LINCOLN COUNTY, WASHINGTON

MULTI-HAZARD MITIGATION PLAN

APRIL 2011

Prepared By

Northwest Management, Inc.

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 **Lincoln County, Washington Multi - Hazard Mitigation Plan** was developed in 2010 by the Lincoln 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.

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 Lincoln County, Washington. The planning team responsible for implementing this project was led by Lincoln County Emergency Management. Agencies and organizations that participated in the planning process included:

- Lincoln County Commissioners and County Departments
- Lincoln County Fire District #5
- City of Davenport
- Town of Reardan
- Town of Odessa
- Lincoln County Fire District #4
- Northwest Management, Inc.
- Amateur Radio Group
- Lincoln Hospital District
- Davenport Ambulance
- Avista Utilities
- Lincoln County Public Health District
- Town of Creston
- Odessa Fire Department
- Town of Wilbur
- Lincoln County Fire District #7
- Town of Harrington
- City of Sprague
- National Park Service

In June of 2010, Lincoln County Emergency Management solicited competitive bids from companies to provide the service of leading the assessment, developing the data, and writing the Lincoln 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
- Avalanche
- Seiche
- Volcano
- Drought

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
- Terrorism/Civil Unrest

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 Lincoln County.

		Magnitude		
		Low	Medium	High
Frequency	Low	**Avalanche**	**Landslide Seiche**	**Earthquake Volcano**
	Medium	**Flood**	**Drought**	
	High		**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 Lincoln 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

Lincoln County Planning Philosophy

This effort will utilize the best and most appropriate science from all partners and will integrate local and regional knowledge about natural hazards while meeting the needs of local citizens and the regional economy.

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.

Jurisdictional Planning and Mitigation Goals

Each participating jurisdiction in Lincoln County was asked to develop their own set of planning and mitigation goals. During the first planning committee meeting, the group discussed several overall short-term and long-term goals as well as goals for the planning process itself. Members of the committee were given a list of example goals statements and a blank goals worksheet to fill out and return. The following section outlines the goals submitted by each jurisdiction.

Lincoln County:

1. *Planning* – Educate communities about the unique challenges of natural hazard preparedness in the County.
2. *Mitigation* – Reduce the impact of hazard events and potential losses incurred by both public and private residents and entities.
3. *Mitigation* – Establish mitigation priorities and develop feasible solutions to hazard-related issues.
4. *Planning* – Strategically locate and plan infrastructure projects that take into consideration the impacts of natural hazards.
5. *Planning* – Seek opportunities to protect, enhance, and integrate emergency and essential services with land use planning and natural resource management.
6. *Mitigation* – Develop mitigation strategies that will alleviate or lessen the impacts of severe weather events throughout the County.
7. *Planning* – Continue to work with local partners to reduce the risks of ignitions and potential losses from wildland fire events.
8. *Planning* – Develop protocol prioritization for the protection of people, structures, infrastructure, and unique ecosystems that contribute to the sustainability of the regional economy and our way of life.

City of Davenport

1. *Planning* – Through pre-planning and mitigation strategies, reduce the mortality and morbidity in citizens resulting from disasters.
2. *Planning* – Protect life and property by planning for disasters and developing mitigation strategies.
3. *Planning* – Develop land use policies to alleviate hazard risks and impacts for future development.
4. *Planning* – Strengthen emergency operations plans and procedures by increasing collaboration among public agencies, non-profit organizations, business, and industry.
5. *Mitigation* – Reduce the impact of hazards events and potential losses incurred by both public and private residents and entities.
6. *Mitigation* – Establish county and city participation in the National Flood Insurance Program and strive to reduce premiums by lowering their Community Rating System score.
7. *Planning* – Educate communities about the unique challenges of natural hazard preparedness in the county.
8. *Planning* – Work with local organizations to improve sheltering capacity during severe weather events.

City of Sprague

1. *Planning* – Establish mitigation priorities and develop mitigation strategies.
2. Planning - Reduce the impact of hazard events and potential losses incurred by both public and private residents and entities.
3. *Planning* - Strengthen emergency operations plans and procedures by increasing collaboration among public agencies, non-profit organizations, business, and industry.
4. *Planning* - Work with local organizations to improve sheltering capacity during severe weather events.

Town of Almira

1. *Mitigation* – Prepare and implement emergency plans in order to reduce the impacts from weather.
2. *Planning* - Bring new businesses to Almira to help improve the sustainability of the community.
3. *Planning* - Replace the town's 80 year old water system including the water tower, the main line, and improvement existing municipal wells.
4. *Planning* – Establish feasible mitigation strategies and priorities.

Town of Creston

1. *Planning* – Minimize the impacts of emergencies and disasters on the people, property, environment, and economy of the Town of Creston.
2. *Planning* - Educate the community about natural and man made hazard emergency situations.
3. *Mitigation* – Reduce the impact of hazard events and potential losses when possible through emergency warning notifications.
4. *Planning* - Establish mitigation priorities and develop strategies.
5. *Mitigation* - Work with Lincoln County in identifying hazardous material flow through the County.
6. *Mitigation* - Work with local organizations to improve sheltering capacity during severe weather events.

Town of Harrington

1. *Planning* - Work with the local school district to improve sheltering capacity during severe weather events including the use of the Harrington Memorial Hall.
2. *Mitigation* – Enforce regulations and restrictions for building in areas of special flood hazard (Ordinance 451) that meet requirements for National Flood Insurance as set out in Harrington's Comprehensive Plan.
3. *Planning* – Work with local partners to coordinate mitigation planning and disaster response.
4. *Planning* – Continue to work with the International Code Council to meet the detailed requirements of the 1991 Uniform Building Code.

Town of Odessa

1. *Planning* – Through the continued progression of mitigation with county operations and services, the advancement of emergency services will provide continued protection for the citizens of the Town of Odessa, reducing the morbidity and mortality in the event of a devastating event.
2. *Mitigation* – Safeguard the well being of all individuals in our community and their properties; while protecting and preserving the natural properties of our environment.

Town of Reardan

1. *Planning* – Protect residents during hazards by immediate notification and possible evacuation and prompt cleanup efforts.
2. *Planning* – 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.

Town of Wilbur

1. *Planning* – Educate communities about the unique challenges of natural hazard preparedness in the County.
2. *Mitigation* – Establish mitigation priorities and develop feasible solutions.
3. *Planning* – Strategically locate and plan infrastructure projects that take into consideration the impacts of natural hazards.

Lincoln Hospital District

1. *Planning* – Effectively and efficiently respond to a variety of emergent or critical situations affecting routine operations and Lincoln Hospital.
2. *Planning* – Through pre-planning and mitigation strategies, reduce the mortality and morbidity in Lincoln County citizens resulting from disasters.
3. *Planning* – Protect life and property in Lincoln County by planning for disasters and developing mitigation strategies.

Odessa Memorial Healthcare Center

1. *Planning* – Establish mitigation priorities and develop mitigation strategies.
2. *Planning* – Strategically locate and plan infrastructure projects that take into consideration the impacts of natural hazards.
3. *Planning* – Strengthen emergency operations plans and procedures by increasing collaboration among public agencies, non-profit organizations, business, and industry.
4. *Planning* - Seek opportunities to protect, enhance, and integrate emergency and essential services.
5. *Mitigation* - Odessa Memorial Healthcare Center will work with the town of Odessa and local organizations to improve sheltering capacity during severe weather events.
6. *Planning* - Continue to work on action items and proposed projects identified in the Lincoln County Community Wildfire Protection 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.

Lincoln County Comprehensive Emergency Management Plan (2009)

The purpose of the Comprehensive Emergency Management Plan (CEMP) is to guide the Lincoln County Department of Emergency Management in its responsibility to preserve lives, protect property and the environment, and to ensure public health in times of natural or technological disasters. The organization also provides for the coordination of recovery efforts following disasters, and will provide actions to mitigate the effects of such disasters, to the extent possible.

The CEMP is an all hazard plan that is promulgated by Lincoln County Board of Commissioners and Mayors of the participating cities and towns within the county and applies to all local public and private entities and organizations participating and included in the plan.

The CEMP is an all hazard approach to emergency and disaster situations likely to occur in the county, as described in the Lincoln County Hazard Identification/Vulnerability Analysis (HIVA), and provides the foundation for:

1. The establishment of an organization and guidelines for efficient and effective use of government, private sector and volunteer resources.

2. An outline of local government responsibilities in emergency management activities as described under RCW 38.52 and other applicable laws.
3. An outline of other participants' responsibilities in emergency management activities as agreed upon by the participating agencies and organizations.

Lincoln County Comprehensive Plan (1983)

The Comprehensive Plan is a legal document for guiding the future development of Lincoln County and is currently undergoing a revision process to be concluded in 2010-2011. The Plan is based upon the stated long-term goals and objectives of the county residents. The 1983 document covers land use, recreation, transportation, and economic elements.

