerabilities, changing risk potential, etc.
- Update county risk profiles and individual community assessments based on new information reflected in the updated models.

All meeting minutes, press releases, and other documentation of revisions should be kept on record by Okanogan County Emergency Management.

# Chapter 3

## Community Profile

IN THIS SECTION:

- Description of the Region
- Geography and Vegetation
- Demographics
- Socioeconomics
- Development Trends
- Hazard Management Capabilities
- Regional Hazard Profile

# Chapter 3 – Community Profile

## Okanogan County Characteristics

The information in this chapter has been excerpted from the Okanogan County Community Comprehensive Plan.[4]

### *Description of the Region*

Okanogan means "rendezvous" and refers to the place where the Okanogan River joins the Columbia River. The Washington Territorial Legislature created the County on February 22, 1888.

The total area of Okanogan County is approximately 3,400,000 acres, of which 767,803 acres is privately owned and about 1,565,754 acres is federally owned. Over 95 percent of the federally owned land is encompassed within the jurisdiction of the United States Forest Service, primarily within the Okanogan National Forest, most of the Pasayten Wilderness, and portions of the Lake Chelan – Sawtooth Wilderness.

Larger than several states, Okanogan County is bordered on the north by the Canada, on the south by the Columbia River, on the east by Ferry County, and on the west by ominous peaks of the North Cascade Mountains. The County covers 5,281 square miles, making it the largest county in Washington. Only 30% of the land within the County is in private ownership due to the amount of state and federal land. The Colville Indian Reservation, located in the southeast corner of the county, occupies approximately 700,000 acres and is an integral part of the heritage of the County.

### *Geography and Natural Resources*

Forested highlands, shrub covered hills, and valleys with fertile farmlands comprise Okanogan County, which is located east of the Cascades along the Canadian border in the north-central part of Washington. Bordering the County on the west are Whatcom, Skagit, and Chelan Counties, to the east is Ferry County, and to the south is Douglas County. The western half of the County is comprised of dense, rugged, mountainous terrain, much of which is within Okanogan National Forest. Similar topography also can be found in the northeast corner of the county. From the north part of the County, the land descends into rolling hills, grassy ranges, and fertile valleys that extend through the center of the county.

Summers, on the plains, are sunny, warm and dry with some hot days. During 4 or 5 months, in the lower elevations extreme highs may be 100°F, while, in the higher elevations 1 or 2 months may reach above 90°F. In winter, minimum temperatures of -10° to -20°F are common although a few stations report -25° to -30°F. Normally, precipitation is light in the summer and heaviest in the winter. Valleys and lowlands receive and average of 10 to 14 inches of precipitation; in the mountains, precipitation increases with elevation where 25 to 30 inches per year can be expected on the higher ridges, with the majority occurring

[4] Okanogan County Comprehensive Plan. 2005. Okanogan County Planning Department. Okanogan County, Washington.

as snow. Growing seasons vary from over 180 days in the Southwest to less than 80 days in the forested highlands.

Okanogan County is a diverse ecosystem with a complex array of vegetation, wildlife, and fisheries that have developed with, and adapted to fire as a natural disturbance process. Nearly a century of wildland fire suppression coupled with past land-use practices (primarily timber harvesting and agriculture) has altered plant community succession and has resulted in dramatic shifts in the fire regimes and species composition. As a result, some forests and rangelands in Okanogan County have become more susceptible to large-scale, higher-intensity fires posing a threat to life, property, and natural resources including wildlife and plant populations. High-intensity, stand-replacing fires have the potential to seriously damage soils and native vegetation. In addition, an increase in the number of large, high-intensity fires throughout the nation's forest and rangelands has resulted in significant safety risks to firefighters and higher costs for fire suppression.

**Vegetation**

Vegetation in Okanogan County is a mix of forestland and agricultural ecosystems. An evaluation of satellite imagery of the region provides some insight to the composition of the vegetation of the area. The full extent of the county was evaluated for cover type by the USDA Forest Service in 2001 as determined from Landsat 7 ETM+ imagery in tabular format.

The most represented vegetated cover type is Douglas-fir at approximately 18% of the total area. The next most common vegetation cover types represented are a Herbaceous at 16%, Shrub at 14%, Subalpine Forest Mix at 9%, and Ponderosa Pine at 9%. Urban areas and agriculture represents approximately 4.3% of the total area (Table 3.1).

**Table 3.1. Vegetative Cover Types in Okanogan County.**

| Cover | Acres | Percent | Cover | Acres | Percent |
|---|---|---|---|---|---|
| Douglas-fir | 617,979 | 18.2% | Subalpine Fir | 37,474 | 1.1% |
| Herbacious | 555,344 | 16.3% | Western Larch | 34,355 | 1.0% |
| Shrub | 461,886 | 13.6% | Water | 33,090 | 1.0% |
| Subalpine Forest Mix | 317,536 | 9.3% | Englemann Spruce | 26,871 | 0.8% |
| Ponderosa Pine | 291,774 | 8.6% | Subalpine Larch | 14,895 | 0.4% |
| Lodgepole Pine | 244,267 | 7.2% | Burned Areas | 13,372 | 0.4% |
| Ponderosa Pine/Douglas-fir | 193,040 | 5.7% | Snow | 13,187 | 0.4% |
| Agriculture | 140,819 | 4.1% | Conifer/Deciduous Mixed | 7,575 | 0.2% |
| Rock | 139,852 | 4.1% | Urban | 5,174 | 0.2% |
| Dry Mixed Forest | 116,988 | 3.4% | Moist Mixed Forest | 4,833 | 0.1% |
| Low Canopy Closure Tree | 44,811 | 1.3% | Pacific Silver Fir | 1,889 | 0.1% |
| Deciduous | 41,797 | 1.2% | Mountain Hemlock | 1,058 | 0.0% |
| Whitebark Pine | 41,385 | 1.2% | **Total** | **3,401,252** | **100.0%** |

**Hydrology**

The Washington Department of Ecology & Water Resources Program is charged with the development of the Washington State Water Plan. Included in the State Water Plan are the statewide water policy plan and component basin and water body plans, which cover specific geographic areas of the state. The Washington Department of Ecology has prepared general lithologies of the major ground water flow systems in Washington.

The state may assign or designate beneficial uses for particular Washington water bodies to support. These beneficial uses are identified in section WAC 173-201A-200 of the Washington Surface Water Quality Standards (WQS). These uses include:

- Aquatic Life Uses: char; salmonid and trout spawning, rearing, and migration; nonanadromous interior redband trout, and indigenous warm water species
- Recreational Uses: primary (swimming) and secondary (boating) contact recreation
- Water Supply Uses: domestic, agricultural, and industrial; and stock watering

While there may be competing beneficial uses in streams, federal law requires protection of the most sensitive of these beneficial uses.

A correlation to mass wasting due to the removal of vegetation caused by high intensity wildland fire has been documented. Burned vegetation can result in changes in soil moisture and loss of rooting strength that can result in slope instability, especially on slopes greater than 30%. The greatest watershed impacts from increased sediment will be in the lower gradient, depositional stream reaches.

Of critical importance to Okanogan County will be the maintenance of the domestic watershed supplies in the Methow River Watershed (Watershed Resources Inventory Area 48) and the Okanogan River Watershed (Watershed Resources Inventory Area 49).

**Air Quality**

The primary means by which the protection and enhancement of air quality is accomplished is through implementation of National Ambient Air Quality Standards (NAAQS). These standards address six pollutants known to harm human health including ozone, carbon monoxide, particulate matter, sulfur dioxide, lead, and nitrogen oxides.[5]

The Clean Air Act, passed in 1963 and amended in 1977, is the primary legal authority governing air resource management. The Clean Air Act provides the principal framework for national, state, and local efforts to protect air quality. Under the Clean Air Act, OAQPS (Office for Air Quality Planning and Standards) is responsible for setting standards, also known as national ambient air quality standards (NAAQS), for pollutants which are considered harmful to people and the environment. OAQPS is also responsible for ensuring these air quality standards are met, or attained (in cooperation with state, Tribal,

[5] USDA-Forest Service (United States Department of Agriculture, Forest Service). 2000. Incorporating Air Quality Effects of Wildland Fire Management into Forest Plan Revisions – A Desk Guide – Draft. April 2000.

and local governments) through national standards and strategies to control pollutant emissions from automobiles, factories, and other sources.[6]

Smoke emissions from fires potentially affect an area and the airsheds that surround it. Climatic conditions affecting air quality in northern Washington are governed by a combination of factors. Large-scale influences include latitude, altitude, prevailing hemispheric wind patterns, and mountain barriers. At a smaller scale, topography and vegetation cover also affect air movement patterns. Air quality in the area is generally moderate to good. However, locally adverse conditions can result from occasional wildland fires in the summer and fall, and prescribed fire and agricultural burning in the spring and fall. All major river drainages are subject to temperature inversions which trap smoke and affect dispersion, causing local air quality problems. This occurs most often during the summer and fall months and would potentially affect all communities in Okanogan County. Winter time inversions are less frequent, but are more apt to trap smoke from heating, winter silvicultural burning, and pollution from other sources.

## *Demographics*

Okanogan County grew in population over 220% around 1900 then 175% in 1910. Since the 1920 census, the average increase in population has averaged around 13% with the most recent census showing an increase of only about 4%.

The U.S. Census Bureau estimates that Okanogan County has only experienced a 3.9% increase in population since 2000 compared to a 14.1% increase statewide. The Census Bureau also reported that there were 1,164 private nonfarm establishments (2010) and 15,747 households (2010). The median income for a household in Okanogan County in 2010 was $40,537, which is less than the statewide median of $58,890.

**Table 3.2. Okanogan County Historical Population Data.[7]**

| Census | Population |
|---|---|
| 1890 | 1,467 |
| 1900 | 4,689 |
| 1910 | 12,887 |
| 1920 | 17,094 |
| 1930 | 18,519 |
| 1940 | 24,546 |
| 1950 | 29,131 |
| 1960 | 25,520 |
| 1970 | 25,867 |
| 1980 | 30,639 |
| 1990 | 33,350 |
| 2000 | 39,564 |
| 2010 | 41,120 |

[6] Louks, B. 2001. Air Quality PM 10 Air Quality Monitoring Point Source Emissions; Point site locations of DEQ/EPA air monitoring locations with monitoring type and pollutant. Oregon Department of Environmental Quality. Feb. 2001. As GIS Data set. Boise, Id.

[7] http://en.wikipedia.org/wiki/Okanogan_County,_Washington. Okanogan County. Accessed October, 2012.

## *Socioeconomics*

This region has a total of 22,527 housing units and a population density of 7.8 persons per square mile as reported in the 2010 Census. Ethnicity is distributed as: white 83.5%, black or African American 0.5%, American Indian or Alaskan Native 12.0%, Asian 0.8%, and Hispanic or Latino 18.1%.

**Table 3.3. Income Categories (2009 data).**

| | Number | Percent |
|---|---|---|
| **Households** | **15,747** | **100.0** |
| Less than $10,000 | 1,967 | 12.5 |
| $10,000 to $14,999 | 1,206 | 7.7 |
| $15,000 to $24,999 | 2,221 | 14.1 |
| $25,000 to $34,999 | 1,943 | 12.3 |
| $35,000 to $49,999 | 2,515 | 16.0 |
| $50,000 to $74,999 | 2,857 | 18.1 |
| $75,000 to $99,999 | 1,571 | 10.0 |
| $100,000 to $149,999 | 1,045 | 6.6 |
| $150,000 to $199,999 | 200 | 1.3 |
| $200,000 or more | 222 | 1.4 |
| Median household income (dollars) | $38,551 | (X) |

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, directs federal agencies to identify and address any disproportionately high adverse human health or environmental effects of its projects on minority or low-income populations. In Okanogan County, approximately 25% of families with dependent children are at or below the poverty level.

With unemployment rates at 6.5% in Okanogan County[8], the regional unemployment rate was close to or below the national unemployment rate of 7.3% (August, 2013 unemployment rates)[9]. The natural resource field comprises approximately 15.9% of the employed population in Okanogan County. As a result, much of the indirect employment within this region relies on the employment created through these resource-based occupations.

**Table 3.4. Employment and Industry Statistics.**

| | Employed Workers | Percent |
|---|---|---|
| **OCCUPATION** | | |
| Management, business, science, and arts occupations | 5,318 | 32.4 |
| Service occupations | 2,940 | 17.9 |
| Sales and office occupations | 3,799 | 23.1 |
| Natural resources, construction, and maintenance occupations | 2,607 | 15.9 |

[8] Bureau of Labor Statistics website. http://data.bls.gov/map/MapToolServlet?state=53&datatype=unemployment&year=2013&period=M07&survey=la&map=county&seasonal=u Accessed September, 2013.

[9] Bureau of Labor Statistics website. http://data.bls.gov/timeseries/LNS14000000. Accessed September, 2013.

| Table 3.4. Employment and Industry Statistics. | | |
|---|---|---|
| | Employed Workers | Percent |
| Production, transportation, and material moving occupations | 1,747 | 10.6 |
| **INDUSTRY** | | |
| Agriculture, forestry, fishing and hunting, and mining | 2,344 | 14.3 |
| Construction | 1,190 | 7.3 |
| Manufacturing | 754 | 4.6 |
| Wholesale trade | 261 | 1.6 |
| Retail trade | 1,783 | 10.9 |
| Transportation and warehousing, and utilities | 914 | 5.6 |
| Information | 280 | 1.7 |
| Finance, insurance, real estate, and rental and leasing | 422 | 2.6 |
| Professional, scientific, management, administrative, and waste management services | 872 | 5.3 |
| Educational, health and social services | 4,184 | 25.5 |
| Arts, entertainment, recreation, accommodation and food services | 1,588 | 9.7 |
| Other services (except public administration) | 637 | 3.9 |

Employment within this region leans heavily towards private wage and salary workers which together, comprise more than 65% of the workforce. Government workers represent a significantly smaller proportion of the work force at approximately 22%.[10]

## *Development Trends*

A relatively large percentage of the county is publicly owned. The majority of the property is held either as public property or as Indian lands. Private land is becoming more and more expensive as the population grows and more property is developed. This factor combined with the mountainous nature of the geography is expected to produce significantly higher demands on privately held land in the future.

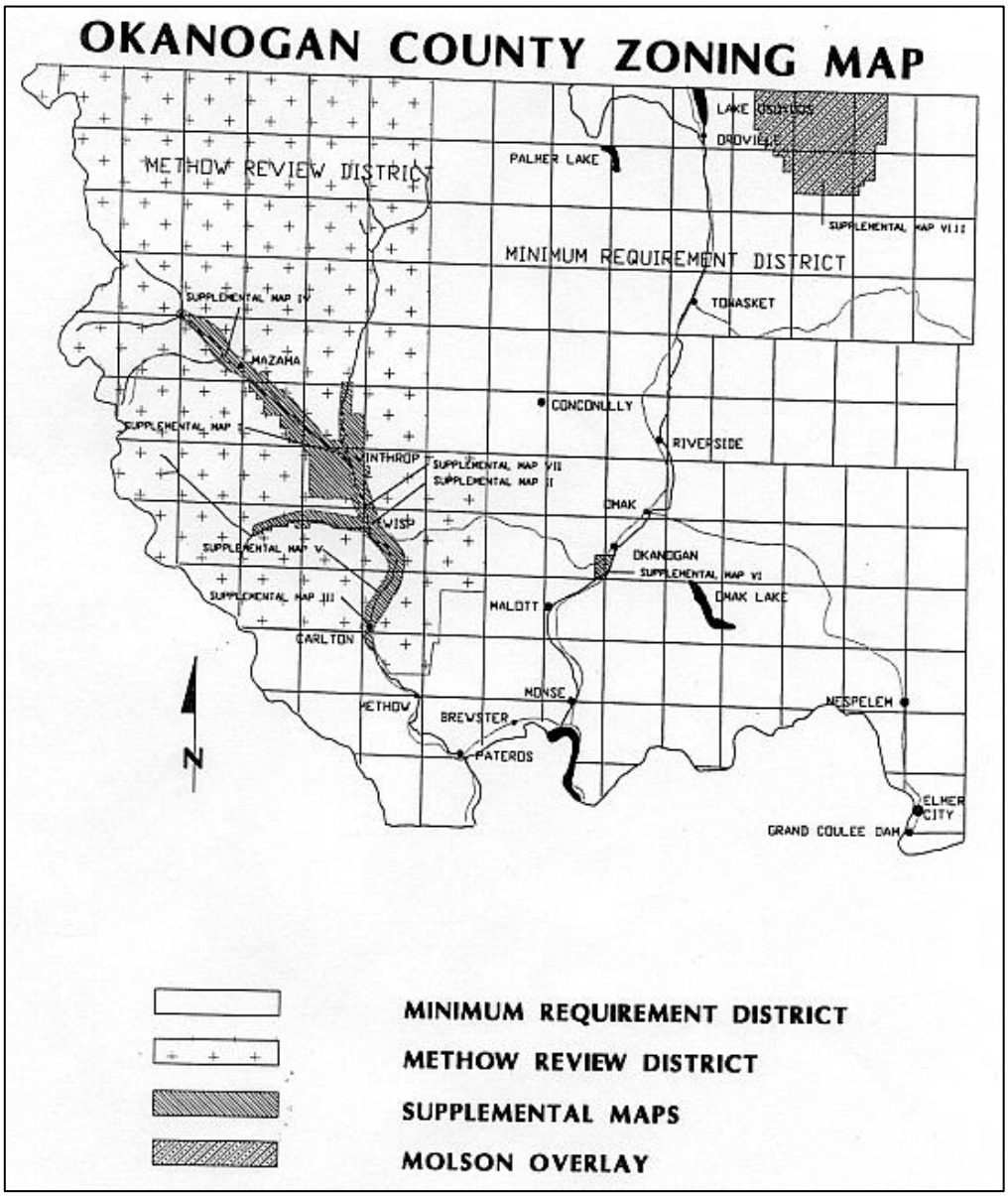
| Table 3.5. Ownership Categories in Okanogan County. | | |
|---|---|---|
| Land Owner | Acres | Percent |
| USFS | 1,502,860 | 44% |
| Private | 767,803 | 23% |
| Tribal | 669,286 | 20% |
| State | 385,473 | 11% |
| BLM | 58,865 | 2% |
| FWS | 2,891 | <1% |
| Water | 12,111 | <1% |
| Other | 1,183 | <1% |
| **Total** | 3,400,472 | **100%** |

The Okanogan County Planning and Development Department is responsible for land division, comprehensive plan and zoning, addressing and the master street address guide, shoreline master

[10] U.S. Census Bureau. 2010. American FactFinder Quick Tables for Okanogan County, Washington. Available online at http://factfinder2.census.gov/bkmk/table/1.0/en/ACS/10_5YR/DP03/0500000US53047. Accessed October, 2012.

program, and critical areas ordinance. Okanogan County Building Department is responsible for building plan review, building permits, and inspections. Most of the privately owned land in the unincorporated area is zoned minimum requirement district. There are also small areas zoned specifically for commercial and industrial uses. Most of the commercial and industrial zoned property is located adjacent to the cities or the general aviation airports in Okanogan County.

**Figure 3.1. Okanogan County Zoning Map.**




There continues to be home expansion into more rural parts of the County. Many large landowners have begun to subdivide their farms particularly around rivers and lakes because these parcels are of high residential value.

## *Hazard Management Capabilities*

The Okanogan County Department of Emergency Management is responsible for the administration and overall coordination of the emergency management program for Okanogan County and the cities of within the county. The Incident Command System (ICS) is the basis for all direction, control and coordination of emergency response and recovery efforts. Emergency response and supporting agencies and organizations have agreed to carry out their objectives in support of the incident command structure to the fullest extent possible.

The Okanogan County Central Dispatch / 911 Center is the only communications center for Okanogan County. It maintains 24-hour emergency alerting and communications capability for receiving, coordinating and disseminating emergency information. The Okanogan County Central Dispatch / 911 Center provides communications coverage over the entire Okanogan County area. It is the central receiving point for emergency notification and warning information and disseminates pertinent emergency information to support agencies.

Amateur Radio Services volunteers may provide additional local or statewide communications networks. This capability can also provide backup communication systems at the Okanogan County Emergency Operations Center if required.

All fire districts and agencies providing fire protection services in Okanogan County have reciprocal memorandums of understanding with each other.

## *Regional Hazard Profile*

SHELDUS is a county-level hazard data set for the U.S. for 18 different natural hazard event types such thunderstorms, hurricanes, floods, wildfires, and tornados. For each event, the database includes the beginning date, location (county and state), property losses, crop losses, injuries, and fatalities that affected Okanogan County.

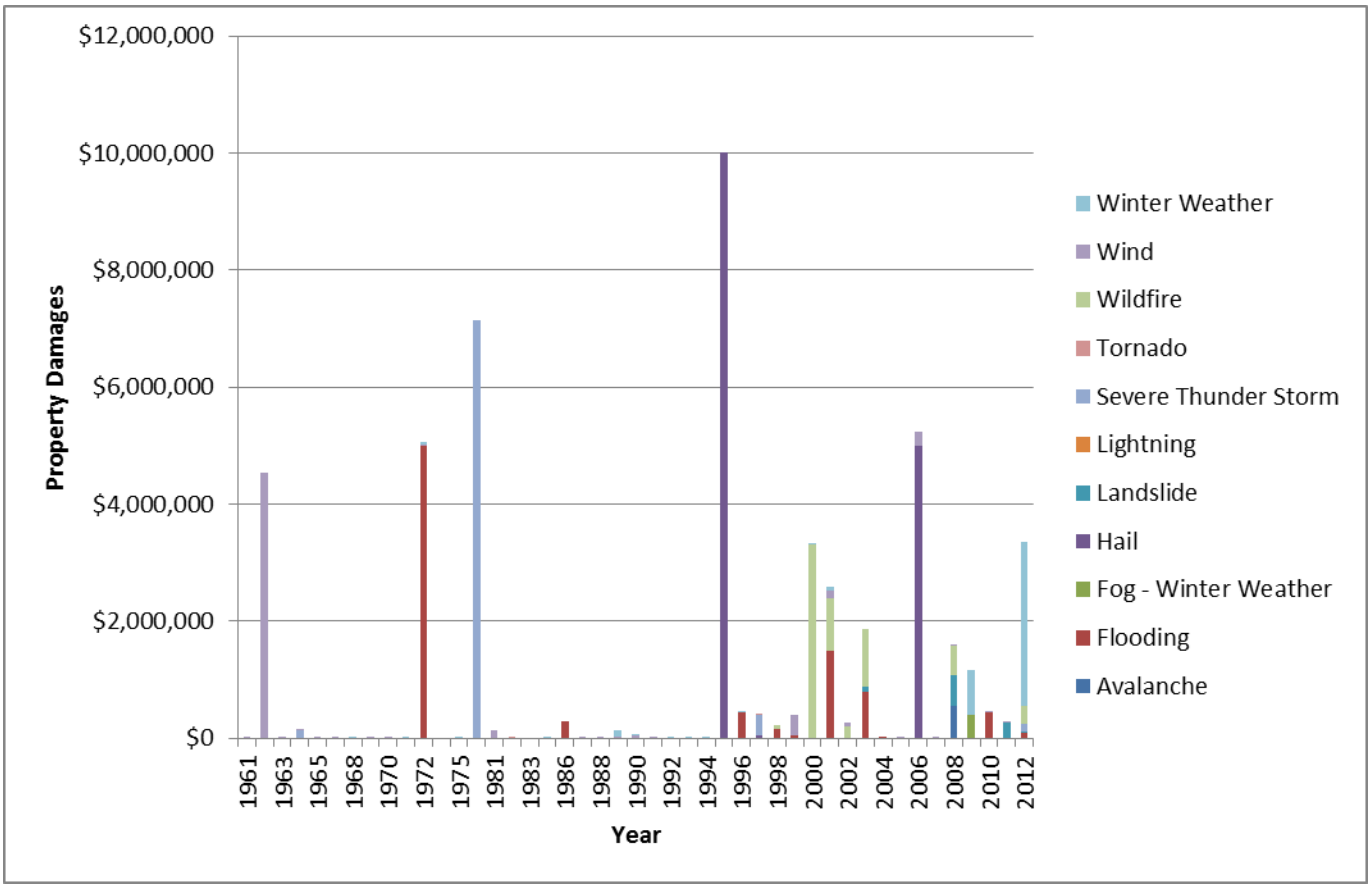
The data was derived from several existing national data sources such as National Climatic Data Center's monthly Storm Data publications and NGDC's Tsunami Event Database. With the release of SHELDUS 7.0, the database includes loss causing and/or deadly event between 1960 through 1975 and from 1995 onward. Between 1976 and 1995, SHELDUS reflects only events that caused at least one fatality or more than $50,000 in property or crop damages.

Prior to 2001, property and crop losses occurring on the same day within the same geography (i.e. county) are aggregated by hazard type. For events that covered multiple counties, the dollar losses, deaths, and injuries were equally divided among the counties (e.g. if 4 counties were affected, then each was given 1/4 of the dollar loss, injuries and deaths). Where dollar loss estimates were provided in ranges (e.g. $50,000 - 100,000) - such as in NCDC Storm data until 1995 - the lowest value in the range of the category was used. This results in the most conservative estimate of losses during the time period of 1960-1995. Since 1995 all

events that were reported by the National Climatic Data Center (NCDC) with a specific dollar amount are included in the database.[11]

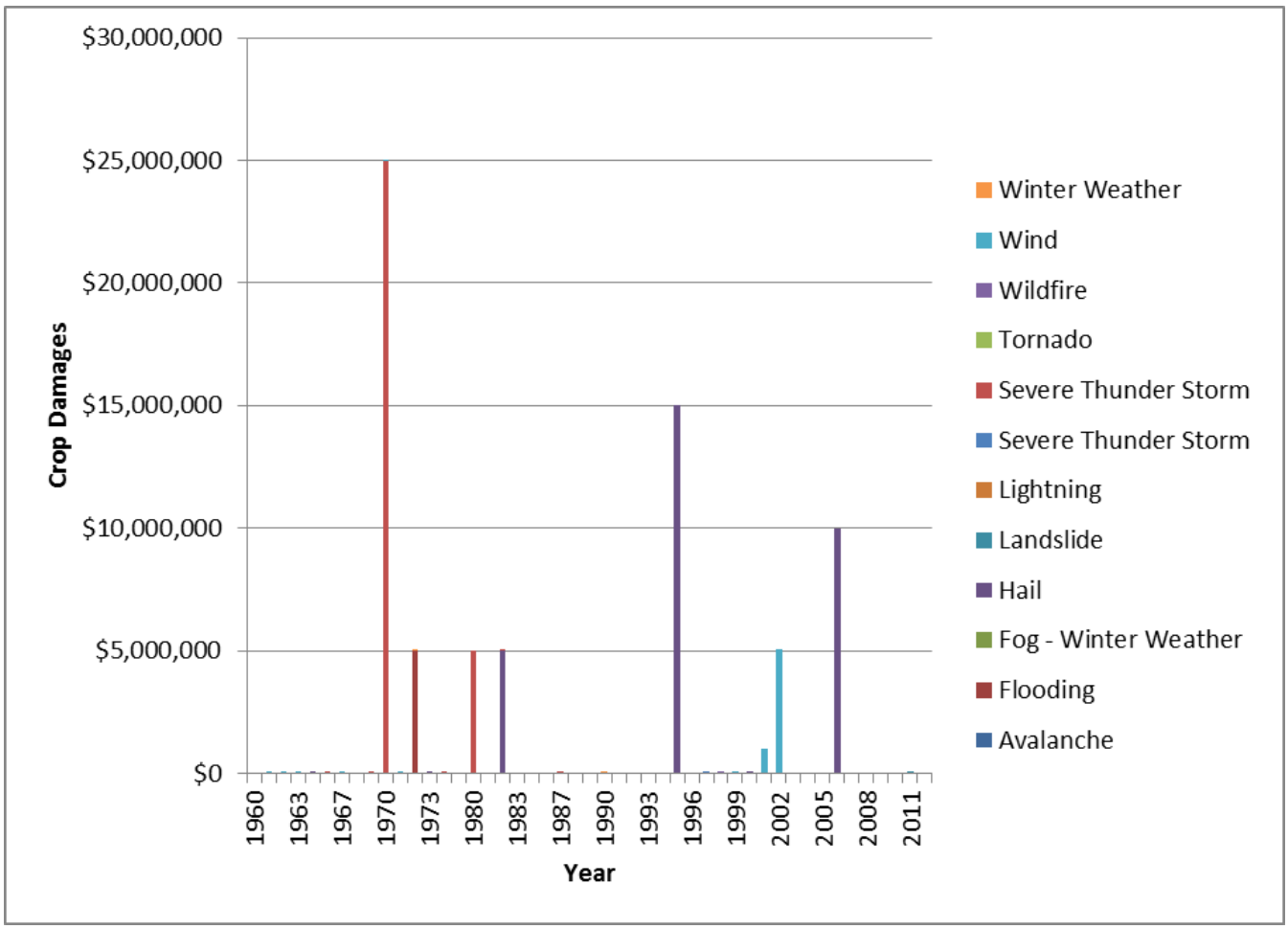
It is important to keep in mind that the SHELDUS database does not include every hazard event that occurred within an area. Only those events that met a specific reporting criterion as explained above are listed. This means that many local events are not included in this database. A record of events that have occurred in Okanogan County from 2005 thru 2012 has been included in Chapter 7.

**Figure 3.2. Summary of SHELDUS Property Damages.**




[11] HVRI. Natural Hazards Losses 1960-2008 (SHELDUS). Hazards &Vulnerability Research Institute. University of South Carolina. Columbia, South Carolina. Available online at http://webra.cas.sc.edu/hvri/. February 2010.

**Figure 3.3 Summary of SHELDUS Crop Damages.**



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# Chapter 4

## Hazard Profiles

IN THIS SECTION:

- Flood Annex
- Earthquake Annex
- Landslide Annex
- Severe Weather Annex
- Wildland Fire Annex

# Chapter 4 – Hazard Profiles

## Regional and Local Hazard Profiles

### *Flood*

Floods have been a serious and costly natural hazard affecting Washington. Floods damage roads, farmlands, and structures, often disrupting lives and businesses. Simply put, flooding occurs when water leaves the river channels, lakes, ponds, and other confinements where we expect it to stay. Flood-related disasters occur when human property and lives are impacted by flood waters. An understanding of the role of weather, runoff, landscape, and human development in the floodplain is therefore the key to understanding and controlling flood-related disasters. Major disasters declarations related to flooding were made for Washington in 1956, 1957, 1963, 1964, 1971, 1972, 1974, 1975, 1977, 1979, 1983, 1986 (x3), 1989, 1990 (x2), 1996, 1997 (x3), 1998, 2003, 2006 (x2), 2007, and 2009. Every county has received a Presidential Disaster Declaration since 1970. Since 1980, federal, state, and local governments have invested more than $525 million to repair public facilities, help individuals recover from flood disasters, and pay for measures to prevent future flood damage. This is nearly 40% of the more than 1.39 billion spent on disaster relief and hazard mitigation during this time.[12]

Floods can be divided into two major categories in eastern Washington: riverine and flash flood. Riverine flooding is associated with a river's watershed, which is the natural drainage basin that conveys water runoff from rain. Riverine flooding occurs when the flow of runoff is greater than the carrying capacities of the natural drainage systems. Rain water that is not absorbed by soil or vegetation seeks surface drainage lines following natural topography lines. These lines merge to form a hierarchical system of rills, creeks, streams and rivers. Generally, floods can be slow or fast rising depending on the size of the river or stream.

Flash floods are much more dangerous and flow much faster than riverine floods. Flash floods may have a higher velocity in a smaller area and will likely recede relatively quickly. Such floods are caused by the introduction of a large amount of water into a limited area (e.g., extreme precipitation events in watersheds less than 50 square miles), crest quickly (e.g., eight hours or less), and generally occur in hilly or otherwise confined terrain. Flash floods occur in both urban and rural settings, principally along smaller rivers and drainage ways that do not typically carry large amounts of water. This type of flood poses more significant safety risks because of the rapid onset, the high water velocity, the potential for channel scour, and the debris load.[13]

There are three types of flash flooding:

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[12] Washington Military Department Emergency Management Division. Washington State Hazard Mitigation Plan. Available online at http://www.emd.wa.gov/plans/washington_state_hazard_mitigation_plan.shtml. January 2008.

[13] Statewide Regional Evacuation Study Program. Central Florida Region Technical Data Report. Volume 1-7, Chapter II – Regional Hazards Analysis. Available online at http://www.cfrpc.org/EVACUATION%20MASTER%20DVD%20-%20PDF%20VERSION/VOLUME%201/Chapter%202/CFRPC%20Chapter%20II%20-%20Hazards%20Analysis.pdf.

- Extreme precipitation and runoff events
- Inadequate urban drainage systems overwhelmed by small intense rainstorms
- Dam failures

Events that may lead to flash flooding include significant rainfall and/or snowmelt on frozen ground in the winter and early spring months, high intensity thunderstorms (usually during the summer months), and rainfall onto burned areas where high heat has caused the soil to become hydrophobic or water repellent which dramatically increases runoff and flash flood potential.

Flash floods from thunderstorms do not occur as frequently as those from general rain and snowmelt conditions but are far more severe. The onset of these flash floods varies from slow to very quick and is dependent on the intensity and duration of the precipitation and the soil types, vegetation, topography, and slope of the basin. When intensive rainfall occurs immediately above developed areas, the flooding may occur in a matter of minutes. Sandy soils and sparse vegetation, especially recently burned areas, are conducive to flash flooding. Mountainous areas are especially susceptible to damaging flash floods, as steep topography may stall thunderstorms in a limited area and may also funnel runoff into narrow canyons, intensifying flow. A flash flood can, however, occur on any terrain when extreme amounts of precipitation accumulate more rapidly than the terrain can allow runoff. Flash floods are most common in Washington during the spring and summer months due to thunderstorm activity.

Occasionally, floating ice or debris can accumulate at a natural or man-made obstruction and restrict the flow of water**.** Ice and debris jams can result in two types of flooding:

- Water held back by the ice jam or debris dam can cause flooding upstream, inundating a large area and often depositing ice or other debris which remains after the waters have receded. This inundation may occur well outside of the normal floodplain.
- High velocity flooding can occur downstream when the jam breaks. These flood waters can have additional destructive potential due to the ice and debris load that they may carry.[14]

Flooding from ice or debris jams is a relatively common phenomenon in north central Washington, and in Okanogan County specifically. Small jams can occur in many of the streams throughout Okanogan County, particularly at bridge abutments and culverts; however, these jams rarely cause significant damage or flooding.

The major source of flood waters in Okanogan County is normal spring snow melt. As spring melt is a "natural" condition; the stream channel is defined by the features established during the average spring high flow (bank-full width). Small flow peaks exceeding this level and the stream's occupation of the floodplain are common events. The magnitude of most floods in Okanogan County depend on the particular combinations of intensity and duration of rainfall, pre-existing soil conditions, area of a basin, elevation of the rain or snow level, and amount of snow pack. Man-made changes to a basin also can affect the size of floods. Although floods can happen at any time during the year, there are typical seasonal patterns for flooding in central Washington, based on the variety of natural processes that cause floods:

[14] Barnhill, Dave, et al. *"Flash Floods – How do they occur?"*. Waterlines. Division of Water, Indiana Department of Natural Resources. Spring-Summer 1999. Indianapolis, Indiana.

- Heavy rainfall on wet or frozen ground, before a snow pack has accumulated, typically cause fall and early winter floods
- Rainfall combined with melting of the low elevation snow pack typically cause winter and early spring floods
- Late spring floods in Okanogan County result primarily from melting of the snow pack
- Summer flash floods are caused by thunderstorms[15]

The most commonly reported flood magnitude measure is the "base flood." This is the magnitude of a flood having a one-percent chance of being equaled or exceeded in any given year. Although unlikely, "base floods" can occur in any year, even successive ones. This magnitude is also referred to as the "100-year Flood" or "Regulatory Flood". Floods are usually described in terms of their statistical frequency. A "100-year flood" or "100-year floodplain" describes an event or an area subject to a 1% probability of a certain size flood occurring in any given year. This concept does not mean such a flood will occur only once in one hundred years. Whether or not it occurs in a given year has no bearing on the fact that there is still a 1% chance of a similar occurrence in the following year. Since floodplains can be mapped, the boundary of the 100-year flood is commonly used in floodplain mitigation programs to identify areas where the risk of flooding is significant. Any other statistical frequency of a flood event may be chosen depending on the degree of risk that is selected for evaluation, e.g., 5-year, 20-year, 50-year, 500-year floodplain.

The areas adjacent to the channel that normally carry water are referred to as the floodplain. In practical terms, the floodplain is the area that is inundated by flood waters. In regulatory terms, the floodplain is the area that is under the control of floodplain regulations and programs (such as the National Flood Insurance Program which publishes the FIRM maps). The floodplain is often defined as:

*"That land that has been or may be covered by floodwaters, or is surrounded by floodwater and inaccessible, during the occurrence of the regulatory flood."*[16]

Winter weather conditions are the main driving force in determining where and when base floods will occur. The type of precipitation that a winter storm produces is dependent on the vertical temperature profile of the atmosphere over a given area.[17] Unusually heavy snow packs or unusual spring temperature regimes (e.g., prolonged warmth) may result in the generation of runoff volumes significantly greater than can be conveyed by the confines of the stream and river channels. Such floods are often the ones that lead to widespread damage and disasters. Floods caused by spring snow melt tend to last for a period of several days to several weeks, longer than the floods caused by other meteorological sources.

Floods that result from rainfall on frozen ground in the winter, or rainfall associated with a warm, regional frontal system that rapidly melts snow at low and intermediate altitudes (rain-on-snow) can be the most

[15] Kresch, David and Karen Dinicola. "What Causes Floods in Washington State". Fact Sheet 228-96. U.S. Geological Survey. Tacoma, Washington.

[16] FEMA. Federal Emergency Management Agency. National Flood Insurance Program. Washington D.C. Available online at www.fema.gov.

[17] "Snowstorms". Rampo College. Resource Section for Meteorology. Available online at http://mset.rst2.edu/portfolios/k/khanna_n/meteorology/snowstorms.htm. October 2006.

severe. Both of these situations quickly introduce large quantities of water into the stream channel system, easily overloading its capacity.

On small drainages, the most severe floods are usually a result of rainfall on frozen ground; however, moderate quantities of warm rainfall on a snow pack, especially for one or more days, can also result in rapid runoff and flooding in streams and small rivers. Although meteorological conditions favorable for short-duration warm rainfall are common, conditions for long-duration warm rainfall are relatively rare. Occasionally, however, the polar front becomes situated along a line from Hawaii through Oregon, and warm, moist, unstable air moves into the region.

The nature and extent of a flood event is the result of the hydrologic response of the landscape. Factors that affect this hydrologic response include soil texture and permeability, land cover and vegetation, land use and land management practices. Precipitation and snow melt, known collectively as runoff, follow one of three paths, or a combination of these paths, from the point of origin to a stream or depression: overland flow, shallow subsurface flow, or deep subsurface ("ground water") flow. Each of these paths delivers water in differing quantities and rates. The character of the landscape will influence the relative allocation of the runoff and will, accordingly, affect the hydrologic response.

Unlike precipitation and ice formation, steps can be taken to mitigate flooding through manipulation or maintenance of the floodplain. Insufficient natural water storage capacity and changes to the landscape can be offset through water storage and conveyance systems that run the gamut from highly engineered structures to constructed wetlands. Careful planning of land use can build on the natural strengths of the hydrologic response. Re-vegetation of burned slopes diverts overland flow (fast and flood producing) to subsurface flow (slower and flood moderating).

The failure to recognize or acknowledge the extent of the natural hydrologic forces in an area has led to development and occupation of areas that can clearly be expected to flood on a regular basis. Despite this, communities are often surprised when the stream leaves its channel to occupy its floodplain. A past reliance on structural means to control floodwaters and "reclaim" portions of the floodplain has also contributed to inappropriate development and continued flood-related damages.

Development in or near floodplains increases the likelihood of flood damage. New developments near a floodplain add structures and people in flood areas thereby increasing, not the extent of the flood itself, but the impacts or damages that may be caused. New construction can also alter surface water flows by diverting water to new courses or increasing the amount of water that runs off impervious pavement and roof surfaces. This second effect diverts waters to places previously unaffected by flood issues. Unlike the weather and the landscape, this flood-contributing factor can be controlled. Development and occupation of the floodplain places individuals and property at risk. Such use can also increase the probability and severity of flood events (and consequent damage) downstream by reducing the water storage capacity of the floodplain, or by pushing the water further from the channel or in larger quantities downstream.[18]

[18] Planning and Flood Risk. Planning Policy Statement 15. The Planning Service, Department of Environment. June 2006. Available online at http://www.planningni.gov.uk/index/policy/policy_publications/planning_statements/pps15-flood-risk.pdf.

## *Second Order Hazard Events*

With the exception of dam failure, flood events are typically caused by severe weather events such as thunder storms or rapid spring runoff. Okanogan County has a relatively low risk of major flood damages; however, flood events can trigger other types of hazard events that may be more damaging than the flood itself. The following chart outlines the interconnection between flood and other types of hazard events.

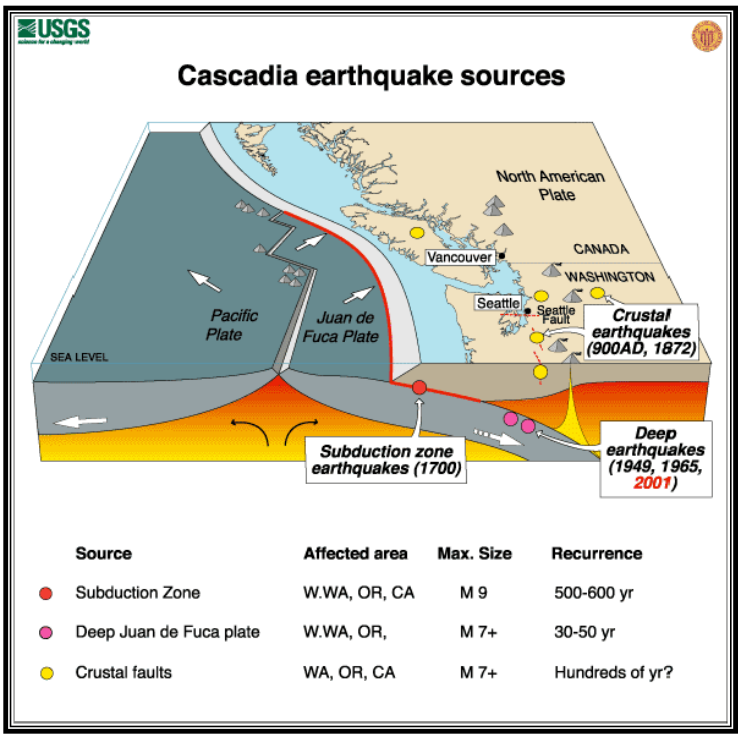
**Table 4.1. Second-Order Hazards Related to Flood Events.**

| Related Causal Events | Related Effects |
|---|---|
| Severe Weather | Landslide |
| Dam Failure | Dam Failure |
| | Transportation Systems |
| | Infectious Disease/Epidemic/Pandemic |
| | Crop Loss |
| | Hazardous Materials |
| | Power Outage |

# *Earthquake*

An earthquake is trembling of the ground resulting from the sudden shifting of rock beneath the earth's crust. Earthquakes may cause landslides and rupture dams. Severe earthquakes destroy power and telephone lines, gas, sewer, or water mains, which, in turn, may set off fires and/or hinder firefighting or rescue efforts. Earthquakes also may cause buildings and bridges to collapse.

**Figure 4.1. Cascadia Earthquake Sources.**




By far, earthquakes pose the largest single natural hazard exposure faced by Washington. They may affect large areas, cause great damage to structures, cause injury, loss of life and alter the socioeconomic functioning of the communities involved. The hazard of earthquakes varies from place to place, dependent upon the regional and local geology.

Earthquakes occur along faults, which are fractures or fracture zones in the earth across which there may be relative motion. If the rocks across a fault are forced to slide past one another, they do so in a *stick-slip* fashion; that is, they accumulate strain energy for centuries or millennia, then release it almost instantaneously. The energy released radiates outward from the source, or focus, as a series of waves - an earthquake. The primary hazards of earthquakes are ground breaking, as the rocks slide past one another, and ground shaking, by seismic waves. Secondary earthquake hazards result from distortion of the surface materials such as water, soil, or structures.

Ground shaking may affect areas 65 miles or more from the epicenter (the point on the ground surface above the focus). As such, it is the greatest primary earthquake hazard. Ground shaking may cause seiche, the rhythmic sloshing of water in lakes or bays. It may also trigger the failure of snow (avalanche) or earth materials (landslide). Ground shaking can change the mechanical properties of some fine grained, saturated soils, whereupon they liquefy and act as a fluid (liquefaction). The dramatic reduction in bearing strength of such soils can cause buried utilities to rupture and otherwise undamaged buildings to collapse.

The earth's crust breaks along uneven lines called faults. Geologists locate these faults and determine which are active and inactive. This helps identify where the greatest earthquake potential exists. Many faults mapped by geologists, are inactive and have little earthquake potential; others are active and have a higher earthquake potential.

Ground shaking from earthquakes can collapse buildings and bridges; disrupt gas, electric, and phone service; and sometimes trigger landslides, avalanches, flash floods, fires, and huge, destructive ocean waves (tsunamis). Buildings with foundations resting on unconsolidated landfill and other unstable soil, or trailers and homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths and injuries and extensive property damage.

Aftershocks are smaller earthquakes that follow the main shock and can cause further damage to weakened buildings. Aftershocks can occur in the first hours, days, weeks, or even months after the quake. Some earthquakes are actually foreshocks, and a larger earthquake might occur.

Ground movement during an earthquake is seldom the direct cause of death or injury. Most earthquake-related injuries result from collapsing walls, flying glass, and falling objects as a result of the ground shaking, or people trying to move more than a few feet during the shaking.[19]

Damaging Pacific Northwest earthquakes can arise from three distinct source zones:

- Deep earthquakes beneath the Puget Sound have damaged Seattle and Olympia
- Shallow faults can cause intense local shaking – urban areas are especially vulnerable
- An offshore subduction zone fault can cause strong shaking across the entire region.[20]

More than 1,000 earthquakes are recorded in Washington each year; a dozen or more of these produce significant shaking or damage. Large earthquakes in 1949 and 1965 killed 15 people and caused more than $200 million (1984 dollars) property damage.

Earth scientists believe that most earthquakes are caused by slow movements inside the Earth that push against the Earth's brittle, relatively thin outer layer, causing the rocks to break suddenly. This outer layer is fragmented into a number of pieces, called plates. Most earthquakes occur at the boundaries of these plates. In Washington, the small Juan de Fuca plate off the coast of Washington, Oregon, and northern California is slowly moving eastward beneath a much larger plate that includes both the North American continent and the land beneath part of the Atlantic Ocean. Plate motions in the Pacific Northwest result in shallow earthquakes widely distributed over Washington and deep earthquakes in the western parts of Washington and Oregon. The movement of the Juan de Fuca plate beneath the North America plate is in many respects similar to the movements of plates in South America, Mexico, Japan, and Alaska, where the world's largest earthquakes occur. [21]

We cannot predict precisely where, when, and how large the next destructive earthquake will be in Washington, but seismological and geological evidence supports several possibilities. Large earthquakes reported historically in Washington have most frequently occurred deep beneath the Puget Sound region. The

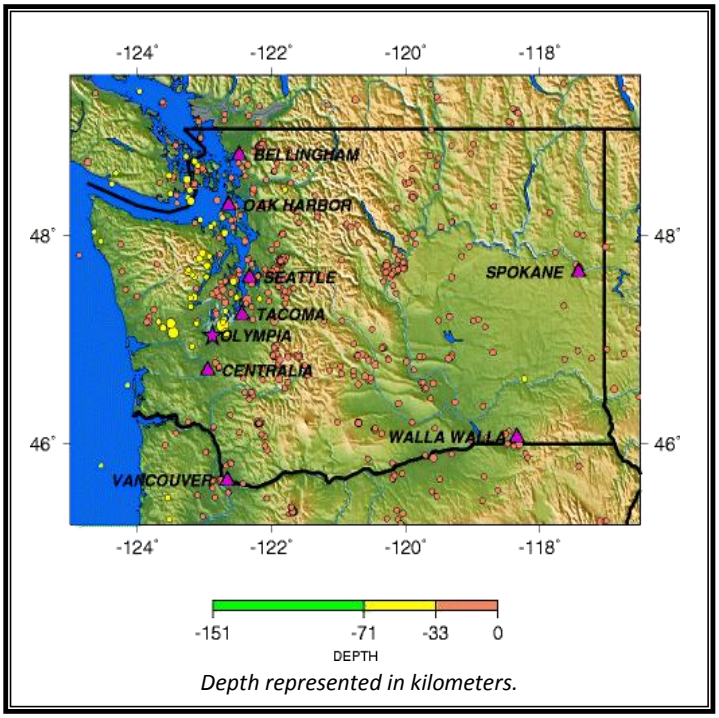
[19] FEMA. Federal Emergency Management Agency. Available online at www.fema.gov. September 2007.

[20] USGS. "Earthquake Hazards in Washington and Oregon Three Source Zones." U.S. Geological Survey. The Pacific Northwest Seismic Network. Available online at http://www.geophys.washington.edu/SEIS/PNSN/. August 2008.

[21] Noson, Linda, Anthony Qamar, and Gerald Thorsen. "Washington State Earthquake Hazards". Pacific Northwest Earthquake Information. Available online at http://www.pnsn.org/INFO_GENERAL/NQT/summary.html.

most recent and best documented of these were the 1949 Olympia earthquake and the 1965 Seattle-Tacoma earthquake. The pattern of earthquake occurrence observed in Washington so far indicates that large earthquakes similar to the 1965 Seattle-Tacoma earthquake are likely to occur about every 35 years and large earthquakes similar to the 1949 Olympia earthquake about every 110 years.

**Figure 4.2. Seismicity of Washington 1990-2006.**



*Depth represented in kilometers.*

The largest earthquake now considered a possibility in the Pacific Northwest is a shallow subduction-style earthquake similar to recent destructive earthquakes in Alaska and Mexico, which had magnitudes greater than 8. An earthquake this large would be expected to occur along the coast of Washington or Oregon. Although we have no record of such large earthquakes in the Pacific Northwest within the last 150 years, some scientists believe that rocks and sediments exposed along the coasts of Washington and Oregon show evidence that as many as eight such earthquakes have occurred in the last several thousand years. This evidence indicates an average interval of time between subduction earthquakes of several hundred years.

The largest earthquake reported in Washington did not occur in the Puget Sound region, but rather at a shallow depth under the North Cascade Mountains. Recent studies in the southern Cascades near Mount St. Helens indicate that other areas in the Cascades may produce large, shallow earthquakes, comparable in size to the 1949 and 1965 Puget Sound earthquakes. The average interval of time between occurrences of such earthquakes in the Cascade Mountains is uncertain because they have occurred infrequently.[22]

[22] Noson, Linda, Anthony Qamar, and Gerald Thorsen. "Washington State Earthquake Hazards". Pacific Northwest Earthquake Information. Available online at http://www.pnsn.org/INFO_GENERAL/NQT/summary.html.

*Earthquakes are measured in two ways. One determines the power, the other describes the physical effects. Magnitude is calculated by seismologists from the relative size of seismograph tracings. This measurement has been named the Richter scale, a numerical gauge of earthquake energy ranging from 1.0 (very weak) to 9.0 (very strong). The Richter scale is most useful to scientists who compare the power in earthquakes. Magnitude is less useful to disaster planners and citizens, because power does not describe and classify the damage an earthquake can cause. The damage we see from earthquake shaking is due to several factors like distance from the epicenter and local rock types. Intensity defines a more useful measure of earthquake shaking for any one location. It is represented by the modified Mercalli scale. On the Mercalli scale, a value of I is the least intense motion and XII is the greatest ground shaking. Unlike magnitude, intensity can vary from place to place. In addition, intensity is not measured by machines. It is evaluated and categorized from people's reactions to events and the visible damage to man-made structures. Intensity is more useful to planners and communities because it can reasonably predict the effects of violent shaking for a local area.*

**Table 4.2. Largest Known Earthquakes Felt in Washington.[23]**

| Year | Max. Modified Mercalli Intensity | Felt Area (sq km) | Location |
|---|---|---|---|
| 1872 | IX(3) | 1,010,000 | North Cascades |
| 1877 | VII(9) | 48,000 | Portland |
| 1880 | VII(10) | | Puget Sound |
| 1891 | VII(10) | | Puget Sound |
| 1893 | VII(8) | 21,000 | Southeastern Washington |
| 1896 | VII(12) | | Puget Sound |
| 1904 | VII(5) | 50,000 | Olympic Peninsula |
| 1909 | VII(5) | 150,000 | Puget Sound |
| 1915 | VI(5) | 77,000 | North Cascades |
| 1918 | VIII(5) | 650,000 | Vancouver Island |
| 1920 | VII(14) | 70,000 | Puget Sound |
| 1932 | VII(15) | 41,000 | Central Cascades |
| 1936 | VII(14) | 270,000 | Southeastern Washington |
| 1939 | VII(14) | 200,000 | Puget Sound |
| 1945 | VII(14) | 128,000 | Central Cascades |
| 1946 | VII(14) | 270,000 | Puget Sound |
| 1946 | VIII(4) | 1,096,000 | Vancouver Island |
| 1949 | VIII(22) | 594,000 | Puget Sound |
| 1949 | VIII | 2,220,000 | Queen Charlotte Island |
| 1959 | VI(12) | 64,000 | North Cascades |
| 1959 | X(26) | 1,586,000 | Hebgen Lake (Montana) |
| 1962 | VII(14) | 51,000 | Portland |
| 1965 | VIII(14) | 500,000 | Puget Sound |
| 1980 | IV | | Mount St Helens |
| 1981 | VII(39) | 104,000 | South Cascades |
| 1983 | VII(42) | 800,000 | Borah Peak (Idaho) |
| 1993 | VII | | Klamath Falls, Or |
| 2001 | | | Nisqually, Wa |
| 2002 | | | Kitsap Peninsula, Wa. |
| 2002 | | | Friday Harbor, Wa. |
| 2003 | | | Port Orchard, Wa. |
| 2003 | | | Carnation, Wa. |
| 2009 | | | Seattle-Tacoma, Wa. |
| 2011 | | | Omak, Wa. |

The largest earthquake now considered a possibility in the Pacific Northwest is a shallow subduction-style earthquake similar to recent destructive earthquakes in Alaska and Mexico, which had magnitudes greater

[23] Noson, Linda Lawrance, et al. Washington State Earthquake Hazards. Washington Division of Geology and Earth Resources Information Circular 85. Olympia, Washington. 1988.

than 8. An earthquake this large would be expected to occur along the coast of Washington or Oregon. Although we have no record of such large earthquakes in the Pacific Northwest within the last 150 years, some scientists believe that rocks and sediments exposed along the coasts of Washington and Oregon show evidence that as many as eight such earthquakes have occurred in the last several thousand years. This evidence indicates an average interval of time between subduction earthquakes of several hundred years. A magnitude 8 subduction earthquake would not only cause widespread dangerous ground shaking but would also likely produce water waves capable of inundating coastal areas in a matter of minutes.

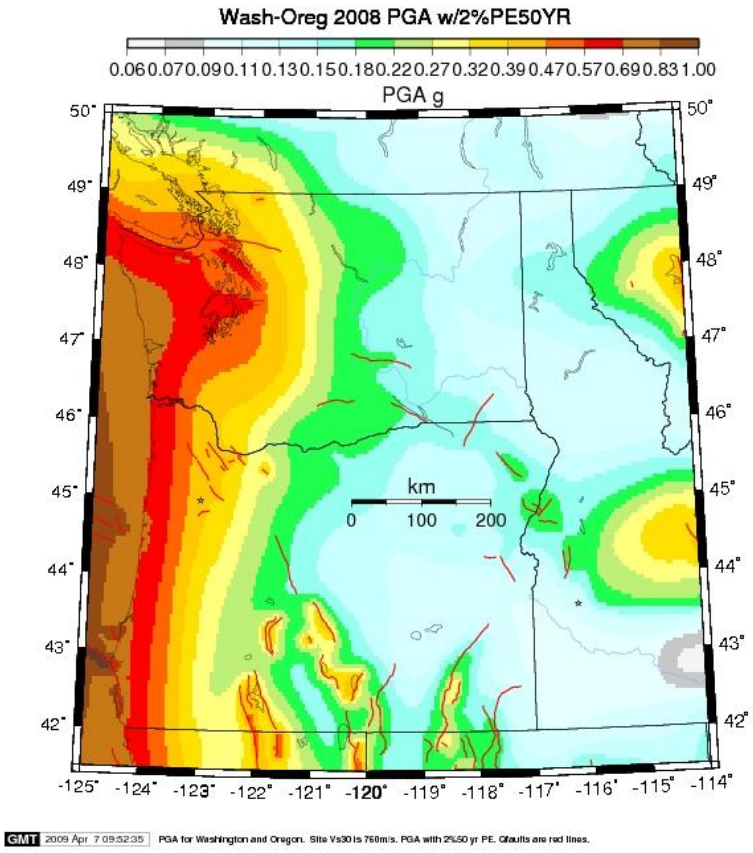
Earthquake damage is primarily caused by ground shaking. However, wood frame houses, well attached to their foundations and built on firm ground, generally sustain little structural damage during earthquakes. In contrast, unreinforced brick buildings commonly suffer severe damage. Ground shaking may also displace and distort the non-structural parts of a building including windows, ceiling tiles, partitions and furniture-producing property damage and endangering life. Other hazards such as ground liquefaction are commonly triggered by strong ground shaking.

**Table 4.3. Earthquakes within 50 miles of Okanogan, Wa.[24]**

| Date | Magnitude | Depth | Date | Magnitude | Depth |
|---|---|---|---|---|---|
| 1979 | 3.6 | 10 | 2000 | 3.1 | 0 |
| 1989 | 4.4 | 15 | 2001 | 3.2 | 0 |
| 1991 | 3.1 | 8 | 2003 | 3.4 | 0 |
| 1991 | 3.6 | 5 | 2004 | 3.3 | 3 |
| 1994 | 3 | 0 | 2010 | 2.6 | 0 |
| 1997 | 3.6 | 4 | 2011 | 2.6 | 5 |
| 1997 | 4.6 | 7 | 2011 | 2.8 | 0 |
| 1997 | 3.6 | 6 | 2011 | 2.5 | 0 |
| 1998 | 3 | 6 | 2011 | 4.6 | 11 |
| 1999 | 3.1 | 10 | 2012 | 2.6 | 0 |

[24] http://www.homefacts.com/earthquakes/Washington/Okanogan-County/Okanogan.html. Accessed in June, 2013.

**Figure 4.3. Washington Peak Ground Acceleration**




The U.S. Geological Survey has gathered data and produced maps of the nation, depicting earthquake shaking hazards. This information is essential for creating and updating seismic design provisions of building codes in the United States. The USGS Shaking Hazard maps for the United States are based on current information about the rate at which earthquakes occur in different areas and on how far strong shaking extends from quake sources. The values shown on the map are "peak ground acceleration (PGA) in percent of g with 2% probability of exceedance in 50 years". Therefore, the map represents longer-term likelihood of ground accelerations. The "2% probability of exceedance in 50 years" refers to the fact that earthquakes are somewhat random in occurrence. One cannot predict exactly whether an earthquake of a given size will or will not occur in the next 50 years. The map takes the random nature of earthquakes into account. It was constructed so that there is a 2% chance (2 chances in 100) that the ground acceleration values shown on the map will be exceeded in a 50 year time period. This map is based on seismic activity and fault-slip rates and takes into account the frequency of occurrence of earthquakes of various magnitudes.[25] Locally, this hazard may be greater than that shown, because site geology may amplify ground motions.

The International Building Code (IBC), a nationwide industry standard, sets construction standards for different seismic zones in the nation. IBC seismic zone rankings for Washington are among the highest in the nation. When structures are built to these standards they have a better chance to withstand earthquakes.

Structures that are in compliance with the 1970 Uniform Building Codes (UBC), which are now replaced by the International Building Code, are generally less vulnerable to seismic damages because that was when the UBC started including seismic construction standards to be applied based on regional location. This stipulated that all structures be constructed to at least seismic risk Zone 2 Standards. The State of Washington adopted the UBC as its state building code in 1972, so it is assumed that buildings built after that date were built in

[25] http://earthquake.usgs.gov/hazards/products/conterminous/2008/maps/wus/pacnw/PGA.Wash.jpg. June 2013.

conformance with UBC seismic standards and have a lesser degree of vulnerability. Obviously, issues such as code enforcement and code compliance are factors that could impact this assumption. However, for planning purposes, establishing this line of demarcation can be an effective tool for estimating vulnerability. In 1994, seismic risk Zone 3 Standards of the UBC went into effect in Washington, requiring all new construction to be capable of withstanding the effects of 0.3 times the force of gravity. More recent housing stock is in compliance with Zone 3 standards. In 2009, the state again upgraded the building code to follow International Building Code Standards.

The Washington State Legislature has also adopted the 2009 version of the International Residential Code as the official state building code starting on July 1, 2010. The 2009 IRC governs the new construction of detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories in height with separate means of egress. Provisions in the 2009 IRC for earthquake structural and foundation design are determined by the seismic design category of a proposed structure.[26]

Future injuries and property losses from earthquake hazards can be reduced by considering these hazards when making decisions about land use, by designing structures that can undergo ground shaking without collapse, by securely attaching the non-structural elements of a building, and by educating the public about what to do before, during, and after an earthquake to protect life and property.[27]

## *Second-Order Hazard Events*

Earthquakes events can result in other types of hazard incidents. In a disaster event, the first hazard event may not be the primary cause of damages or losses within the community. Historical earthquake events have often resulted in structural fires due to broken gas lines, candles, electrical malfunctions, etc. The following chart outlines the interconnection between earthquake hazards and other types of hazard events.

**Table 4.4. Second-Order Hazards Related to Earthquake Events.**

| Related Causal Events | Related Effects |
|---|---|
| None | Dam Failure |
| | Structural/Urban Fire |
| | Wildland Fire |
| | Transportation System |
| | Hazardous Materials |
| | Landslide |
| | Seiche |
| | Volcano |
| | Power Outage |

[26] Washington State Building Code. 2006. International Residential Code. State Building Code Council. Available online at http://sbcc.wa.gov/page.aspx?nid=3.

[27] Noson, Linda Lawrance, et al. Washington State Earthquake Hazards. Washington Division of Geology and Earth Resources Information Circular 85. Olympia, Washington. 1988.

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## *Landslide*

Landslide is a general term for a wide variety of down slope movements of earth materials that result in the perceptible downward and outward movement of soil, rock, and vegetation under the influence of gravity. The materials may move by falling, toppling, sliding, spreading, or flowing. Some landslides are rapid, occurring in seconds, whereas others may take hours, weeks, or even longer to develop. Although landslides usually occur on steep slopes, they also can occur in areas of low relief.[28]

Landslides can occur naturally or be triggered by human-related activities. Naturally-occurring landslides can occur on any terrain, given the right condition of soil, moisture, and the slope's angle. They are caused from an inherent weakness or instability in the rock or soil combined with one or more triggering events, such as heavy rain, rapid snow melt, flooding, earthquakes, vibrations and other natural causes. Other natural triggers include the removal of lateral support through the erosive power of streams, glaciers, waves, and longshore and tidal currents; through weathering, and wetting, drying and freeze-thaw cycles in surficial materials; or through land subsidence or faulting that creates new slopes. Long-term climate change can influence landslide occurrences through increased precipitation, ground saturation, and a rise in groundwater level, which reduces the strength and increases the weight of the soil.

Landslides can also be induced, accelerated or retarded by human actions. Human-related causes of landslides can include grading, terrain/slope cutting and filling, quarrying, removal of retaining walls, lowering of reservoirs, vibrations from explosions, machinery, road and air traffic, and excessive development. Normally stable slopes can fail if disturbed by development activities. Often, a slope can also become unstable by earthmoving, landscaping, or vegetation clearing activities. Changing drainage patterns, groundwater level, slope and surface water through agricultural or landscape irrigation, roof downspouts, septic-tank effluent or broken water or sewer lines can also generate landslides. Due to the geophysical or human factors that can induce a landslide event; they can occur in developed areas, undeveloped areas, or any areas where the terrain was altered for roads, houses, utilities, buildings, and even for lawns in one's backyard.[29]

Washington State has six landslide provinces, each with its own characteristics. Okanogan County is part of the Okanogan Highlands province which "extends from the slopes of the North Cascades in the west to the Selkirk Mountains in the northeast corner of the state. The primary slope stability problem in this province is in the sediments within and along the boundary of the highlands. Thick sections of sediments along the valleys of the Columbia, Spokane, and Sanpoil Rivers are the result of repeated damming of the Columbia River by lobes of the continental ice sheet and repeated catastrophic floods from breached ice dams.

The occurrence of new landslides and the reactivation of old landslides increased dramatically with the filling of reservoirs behind the Grand Coulee and Chief Joseph dams. Drawdowns for flood control and power generation also trigger new landslides and/or reactivate and extend old ones. Some of the landslide complexes extend for thousands of feet along the lakeshores, have head scarps in terraces 300 feet or more above reservoir level and extend well below its surface. With landslide activity common along hundreds of miles of shoreline, one hazard in such a setting is water waves generated by fast-moving landslide masses."[30]

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[28] "Landslides". SAARC Disaster Management Center. New Delhi. Available online at http://saarc-sdmc.nic.in/pdf/landslide.pdf. Accessed March 2011.

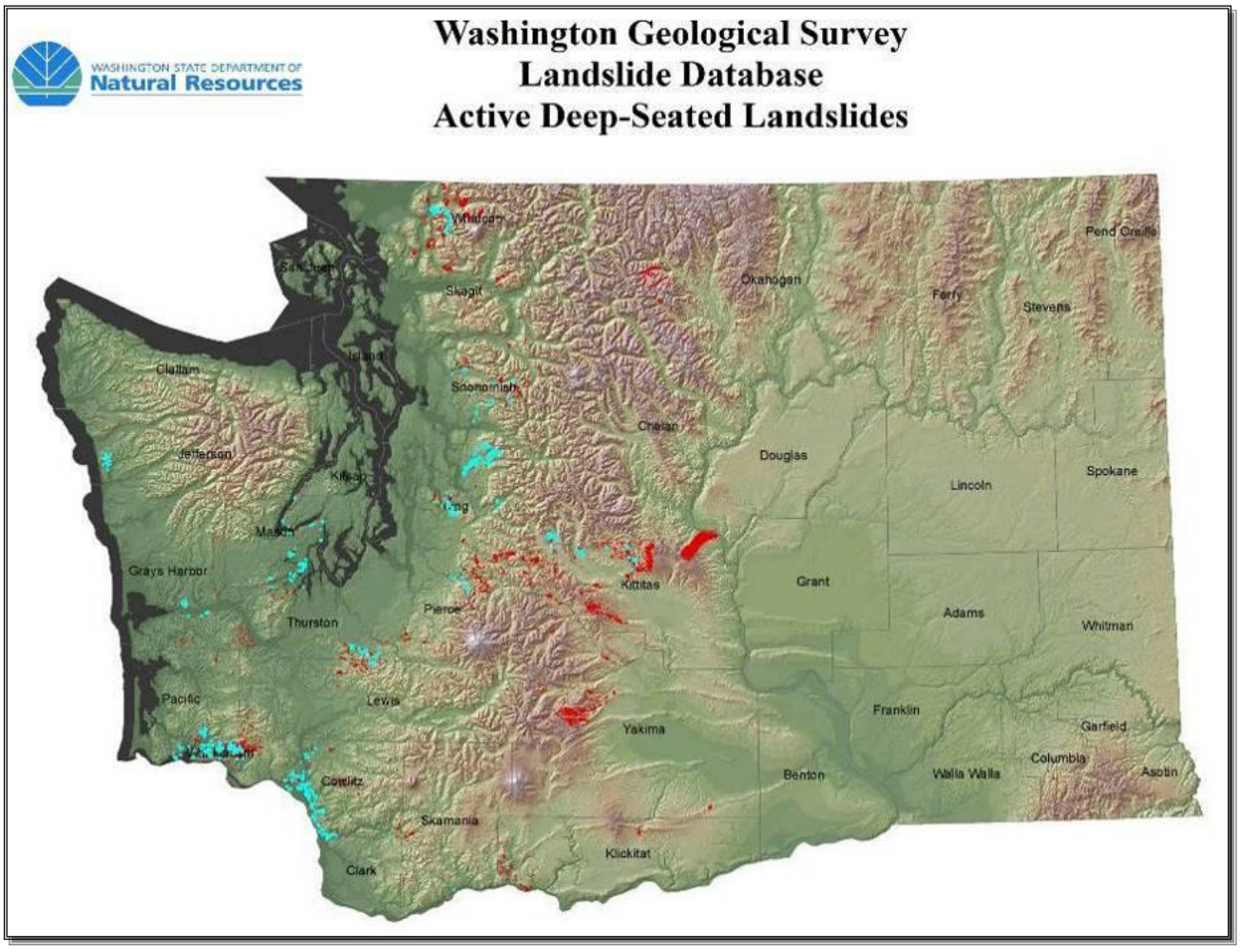
[29] Tetra Tech. DMA 2000 Hazard Mitigation Plan. Onondaga County, New York. April 2010.