Lincoln County Code: Title 16 – Land Divisions

The process by which land is divided is a matter of concern and should be administered in a uniform manner by cities, towns and counties throughout the state. The purpose of this title is to regulate the division of land and to promote the public health, safety, and general welfare in accordance with established standards to prevent the overcrowding of land; to lessen congestion on the streets and highways; to promote effective use of land; to promote safe and convenient travel by the public on streets and highways; to provide adequate provisions for light and air; to facilitate adequate provisions for water, sewerage, parks and recreation areas, sites for schools and school grounds and other public requirements; to provide for proper ingress and egress; to provide for the expeditious review and approval of proposed subdivisions, which conforms to zoning and development standards and commercial needs of the citizens of the County and where to require uniform monumenting of land subdivisions and conveyancing by accurate legal description. In accordance with Chapter 58.17 RCW, Lincoln County has prescribed a method for controlling the division of land in unincorporated areas. Whereas the board of county commissioners deems the controls, standards, procedures and penalties set forth in this title to be essential to the protection of the public health, safety and general welfare of the citizens of Lincoln County and the adoption to be in the public interest.

Lincoln County Code – Flood Damage Prevention

Chapter 15.16 of the Lincoln County Code[4] says that the flood hazard areas of Lincoln County are subject to periodic inundation, which results in loss of life and property, health and safety hazards, disruption of commerce and governmental services, extraordinary public expenditures for flood protection and relief and impairment of the tax base, all of which adversely affect the public health, safety and general welfare. These flood losses are caused by the cumulative effect of obstructions in areas of special flood hazards, which increase flood heights and velocities and when inadequately anchored, damage uses in other areas. Uses that are inadequately flood-proofed, elevated or otherwise protected from flood damage, also contribute to the flood loss. In order to accomplish its purposes, this chapter includes methods and provisions for:

[4] Lincoln County, Washington. January 2005. Lincoln County Code – Title 15 Building and Construction, Chapter 15.16 Flood Damage Prevention. Lincoln County Planning Services. Lincoln County Board of Commissioners. Davenport, Washington.

- Restricting or prohibiting uses which are dangerous to health, safety and property due to water or erosion hazards or which result in damaging increases in erosion or in flood heights or velocities;
- Requiring that uses vulnerable to floods, including facilities, which serve such uses, be protected against flood damage at the time of initial construction;
- Controlling the alteration of natural flood plains, stream channels and natural protective barriers, which help accommodate or channel flood waters;
- Controlling filling, grading, dredging and other development, which may increase flood damage; and
- Preventing or regulating the construction of flood barriers, which will unnaturally divert flood waters or may increase flood hazards in other areas.

Creston Flood Damage Prevention Ordinance

The purpose of Creston's Flood Damage Prevention Ordinance is to promote public health, safety, and general welfare; reduce the annual cost of flood insurance; and minimize public and private losses due to flood conditions in specific areas. The flood hazard areas of Creston are subject to periodic inundation which results in loss of life and property, health and safety hazards, disruption of commerce and governmental services, extraordinary public expenditures for flood protection and relief, and impairment of the tax base. In order to accomplish its purposes, the ordinance includes methods and provisions for:

1. Restricting or prohibiting uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities;
2. Requiring that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;
3. Controlling the alteration of natural flood plains, stream channels, and natural protective barriers, which help accommodate or channel flood waters;
4. Controlling filling, grading, dredging, and other development which may increase flood damage; and
5. Preventing or regulating the construction of flood barriers that unnaturally divert floodwaters or may increase flood hazards in other areas.

Creston Critical Area Ordinance

This ordinance establishes that wetlands, aquifer protection areas, critical wildlife habitat, frequently flood areas, and geologically hazardous areas are classified as critical areas. Cities and counties are required to use best available science in developing policies and regulations to protect the functions and values of critical areas. Any development proposed within a designated critical area shall be subject to project review.

Lake Roosevelt National Recreation Area Fire Management Plan (2000)

The preparation of a Wildland Fire Management Plan is required by the National Park Service (NPS) Wildland Fire Management Guidelines (DO-18), which states: "All parks with vegetation that can sustain fire must have a fire management plan. The resource management objectives of the park may determine whether a prescribed fire component is needed". Vegetation at Lake Roosevelt National Recreation (LRNRA) Area includes at least three fire prone ecosystems, these being steppe (semi-arid grassland), shrub/steppe, and ponderosa pine forests.

The NPS at LRNRA needs this plan to guide management decisions in response to wildland fire incidents occurring within LRNRA and adjacent to the area's boundary. Presently and in the future all wildland fires will be suppressed. The size and configuration of LRNRA's land base eliminates the option of using wildland fire to obtain other resource objectives that may be possible in a park with a large aggregate acreage. In contrast, the preferred alternative proposes to add a prescribed fire component that would enhance the NPS's ability to manage and improve the park's ecosystem components and processes while providing for firefighter and public safety.

Lake Roosevelt National Recreation Area Shoreline Management Plan Environmental Assessment (2009)

The Shoreline Management Plan is intended to evaluate the need to modify visitor access opportunities along the shoreline, whether it is accessed from the lake or from land. Alternatives in the Management Plan make recommendations regarding future management of the shoreline to accommodate visitors and fluctuating lake levels, to better protect natural, cultural and scenic resources, and to more effectively distribute visitor use.

Swanson Lakes Wildlife Area Management Plan (2006)

Management goals for the Washington State Department of Fish and Wildlife (WADFWS) Swanson Lakes Wildlife Area are to preserve habitat and species diversity for wildlife resources, maintain healthy populations of game and non-game species, protect and restore native plant communities, and provide diverse opportunities for the public to encounter, utilize, and appreciate wildlife and wild areas.

One of the agency's goals, as outlined in the Wildlife Area Management Plan, is to provide fire management on agency lands, which they do by maintaining fire protection contracts with the local fire districts. One of the agency's concerns regarding wildland fire is that it threatens sensitive habitats within the Wildlife Area. Swanson Lakes Wildlife Area contains fire-sensitive habitat that is critical to the survival of the Columbian sharp-tailed grouse. Deciduous trees and shrubs provide critical winter habitat, and the cover associated with tall bunchgrasses provides needed hiding and escape cover for sharp-tailed grouse.

Lincoln County Livestock Evacuation Program (Ongoing)

Lincoln County is currently working on an effort to provide for the evacuation of all livestock during emergency situations, particularly wildland fire. This effort is organized by a team of volunteers that helps contact livestock owners in the affected areas and work together to either cut fences to allow animals to escape on their own or evacuate the animals to designed round up grounds. The volunteers involved in this program have organized the necessary equipment including trucks, trailers, and communication devices as well as on-call veterinarians to quickly and safely provide for the safety of the animals. The group involved

in this program is working closely with the Sheriff's office to develop a formal plan outlining the program and its implementation.

Bureau of Land Management, Spokane Field Office Fire Management Plan (2004)

The purpose of the BLM's Spokane District Office Fire Management Plan (FMP) is to identify and integrate all wildland fire management guidance, direction, and activities required to implement national fire policy and fire management direction from the following: Federal Wildland Fire Management Policy and Program Review-1995 and 2001; The Interagency Fire Management Plan Template; and A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy Implementation Plan.

The FMP was developed around the Spokane District office fire management program and addresses all aspects of it, including wildland urban interface (WUI), rural fire assistance, prescribed fire, fuels management, prevention, and suppression. The FMP identifies a fire program that meets its identified fire management objectives.

Washington State Homeland Security Region 9 All Hazards Emergency Preparedness Strategic Plan

The Washington State Homeland Security Region 9 All Hazards Emergency Preparedness Plan[5] (Strategic Plan) was developed to coordinate the activities of the 10 counties in Region 9 as they seek to increase region-wide emergency preparedness and improve critical emergency response and recovery capabilities for large scale incidents. The stakeholders from throughout Region 9 including Adams, Asotin, Columbia, Ferry, Garfield, Lincoln, Pend Oreille, Spokane, Stevens and Whitman Counties and the Kalispel, Spokane, and Colville (within Ferry County) Tribes, came together to develop the plan the purpose of which is to provide a strategic framework for shared emergency preparedness efforts. A critical step in the planning process was the development of the Region 9 Threat and Risk Assessment and Vulnerability Analysis. The results of this analysis were used as a planning tool to provide linkages among hazards, threats, risks and vulnerabilities and to coordinate capabilities-based planning efforts. The capabilities self-assessment was used to identify which critical capabilities should be a focus for improvement Region-wide. Region-wide strategies were developed for implementation in order to reach each of the identified target capabilities. Region-wide strategies are the projects and performance measures that form the heart of the Strategic Plan.

[5] Washington State Homeland Security Region 9. All Hazards Emergency Preparedness Strategic Plan. Spokane, Washington. February 2011.

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 Lincoln County Emergency Manager, Sheriff Wade Magers, lead the planning committee efforts. Northwest Management, Inc. Project Co-Managers were Tera R. King and Vaiden Bloch. 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 public meetings. 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 meetings were 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. Meetings with the committee were held throughout the planning process to facilitate a sharing of information between cooperators.

Description of the Planning Process

The Lincoln 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.

Lincoln County Emergency Manager, Sheriff Wade Magers, began organizing the planning committee in June of 2010 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.	
Adam Kelsey, National Park Service	Leslie Felker, Town of Almira
Andrew Stenbeck, Washington Department of Natural Resources	Linda Fisher, Lincoln County Treasurer
Andy Lefevre, Town of Reardan	Lynn Geissler, Lincoln County Amateur Radio Emergency Services
Arletta Hoffman, City of Sprague	Lynn McWhorter, Town of Wilbur
Bill Bell, Town of Odessa	Mark Stedman, Sprague School District
Brian Finkbeine, Town of Odessa	Matt Castle, Washington Department of Natural Resources
Brian Telford, Lincoln County Sheriff's Office	Matt Schneider, City of Davenport
Bruce Holloway, Spokane County Fire District #3	Mike Finch, Lincoln County Fire District #7
Carol Paul, Lincoln County Fire District #4 and Community of Edwall	Mike Piper, Lincoln County Fire District #5
Carol Schott, Odessa Memorial Healthcare Center	Monte Swenson, Harrington School District
Craig Haden, Lincoln County Fire District #7 and Town of Wilbur	Neil Fink, Town of Odessa
Dale Lathrop, Lincoln County Amateur Radio Emergency Services	Paul Gillilaud, City of Harrington
Dan Johnson, Washington State Police	Peggy Semprimoznik, Lincoln County Clerk
Dave Ayers, Avista Corporation	Phil Nollmeyer, Lincoln County Public Works
Dennis Bly, Lincoln County Board of Commissioners	Rick Becker, Lincoln County Public Works
Dennis Pinar, Lincoln County Fire District #8	Roger Ferris, Washington Fire Commissioners Association
Doug Asbjornsen, Reardan-Edwall School District	Ron Mielke, Lincoln County Fire District #6
Doug Plinsky, Town of Odessa	Ron Shepherd, Lincoln County Prosecuting Attorney and Coroner
Ed Dzedzy, Lincoln County Public Health District	Ryan Rettowski, Town of Reardan
Eric Cassidy, Lincoln County Hospital	Sandy Buchanon, Lincoln County Hospital
Gene Johnson, Lincoln County Fire District #5	Scott Hutsell, Lincoln County Board of Commissioners
Jaime Smith, National Park Service	Shauna Schmerer, Almira School District
Jill Freeze, Davenport School District	Shelly Johnston, Lincoln County Auditor
Jim Kowalkowski, Davenport School District	Sherman Johnson, Town of Reardan
Jo Borden,Lincoln County 911 Coordinator	Steve Goemmel, City of Davenport
John Strohmaier, Lincoln County Superior Court	Steve Peters, Lincoln County Emergency Communications
Jon Fink, Town of Odessa	Steven Finkbeiner, Odessa Memorial Healthcare Center
Josh Grant, Lincoln County District Court	Suellen White, Odessa School District
Judy Boutain, City of Sprague	Ted Hopkins, Lincoln County Board of Commissioners
Juli Anderson, Washington Department of Fish and Wildlife	Tom Martin, Lincoln Hospital District
Kathy Wilcox, Lincoln County Sheriff's Office	Wade Magers, Lincoln County Sheriff
Kelly Watkins, Lincoln County Undersheriff	William Wadlington, Town of Creston (Schools)

Many of these individuals attended the first planning committee meeting personally or sent a representative from their office or organization.

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** – Lincoln 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 Lincoln 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 Lincoln 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 Lincoln 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:

Lincoln County

- City of Davenport
- City of Sprague
- Town of Harrington
- Town of Almira
- Town of Reardan
- Town of Odessa
- Town of Creston
- Town of Wilbur
- Lincoln Hospital District
- Odessa Memorial Healthcare Center

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

The monthly planning committee meetings were 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. Scott Hutsell, Board of Commissioners, represented Lincoln County on the planning committee and reported progress and findings to the Board during their regular meetings. Sheriff Magers also reported to the Board regarding the progress of the Plan. Additionally, representatives on the planning committee periodically attended city council meetings to provide municipality leadership with updates on the project and to request reviews of draft material. All of the adopting jurisdictions maintained active participation in the monthly planning committee meetings.

- One-on-one correspondence and discussions between the planning committee leadership and the representatives of the municipalities and special districts was facilitated as needed to ensure understanding of the process, collect data and other information, and develop specific mitigation strategies. NMI representatives emailed and/or called each jurisdiction individually at least once during the planning process to answer questions and request additional information. Additionally, NMI participated in conference calls with the city of Sprague, the town of Harrington, and the Odessa Memorial Healthcare Center in order to explain the process and gather data for risk assessments and mitigation strategies.

- Public meetings were hosted by the towns of Reardan, Wilbur, Odessa, and Davenport. Each meeting was attended by involved elected officials, 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. NMI 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 as well as each city office hosted copies of the draft Lincoln 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. Nearly all of the participating jurisdictions retained a draft copy of Plan in a public area after the close of the official public comment period.

- Once the draft Plan was completed, planning committee leadership met with 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 Meetings

The following list of people participated in at least one of the planning committee meetings 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.

Lincoln County Participants:

*Indicates Adopting Jurisdiction

- *City of Davenport……Steve Goemmel
- *City of Sprague ……Arletta Hoffman
- *City of Sprague (Clerk/Treasurer) …… Ginny Rajola
- *Lincoln County (Board of Commissioners) ……Scott Hutsell
- *Lincoln County (Emergency Management & Sheriff's Office) ……Wade Magers
- *Lincoln County (Fire District #4) ……Carol Paul
- *Lincoln County (Fire District #5) ……Mike Piper
- *Lincoln County (Public Health District) ……Ed Dzedzy
- *Lincoln County (Public Works) ……Phil Nollmeyer
- *Lincoln County (Public Works) ……Rick Becker
- *Lincoln County (Sheriff's Office) ……Brian Telford
- *Lincoln Hospital District and *City of Davenport (Ambulance) ……Eric Cassidy
- *Lincoln Hospital District……Sandy Buchanon
- *Odessa Memorial Healthcare Center …… Carol Schott
- *Town of Almira ……Jeannette Coppersmith
- *Town of Creston (Schools) …… Bill Wadlington
- *Town of Creston……Karen Paulsen
- *Town of Harrington (Mayor) …… Paul M. Gillilaud

- *Town of Harrington ……Loretta Haugen
- *Town of Odessa (EMS) ……Brian Finkbeine
- *Town of Odessa (Fire Department) ……Don Strebeck
- *Town of Odessa (Mayor) ……Doug Plinski
- *Town of Odessa (Deputy Clerk) …… Carol Kniola
- *Town of Reardan (Mayor) ……Sherman Johnson
- *Town of Wilbur (Fire Chief) and Lincoln County (Fire District #7) ……Craig Haden
- *Town of Wilbur (Clerk/Treasurer) ……Lynn McWhorter
- *Town of Wilbur ……Carla Shirley
- *Town of Wilbur and Lincoln County (Fire District #7) ……Rob Coffman
- Amateur Radio Group ……James Wilson
- Avista Utilities …… Dave Ayres
- National Park Service……Marty Huseman
- Northwest Management, Inc.……Tera King
- Northwest Management, Inc.……Vaiden Bloch

Committee Meeting Minutes

Planning committee meetings were held from June 2010 through September 2010. The minutes and attendance records for each planning committee meeting are 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 Lincoln County planning committee, three formal news releases were submitted to the *Davenport Times, Wilbur Register, Odessa Record, Star, Huckleberry Press,* and the *Lincoln Advertiser*. 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 Lincoln 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 Lincoln 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.

Multi-Hazard Mitigation Planning Underway!

Davenport, WA – The planning process has been launched to complete a multi-jurisdictional Multi - Hazard Mitigation Plan for Lincoln County, Washington as part of the FEMA Pre-Disaster Mitigation program. This project is being funded through a FEMA Pre-Disaster Mitigation grant. The Lincoln County Multi - Hazard Mitigation Plan will include risk analyses, vulnerability assessments, and a summary of mitigation recommendations for disasters such as floods, landslides, wildfire, earthquakes, severe storms, and drought.

Northwest Management, Inc. has been retained by Lincoln County to provide risk assessments, mapping, field inspections, interviews, and to collaborate with the planning committee to author the Plan. The coordinating team includes all area fire districts, land managers, elected officials, county departments, law enforcement, local agencies, city officials, and others. Northwest Management specialists will conduct analyses and work with the committees to formulate recommendations for treatments and other action items that will help lessen potential impacts and losses from various natural hazards.

One of the goals of the planning process will be to increase the participating jurisdictions' eligibility for additional grants that will help reduce the risk and potential impacts of disaster events. The planning team will be conducting public meetings to discuss preliminary findings and to seek public input on the Plan's recommendations later this summer. For more information on the Lincoln County Multi - Hazard Mitigation Plan project, contact Sheriff Wade Magers at 509-725-9264 or Tera King, Northwest Management, at 208-883-4488 ext 133.

Public Meetings

Public meetings were scheduled in a variety of communities during the hazard assessment phase of the planning process. Venues for meetings were chosen by the planning team and located in each geographical area in order to provide an adequate opportunity for members of every community to attend without considerable travel. Public meetings 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.

Public meetings were held in Reardan (northeast corner), Wilbur (northwest corner), Davenport (central and major population center), and Odessa (southwest corner). These meetings were attended by a number of individuals on the committee and from the general public. Attendance at the public meetings was low to moderate, but included 10 in Davenport, 4 in Wilbur, 9 in Reardan, and 3 in Odessa. A record of attendance at public meetings 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.