[30] Washington State Hazard Mitigation Plan. http://www.emd.wa.gov/plans/documents/Tab_7.1.5_Landslide_final.pdf. Accessed October, 2012.

Landslides range from shallow debris flows to deep-seated slumps. They destroy homes, businesses, and public buildings, undermine bridges, derail railroad cars, interrupt transportation infrastructure, damage utilities, and take lives. Sinkholes affect roads and utilities. Losses often go unrecorded because insurance claims are not filed, no report is made to emergency management, there is no media coverage, or the transportation damages are recorded as regular maintenance.

Significant landslide events (those resulting in disasters) are rarer but several have been recorded in the State. Major events had a significant impact on transportation, communities, and natural resources in 1977, 1979, 1986, 1989, 1997, 1998, 2006 (x2), 2007 (x2), and 2009.

**Figure 4.4. Washington Geological Survey Landslide Database.**



[31]

[31] Washington DNR. Washington Geological Survey, Landslide Database. "Washington Landslide Blog." Washington Department of Natural Resources. Available online at http://slidingthought.files.wordpress.com.

Land stability cannot be absolutely predicted with current technology. The best design and construction measures are still vulnerable to slope failure. The amount of protection, usually correlated to cost, is proportional to the level of risk reduction. Debris and vegetation management is integral to prevent landslide damages. Corrective measures help, but can often leave the property vulnerable to risk.

These are characteristics that may be indicative of a landside hazard area:

- Bluff retreat caused by sloughing of bluff sediments, resulting in a vertical bluff face with little vegetation.
- Pre-existing landside area.
- Tension or ground cracks along or near the edge of the top of a bluff.
- Structural damage caused by settling and cracking of building foundations and separation of steps from the main structure.
- Toppling bowed or jack sawed trees.
- Gullying and surface erosion.
- Mid-slope ground water seepage from a bluff face.

By studying the effects of landslides in slide prone areas we can plan for the future. More needs to be done to educate the public and to prevent development in vulnerable areas. WAC 365-190-080 states that geologically hazardous areas pose a threat to the health and safety of citizens when incompatible development is sited in areas of significant hazard. Some hazards can be mitigated by engineering, design, or construction so that risks are acceptable. When technology cannot reduce the risk to acceptable levels, building in hazardous areas should be avoided.[32]

Stream and riverbank erosion, road building or other excavation can remove the toe or lateral slope and exacerbate landslides. Seismic or volcanic activity often triggers landslides as well. Urban and rural living with excavations, roads, drainage ways, landscape watering, logging, and agricultural irrigation may also disturb the solidity of landforms, triggering landslides. In general, any land use changes that affects drainage patterns or that increase erosion or change ground-water levels can augment the potential for landslide activity.

Landslides are a recurrent menace to waterways and highways and a threat to homes, schools, businesses, and other facilities. The unimpeded movement over roads—whether for commerce, public utilities, school, emergencies, police, recreation, or tourism—is essential to the normal functioning of Okanogan County. The disruption and dislocation of these or any other routes caused by landslides can quickly jeopardize travel and vital services. Although small slumps on cut and fill slopes along roads and highways is relatively common, nearly all of the landslide risk in Okanogan County is associated with the steeper slopes along the major rivers in the central portion of the County and in the Cascade Mountains in the western third of the County. The majority of new development within the County is occurring along these slopes; thus, there are increasingly more structures and infrastructure at risk in this landslide prone area.

[32] Canning, Douglas J. "*Geologically Hazardous Areas"*. Shorelands and Environmental Assistance Program. Washington Department of Ecology. Olympia, Washington.

### *Second-Order Hazard Events*

Landslide events are often caused by other types of hazard events, but the costs of cleaning up after a landslide including road and other infrastructure repairs can often dwarf the damages of the initial hazard. The following chart outlines the interconnection between landslides and other types of hazard events.

**Table 4.5. Second-Order Hazards Related to Landslide Events.**

| Related Causal Events | Related Effects |
|---|---|
| Flood | Transportation System |
| Earthquakes | Evacuations |
| Wildland Fire | Power Outage |

## *Severe Weather*

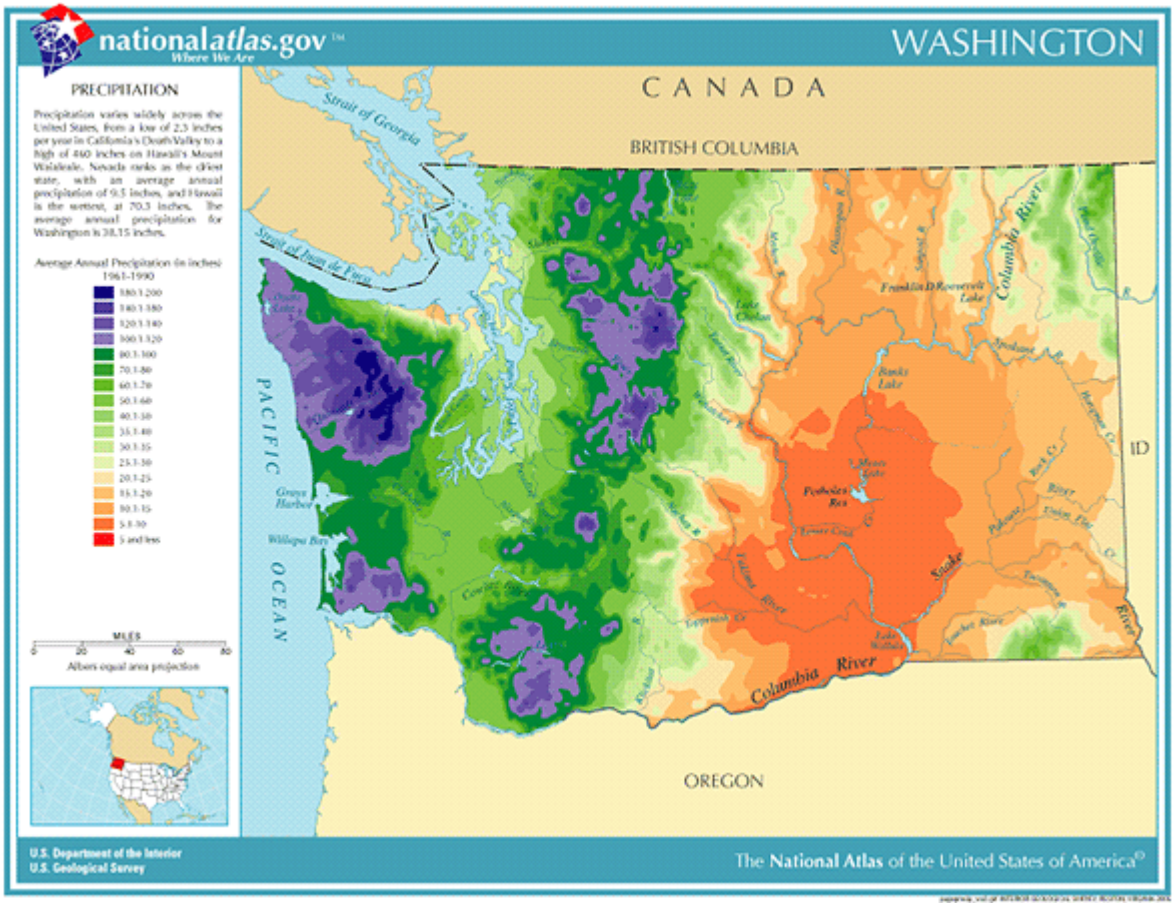
The overall weather patterns that affect Okanogan County are prevalent throughout central Washington. This section of the State is part of the large inland basin between the Cascade and Rocky Mountains. In an easterly and northerly direction, the Rocky Mountains shield the inland basin from the winter season's cold air masses traveling southward across Canada. In a westerly direction, the Cascade Range forms a barrier to the easterly movement of moist and comparatively mild air in winter and cool air in summer. Some of the air from each of these source regions reaches this section of the State and produces a climate which has some of the characteristics of both continental and marine types. Most of the air masses and weather systems crossing central Washington are traveling under the influence of the prevailing westerly winds. Infrequently, dry continental air masses enter the inland basin from the north or east. Major disaster declarations related to severe storms in Washington occurred in 1962, 1972, 1974, 1975, 1977, 1979, 1983, 1986 (x3), 1990 (x2), 1991, 1993, 1996, 1997, 2003, 2006 (x2), 2007 (x2), and 2009 (x2).

Okanogan County has a semi-arid continental type of climate which is hot and dry in the summer and cold and moderately humid in the winter. Temperatures can vary significantly over most of the county because of the wide range of elevations that occur within the County. Precipitation varies from a semi-arid condition in the central and eastern part of the county to the moist conditions of the Cascade Mountains in the west.

Annual precipitation ranges from seven to nine inches near the confluence of the Snake and Columbia Rivers, 15 to 30 inches along the eastern border and 75 to 90 inches near the summit of the Cascade Mountains. In general, the majority of the precipitation occurs during the winter months. The summer season of June through September is dry, characterized by occasional local showers or hail storms. The winter is cloudy and moderately humid with most precipitation received as snowfall. Winter rains and snow melt are absorbed by loam soils. Precipitation is a major controlling factor in agriculture. Precipitation in the north central Washington region is unreliable. Fluctuations in snow fall and rainfall, creating top soil moisture deficiencies, have caused failures or low yields of grain crops in the past.

In January, the average maximum temperature is near 30° F and the minimum temperature is 15° F. Minimum temperatures from -10° to -20°F are recorded almost every winter and temperatures ranging from -25° to -42° F have been recorded in the colder valleys. In July, the average maximum temperature is 85° to 90° and the minimum temperature 45° to 50° F. Maximum temperatures reach 100° F on a few afternoons each summer and temperatures between 105° and 110° F have been recorded.

**Figure 4.5. Annual Precipitation Map for Washington[33].**




During the coldest months, a loss of heat by radiation at night and moist air crossing the Cascades and mixing with the colder air in the inland basin results in cloudiness and occasional freezing drizzle. A "chinook" wind which produces a rapid rise in temperature occurs a few times each winter. Frost penetration in the soil depends to some extent on the vegetative cover, snow cover and the duration of low temperatures. In an average winter, frost in the soil can be expected to reach a depth of 10 to 20 inches. During a few of the colder winters, with little or no snow cover, frost has reached a depth of 25 to 35 inches.

Cold continental air moving southward through Canada will occasionally cross the higher mountains and follow the north-south valleys into the Columbia Basin. On clear, calm winter nights, the loss of heat by radiation from over a snow cover produces ideal conditions for low temperatures. The lowest temperature in the State, -48° F, was recorded December 30, 1965, at Mazama and Winthrop.[34]

Storms are naturally occurring atmospheric disturbances manifested in strong winds accompanied by rain, snow, or other precipitation, and often by thunder or lightning. All areas within this region are vulnerable to severe local storms. The affects are generally transportation problems and loss of utilities. When

[33] http://coolweather.net/staterainfall/washington.htm. Accessed December, 2012.

[34] WRCC. "Historical Climate Information: Climate Extremes by State". Western Regional Climate Center. Available online at http://www.wrcc.dri.edu/. Accessed March 2011.

transportation accidents occur, motorists are stranded and schools and businesses close. The affects vary with the intensity of the storm, the level of preparation by local jurisdictions and residents, and the equipment and staff available to perform tasks to lessen the effects of severe local storms.

### *Second-Order Hazard Events*

Severe weather is often the causal factor in damages from other types of hazard incidents such as flood or wildland fire. The following chart outlines the interconnection between severe weather and other types of hazard events.

**Table 4.6. Second-Order Hazards Related to Severe Weather Events.**

| Related Causal Events | Related Effects |
|---|---|
| None | Drought |
| | Crop Loss |
| | Tornado |
| | Wildland Fire |
| | Flood |
| | Landslides |
| | Power Outage |

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# *Wildland Fire*

An informed discussion of fire mitigation is not complete until basic concepts that govern fire behavior are understood. In the broadest sense, wildland fire behavior describes how fires burn; the manner in which fuels ignite, how flames develop and how fire spreads across the landscape. The three major physical components that determine fire behavior are the fuels supporting the fire, topography in which the fire is burning, and the weather and atmospheric conditions during a fire event. At the landscape level, both topography and weather are beyond our control. We are powerless to control winds, temperature, relative humidity, atmospheric instability, slope, aspect, elevation, and landforms. It is beyond our control to alter these conditions, and thus impossible to alter fire behavior through their manipulation. When we attempt to alter how fires burn, we are left with manipulating the third component of the fire environment; fuels which support the fire. By altering fuel loading and fuel continuity across the landscape, we have the best opportunity to determine how fires burn.

A brief description of each of the fire environment elements follows in order to illustrate their effect on fire behavior.

**Weather**

Weather conditions contribute significantly to determining fire behavior. Wind, moisture, temperature, and relative humidity ultimately determine the rates at which fuels dry and vegetation cures, and whether fuel conditions become dry enough to sustain an ignition. Once conditions are capable of sustaining a fire, atmospheric stability and wind speed and direction can have a significant effect on fire behavior. Winds fan fires with oxygen, increasing the rate at which fire spreads across the landscape. Weather is the most unpredictable component governing fire behavior, constantly changing in time and across the landscape.

**Topography**

Fires burning in similar fuel conditions burn dramatically different under different topographic conditions. Topography alters heat transfer and localized weather conditions, which in turn influence vegetative growth and resulting fuels. Changes in slope and aspect can have significant influences on how fires burn. Generally speaking, north slopes tend to be cooler, wetter, more productive sites. This can lead to heavy fuel accumulations, with high fuel moistures, later curing of fuels, and lower rates of spread. In contrast, south and west slopes tend to receive more direct sun, and thus have the highest temperatures, lowest soil and fuel moistures, and lightest fuels. The combination of light fuels and dry sites lead to fires that typically display the highest rates of spread. These slopes also tend to be on the windward side of mountains. Thus these slopes tend to be “available to burn” a greater portion of the year.

Slope also plays a significant role in fire spread, by allowing preheating of fuels upslope of the burning fire. As slope increases, rate of spread and flame lengths tend to increase. Therefore, we can expect the fastest rates of spread on steep, warm south and west slopes with fuels that are exposed to the wind.

**Fuels**

Fuel is any material that can ignite and burn. Fuels describe any organic material, dead or alive, found in the fire environment. Grasses, brush, branches, logs, logging slash, forest floor litter, conifer needles, and buildings are all examples. The physical properties and characteristics of fuels govern how fires burn. Fuel

loading, size and shape, moisture content and continuity and arrangement all have an effect on fire behavior. Generally speaking, the smaller and finer the fuels, the faster the potential rate of fire spread. Small fuels such as grass, needle litter and other fuels less than a quarter inch in diameter are most responsible for fire spread. In fact, "fine" fuels, with high surface to volume ratios, are considered the primary carriers of surface fire. This is apparent to anyone who has ever witnessed the speed at which grass fires burn. As fuel size increases, the rate of spread tends to decrease, as surface to volume ratio decreases. Fires in large fuels generally burn at a slower rate, but release much more energy, burn with much greater intensity. This increased energy release, or intensity, makes these fires more difficult to control. Thus, it is much easier to control a fire burning in grass than to control a fire burning in timber.

When burning under a forest canopy, the increased intensities can lead to torching (single trees becoming completely involved) and potentially development of crown fire (fire carried from tree crown to tree crown). That is, they release much more energy. Fuels are found in combinations of types, amounts, sizes, shapes, and arrangements. It is the unique combination of these factors, along with the topography and weather, which determine how fires will burn.

The study of fire behavior recognizes the dramatic and often-unexpected affect small changes in any single component has on how fires burn. It is impossible to speak in specific terms when predicting how a fire will burn under any given set of conditions. However, through countless observations and repeated research, some of the principles that govern fire behavior have been identified and are recognized.

## *Wildfire Hazard Assessment*

Okanogan County was analyzed using a variety of models managed on a Geographic Information System (GIS) system. Physical features of the region including roads, streams, soils, elevation, and remotely sensed images were represented by data layers. Field visits were conducted by specialists from Northwest Management, Inc. and others. Discussions with area residents and local fire suppression professionals augmented field visits and provided insights into forest health issues and treatment options. This information was analyzed and combined to develop an objective assessment of wildland fire risk in the region.

### Historic Fire Regime

Historical variability in fire regime is a conservative indicator of ecosystem sustainability, and thus, understanding the natural role of fire in ecosystems is necessary for proper fire management. Fire is one of the dominant processes in terrestrial systems that constrain vegetation patterns, habitats, and ultimately, species composition. Land managers need to understand historical fire regimes, the fire return interval (frequency) and fire severity prior to settlement by Euro-Americans, to be able to define ecologically appropriate goals and objectives for an area. Moreover, managers need spatially explicit knowledge of how historical fire regimes vary across the landscape.

Many ecological assessments are enhanced by the characterization of the historical range of variability which helps managers understand: (1) how the driving ecosystem processes vary from site to site; (2) how these processes affected ecosystems in the past; and (3) how these processes might affect the ecosystems of today and the future. Historical fire regimes are a critical component for characterizing the historical range of variability in fire-adapted ecosystems. Furthermore, understanding ecosystem departures provides the necessary context for managing sustainable ecosystems. Land managers need to understand how ecosystem

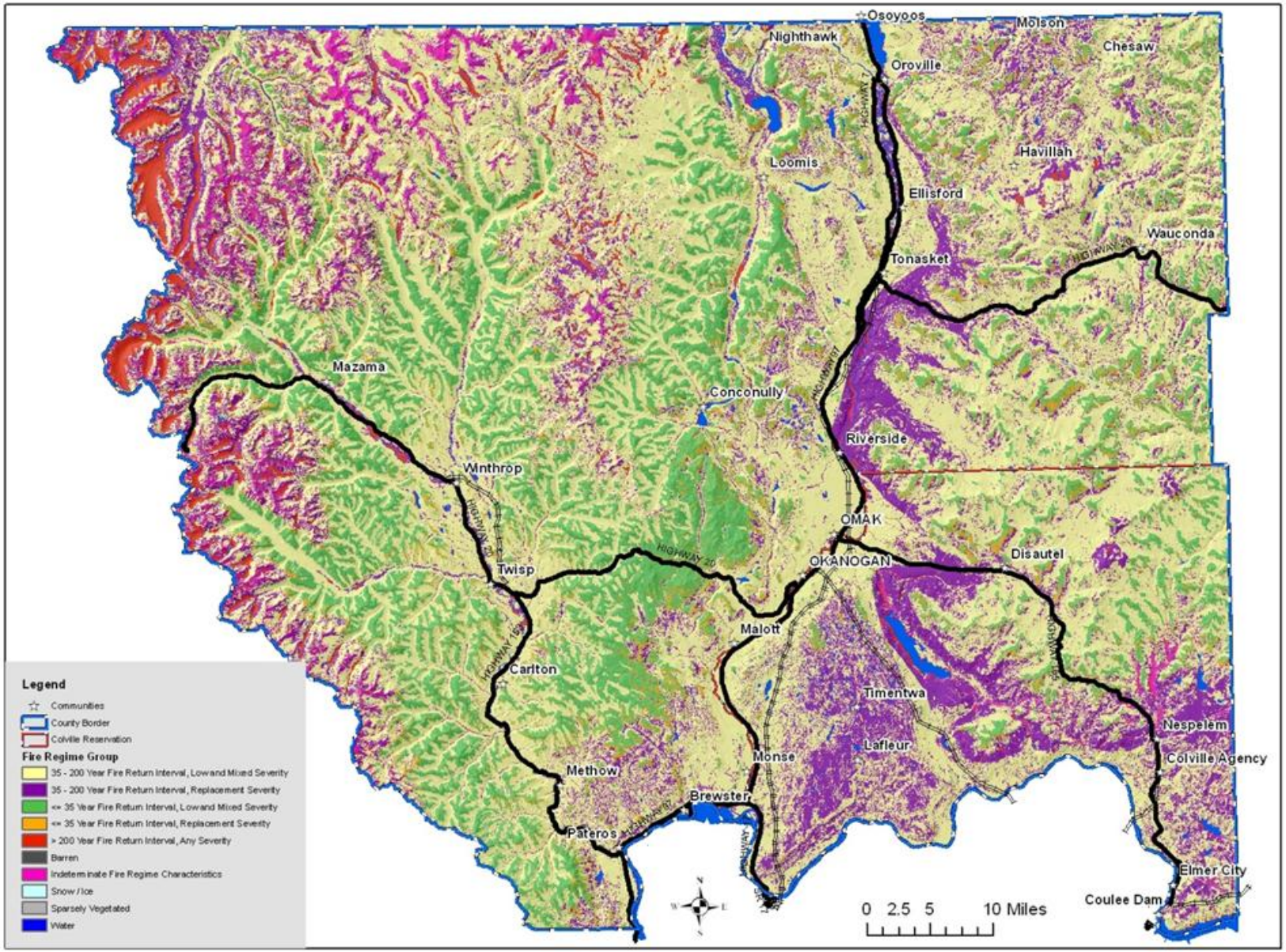
processes and functions have changed prior to developing strategies to maintain or restore sustainable systems. In addition, the concept of departure is a key factor for assessing risks to ecosystem components. For example, the departure from historical fire regimes may serve as a useful proxy for the potential of severe fire effects from an ecological perspective.

**Table 4.7. Assessment of Historic Fire Regimes in Okanogan County, Washington.**

| Regime | Description | Percent | Acres |
|---|---|---|---|
| 1 | <= 35 Year Fire Return Interval, Low and Mixed Severity | 24.5% | 834,491 |
| 2 | <= 35 Year Fire Return Interval, Replacement Severity | 27.8% | 946,243 |
| 3 | 35 - 200 Year Fire Return Interval, Low and Mixed Severity | 12.3% | 416,893 |
| 4 | 35 - 200 Year Fire Return Interval, Replacement Severity | 12.9% | 438,067 |
| 5 | > 200 Year Fire Return Interval, Any Severity | 22.3% | 759,206 |
| | Water | <1% | 6,352 |
| | Barren | | |
| | Sparsely Vegetated | | |
| | Indeterminate Fire Regime Characteristics | | |
| | **Total** | **100%** | **3,401,252** |

The table above shows the amount of acreage in each defined historic fire regime in Okanogan County. The historic fire regime model in Okanogan County shows that much of the river basins historically had a 35 to 200-year fire return interval and typically experienced stand replacement severity fires, however the majority of the County experienced low to mixed severity fires with the same return interval which includes much of the lower elevation forests and shrub steppe. The higher elevation forested areas experienced fire every 35-200 years while some areas experienced fire every 200+ years. This difference is likely due to the more variable topography and presence of snowpack for longer duration in these areas.

**Figure 4.6. Historic Fire Regime in Okanogan County, Washington.**



## Fire Regime Condition Class

A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning.[35, 36] Coarse scale definitions for historic fire regimes have been developed by Hardy et al[37] and Schmidt et al[38] and interpreted for fire and fuels management by Hann and Bunnell.

A fire regime condition class (FRCC) is a classification of the amount of departure from the historic regime. [39] The three classes are based on low (FRCC 1), moderate (FRCC 2), and high (FRCC 3) departure from the central tendency of the natural (historical) regime.[40,41] The central tendency is a composite estimate of vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated natural disturbances. Low departure is considered to be within the natural (historical) range of variability, while moderate and high departures are outside.

An analysis of Fire Regime Condition Classes in Okanogan County shows that approximately one third of the acres in the County that have not been converted for agricultural uses or developed into urban areas, have retained their historic fire regime. Over two million acres are either moderately or highly departed from historical regimes. Most of the valleys in the forested western half of the County appear to be defined as Condition Class 3. The higher elevations in the western half of the county are Condition Class 1. The remainder of the County contains a scattered mix of all three levels of Condition Classes with Classes 2 and 3 surrounding population centers and travel corridors. In most scenarios, the more departed an area is from its natural fire regime, the higher the wildfire potential; however, this is not true 100% of the time.

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[35] Agee, J. K. Fire Ecology of the Pacific Northwest forests. Oregon: Island Press. 1993.

[36] Brown. J. K. "Fire regimes and their relevance to ecosystem management." *Proceedings of Society of American Foresters National Convention*. Society of American Foresters. Washington, D.C. 1995. Pp 171-178.

[37] Hardy, C. C., et al. *"Spatial data for national fire planning and fuel management."* International Journal of Wildland Fire. 2001. Pp 353-372.

[38] Schmidt, K. M., et al. *"Development of coarse scale spatial data for wildland fire and fuel management."* General Technical Report, RMRS-GTR-87. U.S. Department of Agriculture, Forest Service. Rocky Mountain Research Station. Fort Collins, Colorado. 2002.

[39] Hann, W. J. and D. L. Bunnell. "Fire and land management planning and implementation across multiple scales." International Journal of Wildland Fire. 2001. Pp 389-403.

[40] Hardy, C. C., et al. *"Spatial data for national fire planning and fuel management."* International Journal of Wildland Fire. 2001. Pp 353-372.

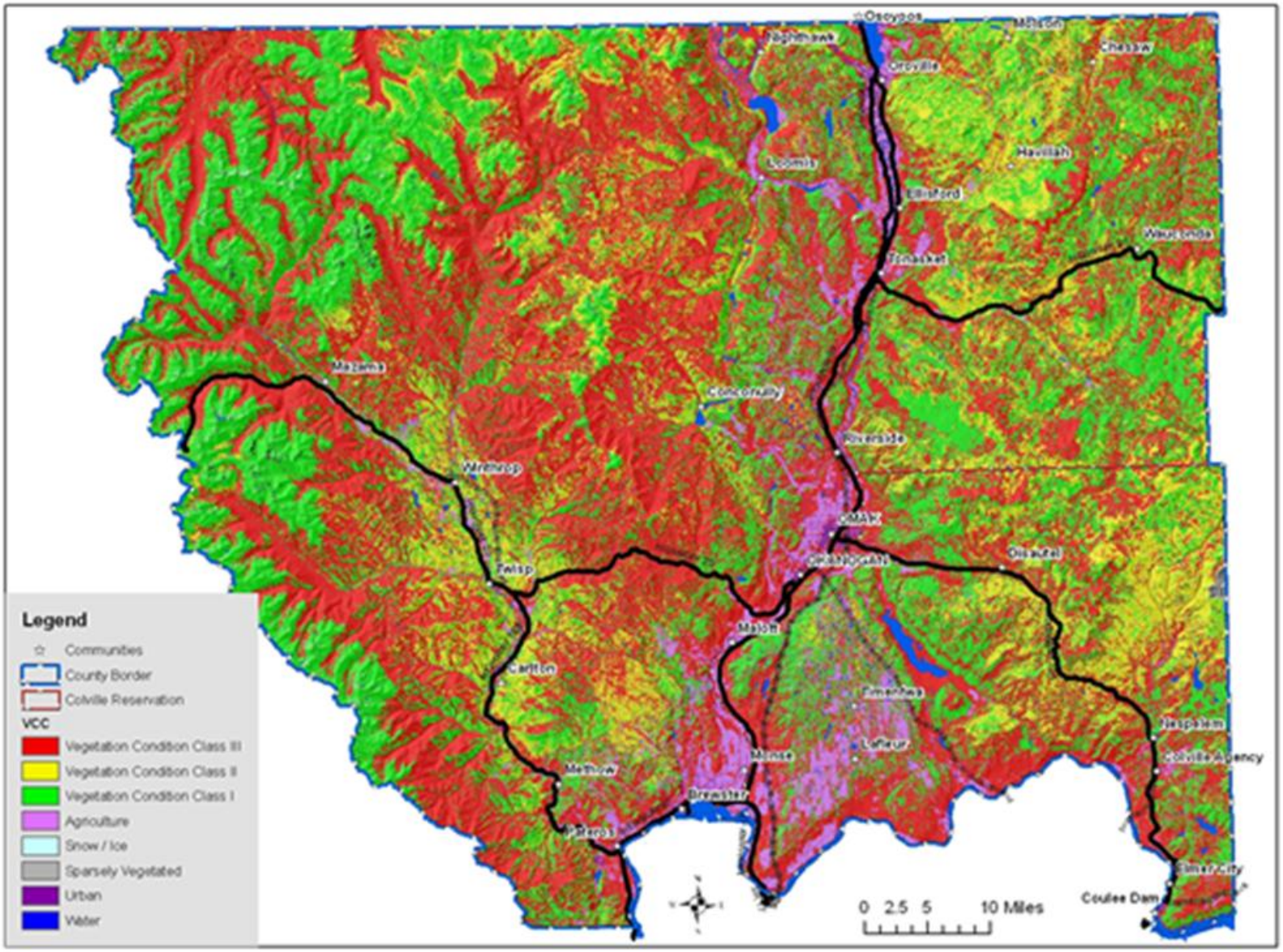
[41] Schmidt, K. M., et al. *"Development of coarse scale spatial data for wildland fire and fuel management."* General Technical Report, RMRS-GTR-87. U.S. Department of Agriculture, Forest Service. Rocky Mountain Research Station. Fort Collins, Colorado. 2002.

**Table 4.8. Assessment of Fire Regime Condition Class in Okanogan County, Washington.**

| Condition Class | Acres | Percent |
|---|---|---|
| Fire Regime Condition Class I | 1,167,096 | 34.3% |
| Fire Regime Condition Class II | 557,482 | 16.4% |
| Fire Regime Condition Class III | 628,165 | 18.5 |
| Water | 6,340 | <1% |
| Urban | 203,831 | 6% |
| Barren | | |
| Sparsely Vegetated | | |
| Agriculture | 838,337 | 24.6% |
| **Total** | **3,401,252** | **100%** |

The large amount of acres that are classified as Condition Class I could be attributed to the remote and rugged terrain that is common in Okanogan County. This rugged terrain has likely limited the amount of anthropogenic impacts such as; agriculture, grazing, and logging.

**Figure 4.7. Fire Regime Condition Class in Okanogan County, Washington.**



## Wildland Urban Interface

The wildland-urban interface (WUI) has gained attention through efforts targeted at wildfire mitigation; however, this analysis technique is also useful when considering other hazards because the concept looks at where people and structures are concentrated in any particular region.

A key component in meeting the underlying need for protection of people and structures is the protection and treatment of hazards in the wildland-urban interface. The wildland-urban interface refers to areas where wildland vegetation meets urban developments or where forest fuels meet urban fuels such as houses. The WUI encompasses not only the interface (areas immediately adjacent to urban development), but also the surrounding vegetation and topography. Reducing the hazard in the wildland-urban interface requires the efforts of federal, state, and local agencies and private individuals.[42] "The role of [most] federal agencies in the wildland-urban interface includes wildland firefighting, hazard fuels reduction, cooperative prevention and education, and technical experience. Structural fire protection [during a wildfire] in the wildland-urban interface is [largely] the responsibility of Tribal, state, and local governments".[43] The role of the federal agencies in Okanogan County is and will be much more limited. Property owners share a responsibility to protect their residences and businesses and minimize danger by creating defensible areas around them and taking other measures to minimize the risks to their structures.[44] With treatment, a wildland-urban interface can provide firefighters a defensible area from which to suppress wildland fires or defend communities against other hazard risks. In addition, a wildland-urban interface that is properly treated will be less likely to sustain a crown fire that enters or originates within it. [45]

By reducing hazardous fuel loads, ladder fuels, and tree densities, and creating new and reinforcing existing defensible space, landowners can protect the wildland-urban interface, the biological resources of the management area, and adjacent property owners by:

- minimizing the potential of high-severity ground or crown fires entering or leaving the area;
- reducing the potential for firebrands (embers carried by the wind in front of the wildfire) impacting the WUI. Research indicates that flying sparks and embers (firebrands) from a crown fire can ignite additional wildfires as far as 1¼ miles away during periods of extreme fire weather and fire behavior;[46]

[42] Norton, P. Bear Valley National Wildlife Refuge Fire Hazard Reduction Project: Final Environmental Assessment. Fish and Wildlife Services, Bear Valley Wildlife Refuge. June 20, 2002.

[43] USFS. 2001. United States Department of Agriculture, Forest Service. Wildland Urban Interface. Web page. Date accessed: 25 September 2001. Accessed at: http://www.fs.fed.us/r3/sfe/fire/urbanint.html

[44] USFS. 2001. United States Department of Agriculture, Forest Service. Wildland Urban Interface. Web page. Date accessed: 25 September 2001. Accessed at: http://www.fs.fed.us/r3/sfe/fire/urbanint.html

[45] Norton, P. Bear Valley National Wildlife Refuge Fire Hazard Reduction Project: Final Environmental Assessment. Fish and Wildlife Services, Bear Valley Wildlife Refuge. June 20, 2002.

[46] McCoy, L. K., et all. Cerro Grand Fire Behavior Narrative. 2001.

- improving defensible space in the immediate areas for suppression efforts in the event of wildland fire.

Three WUI conditions have been identified (Federal Register 66(3), January 4, 2001) for use in wildfire control efforts. These include the Interface Condition, Intermix Condition, and Occluded Condition. Descriptions of each are as follows:

- **Interface Condition** – a situation where structures abut wildland fuels. There is a clear line of demarcation between the structures and the wildland fuels along roads or back fences. The development density for an interface condition is usually 3+ structures per acre;

- **Intermix Condition** – a situation where structures are scattered throughout a wildland area. There is no clear line of demarcation; the wildland fuels are continuous outside of and within the developed area. The development density in the intermix ranges from structures very close together to one structure per 40 acres; and

- **Occluded Condition** – a situation, normally within a city, where structures abut an island of wildland fuels (park or open space). There is a clear line of demarcation between the structures and the wildland fuels along roads and fences. The development density for an occluded condition is usually similar to that found in the interface condition and the occluded area is usually less than 1,000 acres in size.

In addition to these classifications detailed in the Federal Register, Okanogan County has included two additional classifications to augment these categories:

- **Rural Condition** – a situation where the scattered small clusters of structures (ranches, farms, resorts, or summer cabins) are exposed to wildland fuels. There may be miles between these clusters.

- **High Density Urban Areas** – those areas generally identified by the population density consistent with the location of incorporated cities, however, the boundary is not necessarily set by the location of city boundaries or urban growth boundaries; it is set by very high population densities (more than 7-10 structures per acre).

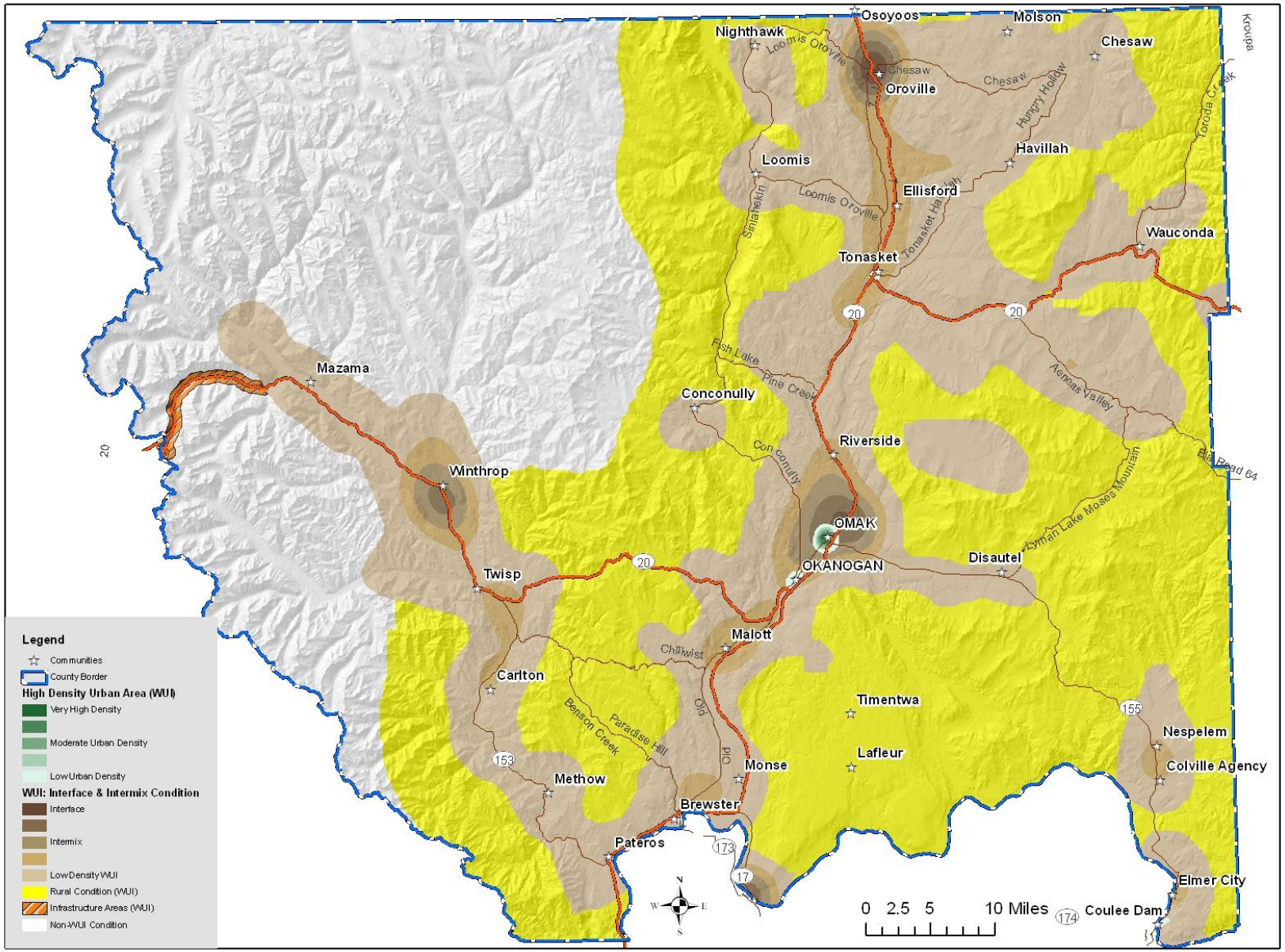
Okanogan County's wildland-urban interface (WUI) is based on population density. Relative population density across the county is estimated using a GIS-based kernel density population model that uses object locations to produce, through statistical analysis, concentric rings or areas of consistent density. To graphically identify relative population density across the county, structure locations are used as an estimate of population density. For this analysis, physical addresses were used as an estimate of structure location. Okanogan County's GIS department produced a 911 address data layer that was used to represent structure location as input for the model. The resulting output identified the extent and level of population density throughout the county. Highly populated areas are easily discernable from low population areas using this method, which enables the determination of urban verses rural populations. Rural areas of the WUI have an approximate density of one structure per 40 acres. The model also showed several small islands where no structures were recorded. Based on the planning committee's review and discussion, the final WUI boundary output was adjusted to incorporate the non-populated areas (no structures) due to their small size and scattered nature as well as their location in high fire risk areas.

By evaluating structure density in this way, WUI areas can be identified on maps by using mathematical formulae and population density indexes. The resulting population density indexes create concentric circles showing high density areas, interface, and intermix condition WUI, as well as rural condition WUI (as defined above). This portion of the analysis allows us to "see" where the highest concentrations of structures are located in reference to high risk landscapes, limiting infrastructure, and other points of concern.

The WUI, as defined here, is unbiased and consistent, allows for edge matching with other counties, and most importantly – it addresses all of the county, not just federally identified communities at risk. It is a planning tool showing where homes and businesses are located and the density of those structures leading to identified WUI categories. It can be determined again in the future, using the same criteria, to show how the WUI has changed in response to increasing population densities. It uses a repeatable and reliable analysis process that is unbiased.

The Healthy Forests Restoration Act makes a clear designation that the location of the WUI is at the determination of the county or reservation when a formal and adopted CWPP is in place. It further states that the federal agencies are obligated to use this WUI designation for all Healthy Forests Restoration Act purposes. The Okanogan County Community Wildfire Protection Plan planning committee evaluated a variety of different approaches to determining the WUI for the county and selected this approach and has adopted it for these purposes. In addition to a formal WUI map for use by the federal agencies, it is hoped that it will serve as a planning tool for the county, the Washington Department of Natural Resources, and local fire districts.

**Figure 4.8. Wildland-Urban Interface Map for Okanogan County, Washington.**



### *Second-Order Hazard Events*

Wildland fires can be caused naturally by lightning or by various technological sources. Wildland fire can also be a secondary effect of another type of hazard. The following chart outlines the interconnection between wildland fire and other types of hazard events.

**Table 4.9. Second-Order Hazards Related to Wildland Fire Events.**

| Related Causal Events | Related Effects |
|---|---|
| Severe Weather | Structural/Urban Fire |
| Drought | Civil Unrest |
| Earthquake | Landslide |
| Transportation Systems | Transportation Systems |
| Hazardous Materials | Power Outage |
| Structural/Urban Fire | |

# Chapter 5

## Jurisdictional Vulnerability Assessment



IN THIS SECTION:

# Chapter 5 – Hazard Assessments

## Jurisdictional Risk and Vulnerability Assessments

The Okanogan County MHMP planning committee reviewed many of the natural and man-made hazards that have affected or pose a potential risk to people or property throughout the County. The committee agreed that the natural hazards identified in the Washington State Enhance Hazard Mitigation Plan had the greatest potential risk for in Okanogan County; thus, the hazards of flood, earthquake, landslide, severe weather, and wildland fire were included in the risk assessment for each jurisdiction. The planning committee recognizes that there are additional hazards, particularly man-made hazards, which may also affect Okanogan County. These types of additional hazards will be reviewed for inclusion during the subsequent annual and 5-year evaluations of the MHMP.

As part of the risk and vulnerability assessment, each member of the planning committee was asked to fill out a critical infrastructure worksheet identifying and locating all structures, infrastructure, and culturally significant sites that the loss or damage of which would have a significant impact on the community. This exercise also included all communication, hazardous materials storage, transportation, and emergency response infrastructure. The list from each member was compiled and added to a GIS database. The critical infrastructure database was used to develop maps and address each type of hazard risk in each jurisdiction.

Furthermore, Okanogan County's existing parcel master listing has been converted to an accessible GIS database. This database allowed the planning committee to map every parcel within the County and city jurisdictions as well as assign an accurate assessed value of both land and improvements for each parcel. This data was combined with the hazard vulnerability models to develop the risk assessments and loss estimations for each jurisdiction.

In order to be eligible for project funds under the Flood Mitigation Assistance (FMA) program authorized by the National Flood Insurance Act of 1968, as amended, communities are required under 44 CFR 79.6(d)(1) to have a mitigation plan that addresses flood hazards. On October 31, 2007, FEMA published amendments to the 44 CFR Part 201 at 72 Federal Register 61720 to incorporate mitigation planning requirements for the FMA program, which combined the Local Mitigation Plan requirement for all hazard mitigation assistances programs under 44 CFR 201.6 to include the FMA as well as the HMGP, PDM, and SRL programs thus eliminating duplicative mitigation planning regulations. The purpose of the flood sections in the following annexes is to fulfill the requirements for both the FMA program and the Local Hazard Mitigation Plan.

# *Okanogan County Annex*

## *Flood Profile*

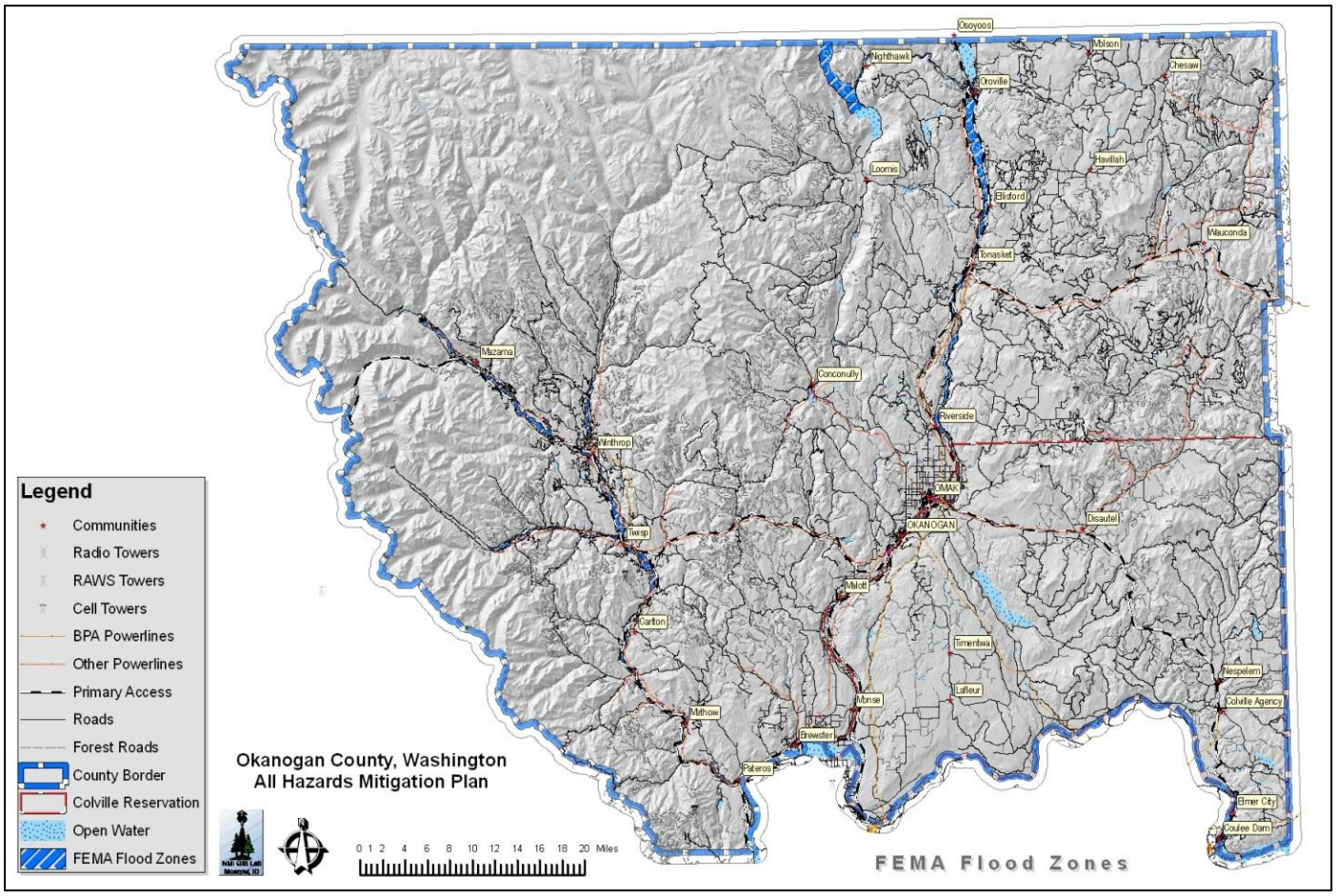
Historically, flooding has been one of the most common natural hazards in Okanogan County. The most notable historical floods occurred in 1894, 1948, and 1972, with the flood of 1894 being a "90 year flood". In more recent years, significant flooding has taken place in 1991, 1996, 1998, and 1999.

**Figure 5.1. Watersheds in Okanogan County, Washington.**


Riverine floods along the Okanogan, Similkameen, Nespelem, Chewuch, Twisp, and Methow Rivers have the most prolonged impact on Okanogan County. These and other perennial streams throughout the County follow an annual cycle with peak streamflow in April and May and low streamflow in August and September. Flash flooding has caused deaths in the area and is a threat to local populated areas due to the topographical makeup of the County. Flash flooding has occurred as recently as 2001, with the washout of a road near Chesaw, and the loss of one life.

Erosion and transported sediment are major secondary hazards of flooding. The intense runoff can strip away topsoil and deposit it elsewhere, usually where the flow is impeded, such as bridge abutments. Sediment deposits have been a major effect of flooding in several Okanogan County communities. The erosion can deposit sediment in river and creek beds, decreasing their capacity to transport water. Severe flooding can also contaminate water sources and spread disease.

**Figure 5.2. FEMA Floodplains in Okanogan County, Washington.**




A high level of sediment is prevalent in Okanogan County drainages during periods of runoff primarily from the abundance of high elevation washouts and agricultural fields in the lowlands. This sediment tends to cause a deteriorating condition in channel beds through erosion and deposition. Natural obstructions to flood waters include trees, brush, and other vegetation along the stream banks in the floodplain areas. Debris can plug culverts and accumulate on bridge abutments at several locations. Many secondary routes are not paved, which results in gravel washing downslope potentially clogging drainage systems or directing water to places that were not intended. Sedimentation and accumulated debris and vegetation are significantly increasing the flood risk throughout Okanogan County. Debris jams during high water events have caused considerable flood damage to adjacent properties.

Participation in the National Flood Insurance Program (NFIP) and subsequent adoption of the Uniform Building Codes, or more stringent local building codes, provide basic guidelines to communities on how to regulate development. When a county participates in the NFIP it enables property owners in the county to insure against flood losses. By employing wise floodplain management, a participating county can protect its citizens against much of the devastating financial loss resulting from flood disasters. Careful local management of development in the floodplains results in construction practices that can reduce flood losses and the high costs associated with flood disasters to all levels of government.

An important part of being an NFIP community is the availability of low cost flood insurance for those homes and businesses within designated flood plains, or in areas that are subject to flooding, but that are not designated as Special Flood Hazard Areas.

**Table 5.1. NFIP Policy Statistics as of 12/13/2012 in Okanogan County.**

| Community Name | Policies In-Force | Insurance In-Force | Written Premium In-Force | FIRM Effective Date | Floodplain Ordinance/ Manager | CRS Ranking |
|---|---|---|---|---|---|---|
| Okanogan County | 231 | $53,912,000 | 162,720 | 1/02/03 | Planning Dept. (509)422-7160 | Not in |
| Brewster | 3 | $1,700,000 | 8,279 | 8/9/1999 | Building Inspector (509)422-3600 | Not in |
| Conconully | 24 | $3,456,200 | 18,330 | 1/2/2003 | Building Inspector (509)689-3464 | Not in |
| Okanogan | 64 | $9,883,200 | 79,606 | 8/2/1995 | Clerk/Treasurer (509)826-6005 | Not in |
| Omak | 10 | $2,032,400 | 8,078 | 11/16/1982 | Public Works Director (509)826-1170 | Not in |
| Oroville | 20 | $3,574,300 | 15,977 | 11/16/1982 | Building Inspector (509)476-2929 | Not in |
| Riverside | 9 | $1,204,400 | 9,668 | 1/5/1982 | Clerk/Treasurer (509)826-4670 | Not in |
| Tonasket | 12 | $1,562,800 | 9,551 | 1/5/1978 | Building Inspector (509)-486-2132 | Not in |
| Twisp | 10 | $2,500,400 | 5,232 | 7/18/1977 | Public Works Inspector (509)997-4081 | Not in |
| Winthrop | 6 | $1,263,700 | 7,221 | 11/2/1977 | Building Inspector (509)996-2320 | Not in |

Overall participation by individuals and business in the NFIP appears to be low relative to the number of structures within the floodplain. Potential reasons are:

- A lack of knowledge about the existence of the availability of low cost flood insurance.
- Home and business owners unaware of their vulnerability to flood events.
- Current cost of insurance is prohibitive.

The first two reasons can be addressed through public education. The third could be addressed by all communities in the county taking advantage of the Community Rating System (CRS). To encourage communities to go beyond the minimum requirements and further prevent and protect against flood damage, the NFIP established the Community Rating System (CRS). To qualify for CRS, communities can

do things like make building codes more rigorous, maintain drainage systems, and inform residents of flood risk. In exchange for becoming more flood-ready, the CRS community's residents are offered discounted premium rates. Based on your community's CRS ratings, you can qualify for up to a 45% discount of your annual flood insurance premium.

### Local Event History

**Spring 1894 Flood** - The flood of 1894 was probably the largest flood event in Okanogan County's recorded history; however, there is limited information available. It is known that the town of Conconully was completely destroyed, which included 1 life lost, 42 buildings destroyed, and approximately $100,000 in property damages. This flood also affected the Okanogan, Methow, and Similkameen River systems causing damage to many of the settlements in the area at the time. Eyewitness accounts claim that the present site of Oroville was covered with water 10 to 15 feet deep as the Similkameen emptied so much water into the Okanogan River that Lake Osoyoos backed up into Canada. It should be noted that, with the exception of ranches along the Similkameen and Okanogan Rivers, and damage to a few of the small towns, the flood of 1894 did less damage in the County than subsequent runoffs in 1948 and 1972. This was due to most of the development at the time being in the hills rather than in towns along the rivers as they are now.

**May 1948 Flood** – Snowmelt flooding broke lake and river records in Eastern Washington and along the Columbia River to the Pacific Ocean. The Columbia River below Priest Rapids, WA, established a new flood of record at 458.65 feet (flood stage 432.0 feet). The Methow River at Pateros WA, established a new flood of record at 12.30 feet (flood stage 10.0 feet). The flood lasted 45 days. Most notable for wiping out the community of Vanport in North Portland in less than one hour as dikes along the Columbia River gave way. Vanport, America's largest wartime housing project, was not rebuilt.

Recurrence interval of this Columbia River flood projected at 30 years. A number of hydroelectric dams constructed on the Columbia after this event also control flooding, reducing the probability of flooding along much of the length of the river in Washington.

**May 1972 Flooding** – Snow melt in north-central Washington counties of Chelan, Douglas, and Okanogan, combined with heavy rains, produced major flooding on the Okanogan and Methow Rivers in Okanogan County and the Entiat River in Chelan County. All three rivers reached record flood stages. Recurrence intervals for flood levels are not available for this disaster.

**May 1989 Flood -** Federal Disaster #822. Stafford Act disaster assistance provided – $3.8 million.

Flooding and heavy rainfall affected Douglas, Okanogan, Stevens, and Whitman Counties. Roads and utilities heavily damaged in four rural counties. Mud from flooding impaired the city of Bridgeport's sewage treatment facility for months. Two million dollars in damage to public facilities. Recurrence intervals for flood levels are not available for this disaster.

**December 1996 – January 1997 Flood** – Federal Disaster #1159. Stafford Act disaster assistance provided – $83 million. Small Business Administration loans approved – $31.7 million. Saturated

ground combined with snow, freezing rain, rain, rapid warming and high winds within a five-day period to cause flooding.

Impacted counties – Adams, Asotin, Benton, Chelan, Clallam, Clark, Columbia, Cowlitz, Douglas, Ferry, Franklin, Garfield, Grant, Grays Harbor, Island, Jefferson, King, Kitsap, Kittitas, Klickitat, Lewis, Lincoln, Mason, Okanogan, Pacific, Pend Oreille, Pierce, San Juan, Skagit, Skamania, Snohomish, Spokane, Stevens, Thurston, Walla Walla, Whatcom, Whitman, and Yakima.

Significant urban flooding occurred north of Pierce County; significant river flooding occurred south of Pierce County; severe groundwater flooding took place in Pierce and Thurston Counties. Twenty-four deaths; $140 million (est.) in insured losses; 250,000 people lost power. More than 130 landslides occurred between Seattle and Everett, primarily along shorelines. Interstate 90 at Snoqualmie pass closed due to avalanche.

**October 2003 Flood** – Heavy rainfall caused severe flooding in Chelan, Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Mason, Okanogan, Pierce, San Juan, Skagit, Snohomish, Thurston and Whatcom counties. Most severe flooding took place along the Skagit River. Record flood levels were set on the Skagit River at Concrete, Sauk River, and Stehekin River.

More than 3,400 people were evacuated. Thirty-three homes were destroyed, 112 homes had major damage, with property damage estimated at $30 million. Numerous federal, state and county roads were damaged by landslides and floodwaters.

### Probability of Future Occurrence

The probability of flood events occurring in Okanogan County is high. Low magnitude flood events can be expected several times each year. However, due to the flat topography and drainage infrastructure, the impacts of these events are slight and usually amount to minor and temporary traffic issues throughout the County. Larger magnitude and high impact flood events have occurred, but are not likely in any given year. These types of flood events have the highest probability of occurrence in the winter or early spring. Minor flash flood events are expected annually most likely as a result of summer thunderstorms or rain-on-snow events.

Okanogan County is not considered to be one of the counties most at risk and vulnerable to flood in Washington according to the State of Washington Hazard Mitigation Plan. It is also not in the top percentage of Washington counties having a high frequency of floods causing damage. The Washington State Hazard Mitigation Plan also reports that Okanogan County has 2 repetitive loss properties. Properties receiving two or more claim payments of more than $1,000 from the National Flood Insurance Program within any rolling 10-year period are considered repetitive loss properties by FEMA.[47] Okanogan County strictly regulates new construction within the known floodplains throughout the county. Over the past century, much of the land within the floodplain has been converted to agriculture

[47] Washington Military Department Emergency Management Division. Washington State Enhanced Hazard Mitigation Plan. Available online at http://www.emd.wa.gov/plans/washington_state_hazard_mitigation_plan.shtml. Accessed October, 2012.

and therefore limits this landscape to other development types. Therefore, no major development has occurred since the previous version of this plan.

### Impacts of Flood Events

There are a number of large, swift bodies of water in Okanogan County, however the probability of a flood-related fatality is low. Nevertheless, flash flood events in particular or accidents could result in a death or injury. First responders or other persons could be pinned under debris and drowned or receive trauma from debris being carried along the waterway. Once flood waters recede, mold can grow in wet material causing a public health hazard. Flood waters may contain sewage and hazardous chemicals that could be left on people's property following a flood event. Furthermore, water and food may be contaminated and heat and electricity may be inoperable for a period of time. Although the probably of these types of impacts occurring at a moderate to large scale is very low, all of these factors could contribute to a decline in current and long term health of Okanogan County residents.

The continuity of operations for Okanogan County and most other jurisdictions within the county will not be compromised due to a flood event. The delivery of some services may be hindered by localized flooding in certain areas; however, due to the availability of alternative routes, this is not a significant concern. Damage to facilities, equipment, or files could impact certain organizations or public services depending on the extent of damage and duration of the event.

Flood events in Okanogan County are most likely to affect private property by damaging homes, businesses, barns, equipment, livestock, and vehicles. Both water and contaminants can damage or permanently ruin equipment. Flood waters can also erode land. This particularly an issue when lands supporting roads, power lines, pipelines, sewage control facilities, levees, bridges, and other infrastructure are damaged by erosion.

In Okanogan County, it is unlikely that flood events would cause any long-term environmental impacts. Some environmental impacts that may be realized by localized flooding could include erosion of stream banks, loss of riparian plant life, or contamination by chemicals or sewage. Flooding in some areas may have some environmental benefits such as establishing meanders that slow the streamflow, replenishing wetland areas, and replenishing the soil with nutrients from sediment.

Flooding in Okanogan County is not likely to have a significant or long-term effect on the local economy. Depending on the magnitude of the event, individual residents and businesses may be adversely impacted, but the economic viability of the community will not be affected. Severe damage to transportation infrastructure may have an short-term impact on certain communities due to the presence of state and U.S. highway routes, but alternative routes are available.

### Value of Resources at Risk

There are approximately 4,412 parcels within the 100-year flood zone (1% chance of flooding in any given year) in Okanogan County, yielding a total improvement value of $506.9 million. However, none of these parcels have been identified as repetitive loss properties in the County. Additionally, there are no identified repetitive loss properties in any of the incorporated cities or any of the other adopting

jurisdictions or special districts. The average damage to structures was estimated based on the parcel's location as either completely within or out of the flood zone. The damage to the contents of the structures was estimated at ½ the losses to the parcels. In reality, the damages will most likely not be equally distributed between buildings based on building materials, building location, and flood location. However, these estimates provide a basic approximation.

Approximately $148.3 million of residential properties and infrastructure and $68.4 million of contents is located within the flood zone. The total value of resources at risk to flood is approximately $506.9 million affecting 17,929 acres in Okanogan County.

## *Earthquake Profile*

Washington ranks second in the nation after California among states vulnerable to earthquake damage according to a Federal Emergency Management Agency study. The study predicts Washington is vulnerable to an average annual loss of $228 million per event. Earthquakes in Eastern Washington are typically shallow, crustal type, and are the least understood of all earthquake types. Okanogan County contains many minor faults; however, generally speaking, only the westernmost edge of the County is at a high risk of experiencing a damaging earthquake relative to the rest of Washington State.

Figure 5.3 depicts an assessment of Earthquakes, and Fault Zones developed by Northwest Management, Inc. for Okanogan County. This geographic assessment includes fault lines mapped across Okanogan County. As can be seen, most of the fault lines in the County have a north-south orientation and usually follow a drainage.

Based on historical records, Okanogan County has not experienced any seriously damaging earthquakes in recorded history. Several distant earthquakes produced intensities strong enough to be felt in central Washington, but no earthquake epicenters were recorded for the region.[48] All earthquakes east of the Cascades have been shallow and most are at depths less than 6 kilometers. The largest earthquake in central Washington since 1969 was a shallow, magnitude 4.6 event northwest of Omak on November 18, 2011. Some of the most active earthquake areas east of the Cascades are near Entiat, south of Lake Chelan, and in the Saddle Mountains, south of Vantage. Many of the earthquakes in eastern Washington occur in clusters near the Saddle Mountains in folded volcanic rocks, which were extruded in southeastern Washington from 16.5 to 6 million years ago.[49]

### Probability of Future Occurrence

As seen in Figure 5.3, the probability for Okanogan County to experience a magnitude 5 or higher earthquake in the next 50 years is approximately between 18% and 40%.

[48] Noson, Linda Lawrance, et al. Washington State Earthquake Hazards. Washington Division of Geology and Earth Resources Information Circular 85. Olympia, Washington. 1988.

[49] Noson, Linda, et al. 1988. "Washington State Earthquake Hazards". Washington Division of Geology and Earth Resources. Olympia, Washington. Information Circular 85.

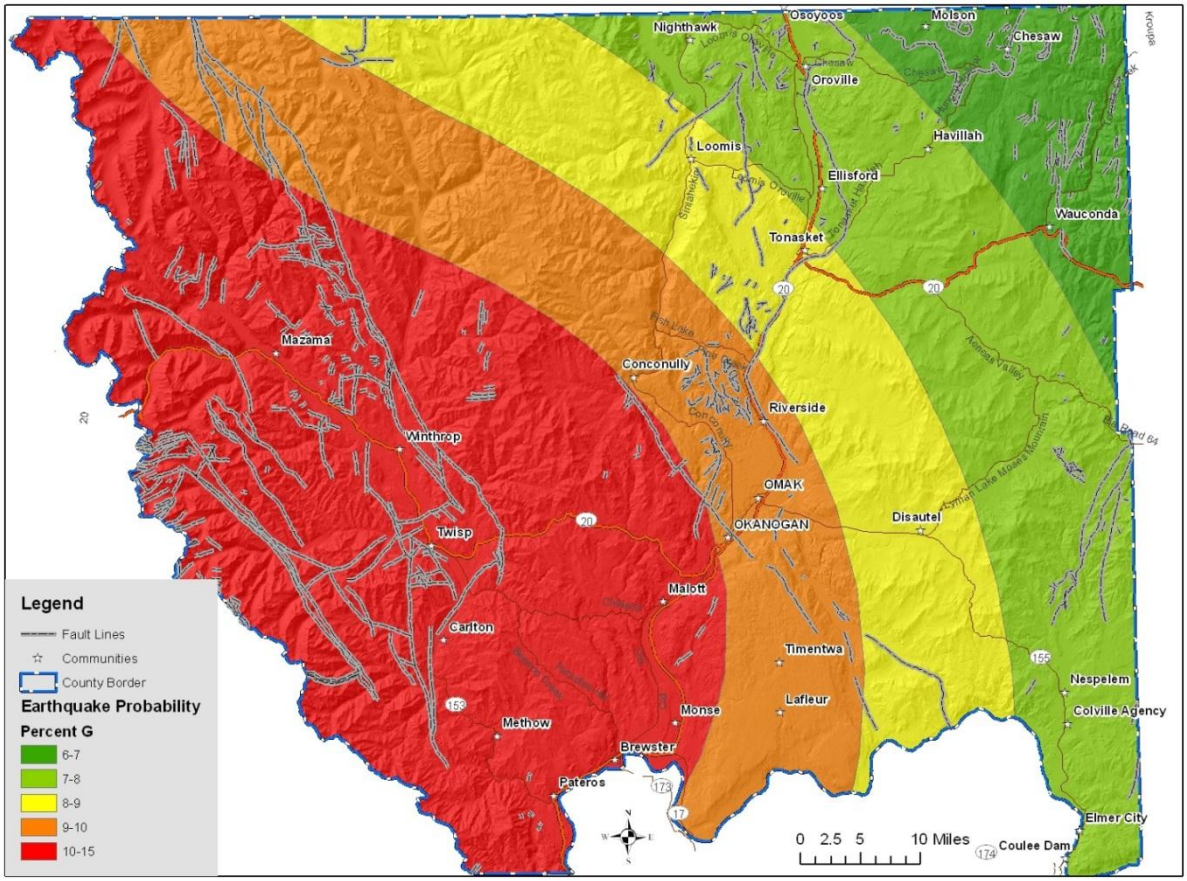
No specific jurisdictions or special districts including the Colville Indian Reservation were identified as having differing issues or levels of risk associated with this hazard.

Past events suggest that an earthquake in the Okanogan County area would cause little to no damage. Most crustal earthquakes are in 5.0 to 5.5 magnitude range, and do not have a history of occurrence in the County. Nonetheless, severity can increase in areas that have softer soils, such as unconsolidated sediments. Damage would be negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; and considerable in poorly built or badly designed structures.

There are several known geologic folds in the western part of Okanogan County. These folds reach into the County from the north and dead-end. Peak ground acceleration (pga) in percent g is a measure of the ground motion, which decreases, the further you are from the earthquake. The USGS Shaking Hazard maps for the United States are based on current information about the rate at which earthquakes occur in different areas and on how far strong shaking extends from quake sources. Colors on the map show the levels of horizontal shaking that have a 1 in 10 chance of being exceeded in a 50-year period. Shaking is expressed as a percentage of "g" (g is the acceleration of a falling object due to gravity). This map is based on seismic activity and fault-slip rates and takes into account the frequency of occurrence of earthquakes of various magnitudes. Locally, this hazard may be greater than that shown, because site geology may amplify ground motions. As seen in Figure 5.3, much of the western third of Okanogan County has 10% chance of exceeding a 10-15% pga in the next 50 years. This trends downwards to a 6-7% pga towards the northeastern corner of the County.[50] No specific jurisdictions or special districts were identified as having differing issues or levels of risk associated with this hazard.

[50] USGS. 2008 United States National Seismic Hazard Maps. U.S. Geological Survey. U.S. Department of Interior. Available online at http://earthquake.usgs.gov/hazards/products/conterminous/2008/. October 2009.