Lincoln County

Multi - Hazard Mitigation Plan

Public Meetings!

September 27 - Community Hall (120 N Lake) in Reardan at 6:30pm
September 28 - Senior Center (101 NE Main St) in Wilbur at 6:30pm
September 29 - Memorial Hall (511 Park St) in Davenport at 7pm
September 30 - Old Town Hall (104 W 1st Ave) in Odessa at 6:30pm

These public meetings will address the **Multi - Hazard Mitigation Plan** being developed for Lincoln County, Washington. These meetings are open to the public and will include a slideshow presentation from Northwest Management, Inc and the planning team on the identified hazards and potential mitigation projects. Public input is being sought in order to better frame the region's efforts for hazard reduction projects, resource enhancements, and emergency preparedness.

Each meeting will last approximately 1 hour.

Learn about the assessments for flood, landslides, severe weather, wildland fire, earthquake, avalanche, inland tsunami, volcano, and drought in Lincoln County. Discuss YOUR priorities for how local communities can best reduce the impacts of these events.

Winter 2009 - Lincoln County Washington

Funnel Cloud in North Lincoln County - June 2009

For more information on the Lincoln County Multi-Hazard Mitigation Plan, please contact Lincoln County Sheriff, Wade Magera, at 509-725-9254.

Public Comment Period

A public comment period was conducted from January 3rd thru January 24th, 2011 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. Hardcopy drafts were printed and made available at the Lincoln County Courthouse and city halls in Davenport, Reardan, Odessa, Harrington, Almira, Creston, Wilbur, and Sprague. Each hardcopy was accompanied by a letter of instruction for submitting comments to the planning committee. Most of these communities retained the hardcopy draft well beyond the actual comment period with the anticipation that anyone

coming into their offices would have the opportunity to ask questions regarding the Plan or provide input. 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.

Lincoln County Hazard Plan Available for Public Review

Davenport, WA. The Lincoln County Multi-Hazard Mitigation Plan has been completed in draft form and is available to the public for review and comment at the Clerk's office in the Lincoln County Courthouse and the city halls in Davenport, Reardan, Odessa, Harrington, Almira, Creston, Wilbur, and Sprague. Electronic copies may be viewed in pdf format at http://www.co.lincoln.wa.us/. The public review phase of the planning process will be open from January 3rd, 2011 thru January 24th, 2011.

The purpose of the Lincoln County Multi-Hazard Mitigation Plan (MHMP) is to reduce the impact of hazards such as floods, landslides, severe weather, wildfire, earthquakes, and drought on Lincoln 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 identifies high risk areas as well as structures and infrastructure that may have an increased potential for loss due to a hazard event. The document also recommends specific projects that may help prevent disasters from occurring altogether or, at the least, lessen their impact on residents and property. The MHMP is being developed by a committee of city and county elected officials and departments, local and state emergency response representatives, land managers, hospital and school district representatives, and others.

The Lincoln County MHMP includes risk analysis at the community level with predictive models for where disasters are likely to occur. This Plan will enable Lincoln 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 will provide valuable information as we plan for the future.

Comments on the MHMP must be submitted to the attention of Sheriff Magers, Lincoln County Emergency Management, at WMagers@co.lincoln.wa.us or mailed to Lincoln County Emergency Management, PO Box 367, Davenport, Washington 99122 by close of business on January 24th, 2011. For more information on the Lincoln County Multi - Hazard Mitigation Plan process, contact Sheriff Magers at 509-725-9264 or Tera King, Northwest Management, at 208-883-4488 ext 133.

Web Posting

The draft plan was also posted for public review on the Lincoln County website homepage 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

Lincoln 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 regularly scheduled committee meetings in 2010, the committee members met to discuss findings, review mapping and analysis, and provide written comments on draft sections of the document. During the public meetings attendees observed map analyses, photographic collections, discussed general findings from the community assessments, and made recommendations on potential project areas.

Sections of the draft Plan were delivered to the planning committee members during the regularly scheduled committee meetings and emailed to the committee the following day. The completed first draft of the document was presented to the committee during the September 2010 planning committee meeting for full committee review. The committee spent several 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 January 3rd thru January 24th, 2011.

Plan Monitoring and Maintenance

As part of the policy of Lincoln 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. Lincoln 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 Lincoln 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 Lincoln 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

Lincoln County Characteristics

The information in this chapter has been excerpted from the Lincoln County Community Wildfire Protection Plans.[6]

Description of the Region

Prior to the 1800's, Lincoln County was inhabited by several groups of Native Americans. The rolling plains were considered wasteland by early military authorities. The first permanent settlers arrived in the mid-1800's and settled in the bottomlands close to the water sources. More people settled in Lincoln County with the construction of the Northern Pacific rail lines. The new arrivals discovered that the best agricultural land was on the deep soils of the rolling hills. Lincoln County was officially established in 1883 (Lincoln County Comprehensive Plan 1983). Currently, Lincoln County covers 2,311 square miles with 4.4 persons per square mile.

Geography and Natural Resources

Lincoln County is located on the Columbia Plateau, which was created by lava flows hundreds of feet thick, modified by glacial action and scoured by repeated floods during the Miocene and Pliocene eras. This fairly level, rough topography is called the Channeled Scablands and includes features such as plateaus, buttes, and channels. Channels are made up of outwash terraces, bars, loess islands and basins. The plateaus contain circular mounds of loess (biscuits) surrounded by cobble-size fragments of basalt. Soils generally consist of silt loams with varying amounts of rock or gravel, and basaltic rock outcroppings. Generally, the soils along on the northern-most end of the county are derived from the local parent material, which includes granite and basalt, covered by and mixed with imported material, which includes glacial, fluvial, and wind-deposited material. The topsoil layers are most often very thin and vulnerable (WDFW 2006).

The average daily temperature varies from a low of -13 degrees Fahrenheit to a high of 100 degrees Fahrenheit, averaging 46 degrees. There are 120 to 160 frost-free days in the growing season with annual precipitation averaging between 12 and 16 inches.[7]

Lincoln 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.

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[6] King, Tera and V. Bloch. 2009. Lincoln County Washington Community Wildfire Protection Plan. Northwest Management, Inc. Moscow, Idaho.

[7] Washington Department of Fish and Wildlife. 2006. Swanson Lakes Wildlife Area Management Plan. Wildlife Management Program, Washington Department of Fish and Wildlife, Olympia. 40 pp.

As a result, some forests and rangelands in Lincoln 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

Much of the terrain in Lincoln County is dominated by shrub-steppe communities, with some grassland interspersed with rock outcrops. The dominant grass and shrub-steppe communities are primarily composed of Bluebunch wheatgrass, Idaho fescue, Wyoming big sage, and rigid sage. Common shrub species are snowberry, rose, serviceberry, and Wax current. Although riparian areas are few, they offer important vertical structure in the vast extent of open grassland. These stands of trees and/or shrubs provide hiding, escape and thermal cover, shade, foraging and nesting sites, perches, and water sources. Overstory trees in riparian zones include quaking aspen, black cottonwood, and water birch, while the understory vegetation is composed of hydrophytic shrub species such as mock orange, alder, Rocky Mountain maple, black hawthorn, and willow.[8]

Located in a semi-arid transition zone, plant communities along the Lake Roosevelt National Recreation Area gradually change from steppe and shrub-steppe communities to ponderosa pine forest. As this is a transition zone between grassland and forest environment, large block definitions can be difficult due to affects of varying aspect and soil types. The three predominant plant communities include bunchgrass grasslands (steppe); shrub-steppe; and transition ponderosa pine forest. Other communities of note include wetland/riparian, lithosolic (rocky soil), rocky outcrops, and mixed-conifer forests.[9]

Table 3.1. Vegetative Cover Types in Lincoln County.

Cover	Acres	Percent
Herbaceous/Nonvascular-dominated	916,299	61%
No Dominant Lifeform	41,479	3%
Non-vegetated	17,945	1%
Shrub-dominated	455,676	30%
Tree-dominated	65,084	4%
Total	**1,496,482**	**100%**

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

[8] Washington Department of Fish and Wildlife. 2006. Swanson Lakes Wildlife Area Management Plan. Wildlife Management Program, Washington Department of Fish and Wildlife, Olympia. 40 pp.

[9] Hebner, Scott. 2000. Fire Management Plan Environmental Assessment. Lake Roosevelt National Recreation Area. October 2000. 63 pp.

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 Lincoln County will be the maintenance of the domestic watershed supplies in the Lower Spokane Watershed (WRIA 54), Lower Lake Roosevelt Watershed (WRIA 53), and Upper Crab-Wilson Watershed (WRIA 43).

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.[10]

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, and local

[10] 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.

governments) through national standards and strategies to control pollutant emissions from automobiles, factories, and other sources.[11]

Smoke emissions from fires potentially affect an area and the airsheds that surround it. Climatic conditions affecting air quality in northeast 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 Lincoln 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

Lincoln County grew in population to a peak of over 17,000 around 1910. During this time, there were more than 2,000 farms in the county and almost twice as many people lived in the rural areas as in the towns. Presently, farms are much larger in average acreage, but fewer in number. [12]

The U.S. Census Bureau estimates that Lincoln County has only experienced a 0.7% increase in population since 2000 compared to a 9.7% increase statewide. The Census Bureau also reported that there were 297 private nonfarm establishments (2006) and 4,151 households (2000). The median income for a household in Lincoln County in 2007 was $41,954, which is less than the statewide median of $55,628.

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[11] 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.

[12] Lincoln County. 1983. Lincoln County Comprehensive Plan. Lincoln County Planning Commission. Davenport, Washington. 34 pp.

Table 3.2. Lincoln County Historical Population Data.[13]	
Census	**Population**
1890	9,312
1900	11,969
1910	17,539
1920	15,141
1930	11,876
1940	11,361
1950	10,970
1960	10,919
1970	9,572
1980	9,604
1990	8,864
2000	10,184

Socioeconomics

This region has a total of 5,298 housing units and a population density of 4.4 persons per square mile as reported in the 2000 Census. Ethnicity is distributed as: white 95.6%, black or African American 0.2%, American Indian or Alaskan Native 1.6%, Asian 0.2%, and Hispanic or Latino 1.9.

Table 3.3. Income Categories (1999 data).		
	Number of Households	**Percent**
Households	**4,180**	**100.0**
Less than $10,000	395	9.4
$10,000 to $14,999	315	7.5
$15,000 to $24,999	673	16.1
$25,000 to $34,999	686	16.4
$35,000 to $49,999	804	19.2
$50,000 to $74,999	783	18.7
$75,000 to $99,999	291	7.0
$100,000 to $149,999	163	3.9
$150,000 to $199,999	41	1.0
$200,000 or more	29	0.7
Median household income (dollars)	35,255	(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 Lincoln County, approximately 8.4% of families with children under 18 years of age ate at or below the poverty level..

[13] Lincoln County. 1983. Lincoln County Comprehensive Plan. Lincoln County Planning Commission. Davenport, Washington. 34 pp.

With unemployment rates at 3.4% in Lincoln County, the regional unemployment rate was close to or below the national unemployment rate of 4.4% (1999 unemployment rates). The natural resource field comprises approximately 17.6% of the employed population in Lincoln 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.

	Number of Employed Workers	Percent
OCCUPATION		
Management, professional, and related occupations	1,537	37.0
Service occupations	659	15.9
Sales and office occupations	945	22.8
Farming, fishing, and forestry occupations	180	4.3
Construction, extraction, and maintenance occupations	464	11.2
Production, transportation, and material moving occupations	367	8.8
INDUSTRY		
Agriculture, forestry, fishing and hunting, and mining	731	17.6
Construction	284	6.8
Manufacturing	129	3.1
Wholesale trade	193	4.6
Retail trade	418	10.1
Transportation and warehousing, and utilities	236	5.7
Information	54	1.3
Finance, insurance, real estate, and rental and leasing	176	4.2
Professional, scientific, management, administrative, and waste management services	197	4.7
Educational, health and social services	1,011	24.3
Arts, entertainment, recreation, accommodation and food services	203	4.9
Other services (except public administration)	199	4.8

Employment within this region leans heavily towards private wage and salary workers which together, comprise more than 60% of the workforce. Government workers represent a significantly smaller proportion of the work force at approximately 25%.[14]

Development Trends

The vast majority of Lincoln County is privately owned. Most of the land is used for ranching and farming purposes; although, more and more residents are moving into the rural areas along the Lake Roosevelt shoreline. Numerous subdivisions and housing clusters are developing along the northern border of the county. Many permanent residents have established homesites along Lake Roosevelt; however, much of

[14] U.S. Census Bureau. 2000. American FactFinder Quick Tables for Lincoln County, Washington. Available online at http://factfinder.census.gov/home/saff/main.html?_lang=en.

the recent and planned development has been in response to the growing recreational or second home market in this area.

Table 3.5. Ownership Categories in Lincoln County.

Land Owner	Acres	Percent
Bureau of Land Management	80,875	5%
Bureau of Reclamation	6,093	0%
Lincoln County	758	0%
Washington Department of Natural Resources	44,176	3%
Private	1,346,138	90%
School District	95	0%
The Nature Conservancy	346	0%
Washington Department of Fish and Wildlife	17,638	1%
Washington Department of Transportation	364	0%
Total	**1,496,482**	**100%**

Hazard Management Capabilities

The Lincoln County Department of Emergency Management is responsible for the administration and overall coordination of the emergency management program for Lincoln 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 Lincoln County Central Dispatch / 911 Center, with support of the Emergency Operations Center, is designated as the primary communications center for Lincoln County. It maintains 24-hour emergency alerting and communications capability for receiving, coordinating and disseminating emergency information. The Lincoln County Central Dispatch / 911 Center provides communications coverage over the entire Lincoln 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 Lincoln County Emergency Operations Center if required.

All fire districts and agencies providing fire protection services in Lincoln 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 Lincoln County.

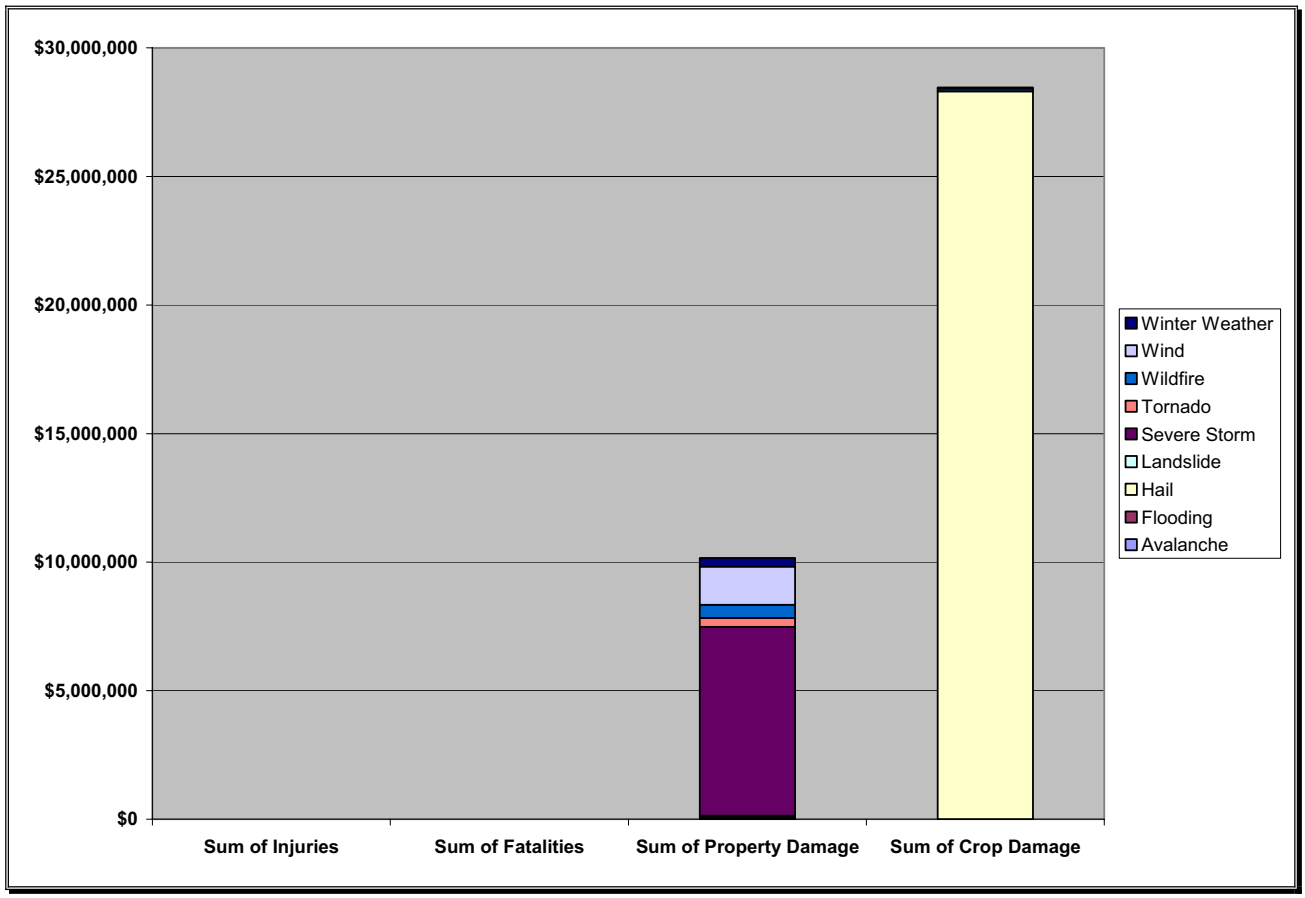
The data were derived from several existing national data sources such as National Climatic Data Center's monthly Storm Data publications and NGDC's Tsunami Event Database. With the release of SHELDUS 7.0, the database includes loss causing and/or deadly event between 1960 through 1975 and from 1995 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.[15]

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. Some of the missing events are considered to be major local hazard events such as the 1995 flooding in Harrington or the 1997 flooding in Sprague and Harrington.

[15] 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 3.1. Summary of SHELDUS Hazard Profile.



Chapter 4

Hazard Profiles

IN THIS SECTION:

- Flood Annex
- Earthquake Annex
- Landslide Annex
- Severe Weather Annex
- Wildland Fire Annex
- Avalanche Annex
- Seiche Annex
- Volcano Annex
- Drought 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.[16]

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.[17]

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[16] 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.