**Figure 5.3. Regional Earthquake Probability Map.**



### Impacts of Earthquake Events

Past events suggest that an earthquake in the Okanogan County area would cause little to no damage. Nonetheless, severity can increase in areas that have softer soils, such as unconsolidated sediments.

Although unlikely in Okanogan County, buildings that collapse can trap and bury people, putting lives at risk and creating clean-up costs. Upgrading existing buildings to resist earthquake forces is more expensive than meeting code requirements for new construction; thus, a high number of structures in Okanogan County, particularly those built prior to seismic code requirements, remain at risk. Many critical facilities are housed in older buildings that are not up to current seismic codes.

Communities in Okanogan County can expect some structural failure of older multistory unreinforced masonry buildings as a result of even lower intensity earthquakes. Cornices, frieze, and other heavy decorative portions of these types of structures may fail. The potential impacts of a substantial earthquake event are highly variable. Many of the structures and infrastructure throughout the county may not incur any damages at all; however, damage to roads, bridges, unreinforced masonry, chimneys, foundations, water lines, sewer lines, natural gas pipelines, and many other components are at risk. Fires can also be a secondary hazard to structures sustaining earthquake damage. The economic losses to business in the area may be very high of owners are forced to stop production or close their doors for even just a day.

Because structural damage by earthquakes is typically not complete destruction, but rather tends to be subtle cracking or settling that undermines the stability of the structure. These types of repairs can be very costly. Additionally, changes to the water table or even the topography can significantly impact local municipal and private wells and could result in the loss of traditional land uses.

### Value of Resources at Risk

HAZUS®-MH MR5[51] is a regional earthquake loss estimation model that was developed by FEMA and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake loss estimations at a regional scale. In order to estimate potential earthquake losses in Okanogan County, HAZUS was used to model a scenario based on the parameters of the nearest historic epicenter. The modeled earthquake occurred near Okanogan, Washington (latitude 47.90, longitude -120.3) and was a 7.3 magnitude shallow crustal event, i.e. the most likely type of earthquake event to occur in Okanogan County. The HAZUS model estimated direct earthquake damages, induced earthquake damage, social impacts, and economic losses. It should be noted that the figures have a high degree of uncertainty and should only be used for general planning purposes.

For the modeled earthquake scenario, the HAZUS software reported no expected damage to essential facilities including hospitals, schools, emergency operations centers, police stations, and fire stations. There are an estimated 24,000 buildings in Okanogan County with a total building replacement value (excluding contents) of $2.6 billion. Approximately 93% of the buildings (and 76% of the building value) is associated with residential housing. The software also reported that 1,132 residential (including single

[51] FEMA. Hazuz®-MH MR5. Department of Homeland Security. Federal Emergency Management Agency, Mitigation Division. Washington, D.C. November 2010.

family) structures would be slightly damaged, 373 would be moderately damaged, 52 would be extensively damaged, and 5 would be completely damaged. An estimated 48 commercial buildings expected to incur slight damages 48, 25 with moderate damage, 5 with extensive damage, and 1 with complete damage. The majority of residential structures expected to be damaged are stick built and manufactured homes.

Casualty estimates were provided for three times of day (2:00 am, 2:00 pm, and 5:00 pm). These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. Only 3 to 4 injuries are forecasted, for each time period, requiring medical attention but no need for hospitalization.

The replacement value of the transportation and utility lifeline systems is estimated to be $3.2 billion and $1 billion, respectively. HAZUS estimated that no damages to the transportation system, potable water and electric power system, or the utility system facilities would be expected. The HAZUS model also does not project any casualties or sheltering as a result of the earthquake scenario.

**Table 5.2. Summary of Utility System Pipeline Damage from HAZUS.**

| System | Total Pipelines Length (kms) | Number of Leaks | Number of Breaks |
|---|---|---|---|
| **Potable Water** | 12,297 | 154 | 38 |
| **Waste Water** | 7,378 | 77 | 19 |
| **Natural Gas** | 4,919 | 26 | 7 |
| **Oil** | 0 | 0 | 0 |

HAZUS estimated the long-term economic impacts for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within Okanogan County. The total economic loss estimate for an earthquake of this magnitude (7.3) in Okanogan County is $37.8 billion, which includes building and lifeline related losses based on the region's available inventory.

HAZUS estimated that there would be approximately $7.4 million in economic losses attributed to bridge repairs, and $4.8 million in economic losses from repairs to airport facilities. Moderate economic losses are also expected due to repair of potable water distribution lines ($690,000), wastewater facilities and distribution lines ($1.33 million), natural gas distribution lines ($120,000), and electrical power facilities ($6 million).

Total building-related losses were estimated at $17.5 million and are broken into two categories; direct building losses and business interruption losses. Of the $17.5 million, 19% was attributed to business interruption losses. The largest loss was sustained by the residential occupancies which contributed over 64% of the total loss.

Unreinforced masonry (URM) structures and unreinforced chimneys of homes will likely be damaged in the event of an earthquake. Damaged or collapsed chimneys could result in the secondary hazard of fire. Nonstructural damage caused by falling and swinging objects may be considerable after any magnitude earthquake. Damage to some older, more fragile bridges and land failure causing minor slides along roadways may isolate some residents.

## *Landslide Profile*

"Washington State has six landslide provinces, each with its own characteristics. One of these provinces is the Okanogan Highlands, which extends from the slopes of the North Cascades in the west to the Selkirk Mountains in the northeast corner of the state. The primary slope stability problem in this province is in the sediments within and along the boundary of the highlands. Thick sections of sediments along the valleys of the Columbia, Spokane, and Sanpoil Rivers are the result of repeated damming of the Columbia River by lobes of the continental ice sheet and repeated catastrophic floods from breached ice dams. The occurrence of new landslides and the reactivation of old landslides increased dramatically with the filling of reservoirs behind the Grand Coulee and Chief Joseph dams. Drawdowns for flood control and power generation also trigger new landslides and/or reactivate and extend old ones. Some of the landslide complexes extend for thousands of feet along the lakeshores, have head scarps in terraces 300 feet or more above reservoir level and extend well below its surface. With landslide activity common along hundreds of miles of shoreline, one hazard in such a setting is water waves generated by fast-moving landslide masses."[52]

Okanogan County is identified as one of the jurisdictions that have the greatest vulnerability for landslides in the State of Washington Hazard Mitigation Plan, specifically along the west side of the County in the Cascade Mountains. Those that have occurred are generally associated with damage and/or blockage of a roadway. There are several recent reports of mudslides, avalanches, and landslides along the steep slopes of the North Cascades Highway. For this reason, the North Cascades stretch of State Route 20 is closed during the winter and the wetter parts of the spring and fall.

Much of the populated areas in Okanogan County are at risk to flooding, which often results in damaging landslides. Flash floods typically carry large amounts of debris, silt, and rocks that are deposited in downstream floodplains. Additionally, soil saturation ensuing from prolonged periods of rain or flooding can lead to slope instability. Cut and fill slopes, even those well outside of the flood plain, are particularly at risk to slides and/or slumping as a result of soil saturation. The Okanogan County Historical Society has records of several personal accounts of the damage caused by flash floods and the associated landslides and mass movement of silt and debris. One such account from a family living near Tonasket says that the silt from a 1926 flash flood filled their house to the windowsills and buried most of their farm equipment. There is also record of a large landslide at Toats Coulee in 1905; however, no further information was given. Areas that are generally prone to landslides are:

- On existing landslides, old or recent
- On or at the base or top of slopes
- In or at the base of minor drainage hollows
- At the base or top of an old fill slope
- At the base or top of a steep cut slope

While a large area of Okanogan County is at high risk to landslides (Figure 5.2), most of this area occupies the rural mountainous regions. Home and business development in the county has been mainly on lands

[52] Gerald W. Thorsen, Landslide Provinces in Washington, Engineering Geology in Washington Volume 1, Washington Division of Geology and Earth Resources Bulletin 78, 1989.

not at significant risk to landslides. The Methow River Valley has significantly more landslide risk than the Okanogan River Valley.

**Figure 5.4. 2006 Landslide due to Flash Flooding in Methow River Valley.**

Using the parcel information and asset values maintained by the Okanogan County Assessor's Office, overlaid with the Landslide Prone Landscapes map developed by Northwest Management, Inc. and Okanogan County, we have completed an assessment of the assets at risk to damage from landslides in Okanogan County. Okanogan County has approximately $151.7 million of land and improvements and 479,629 acres within the landslide impact zones mapped in Figure 5.5.

**Figure 5.5. Landslide Impact Zones in Okanogan County.**

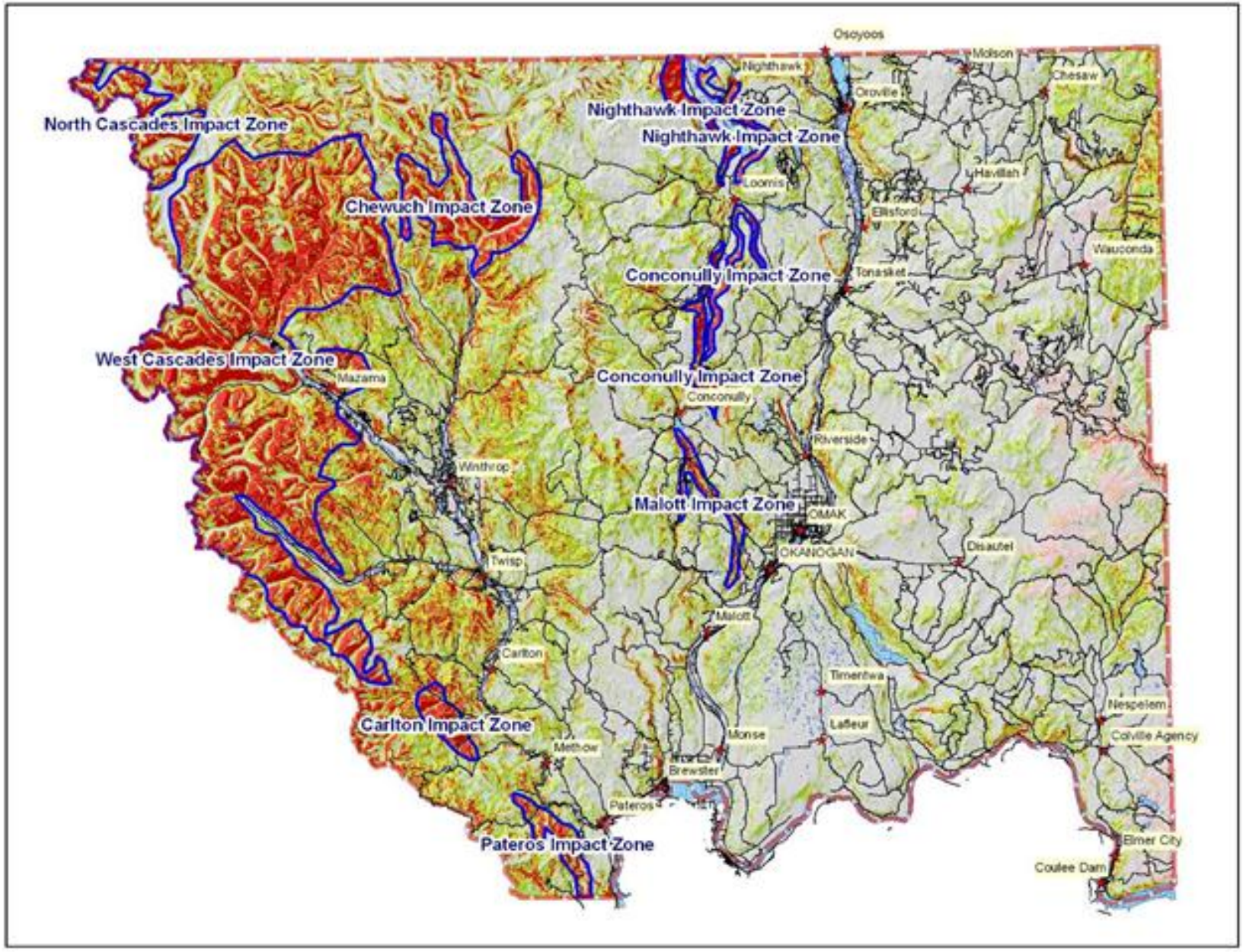
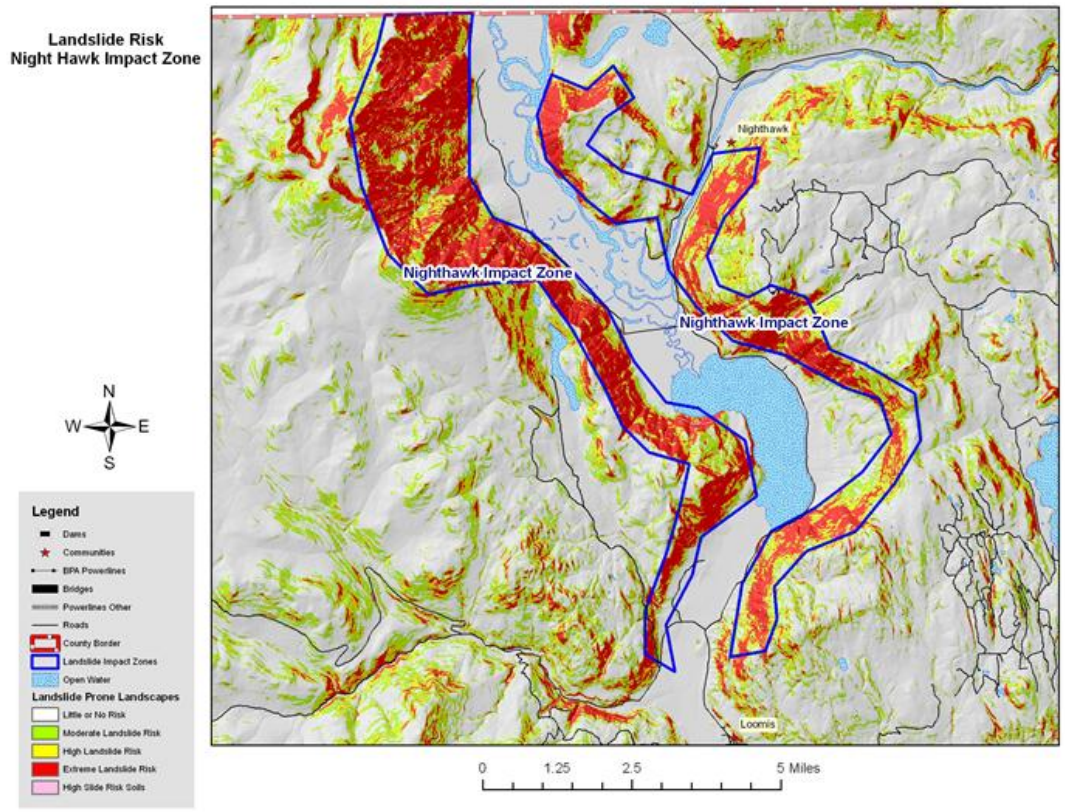
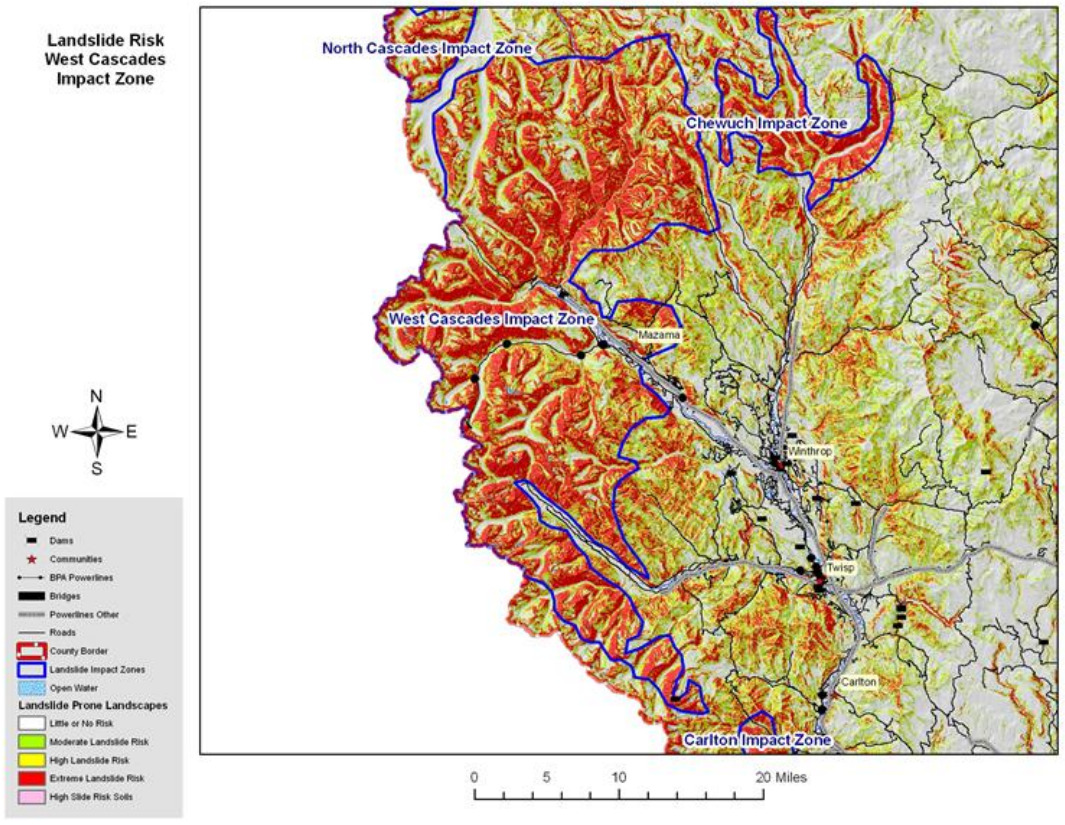


**Figure 5.6. Unincorporated Landslide Impact Areas of Okanogan County**



The majority of the population in Okanogan County has a low risk of landslides; however, homes and infrastructure located in or at the mouth of drainages have an elevated risk. Additionally, sections of some primary access routes are in low to moderate landslide prone areas. There is a moderate probability of small slides occurring on slopes ranging from 5-35%. This type of slide is common on the eyebrows of hills, especially where there has been soil disturbance. Generally, these low angle slides will have a low velocity and will not impact structures or infrastructure.

Soil factors that increase the potential for landslide are soils developed from parent materials high in schist and granite, and soils that are less permeable containing a resistive or hardpan layer. These soils tend to exhibit higher landslide potential under saturated conditions than do well-drained soils. To identify the high-risk soils in Okanogan County, the NRCS State Soils Geographic Database (STATSGO) layer was used to identify the location and characteristics of all soils in the County. The specific characteristics of each major soil type within the County were reviewed. Soils information that suggested characteristics pertaining to very low permeability and/or developed a hardpan layer and soils developed from schist and granite parent material were selected as soils with potential high landslide risk. High-risk soils magnify the effect slope has on landslide potential. Soils identified as having high potential landslide risk are further identified only in areas with slopes between 14° and 30° (25-60%). It is these areas that traditionally exhibit the highest landslide risk due to soil characteristics within a given landscape.

To portray areas of probable landslide risk due to slope related factors, slope models were used to identify areas of low, moderate and high risk. This analysis identified the low risk areas as slopes in the range of 20°-25° (36-46%), moderate as 26°-30° (48-60%) and high risk as slopes in the range of 31°-60° (60-173%). Slopes that exceeded 60° (173%) were considered low risk due to the fact that sliding most likely had already occurred relieving the area of the potential energy needed for a landslide. From the coverage created by these two methods, it is possible to depict areas of assumed risk and their proximity to development and human activity. With additional field reconnaissance the areas of high risk can be further defined by overlaying additional data points identifying actual slide locations, thus improving the resolution by specifically identifying the highest risk areas. This method of analysis is similar to a method developed by the Clearwater National Forest in north central Idaho.[53]

While a large area of Okanogan County is at high risk to landslides (Figure 5.8), most of this area occupies the rural mountainous regions. Home and business development in the county has been mainly on lands not at significant risk to landslides. The Methow River Valley has significantly more landslide risk than the Okanogan River Valley.

Many of the slopes and hillsides in these impact zones are comprised by material deposited by past landslides. In fact, much of the lower slopes near the valley floors are alluvial fans created by sediment being carried downstream and deposited at the mouths of the numerous small drainages. The presence of deposited material indicates the historic occurrence of high-energy, short duration floods and debris flows in these chutes in response to severe climatic conditions, such as thunderstorms and rain-on-snow events. These events are historically infrequent, with recurrence cycles on the order of years to decades. However,

[53] McClelland, D.E., et al. 1977. Assessment of the 1995 and 1996 floods and landslides on the Clearwater National Forest Part 1: Landslide Assessment. Northern Region U.S. Forest Service. December 1977.

they can result in significant damage to buildings and infrastructure, disrupt travel, reduce water quality, and jeopardize safety.

The largest landslides typically occur where human development or disturbance has exposed landslide-prone sediments to steep topography. The abundance of development within the Landslide Impact Zones, both residential and roadway, is likely further undermining the stability of the slope. Today, initiation and reactivation of landslides is closely tied to unusual climatic events and land-use changes. Even small landslide activity on the upper slopes can transform into high-energy debris flows that endanger roads, buildings, and people below. Landslide debris is highly unstable when modified through natural variations in precipitation, artificial cuts, fills, and changes to surface drainage and ground water.

Wildfires in theses impact zones could cause a domino effect of multiple hazards. Higher intensity fires not only remove most of the vegetation, but they also cause soils to become hydrophobic or water repellent for a period of time after the fire. This combination leads to unusually high runoff after rain showers or during the spring runoff season. As streams and rivers begin to reach and exceed flood stage, bank failures and channel migration are common. Road building and other soil disturbances tend to exacerbate this effect leading to even more severe land and soil slides.

### Local Event History

**May 2011 Landslide –** Dozens of Forest Service roads were impacted by landslides equating to $3.75 million in damages. Campgrounds were cutoff and crews had to scramble to open roads so campers could evacuate.

**June 2011 Landslide** – Five years after the Tripod fire, a wetter than average Spring caused a landslide that left high-water marks up to 40 feet on the canyon walls. There were no witnesses during the event but the miles of formerly forested canyon and the tons of debris spread over the agriculture fields below left little question as to what happened.

### Probability of Future Occurrence

Okanogan County does not have many documented landslides. Those that have occurred are generally associated with damage and/or blockage of a roadway. There are several recent reports of mudslides, avalanches, and landslides along the steep slopes of the North Cascades Highway. For this reason, the North Cascades stretch of State Route 20 is closed during the winter and the wetter parts of the spring and fall.

Much of the populated areas in Okanogan County are at risk to flooding, which often results in damaging landslides. There has been limited development in areas where landslides might be expected throughout the county. The majority of the landslide risk occurs in the more remote western half of the county. The landslide risk that occurs in the more inhabited portions of the county naturally limits the amount of development due to how steep and narrow the canyons are. These narrow canyons may only provide enough area for a road, for this reason roads are likely at the most risk to the effects of a landslide. Flash floods typically carry large amounts of debris, silt, and rocks that are deposited in downstream floodplains. Additionally, soil saturation ensuing from prolonged periods of rain or flooding can lead to slope instability. Cut and fill slopes, even those well outside of the flood plain, are particularly at risk to slides and/or

slumping as a result of soil saturation. The Okanogan County Historical Society has records of several personal accounts of the damage caused by flash floods and the associated landslides and mass movement of silt and debris. One such account from a family living near Tonasket says that the silt from a 1926 flash flood filled their house to the windowsills and buried most of their farm equipment. There is also a record of a large landslide at Toats Coulee in 1905; however, no further information was given.

### Impacts of Landslide Events

In Okanogan County, minor landslides along toe-slopes and roadways occur annually with minimal impact to local residents. Major landslides in western Okanogan County and along the steep river corridors could cause property damage, injury, and death and may adversely affect a variety of resources. For example, water supplies, fisheries, sewage disposal systems, forests, dams, and roadways can be affected for years after a slide event. The negative economic effects of landslides include the cost to repair structures, loss of property value, disruption of transportation routes, medical costs in the event of injury, and indirect costs such as lost timber and lost fish stocks.

Water availability, quantity, and quality can be affected by landslides and would have a very significant economic impact on Okanogan County. The loss or redistribution of water would affect agricultural crops grown in certain areas, ranching activities, and personal and municipal wells.

### Value of Resources at Risk

The cost of cleanup and repairs of roadways is difficult to estimate due to the variable circumstances with each incident including size of the slide, proximity to a State or County shop, and whether the slide occurred on the cut slope or the fill slope. Other factors that could affect the cost of the damage may include culverts, streams, and removal of debris. This type of information is impossible to anticipate; thus, no repair costs for damaged roadways have been estimated.

**Table 5.3. Landslide Impact Zones in Okanogan County.**

| Landslide Impact Zone | Number of Structures (Address Points) | Number of Infrastructure | Number of Affected Parcels | Number of Improvements | Value of Structures at Risk |
|---|---|---|---|---|---|
| Carlton Impact Zone | 4 | 0 | 42 | 8 | $488,900 |
| Chewuch Impact Zone | 0 | 0 | 104 | 0 | $0 |
| Conconully Impact Zone | 2 | 0 | 161 | 7 | $410,400 |
| Malott Impact Zone | 20 | 0 | 273 | 30 | $3,469,000 |
| Nighthawk Impact Zone | 2 | 0 | 266 | 24 | $1,141,200 |
| North Cascades Impact Zone | 0 | 0 | 75 | 0 | $0 |
| Pateros Impact Zone | 28 | 0 | 141 | 35 | $4,823,400 |
| West Cascades Impact Zone | 442 | 9 | 1810 | 487 | $85,200,900 |
| **Total** | **498** | **9** | **2886** | **591** | **$95,533,800** |

Slides in the identified Impact Zones are more likely to be larger and more damaging as weaknesses in the underlying rock formations give way. Although infrequent, this type of slide has the potential to not only block, but destroy road corridors, dam waterways, and demolish structures. The highest risk areas in these impact zones are typically at the higher elevations where slopes exceed 25% grade. There are numerous homes in each of these impact zones. Single slide events will not likely impact the entire population, but

rather individual structures. Many of the main access and secondary roads could also be at risk from slides initiating in these impact zones.

In the Landslide Impact Zones of Okanogan County there is $19.1 million tied up in agriculture, $8.1 million is classified as public, $900,900 is considered commercial, $662,600 is industrial, $12.8 million is recreational, $69.9 million is residential properties, and over $40.1 million is classified as vacant. Summaries of improvement value in each area are detailed in Table 5.3.

By far, the largest amount of the total value in the landslide impact zones of Okanogan County comes from residential development. There are 2,886 parcels contributing to the $95.5 million worth of the total assets in the residential category within the landslide impact zones of Okanogan County. The West Cascades Impact Zone (includes Mazama area) is at risk to experiencing the most damage from landslides; however, the Pateros, Conconully, Nighthawk, and Carlton Impact Zones, also have high asset values in the landslide impact zone. Residents in rural areas may also be affected, particularly near Conconully and in the unincorporated communities of Mazama, Nighthawk, and Loomis. Smaller scale slumps and road failures may also be an issue in some places around all Okanogan County communities. There are a total of 22 municipal water supplies located within the various landslide impact zones.

### *Severe Weather*

Severe weather in Okanogan County ranges from the commonly occurring thunderstorms to hail, high winds, tornadoes, drought, dense fog, lightning, and snow storms.

All of Okanogan County is at risk to severe winter weather events and there is a high probability of their continued occurrence in this area. Due to topography and climatologic conditions, the higher elevations are often the most exposed to the effects of these storms. Commonly, higher elevations in the County will receive snowfall, while valley areas may not. Periodically though, individual storms can generate enough force to impact the entire County at one time. From high winds to ice storms to freezing temperatures, there are all types of winter storms that take place during the course of any given year. Winter conditions can change very rapidly. It is not uncommon to have a snowstorm at night with sunshine the next day. Okanogan County is considered to be one of the County's most vulnerable to winter storms and blizzards in Washington according to the Washington State Hazard Mitigation Plan.[54]

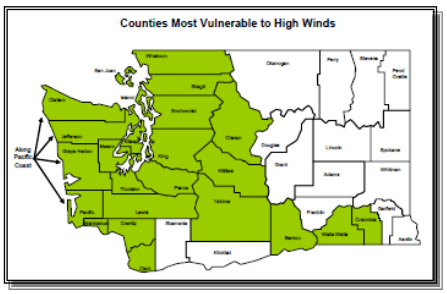
In Okanogan County, ice storms occur when a layer of warm air is between two layers of cold air. Frozen precipitation melts while falling into the warm air layer, and then proceeds to refreeze in the cold layer above the ground. If the precipitate is partially melted, it will land on the ground as sleet. However, if the warm layer completely melts the precipitate, becoming rain, the liquid droplets will continue to fall, and pass through a thin layer of cold air just above the surface. This thin layer of air then cools the rain to a temperature below freezing (0 °C). However, the drops themselves do not freeze, a phenomenon called supercooling. When the supercooled drops strike the ground or anything else below 0 °C, they instantly

[54] Washington Military Department Emergency Management Division. Washington State Hazard Mitigation Plan. Available online at http://www.emd.wa.gov/plans/washington_state_hazard_mitigation_plan.shtml. January 2008.

freeze, forming a thin film of ice that can build up on trees, utilities, roads, and other structures, infrastructure, and personal property.[55]

Due to their relative frequency and minimal severity, severe thunderstorms are not well documented in Okanogan County. Their impacts are fairly limited and do not significantly affect the communities enough to declare a disaster. The secondary impacts of thunderstorms, floods, are emphasized within the flood sections of this document. Areas most vulnerable to this type of storm are those subject to a strong southwesterly flow of moist, unstable air that generates strong, sometimes violent thunderstorms with one or more of the following characteristics: strong damaging winds, large hail, waterspouts, or tornados.

Hail can occur in any strong thunderstorm, which means hail is a threat everywhere. Hail is precipitation that is formed when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere. Large hail stones can fall at speeds faster than 100 miles per hour. Hail damage in Washington is very small in comparison with damage in areas of the central part of the United States. Often the hail that occurs does not grow to a size larger than one-half inch in diameter, and the areas affected are usually small. Quite often hail comes during early spring storms, when it is mostly of the small, soft variety with a limited damaging effect. Later, when crops are more mature and more susceptible to serious damage, hail occurs in widely scattered spots in connection with summer thunderstorms.




Windstorms are frequent in Okanogan County and they have been known to cause substantial damage. Under most conditions, the County's highest winds come from the south or southwest. Due to the abundance of agricultural development in Okanogan County, crop damage due to high winds can have disastrous effects on the local economy. In the case of extremely high winds, some buildings may be damaged or destroyed. Wind damages will generally be categorized into four groups: 1) structure damage to roofs, 2) structure damage from falling trees, 3) damage from wind blown dust on sensitive receptors, or 4) wind driven wildfires. Structural injury from damaged roofs is not uncommon in Okanogan County. Airborne particulate matter increases during high wind events. When this occurs, sensitive receptors including the elderly and those with asthma are at increased risk to complications. The National Weather Service defines high winds as sustained winds of 40 mph or gusts of 58 mph or greater, not caused by thunderstorms, expected to last for an hour or more. Areas most vulnerable to high winds are those affected by a strong pressure difference from deep storms originating over the Pacific Ocean; an outbreak of very cold, Arctic air originating over Canada; or air pressure differences between western and eastern Washington that primarily affect the Columbia River Gorge, Cascade Mountain passes, ridges and east slopes, and portions of the Columbia Basin. Okanogan County is

[55] Wikipedia. "Ice Storm". Wikimedia Foundation, Inc. March 2011. Available online at http://en.wikipedia.org/wiki/Ice_storm.

not considered to be one of the most vulnerable to high winds in Washington State according to the Washington State Hazard Mitigation Plan.[56]

Okanogan County and the entire region are at increased risk to wildfires during high wind events. Ignitions can occur from a variety of sources including downed power lines, lightning, or arson. Once ignited, only wildfire mitigation efforts around the community and scattered homes will assist firefighters in controlling a blaze. Details about wildfire mitigation are discussed in the wildland fire annexes of this Multi - Hazard Mitigation Plan.

A tornado is formed by the turbulent mixing of layers of air with contrasting temperature, moisture, density, and wind flow. This mixing accounts for most of the tornadoes occurring in April and May, when cold, dry air from the north or northwest meets warm, moister air moving up from the south. If this scenario was to occur and a major tornado was to strike a populated area in Okanogan County, damage could be widespread. Businesses could be forced to close for an extended period, and routine services such as telephone or power could be disrupted. The National Weather Service defines a tornado as a violently rotating column of air that contacts the ground; tornados usually develop from severe thunderstorms. Areas most vulnerable to tornado are those subject to severe thunderstorms or those with a recurrence rate of 5 percent or greater, meaning the County experiences one damaging severe thunderstorm event at least once every 20 years.

According to the Tornado Project[57] and the National Climatic Data Center[58], there were 5 reports of tornadoes in Okanogan County between 1880 and 2000. They occurred in May 1982 (F1), May 1987 (F1), July 1997 (F1), July 1997 (F1), and August 1997 (F0).

### Local Event History

**January 1950 "The January 1950 Blizzard" -** On this date, 21.4 inches of snow fell in Seattle, the second greatest 24-hour snowfall recorded. The snowfall was accompanied by 25-40 mph winds. The storm claimed 13 lives in the Puget Sound area. January had 18 days with high temperatures of 32 degrees or lower. The winter of 1949-50 was the coldest winter on record in Seattle, with an average temperature of 34.4 degrees. Eastern Washington, North Idaho, and parts of Oregon also were paralyzed by the snow – some lower-elevation snow depths reached nearly 50 inches and temperatures plunged into minus teens and twenties. Several dozen fatalities occurred.

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[56] Washington Military Department Emergency Management Division. Washington State Hazard Mitigation Plan. Available online at http://www.emd.wa.gov/plans/washington_state_hazard_mitigation_plan.shtml. January 2008.

[57] Tornado Project. 1999. St. Johnsbury, Vermont. Available online at http://www.tornadoproject.com/alltorns/watorn.htm#Columbia.

[58] National Climatic Data Center. 2012. *Storm Events Database*. NOAA Satellite and Information Service. U.S. Department of Commerce. Available online at http://www.ncdc.noaa.gov/stormevents/listevents.jsp?beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=2006&endDate_mm=12&endDate_dd=31&endDate_yyyy=2012&eventType=Tornado&county=OKANOGAN&zone=ALL&submitbutton=Search&statefips=53%2CWASHINGTON.

**1962 Columbus Day Wind Storm** – This storm is top weather event in Washington during the 20th Century according to the National Weather Service, Seattle Forecast Office. This storm is the greatest windstorm to hit the Northwest since weather recordkeeping began in the 19th century, and called the "mother of all wind storms" in the 1900s. The Columbus Day Storm was the strongest widespread non-tropical windstorm to strike the continental U.S. during the 20th century, affecting an area from northern California to British Columbia. The storm claimed seven lives in Washington State; 46 died throughout the impacted region. One million homes lost power. More than 50,000 homes were damaged. Total property damage in the region was estimated at $235 million (1962 dollars). The storm blew down 15 billion board feet of timber worth $750 million (1962 dollars); this is more than three times the timber blown down by the May 1980 eruption of Mount St. Helens, and enough wood to replace every home in the state. Gusts of 88 miles per hour were recorded at Tacoma before power was lost to the recording stations.

**February 1996 Severe Storm** – Federal Disaster #1100. Stafford Act disaster assistance provided was $113 million. Small Business Administration disaster loans approved totaled $61.2 million. Heavy rainfall, mild temperatures and snowmelt caused flooding and mudslides in Adams, Asotin, Benton, Clark, Columbia, Cowlitz, Garfield, Grays Harbor, King, Kitsap, Kittitas, Klickitat, Lewis, Lincoln, Pierce, Skagit, Skamania, Snohomish, Spokane, Thurston, Wahkiakum, Walla Walla, Whitman and Yakima counties, and the Yakama Indian Reservation. This storm caused major flooding on rivers of western and southeast Washington. Mudslides occurred throughout the state. There were three deaths recorded and 10 people injured. Nearly 8,000 homes damaged or destroyed. Traffic flow both east and west, and north and south along major highways was shut down for several days. Damage throughout the Pacific Northwest estimated at $800 million.

**December 1996 - January 1997 Severe Storm –** Federal Disaster #1159. Stafford Act disaster assistance provided was $83 million. Small Business Administration loans approved totaled 31.7 million. Saturated ground combined with snow, freezing rain, rain, rapid warming and high winds within a five-day period produced flooding and landslides. Impacted counties – Adams, Asotin, Benton, Chelan, Clallam, Clark, Columbia, Cowlitz, Douglas, Ferry, Franklin, Garfield, Grant, Grays Harbor, Island, Jefferson, King, Kitsap, Kittitas, Klickitat, Lewis, Lincoln, Mason, Okanogan, Pacific, Pend Oreille, Pierce, San Juan, Skagit, Skamania, Snohomish, Spokane, Stevens, Thurston, Walla Walla, Whatcom, and Yakima. There was twenty-four deaths; $140 million (est.) in insured losses; and 250,000 people lost power.

**2001 – Drought -** On March 14, 2001, Gov. Gary Locke authorized the Department of Ecology to declare a statewide drought emergency; Washington was the first Northwest state to make such a declaration, which remained in effect until December 31, 2001. The central part of the state, from the crest of the Cascade Mountains to the east banks of the Okanogan and Columbia Rivers, suffered the most from water shortages.

Among the impacts of the 2001 drought:

*Energy* – The drought decreased river flows, resulting in less electrical generation and tighter power supplies. Available out-of-state power was extremely expensive, causing higher rates and financial emergencies at many of the state's utilities. Bonneville Power Administration paid to keep electricity-

intensive industries including aluminum smelters to shut down. Many small-scale power generators were placed into emergency service throughout the state.

*Agriculture* – With stream flows below half of normal and groundwater levels threatened, there was significantly less water available for irrigation; irrigated land produces about 70 percent of the state's crops. The Governor's drought order authorized the Department of Ecology to exercise emergency powers to:

- Issue temporary emergency water-rights permits and change existing water rights for farmers in 13 counties.
- Reduce mandated minimum stream flows in the Columbia River basin, helping 300 farmers and saving several million dollars worth of crops.
- Authorize emergency wells in the Yakima River basin.
- Lease water to improve instream flows and subsequently improve water supplies for farmers in the Roza irrigation and Kittitas reclamation districts.

*Fish* – As the drought progressed, reduced stream flows caused numerous fish passage problems on the American River, Rattlesnake Creek, and other Yakima River tributaries. Some fish stocks were lost. To help Columbia River fish populations, the Bonneville Power Administration paid growers in the basin to remove 75,000 acres from agricultural production; this kept additional water in the river during the most critical drought months. Improvements were made at a number of hatcheries, and salmon and steelhead were moved out of two hatcheries that experienced water problems.

*Wildland fire* – Because of low moisture levels in forests, dry weather during the summer of 2001 resulted in 14 major fires that burned more than 178,000 acres of forest; total area burned was 223,857 acres.

**March 2009 Winter Storm** - President Obama declared that a major disaster exists in the State of Washington. This declaration made Public Assistance requested by the Governor available to State and eligible local governments and certain private nonprofit organizations on a cost-sharing basis for emergency work and the repair or replacement of facilities damaged by the severe winter storm and record and near record snow in Clallam, Clark, Columbia, Cowlitz, Garfield, Grays Harbor, Island, Jefferson, King, Klickitat, Lewis, Lincoln, Mason, Pacific, Pend Oreille, Skagit, Skamania, Snohomish, Spokane, Stevens, Thurston, Wahkiakum, Walla Walla, and Whatcom Counties.[59]

**July 2012 Severe Storm, Straight-line Winds and Flooding** - The U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) announced that federal disaster assistance was made available to Washington to supplement state, tribal, and local recovery efforts. Federal funding was available to state and eligible local governments and certain private nonprofit organizations on a cost-sharing basis for emergency work and the repair or replacement of facilities damaged by the severe storm,

[59] FEMA. 2009. *Severe Winter Storm and Record and near Record Snow*. FEMA 1825-DR. Available online at http://www.fema.gov/pdf/news/pda/1825.pdf.

straight-line winds, and flooding in Ferry and Okanogan counties and the Confederated Tribes of the Colville Reservation.

### Probability of Future Occurrence

The probability of Okanogan County experiencing a severe weather event on an annual basis is very high.

Extreme cold, snow accumulation, and wind events are common occurrences between November and March. Major winter storms are expected at least twice each year during the winter season; however, these weather patterns rarely last more than a few days. Severe ice storms also occur in Okanogan County during the winter months. Severe and damaging winter storms have occurred in Okanogan County twice in the last 4 years. The probability of this type of event is moderate to high annually.

Wind events are also common in Okanogan County and can occur throughout the year. Wind is often associated with winter storms during the winter and thunderstorms during the warmer months, but can also occur without additional storm influences. Significant wind events are expected 3-5 times annually.

Several major thunderstorms are expected in Okanogan County each year between April and September; however, these types of events rarely cause serious damage.

Okanogan County has a moderate probability of experiencing a damaging hail storm in any given year. These types of events most frequently occur in the spring, but can occur throughout the summer as well.

Tornadoes are relatively rare, but the conditions for a funnel cloud to form are reported in Okanogan County several times each year. Nevertheless, based on the historical record of tornadoes in this area, the probability for a small tornado to occur in Okanogan County is low. The probability of a higher magnitude tornado occurring in this area is extremely low.

### Impacts of Severe Weather Events

Winter storms with heavy snow, high winds, and/or extreme cold can have a considerable impact on Okanogan County; however, most residents are well accustomed to the severe winter conditions in this part of Washington. Power outages and unplowed roads are a frequent occurrence throughout many parts of the County, but most residents are prepared to handle the temporary inconvenience. Snow loads on roofs, ice-slides off of roofs onto vehicles or other buildings, and damaged frozen pipes are also potential hazards associated with winter weather. These events represent a significant hazard to public health and safety, a substantial disruption of economic activity, and a constant threat to structures during the winter months.

Okanogan County has experienced several “ice storms” in recent memory. The freezing rain from an ice storm covers everything with a heavy layer of ice that can cause hazardous road conditions resulting in numerous accidents. Trees have been heavily damaged as branches break from the weight of the ice. The weight of the ice can also snap power lines and bring down utility poles. The loss of power during the winter months can last from a few hours to a few days and is particularly dangerous for those relying on electrical heat. The loss of a heat source can cause hypothermia, frost bite, or even death and can also lead to damages caused by frozen pipes.

The potential impacts of a severe hail storm in Okanogan County include crop damage, downed power lines, downed or damaged trees, broken windows, roof damage, and vehicle damage. Hail storms can, in extreme cases, cause death by exposure. The most common direct impact from ice storms to people is traffic accidents. The highest potential damage from hail storms in Okanogan County is the economic loss from crop damage. Even small hail can cause significant damage to young and tender plants and fruit. Trees can also be severely damaged by hail.

So far, tornadoes have not had any serious impacts on Okanogan County residents. Minor damages may occur as a result of the high winds associated with a tornado.

### Value of Resources at Risk

It is difficult to estimate the cost of potential winter storm damages to structures and the economy in Okanogan County. Damage to roofs by heavy snow accumulations depends on the moisture content of the snow and the structural characteristics of the buildings. In general, snow in this region tends to have low moisture content because of the low temperatures and arid environment. Snow plowing in Okanogan County occurs from a variety of departments and agencies. The state highways are maintained by the State of Washington. Plowing of county roads is done by the County Road Department and the road departments of the individual cities. Okanogan County has developed a pre-determined list of critical routes in order to prioritize the plowing of arterials and other main access routes. Private landowners are responsible for maintaining their own driveways or other private roads.

Utility supplies are impacted during severe winter storms as power is lost on a regional basis. This has a two-fold impact on Okanogan County residents as not only is power cut to homes and businesses, but primary heating is lost for many residents. Gas furnaces and wood stoves supplement electrical heating, but with wood heating the senior population is at a disadvantage. Frozen water pipes are the most common damage to residential and business structures. Older homes tend to be at a higher risk to frozen water pipes than newer ones. More rural parts of the County are sometimes better prepared to deal with power outages for a few days due to the frequent occurrence of such events; however, prolonged failure, especially during cold winter temperatures can have disastrous effects. All communities should be prepared to deal with power failures. Community shelters equipped with alternative power sources will help local residents stay warm and prepare food. A community-based system for monitoring and assisting elderly or disabled residents should also be developed. All households should maintain survival kits that include warm blankets, flashlights, extra batteries, nonperishable food items, and clean drinking water.

Emergency response to severe winter storms includes site visits by police or fire department personnel, opening of shelters, or assistance with shopping, medical attention, and communications. The economic losses caused by severe winter storms may frequently be greater than structural damages. Employees may not be able to travel to work for several days and businesses may not open. Damages are seen in the form of structural repair and loss of economic activity. Okanogan County schools are occasionally closed during and right after a severe winter storm because of cold temperatures and snow covered roads.

Thunderstorms do occur within Washington affecting all counties, but usually are localized events. Their impacts are fairly limited and do not significantly affect the communities enough to declare a disaster. The loss potential from flooding that results from severe thunderstorms can be significant in Okanogan County.

Although the financial impacts of hail can be substantial and extended, accurately quantifying these impacts is problematic. Hail typically causes direct losses to structures and other personal property as well as to the extensive agricultural development in Okanogan County. Potential losses to agriculture can be disastrous. They can also be very localized; thus, individual farmers can have significant losses, but the event may not drastically affect the economy of the County. Furthermore, crop damage from hail will also be different depending on the time of year and the type of crop. Most farmers carry insurance on their crops to help mitigate the potential financial loss resulting from a localized hail storm. Federal and state aid is available for County's with declared hail disasters resulting in significant loss to local farmers as well as the regional economy. Homeowners in Okanogan County rarely incur severe damage to structures (roofs); however, hail damage to vehicles is not uncommon. The damage to vehicles is difficult to estimate because the number of vehicles impacted by a specific ice storm is unknown. Additionally, most hail damage records are kept by various insurance agencies.

It is difficult to estimate potential losses in Okanogan County due to windstorms and tornadoes. Construction throughout the County has been implemented in the presence of high wind events, and therefore, the community has a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

We have estimated losses based on wind and tornado damage as follows:

- 3% of the buildings damaged causing 50% of value loss (loss could be from downed or damaged trees, damaged outbuildings, damaged fences/poles, damage to siding, damaged landscaping etc.)
- 5% of the buildings received damage to roof (requiring replacement of roof equaling $3,000)

Damages associated with sensitive receptor irritation have not been estimated. We have also not estimated the potential for a large scale wildfire event associated with high winds. Based on the data provided by the County, there are 42,037 total structures in unincorporated Okanogan County with a total value of approximately $1.6 billion. Using the criteria outlined above an estimate of the impact of high winds on the County has been made. The potential wind and tornado damage to all buildings is estimated at approximately $24.3 million. The estimated damage to roofs is approximately $6.3 million.

## *Wildland Fire Profile*

*The Okanogan County Community Wildfire Protection Plan[60] provides a comprehensive analysis of the wildland fire risks and recommended protection and mitigation measures for all jurisdictions in Okanogan County. The information in the "Wildland Fire" sections of this Okanogan County Annex is excerpted from that more detailed document.*

Okanogan County is located in northcentral Washington. The county encompasses approximately 5,315 square miles and has an elevation range from approximately 950 feet to the County's highest point Mt. Gardner which is 8,956 feet above sea level. Land is owned by private individuals, corporations, the state of

[60] Bloch, Vaiden, T. King and B. Tucker. 2012. Okanogan County Community Wildfire Protection Plan. Northwest Management, Inc.. Moscow, Idaho.

Washington, and the federal government. Federal lands are managed by the Bureau of Land Management, National Park Service, Forest Service, and the Bureau of Reclamation. State lands include parcels managed by the Washington Department of Natural Resources and Washington Department of Fish and Wildlife. Okanogan, the largest county in the state, is bordered on the west by Whatcom and Skagit Counties, to the southwest by Chelan County, to the south by Douglas County, to the southeast by Lincoln County, to the east by Ferry County, and to the north by British Columbia. Today's landscape emerged from the melting ice about 10,000 years ago. The central portion of the County lies within the channeled scablands of the Columbia Basin, a region formed by ice age flooding and wind blown volcanic ash. Many small pothole lakes are scattered throughout the scoured basalt scablands located near the Okanogan and Columbia Rivers. Forestlands in the northeast corner roll like the high seas. The Okanogan Mountain Ranges are considered to be part of the foothills to the Rocky Mountains. The troughs between the mountains in this area channel water into the Columbia River system. The rivers in Okanogan County are following paths carved by Ice Age glaciers. Mile-high ice sheets surging south from Canada drowned all but the tallest peaks several times during the last two million years. The ice ground off sharp edges, leaving many of the mountains well rounded.

Cover vegetation and wildland fuels exhibited across the county have been influenced by massive geologic events during the Pleistocene era that scoured and shifted the earth's surface leaving areas of deep rich soil interspersed with rocky mountains and deep valleys. In addition to the geological transformation of the land, wildland fuels vary within a localized area based on slope, aspect, elevation, management practices, and past disturbances. Geological events and other factors have created distinct landscapes that exhibit different fuel characteristics and wildfire concerns.

Okanogan County has three predominant landscape types that exhibit distinct terrain and wildland fuels: forested highlands, shrub covered hills, and fertile valleys. These landscapes, although intermixed in some areas, exhibit specific fire behavior, fuel types, suppression challenges, and mitigation recommendations that make them unique from a planning perspective.

The gentle terrain that occurs in Okanogan County facilitates farming and ranching operations. Agricultural fields occasionally serve to fuel a fire after curing; burning in much the same manner as low grassy fuels. Fires in grass and rangeland fuel types tend to burn at relatively low intensities with moderate flame lengths and only short-range spotting. Common suppression techniques and resources are generally quite effective in this fuel type. Homes and other improvements can be easily protected from direct flame contact and radiant heat through adoption of precautionary measures around structures. Rangelands with a significant shrub component will have much higher fuel loads with greater spotting potential than grass and agricultural fuels. Although fires in agricultural and rangeland fuels may not present the same control problems as those associated with large, high intensity fires in timber, they can cause significant damage if precautionary measures have not been taken prior to a fire event. Wind driven fires in these fuel types spread rapidly and can be difficult to control. During extreme drought and when pushed by high winds, fires in agricultural and rangeland fuels can exhibit extreme rates of spread, which complicates suppression efforts.

Forest and woodland fuels are mostly present in the mountainous terrain less favorable to clearing for agricultural development. A majority of the forests within the County are located in the western half and

northeast corner of the County. Wooded areas tend to be on steep terrain intermingled with grass and shrubland providing an abundance of ladder fuels which lead to horizontal and vertical fuel continuity. These factors, combined with arid and windy conditions characteristic of the river valleys in the region, can result in high intensity fires with large flame length and fire brands that may spot long distances. Such fires present significant control problems for suppression resources and often results in large wildland fires.

Since the previous Community Wildfire Protection Plan, development is rapidly occurring along the Okanogan, Methow, and Columbia Rivers. Many people have purchased small tracts of land in these locations and built dwellings amongst the trees and shrubland. Some lots are being sold in the more mountainous areas outside of the cities for vacation homes. Scenic vistas and rolling topography with close proximity to Okanogan National Forest makes these areas desirable. However, the risk of catastrophic loss from wildfires in this area is significant. Fires igniting along the bottom of the canyon have the potential to grow at a greater rate of speed on the steeper slopes and rapidly advance to higher elevations. Within the forest and woodland areas, large fires may easily produce spot fires up to 2 miles away from the main fire, compounding the problem and creating fires on many fronts. Fire suppression efforts that minimize loss of life and structures in this area are largely dependent upon access, availability and timing of equipment, prior fuels mitigation activities, and public awareness.

## Local Event History

Detailed records of fire ignitions and extents have been compiled by the Washington Department of Natural Resources and the federal agencies within the County. Using the data on past fire extents and ignition, the occurrence of wildland fires in the region of Okanogan County has been evaluated.

**Table 5.4. Summary of ignitions in Okanogan County from Washington DNR database 1972-2012.**

| Cause | Acres Burned | Percent | Number of Ignitions | Percent |
|---|---|---|---|---|
| Children | 1,608 | <1% | 40 | 1% |
| Debris Burning | 10,394 | 6% | 396 | 14% |
| Logging | 13 | <1% | 1,513 | 2% |
| Lightning | 99,168 | 59% | 26 | 52% |
| Miscellaneous | 52,710 | <1% | 463 | <1% |
| Recreation | 4,056 | 31% | 339 | 16% |
| Smoking | 1,093 | 2% | 50 | 12% |
| Arson | 444 | <1% | 62 | 2% |
| **Total** | **169,485** | **100%** | **2,889** | **100%** |

The Washington Department of Natural Resources database used in this analysis includes ignition and extent data from 1972 through 2012 for wildfires occurring on DNR protected lands. An analysis of the DNR reported wildfire ignitions in Okanogan County reveals that during this period over 169,000 DNR-protected acres burned as a result of nearly 3,000 wildfire ignitions. Humans contributed to the majority of ignitions through logging, debris burning, recreation, etc. while the most acres burned were caused by lightning. The majority of the acres burned in this category occurred in 1985 while the highest number of ignitions occurred in 2009. An average of 70 fires and 4,134 acres burned per year was recorded during this period.

The “Miscellaneous” category includes ignitions originating from burning material from aircraft, electric fence, hot ashes, spontaneous combustion (other than sawdust piles), use of fire (other than logging), woodcutting, and an “other” category.

**Figure 5.7. Washington DNR Recorded Ignitions 2003-2012.**

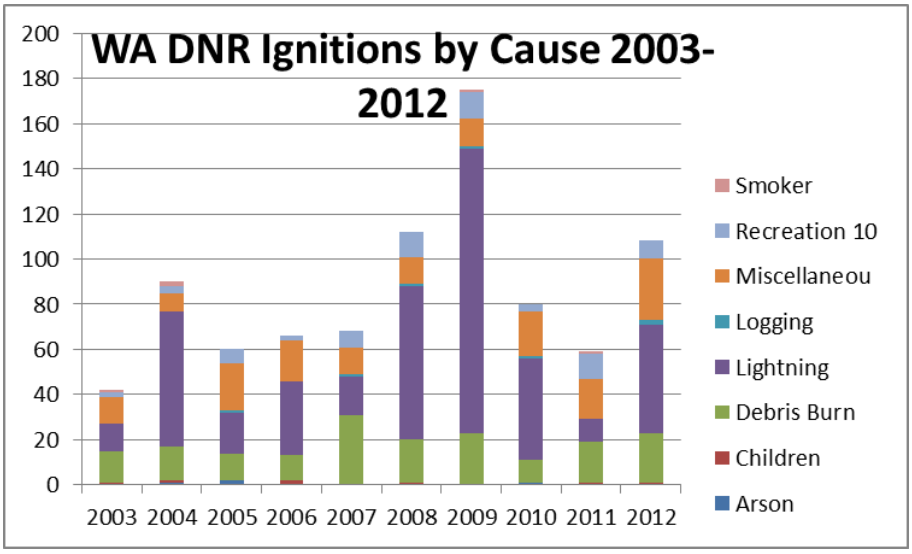
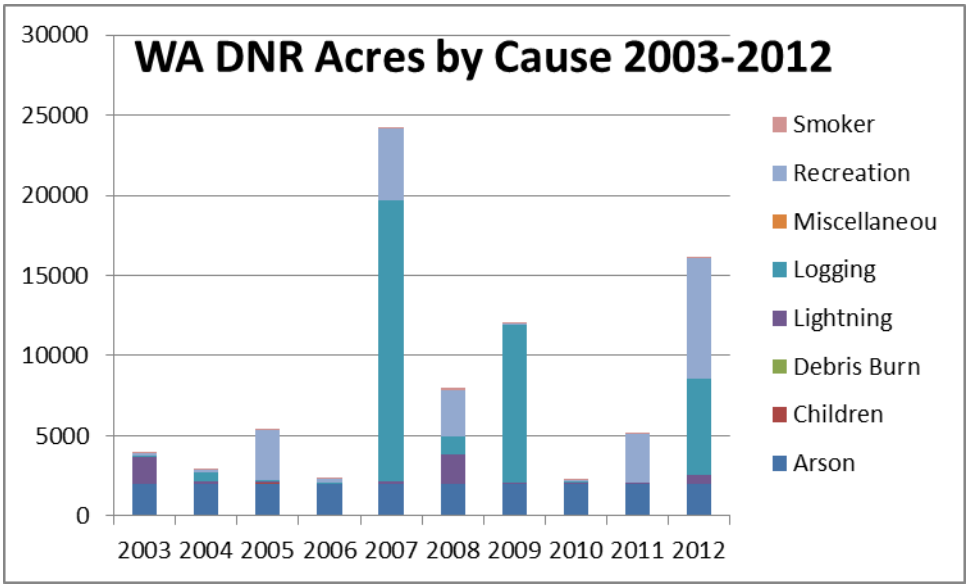
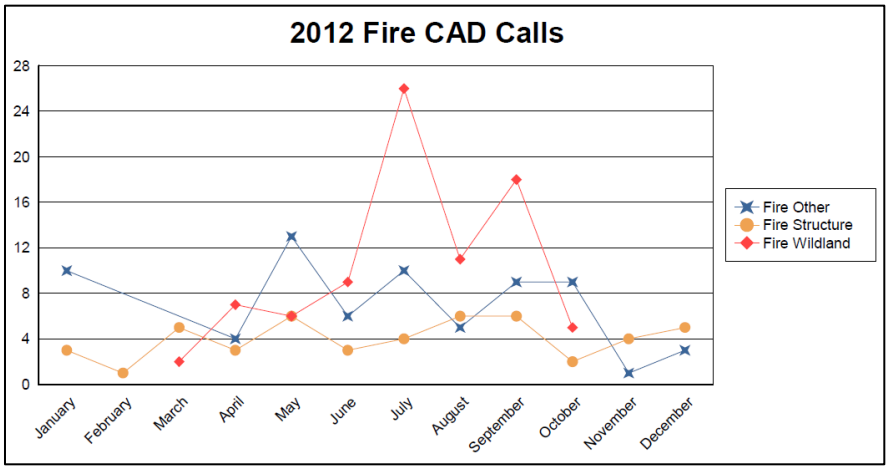



**Figure 5.8. Washington DNR Recorded Acres 2003-2012.**




In order to capture the full breadth of the wildfire ignitions in Okanogan County, ignition data was compiled from Okanogan County Dispatch records. This database includes ignition and extent data from Okanogan County Fire Districts during 2012. Although this data helps to more accurately describe the wildland fire potential in the County, many of the fires may have been included in the Washington DNR database.

**Figure 5.9. Okanogan County Dispatch Record of Fire Calls During 2012.**




This database augments the DNR's data by showing that a majority of the fire related calls received by dispatch are wildfires. The highest number of calls peak during the summer months.

## Probability of Future Occurrence

Fire was once an integral function of the majority of ecosystems in northeastern Washington. The seasonal cycling of fire across the landscape was as regular as the July, August and September lightning storms plying across the canyons and mountains. Depending on the plant community composition, structural configuration, and buildup of plant biomass, fire resulted from ignitions with varying intensities and extent across the landscape. Shorter return intervals between fire events often resulted in less dramatic changes in plant composition.[61] The fires burned from 1 to 47 years apart, with most at 5- to 20-year intervals.[62] With infrequent return intervals, plant communities tended to burn more severely and be replaced by vegetation different in composition, structure, and age.[63] Native plant communities in this region developed under the influence of fire, and adaptations to fire are evident at the species, community, and ecosystem levels. Fire history data (from fire scars and charcoal deposits) suggest fire has played an important role in shaping the vegetation in the Columbia Basin for thousands of years.

Ideally, historical fire data would be used to estimate the annual probability for fires in Okanogan County. However, current data are not adequate to make credible calculations because the data for local, state, and federal responsibility areas are not reported by the same criteria. Nevertheless, the data reviewed above provides a general picture of the level of wildland-urban interface fire risk for Okanogan County overall.

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[61] Johnson, C. G. 1998. Vegetation Response after Wildfires in National Forest of Northeastern Oregon. 128 pp.

[62] Barrett, J. W. 1979. *Silviculture of ponderosa pine in the Pacific Northwest: The state of our knowledge. USDA Forest Service*. General Technical Report PNW-97. Pacific Northwest Forest and Range Experiment Station. Portland, Oregon. 106pp.

[63] Johnson, C.G.; et al. 1994. *Biotic and Abiotic Processes of Eastside Ecosystems: the Effects of Management on Plant and Community Ecology, and on Stand and Landscape Vegetation Dynamics*. Gen. Tech. Report PNW-GTR-322. USDA-Forest Service. PNW Research Station. Portland, Oregon. 722pp.

Based on the historical information available, Okanogan County has a very high probability of wildland fires occurring on an annual basis, with larger fires occurring every 5 to 7 years.

Ignition potential is also high throughout the County. Recreational areas, major roadways, debris burning, and agricultural equipment are typically the most likely human ignition sources. Lightning is also a common source of wildfires in Okanogan County.

### Impacts of Wildland Fire Events

Wildland fires, big and small, are dangerous to both Okanogan County residents and emergency response personnel. Wildland fire suppression activities have a very high frequency of injuries, such as heat exhaustion and smoke inhalation, and have caused numerous deaths nationwide. Fire events in Okanogan County typically result in a multi-department and agency response effort; thus, coordinating activities and ensuring everyone's safety is paramount.

Local residents with property in the path of wildland fire will likely suffer the greatest impacts through loss of structures and/or the value of any timber or agricultural crops on their land. Many fires require an evacuation of nearby residences in order to ensure the safety of citizens. Evacuation procedures require the coordination of law enforcement and fire service organizations and may involve temporary sheltering in extreme cases.

Okanogan County, like most areas, has sensitive populations, such as elderly residents and children, who may be affected by air quality during a wildland fire. Smoke and particulates can severely degrade air quality, triggering health problems. In areas heavily impacted by smoke, people with breathing problems might need additional services from doctors or emergency rooms.

Commerce in Okanogan County and the rest of the region may also be interrupted by wildland fires. Transportation corridors will likely be temporarily closed or slowed due to a fire burning in the area. Heavy smoke from a wildfire several miles away could be dense enough to make travel unsafe on roadways.

The environmental impacts from a fire are dependent on the vegetation present and the intensity of the fire. Most of the rangeland and forest ecosystems present in Okanogan County are adapted to periodic fire events and are actually benefitted by occasional, low intensity burns. On the other hand, overcrowded forest conditions or over mature stands of sage brush will likely burn much more intensely than occurred historically. These types of fires tend to result in a high rate of mortality in the vegetation and often adversely impact soil conditions. High intensity fires are also much more dangerous and difficult to suppress.

Okanogan County is actively pursuing funds to help with wildland fire mitigation projects and public education programs. While mitigation efforts will significantly improve the probability of a structure's survivability, no amount of mitigation will guarantee survival.

### Value of Resources at Risk

It is difficult to estimate potential losses in Okanogan County due to wildland fire due to the unpredictability of wildfire behavior and the nature of ignition sources. It is impossible to forecast the path

a wildfire will take and what type of assets and resources, manmade and ecological, will be at risk. Thus, no value estimates were made for this hazard.

Typically, structures located in forested areas without an adequate defensible space or fire resistant landscaping have the highest risk of loss. Nevertheless, homes and other structures located in the grasslands or agricultural regions are not without wildfire risk. Grass fires are often the most dangerous due to high rates of spread. Fires in this fuel type are considered somewhat easier to suppress given the appropriate resources, but they can also be the most destructive.

## *City of Omak Annex*

### *Flood Profile*

The city of Omak is located on the west side of the Okanogan River. Even though the population center has residences, commercial, industrial, and agricultural located near the river's edge, the community does not have a large amount of properties that are within the 100 year flood zone. This is largely due to levees (in Omak only) and the steeper banks along this stretch of the river.

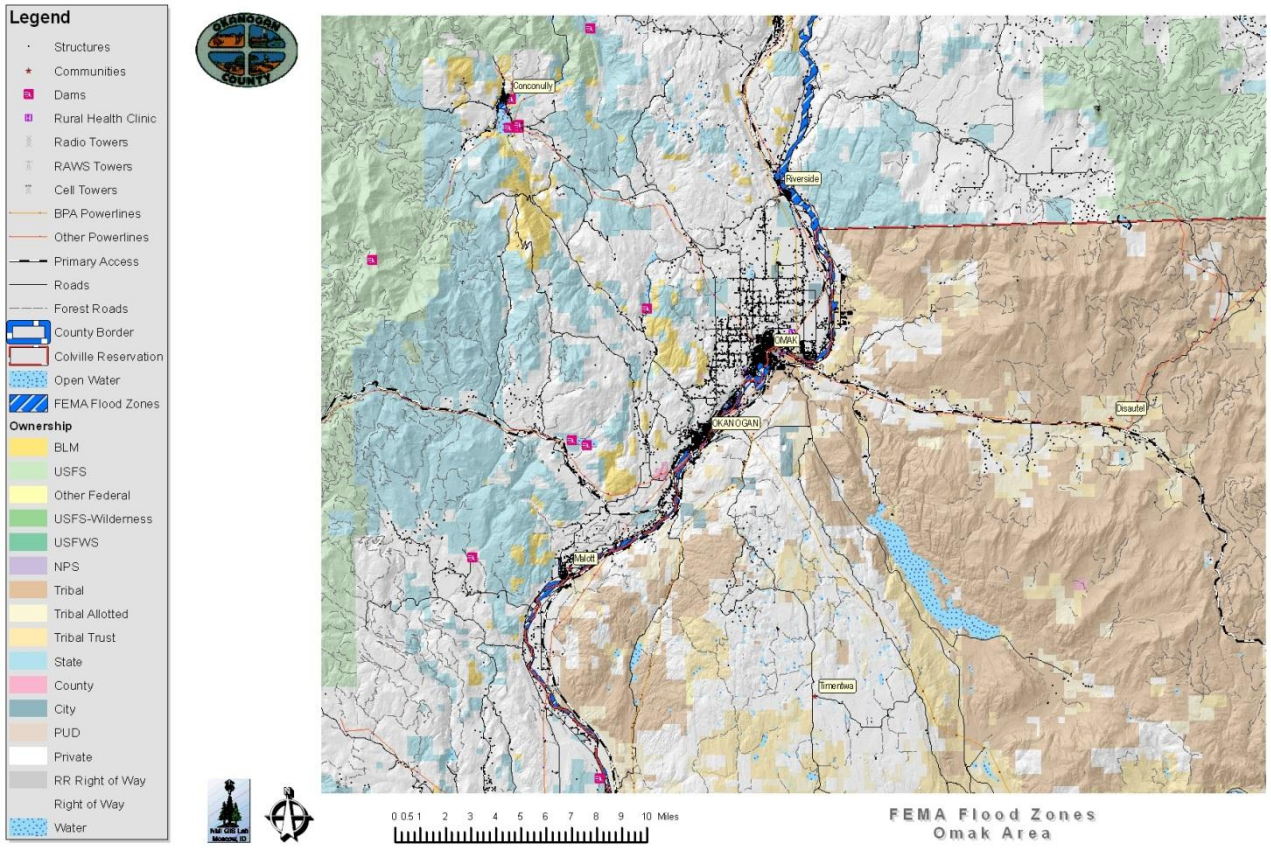
Floods in the area are the result of two different types of weather events, rain-on-snow and thunderstorms. Rain-on-snow events that affect Omak occur when significant snow pack exists in the upper reaches of the foothills and beyond in the Okanogan and Wenatchee National Forest. Warm rains falling on the snow pack result in a significantly increased rate of snowmelt. Often this melting occurs while the ground is frozen and the water cannot be absorbed into the soil, resulting in increased overland flows. Flood waters recede slowly as rain-on-snow weather events tend to last for several days. Low velocity flooding occurs in several of the nearby tributaries almost annually during the spring runoff period. The main tributaries that empty into the Okanogan River within or near Omak include Salmon Creek and Omak Creek. Rural residences, ranches, farms, and roadways located near these smaller waterways may be at significant flood risk. The onset of flooding in the smaller drainages can range from extremely slow to very fast. This variability depends on the cause of flooding and other factors such as rainfall intensity, the areas receiving the rain, temperature, and the condition of the soil. Floods that occur quickly are usually caused by thunderstorms, while floods that occur more slowly are often the result of moderate, but prolonged rainfall, snowmelt, or a combination of both. In the case of intensive rainfall immediately above developed areas, the onset of flooding may occur in a matter of minutes.

Low water permeability soils and sparse vegetation combine to foster flash flooding when intense thunderstorms hit the Omak area. Flash floods from thunderstorms do not occur as frequently as those from general rain and snowmelt conditions, but can more severe. The possibility for injury and death from flash floods is heightened because they occur very rapidly and they are so uncommon that people do not recognize the potential danger.

The major impacts from flooding in the Omak area are the restricted use of several streets, highways, railroad lines, commercial, industrial, and residential areas. There are numerous bridge and culvert crossings over both the Okanogan River and several of the tributaries and irrigation canals throughout their extents within the cities and the surrounding area.

Warm weather or rain after a heavy snowfall is responsible for high flows in the Okanogan River. A high level of sediment is prevalent during periods of intense runoff. This sediment tends to cause a deteriorating condition in streambeds and channels through deposition. Natural obstructions to flood waters include trees, brush, and other vegetation along the stream banks in the floodplain area. Considerable debris is allowed to accumulate in these channels, plugging culverts and bridges at several locations throughout the County.

**Figure 5.10. Cities of Riverside, Omak, and Okanogan FEMA Flood Insurance Rate Map.**




## Probability of Future Occurrence

The probability of flood events occurring in Omak is low to moderate. Low magnitude flood events can be expected several times each year. However, due to the levee and drainage infrastructure, the impacts of these events are slight and will usually amount to minor and temporary traffic issues. Larger magnitude and high impact flood events have occurred, but are not likely in any given year. These types of flood events have the highest probability of occurrence in the winter or early spring in Omak. Minor flash floods are common on the numerous small tributaries feeding the Okanogan River near the community, but are not likely to have an impact on the Okanogan River channel within the city center.

In 1979, 14,000 lineal feet of levee (7,700 feet on the west bank and 6,400 feet on the east bank) were completed along the Okanogan River through Omak. These levees provide 100 year flood protection with three feet of freeboard. Federal expenditures on this project totaled $2,231,030 while local cooperation costs were estimated at $260,000.

### Impacts of Flood Events

The potential impacts from flooding in Omak are very similar to the impacts described for Okanogan County as a whole. First responders and other volunteers aiding with emergency flood control or cleanup efforts are potentially at risk of injury due to accidents or possibly exposure to contaminated water. Although unlikely, the city's water supply could be affected by contaminated flood waters entering the groundwater supply.

The major impacts from flooding in Omak are the restricted use of several streets, commercial, railroad spurs, and residential areas due to overburden of existing drainage facilities. There are numerous bridge and culvert crossings over the Okanogan River throughout its extent within the City and the surrounding area.

The availability of food and other supplies is not likely to be impacted or interrupted by a flood event. Furthermore, the delivery of community services such as postal services, health care, law enforcement, and emergency response is also not likely to be impacted by flood events in Omak. While individual homes and businesses may incur damages as a result of a flood, the economy of the community will not be impacted by this type of hazard.

Environmental damages resulting from a flood event are also unlikely. The Okanogan River occupies a relatively wide floodplain except for a short segment that has been channeled through the community. Scouring and erosion along the banks of the stream along this more narrow section is possible, but due to grass and other vegetation, these impacts will most likely be minimal and localized. Contamination of the riparian area by floodwaters containing chemicals or other pollutants is a possibility, but is more likely to be realized in the surrounding areas than within the community due to the hydrologic profile of the floodplain.

### Value of Resources at Risk

The City of Omak has approximately $346,900 of assets located in the 100-year flood zone on a total of 30 acres. Twenty-eight (77%) of these acres are tribally owned. Residential properties account for 82% ($282,400) of the total value of property in the floodplain, but only 3% (1 acre) of the total acres. Vacant lots account for 12% of the total value and 10% of the total acres within the flood zone in Omak.

Although Okanogan County Fire District #3 and the Okanogan County Public Utilities District provide service to areas within the Omak floodplain, they do not have any facilities or assets located within the identified floodplain. Nevertheless, these districts could be impacted due to emergency calls or limited access caused by flooding.

There is very little critical infrastructure for the city of Omak located within the floodplain. All major city and county services, office buildings, emergency response equipment and communications equipment are located outside of the floodplain and are not at direct risk of damage. Additionally, none of the cities' well heads are within the floodplain.

Roads and bridges are the major infrastructural element that is affected by flooding. Alternative routes to all parts of county are limited during most major flood events. Bridges and culverts have been repeatedly compromised by historical flood events causing major long term damage to road systems.

Local power distribution systems may be compromised when power poles are undermined by flood waters. This is not a common occurrence as most of the power grid is located outside of flood areas.

The City of Okanogan's sewer lagoons are located near the 100-year flood plain, but are at a low risk to being compromised. Contamination of the water supply or backup of sewer water into structures could occur if flood waters did overtop the lagoons or the levee walls were damaged.

## *Earthquake*

There are no recorded occurrences of earthquakes significantly impacting the city of Omak; however, some minimal shaking has been felt as a result of larger earthquakes elsewhere. Omak does not have any differing issues or levels of risk associated with this hazard than Okanogan County as a whole.

### Probability of Future Occurrence

Overall, the County has a 6-15% chance of experiencing an earthquake in the next 50 years. Jurisdictions in the Methow Valley have a slightly higher probability of experiencing an earthquake than those in the Okanogan River valley or on the eastern border of the County (10-15% probability versus 6-10% probability); however, no specific jurisdiction has more risk than another or than the County overall within these areas.[64]

### Impacts and Value of Resources At Risk

Unreinforced masonry (URM) structures and unreinforced chimneys of homes will likely be damaged in the event of an earthquake. There are several publicly accessible unreinforced masonry structures in Omak in addition to the numerous homes and other buildings throughout the Cities with unreinforced chimneys. Damaged or collapsed chimneys could result in the secondary hazard of fire. Nonstructural damage caused by falling and swinging objects may be considerable after any magnitude earthquake. Damage to some older, more fragile bridges and land failure causing minor slides along roadways may isolate some residents.

In Omak, approximately 50 of the downtown structures are unreinforced. These structures were built prior to the inclusion of articles for seismic stability in the Uniform Building Codes in 1972. The number and value of unreinforced masonry homes or homes with masonry chimneys in Omak are unknown, but estimated to include at least 100 buildings.

## *Landslide Profile*

The city of Omak has very low probabilities of experiencing damaging landslides. The few slopes in and around the community are generally less than 20%. While small, low angle slumps may occur on eyebrows of the surrounding rolling hills, these will be infrequent and likely the result of water saturation or a major disturbance such as an earthquake or road construction.

[64] USGS. 2008 United States National Seismic Hazard Maps. U.S. Geological Survey. U.S. Department of Interior. Available online at http://earthquake.usgs.gov/hazards/products/conterminous/2008/. October 2009.

### Impacts and Value of Resources at Risk

There are no structures or infrastructure directly at risk from landslides within the city of Omak.

## *Severe Weather Profile*

The city of Omak does not have any differing levels of risk associated with this hazard than Okanogan County as a whole. The probability of a severe weather event occurring in Omak on an annual basis is moderate. However, the impacts to these communities are usually minimal and are the same as those described for Okanogan County as a whole.

### Impacts and Value of Resources at Risk

It is difficult to estimate the cost of potential winter storm damages to structures and the economy in Omak. Damage to roofs by heavy snow accumulations depends on the moisture content of the snow and the structural characteristics of the buildings. In general, snow in this region tends to have low moisture content because of the low temperatures and arid environment. Frozen water pipes are the most common damage to residential and business structures. Older homes tend to be at a higher risk to frozen water pipes than newer ones. Snow plowing in within the city limits is accomplished by the city's public works department. Private landowners are responsible for maintaining their own driveways or other private roads. Utility supplies are impacted during severe winter storms as power is lost on a regional basis. This has a two-fold impact on residents as not only is power cut to homes and businesses, but primary heating is lost for many residents. Gas furnaces and wood stoves supplement electrical heating, but with wood heating the senior population is at a disadvantage. Emergency response to severe winter storms includes site visits by police or fire department personnel, opening of shelters, or assistance with shopping, medical attention, and communications. The economic losses caused by severe winter storms may frequently be greater than structural damages. Employees may not be able to travel to work for several days and businesses may not open. Damages are seen in the form of structural repair and loss of economic activity. Okanogan County schools are occasionally closed during and right after a severe winter storm because of cold temperatures and snow covered roads.

Thunderstorms are not likely to be severe enough in Omak to cause significant damages. However, the loss potential from flooding that result from severe thunderstorms could be significant.

Although the financial impacts of hail can be substantial and extended, accurately quantifying these impacts is problematic. Hail typically causes direct losses to structures and other personal property within Omak. Homeowners in Omak rarely incur severe damage to structures (roofs); however, hail damage to vehicles is not uncommon. The damage to vehicles is difficult to estimate because the number of vehicles impacted by a specific ice storm is unknown. Additionally, most hail damage records are kept by various insurance agencies.

It is difficult to estimate potential losses in Omak due to windstorms and tornadoes. Construction throughout the County has been implemented in the presence of high wind events, and therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

We have estimated losses based on wind and tornado damage as follows:

- 3% of the buildings damaged causing 50% of value loss (loss could be from downed or damaged trees, damaged outbuildings, damaged fences/poles, damage to siding, damaged landscaping etc.)
- 5% of the buildings received damage to roof (requiring replacement of roof equaling $3,000)

Damages associated with sensitive receptor irritation have not been estimated. We have also not estimated the potential for a large scale wildfire event associated with high winds. Based on the data provided by the County, there are 2,393 total structures in Omak with a total value of approximately $261.6 million. Using the criteria outlined above an estimate of the impact of high winds in Omak has been made. The potential wind and tornado damage to all buildings is estimated at approximately $3.9 million. The estimated damage to roofs is approximately $358,950.

Power failure often accompanies severe storms. Prolonged failure, especially during cold winter temperatures can have disastrous effects. All communities should be prepared to deal with power failures. Community shelters equipped with alternative power sources will help local residents stay warm and prepare food. A community-based system for monitoring and assisting elderly or disabled residents should also be developed. All households should maintain survival kits that include warm blankets, flashlights, extra batteries, nonperishable food items, and clean drinking water.

### *Wildland Fire Profile*

Most of the neighborhoods in Omak are heavily developed for residential, commercial, or agricultural use. Orchards, livestock pasture, hay, or other crops are grown on nearly every available acre that has access to irrigation water. During the summer and fall, this creates a mosaic of lush green vegetation where there is irrigation and cured sage and grass in areas where there isn't.

Wildland fuels within Omak are fairly limited to ditches, empty lots, and the riverbanks due to extensive urban and agricultural development. The surrounding foothills are vegetated primarily by sagebrush and various lower growing grasses. Sparse ponderosa pine can be found in a few of the nearby draws. The slope rising from the east side of the river near Omak is steep, almost vertical in some places; however, it appears to be nearly solid rock with little soil available for plant growth.

Wildfire potential in the agricultural fields near Omak is high. Farming and ranching activities have the potential to increase the risk of a human-caused ignition. Large expanses of crops, CRP, rangeland or pasture provide areas of continuous fuels that may threaten homes and farmsteads near Omak. Under extreme weather conditions, escaped fires in these fuels could threaten individual homes or the community; however, this type of fire is usually quickly controlled. Clearings and fuel breaks disrupt a slow moving wildfire enabling suppression before a fire can ignite heavier fuels. High winds increase the rate of fire spread and intensity of crop and rangeland fires. It is imperative that homeowners implement fire mitigation measures to protect their structures and families prior to a wildfire event.

Wildfire risk in the agricultural landscape is at its highest during late summer and fall when crops are cured and daily temperatures are at their highest. A wind-driven fire in agricultural fuels or dry native fuel complexes would produce a rapidly advancing, but variable intensity fire. Fires burning in some types of

unharvested fields would be expected to burn more intensely with larger flame lengths due to the greater availability of fuels resulting from the higher productivity of the vegetation. Fields enrolled in the CRP or set aside for wildlife habitat can burn very intensely due to an increased amount of fuel build-up from previous years' growth. Fires in these types of fuels are harder to extinguish completely due to the dense duff layer, often leading to hold over fires that may reemerge at a later date causing additional fire starts.

Residents living in Omak have access to the municipal water supply system and public fire hydrants. Outside these areas, development relies on individual, co-op, or multiple-home well systems. Creeks, ponds, and developed drafting areas provide water sources for emergency fire suppression in the rural areas to a limited extent. Irrigation systems are capable of providing additional water supply for suppression equipment on a limited basis. Additional water resources distributed and documented throughout the agricultural landscape are needed to provide water for fire suppression.

Above ground, high voltage transmission lines cross the planning area in many directions in corridors cleared of most vegetation, which provides for a defensible space around the power line infrastructure and may provide a control point for fire suppression, if well maintained. Local public electrical utility lines are both above and below ground traveling through back yards and along roads and highways. Many of these lines are exposed to damage from falling trees and branches. Power and communications may be cut to some of these during a wildfire event.

Okanogan County Fire District #3 protects the community of Omak. The fire district provides structural fire protection as well as wildland fire protection. All of the Okanogan County fire districts have signed a "Memorandum of Understanding" to assist any of the other districts in the County with fire suppression to the utmost of their abilities.

State lands are the sole responsibility of the Washington Department of Natural Resources (suppression & reciprocal agreements may apply). Federal lands are the sole responsibility of the Federal management agency (reciprocal agreement may apply). Much of the private lands in Okanogan County are within joint jurisdiction between the County fire protection districts and the WA DNR.

The DNR provides wildfire protection during the fire season between April and October with a varying degree of resources available in the early spring and late autumn months. The DNR does not provide structural fire suppression, but does provide wildfire protection on non-forested land that threatens DNR-protected lands. The U.S. Forest Service seasonally responds to all wildland fires on their jurisdiction and may also respond to wildland fires on private lands based on a reciprocal agreement with the DNR. The BLM provides wildfire protection on their ownership within Okanogan County and has mutual aid agreements with the DNR for protection of forested land. BLM also does not provide structural fire suppression.

### Probability of Future Occurrence

The area surrounding Omak utilizes irrigation for landscaping and agricultural crops, which not only helps keep the vegetation green and at lower propensity for ignitions, but also gives firefighters abundant access to water resources for suppression purposes. As crop production slows in the fall, the irrigation pressure

tends to taper off, leaving previously lush grasses and other vegetation to dry out and become a potential fire hazard.

The sagebrush and grassland fuels that dominant the area near Omak usually becomes available to burn fairly early in the summer. The growth of a productive orchard takes many years and is, therefore, a long term investment. The potential loss of these orchards and the surrounding structures to fire would severely damage the local economy as well as change the way of life for many residents.

### Impacts of Wildland Fire Events

The potential impacts from a wildfire in Omak are very similar to the impacts described for Okanogan County as a whole. All fires pose a significant safety risk to residents and emergency service personnel. Individual structures, property, and livelihoods could be severely damaged or lost as a result of a fire; however, the community is not likely to suffer severe or long-term economic losses.

Low frequency fires in the shrublands surrounding the community may benefit the ecological environment as nutrients are recycled into the soil. Generally, grass and forbs are rejuvenated by a low intensity fire and grow back quickly; however, heavy rains immediately after a fire could cause erosion.

Smoke from a nearby wildland fire may impact sensitive populations within the community due to degraded air quality conditions. Smoke and/or flames will also impact transportation corridors connecting Omak to other communities; thus, travel and commerce may be interrupted.

### Value of Resources at Risk

It is difficult to estimate potential losses in Omak from wildland fire due to the unpredictability of wildfire behavior and the nature of ignition sources. It is unlikely that more than a few structures or other properties within the city limits of Omak would be lost or damaged by a wildland fire; however, residents in the immediate vicinity may be directly impacted. It is impossible to forecast the path a wildfire will take and what type of assets and resources, manmade and ecological, will be at risk. Thus, no value estimates were made for this hazard.

# City of Tonasket Annex

## Flood Profile

The majority of the Tonasket community is located along the east bank of the Okanogan River. Bonaparte Creek, a tributary to the Okanogan River, runs along the south side of town. The Tonasket Flood Impact Zone is the area within the city limits between the Cascade and Columbia River railway and the Okanogan River bank and is a mixture or residential, commercial, and agricultural.

In addition to the potential flood hazard of the Okanogan River, Bonaparte Creek and, to a lesser extent, Siwash Creek, which drain several small tributaries out of the foothills to the east, empty into the Okanogan River on the south and north ends of Tonasket. Although the Bonaparte Creek does not have FEMA identified floodplain, a flash flood or blockage could cause the stream to breach its banks resulting in severe damage to many homes and businesses in Tonasket. This creek has historically been prone to flash flooding due to low soil permeability upstream; however, this type of event does not occur very frequently in Okanogan County. There are currently no flood control features on Bonaparte Creek.

High water events on the Okanogan River are typically the result of rain-on-snow events or heavy spring runoff. Warm weather or rain after a heavy snowfall is a called rain-on-snow event. Warm rains falling on the snow pack result in a significantly increased rate of snowmelt. Often the melting occurs when the ground is frozen and the water cannot be absorbed fast enough, resulting in increased overland flows. Flood waters recede slowly as the weather events tend to last for several days. The Similkameen River, which as the largest tributary contributes about 70% of the water in the Okanogan River, has the most immediate impact on the Okanogan River water levels near Tonasket.

There is one main bridge across the Okanogan River at Tonasket. Bridge abutments are notorious for causing ice jams and debris blockage during flood events. Due to the bridge's location near the middle of town, a blockage could cause water to back up into the Riverview Trailer Court and adjacent farm ground.

Thunderstorms are localized summer events that can also have an impact on the flooding potential of Tonasket. Flooding due to a thunderstorm can occur rapidly, overwhelming the carrying capacity of channels or the cities storm drainage system in a short time. The duration of this type of flooding tends to be a matter of hours and is usually associated with localized thunderstorms in which the ground cannot absorb moisture as quickly as it is coming down. Bonaparte Creek, Siwash Creek, and other smaller channels are generally more prone to the effects of flooding during a thunderstorm than a river system.

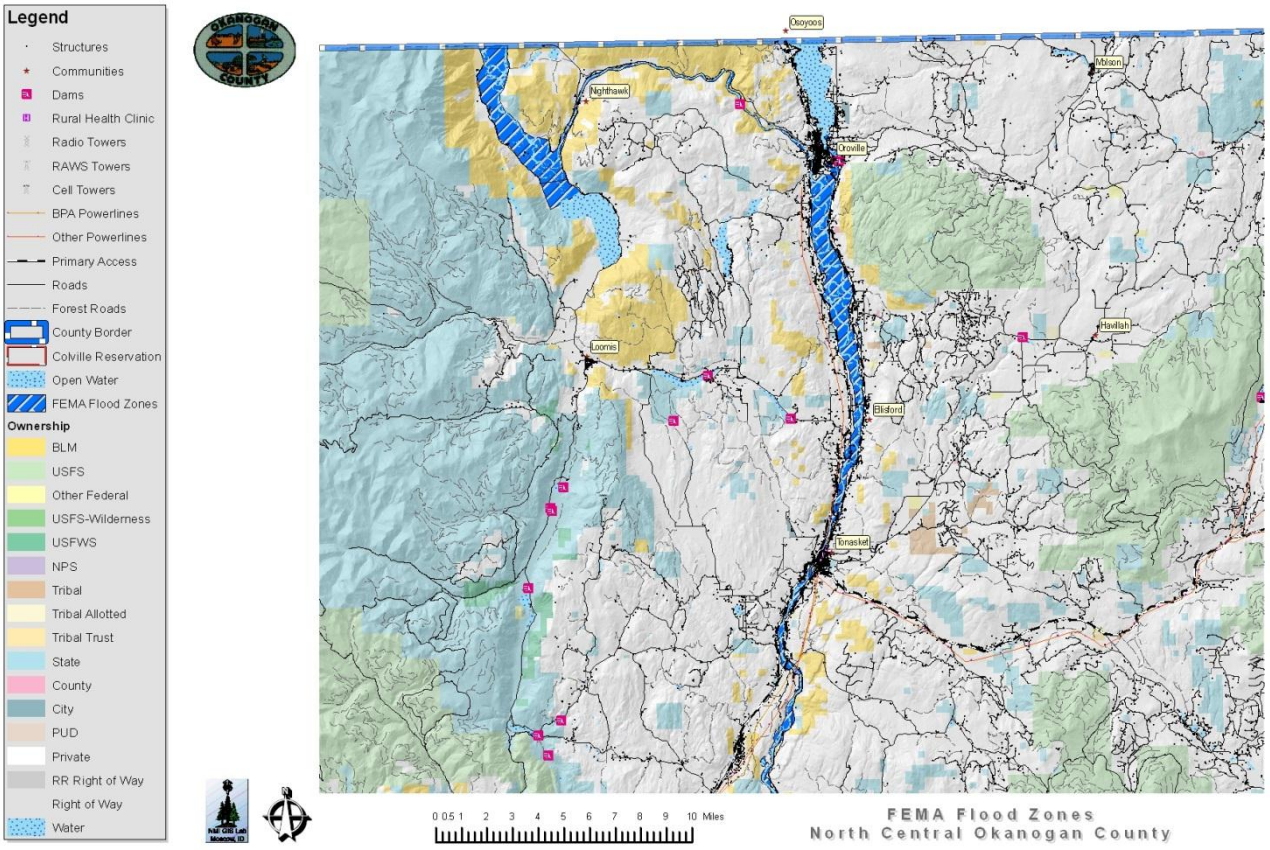
Several streets and road shoulders could potentially erode under flood conditions near Tonasket. Many secondary routes are not paved, which results in gravel washing down-slope potentially clogging drainage systems or directing water to places that were not intended.

Rural residences, ranches, farms, and roadways located near smaller waterways may be at significant flood risk. The onset of flooding in the smaller drainages can range from extremely slow to very fast. This variability depends on the cause of flooding and other factors such as rainfall intensity, the areas receiving the rain, temperature, and the condition of the soil. Floods that occur quickly are usually caused by thunderstorms, while floods that occur more slowly are often the result of moderate, but prolonged

rainfall, snowmelt, or a combination of both. In the case of intense rainfall immediately above developed areas, the onset of flooding may occur in a matter of minutes.

A high level of sediment is prevalent during periods of intense runoff. This sediment tends to cause a deteriorating condition in streambeds and channels through deposition. Natural obstructions to flood waters include trees, brush, and other vegetation along the stream banks in the floodplain area. Considerable debris has been allowed to accumulate in these channels, plugging culverts and bridges at several locations throughout the county.

**Figure 5.11. Cities of Oroville and Tonasket FEMA Flood Insurance Rate Map.**




## Probability of Future Occurrence

The probability of flood events occurring in Tonasket is high. Low magnitude flood events can be expected several times each year. However, due to the flat topography and drainage infrastructure, the impacts of these events are slight and will usually amount to minor and temporary traffic issues. Larger magnitude and high impact flood events have occurred, but are not likely in any given year. These types of flood events have the highest probability of occurrence in the winter or early spring in Tonasket as a result of rain-on-snow events or rapid runoff. Minor flash floods are also common on Okanogan River and several of the small tributaries feeding the main channel near the community.

### Impacts of Flood Events

The potential impacts from flooding in Tonasket are very similar to the impacts described for Okanogan County as a whole. First responders and other volunteers aiding with emergency flood control or cleanup efforts are potentially at risk of injury due to accidents or possibly exposure to contaminated water. Although unlikely, the city's water supply could be affected by contaminated flood waters entering the groundwater supply.

The major impacts from flooding in Tonasket are the restricted use of several streets, commercial, and residential areas. There are numerous bridge and culvert crossings over the Okanogan River and Bonaparte creek throughout the surrounding area.

The availability of food and other supplies is not likely to be impacted or interrupted by a flood event. Furthermore, the delivery of community services such as postal services, health care, law enforcement, and emergency response is also not likely to be impacted by flood events in Tonasket except under extreme (100 year plus floods) circumstances. While individual homes and businesses may incur damages as a result of a flood, the economy of the community will not be impacted by this type of hazard.

Environmental damages resulting from a flood event are also unlikely. Scouring and erosion along the banks of the Okanogan River and Bonaparte Creek in the Tonasket area is possible, but due to grass and other vegetation on the stream banks, these impacts will most likely be minimal and localized. Contamination of the riparian area by floodwaters containing chemicals or other pollutants is also a possibility.

### Value of Resources at Risk

Tonasket has approximately $5.3 million of assets located in the 100-year flood zone, which means there is a 1% chance of these properties flooding in any given year. The vast majority of the value of assets at risk is classified as residential homes ($3.4 million). The value of commercial property within the Tonasket city limits amounts to $1.1 million. These two categories account for approximately 85% of the value in the flood zone. Public land comprises $554,600 and vacant property is worth $180,400, 10% and 3% each of the total value of assets within the floodplain in Tonasket.

Although Okanogan County Fire District #4 and the Okanogan County Public Utilities District provide service to areas within the Tonasket floodplain, they do not have any critical facilities or assets located within the identified floodplain. Nevertheless, these districts could be impacted due to emergency response calls or limited access caused by flooding.

## *Earthquake*

There are no recorded occurrences of earthquakes significantly impacting the city of Tonasket; however, some minimal shaking has been felt as a result of larger earthquakes elsewhere. Tonasket does not have any differing issues or levels of risk associated with this hazard than Okanogan County as a whole.

### Probability of Future Occurrence

Overall, the County has a 6-15% chance of experiencing an earthquake in the next 50 years. Jurisdictions in the Methow Valley have a slightly higher probability of experiencing an earthquake than those in the

Okanogan River valley or on the eastern border of the County (10-15% probability versus 6-10% probability); however, no specific jurisdiction has more risk than another or than the County overall within these areas.[65]

### Impacts and Value of Resources at Risk

Unreinforced masonry (URM) structures and unreinforced chimneys of homes will likely be damaged in the event of an earthquake. There are several publicly accessible unreinforced masonry structures in Sprague in addition to the numerous homes and other buildings throughout the City with unreinforced chimneys. Damaged or collapsed chimneys could result in the secondary hazard of fire. Nonstructural damage caused by falling and swinging objects may be considerable after any magnitude earthquake. Damage to some older, more fragile bridges and land failure causing minor slides along roadways may isolate some residents.

In Tonasket, approximately 26 downtown structures are assumed to be unreinforced masonry. These structures were built prior to the inclusion of articles for seismic stability in the Uniform Building Codes in 1972. The number and value of unreinforced masonry homes or homes with masonry chimneys in Tonasket is unknown, but estimated to include at least 20 buildings.

## *Landslide Profile*

The city of Tonasket has a very low probability of experiencing damaging landslides. The few slopes in and around the community are generally less than 20%. While small, low angle slumps may occur on eyebrows of the surrounding rolling hills, these will be infrequent and likely the result of water saturation or a major disturbance such as an earthquake or road construction.

### Impacts and Value of Resources at Risk

The community of Tonasket is at a low risk of direct impacts from landslides. There is a moderate risk of landslide activity along the major travel corridors that access these communities, which could hinder response by various fire protection districts (Okanogan County Fire Districts #1, 3, 4, 7, 8, and 15) and public utilities districts (Okanogan County PUD) during emergencies. The impact of landslides on roads and the power supply has and will continue to affect the people living in this area. These impacts have historically been minor, resulting in limited vehicle access or a temporary loss of power.

## *Severe Weather Profile*

The city of Tonasket does not have any differing levels of risk associated with this hazard than Okanogan County as a whole. The probability of a severe weather event occurring in Tonasket on an annual basis is very high. However, the impacts to the community are usually minimal and are the same as those described for Okanogan County as a whole.

[65] USGS. 2008 United States National Seismic Hazard Maps. U.S. Geological Survey. U.S. Department of Interior. Available online at http://earthquake.usgs.gov/hazards/products/conterminous/2008/. October 2009.

### Impacts and Value of Resources at Risk

It is difficult to estimate the cost of potential winter storm damages to structures and the economy in Tonasket. Damage to roofs by heavy snow accumulations depends on the moisture content of the snow and the structural characteristics of the buildings. In general, snow in this region tends to have low moisture content because of the low temperatures and arid environment. Additionally, snow rarely accumulates for long periods of time due to regular wind events. Frozen water pipes are the most common damage to residential and business structures. Older homes tend to be at a higher risk to frozen water pipes than newer ones. Snow plowing in within the city limits is accomplished by the city's public works department. Private landowners are responsible for maintaining their own driveways or other private roads. Utility supplies are impacted during severe winter storms as power is lost on a regional basis. This has a two-fold impact on residents as not only is power cut to homes and businesses, but primary heating is lost for many residents. Gas furnaces and wood stoves supplement electrical heating, but with wood heating the senior population is at a disadvantage. Emergency response to severe winter storms includes site visits by police or fire department personnel, opening of shelters, or assistance with shopping, medical attention, and communications. The economic losses caused by severe winter storms may frequently be greater than structural damages. Employees may not be able to travel to work for several days and businesses may not open. Damages are seen in the form of structural repair and loss of economic activity. Tonasket schools are occasionally closed during and right after a severe winter storm because of cold temperatures and snow covered roads.

Thunderstorms are not likely to be severe enough in Tonasket to cause significant damages. However, the loss potential from flooding that result from severe thunderstorms could be significant.

Although the financial impacts of hail can be substantial and extended, accurately quantifying these impacts is problematic. Hail typically causes direct losses to structures and other personal property within Tonasket. Homeowners in Tonasket rarely incur severe damage to structures (roofs); however, hail damage to vehicles is not uncommon. The damage to vehicles is difficult to estimate because the number of vehicles impacted by a specific ice storm is unknown. Additionally, most hail damage records are kept by various insurance agencies.

It is difficult to estimate potential losses due to windstorms and tornadoes in Tonasket. Structures have always been constructed throughout the County in the presence of high wind events, and therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

We have estimated losses based on wind and tornado damage as follows:

- 3% of the buildings damaged causing 50% of value loss (loss could be from downed or damaged trees, damaged outbuildings, damaged fences/poles, damage to siding, damaged landscaping etc.)
- 5% of the buildings received damage to roof (requiring replacement of roof equaling $3,000)

Damages associated with sensitive receptor irritation have not been estimated. We have also not estimated the potential for a large scale wildfire event associated with high winds. Based on the data provided by the County, there are 602 total structures in Tonasket with a total value of approximately $65.1

million. Using the criteria outlined above an estimate of the impact of high winds in Tonasket has been made. The potential wind and tornado damage to all buildings is estimated at approximately $976,877. The estimated damage to roofs is approximately $90,300.

Power failure often accompanies severe storms. Prolonged failure, especially during cold winter temperatures can have disastrous effects. All communities should be prepared to deal with power failures. Community shelters equipped with alternative power sources will help local residents stay warm and prepare food. A community-based system for monitoring and assisting elderly or disabled residents should also be developed. All households should maintain survival kits that include warm blankets, flashlights, extra batteries, nonperishable food items, and clean drinking water.

### *Wildland Fire Profile*

Wildland fuels within the community of Tonasket is limited to ditches or small bare lots due to the existence of numerous structures and agricultural facilities. The foothills and some non-irrigated areas along Highway 97 tend to be vegetated by sagebrush and lower growing grasses, particularly bunchgrasses. These fuels form a continuous fuel bed with similar fuels on the mid and upper slopes surrounding the valley.

Wildfire potential in the agricultural fields near Tonasket is high. Farming and ranching activities have the potential to increase the risk of a human-caused ignition. Large expanses of crops, rangeland, or pasture provide areas of continuous fuels that may threaten homes and farmsteads near Tonasket. Under extreme weather conditions, escaped fires in these fuels could threaten individual homes or the community; however, this type of fire is usually quickly controlled. Clearings and fuel breaks disrupt a slow moving wildfire enabling suppression before a fire can ignite heavier fuels. High winds increase the rate of fire spread and intensity of crop and rangeland fires. It is imperative that homeowners implement fire mitigation measures to protect their structures and families prior to a wildfire event.

Residents living in Tonasket have access to the municipal water supply system and public fire hydrants. Outside these areas, development relies on individual, co-op, or multiple-home well systems. Creeks, ponds, and developed drafting areas provide water sources for emergency fire suppression in the rural areas to a limited extent. Irrigation systems are capable of providing additional water supply for suppression equipment on a limited basis. The development of additional water resources distributed and documented throughout the agricultural landscape are needed to assist with fire suppression efforts.

Above ground, high voltage transmission lines cross the planning area in many directions in corridors cleared of most vegetation, which provides for a defensible space around the power line infrastructure and may provide a control point for fire suppression, if well maintained. Local public electrical utility lines are both above and below ground traveling through back yards and along roads and highways. Many of these lines are exposed to damage from falling trees and branches. Power and communications may be cut to some of these during a wildfire event.

Okanogan County Fire District #4 protects the community of Tonasket. The fire district provides structural fire protection as well as wildland fire protection. All of the Okanogan County fire districts have signed a

"Memorandum of Understanding" to assist any of the other districts in the County with fire suppression to the utmost of their abilities.

State lands are the sole responsibility of the Washington Department of Natural Resources (suppression & reciprocal agreements may apply). Federal lands are the sole responsibility of the Federal management agency (reciprocal agreement may apply). Much of the private lands in Okanogan County are within joint jurisdiction between the County fire protection districts and the WA DNR.

The DNR provides wildfire protection during the fire season between April and October with a varying degree of resources available in the early spring and late autumn months. The DNR does not provide structural fire suppression, but does provide wildfire protection on non-forested land that threatens DNR-protected lands. The U.S. Forest Service seasonally responds to all wildland fires on their jurisdiction and may also respond to wildland fires on private lands based on a reciprocal agreement with the DNR. The BLM provides wildfire protection on their ownership within Okanogan County and has mutual aid agreements with the DNR for protection of forested land. BLM also does not provide structural fire suppression.

### Probability of Future Occurrence

Tonasket allows for irrigation of landscaping and agricultural crops, which not only helps keep the vegetation green and at lower propensity for ignitions, but also gives firefighters abundant access to water resources for suppression purposes.

The sagebrush and grassland fuels that dominant the area around Tonasket usually becomes available to burn fairly early in the summer. The growth of a productive orchard takes many years and is, therefore, a long term investment. The potential loss of these orchards and the surrounding structures to fire would severely damage the local economy as well as change the way of life for many residents.

### Impacts of Wildland Fire Events

The potential impacts from a wildfire in Tonasket are very similar to the impacts described for Okanogan County as a whole. All fires pose a significant safety risk to residents and emergency service personnel. Individual structures, property, and livelihoods could be severely damaged or lost as a result of a fire; however, the community is not likely to suffer severe or long-term economic losses.

Low frequency fires in the shrublands surrounding the community may benefit the ecological environment as nutrients are recycled into the soil. Generally, grass and forbs are rejuvenated by a low intensity fire and grow back quickly; however, heavy rains immediately after a fire could cause erosion.

Smoke from a nearby wildland fire may impact sensitive populations within the community due to degraded air quality conditions. Smoke and/or flames will also impact transportation corridors connecting Tonasket to other communities; thus, travel and commerce may be interrupted.

### Value of Resources at Risk

It is difficult to estimate potential losses in Tonasket from wildland fire due to the unpredictability of wildfire behavior and the nature of ignition sources. It is unlikely that more than a few structures or other

properties within the city limits of Tonasket would be lost or damaged by a wildland fire; however, residents in the immediate vicinity may be directly impacted. It is impossible to forecast the path a wildfire will take and what type of assets and resources, manmade and ecological, will be at risk. Thus, no value estimates were made for this hazard.

# *City of Okanogan Annex*

## *Flood Profile*

The city of Okanogan is located on the west side of the Okanogan River. Even though the population center has residences, commercial, industrial, and agricultural located near the river's edge, only a small portion of downtown Okanogan is within the 100 year flood zone. This includes parts of 1st and 2nd Avenue north.

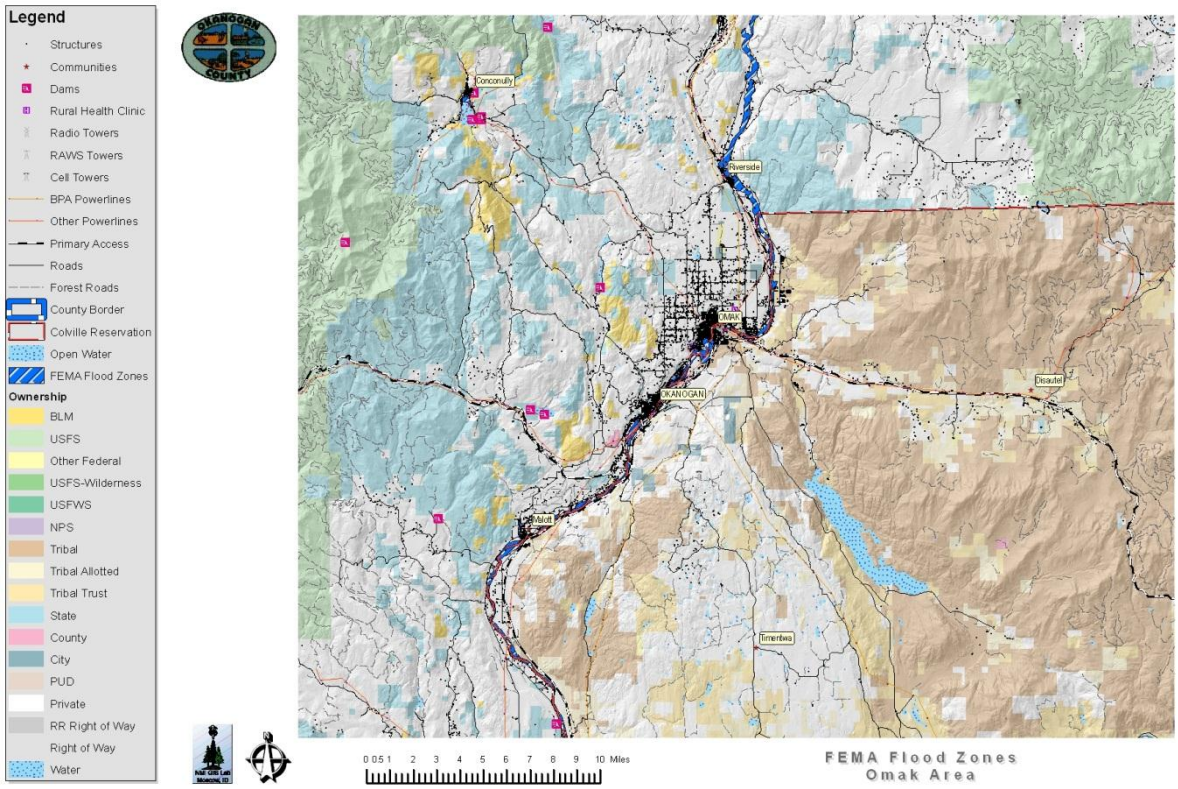
Floods in the area are the result of two different types of weather events, rain-on-snow and thunderstorms. Rain-on-snow events that affect Okanogan occur when significant snow pack exists in the upper reaches of the foothills and beyond in the Okanogan and Wenatchee National Forest. Warm rains falling on the snow pack result in a significantly increased rate of snowmelt. Often this melting occurs while the ground is frozen and the water cannot be absorbed into the soil, resulting in increased overland flows. Flood waters recede slowly as rain-on-snow weather events tend to last for several days. Low velocity flooding occurs in several of the nearby tributaries almost annually during the spring runoff period. The main tributaries that empty into the Okanogan River within or near Okanogan include Salmon Creek and Omak River. Rural residences, ranches, farms, and roadways located near these smaller waterways may be at significant flood risk. The onset of flooding in the smaller drainages can range from extremely slow to very fast. This variability depends on the cause of flooding and other factors such as rainfall intensity, the areas receiving the rain, temperature, and the condition of the soil. Floods that occur quickly are usually caused by thunderstorms, while floods that occur more slowly are often the result of moderate, but prolonged rainfall, snowmelt, or a combination of both. In the case of intensive rainfall immediately above developed areas, the onset of flooding may occur in a matter of minutes.

Low water permeability soils and sparse vegetation combine to foster flash flooding when intense thunderstorms hit the Okanogan area. Flash floods from thunderstorms do not occur as frequently as those from general rain and snowmelt conditions, but can more severe. The possibility for injury and death from flash floods is heightened because they occur very rapidly and they are so uncommon that people do not recognize the potential danger.

The major impacts from flooding in the Okanogan area are the restricted use of several streets, highways, railroad lines, commercial, industrial, and residential areas. There are numerous bridge and culvert crossings over both the Okanogan River and its tributaries throughout their extents within the city and the surrounding area.

Warm weather or rain after a heavy snowfall is responsible for high flows in the Okanogan River. A high level of sediment is prevalent during periods of intense runoff. This sediment tends to cause a deteriorating condition in streambeds and channels through deposition. Natural obstructions to flood waters include trees, brush, and other vegetation along the stream banks in the floodplain area. Considerable debris is allowed to accumulate in these channels, plugging culverts and bridges at several locations throughout the County.

**Figure 5.12. Cities of Riverside, Omak, and Okanogan FEMA Flood Insurance Rate Map.**




## Probability of Future Occurrence

The probability of flood events occurring in Okanogan is low to moderate and most issues come from seepage into basements. Low magnitude flood events can be expected several times each year. However, due to the levee and drainage infrastructure, the impacts of these events are slight and will usually amount to minor and temporary traffic issues. Larger magnitude and high impact flood events have occurred, but are not likely in any given year. These types of flood events have the highest probability of occurrence in the winter or early spring in Okanogan. Minor flash floods are common on the numerous small tributaries feeding the Okanogan River near the community, but are not likely to have an impact on the Okanogan River channel within the city center.

In 1979, 14,000 lineal feet of levee (7,700 feet on the west bank and 6,400 feet on the east bank) were completed along the Okanogan River. These levees provide 100 year flood protection with three feet of freeboard. Federal expenditures on this project totaled $2,231,030 while local cooperation costs were estimated at $260,000.

In 1988 the city of Okanogan requested that the Corps of Engineers initiate a reconnaissance study of possible solutions to the flood control problems within the city. The last major flood event occurred in 1972 and was estimated as an 80 year flood. Three areas were investigated in the initial appraisal. A positive initial appraisal was completed in fiscal year 1988, but a reconnaissance study in 1990 showed that the project was not economically feasible and the study was terminated.

### Impacts of Flood Events

The potential impacts from flooding in Okanogan are very similar to the impacts described for Okanogan County as a whole. First responders and other volunteers aiding with emergency flood control or cleanup efforts are potentially at risk of injury due to accidents or possibly exposure to contaminated water. Although unlikely, the city's water supply could be affected by contaminated flood waters entering the groundwater supply.

The major impacts from flooding in Okanogan are the restricted use of several streets, commercial, railroad spurs, and residential areas due to overburden of existing drainage facilities. There are numerous bridge and culvert crossings over the Okanogan River throughout its extent within the City and the surrounding area.

The availability of food and other supplies is not likely to be impacted or interrupted by a flood event. Furthermore, the delivery of community services such as postal services, health care, law enforcement, and emergency response is also not likely to be impacted by flood events in Okanogan. While individual homes and businesses may incur damages as a result of a flood, the economy of the community will not be impacted by this type of hazard.

Environmental damages resulting from a flood event are also unlikely. The Okanogan River occupies a relatively wide floodplain except for a short segment that has been channeled through the community. Scouring and erosion along the banks of the stream along this more narrow section is possible, but due to grass and other vegetation, these impacts will most likely be minimal and localized. Contamination of the riparian area by floodwaters containing chemicals or other pollutants is a possibility, but is more likely to be realized in the surrounding areas than within the community due to the hydrologic profile of the floodplain.

### Value of Resources at Risk

The City of Okanogan is home to approximately $1.6 million of assets at risk located in the 100-year flood zone meaning they have a 1% chance of flooding in any given year. Of these assets at risk, the largest proportion of values and acres is classified as public land equaling $1.2 million in value on 65 acres located in flood zone. Residential property accounts for 19% of the total value while commercial and vacant ground contributes 2% each.

Although Okanogan County Fire District #3 and the Okanogan County Public Utilities District provide service to areas within the Okanogan floodplains, they do not have any facilities or assets located within the identified floodplain. Nevertheless, these districts could be impacted due to emergency calls or limited access caused by flooding.

There is very little critical infrastructure for the city of Okanogan located within the floodplain. All major city and county services, office buildings, emergency response equipment and communications equipment are located outside of the floodplain and are not at direct risk of damage. Additionally, none of the cities' well heads are within the floodplain.

Roads and bridges are the major infrastructural element that is affected by flooding. Alternative routes to all parts of county are limited during most major flood events. Bridges and culverts have been repeatedly compromised by historical flood events causing major long term damage to road systems.

Local power distribution systems may be compromised when power poles are undermined by flood waters. This is not a common occurrence as most of the power grid is located outside of flood areas.

The City of Okanogan's sewer lagoons are located near the 100-year flood plain, but are at a low risk to being compromised. Contamination of the water supply or backup of sewer water into structures could occur if flood waters did overtop the lagoons or the levee walls were damaged.

## *Earthquake*

There was a 4.6 magnitude recorded in 2011 and located about seven miles northwest of Okanogan; however, only minimal shaking has been felt as a result of this earthquake as well as larger earthquakes elsewhere. Okanogan does not have any differing issues or levels of risk associated with this hazard than Okanogan County as a whole.

### Probability of Future Occurrence

Overall, the County has a 6-15% chance of experiencing an earthquake in the next 50 years. Jurisdictions in the Methow Valley have a slightly higher probability of experiencing an earthquake than those in the Okanogan River valley or on the eastern border of the County (10-15% probability versus 6-10% probability); however, no specific jurisdiction has more risk than another or than the County overall within these areas.[66]

### Impacts and Value of Resources At Risk

Unreinforced masonry (URM) structures and unreinforced chimneys of homes will likely be damaged in the event of an earthquake. There are several publicly accessible unreinforced masonry structures in Okanogan in addition to the numerous homes and other buildings throughout the Cities with unreinforced chimneys. Damaged or collapsed chimneys could result in the secondary hazard of fire. Nonstructural damage caused by falling and swinging objects may be considerable after any magnitude earthquake. Damage to some older, more fragile bridges and land failure causing minor slides along roadways may isolate some residents.

In Okanogan, approximately 33 downtown structures are assumed to be unreinforced masonry. These structures were built prior to the inclusion of articles for seismic stability in the Uniform Building Codes in 1972. The number and value of unreinforced masonry homes or homes with masonry chimneys in Okanogan are unknown, but estimated to include at least 100 buildings.

[66] USGS. 2008 United States National Seismic Hazard Maps. U.S. Geological Survey. U.S. Department of Interior. Available online at http://earthquake.usgs.gov/hazards/products/conterminous/2008/. October 2009.

## *Landslide Profile*

The city of Okanogan has very low probabilities of experiencing damaging landslides. The few slopes in and around the community are generally less than 20%. While small, low angle slumps may occur on eyebrows of the surrounding rolling hills, these will be infrequent and likely the result of water saturation or a major disturbance such as an earthquake or road construction.

### Impacts and Value of Resources at Risk

There are no structures or infrastructure directly at risk from landslides within the city of Okanogan.

## *Severe Weather Profile*

The city of Okanogan does not have any differing levels of risk associated with this hazard than Okanogan County as a whole. The probability of a severe weather event occurring in Okanogan on an annual basis is very high. However, the impacts to these communities are usually minimal and are the same as those described for Okanogan County as a whole.

### Impacts and Value of Resources at Risk

It is difficult to estimate the cost of potential winter storm damages to structures and the economy in Okanogan. Damage to roofs by heavy snow accumulations depends on the moisture content of the snow and the structural characteristics of the buildings. In general, snow in this region tends to have low moisture content because of the low temperatures and arid environment. Frozen water pipes are the most common damage to residential and business structures. Older homes tend to be at a higher risk to frozen water pipes than newer ones. Snow plowing in within the city limits is accomplished by the city's public works department. Private landowners are responsible for maintaining their own driveways or other private roads. Utility supplies are impacted during severe winter storms as power is lost on a regional basis. This has a two-fold impact on residents as not only is power cut to homes and businesses, but primary heating is lost for many residents. Gas furnaces and wood stoves supplement electrical heating, but with wood heating the senior population is at a disadvantage. Emergency response to severe winter storms includes site visits by police or fire department personnel, opening of shelters, or assistance with shopping, medical attention, and communications. The economic losses caused by severe winter storms may frequently be greater than structural damages. Employees may not be able to travel to work for several days and businesses may not open. Damages are seen in the form of structural repair and loss of economic activity. Okanogan County schools are occasionally closed during and right after a severe winter storm because of cold temperatures and snow covered roads.

Thunderstorms are not likely to be severe enough in Okanogan to cause significant damages. However, the loss potential from flooding that result from severe thunderstorms could be significant.

Although the financial impacts of hail can be substantial and extended, accurately quantifying these impacts is problematic. Hail typically causes direct losses to structures and other personal property within Okanogan. The most significant losses are most clearly seen in the agriculture sectors of the economy.

It is difficult to estimate potential losses in Okanogan due to windstorms and tornadoes. Construction throughout the County has been implemented in the presence of high wind events, and therefore, the

community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

We have estimated losses based on wind and tornado damage as follows:

- 3% of the buildings damaged causing 50% of value loss (loss could be from downed or damaged trees, damaged outbuildings, damaged fences/poles, damage to siding, damaged landscaping etc.)
- 5% of the buildings received damage to roof (requiring replacement of roof equaling $3,000)

Damages associated with sensitive receptor irritation have not been estimated. We have also not estimated the potential for a large scale wildfire event associated with high winds. Based on the data provided by the County, there are 1,308 total structures in Okanogan with a total value of approximately $136 million. Using the criteria outlined above an estimate of the impact of high winds in Okanogan has been made. The potential wind and tornado damage to all buildings is estimated at approximately $2 million. The estimated damage to roofs is approximately $196,200.

Power failure often accompanies severe storms. Prolonged failure, especially during cold winter temperatures can have disastrous effects. All communities should be prepared to deal with power failures. Community shelters equipped with alternative power sources will help local residents stay warm and prepare food. A community-based system for monitoring and assisting elderly or disabled residents should also be developed. All households should maintain survival kits that include warm blankets, flashlights, extra batteries, nonperishable food items, and clean drinking water.

### *Wildland Fire Profile*

Most of the neighborhoods in the Okanogan River Valley are heavily developed for residential, commercial, or agricultural use. Orchards, livestock pasture, hay, or other crops are grown on nearly every available acre that has access to irrigation water. During the summer and fall, this creates a mosaic of lush green vegetation where there is irrigation and cured sage and grass in areas where there isn't.

Wildland fuels within Okanogan are fairly limited to ditches, empty lots, and the riverbanks due to extensive urban and agricultural development. Orchards and other crops grow both within the valley and on many of the low benches where irrigation water is available. The surrounding foothills are vegetated primarily by sagebrush and various lower growing grasses. Sparse ponderosa pine can be found in a few of the nearby draws. The slope rising from the east side of the river near Okanogan is steep, almost vertical in some places; however, it appears to be nearly solid rock with little soil available for plant growth.

Wildfire potential in the agricultural fields near Okanogan is high. Farming and ranching activities have the potential to increase the risk of a human-caused ignition. Moderate expanses of crops, rangeland or pasture provide areas of continuous fuels that may threaten homes and farmsteads near Okanogan. Under extreme weather conditions, escaped fires in these fuels could threaten individual homes or the community; however, this type of fire is usually quickly controlled. Clearings and fuel breaks disrupt a slow moving wildfire enabling suppression before a fire can ignite heavier fuels. High winds increase the rate of fire spread and intensity of crop and rangeland fires. It is imperative that homeowners implement fire mitigation measures to protect their structures and families prior to a wildfire event.

Wildfire risk in the agricultural landscape is at its highest during late summer and fall when crops are cured and daily temperatures are at their highest. A wind-driven fire in agricultural fuels or dry native fuel complexes would produce a rapidly advancing, but variable intensity fire. Fires burning in some types of unharvested fields would be expected to burn more intensely with larger flame lengths due to the greater availability of fuels resulting from the higher productivity of the vegetation. Fields enrolled in the CRP or set aside for wildlife habitat can burn very intensely due to an increased amount of fuel build-up from previous years' growth. Fires in these types of fuels are harder to extinguish completely due to the dense duff layer, often leading to hold over fires that may reemerge at a later date causing additional fire starts.

Residents living in Okanogan have access to the municipal water supply system and public fire hydrants. Outside these areas, development relies on individual, co-op, or multiple-home well systems. Creeks, ponds, and developed drafting areas provide water sources for emergency fire suppression in the rural areas to a limited extent. Irrigation systems are capable of providing additional water supply for suppression equipment on a limited basis. Additional water resources distributed and documented throughout the agricultural landscape are needed to provide water for fire suppression.

Above ground, high voltage transmission lines cross the planning area in many directions in corridors cleared of most vegetation, which provides for a defensible space around the power line infrastructure and may provide a control point for fire suppression, if well maintained. Local public electrical utility lines are both above and below ground traveling through back yards and along roads and highways. Many of these lines are exposed to damage from falling trees and branches. Power and communications may be cut to some of these during a wildfire event.

The city of Okanogan Fire Department provides structural fire protection as well as wildland fire protection within the city limits. Okanogan also hosts one of Fire District #3 fire stations that provides structural and wildland fire protection outside of city limits. All of the Okanogan County fire districts and each city/town fire department have signed a "Memorandum of Understanding" to assist any of the other districts in the County with fire suppression to the utmost of their abilities.

State lands are the sole responsibility of the Washington Department of Natural Resources (suppression & reciprocal agreements may apply). Federal lands are the sole responsibility of the Federal management agency (reciprocal agreement may apply). Much of the private lands in Okanogan County are within joint jurisdiction between the County fire protection districts and the WA DNR.

The DNR provides wildfire protection during the fire season between April and October with a varying degree of resources available in the early spring and late autumn months. The DNR does not provide structural fire suppression, but does provide wildfire protection on non-forested land that threatens DNR-protected lands. The U.S. Forest Service seasonally responds to all wildland fires on their jurisdiction and may also respond to wildland fires on private lands based on a reciprocal agreement with the DNR. The BLM provides wildfire protection on their ownership within Okanogan County and has mutual aid agreements with the DNR for protection of forested land. BLM also does not provide structural fire suppression.

### Probability of Future Occurrence

Okanogan allows for irrigation of landscaping and agricultural crops, which not only helps keep the vegetation green and at lower propensity for ignitions, but also gives firefighters abundant access to water resources for suppression purposes. As crop production slows in the fall, the irrigation pressure tends to taper off, leaving previously lush grasses and other vegetation to dry out and become a potential fire hazard.

The sagebrush and grassland fuels that dominant this part of the County usually becomes available to burn fairly early in the summer. The growth of a productive orchard takes many years and is, therefore, a long term investment. The potential loss of these orchards and the surrounding structures to fire would severely damage the local economy as well as change the way of life for many residents.

### Impacts of Wildland Fire Events

The potential impacts from a wildfire in Okanogan are very similar to the impacts described for Okanogan County as a whole. All fires pose a significant safety risk to residents and emergency service personnel. Individual structures, property, and livelihoods could be severely damaged or lost as a result of a fire; however, the community is not likely to suffer severe or long-term economic losses.

Low frequency fires in the shrublands surrounding the community may benefit the ecological environment as nutrients are recycled into the soil. Generally, grass and forbs are rejuvenated by a low intensity fire and grow back quickly; however, heavy rains immediately after a fire could cause erosion.

Smoke from a nearby wildland fire may impact sensitive populations within the community due to degraded air quality conditions. Smoke and/or flames will also impact transportation corridors connecting Okanogan to other communities; thus, travel and commerce may be interrupted.

### Value of Resources at Risk

It is difficult to estimate potential losses in Okanogan from wildland fire due to the unpredictability of wildfire behavior and the nature of ignition sources. It is unlikely that more than a few structures or other properties within the city limits of Okanogan would be lost or damaged by a wildland fire; however, residents in the immediate vicinity may be directly impacted. It is impossible to forecast the path a wildfire will take and what type of assets and resources, manmade and ecological, will be at risk. Thus, no value estimates were made for this hazard.

# *Town of Twisp Annex*

## *Flood Profile*

The community of Twisp is located at the confluence of the Twisp River from the west and the Methow River from the north. Residences, businesses, and other structures associated with the community actually straddle both waterways; however, only small sections of the townsite are within the floodplain identified on the FEMA Flood Insurance Rate Maps.

Floods in the area are typically the result of two different types of weather events, rain-on-snow and thunderstorms. Rain-on-snow- events that affect Twisp occur when significant snow pack exists in the Okanogan and Wenatchee National Forest on each side of the Methow Valley. Warm rains falling on the snow pack result in a significantly increased rate of snowmelt. Often this melting occurs while the ground is frozen and the water cannot be absorbed into the soil, resulting in increased overland flows. Flood waters recede slowly as rain-on-snow weather events tend to last for several days. Low velocity flooding occur in Twisp almost annually during the spring runoff period. Ice jams in the smaller tributaries have historically caused flooding problems. The impacts of successive ice dams being built up and then breaking are felt all along the Twisp River and Methow River drainages as the rush of water quickly overwhelms culverts, bridges, and storm drainage systems.

Low water permeable soil and sparse vegetation in some areas combine to foster flash flooding when intense thunderstorms hit the Twisp area. Floods from thunderstorms do not occur as frequently as those from general rain and snowmelt conditions, but can be far more severe. The possibility for injury and death from flash floods is heightened because they occur quickly and are so uncommon that people do not recognize the potential danger.

The major impacts from both types of flooding in Twisp are the restricted use of several streets, highways, commercial, industrial, and residential areas. There are numerous bridge and culvert crossings over both the Methow River, the Twisp River, and several irrigation canals throughout their extents within the town and the surrounding area.

Warm weather or rain after a heavy snowfall is responsible for high flows in these waterways. A high level of sediment is prevalent during periods of high runoff. This sediment tends to cause a deteriorating condition in channel beds through erosion and deposition. Natural obstructions to flood waters include trees, brush, and other vegetation along the stream banks in the floodplain area. Debris can plug culverts and accumulate on bridge abutments at several locations throughout the town. Several streets and road shoulders are prone to erosion during flood events around the Twisp area. Many secondary routes are not paved, which results in gravel washing down-slope potentially clogging drainage systems or directing water to places that were not intended.

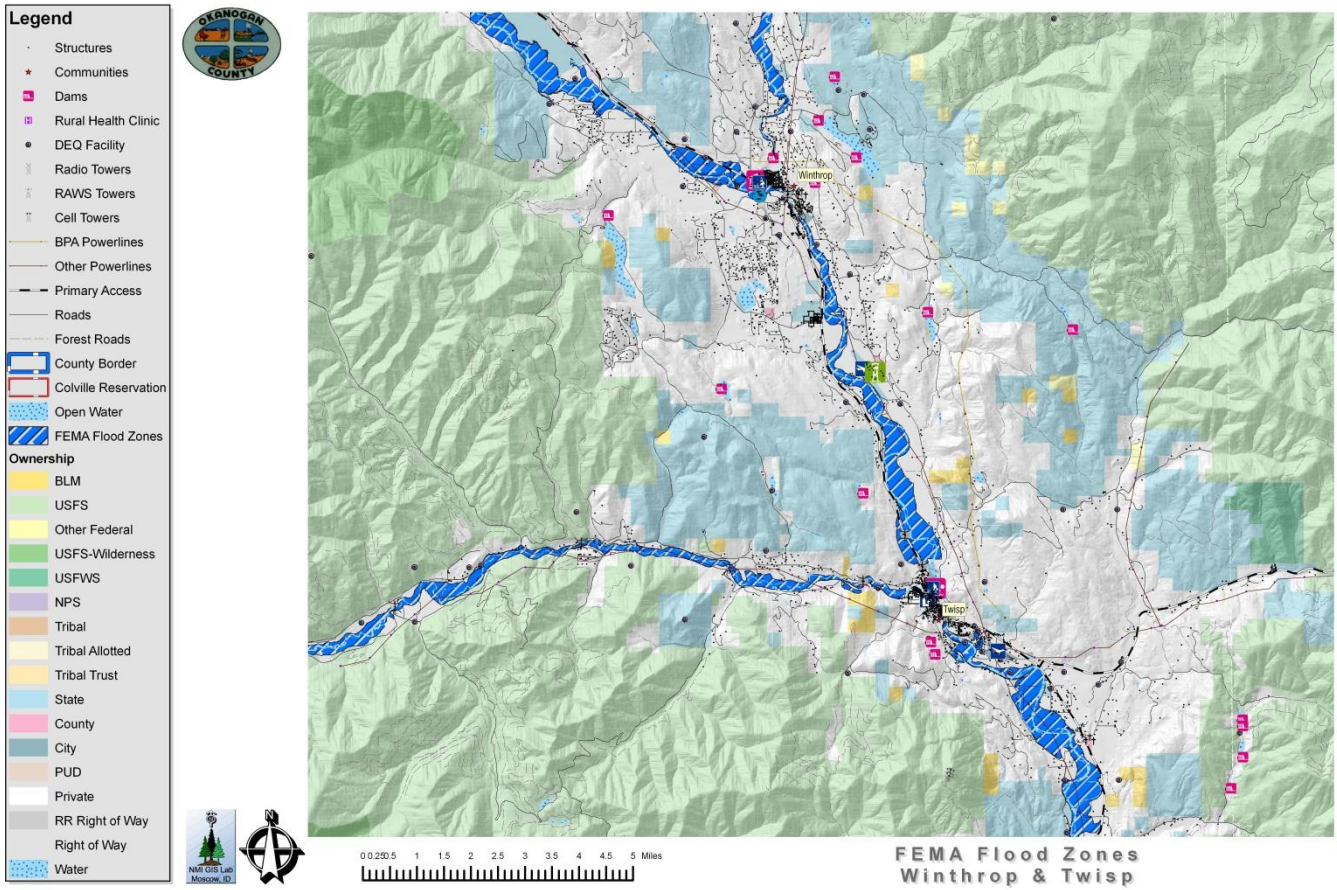
The onset of flooding in the smaller drainages can range from extremely slow to very fast. This variability depends on the cause of flooding and other factors such as rainfall intensity, the areas receiving the rain, temperature, and the condition of the soil. Floods that occur quickly are usually caused by thunderstorms, while floods that occur more slowly are often the result of moderate, but prolonged rainfall, snowmelt, or a

combination of both. In the case of intensive rainfall immediately above developed areas, the onset of flooding may occur in a matter of minutes.

Rural residences, ranches, farms, and roadways located near smaller waterways may be at significant flood risk. The onset of flooding in the smaller drainages can range from extremely slow to very fast. This variability depends on the cause of flooding and other factors such as rainfall intensity, the areas receiving the rain, temperature, and the condition of the soil. Floods that occur quickly are usually caused by thunderstorms, while floods that occur more slowly are often the result of moderate, but prolonged rainfall, snowmelt, or a combination of both. In the case of intense rainfall immediately above developed areas, the onset of flooding may occur in a matter of minutes.

A high level of sediment is prevalent during periods of intense runoff. This sediment tends to cause a deteriorating condition in streambeds and channels through deposition. Natural obstructions to flood waters include trees, brush, and other vegetation along the stream banks in the floodplain area. Considerable debris has been allowed to accumulate in these channels, plugging culverts and bridges at several locations throughout the county.

**Figure 5.13. Towns of Winthrop, and Twisp FEMA Flood Insurance Rate Map.**



### Probability of Future Occurrence

The probability of flood events occurring in Twisp is relatively high. Low magnitude flood events can be expected several times each year. Minor flash flooding is a common occurrence, particularly in the channels coming from Corbett and Childers Draw; however, these events rarely cause damages. Due to the flat topography and drainage infrastructure, the impacts of these events are slight and will usually amount to minor and temporary traffic issues caused by plugged culverts. Larger magnitude and high impact flood events have occurred, but are not likely in any given year. These types of flood events have the highest probability of occurrence in the winter or early spring in Twisp as a result of rain-on-snow events or rapid runoff.

### Impacts of Flood Events

The potential impacts from flooding in Twisp are very similar to the impacts described for Okanogan County as a whole. First responders and other volunteers aiding with emergency flood control or cleanup efforts are potentially at risk of injury due to accidents or possibly exposure to contaminated water. Although unlikely, the town's water supply could be affected by contaminated flood waters entering the groundwater supply.

The major impacts from flooding in Twisp are the restricted use of several streets, commercial, and residential areas. There are numerous bridge and culvert crossings both within the Town and in the surrounding area.

The availability of food and other supplies is not likely to be impacted or interrupted by a flood event. Furthermore, the delivery of community services such as postal services, health care, law enforcement, and emergency response is also not likely to be impacted by flood events in Twisp. While individual homes and businesses may incur damages as a result of a flood, the economy of the community will not be impacted by this type of hazard.

Environmental damages resulting from a flood event are also unlikely. Erosion along the stream banks and deposition of sediments in the Twisp area is possible, but due to grass and other vegetation on the stream banks, these impacts will most likely be minimal and localized. Contamination of the riparian area by floodwaters containing chemicals or other pollutants is also a possibility.

### Value of Resources at Risk

Twisp has approximately $5.3 million of property at risk located in the 100-year flood zone, which means there is a 1% chance of these properties flooding in any given year. Of these assets at risk, the largest proportion of parcels is classified as residential properties with $2.9 million (53%) on 8 acres. Twenty-nine percent of the total acreage (10 acres) is classified as commercial property and is worth approximately 1.3 million. The value of public property in the flood zone is approximately $111,000 while there is $347,000 classified as resource properties and $855,000 on 6 acres is vacant.

Although Okanogan County Fire District #6, the Okanogan County Public Utilities District, and the Okanogan County Electric Co-op provide service to areas within the Twisp floodplain, they do not have any facilities or assets located within the identified floodplain. Nevertheless, these districts could be impacted due to emergency response calls or limited access caused by flooding.

The Twisp area, particularly the Twisp River drainage, is currently experiencing aggressive residential, a trend throughout much of the Methow Valley. The negative impact of locating residential and light commercial resources in the areas most prone to flooding has been seen during the spring flooding events. While county planning efforts have attempted to mitigated some of the risks associated with developing the floodplain, these developments are not without risk to the owners of new homes and also the owners of existing homes and businesses as the flood waters will spillover as the waters rise.

Very few of Twisp's critical facilities are located within the floodplain. All major government offices, shelters, emergency response equipment, communications equipment, and water and sewer facilities are located outside of the floodplain and are not at direct risk of damage.

Roads and bridges are the major infrastructural element that is affected by flooding. Alternative routes to all parts of county are limited during most major flood events. There are four bridges crossings and numerous culverts that are within the 100 year floodplain in the Twisp area. Substandard or unrated bridges accessing private residences, particularly in the Twisp River area, have an increased risk of submersion, damage, or even destruction during a high water event. In some cases, the river bank where these have been placed has not been reinforced and is; therefore, highly susceptible to erosion. Very few private bridges in the Twisp area have been engineered to withstand a 100 year flood event.

Local power distribution systems may be compromised when power poles are undermined by flood waters. This is not a common occurrence as most of the power grid is located outside of flood areas.

## *Earthquake*

There are no recorded occurrences of earthquakes significantly impacting the town of Twisp; however, some minimal shaking has been felt as a result of larger earthquakes elsewhere. Twisp does not have any differing issues or levels of risk associated with this hazard than Okanogan County as a whole.