[17] 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.

There are three types of flash flooding:

- 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.[18]

Flooding from ice or debris jams is a relatively common phenomenon in eastern Washington, but not in Lincoln County specifically. Small jams can occur in many of the streams throughout Lincoln County, particularly at bridge abutments and culverts; however, these jams rarely cause significant damage or flooding.

The major source of flood waters in Lincoln 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 Lincoln 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

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

floods can happen at any time during the year, there are typical seasonal patterns for flooding in eastern Washington, based on the variety of natural processes that cause floods:

- 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 Lincoln County result primarily from melting of the snow pack
- Summer flash floods are caused by thunderstorms[19]

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."[20]

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.[21] 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.

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

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

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

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 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.[22]

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. Lincoln 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.

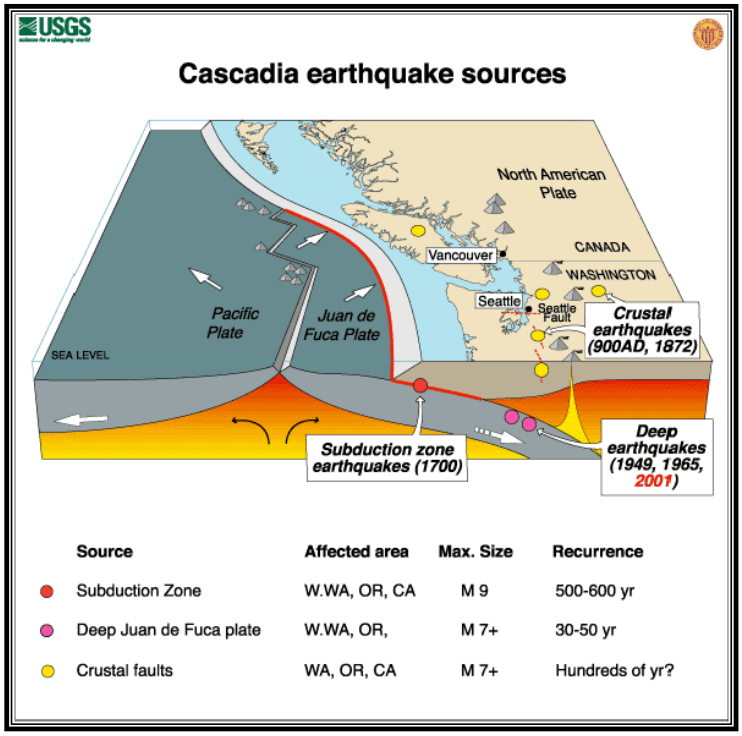
Related Causal Events	Related Effects
Severe Weather	Landslide
Dam Failure	Dam Failure
	Transportation Systems
	Infectious Disease/Epidemic/Pandemic
	Crop Loss
	Hazardous Materials

[22] 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.

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.[23]

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.[24]

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. [25]

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

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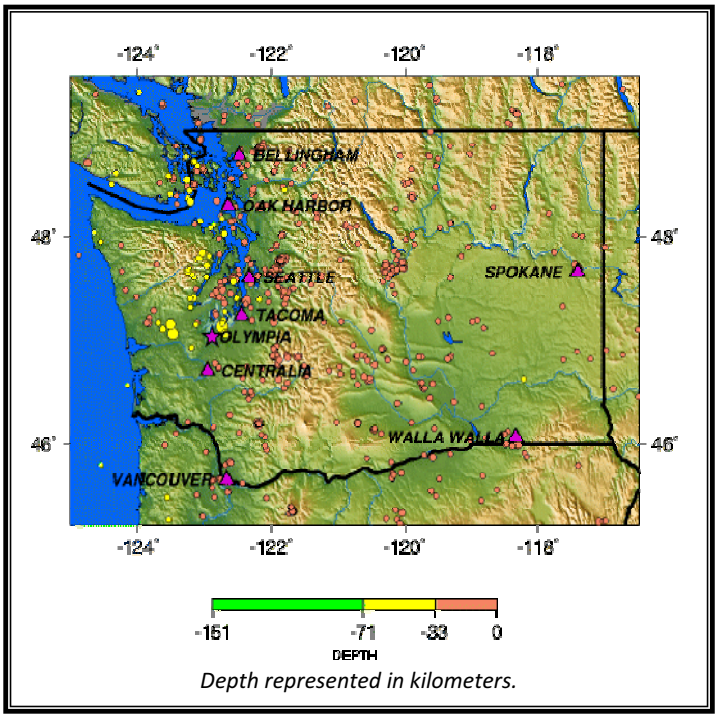
[23] FEMA. Federal Emergency Management Agency. Available online at www.fema.gov. September 2007.

[24] 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.

[25] 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.

reported historically in Washington have most frequently occurred deep beneath the Puget Sound region. The 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.



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. [26]

[26] 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.[27]

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

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. A

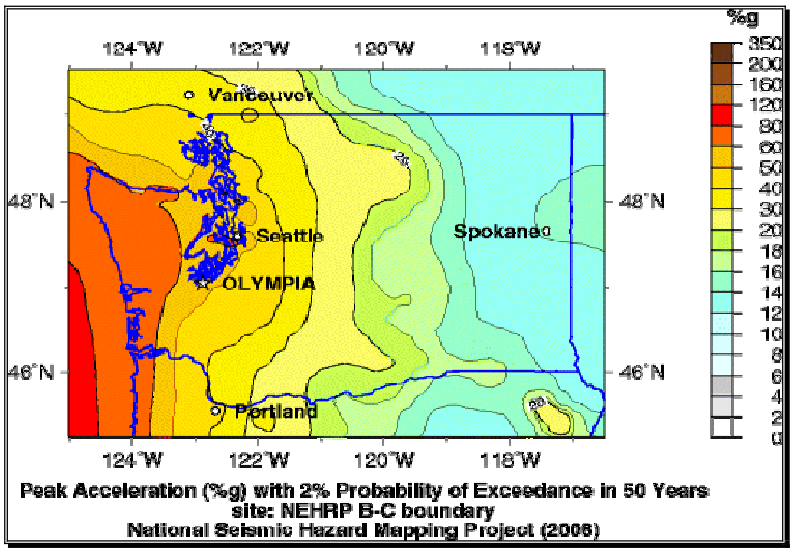
[27] Noson, Linda Lawrance, et al. Washington State Earthquake Hazards. Washington Division of Geology and Earth Resources Information Circular 85. Olympia, Washington. 1988.

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.

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 can not 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.[28] Locally, this hazard may be greater than that shown, because site geology may amplify ground motions.

Figure 4.3. Washington Peak Acceleration Map.



[28] Qamar, Anthony. "Earthquake Hazards in the Pacific Northwest." Cascadia Region Earthquake Workgroup. University of Washington Geophysics. January 2008.

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 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.[29]

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.[30]

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.

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

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

Table 4.3. 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

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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.[31]

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.[32]

Washington State has six landslide provinces, each with its own characteristics. Lincoln County is part of the Columbia Basin province which is underlain by Tertiary volcanic rocks that in general are not prone to landsliding. This province has extensive layers of sediments intermingling with basalt flows. Some large landslides have formed along the steep cliffs of the Columbia River Basalt Group that line the Columbia River and its tributaries. Landslides in this province include slope failures in bedrock and landslides in overlying sediments. Bedrock slope failures are most common in the form of very large ancient slumps or earth flows. A final triggering mechanism appears to have been over-steepening of a slope or removal of toe support by streams or glacial floods. Slide planes are generally in interbedded tuff or fine-grained filling valleys in the basalt. Sliding along Lake Roosevelt in northern Lincoln County is prevalent where Pleistocene deposits fill valleys cut into Paleozoic and Mesozoic igneous and metamorphic rocks.[33]

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

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

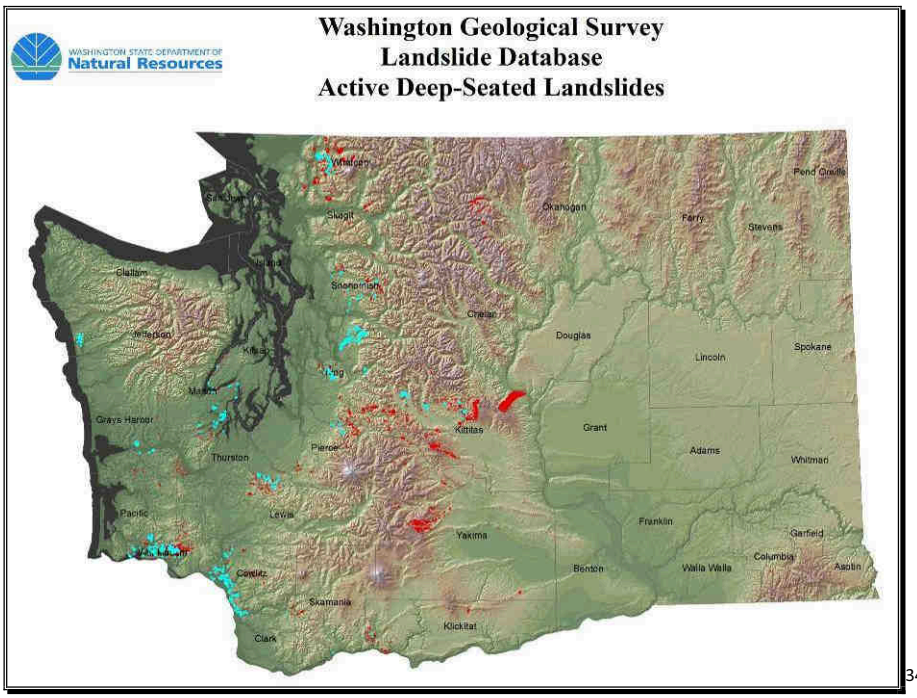
[32] Tetra Tech. DMA 2000 Hazard Mitigation Plan. Onondaga County, New York. April 2010.