### Probability of Future Occurrence

Overall, the County has a 6-15% chance of experiencing an earthquake in the next 50 years. Jurisdictions in the Methow Valley have a slightly higher probability of experiencing an earthquake than those in the Okanogan River valley or on the eastern border of the County (10-15% probability versus 6-10% probability); however, no specific jurisdiction has more risk than another or than the County overall within these areas.[67]

### Impacts and Value of Resources At Risk

Unreinforced masonry (URM) structures and unreinforced chimneys of homes will likely be damaged in the event of an earthquake. There are several publicly accessible unreinforced masonry structures in Twisp in addition to the numerous homes and other buildings throughout the Town with unreinforced chimneys. Damaged or collapsed chimneys could result in the secondary hazard of fire. Nonstructural damage caused by falling and swinging objects may be considerable after any magnitude earthquake. Damage to some

[67] USGS. 2008 United States National Seismic Hazard Maps. U.S. Geological Survey. U.S. Department of Interior. Available online at http://earthquake.usgs.gov/hazards/products/conterminous/2008/. October 2009.

older, more fragile bridges and land failure causing minor slides along roadways may isolate some residents.

In Twisp, nearly all of the downtown structures are assumed to be unreinforced masonry. These structures were built prior to the inclusion of articles for seismic stability in the Uniform Building Codes in 1972. The number and value of unreinforced masonry homes or homes with masonry chimneys in Twisp is unknown, but estimated to include at least 10-20 buildings.

## *Landslide Profile*

The town of Twisp has a very low probability of experiencing damaging landslides. Slopes in and around the community are generally less than 25%. Many of the rural subdivisions and groups of homes in the numerous tributaries of the Methow River have a much higher landslide risk, particularly on the west side of the valley. Slopes along many of these tributaries are within the range of steepness (angle of repose) where loose topsoils, fractured rock, and other unconsolidated material have a high potential to slide. It is also probable that small slides will continue to occur on the cut and fill slopes of some roads. This type of slide is generally small with little permanent damage to the road or other infrastructure; however, there is some risk of traffic being delayed temporarily while road crews clear the debris and stabilize the bank.

### Impacts and Value of Resources at Risk

Twisp does not have a high potential for significant damage caused by landslides; however, many of the rural housing clusters on the west side of the valley do have significant risk. Many homes such as those along the Twisp River, Libby Creek, and Gold Creek have a moderate to high risk depending on their location. Homeowners in these higher risk areas should be aware of the potential risk and construct roads and building sites accordingly. Further weakening of toe slopes could trigger a large scale slide.

There is also moderate risk of landslide activity along the major travel corridors that access communities in the Methow Valley, which could hinder response by various fire protection districts (Okanogan County Fire Districts #6 and 15) and public utilities districts (Okanogan County PUD and Okanogan County Electric Co-Op) during emergencies. Since State Highways 20 and 153 are the only main access routes to these communities, a road closure for even a short period of time, can have serious impacts to residents and visitors traveling through the area. The affects of landslides on roads and the power supply has and will continue to impact the people living in the area. These impacts have historically been minor, resulting in limited vehicle access or temporary power loss.

## *Severe Weather Profile*

The Town of Twisp does not have any differing levels of risk associated with this hazard than Okanogan County as a whole. The probability of a severe weather event occurring in Okanogan on an annual basis is very high. However, the impacts to these communities are usually minimal and are the same as those described for Okanogan County as a whole.

### Impacts and Value of Resources at Risk

It is difficult to estimate the cost of potential winter storm damages to structures and the economy in Twisp. Damage to roofs by heavy snow accumulations depends on the moisture content of the snow and

the structural characteristics of the buildings. In general, snow in this region tends to have low moisture content because of the low temperatures and arid environment. Additionally, snow rarely accumulates for long periods of time due to regular wind events. Frozen water pipes are the most common damage to residential and business structures. Older homes tend to be at a higher risk to frozen water pipes than newer ones. Snow plowing in within the town limits is accomplished by the town's public works department. Private landowners are responsible for maintaining their own driveways or other private roads. Utility supplies are impacted during severe winter storms as power is lost on a regional basis. This has a two-fold impact on residents as not only is power cut to homes and businesses, but primary heating is lost for many residents. Gas furnaces and wood stoves supplement electrical heating, but with wood heating the senior population is at a disadvantage. Emergency response to severe winter storms includes site visits by police or fire department personnel, opening of shelters, or assistance with shopping, medical attention, and communications. The economic losses caused by severe winter storms may frequently be greater than structural damages. Employees may not be able to travel to work for several days and businesses may not open. Damages are seen in the form of structural repair and loss of economic activity. Okanogan County schools are occasionally closed during and right after a severe winter storm because of cold temperatures and snow covered roads.

Thunderstorms are not likely to be severe enough in Twisp to cause significant damages. However, the loss potential from flooding that results from severe thunderstorms could be significant.

Although the financial impacts of hail can be substantial and extended, accurately quantifying these impacts is problematic. Hail typically causes direct losses to structures and other personal property within Twisp. The most significant losses are most clearly seen in the agriculture sectors of the economy. Potential losses to agriculture can be disastrous. Crop damage from hail will also be different depending on the time of year and the type of crop. Most farmers carry insurance on their crops to help mitigate the potential financial loss resulting from a localized hail storm. Homeowners in Twisp rarely incur severe damage to structures (roofs); however, hail damage to vehicles is not uncommon. The damage to vehicles is difficult to estimate because the number of vehicles impacted by a specific ice storm is unknown. Additionally, most hail damage records are kept by various insurance agencies.

It is difficult to estimate potential losses in Twisp due to windstorms and tornadoes. Construction throughout the County has been implemented in the presence of high wind events, and therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

We have estimated losses based on wind and tornado damage as follows:

- 3% of the buildings damaged causing 50% of value loss (loss could be from downed or damaged trees, damaged outbuildings, damaged fences/poles, damage to siding, damaged landscaping etc.)
- 5% of the buildings received damage to roof (requiring replacement of roof equaling $3,000)

Damages associated with sensitive receptor irritation have not been estimated. We have also not estimated the potential for a large scale wildfire event associated with high winds. Based on the data provided by the County, there are 701 total structures in Twisp with a total value of approximately $60.8

million. Using the criteria outlined above an estimate of the impact of high winds in Twisp has been made. The potential wind and tornado damage to all buildings is estimated at approximately $912,342. The estimated damage to roofs is approximately $105,150.

Power failure often accompanies severe storms. More rural parts of the County like Twisp are sometimes better prepared to deal with power outages for a few days due to the frequent occurrence of such events; however, prolonged failure, especially during cold winter temperatures can have disastrous effects. All communities should be prepared to deal with power failures. Community shelters equipped with alternative power sources will help local residents stay warm and prepare food. A community-based system for monitoring and assisting elderly or disabled residents should also be developed. All households should maintain survival kits that include warm blankets, flashlights, extra batteries, nonperishable food items, and clean drinking water.

### *Wildland Fire Profile*

The Methow River Valley and the surrounding hillsides in the Twisp area consists primarily of grass and sage fuels. Agricultural and residential development along the valley bottom has resulted in a patchwork of irrigated crops and home sites. Near the Twisp and Carlton community centers and along the river banks deciduous trees add to the highly productive riparian vegetation. Ponderosa pine and Douglas-fir forests along some of the more distant ridge tops tend to become more dense and continuous to the east and west extending into the Okanogan National Forest on each side of the valley. Several of the developed drainages including Libby Creek and Benson Creek and along State Route 20 (Frazer Creek) within the National Forest have similar fuel compositions consisting of shrub steppe leading into moderate to dense fir stands on the north slopes and low to moderate density ponderosa pine on the south slopes. Fires in the grass and sage fuels of the valley would be expected to spread rapidly, particularly upslope, but burn at low to moderate intensities. Open pine and fir stands would likely support surface fires with only occasional jackpotting of slash piles or other fuels. Further to the east and west in the more forested areas outside the Methow River Valley, wildfires would likely burn more intensely and cause more mortality of the trees.

Okanogan Public Utility District (PUD) and Okanogan County Electric Cooperative (OCEC) provide electrical service to the Methow Valley. Most of the Methow Valley's electricity needs are presently served by a single transmission line, which starts in Okanogan at a substation and follows the route of State Route 20 over Loup Loup Pass to the Twisp substation in the town of Twisp. Okanogan PUD is responsible for maintaining the transmission line under an agreement between the two utilities and the Bonneville Power Administration. Okanogan PUD is currently engaged in an environmental review process to determine whether to construct a second transmission line to serve the valley. This second route would either be located in the upland hills on the east side of the valley or along the valley floor adjacent to State Route 153. Additionally, the valley's residents are served by a network of distribution lines that connect the transmission line to homes and businesses. The Okanogan PUD and OCEC share maintenance of the distribution system. Both utilities maintain some percentage of underground lines in the Methow Valley. The OCEC has reported that 95% of new distribution line construction and feeder upgrades in their service area are being installed underground. There are also a growing number of residents living off the power grid by creating their own power source via solar, wind, or generators. Wildfire risk in the agricultural landscape is at its highest during late summer and fall when crops are cured and daily temperatures are at

their highest. A wind-driven fire in agricultural fuels or dry native fuel complexes would produce a rapidly advancing, but variable intensity fire. Fires burning in some types of unharvested fields would be expected to burn more intensely with larger flame lengths due to the greater availability of fuels resulting from the higher productivity of the vegetation. Fields enrolled in the CRP or set aside for wildlife habitat can burn very intensely due to an increased amount of fuel build-up from previous years' growth. Fires in these types of fuels are harder to extinguish completely due to the dense duff layer, often leading to hold over fires that may reemerge at a later date causing additional fire starts.

Okanogan County Fire District #6 is responsible for structural and wildland fire protection within most of the populated areas of Twisp. Okanogan County Fire Protection District #15 provides protection for the populated areas bordering the Methow River through the Lower Methow Neighborhood.

All of the Okanogan County fire districts have signed a "Memorandum of Understanding" to assist any of the other districts in the County with fire suppression to the utmost of their abilities.

State lands are the sole responsibility of the Washington Department of Natural Resources (suppression & reciprocal agreements may apply). Federal lands are the sole responsibility of the Federal management agency (reciprocal agreement may apply). Much of the private lands in Okanogan County are within joint jurisdiction between the County fire protection districts and the WA DNR.

The DNR provides wildfire protection during the fire season between April and October with a varying degree of resources available in the early spring and late autumn months. The U.S. Forest Service seasonally responds to all wildland fires on their jurisdiction and may also respond to wildland fires on state and private lands based on a reciprocal agreement with the DNR.

### Probability of Future Occurrence

The Twisp area is at moderate to high risk of wildfires. The continuity of fuels along much of the Methow River Valley bottom are broken alfalfa fields and stands of low density trees, which helps slow the spread of fire. Most of the fire risk in this neighborhood occurs on the mid and upper slopes and in the developed drainages. Libby Creek and Texas Creek were identified in the Methow Community Wildfire Protection Plan as potential "hot spots" for fire activity. Economic values, fuel types, fire history, and access issues led to this designation. The riparian fuels along the river banks may also support a wildfire later in the summer as the water level goes down and the thick grass and brush begins to dry out. Fire spread along the waterway has the potential to threaten many homes as several structures are located along or near the water's edge.

### Impacts of Wildland Fire Events

The potential impacts from a wildfire in Twisp are very similar to the impacts described for Okanogan County as a whole. All fires pose a significant safety risk to residents and emergency service personnel. Individual structures, property, and livelihoods could be severely damaged or lost as a result of a fire; however, the community is not likely to suffer severe or long-term economic losses.

Low frequency fires in the shrublands surrounding the community may benefit the ecological environment as nutrients are recycled into the soil. Generally, grass and forbs are rejuvenated by a low intensity fire and grow back quickly; however, heavy rains immediately after a fire could cause erosion.

Smoke from a nearby wildland fire may impact sensitive populations within the community due to degraded air quality conditions. Smoke and/or flames will also impact transportation corridors connecting Twisp to other communities; thus, travel and commerce may be interrupted.

### Value of Resources at Risk

It is difficult to estimate potential losses in Twisp from wildland fire due to the unpredictability of wildfire behavior and the nature of ignition sources. It is unlikely that more than a few structures or other properties within the city limits of Twisp would be lost or damaged by a wildland fire; however, residents in the immediate vicinity may be directly impacted. It is impossible to forecast the path a wildfire will take and what type of assets and resources, manmade and ecological, will be at risk. Thus, no value estimates were made for this hazard.

# *Town of Winthrop Annex*

## *Flood Profile*

The town of Winthrop is located at the confluence of the Methow and Chewuch Rivers. Most of the development associated with the townsite has occurred along the east bank of both drainages. This area is experiencing a boom in residential construction; however, most of this development is occurring out of the city limits and only a handful has been within the 100 year floodplain.

The Methow River runs along the southwestern edge Winthrop community. There are many residences as well as businesses, industrial operations, and the Winthrop Fish Hatchery in this area. The Chewuch River flows along the west side of the town center and forms a large oxbow just to the north of the community. Although the structures located near this oxbow are not identified as being with the floodplain, this bank has a high likelihood of failure during high water events as the river's channel migrates. Undercutting and erosion of banks along oxbows is a common and usually natural occurrence in meandering rivers and streams.

Floods in the area are typically the result of two different types of weather events, rain-on-snow and thunderstorms. Rain-on-snow- events that affect Winthrop occur when significant snow pack exists in the Okanogan and Wenatchee National Forest on each side of the Methow Valley. Warm rains falling on the snow pack result in a significantly increased rate of snowmelt. Often this melting occurs while the ground is frozen and the water cannot be absorbed into the soil, resulting in increased overland flows. Flood waters recede slowly as rain-on-snow weather events tend to last for several days. Low velocity flooding occur in Winthrop almost annually during the spring runoff period. Ice jams in the smaller tributaries have historically caused flooding problems. The impacts of successive ice dams being built up and then breaking are felt all along the Winthrop River and Methow River drainages as the rush of water quickly overwhelms culverts, bridges, and storm drainage systems.

Low water permeable soil and sparse vegetation in some areas combine to foster flash flooding when intense thunderstorms hit the Winthrop area. Floods from thunderstorms do not occur as frequently as those from general rain and snowmelt conditions, but can be far more severe. The possibility for injury and death from flash floods is heightened because they occur quickly and are so uncommon that people do not recognize the potential danger.

The major impacts from both types of flooding in Winthrop are the restricted use of several streets, highways, commercial, industrial, and residential areas. There are numerous bridge and culvert crossings over both the Methow River, the Twisp River, and several irrigation canals throughout their extents within the town and the surrounding area.

Warm weather or rain after a heavy snowfall is responsible for high flows in these waterways. A high level of sediment is prevalent during periods of high runoff. This sediment tends to cause a deteriorating condition in channel beds through erosion and deposition. Natural obstructions to flood waters include trees, brush, and other vegetation along the stream banks in the floodplain area. Debris can plug culverts and accumulate on bridge abutments at several locations throughout the town. Several streets and road shoulders are prone to erosion during flood events around the Twisp area. Many secondary routes are not

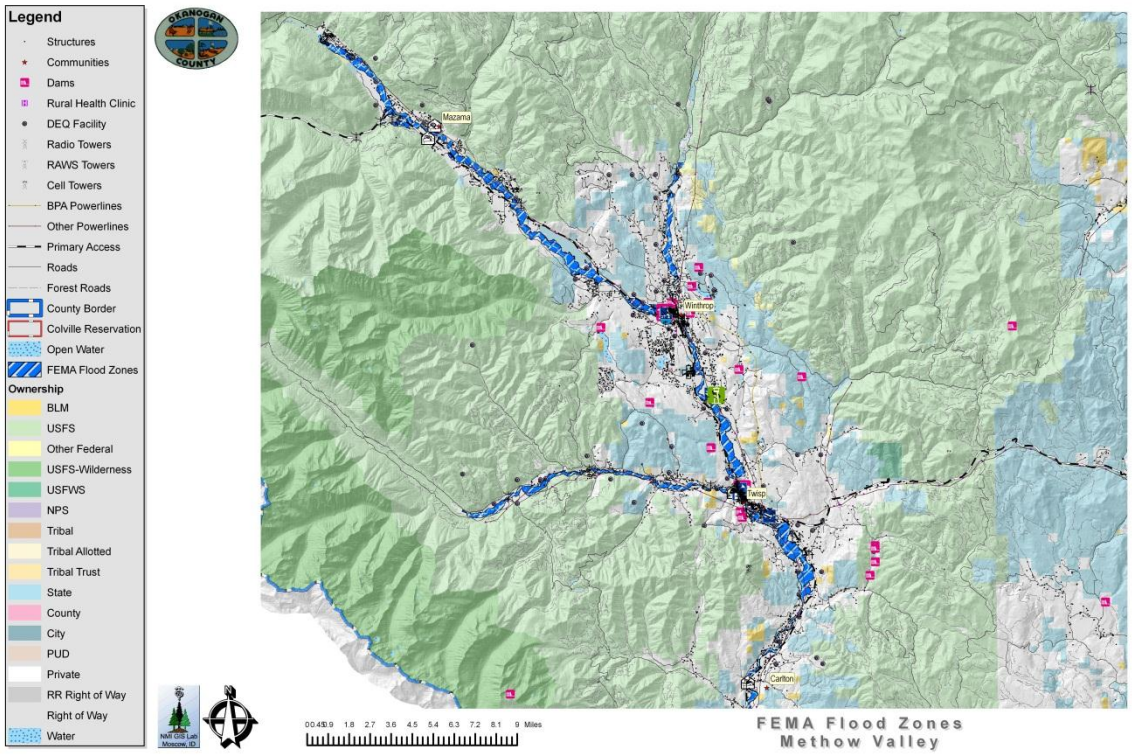
paved, which results in gravel washing down-slope potentially clogging drainage systems or directing water to places that were not intended.

The onset of flooding in the smaller drainages can range from extremely slow to very fast. This variability depends on the cause of flooding and other factors such as rainfall intensity, the areas receiving the rain, temperature, and the condition of the soil. Floods that occur quickly are usually caused by thunderstorms, while floods that occur more slowly are often the result of moderate, but prolonged rainfall, snowmelt, or a combination of both. In the case of intensive rainfall immediately above developed areas, the onset of flooding may occur in a matter of minutes.

Rural residences, ranches, farms, and roadways located near smaller waterways may be at significant flood risk. The onset of flooding in the smaller drainages can range from extremely slow to very fast. This variability depends on the cause of flooding and other factors such as rainfall intensity, the areas receiving the rain, temperature, and the condition of the soil. Floods that occur quickly are usually caused by thunderstorms, while floods that occur more slowly are often the result of moderate, but prolonged rainfall, snowmelt, or a combination of both. In the case of intense rainfall immediately above developed areas, the onset of flooding may occur in a matter of minutes.

A high level of sediment is prevalent during periods of intense runoff. This sediment tends to cause a deteriorating condition in streambeds and channels through deposition. Natural obstructions to flood waters include trees, brush, and other vegetation along the stream banks in the floodplain area. Considerable debris has been allowed to accumulate in these channels, plugging culverts and bridges at several locations throughout the county.

**Figure 5.14. Towns of Mazama, Winthrop, and Twisp FEMA Flood Insurance Rate Map.**



### Probability of Future Occurrence

The probability of flood events occurring in Winthrop is moderate. Low magnitude flood events can be expected several times each year. Due to the flat topography and drainage infrastructure, the impacts of these events are slight and will usually amount to minor and temporary traffic issues caused by plugged culverts. Larger magnitude and high impact flood events have occurred, but are not likely in any given year. These types of flood events have the highest probability of occurrence in the winter or early spring in Winthrop as a result of rain-on-snow events or rapid runoff.

### Impacts of Flood Events

The potential impacts from flooding in Winthrop are very similar to the impacts described for Okanogan County as a whole. First responders and other volunteers aiding with emergency flood control or cleanup efforts are potentially at risk of injury due to accidents or possibly exposure to contaminated water. Although unlikely, the town's water supply could be affected by contaminated flood waters entering the groundwater supply.

The major impacts from flooding in Winthrop are the restricted use of several streets, commercial, and residential areas. There are numerous bridge and culvert crossings both within the Town and in the surrounding area.

The availability of food and other supplies is not likely to be impacted or interrupted by a flood event. Furthermore, the delivery of community services such as postal services, health care, law enforcement, and emergency response is also not likely to be impacted by flood events in Winthrop. While individual homes and businesses may incur damages as a result of a flood, the economy of the community will not be impacted by this type of hazard.

Environmental damages resulting from a flood event are also unlikely. Erosion along the stream banks and deposition of sediments in the Winthrop area is possible, but due to grass and other vegetation on the stream banks, these impacts will most likely be minimal and localized. Contamination of the riparian area by floodwaters containing chemicals or other pollutants is also a possibility.

### Value of Resources at Risk

Winthrop has approximately $12.4 million of assets at risk located in the 100-year flood zone, which means there is a 1% chance of these properties flooding in any given year. Of these assets at risk, the largest proportion of value is classified as residential homes with $4.04 million; however, commercial and vacant properties at $3.01 million and $2.4 million, respectively. Vacant land also accounts for 41% of the total acreage (10 acres) within the floodplain. Seventeen percent of the total acreage (4 acres) and 7% of the total value ($810,900) is categorized as recreational property in Winthrop.

Although Okanogan County Fire District #6 and the Okanogan County Electric Co-Op provide service to areas within the Winthrop floodplain, they do not have any facilities or assets located within the identified floodplain. Nevertheless, these districts could be impacted due to emergency response calls or limited access caused by flooding.

The only critical facility listed as being within the floodplain is the Methow Fish Hatchery. All major city services, office buildings, shelters, emergency response equipment, and communications equipment are located outside of the floodplain and are not at direct risk of damage. There are a few personal water wells located within the floodplain in the greater Winthrop area; however, none of the town's water supply wells are at high risk.

Roads and bridges are the major infrastructural element that is affected by flooding. Alternative routes to all parts of county are limited during most major flood events. Bridges and culverts near Winthrop have been repeatedly compromised by past flood events causing long term damage to road systems.

Local power distribution systems may be compromised when power poles are undermined by flood waters; however, this is not a common occurrence as most of the power grid is located outside of flood areas.

## *Earthquake*

There are no recorded occurrences of earthquakes significantly impacting the town of Winthrop; however, some minimal shaking has been felt as a result of larger earthquakes elsewhere. Winthrop does not have any differing issues or levels of risk associated with this hazard than Okanogan County as a whole.

### Probability of Future Occurrence

Overall, the County has a 6-15% chance of experiencing an earthquake in the next 50 years. Jurisdictions in the Methow Valley have a slightly higher probability of experiencing an earthquake than those in the Okanogan River valley or on the eastern border of the County (10-15% probability versus 6-10% probability); however, no specific jurisdiction has more risk than another or than the County overall within these areas.[68]

### Impacts and Value of Resources At Risk

Unreinforced masonry (URM) structures and unreinforced chimneys of homes will likely be damaged in the event of an earthquake. There are several publicly accessible unreinforced masonry structures in Winthrop in addition to the numerous homes and other buildings throughout the Town with unreinforced chimneys. Damaged or collapsed chimneys could result in the secondary hazard of fire. Nonstructural damage caused by falling and swinging objects may be considerable after any magnitude earthquake. Damage to some older, more fragile bridges and land failure causing minor slides along roadways may isolate some residents.

In Winthrop, none of the downtown structures are unreinforced masonry. These structures were built prior to the inclusion of articles for seismic stability in the Uniform Building Codes in 1972. The number and value of unreinforced masonry homes or homes with masonry chimneys in Winthrop is unknown, but estimated to include at least 20-40 buildings.

[68] USGS. 2008 United States National Seismic Hazard Maps. U.S. Geological Survey. U.S. Department of Interior. Available online at http://earthquake.usgs.gov/hazards/products/conterminous/2008/. October 2009.

## *Landslide Profile*

The town of Winthrop has a very low probability of experiencing damaging landslides. Slopes in and around the community are generally less than 25%. Many of the rural subdivisions and groups of homes in the numerous tributaries of the Methow River have a much higher landslide risk, particularly on the west side of the valley. Slopes along many of these tributaries are within the range of steepness (angle of repose) where loose topsoils, fractured rock, and other unconsolidated material have a high potential to slide. It is also probable that small slides will continue to occur on the cut and fill slopes of some roads. This type of slide is generally small with little permanent damage to the road or other infrastructure; however, there is some risk of traffic being delayed temporarily while road crews clear the debris and stabilize the bank.

### Impacts and Value of Resources at Risk

The communities of Winthrop, Twisp, and Pateros do not have a high potential for significant damage caused by landslides; however, many of the rural housing clusters on the west side of the valley do have significant risk. Many homes such as those along the Twisp River, Libby Creek, and Gold Creek have a moderate to high risk depending on their location. Homeowners in these higher risk areas should be aware of the potential risk and construct roads and building sites accordingly. Further weakening of toe slopes could trigger a large scale slide.

There is also moderate risk of landslide activity along the major travel corridors that access communities in the Methow Valley, which could hinder response by various fire protection districts (Okanogan County Fire Districts #6 and 15) and public utilities districts (Okanogan County PUD and Okanogan County Electric Cooperative) during emergencies. Since State Highways 20 and 153 are the only main access routes to these communities, a road closure for even a short period of time, can have serious impacts to residents and visitors traveling through the area. The affects of landslides on roads and the power supply has and will continue to impact the people living in the area. These impacts have historically been minor, resulting in limited vehicle access or temporary power loss.

## *Severe Weather Profile*

The town of Winthrop does not have any differing levels of risk associated with this hazard than Okanogan County as a whole. The probability of a severe weather event occurring in Winthrop on an annual basis is very high. However, the impacts to these communities are usually minimal and are the same as those described for Okanogan County as a whole.

### Impacts and Value of Resources at Risk

It is difficult to estimate the cost of potential winter storm damages to structures and the economy in Winthrop. Damage to roofs by heavy snow accumulations depends on the moisture content of the snow and the structural characteristics of the buildings. In general, snow in this region tends to have low moisture content because of the low temperatures and arid environment. Additionally, snow rarely accumulates for long periods of time due to regular wind events. Frozen water pipes are the most common damage to residential and business structures. Older homes tend to be at a higher risk to frozen water pipes than newer ones. Snow plowing in within the town limits is accomplished by the town's public works department. Private landowners are responsible for maintaining their own driveways or other private

roads. Utility supplies are impacted during severe winter storms as power is lost on a regional basis. This has a two-fold impact on residents as not only is power cut to homes and businesses, but primary heating is lost for many residents. Gas furnaces and wood stoves supplement electrical heating, but with wood heating the senior population is at a disadvantage. Emergency response to severe winter storms includes site visits by police or fire department personnel, opening of shelters, or assistance with shopping, medical attention, and communications. The economic losses caused by severe winter storms may frequently be greater than structural damages. Employees may not be able to travel to work for several days and businesses may not open. Damages are seen in the form of structural repair and loss of economic activity. Okanogan County schools are occasionally closed during and right after a severe winter storm because of cold temperatures and snow covered roads.

Thunderstorms are not likely to be severe enough in Winthrop to cause significant damages. However, the loss potential from flooding that results from severe thunderstorms could be significant.

Although the financial impacts of hail can be substantial and extended, accurately quantifying these impacts is problematic. Hail typically causes direct losses to structures and other personal property within Winthrop. The most significant losses are most clearly seen in the agriculture sectors of the economy. Potential losses to agriculture can be disastrous. Crop damage from hail will also be different depending on the time of year and the type of crop. Most farmers carry insurance on their crops to help mitigate the potential financial loss resulting from a localized hail storm. Homeowners in Winthrop rarely incur severe damage to structures (roofs); however, hail damage to vehicles is not uncommon. The damage to vehicles is difficult to estimate because the number of vehicles impacted by a specific ice storm is unknown. Additionally, most hail damage records are kept by various insurance agencies.

It is difficult to estimate potential losses in Winthrop due to windstorms and tornadoes. Construction throughout the County has been implemented in the presence of high wind events, and therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

We have estimated losses based on wind and tornado damage as follows:

- 3% of the buildings damaged causing 50% of value loss (loss could be from downed or damaged trees, damaged outbuildings, damaged fences/poles, damage to siding, damaged landscaping etc.)
- 5% of the buildings received damage to roof (requiring replacement of roof equaling $3,000)

Damages associated with sensitive receptor irritation have not been estimated. We have also not estimated the potential for a large scale wildfire event associated with high winds. Based on the data provided by the County, there are 736 total structures in Winthrop with a total value of approximately $60,209,200.

Using the criteria outlined above an estimate of the impact of high winds in Winthrop has been made. The potential wind and tornado damage to all buildings is estimated at approximately $903,138. The estimated damage to roofs is approximately $110,400.

Power failure often accompanies severe storms. More rural parts of the County like Winthrop are sometimes better prepared to deal with power outages for a few days due to the frequent occurrence of such events; however, prolonged failure, especially during cold winter temperatures can have disastrous effects. All communities should be prepared to deal with power failures. Community shelters equipped with alternative power sources will help local residents stay warm and prepare food. A community-based system for monitoring and assisting elderly or disabled residents should also be developed. All households should maintain survival kits that include warm blankets, flashlights, extra batteries, nonperishable food items, and clean drinking water.

### *Wildland Fire Profile*

Fuels in the Winthrop area consist mostly of sagebrush and mid-length grasses on the surrounding hillsides and valley bottom. Around the Pearrygin Lake State Park, the grass is kept well watered and mowed except for a narrow border of riparian vegetation immediately surrounding the lake. Within the valley, much of the native vegetation has been converted to livestock pasture, agricultural fields, or residential development. Riparian vegetation including black cottonwoods, willows, and other hardwoods are present along the Methow River and Chewuch River banks. There are also a few stringers of sparse ponderosa pine in some of the smaller draws. A fire in these fuels would be expected to spread very rapidly through the flashy fuels; however, the extensive development and current road system breaks the continuity of the fuels helping make suppression tactics more effective.

Okanogan Public Utility District (PUD) and Okanogan Rural Electric Cooperative (OCEC) provide electrical service to the Methow Valley. Most of the Methow Valley's electricity needs are presently served by a single transmission line, which starts in Okanogan at a substation and follows the route of State Route 20 over Loup Loup Pass to the Twisp substation in the town of Twisp. Okanogan PUD is responsible for maintaining the transmission line under an agreement between the two utilities and the Bonneville Power Administration. Okanogan PUD is currently engaged in an environmental review process to determine whether to construct a second transmission line to serve the valley. This second route would either be located in the upland hills on the east side of the valley or along the valley floor adjacent to State Route 153. Additionally, the valley's residents are served by a network of distribution lines that connect the transmission line to homes and businesses. The Okanogan PUD and OCEC share maintenance of the distribution system. Both utilities maintain some percentage of underground lines in the Methow Valley. The OCEC has reported that 95% of new distribution line construction and feeder upgrades in their service area are being installed underground. There is also a growing number of residents living off the power grid by creating their own power source via solar, wind, or generators.

Okanogan County Fire District #6 is responsible for structural and wildland fire protection within most of the populated areas of the Winthrop and Twisp-Carlton Neighborhoods. Okanogan County Fire Protection District #15 provides protection for the populated areas bordering the Methow River through the Lower Methow Neighborhood.

State lands are the sole responsibility of the Washington Department of Natural Resources (suppression & reciprocal agreements may apply). Federal lands are the sole responsibility of the Federal management

agency (reciprocal agreement may apply). Much of the private lands in Okanogan County are within joint jurisdiction between the County fire protection districts and the WA DNR.

The DNR provides wildfire protection during the fire season between April and October with a varying degree of resources available in the early spring and late autumn months. The U.S. Forest Service seasonally responds to all wildland fires on their jurisdiction and may also respond to wildland fires on state and private lands based on a reciprocal agreement with the DNR.

### Probability of Future Occurrence

The Winthrop Neighborhood has a moderate risk of experiencing a large wildland fire due to the extensive development and conversion of the native fuels to pasture or other agricultural use. There is; however, a high potential for an ignition from various sources as a result of the density of recreation or other human activities. Recreational activities along the Methow and Chewuch Rivers and at Pearrygin Lake State Park have a high likelihood of an ignition from campfires, BBQs, ATVs, etc. Careful maintenance of the fuels within and surrounding the park reduces this potential risk and helps protect the park from fires spreading into the area from the surrounding area. In the event of a threatening fire, the town of Winthrop may be at high risk due to the use of wood building materials on many of the buildings. The plank board siding, wooden sidewalks, and wood shingled roofs would be very receptive to ignition from fire brands.

### Impacts of Wildland Fire Events

The potential impacts from a wildfire in Winthrop are very similar to the impacts described for Okanogan County as a whole. All fires pose a significant safety risk to residents and emergency service personnel. Individual structures, property, and livelihoods could be severely damaged or lost as a result of a fire; however, the community is not likely to suffer severe or long-term economic losses.

Low frequency fires in the shrublands surrounding the community may benefit the ecological environment as nutrients are recycled into the soil. Generally, grass and forbs are rejuvenated by a low intensity fire and grow back quickly; however, heavy rains immediately after a fire could cause erosion.

Smoke from a nearby wildland fire may impact sensitive populations within the community due to degraded air quality conditions. Smoke and/or flames will also impact transportation corridors connecting Winthrop to other communities; thus, travel and commerce may be interrupted.

### Value of Resources at Risk

It is difficult to estimate potential losses in Winthrop from wildland fire due to the unpredictability of wildfire behavior and the nature of ignition sources. It is unlikely that more than a few structures or other properties within the city limits of Winthrop would be lost or damaged by a wildland fire; however, residents in the immediate vicinity may be directly impacted. It is impossible to forecast the path a wildfire will take and what type of assets and resources, manmade and ecological, will be at risk. Thus, no value estimates were made for this hazard.

# *Town of Riverside Annex*

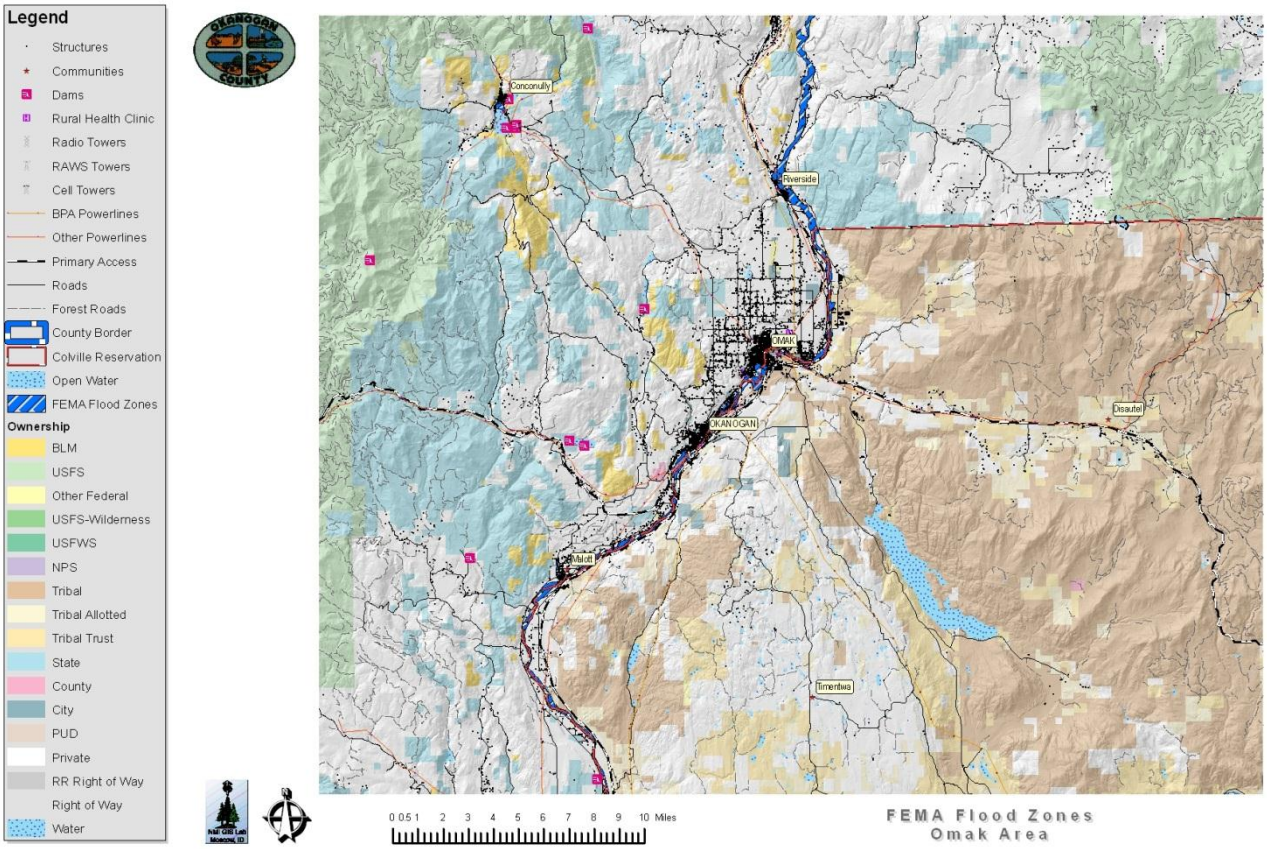
## *Flood Profile*

A large portion of the community of Riverside is located within the 100 year floodplain of the Okanogan River. All but a small portion near the Riverside Bridge is located on the west side of the river and much of this area has been developed for agricultural purposes. Johnson Creek, coming from the west, empties into the Okanogan River at Riverside; however, this stream does not seem to add to the floodplain.

In addition to the potential flood hazard of the Okanogan River, Johnson Creek, which drains several small tributaries out of the foothills to the west, flows through the middle of the residential neighborhood of Riverside. Although Johnson Creek has no identified floodplain, a blockage could cause the stream to breach its banks resulting in severe damage to many homes and businesses.

Flooding in Riverside is usually the result of rain-on-snow events or heavy spring runoff in the high country. Warm weather or rain after a heavy snowfall is called a rain-on-snow event. Warm rains falling on the snow pack result in a significantly increased rate of snowmelt. Often the melting occurs when the ground is frozen and the water cannot be absorbed fast enough, resulting in increased overland flows. Flood waters recede slowly as the weather events tend to last for several days.

**Figure 5.15. Town of Riverside, Omak, and Okanogan FEMA Flood Insurance Rate Map.**



### Probability of Future Occurrences

The probability of flood events occurring in Riverside is low to moderate. Low magnitude flood events can be expected several times each year. However, due to the levee and drainage infrastructure, the impacts of these events are slight and will usually amount to minor and temporary traffic issues. Larger magnitude and high impact flood events have occurred, but are not likely in any given year. These types of flood events have the highest probability of occurrence in the winter or early spring in Riverside. Minor flash floods are common on the numerous small tributaries feeding the Okanogan River near the community, but are not likely to have an impact on the Okanogan River channel within the city center.

### Impacts of Flood Events

The potential impacts from flooding in Riverside are very similar to the impacts described for the County as a whole. First responders and other volunteers aiding with emergency flood control or cleanup efforts are potentially at risk of injury due to accidents or possibly exposure to contaminated water. Although unlikely, the city's water supply could be affected by contaminated flood waters entering the groundwater supply.

The major impacts from flooding in Riverside are the restricted use of several streets, commercial and residential areas due to overburden of existing drainage facilities. There are numerous bridge and culvert crossings over the Okanogan River throughout its extent within the Town and the surrounding area.

The availability of food and other supplies is not likely to be impacted or interrupted by a flood event. Furthermore, the delivery of community services such as postal services, health care, law enforcement, and emergency response is also not likely to be impacted by flood events in Riverside. While individual homes and businesses may incur damages as a result of a flood, the economy of the community will not be impacted by this type of hazard.

Environmental damages resulting from a flood event are also unlikely. The Okanogan River occupies a relatively wide floodplain except for a short segment that has been channeled through the community. Scouring and erosion along the banks of the stream along this more narrow section is possible, but due to grass and other vegetation, these impacts will most likely be minimal and localized. Contamination of the riparian area by floodwaters containing chemicals or other pollutants is a possibility, but is more likely to be realized in the surrounding areas than within the community due to the hydrologic profile of the floodplain.

### Value of Resources at Risk

Riverside has approximately $2.9 million of assets at risk located in the 100-year flood zone, which means there is a 1% chance of these properties flooding in any given year. Of these assets at risk, the largest proportion of assets is classified as resource properties, which is primarily agricultural. Over $1.1 million of the total value and 176 acres are classified in the resource category. Residential property accounts for 53% ($1.5 million), but only 15% ( 38 acres) of the total acreage. Vacant lots account for 8% (20 acres) of the total acreage, but only 2% ($61,200) of the total value of assets at risk in the Riverside floodplain.

Although Okanogan County Fire District #7 and the Okanogan County Public Utilities District provide service to areas within the Riverside floodplain, they do not have any facilities or assets located within the identified floodplain. Nevertheless, these districts could be impacted due to emergency response calls or limited access caused by flooding.

There is no critical infrastructure or facilities located within the floodplain in Riverside; however, there are several homes, businesses, and agricultural developments.

Roads and bridges are the major infrastructural element that could be affected by flooding. Alternative routes to all parts of county are limited during most major flood events.

Local power distribution systems may be compromised when power poles are undermined by flood waters; however, this is not a common occurrence as most of the power grid is located outside of flood areas.

## *Earthquake*

There are no recorded occurrences of earthquakes significantly impacting the city of Riverside; however, some minimal shaking has been felt as a result of larger earthquakes elsewhere. Riverside does not have any differing issues or levels of risk associated with this hazard than Okanogan County as a whole.

### Probability of Future Occurrence

Overall, the County has a 6-15% chance of experiencing an earthquake in the next 50 years. Jurisdictions in the Methow Valley have a slightly higher probability of experiencing an earthquake than those in the Okanogan River valley or on the eastern border of the County (10-15% probability versus 6-10% probability); however, no specific jurisdiction has more risk than another or than the County overall within these areas.[69]

### Impacts and Value of Resources at Risk

Unreinforced masonry (URM) structures and unreinforced chimneys of homes will likely be damaged in the event of an earthquake. There are a few publicly accessible unreinforced masonry structures in Riverside in addition to the numerous homes and other buildings throughout the Town with unreinforced chimneys. Damaged or collapsed chimneys could result in the secondary hazard of fire. Nonstructural damage caused by falling and swinging objects may be considerable after any magnitude earthquake. Damage to some older, more fragile bridges and land failure causing minor slides along roadways may isolate some residents.

In Riverside, only 3 of the downtown structures are assumed to be unreinforced masonry. These structures were built prior to the inclusion of articles for seismic stability in the Uniform Building Codes in 1972. The number and value of unreinforced masonry homes or homes with masonry chimneys in Riverside are unknown, but estimated to include at least 10-30 buildings.

## *Landslide Profile*

The city of Riverside has very low probabilities of experiencing damaging landslides. The few slopes in and around the community are generally less than 20%. While small, low angle slumps may occur on eyebrows of the surrounding rolling hills, these will be infrequent and likely the result of water saturation or a major disturbance such as an earthquake or road construction.

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[69] USGS. 2008 United States National Seismic Hazard Maps. U.S. Geological Survey. U.S. Department of Interior. Available online at http://earthquake.usgs.gov/hazards/products/conterminous/2008/. October 2009.

### Impacts and Value of Resources at Risk

There are no structures or infrastructure directly at risk from landslides within the town of Riverside.

## *Severe Weather Profile*

The town of Riverside does not have any differing levels of risk associated with this hazard than Okanogan County as a whole. The probability of a severe weather event occurring in Riverside on an annual basis is very high. However, the impacts to the community are usually minimal and are the same as those described for Okanogan County as a whole.

### Impacts and Value of Resources at Risk

It is difficult to estimate the cost of potential winter storm damages to structures and the economy in Riverside. Damage to roofs by heavy snow accumulations depends on the moisture content of the snow and the structural characteristics of the buildings. In general, snow in this region tends to have low moisture content because of the low temperatures and arid environment. Additionally, snow rarely accumulates for long periods of time due to regular wind events. Frozen water pipes are the most common damage to residential and business structures. Older homes tend to be at a higher risk to frozen water pipes than newer ones. Snow plowing in within the town limits is accomplished by the town's public works department. Private landowners are responsible for maintaining their own driveways or other private roads. Utility supplies are impacted during severe winter storms as power is lost on a regional basis. This has a two-fold impact on residents as not only is power cut to homes and businesses, but primary heating is lost for many residents. Gas furnaces and wood stoves supplement electrical heating, but with wood heating the senior population is at a disadvantage. Emergency response to severe winter storms includes site visits by police or fire department personnel, opening of shelters, or assistance with shopping, medical attention, and communications. The economic losses caused by severe winter storms may frequently be greater than structural damages. Employees may not be able to travel to work for several days and businesses may not open. Damages are seen in the form of structural repair and loss of economic activity. Okanogan County schools are occasionally closed during and right after a severe winter storm because of cold temperatures and snow covered roads.

Thunderstorms are not likely to be severe enough in Riverside to cause significant damages. However, the loss potential from flooding that results from severe thunderstorms could be significant.

Although the financial impacts of hail can be substantial and extended, accurately quantifying these impacts is problematic. Hail typically causes direct losses to structures and other personal property within Riverside. The most significant losses are most clearly seen in the agriculture sectors of the economy. Potential losses to agriculture can be disastrous. Crop damage from hail will also be different depending on the time of year and the type of crop. Most farmers carry insurance on their crops to help mitigate the potential financial loss resulting from a localized hail storm. Homeowners in Riverside rarely incur severe damage to structures (roofs); however, hail damage to vehicles is not uncommon. The damage to vehicles is difficult to estimate because the number of vehicles impacted by a specific ice storm is unknown. Additionally, most hail damage records are kept by various insurance agencies.

It is difficult to estimate potential losses in Riverside due to windstorms and tornadoes. Construction throughout the County has been implemented in the presence of high wind events, and therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

We have estimated losses based on wind and tornado damage as follows:

- 3% of the buildings damaged causing 50% of value loss (loss could be from downed or damaged trees, damaged outbuildings, damaged fences/poles, damage to siding, damaged landscaping etc.)
- 5% of the buildings received damage to roof (requiring replacement of roof equaling $3,000)

Damages associated with sensitive receptor irritation have not been estimated. We have also not estimated the potential for a large scale wildfire event associated with high winds. Based on the data provided by the County, there are 305 total structures in Riverside with a total value of approximately $9.7 million. Using the criteria outlined above an estimate of the impact of high winds in Riverside has been made. The potential wind and tornado damage to all buildings is estimated at approximately $144,974. The estimated damage to roofs is approximately $45,750.

Power failure often accompanies severe storms. More rural parts of the County are sometimes better prepared to deal with power outages for a few days due to the frequent occurrence of such events; however, prolonged failure, especially during cold winter temperatures can have disastrous effects. All communities should be prepared to deal with power failures. Community shelters equipped with alternative power sources will help local residents stay warm and prepare food. A community-based system for monitoring and assisting elderly or disabled residents should also be developed. All households should maintain survival kits that include warm blankets, flashlights, extra batteries, nonperishable food items, and clean drinking water.

### *Wildland Fire Profile*

Most of the neighborhoods in Riverside are heavily developed for residential, commercial, or agricultural use. Orchards, livestock pasture, hay, or other crops are grown on nearly every available acre that has access to irrigation water. During the summer and fall, this creates a mosaic of lush green vegetation where there is irrigation and cured sage and grass in areas where there isn't.

Wildland fuels within the community of Riverside are fairly limited to ditches, empty lots, and the riverbanks due to extensive urban and agricultural development. Orchards and other crops grow both within the valley and on many of the low benches where irrigation water is available. The surrounding foothills are vegetated primarily by sagebrush and various lower growing grasses. Sparse ponderosa pine can be found in a few of the nearby draws. The slope rising from the east side of the river near Okanogan is steep, almost vertical in some places; however, it appears to be nearly solid rock with little soil available for plant growth.

Wildfire potential in the agricultural fields near Riverside is high. Farming and ranching activities have the potential to increase the risk of a human-caused ignition. Large expanses of crops, CRP, rangeland or pasture provide areas of continuous fuels that may threaten homes and farmsteads near Riverside. Under

extreme weather conditions, escaped fires in these fuels could threaten individual homes or the community; however, this type of fire is usually quickly controlled. Clearings and fuel breaks disrupt a slow moving wildfire enabling suppression before a fire can ignite heavier fuels. High winds increase the rate of fire spread and intensity of crop and rangeland fires. It is imperative that homeowners implement fire mitigation measures to protect their structures and families prior to a wildfire event.

Wildfire risk in the agricultural landscape is at its highest during late summer and fall when crops are cured and daily temperatures are at their highest. A wind-driven fire in agricultural fuels or dry native fuel complexes would produce a rapidly advancing, but variable intensity fire. Fires burning in some types of unharvested fields would be expected to burn more intensely with larger flame lengths due to the greater availability of fuels resulting from the higher productivity of the vegetation. Fields enrolled in the CRP or set aside for wildlife habitat can burn very intensely due to an increased amount of fuel build-up from previous years' growth. Fires in these types of fuels are harder to extinguish completely due to the dense duff layer, often leading to hold over fires that may reemerge at a later date causing additional fire starts.

Residents living in Riverside have access to the municipal water supply system and public fire hydrants. Outside these areas, development relies on individual, co-op, or multiple-home well systems. Creeks, ponds, and developed drafting areas provide water sources for emergency fire suppression in the rural areas to a limited extent. Irrigation systems are capable of providing additional water supply for suppression equipment on a limited basis. Additional water resources distributed and documented throughout the agricultural landscape are needed to provide water for fire suppression.

Above ground, high voltage transmission lines cross the planning area in many directions in corridors cleared of most vegetation, which provides for a defensible space around the power line infrastructure and may provide a control point for fire suppression, if well maintained. Local public electrical utility lines are both above and below ground traveling through back yards and along roads and highways. Many of these lines are exposed to damage from falling trees and branches. Power and communications may be cut to some of these during a wildfire event.

State lands are the sole responsibility of the Washington Department of Natural Resources (suppression & reciprocal agreements may apply). Federal lands are the sole responsibility of the Federal management agency (reciprocal agreement may apply). Much of the private lands in Okanogan County are within joint jurisdiction between the County fire protection districts and the WA DNR.

The DNR provides wildfire protection during the fire season between April and October with a varying degree of resources available in the early spring and late autumn months. The DNR does not provide structural fire suppression, but does provide wildfire protection on non-forested land that threatens DNR-protected lands. The U.S. Forest Service seasonally responds to all wildland fires on their jurisdiction and may also respond to wildland fires on private lands based on a reciprocal agreement with the DNR. The BLM provides wildfire protection on their ownership within Okanogan County and has mutual aid agreements with the DNR for protection of forested land. BLM also does not provide structural fire suppression.Probability of Future Occurrence

The probability of a wildland fire threatening Creston on an annual basis is high. Homes and other structures located in the grasslands or agricultural fields within or surrounding the community have a high

wildfire risk. Rangeland or grass fires are often the most dangerous due to high rates of spread. Fires in this fuel type are considered somewhat easier to suppress given the appropriate resources, but they can also be the most destructive. Homes along the perimeter of the community would have the highest risk due to their adjacency to flashy fuels.

### Impacts of Wildland Fire Events

Riverside allows for irrigation of landscaping and agricultural crops, which not only helps keep the vegetation green and at lower propensity for ignitions, but also gives firefighters abundant access to water resources for suppression purposes. As crop production slows in the fall, the irrigation pressure tends to taper off, leaving previously lush grasses and other vegetation to dry out and become a potential fire hazard.

The sagebrush and grassland fuels that dominant this part of the County usually becomes available to burn fairly early in the summer. The growth of a productive orchard takes many years and is, therefore, a long term investment. The potential loss of these orchards and the surrounding structures to fire would severely damage the local economy as well as change the way of life for many residents.

### Value of Resources at Risk

It is difficult to estimate potential losses in Riverside from wildland fire due to the unpredictability of wildfire behavior and the nature of ignition sources. It is unlikely that more than a few structures or other properties within the city limits of Riverside would be lost or damaged by a wildland fire; however, residents in the immediate vicinity may be directly impacted. It is impossible to forecast the path a wildfire will take and what type of assets and resources, manmade and ecological, will be at risk. Thus, no value estimates were made for this hazard.

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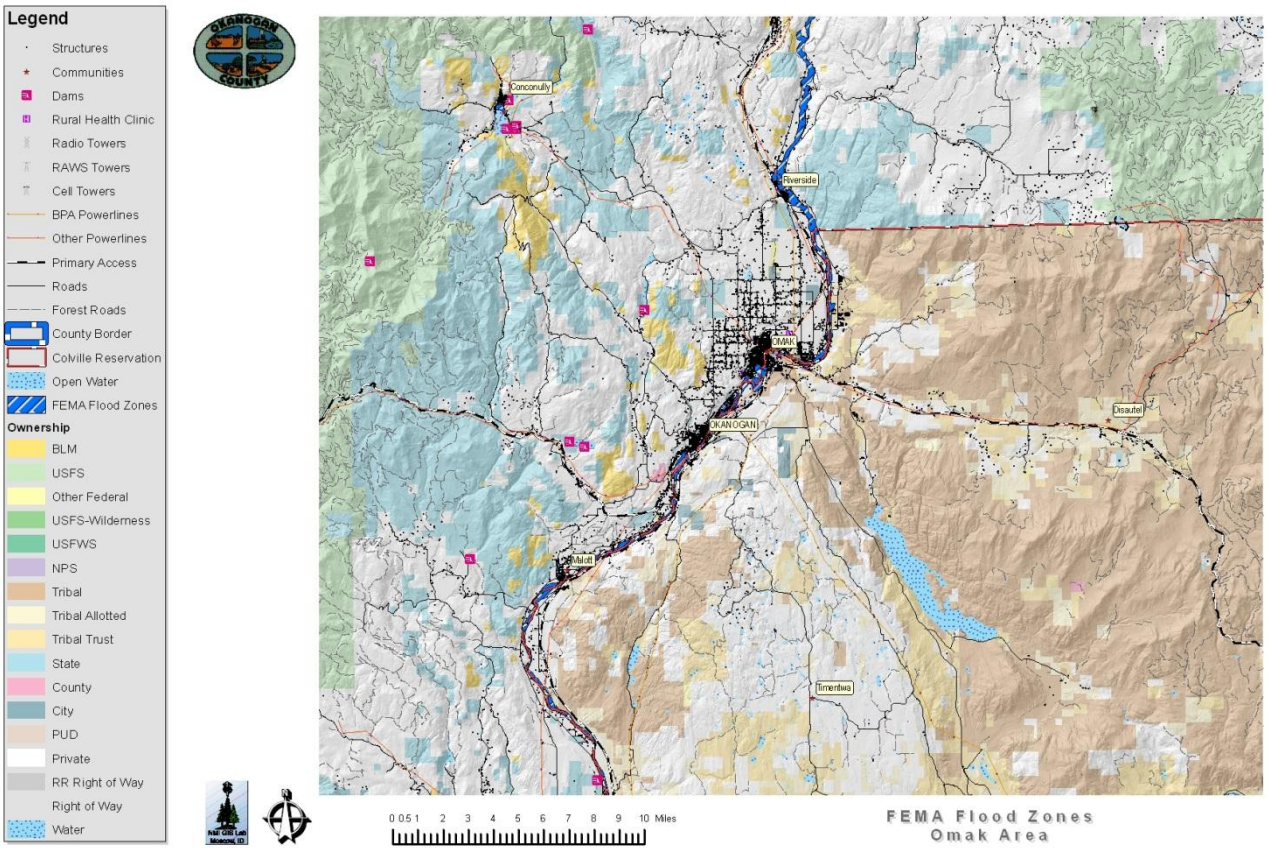
# *Town of Conconully Annex*

## *Flood Profile*

The town of Conconully sits in a small basin with Salmon Lake directly abutting the east side of the community and Conconully Reservoir directly to the south. Salmon Lake is formed by the Salmon Lake Dam with water from the North Fork of Salmon Creek. Conconully Reservoir is formed by damming the water from Salmon Creek and the South Fork of Salmon Creek with the spillway being located about one mile south of Conconully. Salmon Creek runs through the business district therefore, nearly all of the town of Conconully is located within the 100 year flood plain with the exceptions being the northwestern most corner of the downtown area, residents located along Sinlahekin Road on the north side of Conconully Lake, and residents on West Fork Road along the west side of Conconully Reservoir.

All of these waterways are extremely prone to flash flooding from localized weather events due to typically shallow channels and wide floodplains. Rain-on-snow events can also have a significant effect on this watershed. Warm rains result in a significantly increased rate of snowmelt. Often this melting occurs while the ground is frozen and the water cannot be absorbed into the soil, resulting in increased overland flows. Flood waters recede slowly as rain-on-snow weather events tend to last for several days. Low velocity flooding occurs in several of the nearby tributaries almost annually during the spring runoff period.

**Figure 5.16. Town of Conconully FEMA Flood Insurance Rate Map.**



### Probability of Future Occurrence

Portions of the town of Conconully flood almost on an annual basis. Much of the townsite sits below the water table; thus, even a slightly elevated water level tends to flood some structures in town. Additionally, the close proximity of Salmon Lake also adds to the potential for flooding and water seepage in the town. During a high water event, excess flow can be released from the Conconully Reservoir downstream into Salmon Creek and would not likely affect any structures in Conconully unless the spillway could not release water quickly enough causing water to back up into the townsite.

The Salmon Lake Dam controls water levels on Conconully Reservoir and is adjacent to the east edge of the townsite with the outlet stream located on the south end of the dam. Water released from the reservoir flows along southeast corner of downtown Conconully and into Conconully Reservoir. The main access route, Conconully Road, crosses this outlet stream just before it drains into Conconully Reservoir. Thus, during high water events, not only is there a chance that the entire town could be flooded by water overtopping Salmon Lake Dam, but the main escape route could be compromised by flood waters at the Conconully Road Bridge. This type of disaster was demonstrated in 1894 when the town of Conconully was completely destroyed by a 92-year flood event.

Flooding in Conconully, as with the rest of Okanogan County, is usually the result of rain-on-snow events or heavy spring runoff. Warm rains falling on the snow pack result in a significantly increased rate of snowmelt. Often the melting occurs when the ground is frozen and the water cannot be absorbed fast enough, resulting in increased overland flows. Flood waters recede slowly as the weather events tend to last for several days. Even though the two reservoirs help keep surface flow flood waters from inundating Conconully, the town's location at one of the lowest points in this small basin, tends to result in ground water seepage into structures and in many of the streets.

Several streets and road shoulders, particularly along the lake shores could erode under flood conditions around the Conconully area. Most secondary routes are not paved, which results in gravel washing down-slope potentially clogging drainage systems or directing water to places that were not intended.

### Impacts of Flood Events

The potential impacts from flooding in Conconully are very similar to the impacts described for Okanogan County as a whole. First responders and other volunteers aiding with emergency flood control measures or cleanup efforts are potentially at risk of injury due to accidents or possibly exposure to contaminated water. Although unlikely, the town's water supply could be affected by contaminated flood waters entering the groundwater supply.

The primary access into Conconully is Conconully Road from Okanogan. This is a paved, two lane road that is located outside the flood zone except as it enters the Conconully area. The only other potential escape route would be Sinlahekin Road towards Fish Lake to the northeast, which is a graveled, two-lane road. The Sinlahekin Road travels along a very steep sided valley bottom and has a relatively high potential for washouts or other damage during a flood event. Additionally, the outlet of this route could be compromised by flooding in the nearby Fish Lake area.

The availability of food and other supplies could be impacted or interrupted by a flood event. Furthermore, the delivery of community services such as postal services, health care, law enforcement, and emergency response might also be impacted by flood events in Conconully except in extreme circumstances such as a 100-year plus flood event. While individual homes and businesses may incur some damages as a result of a flood, the economy would likely incur the largest impact due to the potential loss of tourism during peak seasons.

Environmental damages resulting from a flood event are also unlikely. Erosion along the stream banks and deposition of sediments in the Conconully area is possible, but due to grass and other vegetation on the stream banks, these impacts will most likely be minimal and localized. Contamination of the riparian area by floodwaters containing chemicals or other pollutants is also a possibility.

### Value of Resources at Risk

Conconully has approximately $11.6 million of assets at risk located in the 100-year flood zone, which means there is a 1% chance of these properties flooding in any given year. Of these assets at risk, the largest proportion of value (61%) is classified as residential homes with $7.1 million; however, recreational and public properties account for $1.3 million and $1.2 million, respectively. Public land accounts for 49% of the total acreage (63 acres) within the floodplain due to the location of Conconully State Park. Twenty-four percent of the total acreage (31 acres) is classified as resource land; however, this category makes up less than 1% of the total value in the Conconully flood zone.

Although the Okanogan County Public Utilities District provides services to areas within the Conconully floodplain, they do not have any facilities or assets located within the identified floodplain.

Both the Conconully Town Hall and the city's fire station are within the 100 year flood zone; thus, there is a high potential for local emergency service and government operations to be hindered by flood waters. Equipment, structures, files, etcetera could be damaged or lost during a flood event.

Roads and bridges are the major infrastructural element that is affected by flooding. Alternative routes out of the Conconully area may be limited or completely lost during a major flood event. Bridges, particularly the Conconully Road Bridge, and culverts near Conconully have been repeatedly compromised by past flood events causing long term damage to road systems.

Local power distribution systems may be compromised when power poles are undermined by flood waters; however, this is not a common occurrence as most of the power grid is located outside of flood areas.

Several municipal water systems in Conconully are within the floodplain including the city well and the State Park water system; thus, numerous residents could be without clean drinking water as pumps and well houses become inoperable or contaminated by flood waters.

## *Earthquake*

There are no recorded occurrences of earthquakes significantly impacting the town of Conconully; however, some minimal shaking has been felt as a result of larger earthquakes elsewhere. Conconully does not have any differing issues or levels of risk associated with this hazard than Okanogan County as a whole.

### Probability of Future Occurrence

Overall, the County has a 6-15% chance of experiencing an earthquake in the next 50 years. Jurisdictions in the Methow Valley have a slightly higher probability of experiencing an earthquake than those in the Okanogan River valley or on the eastern border of the County (10-15% probability versus 6-10% probability); however, no specific jurisdiction has more risk than another or than the County overall within these areas.[70]

### Impacts and Value of Resources At Risk

Unreinforced masonry (URM) structures and unreinforced chimneys of homes will likely be damaged in the event of an earthquake. There are no publicly accessible unreinforced masonry structures in Conconully, 10 homes and other buildings throughout the Town have unreinforced chimneys. Damaged or collapsed chimneys could result in the secondary hazard of fire. Nonstructural damage caused by falling and swinging objects may be considerable after any magnitude earthquake. Damage to some older, more fragile bridges and land failure causing minor slides along roadways may isolate some residents.

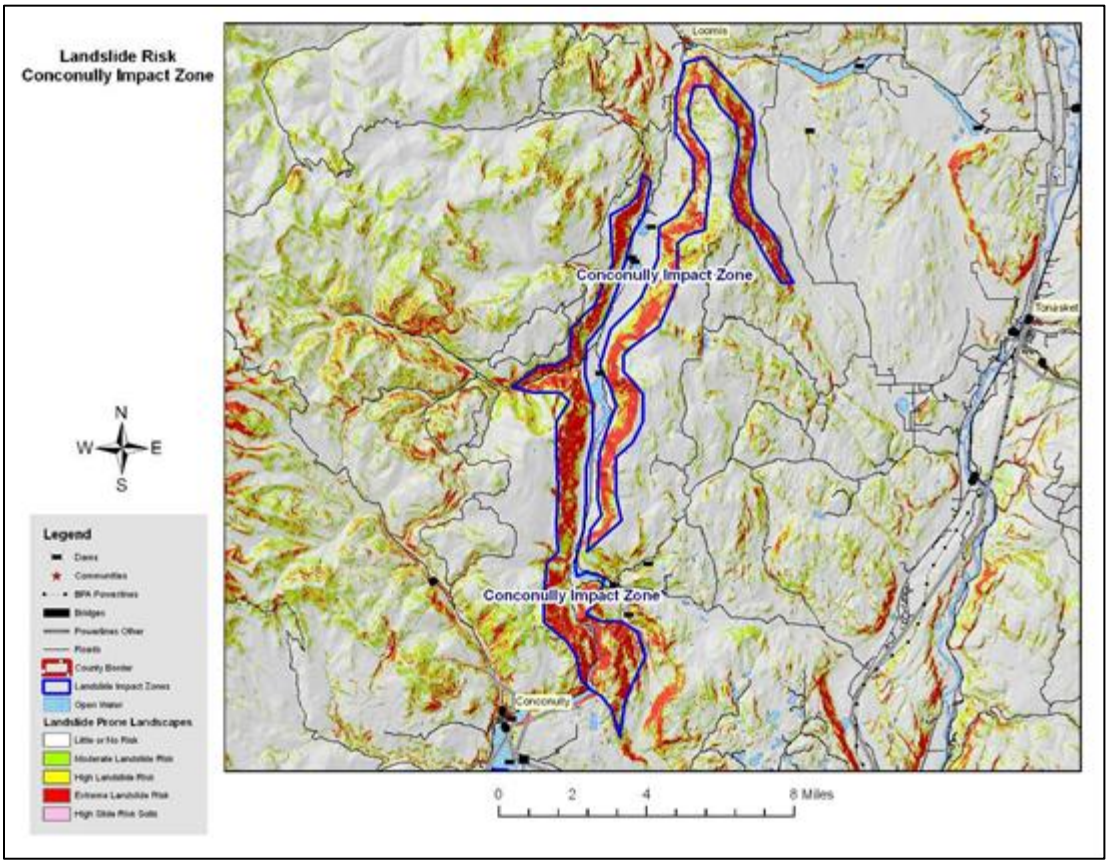
In Conconully, none of the downtown structures are unreinforced masonry. The value of structures in the downtown district is unknown. There are no known unreinforced masonry homes and approximately 10 homes with masonry chimneys in Conconully.

## *Landslide Profile*

The actual town site of Conconully is not directly within the Conconully Landslide Impact Zone; however, the slopes along both sides of the Sinlahekin Road extending all the way from Conconully to Loomis are within the Impact Zone and; therefore, at high risk. There is also an area of high landslide risk associated with the Malott Impact Zone that affects the south end of Conconully Reservoir.

[70] USGS. 2008 United States National Seismic Hazard Maps. U.S. Geological Survey. U.S. Department of Interior. Available online at http://earthquake.usgs.gov/hazards/products/conterminous/2008/. October 2009.

**Figure 5.17. Town of Conconully Landslide Impact Zone Map.**




## Potential of Future Occurrence

The primary slope stability problem in the Conconully area is associated with the steepness of the slopes and the presence of unconsolidated soils. The slopes rising from the Sinlahekin Valley are very steep; thus, landslides could easily be triggered by water saturation of the overlying soils, flash flooding, human activity, wildfires, earthquakes, or other factors.

Fires in the Conconully area can cause a domino effect of multiple hazards. Higher intensity fires not only remove most of the vegetation, but they also cause soils to become hydrophobic or water repellent for a period of time after the fire. This combination leads to unusually high runoff after rain showers or during the spring runoff season. As streams and rivers begin to reach and exceed flood stage, bank failures and channel migration are common. Road building and other soil disturbances tend to exacerbate this effect leading to even more severe land and soil slides.

There is a high potential for landslides along Sinlahekin Road north of Conconully and along Salmon Creek on the south end of Conconully Reservoir. The major threat from landslides in these areas is the disruption of traffic flow or possible entrapment due to the closure of roads. This area depends heavily on tourist traffic associated with Conconully State Park. The power supply system runs along Conconully Road from the Conconully to Okanogan. This area is not at high risk to landslides.

There are a few homes at very high risk to landslides along Sinlahekin Road near Conconully. These homes sit directly along the toe slope of the identified high risk slopes. Intense home construction and road building in this area could trigger a devastating landslide.

### Impacts and Value of Resources at Risk

There are 9 structures or improvements and 161 parcels with a total value of $410,400 in the Conconully Impact Zone. Fish Lake Road and Sinlahekin Road, which are secondary access routes, are the only critical infrastructure within this Impact Zone. It is difficult to estimate the potential dollar loss of these roadways as loss would be highly dependent on the extent of the damage.