[33] Radbruch-Hall, Dorothy H., et al. "Landslide Overview Map of the Conterminous United States." Geological Survey Professional Paper 1183. United States Department of the Interior. Washington. 1982.

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.



[34]

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.

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

- 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.[35]

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 Lincoln 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 Lincoln County is associated with the steeper slopes along the Columbia River on the northern border. 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.

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 4.4. Second-Order Hazards Related to Landslide Events.

Related Causal Events	Related Effects
Flood	Transportation System
Earthquakes	
Wildland Fire	

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

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Severe Weather

The overall weather patterns that affect Lincoln County are prevalent throughout eastern 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 eastern 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).

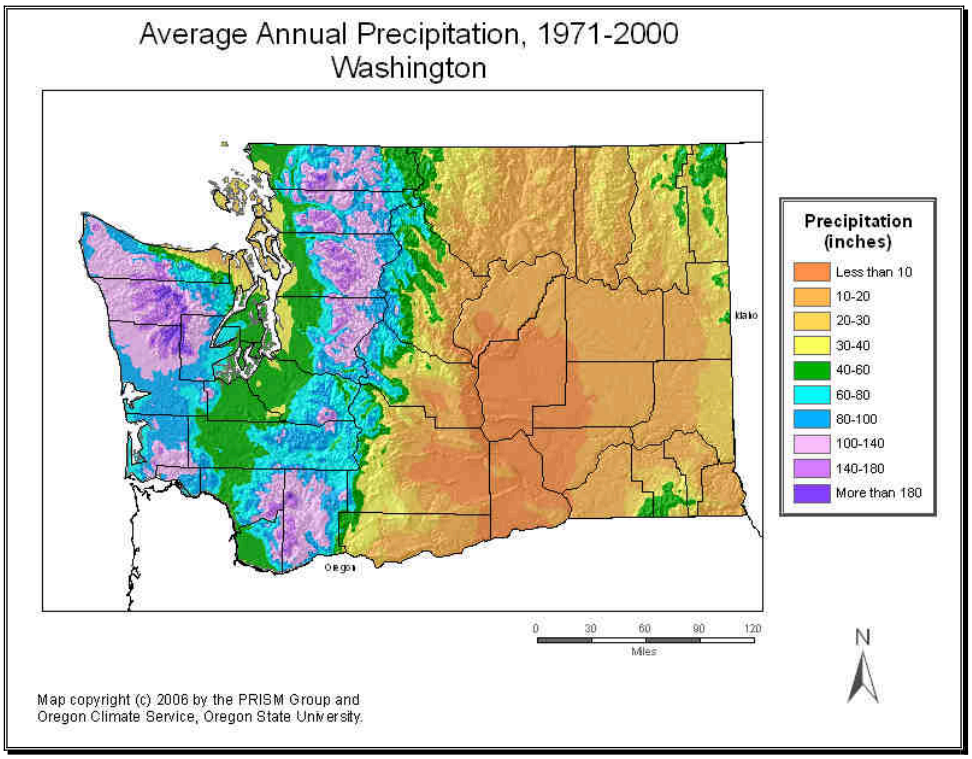
Lincoln County has a semi-arid continental type of climate which is hot and dry in the summer and cold and moderately humid in the winter. Temperatures are quite uniform over most of the county because terrain does not vary more than 1,200 feet from the lowest to highest elevations. Precipitation varies from an arid condition in the western part of the county to semi-arid conditions in the northeast. The entire area lies in the dry intermontane basin between the Cascades and the Rocky Mountain System.

Annual precipitation ranges from 8 inches and less along the western line of Lincoln County to over 20 inches in the northeastern corner. In general, the western two-thirds of the county receives less than 16 inches of rainfall. Available data shows that Odessa is the driest area with about 11 inches of precipitation per year. Davenport, in the northeast, receives about 16 inches. 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. A generally reliable snow cover through mid-winter protects winter wheat and barley sprouts from freezing temperatures. Precipitation is a major controlling factor in agriculture. Most crop farming is in a zone of 10 to 20 inch annual precipitation near the reliability margin for growing wheat. Climatic conditions require adherence to a dry farming system of summer fallowing grain crops and fall seeding to take advantage of maximum precipitation during the winter months. Precipitation in the northcentral 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.

Monthly temperature averages range from below freezing in mid-winter to highs of about 65 to 71 degrees Fahrenheit in mid-summer. Records at Davenport, Odessa, and Wilbur show that winter months are cold and summer months are hot. During December and January average temperatures range from 28 to 35 degrees while in July and August they range from 66 to 71 degrees.[36]

[36] Lincoln County, Washington. "History." Available online at http://www.co.lincoln.wa.us/About%20Lincoln%20County/history.htm.

Figure 4.5. Annual Precipitation Map for Washington[37].



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 just to the northwest of Lincoln County.[38]

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

[37] PRISM Group. "Average Annual Precipitation, 1971-2000: Washington". PRISM Climate Service. Oregon State University. 2006. Available online at http://www.prism.oregonstate.edu/state_products/index.phtml?id=WA.

[38] 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 4.5. Second-Order Hazards Related to Severe Weather Events.

Related Causal Events	Related Effects
None	Drought
	Crop Loss
	Tornado
	Wildland Fire
	Flood

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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 affect 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 roll 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 affect 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

Lincoln 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

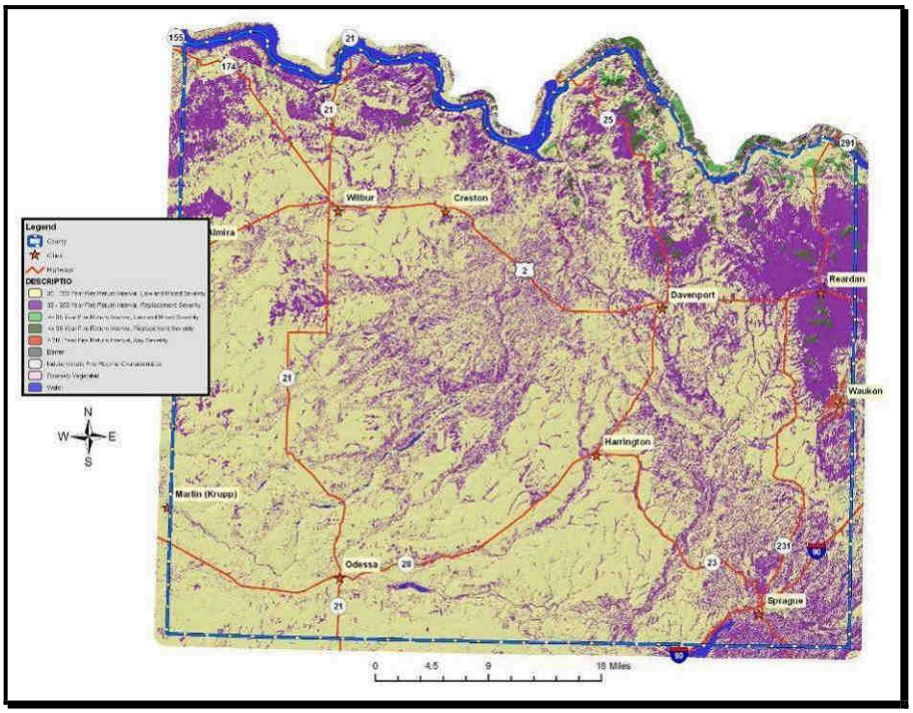
of today and the future. Historical fire regimes are a critical component for characterizing the historical range of variability in fire-adapted ecosystems. Furthermore, understanding ecosystem departures provides the necessary context for managing sustainable ecosystems. Land managers need to understand 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 4.6. Assessment of Historic Fire Regimes in Lincoln County, Washington.

Regime	Description	Percent	Acres
1	<= 35 Year Fire Return Interval, Low and Mixed Severity	0%	5,993
2	<= 35 Year Fire Return Interval, Replacement Severity	1%	10,910
3	35 - 200 Year Fire Return Interval, Low and Mixed Severity	71%	1,066,984
4	35 - 200 Year Fire Return Interval, Replacement Severity	26%	388,048
5	> 200 Year Fire Return Interval, Any Severity	0%	3,578
	Water	1%	16,665
	Barren	0%	1,280
	Sparsely Vegetated	0%	4
	Indeterminate Fire Regime Characteristics	0%	3,020
	Total	**100%**	**1,496,482**

The table above shows the amount of acreage in each defined historic fire regime in Lincoln County. The historic fire regime model in Lincoln County shows that much of the northern rim and channeled scabland areas historically had a 35 to 200-year fire return interval and typically experienced stand replacement severity fires. Areas historically characterized as open rangelands that have now been converted to agriculture also had a greater than 35-year fire return interval, but these areas burned at lower intensities. There are also small pockets in the northeastern corner of Lincoln County that historically had a less than 35-year fire return interval and burned at low to mixed severity. This difference is likely due to the more variable topography and presence of forest stands in this area.