No additional facilities or assets owned or maintained by the County, municipalities, fire districts or departments, or other special districts are currently located in the Conconully Landslide Impact Zone; however, Okanogan County Fire District #9 and the Okanogan County Public Utilities District service areas do cover this area. Access into the Conconully area could be hindered by landslides along the transportation corridors.

## *Severe Weather Profile*

The town of Conconully does not have any differing levels of risk associated with this hazard than Okanogan County as a whole. The probability of a severe weather event occurring in Conconully on an annual basis is very high. However, the impacts to the community are usually minimal and are the same as those described for Okanogan County as a whole.

### Impacts and Value of Resources at Risk

It is difficult to estimate the cost of potential winter storm damages to structures and the economy in Conconully. Damage to roofs by heavy snow accumulations depends on the moisture content of the snow and the structural characteristics of the buildings. In general, snow in this region tends to have low moisture content because of the low temperatures and arid environment. Additionally, snow rarely accumulates for long periods of time due to regular wind events. Frozen water pipes are the most common damage to residential and business structures. Older homes tend to be at a higher risk to frozen water pipes than newer ones. Snow plowing in within the town limits is accomplished by the town's public works department. Private landowners are responsible for maintaining their own driveways or other private roads. Utility supplies are impacted during severe winter storms as power is lost on a regional basis. This has a two-fold impact on residents as not only is power cut to homes and businesses, but primary heating is lost for many residents. Gas furnaces and wood stoves supplement electrical heating, but with wood heating the senior population is at a disadvantage. Emergency response to severe winter storms includes site visits by police or fire department personnel, opening of shelters, or assistance with shopping, medical attention, and communications. The economic losses caused by severe winter storms may frequently be greater than structural damages. Employees may not be able to travel to work for several days and businesses may not open. Damages are seen in the form of structural repair and loss of economic activity. Okanogan County schools are occasionally closed during and right after a severe winter storm because of cold temperatures and snow covered roads.

Thunderstorms are not likely to be severe enough in Conconully to cause significant damages. However, the loss potential from flooding that results from severe thunderstorms could be significant.

Although the financial impacts of hail can be substantial and extended, accurately quantifying these impacts is problematic. Hail typically causes direct losses to structures and other personal property within Conconully. The most significant losses are most clearly seen in the agriculture sectors of the economy. Potential losses to agriculture can be disastrous. Crop damage from hail will also be different depending on the time of year and the type of crop. Most farmers carry insurance on their crops to help mitigate the potential financial loss resulting from a localized hail storm. Homeowners in Conconully rarely incur severe damage to structures (roofs); however, hail damage to vehicles is not uncommon. The damage to vehicles is difficult to estimate because the number of vehicles impacted by a specific ice storm is unknown. Additionally, most hail damage records are kept by various insurance agencies.

It is difficult to estimate potential losses in Conconully due to windstorms and tornadoes. Construction throughout the County has been implemented in the presence of high wind events, and therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

We have estimated losses based on wind and tornado damage as follows:

- 3% of the buildings damaged causing 50% of value loss (loss could be from downed or damaged trees, damaged outbuildings, damaged fences/poles, damage to siding, damaged landscaping etc.)
- 5% of the buildings received damage to roof (requiring replacement of roof equaling $3,000)

Damages associated with sensitive receptor irritation have not been estimated. We have also not estimated the potential for a large scale wildfire event associated with high winds. Based on the data provided by the County, there are 363 total structures in Conconully with a total value of approximately $15.8 million. Using the criteria outlined above an estimate of the impact of high winds in Conconully has been made. The potential wind and tornado damage to all buildings is estimated at approximately $236,349. The estimated damage to roofs is approximately $54,450.

Power failure often accompanies severe storms. More rural parts of the County like Conconully are sometimes better prepared to deal with power outages for a few days due to the frequent occurrence of such events; however, prolonged failure, especially during cold winter temperatures can have disastrous effects. All communities should be prepared to deal with power failures. Community shelters equipped with alternative power sources will help local residents stay warm and prepare food. A community-based system for monitoring and assisting elderly or disabled residents should also be developed. All households should maintain survival kits that include warm blankets, flashlights, extra batteries, nonperishable food items, and clean drinking water.

### *Wildland Fire Profile*

The Conconully community is located along the western edge of the Happy Hill Neighborhood and the southwestern edge of the Pine Creek Neighborhood. This neighborhood encompasses the incorporated town of Conconully and the Conconully State Park. Although there are many permanent residents,

Conconully has been heavily developed as a recreationally destination. There are several resorts, campgrounds, and other recreational facilities surrounding the town site and the Conconully Reservoir and Salmon Lake. Most of the current development occurs within the town site, along the northern shore of Salmon Lake, and along the northwestern corner of Conconully Reservoir. In addition, there are numerous scattered residences along West Fork Road to the southwest and along Salmon Creek North Fork Road to the north.

The fuels in the Conconully Neighborhood are somewhat variable. Sparse to moderate density ponderosa pine and Douglas-fir stands are dominant around the shores of Salmon Lake, Conconully Reservoir, and extending to the west towards the Okanogan National Forest boundary. The understory vegetation is a mixture of open grass and shrub transitioning to mostly shrub and conifer regeneration as the elevation increases. Where homes occur some of the larger trees and understory vegetation in the immediate area has been thinned to allow for development. The south and west aspect slopes near the community are mostly covered with various grasses, a few sparse shrubs, and an occasional ponderosa pine. Due to the variable topography and vegetation, fire behavior will also tend to be variable. Fires will typically burn more intensely were forest fuels are more dense such as in the Salmon Creek drainages. On grass slopes and in open, well-spaced forest stands, fires will typically move quickly through the flashy surface fuels, but burn with less intensity. Many of the structures within the Conconully community were built using wood materials for siding, decking, and or roofing, which because of its ignitability, adds to the potential fuel load.

There is no municipal water system in the town of Conconully, therefore residents in this area rely on personal or multiple home well systems, which includes residents of the rural neighborhoods of Pine Creek, Happy Hill, and Cook Mountain.

The neighborhoods of Pine Creek, Happy Hill, and Cook Mountain are provided electrical power via public distribution lines stemming from the main transmission lines in the Okanogan River valley. A branch of one of the main transmission lines travels from the valley up Conconully Road to the Town of Conconully.

Much of the Happy Hill and Conconully Neighborhoods have structural and wildland fire protection provided by Okanogan County Fire Protection District #9, excluding the north end of the Limebelt area. Additionally, the Town of Conconully maintains its own Volunteer Fire Department with fire protection responsibility within the community. Okanogan County Fire Protection District #3 extends part way up State Route 20 and the Chilliwist Road to provide structural and wildland fire protection to residents in those areas. Residents in the Pine Creek area lack any fire protection from a rural district.

State lands are the sole responsibility of the Washington Department of Natural Resources (suppression & reciprocal agreements may apply). Federal lands are the sole responsibility of the Federal management agency (reciprocal agreement may apply). Much of the private lands in Okanogan County are within joint jurisdiction between the County fire protection districts and the WA DNR.

The DNR provides wildfire protection during the fire season between April and October with a varying degree of resources available in the early spring and late autumn months. The U.S. Forest Service seasonally responds to all wildland fires on their jurisdiction and may also respond to wildland fires on private lands based on a reciprocal agreement with the DNR.

### Probability of Future Occurrence

Residents in the Conconully Neighborhood have a very high risk of experiencing wildfire as was seen during the 2006 Tripod Fire. Not only are the fuels and topography in this area very conducive to fire, but there is a high likelihood of an ignition due to the extreme recreational use. Campfires and ATV's are just a few of the potential human-caused ignition sources. Further increasing the risk is the popularity of wood siding, decking, and roofing on homes throughout the area. Many homes and other structures are crammed onto small lots between the lake shores and the access routes with forest fuels on the slope above and among the structures. In the event of a fire, these homes would form a continuous fuel bed that could facilitate the spread the fire from home to home.

The Town of Conconully was threatened during the Tripod Fire of 2006; thus, significant fuel reduction work was completed in order to help prevent the fire from destroying the entire community. Emergency thinning of forest stands and clearing of brush and slash within the townsite and surrounding area was conducted due to the high likelihood of the fire spreading directly towards Conconully. Efforts should be made to encourage residents and land managers to maintain this lessened fire risk condition.

### Impacts of Wildland Fire Events

The potential impacts from a wildfire in Conconully are very similar to the impacts described for Okanogan County as a whole. All fires pose a significant safety risk to residents and emergency service personnel. Individual structures, property, and livelihoods could be severely damaged or lost as a result of a fire; however, the community is not likely to suffer severe or long-term economic losses.

Low frequency fires in the shrublands surrounding the community may benefit the ecological environment as nutrients are recycled into the soil. Generally, grass and forbs are rejuvenated by a low intensity fire and grow back quickly; however, heavy rains immediately after a fire could cause erosion.

Smoke from a nearby wildland fire may impact sensitive populations within the community due to degraded air quality conditions. Smoke and/or flames will also impact transportation corridors connecting Conconully to other communities; thus, travel and commerce may be interrupted.

### Value of Resources at Risk

It is difficult to estimate potential losses in Conconully from wildland fire due to the unpredictability of wildfire behavior and the nature of ignition sources. It is unlikely that more than a few structures or other properties within the city limits of Winthrop would be lost or damaged by a wildland fire; however, residents in the immediate vicinity may be directly impacted. It is impossible to forecast the path a wildfire will take and what type of assets and resources, manmade and ecological, will be at risk. Thus, no value estimates were made for this hazard.

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# *City of Oroville Annex*

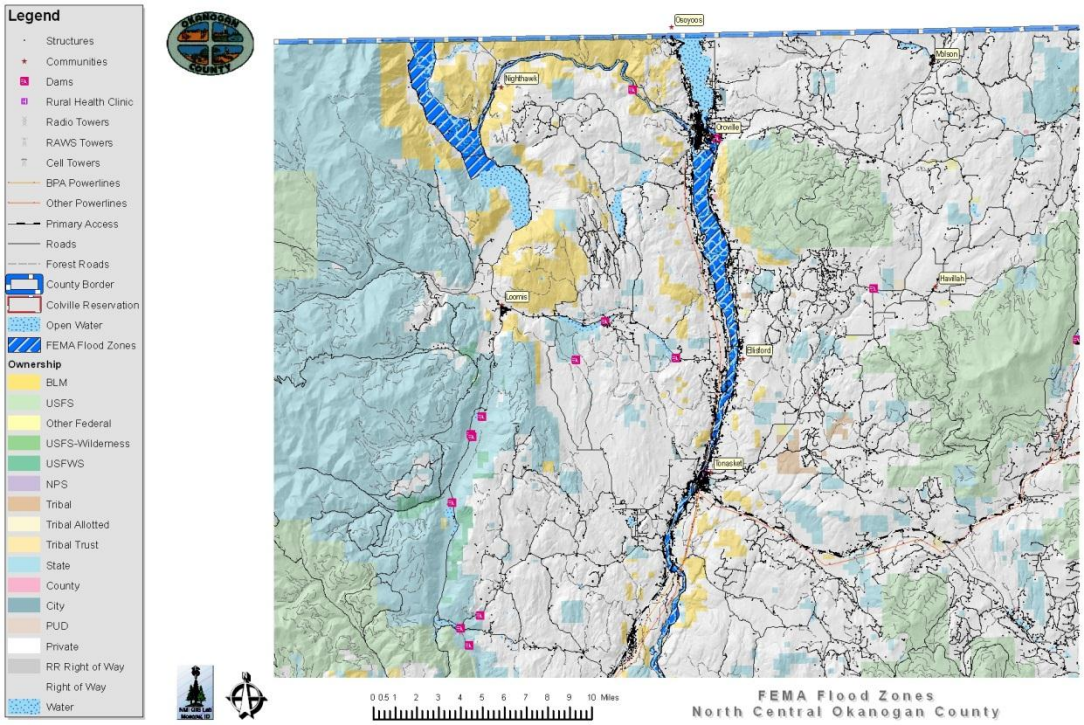
## *Flood Profile*

The City of Oroville is located on a narrow strip of land between the Okanogan River and Similkameen River just north of their confluence. The southern tip of Osoyoos Lake, which is created by the Osoyoos Dam on the Okanogan River, lies directly north and upstream of the city limits. The two individual rivers have narrow floodplains that only affect small areas along the eastern and western boundaries of the community. The floodplain widens significantly south of Oroville as the Similkameen River drains into the Okanogan River and continues flowing southward through the Okanogan River valley.

Rural residences, ranches, farms, and roadways located near smaller waterways may be at significant flood risk. The onset of flooding in the smaller drainages can range from extremely slow to very fast. This variability depends on the cause of flooding and other factors such as rainfall intensity, the areas receiving the rain, temperature, and the condition of the soil. Floods that occur quickly are usually caused by thunderstorms, while floods that occur more slowly are often the result of moderate, but prolonged rainfall, snowmelt, or a combination of both. In the case of intense rainfall immediately above developed areas, the onset of flooding may occur in a matter of minutes.

A high level of sediment is prevalent during periods of intense runoff. This sediment tends to cause a deteriorating condition in streambeds and channels through deposition. Natural obstructions to flood waters include trees, brush, and other vegetation along the stream banks in the floodplain area. Considerable debris has been allowed to accumulate in these channels, plugging culverts and bridges at several locations throughout the county.

**Figure 5.18. Town of Oroville FEMA Flood Insurance Rate Map.**



### Probability of Future Occurrence

The majority of the potential flood hazard in and around Oroville is caused by the close proximity of the Okanogan River, the Similkameen River, and, to a lesser extent, Tonasket Creek, which drain several small tributaries out of the foothills both to the east and west. There is no identified floodplain associated with Osoyoos Lake due to the Osoyoos Lake Dam, which regulates water levels. Although the Tonasket Creek does not have FEMA identified floodplain, a flash flood or blockage could cause the stream to breach its banks resulting in severe damage to many homes and businesses on the eastern edge of Oroville. This creek has historically been prone to flash flooding due to low soil permeability upstream; however, this type of event does not occur very frequently in Oroville.

High water events on the Okanogan and Similkameen Rivers are typically the result of rain-on-snow events or heavy spring runoff. Warm weather or rain after a heavy snowfall is a called rain-on-snow event. Warm rains falling on the snow pack result in a significantly increased rate of snowmelt. Often the melting occurs when the ground is frozen and the water cannot be absorbed fast enough, resulting in increased overland flows. Flood waters recede slowly as the weather events tend to last for several days. The Similkameen River, which as the largest tributary contributes about 70% of the water in the Okanogan River, has the most immediate impact on the Okanogan River water levels.

Thunderstorms are localized summer events that can also have an impact on the flooding potential of Oroville. Flooding due to a thunderstorm can occur rapidly, overwhelming the carrying capacity of channels or the city's storm drainage system in a short time. The duration of this type of flooding tends to be a matter of hours and is usually associated with localized thunderstorms in which the ground cannot absorb moisture as quickly as it is coming down. Tonasket Creek and other smaller channels are generally more prone to the effects of flooding during a thunderstorm than a river system.

Several streets and road shoulders could potentially erode under flood conditions near Oroville. Many secondary routes are not paved, which results in gravel washing down-slope potentially clogging drainage systems or directing water to places that were not intended.

### Impacts of Flood Events

The potential impacts from flooding in Oroville are very similar to the impacts described for Okanogan County as a whole. First responders and other volunteers aiding with emergency flood control or cleanup efforts are potentially at risk of injury due to accidents or possibly exposure to contaminated water. Although unlikely, the town's water supply could be affected by contaminated flood waters entering the groundwater supply.

The primary access into Oroville is U.S. Highway 97. This is a two-lane, paved road that is well-traveled by area commuters. The highway roughly parallels the Okanogan River and is susceptible to being compromised by flood events at several points within the county. Secondary escape routes include the Loomis-Oroville Road, which follows the Similkameen River and the Oroville-Toroda Creek Road, which follows Tonasket Creek eastward. It is likely that these routes would also be compromised during a major flood event.

The availability of food and other supplies is not likely to be impacted or interrupted by a flood event. Furthermore, the delivery of community services such as postal services, health care, law enforcement, and emergency response is also not likely to be impacted by flood events in Oroville. While individual homes and businesses may incur damages, the economy of the community will not be impacted by most flood events. A 100-year plus flood event that damages the local grain elevators or rail yard may lead to temporary economic hardships within the community. Large flood events of this magnitude have a higher probability of occurrence during the winter or spring when the elevators are more likely to be empty, thus lessening the potential economic impact.

Environmental damages resulting from a flood event are unlikely in Oroville. The Similkameen River occupies a relatively narrow floodplain that has been channeled prior to entering the city. Scouring and erosion along the banks of the stream along this more narrow section is possible, but due to grass and other vegetation, these impacts will most likely be minimal and localized. Contamination of the riparian area by floodwaters containing chemicals or other pollutants is a possibility, but is more likely to be realized in the surrounding areas than within the community due to the hydrologic profile of the floodplain. South of Oroville, the floodplain widens where the Similkameen and Okanogan Rivers converge, which lessens the risk of erosion and scouring.

### Value of Resources at Risk

Oroville has approximately $14.5 million of assets located in the 100-year flood zone, which means there is a 1% chance of these properties flooding in any given year. The vast majority of the value of assets at risk is classified as residential homes ($11.5 million). The value of commercial property within the Oroville city limits amounts to $1.9 million. These two categories account for approximately 93% of the value in the flood zone (Figure 4.15). Recreational property comprises $428,200 and vacant property is worth $278,800, 3% and 2% each of the total value of assets within the floodplain in Oroville.

Although Okanogan County Fire District #1 and the Okanogan County Public Utilities District provide service to areas within the Oroville floodplain, they do not have any critical facilities or assets located within the identified floodplain. Nevertheless, these districts could be impacted due to emergency response calls or limited access caused by flooding.

Roads and bridges are the major infrastructural element that is affected by flooding. Alternative routes to all parts of county are limited during most major flood events. Bridges and culverts have been repeatedly compromised by past flood events causing major long term damage to road systems.

There are currently no critical facilities or assets within the floodplain in Oroville including governmental facilities, emergency response stations, water systems, power lines, etc.

## *Earthquake*

There are no recorded occurrences of earthquakes significantly impacting the town of Oroville; however, some minimal shaking has been felt as a result of larger earthquakes elsewhere. Oroville does not have any differing issues or levels of risk associated with this hazard than Okanogan County as a whole.

### Probability of Future Occurrence

Overall, the County has a 6-15% chance of experiencing an earthquake in the next 50 years. Jurisdictions in the Methow Valley have a slightly higher probability of experiencing an earthquake than those in the Okanogan River valley or on the eastern border of the County (10-15% probability versus 6-10% probability); however, no specific jurisdiction has more risk than another or than the County overall within these areas.[71]

### Impacts and Value of Resources At Risk

Unreinforced masonry (URM) structures and unreinforced chimneys of homes will likely be damaged in the event of an earthquake. There are several publicly accessible unreinforced masonry structures in Oroville in addition to the numerous homes and other buildings throughout the Town with unreinforced chimneys. Damaged or collapsed chimneys could result in the secondary hazard of fire. Nonstructural damage caused by falling and swinging objects may be considerable after any magnitude earthquake. Damage to some older, more fragile bridges and land failure causing minor slides along roadways may isolate some residents.

In Oroville, a few of the downtown structures are assumed to be unreinforced masonry including the Alpine Brewing Company. These structures were built prior to the inclusion of articles for seismic stability in the Uniform Building Codes in 1972. The number and value of unreinforced masonry homes or homes with masonry chimneys in Oroville is unknown, but estimated to include at least 10 brick construction homes and approximately 30 residences with masonry chimneys.

## *Landslide Profile*

The Town of Oroville has very low probabilities of experiencing damaging landslides. The few slopes in and around the community are generally less than 20%. While small, low angle slumps may occur on eyebrows of the surrounding rolling hills, these will be infrequent and likely the result of water saturation or a major disturbance such as an earthquake or road construction.

### Impacts and Value of Resources at Risk

There are no structures or infrastructure directly at risk from landslides within the town of Oroville.

## *Severe Weather Profile*

The town of Oroville does not have any differing levels of risk associated with this hazard than Okanogan County as a whole. The probability of a severe weather event occurring in Oroville on an annual basis is very high. However, the impacts to the community are usually minimal and are the same as those described for Okanogan County as a whole.

[71] USGS. 2008 United States National Seismic Hazard Maps. U.S. Geological Survey. U.S. Department of Interior. Available online at http://earthquake.usgs.gov/hazards/products/conterminous/2008/. October 2009.

### Impacts and Value of Resources at Risk

It is difficult to estimate the cost of potential winter storm damages to structures and the economy in Oroville. Damage to roofs by heavy snow accumulations depends on the moisture content of the snow and the structural characteristics of the buildings. In general, snow in this region tends to have low moisture content because of the low temperatures and arid environment. Additionally, snow rarely accumulates for long periods of time due to regular wind events. Frozen water pipes are the most common damage to residential and business structures. Older homes tend to be at a higher risk to frozen water pipes than newer ones. Snow plowing in within the town limits is accomplished by the town's public works department and the Washington Department of Transportation. Private landowners are responsible for maintaining their own driveways or other private roads. Utility supplies are impacted during severe winter storms as power is lost on a regional basis. This has a two-fold impact on residents as not only is power cut to homes and businesses, but primary heating is lost for many residents. Gas furnaces and wood stoves supplement electrical heating, but with wood heating the senior population is at a disadvantage. Emergency response to severe winter storms includes site visits by police or fire department personnel, opening of shelters, or assistance with shopping, medical attention, and communications. The economic losses caused by severe winter storms may frequently be greater than structural damages. Employees may not be able to travel to work for several days and businesses may not open. Damages are seen in the form of structural repair and loss of economic activity. Okanogan County schools are occasionally closed during and right after a severe winter storm because of cold temperatures and snow covered roads.

Thunderstorms are not likely to be severe enough in Oroville to cause significant damages. However, the loss potential from flooding that results from severe thunderstorms could be significant.

Although the financial impacts of hail can be substantial and extended, accurately quantifying these impacts is problematic. Hail typically causes direct losses to structures and other personal property within Oroville. The most significant losses are most clearly seen in the agriculture sectors of the economy. Potential losses to agriculture can be disastrous. Crop damage from hail will also be different depending on the time of year and the type of crop. Most farmers carry insurance on their crops to help mitigate the potential financial loss resulting from a localized hail storm. Homeowners in Oroville rarely incur severe damage to structures (roofs); however, hail damage to vehicles is not uncommon. The damage to vehicles is difficult to estimate because the number of vehicles impacted by a specific ice storm is unknown. Additionally, most hail damage records are kept by various insurance agencies.

It is difficult to estimate potential losses in Oroville due to windstorms and tornadoes. Construction throughout the County has been implemented in the presence of high wind events, and therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

We have estimated losses based on wind and tornado damage as follows:

- 3% of the buildings damaged causing 50% of value loss (loss could be from downed or damaged trees, damaged outbuildings, damaged fences/poles, damage to siding, damaged landscaping etc.)
- 5% of the buildings received damage to roof (requiring replacement of roof equaling $3,000)

Damages associated with sensitive receptor irritation have not been estimated. We have also not estimated the potential for a large scale wildfire event associated with high winds. Based on the data provided by the County, there are 1,171 total structures in Oroville with a total value of approximately $97.7 million. Using the criteria outlined above an estimate of the impact of high winds in Oroville has been made. The potential wind and tornado damage to all buildings is estimated at approximately $1.5 million. The estimated damage to roofs is approximately $175,650.

Power failure often accompanies severe storms. Prolonged failure, especially during cold winter temperatures can have disastrous effects. All communities should be prepared to deal with power failures. Community shelters equipped with alternative power sources will help local residents stay warm and prepare food. A community-based system for monitoring and assisting elderly or disabled residents should also be developed. All households should maintain survival kits that include warm blankets, flashlights, extra batteries, nonperishable food items, and clean drinking water.

### *Wildland Fire Profile*

Oroville is heavily developed for residential, commercial, or agricultural use. Orchards, livestock pasture, hay, or other crops are grown on nearly every available acre that has access to irrigation water. During the summer and fall, this creates a mosaic of lush green vegetation where there is irrigation and cured sage and grass in areas where there isn't.

Wildland fuels within the valley floor of the City of Oroville are minimal due to extensive commercial and residential development as well as the proliferation of the orchards and other crops. The foothills rising out of the valley are typically covered by sage brush and bunchgrasses that form a continuous fuel bed. The steepness of the topography is variable; however, the foothills near the valley have low to moderate steepness, but the degree of slope tends to increase on the mid and upper slopes. The slope rising from the east side of the valley between the community of Oroville and Swanson Mill Road is much steeper and sparsely forested by ponderosa pine. This slope is characterized by sheer rock faces and outcroppings; however, the lack of vegetation does not generally help to slow the upslope spread of wildfire.

All of the residents within the city limits of Oroville have access to the municipal water systems. Those outside the city limits and in unincorporated communities typically rely on personal or multiple home well systems. Oroville is served by the Oroville-Tonasket Irrigation District.

Grand Coulee Dam generates power, which is then distributed by high tension lines across the Colville Indian Reservation to the substations in Okanogan and to a substation located near Coleman Butte. This transmission line continues north to the City of Tonasket generally following the State Route 97 corridor.

The Okanogan Fire Protection District #1 provides both structural and wildfire protection for nearly all of the Oroville. Mutual aid agreements between fire districts supplement wildland fire protection when needed. Additional fire protection is provided by the Washington DNR, which provides wildfire protection and suppression on privately owned forestland and state-owned forestland. The DNR does not provide structural fire suppression, but does provide wildfire protection on non-forested land that threatens DNR-protected lands. The BLM provides wildfire protection on their ownership within Okanogan County and has

mutual aid agreements with the DNR for protection of forested land. BLM also does not provide structural fire suppression.

### Probability of Future Occurrence

The area surrounding Oroville utilizes irrigation for landscaping and agricultural crops, which not only helps keep the vegetation green and at lower propensity for ignitions, but also gives firefighters abundant access to water resources for suppression purposes. As crop production slows in the fall, the irrigation pressure tends to taper off, leaving previously lush grasses and other vegetation to dry out and become a potential fire hazard.

The sagebrush and grassland fuels that dominant the area near Oroville usually becomes available to burn fairly early in the summer. The growth of a productive orchard takes many years and is, therefore, a long term investment. The potential loss of these orchards and the surrounding structures to fire would severely damage the local economy as well as change the way of life for many residents.

### Impacts of Wildland Fire Events

The potential impacts from a wildfire in Oroville are very similar to the impacts described for Okanogan County as a whole. All fires pose a significant safety risk to residents and emergency service personnel. Individual structures, property, and livelihoods could be severely damaged or lost as a result of a fire; however, the community is not likely to suffer severe or long-term economic losses.

Low frequency fires in the shrublands surrounding the community may benefit the ecological environment as nutrients are recycled into the soil. Generally, grass and forbs are rejuvenated by a low intensity fire and grow back quickly; however, heavy rains immediately after a fire could cause erosion.

Smoke from a nearby wildland fire may impact sensitive populations within the community due to degraded air quality conditions. Smoke and/or flames will also impact transportation corridors connecting Oroville to other communities; thus, travel and commerce may be interrupted.

### Value of Resources at Risk

It is difficult to estimate potential losses in Oroville from wildland fire due to the unpredictability of wildfire behavior and the nature of ignition sources. It is unlikely that more than a few structures or other properties within the city limits of Oroville would be lost or damaged by a wildland fire; however, residents in the immediate vicinity may be directly impacted. It is impossible to forecast the path a wildfire will take and what type of assets and resources, manmade and ecological, will be at risk. Thus, no value estimates were made for this hazard.

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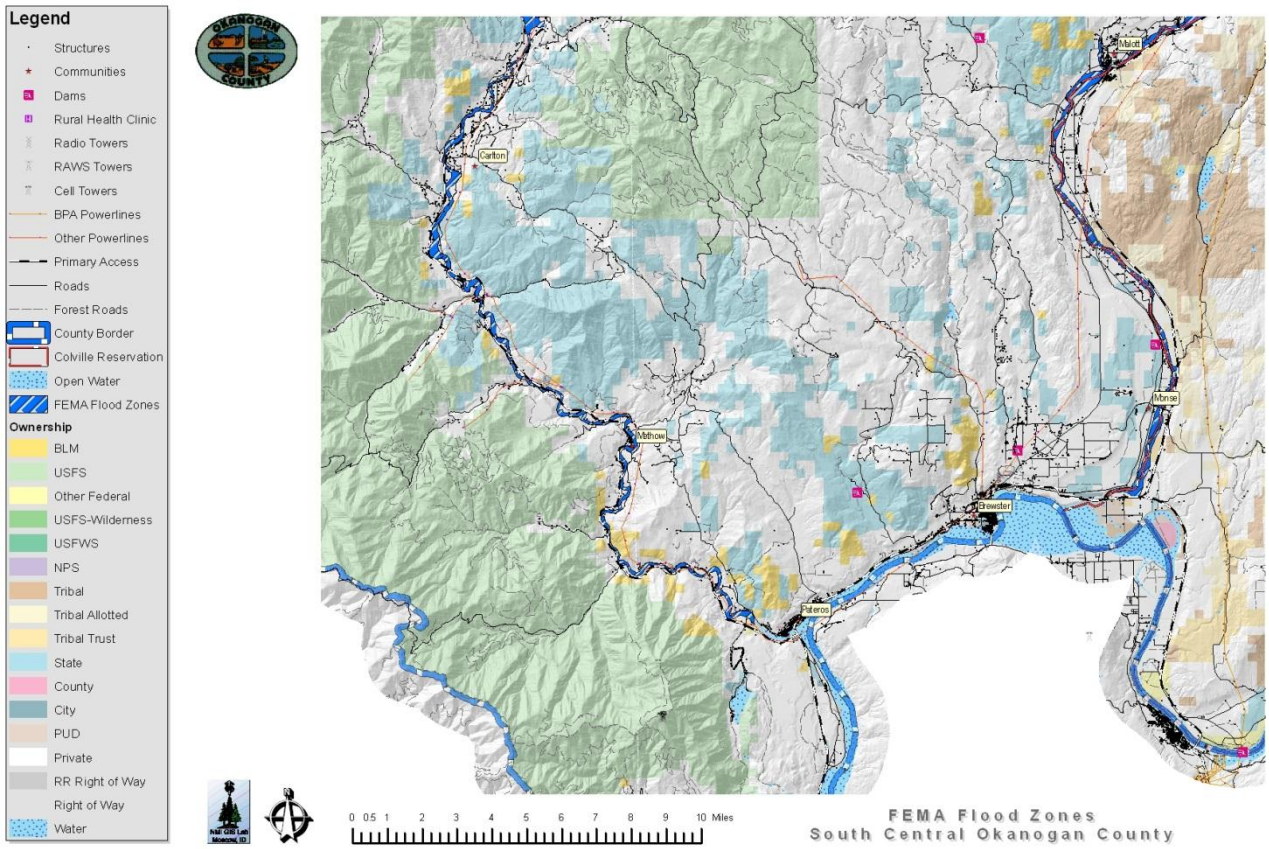
# *City of Brewster Annex*

## *Flood Profile*

The community of Brewster is located on the southern edge of Okanogan County along the Columbia River just downstream of the mouth of the Okanogan River. Much of the perimeter of city lies along the banks of the Columbia River; however, only small sections of the townsite are within the floodplain identified on the FEMA Flood Insurance Rate Maps. The water level on this section of the Columbia River is controlled by the Chief Joseph Dam approximately twelve miles upstream.

**Figure 5.19. Town of Brewster FEMA Flood Insurance Rate Map.**




### Probability of Future Occurrences

Floods in Brewster are typically the result of two different types of events, rain-on-snow and thunderstorms. Rain-on-snow- events that affect Brewster occur when significant snow pack exists in the Okanogan National Forest or when large regional rain-on-snow or major spring runoff events occur in the Columbia River basin. Warm rains falling on the snow pack result in a significantly increased rate of snowmelt. Often this melting occurs while the ground is frozen and the water cannot be absorbed into the soil, resulting in increased overland flows. Due to large area, flood waters along the Columbia would likely recede slowly; however, due to the numerous dams and varying capacity of reservoirs, it is difficult to estimate the extent of the potential damage.

Low water permeable soil and sparse vegetation in the Swamp Creek drainage north of the townsite could combine to foster flash flooding when intense thunderstorms hit the Brewster area. Flooding of smaller drainages due to thunderstorms or spring runoff is likely to occur more frequently than flooding along the Columbia River. Nevertheless, the possibility for injury and death from flash floods is heightened because they occur quickly and usually with little warning.

The major impacts from both types of flooding in Brewster are the restricted use of several streets, highways, commercial, industrial, and residential areas. The State Highway 173 bridge spanning the Columbia River is the only crossing for approximately twelve miles. Flood damage to this bridge would cost millions of dollars to repair.

### Impacts of Flood Events

The potential impacts from flooding in Brewster are very similar to the impacts described for Okanogan County as a whole. First responders and other volunteers aiding with emergency flood control or cleanup efforts are potentially at risk of injury due to accidents or possibly exposure to contaminated water. Depressions and low spots are likely to have standing water during prolonged rain events and during the spring due to the high water table; thus, contaminants in the soil or on vegetation in these areas could impact the water supply.

The availability of food and other supplies is not likely to be impacted or interrupted by a flood event. Furthermore, the delivery of community services such as postal services, health care, law enforcement, and emergency response is also not likely to be impacted by flood events in Brewster. While individual homes may incur damages as a result of a flood, the economy of the community will not be impacted by this type of hazard.

Environmental damages resulting from a flood event are not likely to occur. In fact, this type of event will likely improve established wetland areas.

### Value of Resources at Risk

Brewster has approximately $8.7 million of property at risk located in the 100-year flood zone, which means there is a 1% chance of these properties flooding in any given year. Of these assets at risk, the largest proportion of parcels is classified as commercial properties with $4.2 million (49%) on 2 acres. Thirty-eight percent of the total acreage (7 acres) is classified as resource property and is worth approximately $104,400. The value of residential property in the flood zone is approximately $2.8 million.

Although Okanogan County Fire District #15 and the Okanogan County Public Utilities District provide service to areas within the Brewster floodplain, they do not have any facilities or assets located within the identified floodplain. Nevertheless, these districts could be impacted due to emergency response calls or limited access caused by flooding.

Roads and bridges are the major infrastructural element that could be affected by flooding. Alternative routes to all parts of county are limited during most major flood events. Bridges and culverts have been repeatedly compromised by past flood events causing major long term damage to road systems.

There are currently no critical facilities or assets within the floodplain in Brewster including governmental facilities, emergency response stations, water systems, etc. Two powerline rights-of-way pass over the community; however, no associate infrastructure is at risk to flood damage.

## *Earthquake*

There are no recorded occurrences of earthquakes significantly impacting the town of Brewster; however, some minimal shaking has been felt as a result of larger earthquakes elsewhere. Brewster does not have any differing issues or levels of risk associated with this hazard than Okanogan County as a whole.

### Probability of Future Occurrence

Overall, the County has a 6-15% chance of experiencing an earthquake in the next 50 years. Jurisdictions in the Okanogan River valley or on the eastern border of the County have a 6-10% probability; however, no specific jurisdiction has more risk than another or than the County overall within these areas.[72]

### Impacts and Value of Resources At Risk

Unreinforced masonry (URM) structures and unreinforced chimneys of homes will likely be damaged in the event of an earthquake. There are a few publicly accessible unreinforced masonry structures in Brewster in addition to the numerous homes and other buildings throughout the City with unreinforced chimneys. Damaged or collapsed chimneys could result in the secondary hazard of fire. Nonstructural damage caused by falling and swinging objects may be considerable after any magnitude earthquake. Damage to some older, more fragile bridges and land failure causing minor slides along roadways may isolate some residents.

In Brewster, several of the downtown structures are assumed to be unreinforced masonry. These structures were built prior to the inclusion of articles for seismic stability in the Uniform Building Codes in 1972. The number and value of unreinforced masonry homes or homes with masonry chimneys in Brewster is unknown, but estimated to include 20 buildings.

## *Landslide Profile*

The town of Brewster has a very low probability of experiencing damaging landslides. Slopes in and around the community are generally less than 25%. While small, low angle slumps may occur on eyebrows of the hills south of town, these will be infrequent and likely the result of water saturation or a major disturbance such as an earthquake or road construction.

The intense irrigation of orchards and other crops throughout the valley could cause smaller scale slides and slumps, particularly on steeper slopes. Over watering or malfunctioning irrigation canals, pipes, or headgates could cause the ground to become saturated. Cut and fill slopes and other disturbed soils have a particularly high risk of becoming unstable due to water saturation.

[72] USGS. 2008 United States National Seismic Hazard Maps. U.S. Geological Survey. U.S. Department of Interior. Available online at http://earthquake.usgs.gov/hazards/products/conterminous/2008/. October 2009.

### Impacts and Value of Resources at Risk

There are no structures or infrastructure directly at risk from landslides within the City of Brewster.

## *Severe Weather Profile*

The City of Brewster does not have any differing levels of risk associated with this hazard than Okanogan County as a whole. The probability of a severe weather event occurring in Brewster on an annual basis is very high. However, the impacts to the community are usually minimal and are the same as those described for Okanogan County as a whole.

### Impacts and Value of Resources at Risk

It is difficult to estimate the cost of potential winter storm damages to structures and the economy in Brewster. Damage to roofs by heavy snow accumulations depends on the moisture content of the snow and the structural characteristics of the buildings. In general, snow in this region tends to have low moisture content because of the low temperatures and arid environment. Additionally, snow rarely accumulates for long periods of time due to regular wind events. Frozen water pipes are the most common damage to residential and business structures. Older homes tend to be at a higher risk to frozen water pipes than newer ones. Snow plowing in within the town limits is accomplished by the town's public works department. Private landowners are responsible for maintaining their own driveways or other private roads. Utility supplies are impacted during severe winter storms as power is lost on a regional basis. This has a two-fold impact on residents as not only is power cut to homes and businesses, but primary heating is lost for many residents. Gas furnaces and wood stoves supplement electrical heating, but with wood heating the senior population is at a disadvantage. Emergency response to severe winter storms includes site visits by police or fire department personnel, opening of shelters, or assistance with shopping, medical attention, and communications. The economic losses caused by severe winter storms may frequently be greater than structural damages. Employees may not be able to travel to work for several days and businesses may not open. Damages are seen in the form of structural repair and loss of economic activity. Okanogan County schools are occasionally closed during and right after a severe winter storm because of cold temperatures and snow covered roads.

Thunderstorms are not likely to be severe enough in Brewster to cause significant damages. However, the loss potential from flooding that results from severe thunderstorms could be significant.

Although the financial impacts of hail can be substantial and extended, accurately quantifying these impacts is problematic. Hail typically causes direct losses to structures and other personal property within Brewster. The most significant losses are most clearly seen in the agriculture sectors of the economy. Potential losses to agriculture can be disastrous. Crop damage from hail will also be different depending on the time of year and the type of crop. Most farmers carry insurance on their crops to help mitigate the potential financial loss resulting from a localized hail storm. Homeowners in Brewster rarely incur severe damage to structures (roofs); however, hail damage to vehicles is not uncommon. The damage to vehicles is difficult to estimate because the number of vehicles impacted by a specific ice storm is unknown. Additionally, most hail damage records are kept by various insurance agencies.

It is difficult to estimate potential losses in Brewster due to windstorms and tornadoes. Construction throughout the County has been implemented in the presence of high wind events, and therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

We have estimated losses based on wind and tornado damage as follows:

- 3% of the buildings damaged causing 50% of value loss (loss could be from downed or damaged trees, damaged outbuildings, damaged fences/poles, damage to siding, damaged landscaping etc.)
- 5% of the buildings received damage to roof (requiring replacement of roof equaling $3,000)

Damages associated with sensitive receptor irritation have not been estimated. We have also not estimated the potential for a large scale wildfire event associated with high winds. Based on the data provided by the County, there are 992 total structures in Brewster with a total value of approximately $112.7 million. Using the criteria outlined above an estimate of the impact of high winds in Brewster has been made. The potential wind and tornado damage to all buildings is estimated at approximately $1.7 million. The estimated damage to roofs is approximately $148,800.

Power failure often accompanies severe storms. Prolonged failure, especially during cold winter temperatures can have disastrous effects. All communities should be prepared to deal with power failures. Community shelters equipped with alternative power sources will help local residents stay warm and prepare food. A community-based system for monitoring and assisting elderly or disabled residents should also be developed. All households should maintain survival kits that include warm blankets, flashlights, extra batteries, nonperishable food items, and clean drinking water.

## *Wildland Fire Profile*

The channeled scablands are a dominant landscape in Brewster. This unique geological feature was created by ice age floods that swept across eastern Washington and down the Columbia River Plateau periodically during the Pleistocene era. The massive erosion caused by the flood events scoured the landscape down to the underlying basalt creating vast areas of rocky cliffs, river valleys, channel ways and pothole lakes. Typical vegetation found throughout this landscape is grass, mixed shrub and sagebrush with areas of wetlands, marsh, ponderosa pine islands, cultivated crops and CRP fields. The channeled scablands landscape prevails in the southcentral portion of the county within the Colville Indian Reservation and along the major waterways of the Okanogan River, Columbia River, Tumwater Creek and Rice Canyon. Landownership is predominantly private or Tribal with areas owned by the State of Washington and the Bureau of Land Management occurring along the western fringes of the scablands. Tribal ownership includes numerous named and unnamed lakes that occur between the Okanogan River and Omak Lake. Private landownership includes cattle ranches and in holdings of cultivated farmland and CRP fields. New development occurs primarily near communities and along major roads. Most of the pressure for multi-housing subdivisions occurs in close proximity to the towns. Rural development is widely dispersed consisting primarily of isolated ranching headquarters, home sites, irrigation systems, and developed springs or wells. In nearly all developed areas, structures are in close proximity to vegetation that becomes a significant fire risk at certain times of the year.

Residents living in the populated center of Brewster have access to municipal water supply systems with public fire hydrants. Outside this area, development relies on individual, co-op or multiple-home well systems. Creeks, ponds and developed drafting areas provide water sources for emergency fire suppression in the rural areas to a limited extent. Water tanks have been set up at several ranches throughout the area as a supplemental water supply during fire season. Irrigation systems are capable of providing additional water supplies for suppression equipment on a limited basis. Additional water resources distributed and documented throughout the agricultural landscape are needed to provide adequate water for fire suppression.

There is a transmission line that goes south to the Brewster area following State Route 97 for 13 miles and then crosses the Okanogan River and ends in Brewster Flat.

Public utility lines travel both above and below ground along roads and cross-country to remote facilities. Many irrigation systems and wells rely on above ground power lines for electricity. These power poles pass through areas of dense wildland fuels that could be destroyed or compromised in the event of a wildfire. Cell phone service is well established in most parts of the county with only limited dead zones.

Okanogan County Fire Protection District #15 provides structural and wildland fire protection for the City of Brewster.

### Probability of Future Occurrence

Brewster allows for irrigation of landscaping and agricultural crops, which not only helps keep the vegetation green and at lower propensity for ignitions, but also gives firefighters abundant access to water resources for suppression purposes. As crop production slows in the fall, the irrigation pressure tends to taper off, leaving previously lush grasses and other vegetation to dry out and become a potential fire hazard.

The sagebrush and grassland fuels that dominant this part of the County usually becomes available to burn fairly early in the summer. The growth of a productive orchard takes many years and is, therefore, a long term investment. The potential loss of these orchards and the surrounding structures to fire would severely damage the local economy as well as change the way of life for many residents.

### Impacts of Wildland Fire Events

The potential impacts from a wildfire in Brewster are very similar to the impacts described for Okanogan County as a whole. All fires pose a significant safety risk to residents and emergency service personnel. Individual structures, property, and livelihoods could be severely damaged or lost as a result of a fire; however, the community is not likely to suffer severe or long-term economic losses.

Low frequency fires in the shrublands surrounding the community may benefit the ecological environment as nutrients are recycled into the soil. Generally, grass and forbs are rejuvenated by a low intensity fire and grow back quickly; however, heavy rains immediately after a fire could cause erosion.

Smoke from a nearby wildland fire may impact sensitive populations within the community due to degraded air quality conditions. Smoke and/or flames will also impact transportation corridors connecting Brewster to other communities; thus, travel and commerce may be interrupted.

### Value of Resources at Risk

It is difficult to estimate potential losses in Brewster from wildland fire due to the unpredictability of wildfire behavior and the nature of ignition sources. It is unlikely that more than a few structures or other properties within the city limits of Brewster would be lost or damaged by a wildland fire; however, residents in the immediate vicinity may be directly impacted. It is impossible to forecast the path a wildfire will take and what type of assets and resources, manmade and ecological, will be at risk. Thus, no value estimates were made for this hazard.

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# *City of Pateros Annex*

## *Flood Profile*

The community of Pateros is located on the southern edge of Okanogan County at the confluence of Columbia River and the Methow River. Much of the perimeter of city lies along the banks of the Columbia River and Methow Rivers; however, there are no sections of the townsite that are within the floodplain identified on the FEMA Flood Insurance Rate Maps. The water level on this section of the Columbia River is controlled by the Chief Joseph Dam approximately twelve miles upstream.

Rural residences, ranches, farms, and roadways located near smaller waterways may be at significant flood risk. The onset of flooding in the smaller drainages can range from extremely slow to very fast. This variability depends on the cause of flooding and other factors such as rainfall intensity, the areas receiving the rain, temperature, and the condition of the soil. Floods that occur quickly are usually caused by thunderstorms, while floods that occur more slowly are often the result of moderate, but prolonged rainfall, snowmelt, or a combination of both. In the case of intense rainfall immediately above developed areas, the onset of flooding may occur in a matter of minutes.

A high level of sediment is prevalent during periods of intense runoff. This sediment tends to cause a deteriorating condition in streambeds and channels through deposition. Natural obstructions to flood waters include trees, brush, and other vegetation along the stream banks in the floodplain area. Considerable debris has been allowed to accumulate in these channels, plugging culverts and bridges at several locations throughout the county.

### Probability of Future Occurrence

Floods along the Methow River are typically the result of two different types of events, rain-on-snow and thunderstorms. Rain-on-snow- events that affect Pateros occur when significant snow pack exists in the Okanogan-Wenatchee National Forest or when large regional rain-on-snow or major spring runoff events occur in the Columbia River basin. Warm rains falling on the snow pack result in a significantly increased rate of snowmelt. Often this melting occurs while the ground is frozen and the water cannot be absorbed into the soil, resulting in increased overland flows. Due to large area, flood waters along the Columbia would likely recede slowly; however, due to the numerous dams and varying capacity of reservoirs, it is difficult to estimate the extent of the potential damage.

Low water permeable soil and sparse vegetation in the Swamp Creek drainage north of the townsite could combine to foster flash flooding when intense thunderstorms hit the Brewster area. Flooding of smaller drainages due to thunderstorms or spring runoff is likely to occur more frequently than flooding along the Columbia River. Nevertheless, the possibility for injury and death from flash floods is heightened because they occur quickly and usually with little warning.

The major impacts from both types of flooding in Pateros are extremely low given the terrain and how the city lies in relation to the rivers.

### Impacts of Flood Events

The potential impacts from flooding in Pateros are very similar to the impacts described for Okanogan County as a whole. First responders and other volunteers aiding with emergency flood control or cleanup efforts are potentially at risk of injury due to accidents or possibly exposure to contaminated water. Depressions and low spots are likely to have standing water during prolonged rain events and during the spring due to the high water table; thus, contaminants in the soil or on vegetation in these areas could impact the water supply.

The availability of food and other supplies is not likely to be impacted or interrupted by a flood event. Furthermore, the delivery of community services such as postal services, health care, law enforcement, and emergency response is also not likely to be impacted by flood events in Pateros. While individual homes may incur damages as a result of a flood, the economy of the community will not be impacted by this type of hazard.

Environmental damages resulting from a flood event are not likely to occur. In fact, this type of event will likely improve established wetland areas.

### Value of Resources at Risk

There are no critical facilities located in the floodplain of the Columbia River in Pateros. City services, office buildings, emergency response equipment and communications equipment are located outside of the floodplain and are not at direct risk of damage.

## *Earthquake*

There are no recorded occurrences of earthquakes significantly impacting the City of Pateros; however, some minimal shaking has been felt as a result of larger earthquakes elsewhere. Pateros does not have any differing issues or levels of risk associated with this hazard than Okanogan County as a whole.

### Probability of Future Occurrence

Overall, the County has a 6-15% chance of experiencing an earthquake in the next 50 years. Jurisdictions in the Methow Valley have a 10-15% probability; however, no specific jurisdiction has more risk than another or than the County overall within this area.[73]

### Impacts and Value of Resources at Risk

Unreinforced masonry (URM) structures and unreinforced chimneys of homes will likely be damaged in the event of an earthquake. There are several publicly accessible unreinforced masonry structures in Pateros in addition to the numerous homes and other buildings throughout the city with unreinforced chimneys. Damaged or collapsed chimneys could result in the secondary hazard of fire. Nonstructural damage caused by falling and swinging objects may be considerable after any magnitude earthquake. Damage to some older, more fragile bridges and land failure causing minor slides along roadways may isolate some residents.

In Pateros, several of the downtown structures are assumed to be unreinforced masonry. These structures were built prior to the inclusion of articles for seismic stability in the Uniform Building Codes in 1972. The number and value of unreinforced masonry homes or homes with masonry chimneys in Pateros is unknown, but estimated to include at least 20 buildings.

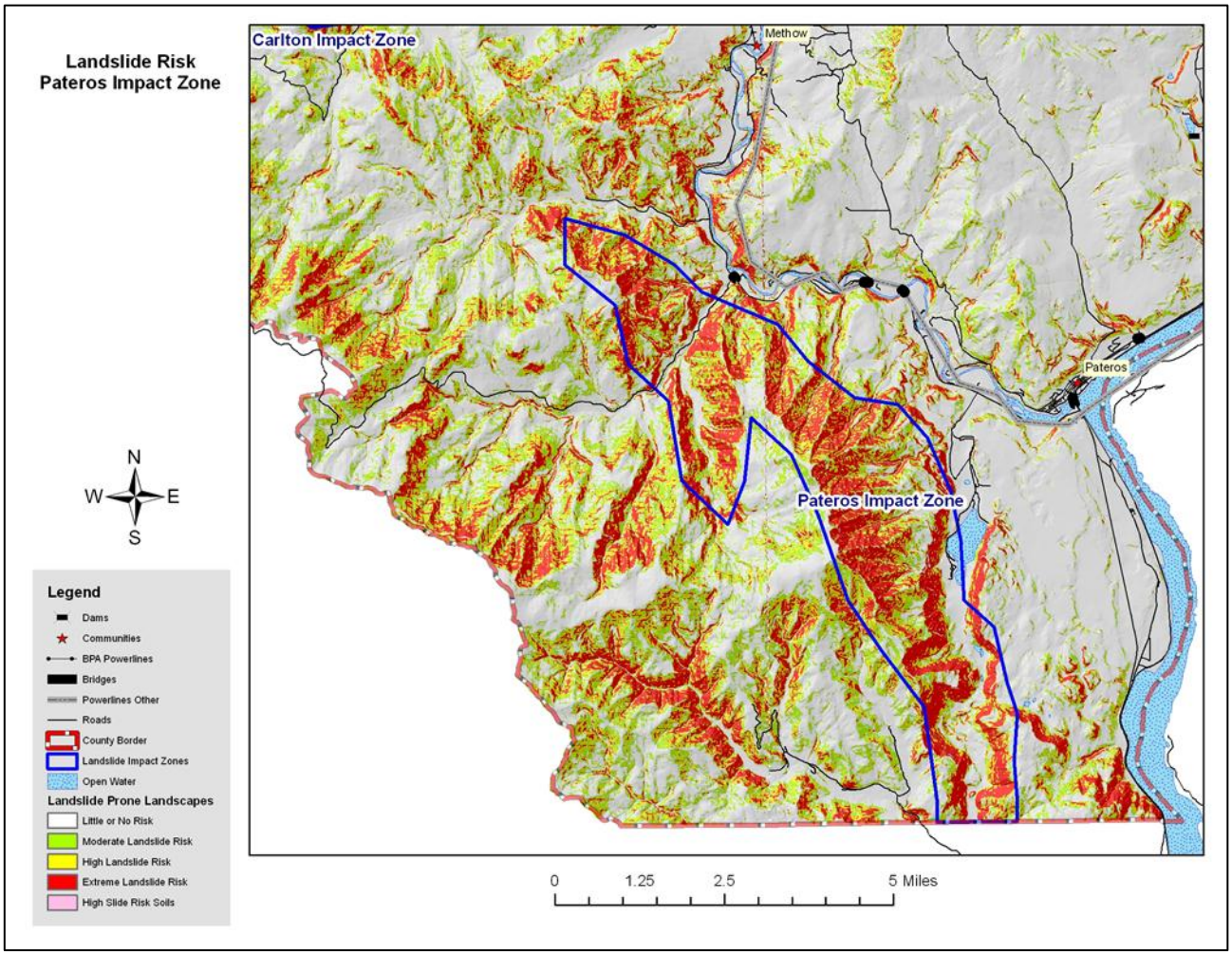
## *Landslide Profile*

The city of Pateros has a very low probability of experiencing damaging landslides. Slopes in and around the community are generally less than 20%. While small, low angle slumps may occur on eyebrows of the surrounding hills, these will be infrequent and likely the result of water saturation or a major disturbance such as an earthquake or road construction.

The identified Pateros Landslide Impact Zone lies just outside of the city limits. This Zone encompasses 141 parcels with 35 improvements totaling $4.8 million of value that could be affected in the event of a landslide in this area.

[73] USGS. 2008 United States National Seismic Hazard Maps. U.S. Geological Survey. U.S. Department of Interior. Available online at http://earthquake.usgs.gov/hazards/products/conterminous/2008/. October 2009.

**Figure 5.21. Pateros Landslide Impact Zone.**




## Impacts and Value of Resources at Risk

There are no structures or infrastructure directly at risk from landslides within the city of Pateros.

## *Severe Weather Profile*

The city of Pateros does not have any differing levels of risk associated with this hazard than Okanogan County as a whole. The probability of a severe weather event occurring in Pateros on an annual basis is very high. However, the impacts to the community are usually minimal and are the same as those described for Okanogan County as a whole.

### Impacts and Value of Resources at Risk

It is difficult to estimate the cost of potential winter storm damages to structures and the economy in Pateros. Damage to roofs by heavy snow accumulations depends on the moisture content of the snow and the structural characteristics of the buildings. In general, snow in this region tends to have low moisture content because of the low temperatures and arid environment. Additionally, snow rarely accumulates for long periods of time due to regular wind events. Frozen water pipes are the most common damage to

residential and business structures. Older homes tend to be at a higher risk to frozen water pipes than newer ones. Snow plowing in within the city limits is accomplished by the city's public works department. Private landowners are responsible for maintaining their own driveways or other private roads. Utility supplies are impacted during severe winter storms as power is lost on a regional basis. This has a two-fold impact on residents as not only is power cut to homes and businesses, but primary heating is lost for many residents. Gas furnaces and wood stoves supplement electrical heating, but with wood heating the senior population is at a disadvantage. Emergency response to severe winter storms includes site visits by police or fire department personnel, opening of shelters, or assistance with shopping, medical attention, and communications. The economic losses caused by severe winter storms may frequently be greater than structural damages. Employees may not be able to travel to work for several days and businesses may not open. Damages are seen in the form of structural repair and loss of economic activity. Okanogan County schools are occasionally closed during and right after a severe winter storm because of cold temperatures and snow covered roads.

Thunderstorms are not likely to be severe enough in Pateros to cause significant damages. However, the loss potential from flooding that results from severe thunderstorms could be significant.

Although the financial impacts of hail can be substantial and extended, accurately quantifying these impacts is problematic. Hail typically causes direct losses to structures and other personal property within Pateros. The most significant losses are most clearly seen in the agriculture sectors of the economy. Potential losses to agriculture can be disastrous. Crop damage from hail will also be different depending on the time of year and the type of crop. Most farmers carry insurance on their crops to help mitigate the potential financial loss resulting from a localized hail storm. Homeowners in Pateros rarely incur severe damage to structures (roofs); however, hail damage to vehicles is not uncommon. The damage to vehicles is difficult to estimate because the number of vehicles impacted by a specific ice storm is unknown. Additionally, most hail damage records are kept by various insurance agencies.

It is difficult to estimate potential losses in Pateros due to windstorms and tornadoes. Construction throughout the County has been implemented in the presence of high wind events, and therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

We have estimated losses based on wind and tornado damage as follows:

- 3% of the buildings damaged causing 50% of value loss (loss could be from downed or damaged trees, damaged outbuildings, damaged fences/poles, damage to siding, damaged landscaping etc.)
- 5% of the buildings received damage to roof (requiring replacement of roof equaling $3,000)

Damages associated with sensitive receptor irritation have not been estimated. We have also not estimated the potential for a large scale wildfire event associated with high winds. Based on the data provided by the County, there are 372 total structures in Pateros with a total value of approximately $45.1 million. Using the criteria outlined above an estimate of the impact of high winds in Pateros has been made. The potential wind and tornado damage to all buildings is estimated at approximately $676,904. The estimated damage to roofs is approximately $55,800.

Power failure often accompanies severe storms. Prolonged failure, especially during cold winter temperatures can have disastrous effects. All communities should be prepared to deal with power failures. Community shelters equipped with alternative power sources will help local residents stay warm and prepare food. A community-based system for monitoring and assisting elderly or disabled residents should also be developed. All households should maintain survival kits that include warm blankets, flashlights, extra batteries, nonperishable food items, and clean drinking water.

### *Wildland Fire Profile*

The channeled scablands are a dominant landscape in Pateros. This unique geological feature was created by ice age floods that swept across eastern Washington and down the Columbia River Plateau periodically during the Pleistocene era. The massive erosion caused by the flood events scoured the landscape down to the underlying basalt creating vast areas of rocky cliffs, river valleys, channel ways and pothole lakes. Typical vegetation found throughout this landscape is grass, mixed shrub and sagebrush with areas of wetlands, marsh, ponderosa pine islands, cultivated crops and CRP fields. The channeled scablands landscape prevails in the southcentral portion of the county within the Colville Indian Reservation and along the major waterways of the Okanogan River, Columbia River, Tumwater Creek and Rice Canyon. Landownership is predominantly private or Tribal with areas owned by the State of Washington and the Bureau of Land Management occurring along the western fringes of the scablands. Tribal ownership includes numerous named and unnamed lakes that occur between the Okanogan River and Omak Lake. Private landownership includes cattle ranches and in holdings of cultivated farmland and CRP fields. New development occurs primarily near communities and along major roads. Most of the pressure for multi-housing subdivisions occurs in close proximity to the city. Rural development is widely dispersed consisting primarily of isolated ranching headquarters, home sites, irrigation systems, and developed springs or wells. In nearly all developed areas, structures are in close proximity to vegetation that becomes a significant fire risk at certain times of the year.

Residents living in the populated center of Pateros have access to municipal water supply systems with public fire hydrants. Outside this area, development relies on individual, co-op or multiple-home well systems. Creeks, ponds and developed drafting areas provide water sources for emergency fire suppression in the rural areas to a limited extent. Water tanks have been set up at several ranches throughout the area as a supplemental water supply during fire season. Irrigation systems are capable of providing additional water supplies for suppression equipment on a limited basis. Additional water resources distributed and documented throughout the agricultural landscape are needed to provide adequate water for fire suppression.

Public utility lines travel both above and below ground along roads and cross-country to remote facilities. Many irrigation systems and wells rely on above ground power lines for electricity. These power poles pass through areas of dense wildland fuels that could be destroyed or compromised in the event of a wildfire. Cell phone service is well established in most parts of the county with only limited dead zones.

Okanogan County Fire Protection District #15 provides structural and wildland fire protection for the City of Pateros.

### Probability of Future Occurrence

Pateros allows for irrigation of landscaping and agricultural crops, which not only helps keep the vegetation green and at lower propensity for ignitions, but also gives firefighters abundant access to water resources for suppression purposes. As crop production slows in the fall, the irrigation pressure tends to taper off, leaving previously lush grasses and other vegetation to dry out and become a potential fire hazard.

The sagebrush and grassland fuels that dominant this part of the County usually becomes available to burn fairly early in the summer. The growth of a productive orchard takes many years and is, therefore, a long term investment. The potential loss of these orchards and the surrounding structures to fire would severely damage the local economy as well as change the way of life for many residents.

### Impacts of Wildland Fire Events

The potential impacts from a wildfire in Pateros are very similar to the impacts described for Okanogan County as a whole. All fires pose a significant safety risk to residents and emergency service personnel. Individual structures, property, and livelihoods could be severely damaged or lost as a result of a fire; however, the community is not likely to suffer severe or long-term economic losses.

Low frequency fires in the shrublands surrounding the community may benefit the ecological environment as nutrients are recycled into the soil. Generally, grass and forbs are rejuvenated by a low intensity fire and grow back quickly; however, heavy rains immediately after a fire could cause erosion.

Smoke from a nearby wildland fire may impact sensitive populations within the community due to degraded air quality conditions. Smoke and/or flames will also impact transportation corridors connecting Brewster to other communities; thus, travel and commerce may be interrupted.

### Value of Resources at Risk

It is difficult to estimate potential losses in Wilbur from wildland fire due to the unpredictability of wildfire behavior and the nature of ignition sources. It is unlikely that more than a few structures or other properties within the city limits of Wilbur would be lost or damaged by a wildland fire; however, residents in the immediate vicinity may be directly impacted. It is impossible to forecast the path a wildfire will take and what type of assets and resources, manmade and ecological, will be at risk. Thus, no value estimates were made for this hazard.

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# *Town of Nespelem Annex*

## *Flood Profile*

Nespelem is an incorporated city on the Colville Indian Reservation in Okanogan County. Currently, Nespelem is not affected by a FEMA identified 100 or 500 year floodplain; thus, Nespelem has very little to no risk of experiencing flood events. Nespelem is also located on the eastern side of Okanogan County along State Route 155. The majority of the Nespelem community is situated along the eastern bank of the Nespelem River, a small tributary of the Columbia River; however, there is no FEMA identified floodplain associated with this waterway.

The only floodplain that may affect properties or residents on the Reservation is associated with the Okanogan River along the western Reservation boundary.

### Probability of Future Occurrence

Floods along the Nespelem River drainage are typically the result of two different types of weather events, rain-on-snow and thunderstorms. Rain-on-snow- events that affect the Nespelem River occur when significant snow pack exists in the upper reaches of the foothills and beyond of the Colville Reservation. Warm rains falling on the snow pack result in a significantly increased rate of snowmelt. Often this melting occurs while the ground is frozen and the water cannot be absorbed into the soil, resulting in increased overland flows. Flood waters recede slowly as rain-on-snow weather events tend to last for several days. Low velocity flooding occurs in several tributaries to the Columbia River on the Reservation including Stepstone Creek, North Star Creek, Mill Creek, and others almost annually during the spring runoff period.

Sandy soil and sparse vegetation combine to foster flash flooding when intense thunderstorms hit the valley. Floods from thunderstorms do not occur as frequently as those from general rain and snowmelt conditions, but can be far more severe. The possibility for injury and death from flash floods is heightened because they are so uncommon that people do not recognize the potential danger. Thunderstorms generally occur in June to September while late December to February is the worst time for rain on snow events. Water levels in the Nespelem River are not generally impacted by localized thunderstorms.

Warm weather or rain after a heavy snowfall is usually responsible for high flows in the Nespelem River drainage. A high level of sediment is prevalent during periods of high runoff. This sediment tends to cause deterioration in streambeds and channels through deposition. Natural obstructions to flood waters include trees, brush, and other vegetation along the stream banks.

### Impacts of Flood Events

The potential impacts from flooding to communities located within the Colville Reservation boundary are very similar to the impacts described for Okanogan County as a whole. First responders and other volunteers aiding with emergency flood control or cleanup efforts are potentially at risk of injury due to accidents or possibly exposure to contaminated water. Depressions and low spots are likely to have standing water during prolonged rain events and during the spring due to the high water table; thus, contaminants in the soil or on vegetation in these areas could impact the water supply.

The availability of food and other supplies is not likely to be impacted or interrupted by a flood event. Furthermore, the delivery of community services such as postal services, health care, law enforcement, and emergency response is also not likely to be impacted by flood events on the Colville Reservation. While individual homes may incur damages as a result of a flood, the economy of the communities will not be impacted by this type of hazard.

Environmental damages resulting from a flood event are not likely to occur. In fact, this type of event will likely improve established wetland areas.

### Value of Resources at Risk

Although there are no communities on the Colville Reservation that are directly affected by a 100 year floodplain, the Colville Tribe does have several assets at risk to flooding along the Okanogan River. Within the 100-year floodplain, properties have a 1% chance of experiencing a flood in any given year.

**Table5.5. Assets on Colville Reservation within 100 Year Floodplain.**

| Owner | Number of Acres |
|---|---|
| City | 0 |
| County | 2.9 |
| Federal | 0.6 |
| Public Utilities District | 147.4 |
| Private | 524.5 |
| Railroad Right of Way | 6.9 |
| Right of Way | 15.2 |
| Tribal | 189.7 |
| Tribal Allotment | 150.8 |
| Tribal Trust | 98.7 |

There is an estimated 48 improvements on parcels within the 100 year floodplain on the Colville Reservation with an estimated value of $2,365,600.

There are very few critical facilities located in the floodplain of the Okanogan River on the Reservation. City and tribal services, office buildings, emergency response equipment and communications equipment are located outside of the floodplain and are not at direct risk of damage.

Roads and bridges are the major infrastructural element that is affected by flooding. There are currently two bridges crossing the Nespelem River and Little Nespelem River within the Colville Reservation; one is located in Nespelem and the other is located just south of Colville Indian Agency.

## *Earthquake*

There are no recorded occurrences of earthquakes significantly impacting the Nespelem; however, some minimal shaking has been felt as a result of larger earthquakes elsewhere. The Nespelem does not have any differing issues or levels of risk associated with this hazard than Okanogan County as a whole.

### Probability of Future Occurrence

Overall, the County has a 6-15% chance of experiencing an earthquake in the next 50 years. Jurisdictions on the eastern border of the County have a 6-10% probability of experiencing an earthquake in the next 50 years; however, no specific jurisdiction has more risk than another or than the County overall within these areas.[74]

### Impacts and Value of Resources at Risk

Unreinforced masonry (URM) structures and unreinforced chimneys of homes will likely be damaged in the event of an earthquake. There are a few publicly accessible unreinforced masonry structures in Nespelem in addition to the numerous homes and other buildings throughout the Reservation with unreinforced chimneys. Damaged or collapsed chimneys could result in the secondary hazard of fire. Nonstructural damage caused by falling and swinging objects may be considerable after any magnitude earthquake. Damage to some older, more fragile bridges and land failure causing minor slides along roadways may isolate some residents.

In Nespelem, a few of the downtown structures are assumed to be unreinforced masonry. These structures were built prior to the inclusion of articles for seismic stability in the Uniform Building Codes in 1972. The number and value of unreinforced masonry homes or homes with masonry chimneys in Nespelem is unknown, but estimated to include at least 10 buildings.

## *Landslide Profile*

The community of Nespelem has a low risk of damage caused by landslides. Most of the potential risk in this area comes from unstable soils. Soils composed mostly of schist and granite, as they are in this part of Okanogan County, are typically at higher risk of slumping than other soil types. Slides in this area would be expected along cut and fill slopes and potentially in crop fields or on construction sites where there has been disturbance. These will tend to be smaller scale slides; however, there is some potential for larger events.

### Impacts and Value of Resources at Risk

There is little direct landslide risk to communities on the eastern edge of the county; however, individual landowners could be affected. Road systems may also be damaged as small slides limit vehicle access.

The Confederated Tribes of the Colville Reservation and the Nespelem REA utilities district provided services in this area; however, none of their facilities or assets are at direct risk of landslides. Most of Tribe's governmental facilities are located in Nespelem; thus, slides in the area would likely require a response or assistance from their public offices.

[74] USGS. 2008 United States National Seismic Hazard Maps. U.S. Geological Survey. U.S. Department of Interior. Available online at http://earthquake.usgs.gov/hazards/products/conterminous/2008/. October 2009.

## *Severe Weather Profile*

The town of Nespelem does not have any differing levels of risk associated with this hazard than Okanogan County as a whole. The probability of a severe weather event occurring in Nespelem on an annual basis is very high. However, the impacts to the community are usually minimal and are the same as those described for Okanogan County as a whole.

### Impacts and Value of Resources at Risk

It is difficult to estimate the cost of potential winter storm damages to structures and the economy in Nespelem. Damage to roofs by heavy snow accumulations depends on the moisture content of the snow and the structural characteristics of the buildings. In general, snow in this region tends to have low moisture content because of the low temperatures and arid environment. Additionally, snow rarely accumulates for long periods of time due to regular wind events. Frozen water pipes are the most common damage to residential and business structures. Older homes tend to be at a higher risk to frozen water pipes than newer ones. Snow plowing in within the town limits is accomplished by the town's public works department. Private landowners are responsible for maintaining their own driveways or other private roads. Utility supplies are impacted during severe winter storms as power is lost on a regional basis. This has a two-fold impact on residents as not only is power cut to homes and businesses, but primary heating is lost for many residents. Gas furnaces and wood stoves supplement electrical heating, but with wood heating the senior population is at a disadvantage. Emergency response to severe winter storms includes site visits by police or fire department personnel, opening of shelters, or assistance with shopping, medical attention, and communications. The economic losses caused by severe winter storms may frequently be greater than structural damages. Employees may not be able to travel to work for several days and businesses may not open. Damages are seen in the form of structural repair and loss of economic activity. Okanogan County schools are occasionally closed during and right after a severe winter storm because of cold temperatures and snow covered roads.

Thunderstorms are not likely to be severe enough in Nespelem to cause significant damages. However, the loss potential from flooding that results from severe thunderstorms could be significant.

Although the financial impacts of hail can be substantial and extended, accurately quantifying these impacts is problematic. Hail typically causes direct losses to structures and other personal property within Nespelem. The most significant losses are most clearly seen in the agriculture sectors of the economy. Potential losses to agriculture can be disastrous. Crop damage from hail will also be different depending on the time of year and the type of crop. Most farmers carry insurance on their crops to help mitigate the potential financial loss resulting from a localized hail storm. Homeowners in Nespelem rarely incur severe damage to structures (roofs); however, hail damage to vehicles is not uncommon. The damage to vehicles is difficult to estimate because the number of vehicles impacted by a specific ice storm is unknown. Additionally, most hail damage records are kept by various insurance agencies.

It is difficult to estimate potential losses in Nespelem due to windstorms and tornadoes. Construction throughout the County has been implemented in the presence of high wind events, and therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

We have estimated losses based on wind and tornado damage as follows:

- 3% of the buildings damaged causing 50% of value loss (loss could be from downed or damaged trees, damaged outbuildings, damaged fences/poles, damage to siding, damaged landscaping etc.)
- 5% of the buildings received damage to roof (requiring replacement of roof equaling $3,000)

Damages associated with sensitive receptor irritation have not been estimated. We have also not estimated the potential for a large scale wildfire event associated with high winds. Based on the data provided by the County, there are 221 total structures in Nespelem with a total value of approximately $2.5 million. Using the criteria outlined above an estimate of the impact of high winds in Nespelem has been made. The potential wind and tornado damage to all buildings is estimated at approximately $37,388. The estimated damage to roofs is approximately $33,150.

Power failure often accompanies severe storms. Prolonged failure, especially during cold winter temperatures can have disastrous effects. All communities should be prepared to deal with power failures. Community shelters equipped with alternative power sources will help local residents stay warm and prepare food. A community-based system for monitoring and assisting elderly or disabled residents should also be developed. All households should maintain survival kits that include warm blankets, flashlights, extra batteries, nonperishable food items, and clean drinking water.

### *Wildland Fire Profile*

The Town of Nespelem is located in the southeastern tip of Okanogan County. The Town of Nespelem includes the communities of Nespelem and Colville Agency with most of the structures occurring nearby.

Fuels in Nespelem are fairly consistent. Much of this area is covered by low growing grasses and sagebrush with some scattered ponderosa pine in the draws. Dense riparian fuels including black cottonwoods and willows are prominent along the Nespelem River and the Little Nespelem River. Fires occurring throughout these communities would be expected to spread very rapidly, but burn with a moderate intensity through the flashy fuels. The riparian vegetation along the waterways may support a more intense fire later in the summer as the water levels go down and fuels become dry.

The north end of Nespelem is partially forested with ponderosa pine and Douglas-fir being the primary overstory species. Several landowners have conducted both commercial and pre-commercial thinnings along State Route 155, which, with slash treatment, helps reduce the potential for an intense fire around homes in this area.

The primary access route through the Nespelem and Coulee Dam Neighborhoods is State Route 155, a paved, two-lane highway. The Columbia River Road is also a paved, two-lane highway traveling from Colville Agency west along the Columbia River. There are several secondary roads throughout the area accessing homes or recreational areas. These roads are typically regularly maintained, graveled routes. Gold Lake Road and Cache Creek Road are graveled routes heading from Nespelem north and east, respectively, into neighboring Ferry County. Other secondary roads include Moses Road, Buffalo Lake Road, Rebecca Lake Road, Peter Dan Road

Residents in the community of Nespelem has access to the municipal water system. Homes outside of the city limits rely on personal well systems.

Two Bonneville Power Administration transmission lines are located within the Nespelem and Coulee Dam Communities. One of these lines ends at Colville Agency, while the other passes through the bottom half of the Coulee Dam Community.

Grand Coulee Dam on the Columbia River is located in the southwestern tip of the Coulee Dam Neighborhood. The Grand Coulee Dam, located on the Columbia River in central Washington, is the largest concrete structure in the United States. It forms the centerpiece of the Columbia Basin Project, a multipurpose endeavor managed by the U.S. Bureau of Reclamation. In addition to producing up to 6.5 million kilowatts of power, the dam irrigates over half a million acres of Columbia River basin farm land and provides abundant wildlife and recreation areas.

Structures in the communities of Nespelem and Colville Agency currently have no organized structural fire protection. The Bureau of Indian Affairs provides wildland fire protection on all lands within the Confederated Tribes of the Colville Reservation.

State lands are the sole responsibility of the Washington Department of Natural Resources (suppression & reciprocal agreements may apply). Federal lands are the sole responsibility of the Federal management agency (reciprocal agreement may apply). Much of the private lands in Okanogan County are within joint jurisdiction between the County fire protection districts and the WA DNR.

The DNR provides wildfire protection during the fire season between April and October with a varying degree of resources available in the early spring and late autumn months. The U.S. Forest Service seasonally responds to all wildland fires on their jurisdiction and may also respond to wildland fires on private lands based on a reciprocal agreement with the DNR.

### Probability of Future Occurrence

The Community in Nespelem is at moderate risk of wildland fire. Most of the structures in this community is located within or very near the community center. Residents generally keep the grass and other fuels around their homes to a minimum by mowing or grazing livestock.

The highly productive vegetation in the Nespelem River, Little Nespelem River, and other drainages has the potential to burn very intensely. A severe fire in these corridors has an increased possibility of damaging the ecosystem of the waterway as this type of vegetation is not usually very resilient after a burn. Furthermore, a fire in these fuels could potentially threaten many homes as it spreads through the dense fuels along the stream and river banks.

All of the residents in Nespelem are currently without rural fire protection. This could lead to delayed response times as resources are called from out of the area to respond to a structural or wildland fire situation.

### Impacts of Wildland Fire Events

The potential impacts from a wildfire in Nespelem are very similar to the impacts described for Okanogan County as a whole. All fires pose a significant safety risk to residents and emergency service personnel. Individual structures, property, and livelihoods could be severely damaged or lost as a result of a fire; however, the community is not likely to suffer severe or long-term economic losses.

A fire in the shrublands surrounding the community may benefit the ecological environment as nutrients are recycled into the soil. Generally, grass and forbs are rejuvenated by a low intensity fire and grow back quickly; however, heavy rains immediately after a fire could cause erosion.

Smoke from a nearby wildland fire may impact sensitive populations within the community due to degraded air quality conditions. Smoke and/or flames will also impact transportation corridors connecting Nespelem to other communities; thus, travel and commerce may be interrupted.

### Value of Resources at Risk

It is difficult to estimate potential losses in Nespelem from wildland fire due to the unpredictability of wildfire behavior and the nature of ignition sources. It is unlikely that more than a few structures or other properties within the city limits of Nespelem would be lost or damaged by a wildland fire; however, residents in the immediate vicinity may be directly impacted. It is impossible to forecast the path a wildfire will take and what type of assets and resources, manmade and ecological, will be at risk. Thus, no value estimates were made for this hazard.

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# *Town of Elmer City Annex*

## *Flood Profile*

Elmer City is one of the few incorporated cities on the Colville Reservation in Okanogan County. Elmer City is not affected by a FEMA identified 100 or 500 year floodplain; thus, they have very little to no risk of experiencing flood events. A FEMA Flood Insurance Rate Map has been developed for Elmer City; however, this map does not delineate any 100 or 500 year floodplain. The community of Elmer City is located along the rim of the Columbia River canyon at elevations equivalent or well above the top of Grand Coulee Dam and several hundred feet above the high water mark of the Columbia River.

### Probability of Future Occurrence

Floods in Elmer City are typically the result of two different types of events, rain-on-snow and thunderstorms. Rain-on-snow- events that affect Elmer City occur when significant snow pack exists in the Colville Indian Reservation or when large regional rain-on-snow or major spring runoff events occur in the Columbia River basin. Warm rains falling on the snow pack result in a significantly increased rate of snowmelt. Often this melting occurs while the ground is frozen and the water cannot be absorbed into the soil, resulting in increased overland flows. Due to large area, flood waters along the Columbia would likely recede slowly; however, due to the numerous dams and varying capacity of reservoirs, it is difficult to estimate the extent of the potential damage.

### Impacts of Flood Events

The potential impacts from flooding to communities located within the Colville Reservation boundary are very similar to the impacts described for Okanogan County as a whole. First responders and other volunteers aiding with emergency flood control or cleanup efforts are potentially at risk of injury due to accidents or possibly exposure to contaminated water. Depressions and low spots are likely to have standing water during prolonged rain events and during the spring due to the high water table; thus, contaminants in the soil or on vegetation in these areas could impact the water supply.

The availability of food and other supplies is not likely to be impacted or interrupted by a flood event. Furthermore, the delivery of community services such as postal services, health care, law enforcement, and emergency response is also not likely to be impacted by flood events on the Colville Reservation. While individual homes may incur damages as a result of a flood, the economy of the communities will not be impacted by this type of hazard.

Environmental damages resulting from a flood event are not likely to occur. In fact, this type of event will likely improve established wetland areas.

### Value of Resources at Risk

There are no critical facilities located in the floodplain of the Columbia River in Elmer City. City and tribal services, office buildings, emergency response equipment and communications equipment are located outside of the floodplain and are not at direct risk of damage.

Roads and bridges are the major infrastructural element that is affected by flooding. There are currently no bridge crossings that are at risk in Elmer City.

## *Earthquake*

There are no recorded occurrences of earthquakes significantly impacting the Elmer City; however, some minimal shaking has been felt as a result of larger earthquakes elsewhere. Elmer City does not have any differing issues or levels of risk associated with this hazard than Okanogan County as a whole.

### Probability of Future Occurrence

Overall, the County has a 6-15% chance of experiencing an earthquake in the next 50 years. Jurisdictions in the eastern part of Okanogan County have a 6-10% probability of experiencing an earthquake in the next 50 years; however, no specific jurisdiction has more risk than another or than the County overall within these areas.[75]

### Impacts and Value of Resources at Risk

Unreinforced masonry (URM) structures and unreinforced chimneys of homes will likely be damaged in the event of an earthquake. There are a few publicly accessible unreinforced masonry structures in Elmer City in addition to the numerous homes and other buildings throughout the Reservation with unreinforced chimneys. Damaged or collapsed chimneys could result in the secondary hazard of fire. Nonstructural damage caused by falling and swinging objects may be considerable after any magnitude earthquake. Damage to some older, more fragile bridges and land failure causing minor slides along roadways may isolate some residents.

In Elmer City, there are a few downtown structures that are assumed to be unreinforced masonry. These structures were built prior to the inclusion of articles for seismic stability in the Uniform Building Codes in 1972. The number and value of unreinforced masonry homes or homes with masonry chimneys in Elmer City is unknown, but estimated to include at least 10 buildings.

## *Landslide Profile*

The community of Elmer City has a low risk of damage caused by landslides. Most of the potential risk in this area as well comes from unstable soils. Soils composed mostly of schist and granite, as they are in this part of Okanogan County, are typically at higher risk of slumping than other soil types. Slides in this area would be expected along cut and fill slopes and potentially in crop fields or on construction sites where there has been disturbance. These will tend to be smaller scale slides; however, there is some potential for larger events.

### Impacts and Value of Resources at Risk

There is little direct landslide risk to communities on the eastern edge of the County; however, individual landowners could be affected. Road systems may also be damaged as small slides limit vehicle access.

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[75] USGS. 2008 United States National Seismic Hazard Maps. U.S. Geological Survey. U.S. Department of Interior. Available online at http://earthquake.usgs.gov/hazards/products/conterminous/2008/. October 2009.

The Confederated Tribes of the Colville Reservation and the Elmer City REA utilities district provided services in this area; however, none of their facilities or assets are at direct risk of landslides.

## *Severe Weather Profile*

The Town of Elmer City does not have any differing levels of risk associated with this hazard than Okanogan County as a whole. The probability of a severe weather event occurring in Elmer City on an annual basis is very high. However, the impacts to the community are usually minimal and are the same as those described for Okanogan County as a whole.

### Impacts and Value of Resources at Risk

It is difficult to estimate the cost of potential winter storm damages to structures and the economy in Elmer City. Damage to roofs by heavy snow accumulations depends on the moisture content of the snow and the structural characteristics of the buildings. In general, snow in this region tends to have low moisture content because of the low temperatures and arid environment. Additionally, snow rarely accumulates for long periods of time due to regular wind events. Frozen water pipes are the most common damage to residential and business structures. Older homes tend to be at a higher risk to frozen water pipes than newer ones. Snow plowing in within the town limits is accomplished by the town's public works department. Private landowners are responsible for maintaining their own driveways or other private roads. Utility supplies are impacted during severe winter storms as power is lost on a regional basis. This has a two-fold impact on residents as not only is power cut to homes and businesses, but primary heating is lost for many residents. Gas furnaces and wood stoves supplement electrical heating, but with wood heating the senior population is at a disadvantage. Emergency response to severe winter storms includes site visits by police or fire department personnel, opening of shelters, or assistance with shopping, medical attention, and communications. The economic losses caused by severe winter storms may frequently be greater than structural damages. Employees may not be able to travel to work for several days and businesses may not open. Damages are seen in the form of structural repair and loss of economic activity. Okanogan County schools are occasionally closed during and right after a severe winter storm because of cold temperatures and snow covered roads.

Thunderstorms are not likely to be severe enough in Elmer City to cause significant damages. However, the loss potential from flooding that results from severe thunderstorms could be significant.

Although the financial impacts of hail can be substantial and extended, accurately quantifying these impacts is problematic. Hail typically causes direct losses to structures and other personal property within Elmer City. The most significant losses are most clearly seen in the agriculture sectors of the economy. Potential losses to agriculture can be disastrous. Crop damage from hail will also be different depending on the time of year and the type of crop. Most farmers carry insurance on their crops to help mitigate the potential financial loss resulting from a localized hail storm. Homeowners in Elmer City rarely incur severe damage to structures (roofs); however, hail damage to vehicles is not uncommon. The damage to vehicles is difficult to estimate because the number of vehicles impacted by a specific ice storm is unknown. Additionally, most hail damage records are kept by various insurance agencies.

It is difficult to estimate potential losses in Elmer City due to windstorms and tornadoes. Construction throughout the County has been implemented in the presence of high wind events, and therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

We have estimated losses based on wind and tornado damage as follows:

- 3% of the buildings damaged causing 50% of value loss (loss could be from downed or damaged trees, damaged outbuildings, damaged fences/poles, damage to siding, damaged landscaping etc.)
- 5% of the buildings received damage to roof (requiring replacement of roof equaling $3,000)

Damages associated with sensitive receptor irritation have not been estimated. We have also not estimated the potential for a large scale wildfire event associated with high winds. Based on the data provided by the County, there are 336 total structures in Elmer City with a total value of approximately $7.9 million. Using the criteria outlined above an estimate of the impact of high winds in Elmer City has been made. The potential wind and tornado damage to all buildings is estimated at approximately $118,673. The estimated damage to roofs is approximately $50,400.

Power failure often accompanies severe storms. Prolonged failure, especially during cold winter temperatures can have disastrous effects. All communities should be prepared to deal with power failures. Community shelters equipped with alternative power sources will help local residents stay warm and prepare food. A community-based system for monitoring and assisting elderly or disabled residents should also be developed. All households should maintain survival kits that include warm blankets, flashlights, extra batteries, nonperishable food items, and clean drinking water.

### *Wildland Fire Profile*

The Town of Elmer City is located in the southeastern tip of Okanogan County and occurs within the Colville Reservation.

Fuels in Elmer City are fairly consistent. Much of this area is covered by low growing grasses and sagebrush with some scattered ponderosa pine in the draws. Fires occurring throughout this community would be expected to spread very rapidly, but burn with a moderate intensity through the flashy fuels. The riparian vegetation along the waterways may support a more intense fire later in the summer as the water levels go down and fuels become dry.

The primary access route through Elmer City is State Route 155, a paved, two-lane highway. The Columbia River Road is also a paved, two-lane highway traveling from Colville Agency west along the Columbia River. There are several secondary roads throughout the area accessing homes or recreational areas. These roads are typically regularly maintained, graveled routes. Secondary roads include Moses Road, Buffalo Lake Road, Rebecca Lake Road, Peter Dan Road

Residents in the community of Elmer City have access to the municipal water system. Homes outside of the city limits rely on personal well systems.

Two Bonneville Power Administration transmission lines are located within the Nespelem and Coulee Dam Communities. One of these lines ends at Colville Agency, while the other passes through the bottom half of the Coulee Dam Community.

Grand Coulee Dam on the Columbia River is located in the southwestern tip of the Coulee Dam Neighborhood. The Grand Coulee Dam, located on the Columbia River in central Washington, is the largest concrete structure in the United States. It forms the centerpiece of the Columbia Basin Project, a multipurpose endeavor managed by the U.S. Bureau of Reclamation. In addition to producing up to 6.5 million kilowatts of power, the dam irrigates over half a million acres of Columbia River basin farm land and provides abundant wildlife and recreation areas.

Okanogan County Fire Protection District #2 is responsible for structural and wildland fire protection within and immediately surrounding the town of Elmer City. The Bureau of Indian Affairs provides wildland fire protection on all lands within the Confederated Tribes of the Colville Reservation.

State lands are the sole responsibility of the Washington Department of Natural Resources (suppression & reciprocal agreements may apply). Federal lands are the sole responsibility of the Federal management agency (reciprocal agreement may apply). Much of the private lands in Okanogan County are within joint jurisdiction between the County fire protection districts and the WA DNR.

The DNR provides wildfire protection during the fire season between April and October with a varying degree of resources available in the early spring and late autumn months. The U.S. Forest Service seasonally responds to all wildland fires on their jurisdiction and may also respond to wildland fires on private lands based on a reciprocal agreement with the DNR.

### Probability of Future Occurrence

The potential impacts from a wildfire in Elmer City are very similar to the impacts described for Okanogan County as a whole. All fires pose a significant safety risk to residents and emergency service personnel. Individual structures, property, and livelihoods could be severely damaged or lost as a result of a fire; however, the community is not likely to suffer severe or long-term economic losses.

A fire in the shrublands surrounding the community may benefit the ecological environment as nutrients are recycled into the soil. Generally, grass and forbs are rejuvenated by a low intensity fire and grow back quickly; however, heavy rains immediately after a fire could cause erosion.

Smoke from a nearby wildland fire may impact sensitive populations within the community due to degraded air quality conditions. Smoke and/or flames will also impact transportation corridors connecting Elmer City to other communities; thus, travel and commerce may be interrupted.

### Impacts of Wildland Fire Events

The potential impacts from a wildfire in Elmer City are very similar to the impacts described for Okanogan County as a whole. All fires pose a significant safety risk to residents and emergency service personnel. Individual structures, property, and livelihoods could be severely damaged or lost as a result of a fire; however, the community is not likely to suffer severe or long-term economic losses.

A fire in the grasslands surrounding the community may benefit the ecological environment as nutrients are recycled into the soil. Generally, grass and forbs are rejuvenated by a low intensity fire and grow back quickly; however, heavy rains immediately after a fire could cause erosion.

Smoke from a nearby wildland fire may impact sensitive populations within the community due to degraded air quality conditions. Smoke and/or flames will also impact transportation corridors connecting Davenport to other communities; thus, travel and commerce may be interrupted.

### Value of Resources at Risk

It is difficult to estimate potential losses in Elmer City from wildland fire due to the unpredictability of wildfire behavior and the nature of ignition sources. It is unlikely that more than a few structures or other properties within the city limits of Elmer City would be lost or damaged by a wildland fire; however, residents in the immediate vicinity may be directly impacted. It is impossible to forecast the path a wildfire will take and what type of assets and resources, manmade and ecological, will be at risk. Thus, no value estimates were made for this hazard.

# *Town of Coulee Dam Annex*

## *Flood Profile*

Coulee Dam is an incorporated city on the Colville Indian Reservation in Okanogan County. The Town of Coulee Dam would not be affected by a FEMA identified 100 or 500 year floodplain; thus, they have very little to no risk of experiencing flood events. The Town of Coulee Dam is located along the rim of the Columbia River canyon at elevations equivalent or well above the top of Grand Coulee Dam and several hundred feet above the high water mark of the Columbia River.

### Probability of Future Occurrence

Floods in Coulee Dam are typically the result of two different types of events, rain-on-snow and thunderstorms. Rain-on-snow- events that affect Coulee Dam occur when significant snow pack exists in the Colville Indian Reservation or when large regional rain-on-snow or major spring runoff events occur in the Columbia River basin. Warm rains falling on the snow pack result in a significantly increased rate of snowmelt. Often this melting occurs while the ground is frozen and the water cannot be absorbed into the soil, resulting in increased overland flows. Due to large area, flood waters along the Columbia would likely recede slowly; however, due to the numerous dams and varying capacity of reservoirs, it is difficult to estimate the extent of the potential damage.

### Impacts of Flood Events

The potential impacts from flooding to communities located within the Colville Reservation boundary are very similar to the impacts described for Okanogan County as a whole. First responders and other volunteers aiding with emergency flood control or cleanup efforts are potentially at risk of injury due to accidents or possibly exposure to contaminated water. Depressions and low spots are likely to have standing water during prolonged rain events and during the spring due to the high water table; thus, contaminants in the soil or on vegetation in these areas could impact the water supply.

The availability of food and other supplies is not likely to be impacted or interrupted by a flood event. Furthermore, the delivery of community services such as postal services, health care, law enforcement, and emergency response is also not likely to be impacted by flood events on the Colville Reservation. While individual homes may incur damages as a result of a flood, the economy of the communities will not be impacted by this type of hazard.

Environmental damages resulting from a flood event are not likely to occur. In fact, this type of event will likely improve established wetland areas.

### Value of Resources at Risk

There are no critical facilities located in the floodplain of the Columbia River in Coulee Dam. City and tribal services, office buildings, emergency response equipment and communications equipment are located outside of the floodplain and are not at direct risk of damage.

Roads and bridges are the major infrastructural element that is affected by flooding. There are currently no bridge crossings that are at risk in Coulee Dam.

## *Earthquake*

There are no recorded occurrences of earthquakes significantly impacting the town of Coulee Dam; however, some minimal shaking has been felt as a result of larger earthquakes elsewhere. The town of Coulee Dam does not have any differing issues or levels of risk associated with this hazard than Okanogan County as a whole.

### Probability of Future Occurrence

Overall, the County has a 6-15% chance of experiencing an earthquake in the next 50 years. Jurisdictions in the eastern part of Okanogan County have a 6-10% probability of experiencing an earthquake in the next 50 years; however, no specific jurisdiction has more risk than another or than the County overall within these areas.[76]

### Impacts and Value of Resources at Risk

Unreinforced masonry (URM) structures and unreinforced chimneys of homes will likely be damaged in the event of an earthquake. There are several publicly accessible unreinforced masonry structures in the town of Coulee Dam in addition to the numerous homes and other buildings throughout the community with unreinforced chimneys. Damaged or collapsed chimneys could result in the secondary hazard of fire. Nonstructural damage caused by falling and swinging objects may be considerable after any magnitude earthquake. Damage to some older, more fragile bridges and land failure causing minor slides along roadways may isolate some residents.

In Coulee Dam, there are approximately 5 downtown structures that are assumed to be unreinforced masonry. These structures were built prior to the inclusion of articles for seismic stability in the Uniform Building Codes in 1972. The number and value of unreinforced masonry homes or homes with masonry chimneys in the town of Coulee Dam is unknown, but estimated to include at least 25 buildings.

## *Landslide Profile*

The community of Coulee Dam has a low risk of damage caused by landslides. Soils composed mostly of schist and granite, as they are in this part of Okanogan County, are typically at higher risk of slumping than other soil types. Slides in this area would be expected along cut and fill slopes and potentially in crop fields or on construction sites where there has been disturbance. These will tend to be smaller scale slides; however, there is some potential for larger events.

### Impacts and Value of Resources at Risk

There is little direct landslide risk to communities on the eastern edge of the county; however, individual landowners could be affected. Road systems may also be damaged as small slides limit vehicle access.

The Confederated Tribes of the Colville Reservation and the Coulee Dam REA utilities district provided services in this area; however, none of their facilities or assets are at direct risk of landslides.

[76] USGS. 2008 United States National Seismic Hazard Maps. U.S. Geological Survey. U.S. Department of Interior. Available online at http://earthquake.usgs.gov/hazards/products/conterminous/2008/. October 2009.

## *Severe Weather Profile*

The town of Coulee Dam does not have any differing levels of risk associated with this hazard than Okanogan County as a whole. The probability of a severe weather event occurring in Coulee Dam on an annual basis is very high. However, the impacts to the community are usually minimal and are the same as those described for Okanogan County as a whole.

### Impacts and Value of Resources at Risk

It is difficult to estimate the cost of potential winter storm damages to structures and the economy in the town of Coulee Dam. Damage to roofs by heavy snow accumulations depends on the moisture content of the snow and the structural characteristics of the buildings. In general, snow in this region tends to have low moisture content because of the low temperatures and arid environment. Additionally, snow rarely accumulates for long periods of time due to regular wind events. Frozen water pipes are the most common damage to residential and business structures. Older homes tend to be at a higher risk to frozen water pipes than newer ones. Snow plowing in within the town limits is accomplished by the town's public works department. Private landowners are responsible for maintaining their own driveways or other private roads. Utility supplies are impacted during severe winter storms as power is lost on a regional basis. This has a two-fold impact on residents as not only is power cut to homes and businesses, but primary heating is lost for many residents. Gas furnaces and wood stoves supplement electrical heating, but with wood heating the senior population is at a disadvantage. Emergency response to severe winter storms includes site visits by police or fire department personnel, opening of shelters, or assistance with shopping, medical attention, and communications. The economic losses caused by severe winter storms may frequently be greater than structural damages. Employees may not be able to travel to work for several days and businesses may not open. Damages are seen in the form of structural repair and loss of economic activity. Okanogan County schools are occasionally closed during and right after a severe winter storm because of cold temperatures and snow covered roads.

Thunderstorms are not likely to be severe enough in the town of Coulee Dam to cause significant damages. However, the loss potential from flooding that results from severe thunderstorms could be significant.

Although the financial impacts of hail can be substantial and extended, accurately quantifying these impacts is problematic. Hail typically causes direct losses to structures and other personal property within the town of Coulee Dam. The most significant losses are most clearly seen in the agriculture sectors of the economy. Potential losses to agriculture can be disastrous. Crop damage from hail will also be different depending on the time of year and the type of crop. Most farmers carry insurance on their crops to help mitigate the potential financial loss resulting from a localized hail storm. Homeowners in the town of Coulee Dam rarely incur severe damage to structures (roofs); however, hail damage to vehicles is not uncommon. The damage to vehicles is difficult to estimate because the number of vehicles impacted by a specific ice storm is unknown. Additionally, most hail damage records are kept by various insurance agencies.

It is difficult to estimate potential losses in the town of Coulee Dam due to windstorms and tornadoes. Construction throughout the County has been implemented in the presence of high wind events, and

therefore, the community is at a higher level of preparedness to high wind events than many other areas experiencing lower average wind speeds.

We have estimated losses based on wind and tornado damage as follows:

- 3% of the buildings damaged causing 50% of value loss (loss could be from downed or damaged trees, damaged outbuildings, damaged fences/poles, damage to siding, damaged landscaping etc.)
- 5% of the buildings received damage to roof (requiring replacement of roof equaling $3,000)

Damages associated with sensitive receptor irritation have not been estimated. We have also not estimated the potential for a large scale wildfire event associated with high winds. Based on the data provided by the County, there are 508 total structures in the town of Coulee Dam with a total value of approximately $52.3 million. Using the criteria outlined above an estimate of the impact of high winds in the town of Coulee Dam has been made. The potential wind and tornado damage to all buildings is estimated at approximately $783,729. The estimated damage to roofs is approximately $76,200.

Power failure often accompanies severe storms. Prolonged failure, especially during cold winter temperatures can have disastrous effects. All communities should be prepared to deal with power failures. Community shelters equipped with alternative power sources will help local residents stay warm and prepare food. A community-based system for monitoring and assisting elderly or disabled residents should also be developed. All households should maintain survival kits that include warm blankets, flashlights, extra batteries, nonperishable food items, and clean drinking water.

### *Wildland Fire Profile*

The Town of Coulee Dam is located in the southeastern tip of Okanogan County and occurs within the Colville Reservation. The Columbia River forms the southern and western border of the Coulee Dam Neighborhood with Grand Coulee Dam occurring at the southwestern tip.

Fuels near Coulee Dam are fairly consistent. Much of this area is covered by low growing grasses and sagebrush with some scattered ponderosa pine in the draws. Fires occurring throughout this community would be expected to spread very rapidly, but burn with a moderate intensity through the flashy fuels. The riparian vegetation along the waterways may support a more intense fire later in the summer as the water levels go down and fuels become dry.

The primary access route through Coulee Dam is State Route 155, a paved, two-lane highway. The Columbia River Road is also a paved, two-lane highway traveling from Colville Agency west along the Columbia River. There are several secondary roads throughout the area accessing homes or recreational areas. These roads are typically regularly maintained, graveled routes. Secondary roads include Moses Road, Buffalo Lake Road, Rebecca Lake Road, Peter Dan Road

Residents in the community of Elmer City have access to the municipal water system. Homes outside of the city limits rely on personal well systems.

Two Bonneville Power Administration transmission lines are located within the Nespelem and Coulee Dam Communities. One of these lines ends at Colville Agency, while the other passes through the bottom half of the Coulee Dam Community.

Grand Coulee Dam on the Columbia River is located in the southwestern tip of the Coulee Dam Neighborhood. The Grand Coulee Dam, located on the Columbia River in central Washington, is the largest concrete structure in the United States. It forms the centerpiece of the Columbia Basin Project, a multipurpose endeavor managed by the U.S. Bureau of Reclamation. In addition to producing up to 6.5 million kilowatts of power, the dam irrigates over half a million acres of Columbia River basin farm land and provides abundant wildlife and recreation areas.

Okanogan County Fire Protection District #2 is responsible for structural and wildland fire protection within and immediately surrounding the Town of Coulee Dam. Many of the residents in the Coulee Dam community are currently without rural fire protection. This could lead to delayed response times as resources are called from out of the area to respond to a structural or wildland fire situation. The Bureau of Indian Affairs provides wildland fire protection on all lands within the Confederated Tribes of the Colville Reservation.

State lands are the sole responsibility of the Washington Department of Natural Resources (suppression & reciprocal agreements may apply). Federal lands are the sole responsibility of the Federal management agency (reciprocal agreement may apply). Much of the private lands in Okanogan County are within joint jurisdiction between the County fire protection districts and the WA DNR.

The DNR provides wildfire protection during the fire season between April and October with a varying degree of resources available in the early spring and late autumn months. The U.S. Forest Service seasonally responds to all wildland fires on their jurisdiction and may also respond to wildland fires on private lands based on a reciprocal agreement with the DNR.

### Probability of Future Occurrence

The potential impacts from a wildfire in Coulee Dam are very similar to the impacts described for Okanogan County as a whole. All fires pose a significant safety risk to residents and emergency service personnel. Individual structures, property, and livelihoods could be severely damaged or lost as a result of a fire; however, the community is not likely to suffer severe or long-term economic losses.

A fire in the shrublands surrounding the community may benefit the ecological environment as nutrients are recycled into the soil. Generally, grass and forbs are rejuvenated by a low intensity fire and grow back quickly; however, heavy rains immediately after a fire could cause erosion.

Smoke from a nearby wildland fire may impact sensitive populations within the community due to degraded air quality conditions. Smoke and/or flames will also impact transportation corridors connecting Coulee Dam to other communities; thus, travel and commerce may be interrupted.

### Impacts of Wildland Fire Events

The potential impacts from a wildfire in Coulee Dam are very similar to the impacts described for Okanogan County as a whole. All fires pose a significant safety risk to residents and emergency service personnel.

Individual structures, property, and livelihoods could be severely damaged or lost as a result of a fire; however, the community is not likely to suffer severe or long-term economic losses.

A fire in the grasslands surrounding the community may benefit the ecological environment as nutrients are recycled into the soil. Generally, grass and forbs are rejuvenated by a low intensity fire and grow back quickly; however, heavy rains immediately after a fire could cause erosion.

Smoke from a nearby wildland fire may impact sensitive populations within the community due to degraded air quality conditions. Smoke and/or flames will also impact transportation corridors connecting Coulee Dam to other communities; thus, travel and commerce may be interrupted.

### Value of Resources at Risk

It is difficult to estimate potential losses in Coulee Dam from wildland fire due to the unpredictability of wildfire behavior and the nature of ignition sources. It is unlikely that more than a few structures or other properties within the city limits of Coulee Dam would be lost or damaged by a wildland fire; however, residents in the immediate vicinity may be directly impacted. It is impossible to forecast the path a wildfire will take and what type of assets and resources, manmade and ecological, will be at risk. Thus, no value estimates were made for this hazard.

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# Chapter 6

## Mitigation Strategy

IN THIS SECTION:

- Mechanisms to Incorporate Mitigation Strategies
- Prioritization of Action Items
- Jurisdictional Mitigation Strategies
    - Okanogan County Annex
    - City of Omak Annex
    - City of Okanogan
    - City of Pateros Annex
    - City of Brewster Annex
    - City of Oroville Annex
    - City of Tonasket Annex
    - Town of Elmer City Annex
    - Town of Nespelem Annex
    - Town of Coulee Dam Annex
    - Town of Conconully Annex
    - Town of Riverside Annex
    - Town of Winthrop Annex
    - Town of Twisp

# Chapter 6 – Mitigation Strategy

## Administration and Implementation of Action Items

Critical to the implementation of this Multi - Hazard Mitigation Plan will be the identification of, and implementation of, an integrated schedule of action items targeted at achieving an elimination of lives lost and reduction in structures destroyed, infrastructure compromised, and unique ecosystems damaged that serve to sustain the way-of-life and economy in Okanogan County, Washington. Since there are many management agencies and thousands of private landowners in this area, it is reasonable to expect that differing schedules of adoption will be made and varying degrees of compliance will be observed across all ownerships.

All risk assessments were made based on the conditions existing during 2012, thus, the recommendations in this section have been made in light of those conditions. However, the components of risk and the preparedness of the Counties' resources are not static. It will be necessary to fine-tune this Plan's recommendations annually to adjust for changes in the components of risk, population density changes, infrastructure modifications, and other factors.

### *Mechanisms to Incorporate Mitigation Strategies*

Okanogan County and the incorporated cities/towns, encourage the philosophy of instilling disaster resistance in normal day-to-day operations. By implementing plan activities through existing programs and resources, the cost of mitigation is often a small portion of the overall cost of a project's design or program. Through their resolution of adoption as well as their participation on the planning committee, each jurisdiction is aware of, and committed to incorporating the risk assessments and mitigation strategies contained herein. It is anticipated that the research, local knowledge, and documentation of hazard conditions coalesced in this document will serve as a tool for decision-makers as new policies, plans, and projects are evaluated.

There are several planning processes and mechanisms in Okanogan County that will either use the risk assessment information presented in this document to inform decisions or will integrate the mitigation strategy directly into capital improvement, infrastructure enhancement, and training projects; prevention campaigns; and land use and development plans. Although not inclusive, the following is a list of mechanisms available to each jurisdiction for incorporating the mitigation requirements:

**Okanogan County Mechanisms**

1. Comprehensive Plan
2. Transportation Plan
3. Emergency Operations Plan
4. Building Codes and Ordinances
5. Departmental Budgets
6. Site Master Plans (wastewater treatment, landfill, etc.)

7. Personnel Training Programs

**Incorporated City Mechanisms**

1. Transportation Plans
2. City Budgets
3. Building Codes and Ordinances
4. Site Master Plans (airport, business incubators, etc.)

**Hospital District Mechanisms**

1. Emergency Operations Plan
2. Annual Budget
3. Board of Directors Bylaws (Operational Protocols)

**Agencies and other Organization Mechanisms**

1. Annual Budget
2. Prevention Programs
3. Training Programs
4. Long Term Land Use Plans (Forest Plans, Wildlife Management Area Plans, etc.)

The Okanogan County Emergency Manager is responsible for educating the Board of Commissioners and other County departments as well as city planners on the contents and incorporation requirements of the Multi-Hazard Mitigation Plan. The Emergency Manager and other planning committee partners should be aware of the risk assessments and mitigation strategies respective to their jurisdictions in order to include them in the planning processes and discussions for other types of projects as they come up. The Okanogan County Emergency Manager is responsible for ensuring that each participating jurisdiction as well as other partners receive a copy of the Multi-Hazard Mitigation Plan readily available for reference purposes. Furthermore, as previously mentioned, the Okanogan County Emergency Manager is responsible for annual and 5-year evaluations of the Multi-Hazard Mitigation Plan. The annual meetings will serve a dual purpose of updating the document and refreshing each jurisdiction's memory of the contents and mitigation requirements of Multi-Hazard Mitigation Plan. Members of the planning committee are also responsible of educating decision-makers in their own jurisdictions on the use and incorporation of mitigation requirements of this document into other planning mechanisms such as those listed above.

## *Prioritization of Action Items*

The prioritization process includes a special emphasis on benefit-cost analysis review. The process reflects that a key component in funding decision is a determination that the project will provide an equivalent or more in benefits over the life of the project when compared with the costs. Projects will be administered by local jurisdictions with overall coordination provided by the Okanogan County Emergency Manager.

County Commissioners and the elected officials of all jurisdictions have evaluated opportunities and established their own unique priorities to accomplish mitigation activities where existing funds and resources are available and there is community interest in implementing mitigation measures. If no federal funding is used in these situations, the prioritization process may be less formal. Often the types of

projects a county can afford to do on their own are in relation to improved codes and standards, department planning and preparedness, and education. These types of projects may not meet the traditional project model, selection criteria, and benefit-cost model. Okanogan County will use this Multi-Hazard Mitigation Plan as guidance when considering pre-disaster mitigation proposals brought before the Board of Commissioners by department heads, city officials, fire districts, and local civic groups.

When federal or state funding is available for hazard mitigation, there are usually requirements that establish a rigorous benefit-cost analysis as a guiding criterion in establishing project priorities. Okanogan County understands the basic federal grant program criteria which will drive the identification, selection, and funding of the most competitive and worthy mitigation projects. FEMA's three grant programs (the Hazard Mitigation Grant Program, the Flood Mitigation Assistance, and Pre-Disaster Mitigation program) that offer federal mitigation funding to state and local governments all include the benefit-cost and repetitive loss selection criteria.

The prioritization of new projects and deletion of completed projects will occur annually and be facilitated by the Okanogan County Emergency Manager and the joint planning committee. All mitigation activities, recommendations, and action items mentioned in this document are dependent on available funding and staffing.

## *Prioritization Scheme*

All of the action items and project recommendations made in this Plan were prioritized by each respective jurisdiction in coordination with their governing body. Each jurisdiction's representative on the planning committee met with their governing bodies and prioritized their own list of projects and mitigation measures through a group discussion and voting process. Although completed individually, each jurisdiction's mitigation strategy was discussed and analyzed on the merits described in the STAPLEE process including the social, technical, administrative, political, legal, economical, and environmental factors associated with each recommended action item. Projects were ranked on a "High", "Moderate", or "Low" scale with emphasis on project feasibility and the benefit/cost correlation.

Many of the action items and project recommendations listed below are designed to mitigate the potential effects that wildland fires could have on any of Okanogan County's communities. A flux of people are moving into more rural parts of the county which places more stress on Okanogan County to protect these citizens and their property. Wildland fires are becoming a growing concern nationally as well, and efforts are underway to educate citizens and reduce fuels on federal, state, local, and private ownerships. The total acreage that is burned throughout the nation annually appears to be increasing every decade, as well as the cost to contain these fires. Therefore there are numerous state and federal programs to assist landowners with mitigating that risk.

# Jurisdictional Mitigation Strategies

## *Okanogan County*

| Table 6.1. Okanogan County Mitigation Strategies. | | | | | | |
|---|---|---|---|---|---|---|
| **Hazard** | **Action Item** | **Goals Addressed** *refer to goals on pg. 7 | **Responsible Departments or Organizations** | **2012 Status** | **Potential Resources** | **Projected Completion Year** |
| **General** | 6.1.a. Continue to develop and implement public education programs. | Goal # 2,3,5<br>Priority Ranking: High | County DEM and Okanogan Conservation District | On-going | Numerous Community Preparedness Events have been conducted. Annual flood, fire, and hazardous materials workshop are presented. Preparedness information is presented at the County Fair, local organization and rural community meetings. Preparedness information sent out in PUD billings. New members were added to the Community Emergency Response Team (CERT) – with plans to provide CERT training to interested Search and Rescue personnel. The County DEM website contains preparedness information and is updated monthly. | On-going |

| Table 6.1. Okanogan County Mitigation Strategies. | | | | | | |
|---|---|---|---|---|---|---|
| **Hazard** | **Action Item** | **Goals Addressed** *refer to goals on pg. 7 | **Responsible Departments or Organizations** | **2012 Status** | **Potential Resources** | **Projected Completion Year** |
| **Flood,** | 6.1.b. Participation in National Flood Insurance Program. | Goal # 2,3,5,6,7,8<br>Priority Ranking: High | Okanogan County Commissioners | On-going | City Officials | On-going |
| **Flood** | 6.1.c. Encourage residents to participate in the National Flood Insurance Program. | Goal # 2,3,8<br>Priority Ranking: High | County Planning Department | On-going | County & City Officials | On-going |
| **Flood** | 6.1.d. Work with FEMA to update the Okanogan County Flood Insurance Rate Maps. | Goal #2,3,5,6,7,8<br>Priority Ranking: High | County Planning Department | On-going | County & City Officials | On-going |
| **Flood** | 6.1.e. Obtain resources to provide National Flood Insurance Program training to County staff and elected officials. | Goal # 2,3,5,8<br>Priority Ranking: High | County Commissioners | Deleted Action Item Due to Insufficient Funding/Manpower | | N/A |
| **Flood** | 6.1.f. Obtain resources and materials to develop a National Flood Insurance Program outreach program for local residents. | Goal # 2,3,8<br>Priority Ranking: High | County Commissioners | Deleted Action Item Due to Insufficient Funding/Manpower | | N/A |

| Table 6.1. Okanogan County Mitigation Strategies. | | | | | | |
|---|---|---|---|---|---|---|
| **Hazard** | **Action Item** | **Goals Addressed** *refer to goals on pg. 7 | **Responsible Departments or Organizations** | **2012 Status** | **Potential Resources** | **Projected Completion Year** |
| **General** | 6.1.g. Rural signage (road signs and house numbers) improvements across the County. | Goal # 2,3,5,6,7<br>Priority Ranking: Moderate | Okanogan County Planning Department & Fire Districts | On-going | Okanogan County DEM, Fire Districts | On-going |
| **Landslide, Flood, Wildfire, Earthquake, Severe Weather** | 6.1.h. Complete risk assessments for additional hazards identified in Phase I Profile. | Goal # 1,2,4,5,6,7<br>Priority Ranking: High | Okanogan County DEM | New Item | Okanogan County Commissioners, City Officials | 2018 |
| **General** | 6.1.i. Incorporate the Okanogan County All Hazard Mitigation Plan into the Okanogan County Comprehensive Plan, where applicable. | Goal # 1,2,5<br>Priority Ranking: High | Okanogan County Planning and County Commissioners | Deleted Item Due to Insufficient Funding/Manpower | | N/A |
| **Wildfire** | 6.1.j. Adopt International Fire Code to help alleviate emergency access issues in new construction. | Goal # 2,3,5,6,7<br>Priority Ranking: High | Okanogan County Commissioners | Deleted Item Due to Insufficient Funding/Manpower | Okanogan County Planning Department, Fire Departments | N/A |

| Table 6.1. Okanogan County Mitigation Strategies. | | | | | | |
|---|---|---|---|---|---|---|
| **Hazard** | **Action Item** | **Goals Addressed** *refer to goals on pg. 7 | **Responsible Departments or Organizations** | **2012 Status** | **Potential Resources** | **Projected Completion Year** |
| **General** | 6.1.k. Incorporate this All Hazard Mitigation Plan as an element of the Okanogan County Public Health District's Facilities Master Plan. | Goal # 1,2,5<br>Priority Ranking: High | Okanogan County Planning Department | Deleted Action Item Due to Insufficient Funding/Manpower | | N/A |
| **Flood** | 6.1.l. Develop reach-based mitigation plans for residences already in the floodplain and channel migration zones. | Goal # 2,3,5,6,7<br>Priority Ranking: Moderate | Okanogan County Commissioners | Deleted Action Item Due to Insufficient Funding/Manpower | | N/A |
| **Flood** | 6.1.m. Develop channel migration studies for all rivers in Okanogan County. | Goal # 2,5,6,7<br>Priority Ranking: Moderate | Okanogan County Commissioners | Deleted Action Item Due to Insufficient Funding/Manpower | | N/A |
| **Flood** | 6.1.n. Develop a Countywide policy supporting recommendations derived from channel migration studies. | Goal # 1,2,5,6,7<br>Priority Ranking: High | Okanogan County Commissioners | Deleted Action Item Due to Insufficient Funding/Manpower | | N/A |
| **General** | 6.1.o. Incorporate this All Hazard Mitigation Plan into the Public Utility District's Emergency and Operating Plans. | Goal # 1,2,5<br>Priority Ranking: High | Okanogan County Public Utilities District | Completed | Okanogan County DEM | N/A |

| Table 6.1. Okanogan County Mitigation Strategies. | | | | | | |
|---|---|---|---|---|---|---|
| **Hazard** | **Action Item** | **Goals Addressed** *refer to goals on pg. 7 | **Responsible Departments or Organizations** | **2012 Status** | **Potential Resources** | **Projected Completion Year** |
| **Flood** | 6.1.p. Update flood hazard chapter following the adoption of new FEMA Flood Insurance Rate Maps. | Goal # 1,2,4,5,6,7<br>Priority Ranking: High | Okanogan County Planning Department | On-going | County Commissioners | On-going |
| **General** | 6.1.q. Assess and hardwire necessary government buildings, emergency facilities, and community shelters for use with a portable generator. | Goal # 1,2,5,6<br>Priority Ranking: Moderate | Okanogan County DEM | On-going | Okanogan County Commissioners, City Officials | On-going |
| **Earthquake** | 6.1.r. Inspect buildings, particularly un-reinforced masonry, for hazard stability. | Goal # 2,5,6<br>Priority Ranking: Moderate | Okanogan County Building Department | On-going | | On-going |
| **Severe Weather** | 6.1.s. Inspect schools and other public buildings for snow-load resistance and retrofit as necessary. | Goal # 2,5,6<br>Priority Ranking: High | Okanogan County Building Department | Deleted Action Item Due to Insufficient Funding/Manpower | | N/A |
| **Flood** | 6.1.t. Review all road profiles which are within flood zones to determine degree of road profile rise needed to elevate it above the flood zone. | Goal # 2,5,6<br>Priority Ranking: High | Okanogan County Public Works | Deleted Action Item Due to Insufficient Funding/Manpower | | N/A |

| Table 6.1. Okanogan County Mitigation Strategies. | | | | | | |
|---|---|---|---|---|---|---|
| **Hazard** | **Action Item** | **Goals Addressed** *refer to goals on pg. 7 | **Responsible Departments or Organizations** | **2012 Status** | **Potential Resources** | **Projected Completion Year** |
| **Flood** | 6.1.u. Prepare and maintain a prioritized list of existing undersized culverts that are in need of replacing. | Goal # 2,5,6<br>Priority Ranking: Moderate | Okanogan County Public Works | On-going | City Public Works Departments | 2019 |
| **General** | 6.1.v. Obtain FEMA "Emergency Evacuation Route" signs to be posted on primary and secondary access routes during an emergency. | Goal # 2,3,5,6<br>Priority Ranking: Moderate | Okanogan County DEM | Deleted Action Item Due to Insufficient Funding/Manpower | | N/A |
| **Flood, Landslide** | 6.1.w. Develop a Countywide prioritized list of watersheds that require stream bank and channel stabilization and/or restoration. | Goal # 2,5,7<br>Priority Ranking: Moderate | Okanogan Conservation District, Okanogan County Natural Resource Planning Department | Deleted Action Item Due to Insufficient Funding/Manpower | | N/A |
| **Severe Weather, Wildfire** | 6.1.x. Continue the vegetation management program that includes, but is not limited to thinning and clearing brush and other vegetation from under and adjacent to transmission and distribution lines. | Goal # 2,5,7<br>Priority Ranking: High | Okanogan County Public Utilities District | On-going | Bonneville Power Administration | On-going |

| Table 6.1. Okanogan County Mitigation Strategies. | | | | | | |
|---|---|---|---|---|---|---|
| **Hazard** | **Action Item** | **Goals Addressed** *refer to goals on pg. 7 | **Responsible Departments or Organizations** | **2012 Status** | **Potential Resources** | **Projected Completion Year** |
| **General** | 6.1.y. Improve primary and secondary emergency routes to address access issues including response, evacuation, and linkages outside the County. | Goal # 2,5,6<br>Priority Ranking: High | Okanogan County Public Works | On-going | Okanogan County GIS, Okanogan County DEM, Okanogan County Sheriff's Office | On-going |
| **General** | 6.1.z. Obtain portable generators for use during power outages and other emergency situations. | Goal # 2,5,6<br>Priority Ranking: Moderate | Okanogan County DEM | Partially Completed: Obtained generator to support the County Emergency Operations Center. Still need generators for other areas of concern | Okanogan County Sheriff's Office | On-going |

| Table 6.1. Okanogan County Mitigation Strategies. | | | | | | |
|---|---|---|---|---|---|---|
| **Hazard** | **Action Item** | **Goals Addressed** *refer to goals on pg. 7 | **Responsible Departments or Organizations** | **2012 Status** | **Potential Resources** | **Projected Completion Year** |
| **General** | 6.1.aa. Enhance radio availability in the County, link into existing dispatch, improve range within the region, and conversion to consistent standard of radio types or obtain necessary components to link between existing radio types. | Goal # 2,5,6<br>Priority Ranking: High | Okanogan County Sheriff's Office | Partially Completed:<br>Installed a repeater in the northern portion of the county – allows fire departments to use fire tactical response frequencies and not mobile-to-mobile.<br>Enhanced delivery of information to the first responders – delivers detailed description of the event to cell phone or email.<br>Preparing and installing pre-identified response plans into the dispatch communications system –allows dispatchers to dispatch specific sets of responders to specific incidents or locations – 2nd half 2013.<br>Completed narrow-banding for the entire county. | Okanogan County DEM, BLM, USFS, WA DNR | On-going |

# *City of Omak*

**Table 6.2. City of Omak Mitigation Strategies.**

| Hazard | Action Item | Goals Addressed *refer to goals on pg. 7 | Responsible Departments or Organizations | 2012 Status | Potential Resources | Projected Completion Year |
|---|---|---|---|---|---|---|
| **General** | 6.2.a. Increase public awareness of the risks associated with hazards/disasters and emergency preparedness. | Goal # 1,2,3<br>Priority Ranking: High | Mayor, City Council, City Department, & First Responders | New Project | On Going | General |
| **General** | 6.2.b. Conduct community-wide multi-hazard risk assessment and prioritize hazards for planning and mitigation projects. | Goal # 1,2,3,4<br>Priority Ranking: High | Mayor, City Council, City Department, & First Responders | New Project | 2016 | General |
| **General** | 6.2.c. Replace Central Street Bridge crossing Okanogan River to standards that meeting the weight rating for emergency response vehicles. | Goal # 1,2,5<br>Priority Ranking: Moderate | Mayor & City Council | New Project | 2019 | General |
| **Flood** | 6.2.d. Encourage homeowners in flood prone areas to participation in the National Flood Insurance Program | Goal # 1,3,5,8<br>Priority Ranking: Moderate | Mayor & City Council | New Project | On Going | Flood |

| Table 6.2. City of Omak Mitigation Strategies. | | | | | | |
|---|---|---|---|---|---|---|
| **Hazard** | **Action Item** | **Goals Addressed** *refer to goals on pg. 7 | **Responsible Departments or Organizations** | **2012 Status** | **Potential Resources** | **Projected Completion Year** |
| **Wildland Fire** | 6.2.e. Continue to work on actions items and proposed projects in the OC CWPP | Goal # 1,2,3,4,5,6,7,8<br>Priority Ranking: Moderate | Mayor, City Council and First Responders | New Project | On Going | Wildland Fire |

In the 2009 Okanogan County All Hazard Mitigation Plan, action items specific to the cities and/or special districts were not separated from the overall OC mitigation strategy; therefore, most of the projects listed for the City of Omak are new. However, the city has been actively working on hazard mitigation measures. The following is a list of completed projects since 2009.

Completed Actions:

1. Currently in the process of upgrading the city's sewer systems – replacing old outdate lines 4 miles.
2. Participated in school bus accident drill.
3. As land/property areas are annexed install fire hydrants.
4. Purchased/store ecology block for flood mitigation on the Okanogan River.

**Table 6.3. City of Pateros Mitigation Strategies.**

| Hazard | Action Item | Goals Addressed *refer to goals on pg. 7 | Responsible Departments or Organizations | 2012 Status | Potential Resources | Projected Completion Year |
|---|---|---|---|---|---|---|
| **General** | 6.3.a. Educate residents about the potential risks of hazards and appropriate preparedness. | Goal # 1,2,3<br>Priority Ranking: High | Mayor, City Council & First Responders | New Project | On Going | Mayor, City Council & First Responders |
| **General** | 6.3.b. Conduct community-wide multi-hazard risk assessment and prioritize hazards for planning and mitigation projects. | Goal # 1,2,3,4<br>Priority Ranking: High | Mayor, City Council, City Department, & First Responders | New Project | 2016 | Mayor, City Council, City Department, & First Responders |
| **Severe Weather** | 6.3.c. Purchase and install generator City Hall and domestic drinking water system. | Goal # 1,2,5<br>Priority Ranking: Moderate | Mayor, City Council, & Public Works | New Project | 2019 | Mayor, City Council, & Public Works |
| **Flood** | 6.3.d. Encourage homeowners in flood prone areas to participation in the National Flood Insurance Program. | Goal #1,3,5,8<br>Priority Ranking: Moderate | Mayor & City Council | New Project | On Going | Mayor & City Council |

| Table 6.3. City of Pateros Mitigation Strategies. | | | | | | |
|---|---|---|---|---|---|---|
| **Hazard** | **Action Item** | **Goals Addressed** *refer to goals on pg. 7 | **Responsible Departments or Organizations** | **2012 Status** | **Potential Resources** | **Projected Completion Year** |
| **Wildfire** | 6.3.e. Continue to work on actions items and proposed projects in the OC CWPP. | Goal # 1,2,3,4,5,6,7,8<br>Priority Ranking: Moderate | Mayor, City Council & First Responder | New Project | On Going | Mayor, City Council & First Responder |

In the 2009 Okanogan County All Hazard Mitigation Plan, action items specific to the cities and/or special districts were not separated from the overall OC mitigation strategy; therefore, most of the projects listed for City of Pateros are new. However, the town has been actively working on hazard mitigation measures.

Action Items Completed:

1. Installed back-up generators on infrastructure for water and waste systems.
2. Determined for sufficient power would be available at the Water Treatment plant to back up for City Hall.
3. Exceeds requirements for fire hydrants.
4. Participating in a grant from the Energy Department to become more energy efficient.

## *City of Brewster*

**Table 6.4. City of Brewster Mitigation Strategies.**

| Hazard | Action Item | Goals Addressed *refer to goals on pg. 7 | Responsible Departments or Organizations | 2012 Status | Potential Resources | Projected Completion Year |
|---|---|---|---|---|---|---|
| **General** | 6.4.a. Educate residents about the potential risks of hazards and appropriate preparedness. | Goal # 1,2,3<br>Priority Ranking: High | Mayor, City Council & First Responders | New Project | On Going | Mayor, City Council & First Responders |
| **General** | 6.4.b. Conduct community-wide multi-hazard risk assessment and prioritize hazards for planning and mitigation projects. | Goal # 1,2,3,4<br>Priority Ranking: High | Mayor, City Council, City Department, & First Responders | New Project | 2016 | Mayor, City Council, City Department, & First Responders |
| **Flood** | 6.4.c. Encourage homeowners in flood prone areas to participation in the National Flood Insurance Program. | Goal # 1,3,5,8<br>Priority Ranking: Moderate | Mayor & City Council | New Project | On Going | Mayor & City Council |
| **Wildfire** | 6.4.d. Continue to work on actions items and proposed projects in the OC CWPP. | Goal #1,2,3,4,5,6,7,8<br>Priority Ranking: Moderate | Mayor, City Council, & First Responders | New Project | On Going | Mayor, City Council, & First Responders |

In the 2009 Okanogan County All Hazard Mitigation Plan, action items specific to the cities and/or special districts were not separated from the overall OC mitigation strategy; therefore, most of the projects listed for City of Brewster are new. However, the town has been actively working on hazard mitigation measures. The following is a list of completed project since 2009.

1. Purchased and installed back-up generator on water and sewer system.
2. Added 6 additional fire hydrants.

**Table 6.5. City of Oroville Mitigation Strategies.**

| Hazard | Action Item | Goals Addressed *refer to goals on pg. 7 | Responsible Departments or Organizations | 2012 Status | Potential Resources | Projected Completion Year |
|---|---|---|---|---|---|---|
| **General** | 6.5.a. Install back-up generators in sewer pump stations, for wastewater plant, and water wells and pump stations. | Goal # 1,2,5<br>Priority Ranking: Moderate | Mayor and Council, PW Superintendent), Community Development Council Director (CDD) | New Project | 10 years for all, or on-going | Mayor and Council, PW Superintendent), Community Development Council Director (CDD) |
| **General** | 6.5.b. Analyze community-wide-multi-hazard risk assessments and prioritize hazards for planning and mitigation projects. | Goal # 1,2,3<br>Priority Ranking: High | Mayor, City Council , CDD, & First Responders | New Project | 2016 | Mayor, City Council , CDD, & First Responders |
| **General** | 6.5.c. Educate residents about the potential risks of hazards and appropriate preparedness. | Goal # 1,2,3<br>Priority Ranking: High | Mayor, City Council CDD & Fire Department | New Project | On Going | Mayor, City Council CDD & Fire Department |
| **General** | 6.5.d. Identify and implement increased security measures for the city hall, CDO, Police Department and the fire station in order to reduce asset accessibility. | Goal # 1,2,4,5,6,7<br>Priority Ranking: Moderate | Mayor, City Council, CDD, LE, & OCDEM | New Project | 5 years | Mayor, City Council, CDD, LE, & OCDEM |

| Table 6.5. City of Oroville Mitigation Strategies. | | | | | | |
|---|---|---|---|---|---|---|
| **Hazard** | **Action Item** | **Goals Addressed** *refer to goals on pg. 7 | **Responsible Departments or Organizations** | **2012 Status** | **Potential Resources** | **Projected Completion Year** |
| **Earthquake** | 6.5.e. Review and update Earthquake Hazard section of Critical Areas Ordinance. | Goal # 1,5,6<br>Priority Ranking: Moderate | CDD | New Project | On-going | CDD |
| **Severe Weather** | 6.5.f. Encourage schools and other public facilities to inspection building for snow load resistance. | Goal # 1,2,5<br>Priority Ranking: Moderate | Building Official, Schools and Building Departments | New Project | On Going | Building Official, Schools and Building Departments |
| **Flood** | 6.5.g. Complete the list of dike improvements/maintenance issues identified by the ACE. | Goal # 1,2,5<br>Priority Ranking: Moderate | Mayor, City Council, Public Works Superintendent | New Project | 2017 | Mayor, City Council, Public Works Superintendent |
| **Flood** | 6.5.h. Encourage homeowners in flood prone areas to participation in the National Flood Insurance Program. | Goal # 1,3,5,8<br>Priority Ranking: Moderate | CDD | New Project | On Going | CDD |

| Table 6.5. City of Oroville Mitigation Strategies. | | | | | | |
|---|---|---|---|---|---|---|
| **Hazard** | **Action Item** | **Goals Addressed** *refer to goals on pg. 7 | **Responsible Departments or Organizations** | **2012 Status** | **Potential Resources** | **Projected Completion Year** |
| **Wildfire** | 6.5.i. Continue to work on actions items and proposed projects in the OC CWPP. | Goal # 1,2,3,4,5,6,7,8<br>Priority Ranking: Moderate | OC DEM; First Responder Organizations & Various Agencies | New Project | On Going | OC DEM; First Responder Organizations & Various Agencies |
| **Wildfire (Interface)** | 6.5.j. Invoke fire flow standards within unincorporated water service area for new development. | Goal # 1,2,5<br>Priority Ranking: Moderate | Mayor and Council, Clerk/Treasurer, PWS, CDD | New Project | On-going | Mayor and Council, Clerk/Treasurer, PWS, CDD |

In the 2009 Okanogan County All Hazard Mitigation Plan, action items specific to the cities and/or special districts were not separated from the overall OC mitigation strategy; therefore, most of the projects listed for City of Oroville new. However, the town has been actively working on hazard mitigation measures. The following is a list of completed projects since 2009.

1. Developed and Adopted Critical Areas Ordinance which includes prohibition of new subdivisions in the 100-year floodplain unless new lots include at least 5000 s.f. outside the 100-year flood boundary.
2. Negotiated new water reservoir at new Border Patrol facility, construction begins August, 2013.
3. On-going updates, and continued enforcement, of Flood Damage Prevention Ordinance.

## *City of Tonasket*

**Table 6.6. City of Tonasket Mitigation Strategies.**

| Hazard | Action Item | Goals Addressed *refer to goals on pg. 7 | Responsible Departments or Organizations | 2012 Status | Potential Resources | Projected Completion Year |
|---|---|---|---|---|---|---|
| **General** | 6.6.a. Educate residents about the potential risks of hazards and appropriate preparedness. | Goal # 1,2,3<br>Priority Ranking: High | Mayor, City Council, City Department, First Responders | New Project | USFS, WA DNR, Okanogan Conservation District | On-going |
| **General** | 6.6.b. Conduct community-wide multi-hazard risk assessment and prioritize hazards for planning and mitigation projects. | Goal # 1,2,3,4<br>Priority Ranking: High | Mayor, City Council, City Department, & First Responders | New Project | Okanogan County Emergency Management, Conservation District, WA DNR, USFS | 2016 |
| **Flood** | 6.6.c. Encourage homeowners in flood prone areas to participation in the National Flood Insurance Program. | Goal # 1,3,5,8<br>Priority Ranking: High | Mayor & City Council | New Project | Okanogan County Emergency Management | On-going |
| **Wildfire** | 6.6.d. Continue to work on action items and proposed projects in the OC CWPP. | Goal #1,2,3,4,5,6,7,8<br>Priority Ranking: High | Okanogan County Emergency Management, First Responder Organization and various agencies. | New Project | CWPP Steering Committee | On-going |

In the 2009 Okanogan County All Hazard Mitigation Plan, action items specific to the cities and/or special districts were not separated from the overall OC mitigation strategy; therefore, most of the projects listed for the City of Tonasket are new. However, the city has been actively working on hazard mitigation measures.

## *Town of Elmer City*

**Table 6.7. Town of Elmer City Mitigation Strategies.**

| Hazard | Action Item | Goals Addressed *refer to goals on pg. 7 | Responsible Departments or Organizations | 2012 Status | Potential Resources | Projected Completion Year |
|---|---|---|---|---|---|---|
| **General** | 6.7.a. Educate citizens on how to minimize hazards on their property. | Goal # 1,2,3<br>Priority Ranking: High | Mayor, City Council, City Department, First Responders | New Project | USFS, WA DNR, Okanogan Conservation District, Okanogan County Emergency Management | On-going |
| **General** | 6.7.b. Conduct community-wide multi-hazard risk assessment and prioritize hazards for planning and mitigation projects. | Goal # 1,2,3,4<br>Priority Ranking: High | Mayor, City Council, City Department, & First Responders | New Project | Okanogan County Emergency Management | 2016 |
| **Wildfire** | 6.7.c. Continue to work on actions items and proposed projects in the OC CWPP. | Goal # 1,2,3,4,5,6,7,8<br>Priority Ranking: Moderate | Mayor, City Council, & First Responders | New Project | CWPP Steering Committee | On-going |

In the 2009 Okanogan County All Hazard Mitigation Plan, action items specific to the town were not separated from the overall OC mitigation strategy; therefore, most of the projects listed for the Town of Elmer City are new. However, the town has been actively working on hazard mitigation measures and their preparedness was tested in 2012 when two large fires swept through the area. With great luck no homes were loss but the area did experience an extended power outage.

## *Town of Nespelem*

**Table 6.8. Town of Nespelem Mitigation Strategies.**

| Hazard | Action Item | Goals Addressed *refer to goals on pg. 7 | Responsible Departments or Organizations | 2012 Status | Potential Resources | Projected Completion Year |
|---|---|---|---|---|---|---|
| **General** | 6.8.a. Educate citizens on how to minimize hazards on their property. | Goal # 1,2,3<br>Priority Ranking: High | Mayor, City Council, City Department, First Responders | New Project | USFS, WA DNR, Okanogan Conservation District, Okanogan County Emergency Management | On-going |
| **General** | 6.8.b. Conduct community-wide multi-hazard risk assessment and prioritize hazards for planning and mitigation projects. | Goal # 1,2,3,4<br>Priority Ranking: High | Mayor, City Council, City Department, & First Responders | New Project | Okanogan County Emergency Management | 2016 |
| **Wildfire** | 6.8.c. Continue to work on actions items and proposed projects in the OC CWPP. | Goal # 1,2,34,5,6,7,8<br>Priority Ranking: Moderate | Mayor, City Council, and First Responders | New Project | CWPP Steering Committee | On-going |

In the 2009 Okanogan County All Hazard Mitigation Plan, action items specific to the cities and/or special districts were not separated from the overall OC mitigation strategy; therefore, most of the projects listed for the Town of Nespelem are new. However, the town has been actively working on hazard mitigation measures and their preparedness was tested in 2012 when two large fires swept through the area. With great luck no homes were lost but the area did experience an extended power outage.

## *Town of Coulee Dam*

**Table 6.9. Town of Coulee Dam Mitigation Strategies.**

| Hazard | Action Item | Goals Addressed *refer to goals on pg. 7 | Responsible Departments or Organizations | 2012 Status | Potential Resources | Projected Completion Year |
|---|---|---|---|---|---|---|
| **General** | 6.8.a. Increase public education and work closely with and support all county and community partners to prepare for and recover from disasters. | Goal # 1,2,3<br>Priority Ranking: High | Mayor, City Council, City Department, First Responders | New Project | USFS, WA DNR, Okanogan Conservation District, Okanogan County Emergency Management | On-going |
| **General** | 6.8.b. Conduct community-wide multi-hazard risk assessment and prioritize hazards for planning and mitigation projects. | Goal # 1,2,3,4<br>Priority Ranking: High | Mayor, City Council, City Department, & First Responders | New Project | Okanogan County Emergency Management | 2016 |
| **Wildfire** | 6.8.c. Continue to work on actions items and proposed projects in the OC CWPP. | Goal # 1,2,34,5,6,7,8<br>Priority Ranking: Moderate | Mayor, City Council, and First Responders | New Project | CWPP Steering Committee | On-going |

In the 2009 Okanogan County All Hazard Mitigation Plan, action items specific to the cities and/or special districts were not separated from the overall OC mitigation strategy; therefore, most of the projects listed for the Town of Coulee Dam are new. However, the town has been actively working on hazard mitigation measures and their preparedness was tested in 2012 when two large fires swept through the area. With great luck no homes were lost but the area did experience an extended power outage.

## *Town of Conconully*

**Table 6.10. Town of Conconully Mitigation Strategies.**

| Hazard | Action Item | Goals Addressed *refer to goals on pg. 7 | Responsible Departments or Organizations | 2012 Status | Potential Resources | Projected Completion Year |
|---|---|---|---|---|---|---|
| **General** | 6.10.a. Educate residents about the potential risks of hazards and appropriate preparedness. | Goal # 1,2,3<br>Priority Ranking: High | Mayor, City Council & First Responders | New Project | USFS, WA DNR, Okanogan Conservation District, Okanogan County Emergency Management | On Going |
| **General** | 6.10.b. Develop a Conconully Emergency Plan. (The plan will be a community prepared plan that addresses specific hazards of the area, expected response actions, and identifies available resources). | Goal # 1,2,3,5<br>Priority Ranking: High | Mayor, First Responders, City Departments, OCDM, & Citizens | New Project | Okanogan County Emergency Management | 2015 |
| **Flood** | 6.10.c. Continue to work with the county, Bureau of Reclamation to expand procedures for dam failure for both the Conconully Dam and the Salmon Lake Dam. | Goal # 1,2,5<br>Priority Ranking: Moderate | Mayor, City Council, County, and Bureau of Reclamation | New Project | Okanogan County Emergency Management | On Going |
| **Flood** | 6.10.d. Encourage homeowners in flood prone areas to participation in the National Flood Insurance Program. | Goal #1,3,5,8<br>Priority Ranking: Moderate | Mayor & City Council | New Project | Okanogan County Emergency Management | On Going |

| Table 6.10. Town of Conconully Mitigation Strategies. | | | | | | |
|---|---|---|---|---|---|---|
| **Hazard** | **Action Item** | **Goals Addressed** *refer to goals on pg. 7 | **Responsible Departments or Organizations** | **2012 Status** | **Potential Resources** | **Projected Completion Year** |
| **Wildfire** | 6.10.e. Continue to work on actions items and proposed projects in the OC CWPP. | Goal # 1,2,3,4,5,6,7,8<br>Priority Ranking: Moderate | Mayor, City Council, and First Responders | New | CWPP Steering Committee | On Going |

In the 2009 Okanogan County All Hazard Mitigation Plan, action items specific to the cities and/or special districts were not separated from the overall OC mitigation strategy; therefore, most of the projects listed for Town of Conconully are new. However, the town has been actively working on hazard mitigation measures. The following is a list of completed projects since 2009.

Completed Actions:

1. With the assistance of the Army Corps of Engineers numerous large tree were removed from Salmon Creek, that flows through town, and a levee (of sorts) was constructed at the lower inlet of North Fork Salmon Creek to control the flow of the creek and to prevent the wash out of bridges.
2. Completed a project to enclosed (piping) and added better control to the irrigation ditch that flows into the Conconully Dam (reservoir).

## *Town of Riverside*

**Table 6.11. Town of Riverside Mitigation Strategies.**

| Hazard | Action Item | Goals Addressed*refer to goals on pg. 7 | Responsible Departments or Organizations | 2012 Status | Potential Resources | Projected Completion Year |
|---|---|---|---|---|---|---|
| **General** | 6.11.a. Analyze community-wide-multi-hazard risk assessments and prioritize hazards for planning and mitigation projects. | Goal # 1,2,3<br>Priority Ranking: High | Mayor, City Council & DEM | New Project | Okanogan County Emergency Management | 1 year |
| **General** | 6.11.b. Educate residents about the potential risks of hazards and appropriate preparedness. | Goal # 1,2,3<br>Priority Ranking: Moderate | Mayor, City Council & Fire Departments | New Project | Okanogan County Emergency Management | On-going |
| **Flood** | 6.11.c. Encourage homeowners in flood prone areas to participation in the National Flood Insurance Program. | Goal # 1,3,5,8<br>Priority Ranking: Moderate | Mayor & City Council | New Project | Okanogan County Emergency Management | On-going |
| **Wildfire** | 6.11.d. Continue to work on actions items and proposed projects in the OC CWPP | Goal #1,2,3,4,5,6,7,8<br>Priority Ranking: Moderate | Mayor, City Council & First Responders | New Project | CWPP Steering Committee | On-going |

In the 2009 Okanogan County All Hazard Mitigation Plan, action items specific to the cities and/or special districts were not separated from the overall OC mitigation strategy; therefore, most of the projects listed for Town of Riverside are new. However, the town has been actively working on hazard mitigation measures. The following is a list of completed projects since 2009.

1. Obtained and installed back-up generators for two wells.
2. Currently upgrading the sewer system.
3. Upgrading the water system to include meters and telemetry.

## *Town of Winthrop*

**Table 6.12. Town of Winthrop Mitigation Strategies.**

| Hazard | Action Item | Goals Addressed *refer to goals on pg. 7 | Responsible Departments or Organizations | 2012 Status | Potential Resources | Projected Completion Year |
|---|---|---|---|---|---|---|
| **General** | 6.12.a. Educate residents about the potential risks of hazards and appropriate preparedness. | Goal # 1,2,3<br>Priority Ranking: High | Mayor, City Council & First Responders | New Project | Okanogan County Emergency Management | On Going |
| **Flood** | 6.12.b. Continue to update and improve the MV Emergency Plan. (The MVEP is a community prepared plan that addresses specific hazards of the area, expected response actions, and identifies available resources). | Goal # 1,2,3,5<br>Priority Ranking: Moderate | Mayor, First Responders, & Citizens | New Project | Okanogan County Emergency Management | On Going |
| **Flood** | 6.12.c. Purchase and install a generator for water pump station. | Goal # 1,2<br>Priority Ranking: High | Mayor, City Council, and Public Works | New Project | Okanogan County Emergency Management | 2019 |
| **Flood** | 6.12.d. Encourage homeowners in flood prone areas to participation in the National Flood Insurance Program. | Goal #1,3,5,8<br>Priority Ranking: Moderate | Mayor & City Council | New Project | Okanogan County Emergency Management | On Going |

| Table 6.12. Town of Winthrop Mitigation Strategies. | | | | | | |
|---|---|---|---|---|---|---|
| **Hazard** | **Action Item** | **Goals Addressed** *refer to goals on pg. 7 | **Responsible Departments or Organizations** | **2012 Status** | **Potential Resources** | **Projected Completion Year** |
| **Flood** | 6.12.e. Continue to work on actions items and proposed projects in the OC CWPP. | Goal # 1,2,3,4,5,6,7,8<br>Priority Ranking: Moderate | Mayor, City Council, & First Responders | New Project | CWPP Steering Committee | On Going |

In the 2009 Okanogan County All Hazard Mitigation Plan, action items specific to the cities and/or special districts were not separated from the overall OC mitigation strategy; therefore, most of the projects listed for the Town of Winthrop are new. However, the town has been actively working on hazard mitigation measures. The following is a list of completed projects since 2009.

1. Back-up generator installed at "The Barn", a facility utilized as a Red Cross shelter, cooling station, general community meeting place, etc.
2. Supported a Community Preparedness Fair for the entire valley.
3. Purchased a generator to cover main well pumps.
4. Purchased additional snow removal equipment.

## *Town of Twisp*

**Table 6.13. Town of Twisp Mitigation Strategies.**

| Hazard | Action Item | Goals Addressed *refer to goals on pg. 7 | Responsible Departments or Organizations | 2012 Status | Potential Resources | Projected Completion Year |
|---|---|---|---|---|---|---|
| **General** | 6.13.a. Educate residents about the potential risks of hazards and appropriate preparedness. | Goal # 1,2,3<br>Priority Ranking: High | Mayor, City Council & First Responders | New Project | Okanogan County Emergency Management | On Going |
| **General** | 6.13.b. Continue to update and improve the MV Emergency Plan. (The MVEP is a community prepared plan that addresses specific hazards of the area, expected response actions, and identifies available resources). | Goal # 1,2,3,5<br>Priority Ranking: Moderate | Mayor, First Responders,<br>& Citizens | New Project | Okanogan County Emergency Management | On Going |
| **Severe Weather** | 6.13.c. Purchase and install back-up generator to cover City Hall and Police Station. | Goal # 1,2<br>Priority Ranking: High | Mayor, City Council, Public Works | New Project | Okanogan County Emergency Management | 2015 |
| **Flood** | 6.13.d. Encourage homeowners in flood prone areas to participation in the National Flood Insurance Program. | Goal #1,3,5,8<br>Priority Ranking: Moderate | Mayor & City Council | New Project | Okanogan County Emergency Management | On Going |

| Table 6.13. Town of Twisp Mitigation Strategies. | | | | | | |
|---|---|---|---|---|---|---|
| **Hazard** | **Action Item** | **Goals Addressed** *refer to goals on pg. 7 | **Responsible Departments or Organizations** | **2012 Status** | **Potential Resources** | **Projected Completion Year** |
| **Wildfire** | 6.13.e. Continue to work on actions items and proposed projects in the OC CWPP. | Goal # 1,2,3,4,5,6,7,8<br>Priority Ranking: Moderate | Mayor, City Council & First Responders | New Project | CWPP Steering Committee | On Going |

In the 2009 Okanogan County All Hazard Mitigation Plan, action items specific to the cities and/or special districts were not separated from the overall OC mitigation strategy; therefore, most of the projects listed for the Town of Twisp are new. However, the town has been actively working on hazard mitigation measures. The following is a list of completed projects since 2009.

Completed Actions:

1. Obtained and installed generator at a local gas station/mini mart and local grocery store.
2. Obtained and installed a generator at water boost station.
3. Sponsored a community-wide Disaster Preparedness Fair for the entire valley.
4. With the assistance of the ACE, built a dike on Twisp River to protect mobile home parks.
5. First responders participated in table top exercises, drill, and functional exercises, for example: school shooter, school evacuation, and school bus accident.

# *City of Okanogan*

**Table 6.14. City of Okanogan Mitigation Strategies.**

| Hazard | Action Item | Goals Addressed *refer to goals on pg. 7 | Responsible Departments or Organizations | 2012 Status | Potential Resources | Projected Completion Year |
|---|---|---|---|---|---|---|
| **General** | 6.14.a. Reduce the impact of hazard events and potential losses incurred by both public and private residents and entities. | Goal # 1,2,3<br>Priority Ranking: High | Mayor, City Council, City Department, First Responders | New Project | USFS, WA DNR, Okanogan Conservation District | On Going |
| **General** | 6.14.b. Conduct community-wide multi-hazard risk assessment and prioritize hazards for planning and mitigation projects. | Goal # 1,2,3,4<br>Priority Ranking: High | Mayor, City Council, City Department, & First Responders | New Project | Okanogan County Emergency Management | 2016 |
| **Flood** | 6.14.c. Develop an emergency dam failure warning system for citizens downstream of the Conconully Dam (Reservoir) and Salmon Lake Dam.. | Goal # 1,2,3,4<br>Priority Ranking: Moderate | Mayor, City Council, Commissioners, Law & Fire District | New Project | Okanogan County Emergency Management | 2019 |
| **Flood** | 6.14.d. Encourage homeowners in flood prone areas to participation in the National Flood Insurance Program. | Goal #1,2,3,5,8<br>Priority Ranking: Moderate | Mayor & City Council | New Project | Okanogan County Emergency Management | On Going |

| Table 6.14. City of Okanogan Mitigation Strategies. | | | | | | |
|---|---|---|---|---|---|---|
| **Hazard** | **Action Item** | **Goals Addressed** *refer to goals on pg. 7 | **Responsible Departments or Organizations** | **2012 Status** | **Potential Resources** | **Projected Completion Year** |
| **Wildfire** | 6.14.e. Continue to work on actions items and proposed projects in the OC CWPP. | Goal # 1,2,3,4,5,6,7,8<br>Priority Ranking: Moderate | Mayor, City Council, & First Responders | New Project | CWPP Steering Committee | On Going |

In the 2009 Okanogan County All Hazard Mitigation Plan, action items specific to the cities and/or special districts were not separated from the overall OC mitigation strategy; therefore, most of the projects listed for the City of Okanogan are new. However, the city has been actively working on hazard mitigation measures. The following is a list of completed projects since 2009.

Completed Actions:

1. Performed several water and sewer main repairs.
2. Participated in school bus accident drill. Repaired washout embankment (with rip/rap, etc.) at the Mill Street Bridge off Salmon Creek to protect bridge structure and homes during snow run off.
3. With the assistance of the ACE, replaced eroded section of the Okanogan River bank.
4. Increased the number of fire hydrants due to local annexations.
5. Prepared and store more than 3,500 full sand bags.

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# Chapter 7

## Appendices

IN THIS SECTION:

- List of Tables
- List of Figures
- Record of Local Adoption
- Planning Committee Minutes
- Record of Meeting Attendance
- Record of Email Correspondence
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- Potential Funding Sources

# Chapter 7 – Appendices

## Supporting Information

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# *Record of Local Adoption*

Each participating jurisdiction formally adopted the Okanogan County Multi-Hazard Mitigation Plan by resolution in an open public hearing. The following is a record of the resolutions passed by the governing body in each represented jurisdiction.

## Okanogan County Resolution of Adoption

**Okanogan County Commissioners**

**RESOLUTION 89-2014**

*A resolution of the Okanogan County Board of Commissioners declaring county support and adoption of the Okanogan County Multi-Hazard Mitigation Plan including Community Wildfire Protection Plan and Terrorism Mitigation plan components.*

**WHEREAS,** The Okanogan County Board of Commissioners supports the Okanogan County Multi-Hazard Mitigation Plan, and

**WHEREAS,** The Okanogan County Board of Commissioners has participated in the development of the Okanogan County Multi-Hazard Mitigation Plan, and

**WHEREAS,** The Okanogan County Multi-Hazard Mitigation Plan will be utilized as a guide for planning as related to FEMA Pre-Disaster Mitigation and other purposes as deemed appropriate.

**THEREFORE BE IT RESOLVED,** that the Okanogan County Board of Commissioners do hereby adopt, support, and will facilitate the implementation of the Okanogan County Multi-Hazard Mitigation Plan including Community Wildfire Protection Plan and Terrorism Mitigation Plan components as deemed appropriate.

Dated at Okanogan, Washington this 14 day of October 2014.

COUNTY COMMISSIONERS SEAL OKANOGAN COUNTY WASHINGTON

**BOARD OF COUNTY COMMISSIONERS**
**OKANOGAN, WASHINGTON**

ATTEST:

LaTeña Johns, Clerk of the Board

Ray Campbell, Chairman

Sheilah Kennedy, Member

APPROVED AS TO FORM:

Dave Jorgensen, Civil Deputy PA

Jim DeTro, Member

## City of Okanogan Resolution of Adoption

**RESOLUTION No. 2014-09**

**A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF OKANOGAN, WASHINGTON, DECLARING SUPPORT AND ADOPTION OF THE OKANOGAN COUNTY MULTI-HAZARD MITIGATION PLAN, WHICH INCLUDES THE COMMUNITY WILDFIRE PROTECTION PLAN AND TERRORISM & CIVIL UNREST MITIGATION PLAN.**

**WHEREAS,** The City Council of Okanogan supports the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan, and;

**WHEREAS,** The City Council of Okanogan has participated in the development of the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan and;

**WHEREAS,** The Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan will be utilized as a guide for planning as related to FEMA Pre-Disaster Mitigation, The National Fire Plan, The Healthy Forest Restoration Act, and other purposes as deemed appropriate by the City Council of Okanogan, and;

**NOW, THEREFORE, BE IT RESOLVED** by the City Council of the City of Okanogan does hereby adopt, support, and will facilitate the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan's implementation

**PASSED AND APPROVED by the City Council of the City of Okanogan, Washington** this 16th day of SEPTEMBER, 2014.

**APPROVED:**

**Jon K. Culp, Mayor**

**ATTEST:**

**Craig Attwood, City Clerk**

1

## City of Omak Resolution of Adoption

COPY

**RESOLUTION No. 64-2014**

**A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF OMAK, WASHINGTON, DECLARING SUPPORT AND ADOPTION OF THE OKANOGAN COUNTY MULTI-HAZARD MITIGATION PLAN**

**WHEREAS**, RCW Chapter 38.52 and WAC Chapter 118-30 require counties and cities within the State of Washington to establish emergency management organizations and emergency plans for the protection of persons and property in the event of disaster, and to provide for the coordination of emergency management functions with other public agencies and organizations; and

**WHEREAS,** several emergency services groups throughout the County participated in updating the County Emergency Management Plan adopted in 2011, with the result being the Okanogan County Multi-Hazard Mitigation Plan.

**NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF OMAK, WASHINGTON,** that the **Okanogan County Multi-Hazard Mitigation Plan** is approved as the official plan providing emergency services when protection of life, property and the environment cannot be accomplished as a normal daily function of the local government.

**PASSED BY THE CITY COUNCIL** this 15th day of September, 2014.

**APPROVED:**

Cindy Gagné, Mayor

**ATTEST:**

Kathy Lobdell, City Clerk

**APPROVED AS TO FORM:**

Michael D. Howe, City Attorney

## City of Oroville Resolution of Adoption

**Resolution of the City Council of Oroville**
**located in Okanogan County, Washington**
**#** 537

A resolution of the City Council of Oroville declaring City support and adoption of the Okanogan County Multi-Hazard Mitigation Plan, which includes the Community Wildfire Protection Plan and Terrorism & Civil Unrest Mitigation Plan.

Whereas, The City Council of Oroville supports the Okanogan County Multi- Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan, and

Whereas, The City Council of Oroville has participated in the development of the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan, and

Whereas, The Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan will be utilized as a guide for planning as related to FEMA Pre-Disaster Mitigation, The National Fire Plan, The Healthy Forest Restoration Act, and other purposes as deemed appropriate by the City Council of Oroville,

Therefore be it resolved, that the City Council of Oroville does hereby adopt, support, and will facilitate the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan's implementation.

Passed and approved this 16th Day of September, 2014

City Council of Oroville located in Okanogan County, Washington

By:

Mayor, City of Oroville

Attested by:
City Clerk

## City of Brewster Resolution of Adoption

# RESOLUTION NO. 14 – 07

**A resolution of the City Council of the City of Brewster declaring City support and adoption of the Okanogan County Multi-Hazard Mitigation Plan, which includes the Community Wildfire Protection Plan and Terrorism & Civil Unrest Mitigation Plan.**

**Whereas,** The City Council of Brewster supports the Okanogan County Multi- Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan, and

**Whereas,** The City Council of Brewster has participated in the development of the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan, and

**Whereas,** The Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan will be utilized as a guide for planning as related to FEMA Pre-Disaster Mitigation, The National Fire Plan, The Healthy Forest Restoration Act, and other purposes as deemed appropriate by the City Council of Brewster,

Therefore be it resolved, that the City Council of Brewster does hereby adopt, support, and will facilitate the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan's implementation.

Adopted this 17th day of September, 2014.

**APPROVED:**

Lee Webster, Mayor

**ATTEST:**

City Clerk, Misty Ruiz

FILED WITH THE CITY CLERK:
PASSED BY THE CITY COUNCIL:
RESOLUTION NO. 14 - 07

**City of Pateros Resolution of Adoption**

## Resolution of the City Council of Pateros located in Okanogan County, Washington
**#2014-14**

A resolution of the City Council of Pateros declaring City support and adoption of the Okanogan County Multi-Hazard Mitigation Plan, which includes the Community Wildfire Protection Plan and Terrorism & Civil Unrest Mitigation Plan.

Whereas, The City Council of Pateros supports the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan, and

Whereas, The City Council of Pateros has participated in the development of the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan, and

Whereas, The Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan will be utilized as a guide for planning as related to FEMA Pre-Disaster Mitigation, The National Fire Plan, The Healthy Forest Restoration Act, and other purposes as deemed appropriate by the City Council of Pateros,

Therefore be it resolved, that the City Council of Pateros does hereby adopt, support, and will facilitate the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan's implementation.

Passed and approved this 16th Day of June, 2014

City Council of Pateros located in Okanogan County, Washington

By:

Mayor, City of Pateros

Attested by:
City Clerk

## Town of Elmer City Resolution of Adoption

**Resolution of the Town Council of Elmer City**
**located in Okanogan County, Washington**
R4-14

A resolution of the Town Council of Elmer City declaring Town support and adoption of the Okanogan County Multi-Hazard Mitigation Plan, which includes the Community Wildfire Protection Plan and Terrorism & Civil Unrest Mitigation Plan.

Whereas, The Town Council of Elmer City supports the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan, and

Whereas, The Town Council of Elmer City has participated in the development of the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan, and

Whereas, The Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan will be utilized as a guide for planning as related to FEMA Pre-Disaster Mitigation, The National Fire Plan, The Healthy Forest Restoration Act, and other purposes as deemed appropriate by the Town Council of Elmer City,

Therefore be it resolved, that the Town Council of Elmer City does hereby adopt, support, and will facilitate the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan's implementation.

Passed and approved this 12th Day of June 2014.

Town Council of Elmer City located in Okanogan County, Washington.

By:
Mayor, Town of Elmer City

Attested by:
Town Clerk

## Town of Coulee Dam Resolution of Adoption

**Resolution of the Town Council of Coulee Dam**
**located in Okanogan County, Washington**
# 2014-004

A resolution of the Town Council of Coulee Dam declaring Town support and adoption of the Okanogan County Multi-Hazard Mitigation Plan, which includes the Community Wildfire Protection Plan and Terrorism & Civil Unrest Mitigation Plan.

Whereas, The Town Council of Coulee Dam supports the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan, and

Whereas, The Town Council of Coulee Dam has participated in the development of the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan, and

Whereas, The Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan will be utilized as a guide for planning as related to FEMA Pre-Disaster Mitigation, The National Fire Plan, The Healthy Forest Restoration Act, and other purposes as deemed appropriate by the Town Council of Coulee Dam,

Therefore be it resolved, that the Town Council of Coulee Dam does hereby adopt, support, and will facilitate the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan's implementation.

Passed and approved this 24th Day of September, 2014

Town Council of Coulee Dam located in Okanogan County, Washington

By:
Mayor, Town of Coulee Dam

Attested by:
Town Clerk

## Town of Twisp Resolution of Adoption

**RESOLUTION #14-544**

**A Resolution of the Town of Twisp, Washington declaring Town support and adoption of the Okanogan County Multi-Hazard Mitigation Plan, which includes the Community Wildfire Protection Plan and Terrorism and Civil Unrest Mitigation Plan**

**WHEREAS**, the Town Council of the Town of Twisp supports the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism and Civil Unrest Mitigation Plan; and

**WHEREAS**, the Town Council of the Town of Twisp has participated in the development of the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism and Civil Unrest Mitigation Plan; and

**WHEREAS**, the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism and Civil Unrest Mitigation Plan will be utilized as a guide for planning as related to FEMA Pre-Disaster Mitigation, the National Fire Plan, the Healthy Forest Restoration Act, and other purposes as deemed appropriate by the Town Council of the Town of Twisp.

**NOW, THEREFORE BE IT RESOLVED** by the Town Council of the Town of Twisp does hereby adopt, support, and will facilitate the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism and Civil Unrest Mitigation Plan.

**Adopted this 26th day of August, 2014 by the Town Council of the Town of Twisp located in Okanogan County, Washington.**

**APPROVED:**

Soo Ing-Moody, Mayor

**ATTEST:**

Jackie Moriarty, Clerk/Treasurer

Town of Twisp - Resolution #14-544

## Town of Winthrop Resolution of Adoption

### Resolution No. 2014-18

A resolution of the Town Council of Winthrop declaring Town support and adoption of the Okanogan County Multi-Hazard Mitigation Plan, which includes the Community Wildfire Protection Plan and Terrorism & Civil Unrest Mitigation Plan.

Whereas, The Town Council of Winthrop supports the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan, and

Whereas, The Town Council of Winthrop has participated in the development of the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan, and

Whereas, The Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan will be utilized as a guide for planning as related to FEMA Pre-Disaster Mitigation, The National Fire Plan, The Healthy Forest Restoration Act, and other purposes as deemed appropriate by the Town Council of Winthrop,

Therefore be it resolved, that the Town Council of Winthrop does hereby adopt, support, and will facilitate the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan's implementation.

Passed and approved by the Town Council this 16th day of July, 2014.

APPROVED:

Sue Langdalen, Mayor

ATTEST:

Michelle Gaines, Clerk/Treasurer

## Town of Riverside Resolution of Adoption

### Resolution of Adoption by the Town of Riverside, Washington
# 2012-6

**A resolution of the Town of Riverside declaring support and adoption of the Okanogan County Multi-Hazard Mitigation Plan including Community Wildfire Protection Plan and Terrorism Mitigation Plan components.**

Whereas, The Town Council of Riverside supports the Okanogan County Multi-Hazard Mitigation Plan, and

Whereas, The Town Council of Riverside has participated in the development of the Okanogan County Multi-Hazard Mitigation Plan, and

Whereas, The Okanogan County Multi-Hazard Mitigation Plan will be utilized as a guide for planning as related to FEMA Pre-Disaster Mitigation and other purposes as deemed appropriate by the Town Council of Riverside , and

Therefore be it resolved, that the Town Council of Riverside does hereby adopt, support, and will facilitate the implementation of the Okanogan County Multi-Hazard Mitigation Plan including Community Wildfire Protection Plan and Terrorism Mitigation Plan components as deemed appropriate.

Passed and approved this 11 Day of December 2012

by the Town Council of Riverside located in Okanogan County, Washington.

Margie Mefford
By:
Mayor, Town of Riverside

Grace Quinn Paul
Attested by:
Clerk, Town of Riverside

## Town of Tonasket Resolution of Adoption

**RESOLUTION 2014-15**

**A RESOLUTION** of the City Council of the City of Tonasket, Washington, declaring City support and adoption of the Okanogan County Multi-Hazard Mitigation Plan, which includes the Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan.

**WHEREAS,** The City Council of Tonasket supports the Okanogan County Multi-Hazard Mitigation Plan, the Community Wildfire Protection Plan, and the Terrorism & Civil Unrest Mitigation Plan; and

**WHEREAS,** The City Council of Tonasket has participated in the development of the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Plan and Terrorism & Civil Unrest Mitigation Plan; and

**WHEREAS,** The Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan will be utilized as a guide for planning as related to FEMA Pre-Disaster Mitigation, The National Fire Plan, The Healthy Forest Restoration Act, and other purposes as deemed appropriate by the City Council of Tonasket.

**NOW, THERFORE BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF TONASKET,** that the City Council of Tonasket does hereby adopt, support, and will facilitate the Okanogan County Multi-Hazard Mitigation Plan, Community Wildfire Protection Plan, and Terrorism & Civil Unrest Mitigation Plan's implementation.

**PASSED AND APPROVED BY THE CITY COUNCIL** this 28 day of Oct, 2014.

**APPROVED:**

**Patrick Plumb, Mayor**

**ATTEST:**

**Alice J. Attwood, Clerk-Treasurer**

## Town of Tonasket Resolution of Adoption

**Resolution of the Town Council of Conconully**
**located in Okanogan County, Washington**

Resolution 294.14

A resolution of the Town Council of Conconully declaring Town support and adoption of the Okanogan County Multi-Hazard Mitigation Plan

Whereas, The Town Council of Conconully supports the Okanogan County Multi-Hazard Mitigation Plan, and

Whereas, The Town Council of Conconully has participated in the development of the Okanogan County Multi-Hazard Mitigation Plan, and

Whereas, The Okanogan County Multi-Hazard Mitigation Plan will be utilized as a guide for planning as related to FEMA Pre-Disaster Mitigation, and for FEMA Disaster Hazard Mitigation Plan Grants and other purposes as deemed appropriate by the Town Council of Conconully,

Therefore be it resolved, that the Town Council of Conconully does hereby adopt, support, and will facilitate the Okanogan County Multi-Hazard Mitigation Plan implementation.

Passed and approved this 11th Day of November 2014

Town Council of Conconully located in Okanogan County, Washington

By:
Sam Martrin, Mayor
Town of Conconully

Attested by:
Tami Cochran, Clerk-Treasurer
Town of Conconully

# *Planning Committee Minutes*

## January 16th, 2013 – Okanogan County Sheriff's Office

**OKANOGAN COUNTY, WASHINGTON**

**Multi-Hazard Mitigation & Community Wildfire Protection Plan Updates**

Okanogan County Sheriff's Office

January 16th, 2013

Introductions:

Scott Miller, from the Okanogan County Department of Emergency Management, introduced the intention of the meeting and asked that everyone introduce themselves. Scott then handed the floor to Steve Harris of the Washington DNR.

Agenda Item #1 – Steve Harris:

Steve Miller updated the group on Hazardous Fuels Treatment projects recently completed. He also asked the group for some ideas for new project areas. The group made several recommendations for areas that need fuels mitigation work.

Agenda Item #2– Multi-Hazard Mitigation Plan & Community Wildfire Protection Plan:

Brad, from Northwest Management (NMI), talked briefly about the plan update process and what has been done so far. Brad passed out the first few chapters from each plan to the group. He stated that if anyone wants a copy electronically, email him at tucker@nmi2.com . The group was asked to review the maps for accuracy.

The group decided that fire was the County's number one risk. The group was then split into two smaller groups to cover the action items for the MHMP and CWPP. The smaller groups updated the original action items and added a few new action items. Some of the MHMP group members had some ideas for action items but needed to run them by their jurisdiction's officials.

Agenda Item #3 – Reminders:

Fire District surveys need to be turned into Glenda (if you have not done so). NMI needs any shapefiles for finished or proposed projects. Review drafts and submit corrections to NMI.

Agenda Item #4 – Meeting Schedule:

Public meeting will be held in March or April the date will be announced once it has been decided. NMI hopes to have Final Drafts of both documents completed by the end of June for submission to Washington Military Department for review.

Adjournment:

The Okanogan County MHMP & CWPP update steering committee meeting was adjourned at 2 p.m.

## *Record of Meeting Attendance*

The following is a record of the attendance taken at each of the committee and public meetings held during the Multi-Hazard Mitigation Planning process.

**Figure 7.1. Committee Meeting Sign-in Sheet for January 16th, 2013.**

| | |
|---|---|
| **Project:** MHMP/CWPP LCG Coordination Meeting | **Meeting Date:** January 16, 2013 |
| **Facilitator:** Scott Miller, Northwest Management, & DNR | **Place/ Room:** Sheriff's Office Conference Room |

| Name | Organization/Email | Phone Number |
|---|---|---|
| Noble Kelly | Chilowist | 422 5428 |
| Steve DeCook | DNR | 685-2713 |
| Kevin Bowling | Omak Fire firesic@omakcity.com | 826-0760 |
| ROBERT BURKS | TONASKET POLICE | 322-3735 |
| J. Foster Fanning | WA DNR \ Fy OK FPD #14 | 509.993.3390 |
| Tera R. King | NW Mgmt. | 208-883-4488 |
| Vaiden Bloch | NW Management Inc | 208 883-44-99 |
| Brad Tucker | Northwest Management | 208-883-4488 |
| Barbara Peterson | RFD #9 | 509/422-3179 |
| Mel Peterson | " " | " " |
| Chris Branch | City of Oroville Fire & EMS | 5095603535 |
| Cedar A. Hennigs | City of Okanogan | 509-422-5757 |
| MIKE WOECKE | FD1 | 486-1386 |
| Robert Bauer | FD16 | 486-0785 |

| | | | |
|---|---|---|---|
| **Project:** | MHMP/CWPP LCG Coordination Meeting | **Meeting Date:** | January 16, 2013 |
| **Facilitator:** | Scott Miller, Northwest Management, & DNR | **Place/ Room:** | Sheriff's Office Conference Room |

| Name | Organization/Email | Phone Number |
|---|---|---|
| Tim Jaquaw | FD #9 | 429-4153 |
| Bob PARTEN | OK CO Pub Wrks | 422-7335 |
| Ron Morris | 16 Lundquist Rd SE Malott " | 422-0218 |
| Sandy Morris | " Home owners | |
| Edd Townsend | RFPD #8 - | 322-2262 |
| Sarah Wilkinson | USACE - Chief Joseph Dam | 686-3543 |
| JEN CROFT | USFS - TONASKET RD | 486-2186 |
| JEFF AVERS | USFS - TONASKET RD | 486-2186 |
| Kevan Roberts | DNR - Northeast Region | 684-7474 |
| Steve Harris | DNR - " " | 685-2712 |
| Tim Vugteveen | DNR Highland District | 684-7474 |
| DONNY SMITH | DNR SO OKANOGAN don.smith@dnr.wa.gov | 684-7474 |
| Greg Saltsman | DNR SO OKDIST greg.saltsman@dnr.wa.gov | 684-7474 |
| Cody Acord | OCFD #6 cacord@okanogancountyfd6.com | 997-2981 |

| | | | |
|---|---|---|---|
| **Project:** | MHMP/CWPP LCG Coordination Meeting | **Meeting Date:** | January 16, 2013 |
| **Facilitator:** | Scott Miller, Northwest Management, & DNR | **Place/ Room:** | Sheriff's Office Conference Room |

| Name | Organization/Email | Phone Number |
|---|---|---|
| Glenda Beauregard | OC DEM gbeauregard@co.okanongan.wa.us | 509-422-7206 |
| Scott Miller | OC DEM/Emergency Manager smiller@co.okanongan.wa.us | 509-422-7207 |

| Project: MHMP/CWPP LCG Coordination Meeting | Meeting Date: January 16, 2013 |
|---|---|
| Facilitator: Scott Miller, Northwest Management, & DNR | Place/ Room: Sheriff's Office Conference Room |

| Name | Organization/Email | Phone Number |
|---|---|---|
| Monica Nicholson | USFS · Methow Valley / monicanicholson@fs.fed.us | 509.679.4590 |
| Kathy Busse | USFS - Methow Vly kbusse@fs.fed.us | 509-996-4069 |
| Don Waller | OCFD #6 dwaller@okanogancountyfd6.com | 509-997-2981 |
| Kirsten Cook | Okanogan Conservation District kiestenc@okanogancd.org | 509-422-0855 x100 |
| DAVID DAHLSTROM | WINTHROP MARSHALS OFFICE MARSHAL@TOWNOFWINTHROP.COM | (509) 996-2160 |
| KEN BASEMA | KBASEMA@TOWNOFWINTHROP.COM | 509-341-4128 |
| Perry Huston | OK CO Plan ~~Intern~~ phuston@co.okanogan.wa.us | 509-422-7218 |
| Ted Murray | OC-GIS Tmurray@co.okanogan.wa.us | 509-422-7118 |
| Mike Solheim | BLM fuels msolheim@blm.gov | 509-536-1236 |
| Richard Parrish | AFMO Fuels rparrish@blm.gov | 509-536-1200 |
| Ron Wonch | DNR Landowner Assistance | 509-684-7474 |
| Roy Schwilke | PUD No 1 of Okanogan County roys@okpud.org | 509-422-8473 |
| Paul D. Budrow | Twisp Police Dept. | 509-997-6112 |
| Peggy Kelly | Chiliwist | 509-422-5428 |

# *Record of Published Articles*

The following is a subset of Multi-Hazard Mitigation-related articles published in local newspapers during the planning process. A total of three specific press releases were sent at critical stages of the process; one to introduce the project and invite interested parties, one to announce the public meetings, and one to announce the availability of the document for public comment. Additionally, during the local adoption phase of the process, Okanogan County and city jurisdictions advertised the formal adoption of the Plan by resolution at a public hearing. The agendas for these meetings are published by the jurisdiction in the most appropriate local media outlet.

**Figure 7.2. Article published in the Methow Valley News on November 14th, 2012.**

County to update risk plans

Okanogan County is updating its Multi-Hazard Mitigation Plan and Community Wildfire Protection Plan.

Local agencies and organizations have created a committee to complete the required five-year updates as part of the FEMA Pre-Disaster Mitigation program and National Fire Plan and Healthy Forests Restoration Act. The project is being funded through a federal grant.

Once completed, the updated draft plans will be available for public review and comment. For more information call Glenda Beauregard, Okanogan County Emergency Management, at (509) 422-7206 or gbeauregard@co.okanogan.wa.us.

The planning update will include risk analyses, vulnerability assessments, and mitigation recommendations for the hazards of flood, landslide, earthquake, severe weather, wildland fire and extended power outages.

*Nov. 14, 2012*

**Methow Valley News Online**

http://www.methowvalleynews.com/story.php?id=8911

**Figure 7.3. Article published by North Cascades Broadcasting on November 14th, 2012.**

Okanogan County has launched a project to update the Okanogan County Multi-Hazard Mitigation Plan and Community Wildfire Protection Plan. Local agencies and organizations in Okanogan County have created a committee to complete the required 5-year updates of these documents as part of the FEMA Pre-Disaster Mitigation program and National Fire Plan and Healthy Forests Restoration Act. The project is being funded through a Title III grant.
The planning update will include risk analyses, vulnerability assessments, and mitigation recommendations for the hazards of flood, landslide, earthquake, severe weather, wildland fire, and extended power outages. Northwest Management, Inc. has been retained by Okanogan County to provide risk assessments, hazard mapping, field inspections, interviews, and to collaborate with the planning committee to update the Plans. The committee includes representatives from local communities, rural and wildland fire districts, Washington Department of Natural Resources, U.S Forest Service, Bureau of Land Management, highway districts, private landowners, area businesses, various Okanogan County departments, and others.

One of the goals of the planning process will be to increase the participating jurisdictions' eligibility for additional grants that will help minimize the risk and potential impact of disaster events. The plan will be located on the main page of the Emergency Management website at okanogandem.org. The planning team will be conducting a public meeting to discuss preliminary findings and to seek public input on the Plans' recommendations. A notice of the dates and locations of this meeting will be posted in local newspapers. Once completed, the updated draft Plans will also be available for public review and comment. For more information on the Okanogan County Multi - Hazard Mitigation Plan and Community Wildfire Protection Plan updates, contact Glenda Beauregard, Okanogan County Emergency Management, at 509-422-7206 or gbeauregard@co.okanogan.wa.us.



**North Cascades Broadcasting, Inc**

http://www.komw.net/artman/publish/article_6133.shtml

## *Public Meeting Slideshow*

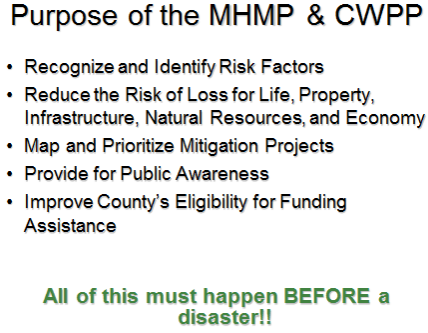
The following slideshow was presented during the September public meetings. This presentation made up the formal portion of the meeting presentation; however, members of the committee and representatives from NMI were available at each meeting to informally answer questions, explain the models and other mapping products, and take notes on public input and ideas for consideration by the committee.

**Figure 7.4. Public Meeting Slideshow.**

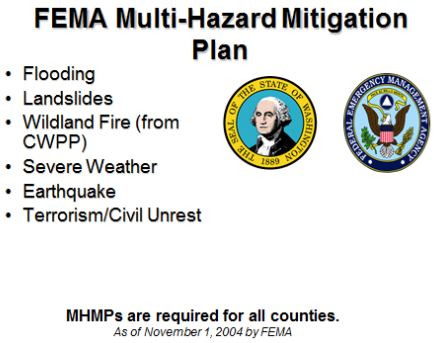
Slide 1


Slide 2


Slide 3




Slide 4

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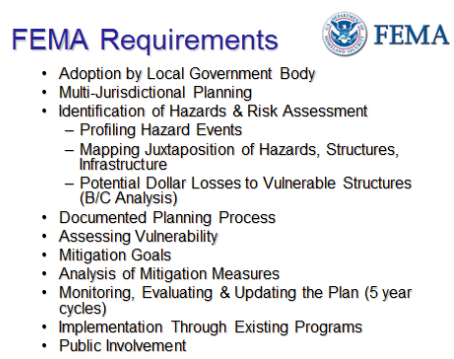


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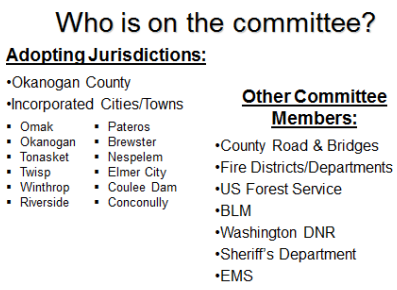
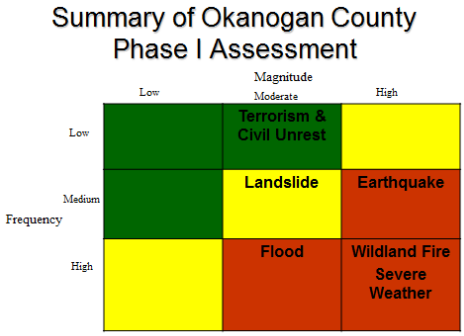


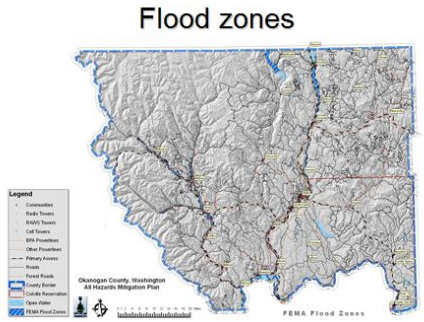
Slide 7



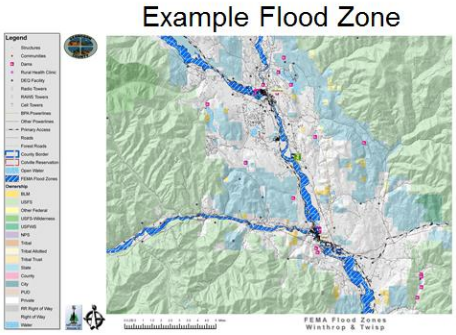

Slide 8


Slide 9


Slide 10

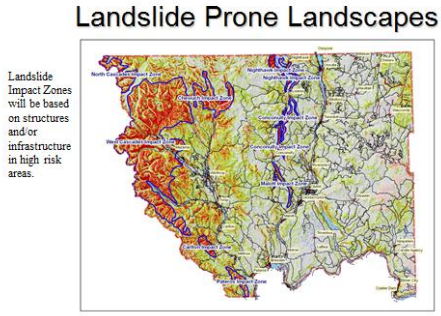



Slide 11

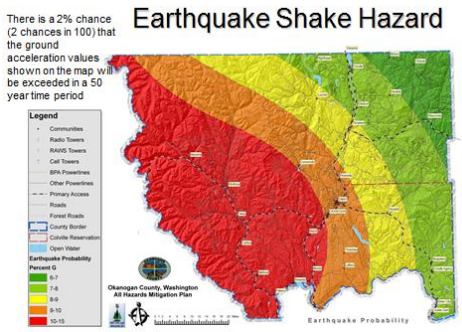



Slide 12


Slide 13

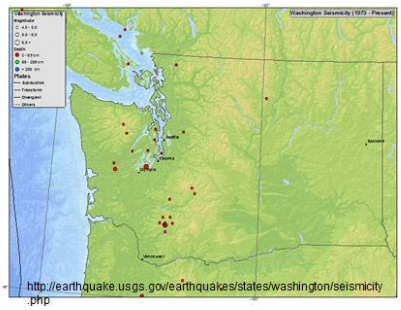



Slide 14



Slide 15

- Seismicity 1973-Present

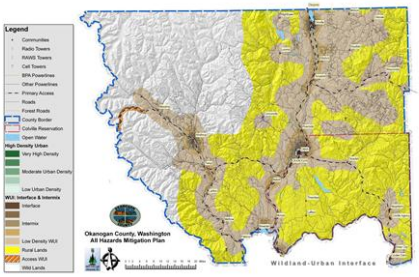



Slide 16

## Wildland Fire

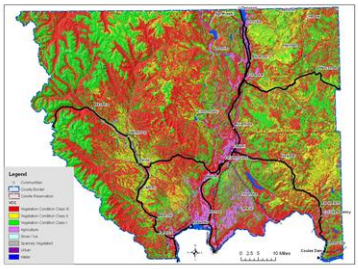

Slide 17

## Wildland Urban Interface




Slide 18

## Vegetation Condition Class




Slide 19

## Terrorism and Civil Unrest

- Potential Vulnerabilities
  - Railways – hazardous materials
  - Government Buildings
  - Infrastructure – Highways, water (dams), power, and sewer systems
  - Land Management Offices (Ecoterrrorism?)
  - Commerce
- Refugees?

Slide 20

## Preparedness

- Emergency Services
- Fire Protection
- Weather Impacts
- Flood Protection/Programs
- Earthquake, Landslide, & Storm Readiness
- Hospital Protection
- Public Works/Highway District Readiness
- Communications

Slide 21

## Types of Projects

- Defensible Space and Fuels Treatments
- Floodplain Management and Infrastructure Upgrades
- Slope Stabilization
- Studies (e.g. watershed) and Evaluations (e.g. culvert capacity)
- Access Improvements
- Emergency Response Needs
- Policy Issues
- Infrastructure Hardening and Communication Upgrades
- Public Education

Slide 22

## Public Involvement

- Press Releases about planning efforts
- Informational flyers
- Public Meeting
- Public Review of the DRAFT Plan will be facilitated once all sections have been completed and reviewed by the committee
- Open public adoption hearings

Slide 23

## Your Input

- Maps on the walls – Mark them up!
- Talk to one of the planning committee members.
- Let us know your ideas and concerns.
- Make this YOUR Plan!

- Thank you for attending and participating! Please visit with us.

Slide 24

## *Record of Hazard Events*

The following list was provided by the Okanogan Emergency Management Department. This list shows the hazards that have occurred in Okanogan County from 2005 thru 2012. Examining this list provides some insight into the breadth of hazards that commonly occur within Okanogan County.

| 2005 | | | | |
|---|---|---|---|---|
| Event | Location | Date(s) | Acreage | Other/Homes Lost |
| Burnt Bread Fire Type 2 Team | 21 miles SE of Tonasket; Mt Annie in Sourdough Creek/Cape Labelle Road | 6 – 10 Aug | 1,352 | 26 Homes, level 1 evacuation notices North side of Cape Labelle Road from Neil Circle Road to Turner Lake Road; only the barn where fire was suspected to have started. Cost to date: $1,730,139 (Aug 13, 2005) |
| Pearrygin Lake Fire Type 2 Team | | July 4 -13 | 530 | |
| Second HUD Fire Type 3 Team | Swipkin and Pothole Canyons (left side of hwy 97 sort of across from Omak Air Port)<br>3 miles NE of Omak | July 4 | 2,000 | |
| Squaw Creek Fire Type 2 Team | 2 miles SW of Methow | Sept 8 | 1,100 | 6 – 12 homes evac. Level 3 (PUD sued by DNR = dead tree that fell on power line; 1 unoccupied structure lost. |
| Ice Damming – Twisp & Early Winters Creek (Mazama) & on Okanogan | | Jan 26/27 | | Resolution 11-2005<br>Ice jam ¼ mile above Malott bridge extends 4 miles; jamming on Twisp river had to be removed |
| Ice & water surge from Canada – Ice damming = Similkameen & Okanogan Rivers | 18” thick x 5-10 ft across; diverted water into Palmer Creek/Lake | Jan 21 | | Log jam above Enloe Dam; 18” thick x 5-10 ft across down Similkameen River; diverted water into Palmer Creek/Lake |

| 2006 | | | | |
|---|---|---|---|---|
| Incident | Location | Date(s) | Acreage | Other/Homes Lost |
| Spur Fire Type 2 Team | 12 miles NW Conconully; near Horseshoe Meadow, SW of Tiffany Spring Campground | 7/6 | 363 + | DNR, FS, Private<br><br>Caused by lightening |
| Tripod Fire – Became "Complex" fire to cover both fires | 6 miles NE Winthrop | 7/24 | 175,000 + | DNR, FS, Private |
| Colville Indian Power and Veneer Mill Fire Omak Mill Fire | Omak | June 29 | | Level 1 evacuations |
| Cameron Lake Fire | | Aug | | Level 1 evacuations for 10 home along Cameron Lake Rd - |
| Flooding | Lost River & Conconully & Sinlahekin Rd; Methow River; Blue Lake; Trailer Court in Twisp & Lost River dike problem | May 17 – 20 | | Cabin on edge MR; log jam Enloe Dam (logs removed then replaced) |
| Seepage | Conconully Dam Seepage into homes and community | June | | 2/3 homes below dam flooded basements |
| Severe Storm | Loomis/Oroville/Carlton areas | July | | Loomis received 1.5 – 2 inches hail in less than 1 hour; Oroville got over 1 inch – debris over road 5 locations; Debris over hwy 153 |

| 2007 | | | | |
|---|---|---|---|---|
| Incident | Location | Date(s) | Acreage | Other/Homes Lost |
| Tunk Grade Fire Type 2 Team FMAG approved | 10 miles NE Omak; Riverside area | 7/14 at 1723 – 7/19 | 15,980 | Significant events: Closed Hwy 20;<br>Cause: Lightening; 1 structure destroyed; 30 home threatened (FM-2714) |
| Little Chopaka Fire | 10 miles NW Loomis | 7/10 – 7/13 | 4,428 | BLM/FS |
| Whiskey Mt. Fire | South Oroville | Aug | 1,200 | DNR/FS |
| Landslide in Princeton BC – evacuated miners from | | 2 Aug | | |

| | | | | |
|---|---|---|---|---|
| Similkameen River | | | | |
| South Omak Lake Fire | Tribal Land – Boot Mt and Omak Lake area | 8/30 – 9/4 | 10,500 | Unknown cause; FD's provided structure support |

| 2008 | | | | |
|---|---|---|---|---|
| Incident | Location | Date(s) | Acreage | Other/Homes Lost |
| Cayuse Fire<br><br>Type 2 Team | 14 miles east of Tonasket | 9 – 17 July | 1,768 | FS/DNR/Cty<br>Six homes threatened. Fire went into an area that was part of a prescribed burn in 2000 in Section 17 (Cayuse horse pasture area on National Forest land), and slowed fire's advance. |
| Chiliwist Butte Fire (no folder) | 3 miles northwest of Malott | Aug 13 – 19 | 330 | DNR<br>Timber; no homes |
| French Valley Fire<br><br>Type 2 Team | 6 miles east of Omak.<br>Tribal Lands | 10 July 2008 | 1,420 | Colville Agency, Bureau of Indian Affairs<br>cause under investigation<br>It slowed quickly after moving into an old burn area |
| Green Lake | Intersection Salmon Creek Rd and Green Lake Rd, 6 miles NW of Okanogan | July 31 | 2,275 | DNR/FWS/BLM<br>SO provided security.<br>$2,590.00 |
| JackAsse Butte Fire<br>Type 2 Team | Directly across from the City of Okanogan – on Tribal land. | 1 – 3 July | 1500 | Risks – communications infrastructure & power Malott, Twisp & Winthrop<br>Caused by lightening; big time involvement of local FD's |
| Rattlesnake Point Complex Fire<br>(Complex = Rattlesnake Point, Jackasse Butte; Coyote Creek and Kartar Valley)<br>Type 2 Team | Rattlesnake = 10 miles SW of Okanogan and on Tribal Land; | June 30 at 9 pm – 3 July | 2,633 | BIA<br>Cause – Lightening |
| Columbia River Road Fire<br>Type 2 Team | 9 miles W of Nespelem; between Hwy 155 and Columbia River | 8/7/08 – 3:10 am | 22,155 | Tribal Land |

| 2008 | | | | |
|---|---|---|---|---|
| Incident | Location | Date(s) | Acreage | Other/Homes Lost |
| Happy Hill Fire | SE of Conconully | 8/22/08 1:40 | 15 | FD's 3 & 7 and DNR<br>Road closed Hess Lake to Happy Hill |
| Green Lake Wildland Fire Type 2 Team | 4 miles NW of Okanogan | July 31 – Aug 8 | 2,614 | Burned area = DNR 18 acres, FWS 755 acres, BLM 602 acres; private 1,240 acres |
| Wind Damage | | July 16 | | OC PUD $72,400; Nesp. Coop $35,000; PW $5,000 tree removal. Winds 59 mph in Omak |
| Anhydrous Ammonia Leak and **Fire** (Brewster) | Brewster Packing Shed | Aug 3 | | Everyone!<br>Evacuated Senior Living and Hospital, etc. |
| Okanogan/Methow/Similkameen - FLOODING | | 5/19 – 6/4 | | Lost River; Mazama; Wolf Creek; Wolf Song problem areas. Resolution 41-2008 |

| 2009 | | | | |
|---|---|---|---|---|
| Incident | Location | Date(s) | Acreage | Other/Homes Lost |
| Poorman Creek Fire | Twisp area | June | 50 | Two homes destroyed |
| Little Buck Fire | Winthrop area | July | Small | |
| Mineral Hills Fire | Near Conconully | July | Small | |
| Lightning strikes | Quartz Gulch (MV); Buckhorn Mt; Poeny Creek; Rendezvous Road and Tunk Mtn) | July | Small | |
| Johnson Lake Complex Fire Type 2 Team | Tribal – Johnson Lake, Fish Hatchery, Owhi Tree<br>6 miles NE of the Towns of Nespelem | July 23 - 28 | 955 | No evacuations |
| Shull Ridge Complex Fire | Up close to Canada | Aug | 180 + | Way up in mountains! |
| Oden Road Fire | 5 Miles W. Okanogan | Aug | 10,285 + | FMAG approved<br>Hwy 20 closed for period of time<br>Lost 2 primary residences, several out buildings and 1 unoccupied cabin; Loup Loup transmission lines affected |
| Mile Post 272 & 281 Fire | Malott/Okanogan; | Sept | 310 | Tribal Land |

| | | | | |
|---|---|---|---|---|
| | Tribal Land | | | |
| Mile Post 38 Fire<br>Type 2 Team | Tribal Land | Sept | 1,923 + | Tribe evacuated Convalescent Center – no property lost |
| Poorman Creek Ice Jam | | Jan | | |
| Chopaka Ice Jam Potential | Palmer Lake area – concerned about animal | Dec | | Nothing significant. |

| 2010 | | | | |
|---|---|---|---|---|
| Incident | Location | Date(s) | Acreage | Other/Homes Lost |
| Dalton Road Fire | Kremel Rd/Dalton Road | July | 4 | FD 7, 8, 3, & 4 |
| Horsespring Coulee Fire | | July | 83 | Lightning; DNR & FD 10, 11, &16 |
| Dunn Mt Fire | Limebelt Road | Aug | | Lightning; DNR/FD 9; only access is by helicopter |
| Finley Canyon Fire | Near Tice Ranch (MV) | Aug | 38.3 | Cause under investigation; DNR/FD6 |
| Wagon Wheel Holdover Fire | Near Molson | Aug | 8 | Lightning caused; DNR FD 11 |
| Wildland Fire<br>B & O | | Oct | | Small |
| Bonaparte Fire | | Oct | | Power pole knocked down by home owner using backhoe – snatched a guy wire supporting PUD pole |
| Pleasant Valley Fire | | Nov | | Controlled burn out of control |
| Aeneas Valley Road Fire | 1.2 miles up Aeneas Valley Road | Nov | | U85 confirmed controlled burn |
| Highland Orchard Packing Shed Fire | | Nov | | |
| Oden Road Fire Area<br>**FLOODING** | Hwy 20 | Jan | | Rain & frozen ground; blocked culvert; damaged Hwy 20 pretty bad |
| Wind Storm – mid valley | Electricity knocked out north Omak and caused widespread power | May 3 | | Fierce windstorm cracked a cross arm on a PUD transmission line structure near DOT hop off Hwy 97 – next day cross arm failed and dropped an 115,000-volt line. On its way down it contacted a ground wire and started a small fire.<br>Okanogan and North Omak substations tripped, etc. |
| Flash Flood | Conconully to | Sept | | Bergh Orchard & McLaughlin |

| | | | | |
|---|---|---|---|---|
| | Aeneas Valley - Road infrastructure; private driveways; orchards; railroads | 19 | | Canyon – significant damage |

| 2011 | | | | |
|---|---|---|---|---|
| Incident | Location | Date(s) | Acreage | Other/Homes Lost |
| Marlys Rd Fire | Outside Tonasket | Aug 9 | 408 | DNR |
| High Country Fire | | Aug | 157 | DNR |
| Salmon Fire | 10 miles W of Omak | Aug | 1,910 | DNR |
| Washington Flats-Coulee Dam Area Fire | | Aug | 1,000 | BIA + **DOUGLAS COUNTY** |
| Twisp River – Ice Jam | | Jan | | Ice jams – nothing significant |
| Salmon Meadows/Kerr Campground Landslide | Above Conconully | May | | Sheriff's Office got campers out of sites – USFS land |
| Salmon Creek Rd Flooding | Between Spring Coulee Road and Danker cut-off | May | | PW handled – lots of water over roadway – creek going over its boundaries |
| Sinlahekin Road Flooding | | May | | Water and debris over road |
| Pearrygin Landslide | | June | | Damaged road, home site and all the way down to the state park – State Park hit bad. |
| Flooding Event **EOC Activation** | All rivers high – over flood stage Okanogan River at Tonasket and in the Similkameen area ACE left 17 June | May/June | Sand-bags issued, etc. | ACE assisted –North Fork of Salmon Creek in Conconully significantly reinforced and dredged diversion channel (ACE); levee on Methow River reinforced and armored (ACE); breach in levee on the Okanogan River in City of Okanogan (ACE); log jam Oak Street bridge in City of Okanogan (ACE) – private homes close to Okanogan River encountered seepage in basement – emergency permitting with WDFW **EOC Activation** |
| Earthquake | 4.6 outside Conconully | | | Felt as far away as Puget Sound, Nelson, BC; Spirit Lake, ID. |

| 2012 | | | | |
|---|---|---|---|---|
| Incident | Location | Date(s) | Acreage | Other/Homes Lost |
| Roundup Loop Fire-Oroville | Home owner started working with saw/sparks | 3/21 | | Small |
| Mill Road Fire | Omak/Okanogan | 4/12 | 2 acres | |
| Garfield Fire | FD 3 & 8 | 4/15 | | Power line down |
| Old Riverside Hwy Fire | | 4/15 | | |
| Signal Hill Fire | Hwy 20 & Old Twisp | 4/17 | 30 | DNR; lost 1 house |
| Emily Road Fire | | 4/18 | | |
| Cayse Mtn Road Fire | | 5/19 | | Uncontrolled burn |
| Lester/Bear Rd Fire (Winthorp) | | 5/20 | 1 | DNR & FD 6 |
| Crumbacher Fire | PUD power pole started fire on side of road | 7/8 | 7.2 | |
| Crane Road Fire – **Douglas County** | West of Bridgeport | 7/31 | | |
| Antoine Fire Type 2 Team | Near Wells Dam and burned in both Chelan and Okanogan County | 8/5 – 8/9 | 6,837 | |
| Cayuse Grass Fire | | 8/11 | | |
| Buffalo Lake Road Fire – | Near Elmer City, past Coulee Dam, along the shore of Roosevelt Lake – Colville Tribe, BIA – etc. we did evac. planning for Coulee Dam and Elmer City. | 8/14 – 8/20 | 11,299 | |
| Frosty Fire | Grass and timber | 8/26 | 5 acres | |
| Davis Canyon Fire | 6 miles S. of Malott | 8/28 | | |
| Barker Canyon Complex Fire<br>- Barker Canyon<br>- Leahy Junction<br>- Tim's Landing<br>Type 2 Team | Douglas county but Scott responded because of the Town of Coulee Dam | 9/8 | 91,883 Douglas County | |
| Okanogan Complex Fire<br>- Hunter Mtn<br>- Buckhorn<br>- Leecher Fire<br>Type 2 Team | Lightning strikes; Carlton area; Level 3 notifications | 9/8 - 30 | 6,619 | |
| Goat Fire | Human caused other side of Alta Lake area | 9/16 – 10/2 | 7,378 | |
| St Mary's Mission Road Fire | Intersection Hwy 155 and St Mary's Mission Road – Tribal Land | 10/2 – 12' ish | 16,853 | |
| Chilliwist Fire | Human caused/escaped confirmed burn ; FD #3, 7 & 15 | 11/7 | 348 | |

| 2012 | | | | |
|---|---|---|---|---|
| Incident | Location | Date(s) | Acreage | Other/Homes Lost |
| | responded | | | |
| Flooding | North End | 3/15 - 18 | | |
| Flooding | Hwy 97 & 20, Salmon Creek Road, Mostly focused on Okanogan, Conconully, Loomis, Aeneas and upper Beaver – PUD isolated outages transformer failures Oroville and Aeneas | 7/15 | | |
| Severe Storm and Flash Flooding | Mainly flash floods in Omak; trees down lots of road washed out and tree on house in Loomis area<br>WAEMD visited 8/3 – Flooding down town Omak; Nespelem water problem; Coulee Dam minor damage; MV Hospital damaged; Riverside water system damaged – lots of county road damage | 7/20 | | – Received FEMA major disaster declaration (DR-4083) Severe Storm, Straight-line Winds, and Flooding |

## *Potential Funding Sources*

The following is a list of funding sources that may be available for certain types of mitigation and/or prevention projects recommended in the mitigation strategies. This is not an inclusive list nor is every program on this list available every year. These types of programs typically change in format, requirements, and funding available on an annual basis.

Program: **Rural Fire Assistance**
Source: Bureau of Land Management
Description: BLM provides funds to rural fire departments for wildfire fighting; also provides wildland fire equipment, training and/or prevention materials.
More info: Contact BLM RFA Coordinator or http://www.blm.gov/nifc/st/en/prog/fire/fuelsmgmt.html

Program: **Communities at Risk**
Source: Bureau of Land Management
Description: Assistance to communities for hazardous fuels reduction projects in the wildland urban interface; includes funding for assessments and mitigation planning.
More info: http://www.blm.gov/nifc/st/en/prog/fire/community_assistance.html

Program: **DNR Fire District Assistance Program**
Source: Washington DNR
Description: The purpose of these programs is to provide local and rural fire districts in Washington State opportunities to establish, develop, improve, and maintain their wildland firefighting capabilities. Improving the capabilities of local districts helps defend Washington against wildfire. These programs can make several types of training, equipment, and other assistance more affordable to local fire districts.
More info: www.dnr.wa.gov

Program: **Fire Management Assistance Grant Program (FMAGP)**
Source: Washington Military Department
Description: The federally funded Fire Management Assistance Grant Program (FMAGP) provides financial assistance to state, local, and federally recognized tribal governments for the mitigation, management, and control of fires on publicly or privately owned forests or grasslands. A federal fire management assistance declaration may be requested and issued for an uncontrolled fire when a threat of a major disaster exists.
More info: www.emd.wa.gov

Program: **Volunteer Fire Assistance**
Source: US Forest Service
Description: Provides funding and technical assistance to local and volunteer fire departments for organizing, training and equipment to enable them to effectively meet their structure and wildland protection responsibilities. US Forest Service grants provided to state foresters through state and private grants under the authority of Coop Forestry Assistance Act.
More info: http://www.fs.fed.us/fire/partners/vfa/help/guide.htm

Program: **Federal Excess Property**
Source: US Forest Service
Description: Provides assistance to state, county and local governments by providing excess federal property (equipment, supplies, tools) for wildland and rural community fire response.
More info: Contact Washington Department of Natural Resources

Program: **Economic Action Program**
Source: US Forest Service
Description: A USFS, state and private program with involvement from local Forest Service offices to help identify projects. Addresses long-term economic and social health of rural areas; assists the development of enterprises through diversified uses of forest products, marketing assistance, and utilization of hazardous fuel byproducts.
More info: Okanogan-Wenatchee National Forest (509)-664-9200

Program: **Forest Stewardship Program**
Source: US Forest Service
Description: Funding helps enable preparation of management plans on state, private and tribal lands to ensure effective and efficient hazardous fuel treatment.
More info: Washington Department of Natural Resources

Program: **Community Planning**
Source: US Forest Service
Description: USFS provides funds to recipients with involvement of local Forest Service offices for the development of community strategic action and fire risk management plans to increase community resiliency and capacity.
More info: Okanogan-Wenatchee National Forest (509)-664-9200

Program: **Firefighters Assistance**
Source: Federal Emergency Management Agency and US Fire Administration Program
Description: Financial assistance to help improve fire-fighting operations, services and provide equipment.
More info: www.fema.gov

Program: **Pre-Disaster Mitigation Program**
Source: Federal Emergency Management Agency
Description: Emergency management assistance to local governments to develop hazard mitigation plans.
More info: Washington Military Department Emergency Management Division

Program: **Community Facilities Loans and Grants**
Source: Rural Housing Service (RHS) U. S. Dept. of Agriculture
Description: Provides grants (and loans) to cities, counties, states and other public entities to improve community facilities for essential services to rural residents. Projects can include fire and rescue services; funds have been provided to purchase fire-fighting equipment for rural areas. No match is required.
More info: http://www.rurdev.usda.gov or local county Rural Development office.

Program: **Sale of Federal Surplus Personal Property**
Source: General Services Administration
Description: This program sells property no longer needed by the federal government. The program provides individuals, businesses and organizations the opportunity to enter competitive bids for purchase of a wide variety of personal property and equipment. Normally, there is no use restrictions on the property purchased.
More info: www.gsa.gov

Program: **Reimbursement for Firefighting on Federal Property**
Source: U. S. Fire Administration, Federal Emergency Management Agency
Description: Program provides reimbursement to fire service organizations that have engaged in firefighting operations on federal land. Payments can be for direct expenses and direct losses.
More info: www.cfda.gov

Program: **Hazard Mitigation Grant Program**
Source: Federal Insurance and Mitigation Administration, FEMA

Description: Provides states and local governments with financial assistance to implement measures to reduce or eliminate damage and losses from natural hazards. Funded projects have included vegetation management projects. It is each State's responsibility to identify and select hazard mitigation projects.

More info: www.fema.gov

## *List of Acronyms*

| | |
|---|---|
| **DOH** | Washington Department of Health |
| **EMD** | Washington Military Department Emergency Management Division |
| **FAA** | Federal Aviation Administration |
| **USDA** | United States Department of Agriculture |
| **NRCS** | Natural Resources Conservation Service |
| **NWS** | National Weather Service |
| **NOAA** | National Oceanic and Atmospheric Administration |
| **FEMA** | Federal Emergency Management Agency |
| **DOT** | Washington Department of Transportation |
| **ARES** | Amateur Radio Emergency Services |
| **WSP** | Washington State Police |
| **WSU** | Washington State University |
| **DOE** | Washington Department of Ecology |
| **DNR** | Washington Department of Natural Resources |
| **DFW** | Washington Department of Fish and Wildlife |
| **BLM** | Bureau of Land Management |

This plan was developed by Northwest Management, Inc. under contract with Okanogan County Emergency Management.

**Copies of this Plan can be obtained by contacting:**

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