Figure 4.6. Historic Fire Regime in Lincoln 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.[39, 40] Coarse scale definitions for historic fire regimes have been developed by Hardy et al[41] and Schmidt et al[42] 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.[43] The three classes are based on low (FRCC 1), moderate (FRCC 2), and high (FRCC 3) departure from the

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

[40] 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.

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

[42] 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.

[43] 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.

central tendency of the natural (historical) regime.[44,45] 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 Lincoln County shows that a significant portion of the county is either moderately departed (30%) or severely departed (9%) from its natural fire regime and associated vegetation and fuel characteristics. 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.

Table 4.7. Assessment of Fire Regime Condition Class in Lincoln County, Washington.

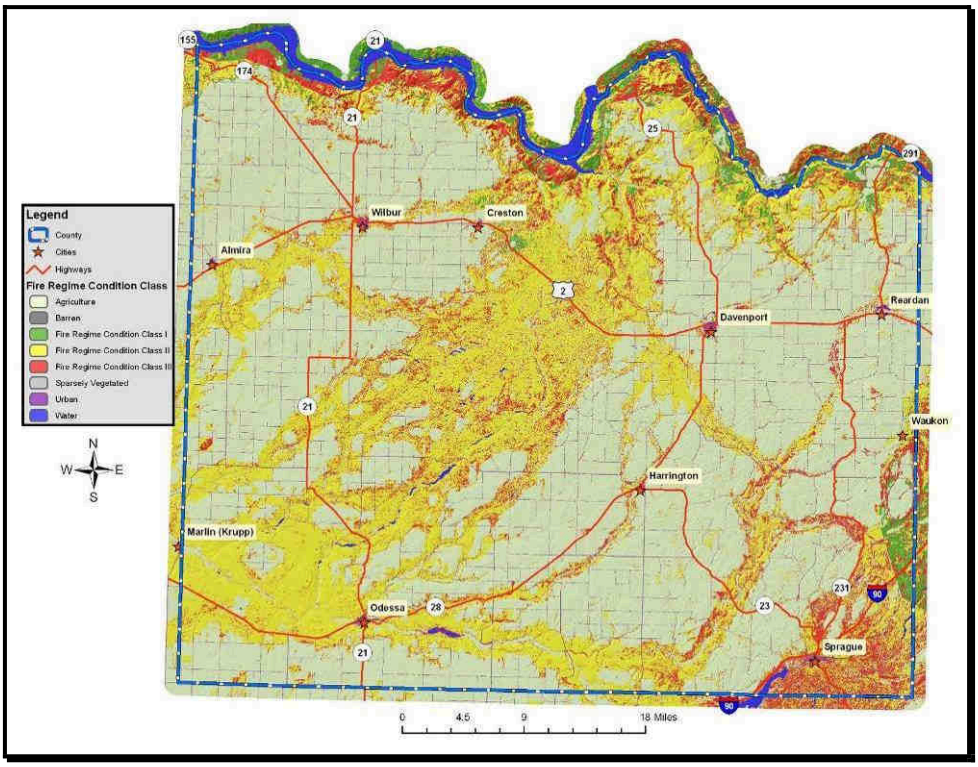
Condition Class	Acres	Percent
Fire Regime Condition Class I	2%	25,353
Fire Regime Condition Class II	30%	448,064
Fire Regime Condition Class III	9%	130,418
Water	1%	16,665
Urban	3%	41,462
Barren	0%	1,280
Sparsely Vegetated	0%	4
Agriculture	56%	833,236
Total	**100%**	**1,496,482**

Of the acres in Lincoln County that have not been converted for agricultural uses, there are very few areas that still maintain their historic fire regime. Most of the channeled scabland areas are defined as Condition Class 2 or moderately departed from the historical regime. The most severely departed areas (Condition Class 3) occur in the southeastern corner of the County near Sprague and along the river breaks on the northern end of the County, particularly along the Columbia River.

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

[45] 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.

Figure 4.7. Fire Regime Condition Class in Lincoln 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.[46] "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".[47] The role of the federal agencies in Lincoln 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

[46] 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.

[47] 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

around them and taking other measures to minimize the risks to their structures.[48] 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. [49]

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;[50]
- 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.

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[48] 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

[49] 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.

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

In addition to these classifications detailed in the Federal Register, Lincoln 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).

Lincoln 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. Lincoln 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.

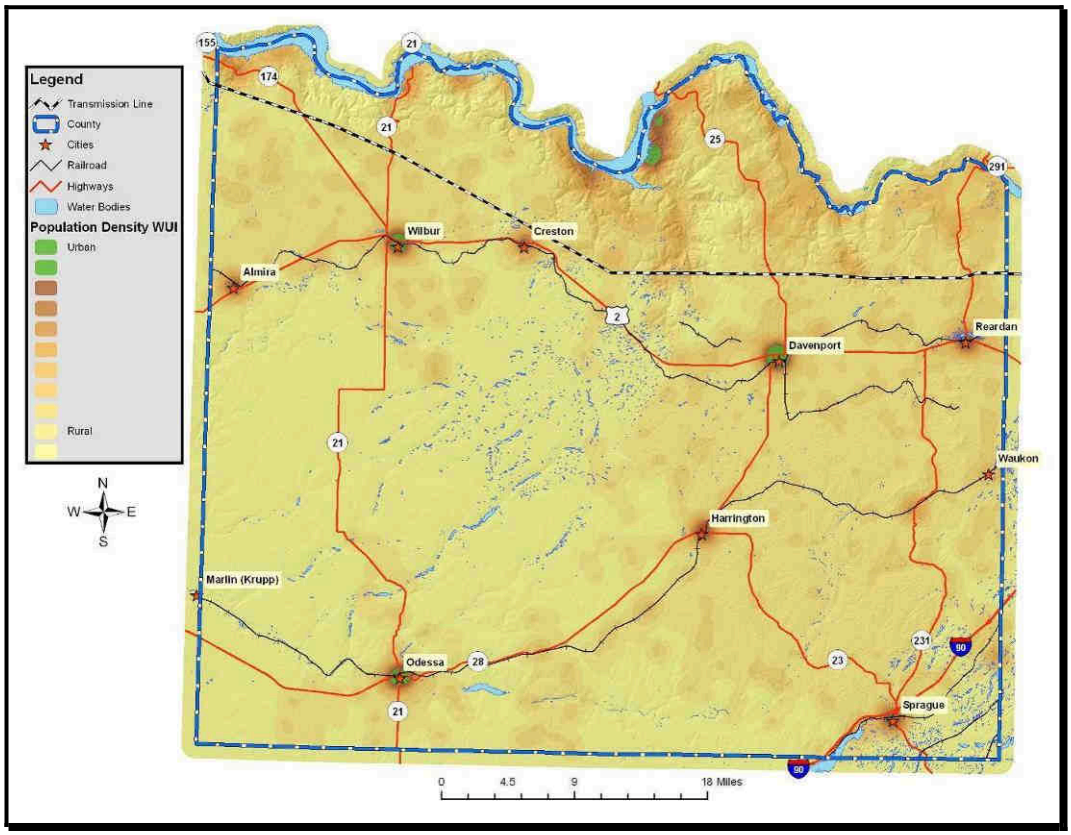
By evaluating structure density in this way, WUI areas can be identified on maps by using mathematical formulae and population density indexes. The resulting population density indexes create concentric circles showing high density areas, interface, and intermix condition WUI, as well as rural condition 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 Lincoln 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 Lincoln 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 4.8. 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	
Structural/Urban Fire	

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Avalanche

An avalanche is a rapid flow of snow down slope from either natural triggers or human activity. Typically occurring in mountainous terrain, an avalanche can mix air and water with the descending snow. Powerful avalanches have the capability to entrain ice, rocks, trees, and other material on the slope. Avalanches are primarily composed of flowing snow and are distinct from mudslides, rock slides, rock avalanches, and serac collapses on an icefall.[51] Avalanches are uncommon in Lincoln County due to the arid climate, but the steep northern aspects on the northern border of the county do have the potential for significant damages caused by avalanches in heavier snow fall years.

There are two types of avalanches; point release (loose snow) and slab. A loose snow or point release avalanche has a trademark tear drop or upside down V track in the snow. As the name suggests this is essentially loose or unconsolidated snow that initiated from a point source, at or near the surface of the snowpack, commonly near exposed rock. During the typical settling process during and after a storm, snow tends to become unstable before it begins to bond together. This can result in loose snow avalanches. Adding heat to the snowpack can also cause the surface layers to loose their strength and sluff, or produce a point release avalanche, which is why they are often seen near rocks. The added heat absorbed by the darker colored rock can weaken or melt the surrounding snow faster.

Loose snow avalanches are generally low hazard events as their size is often too small to present a significant danger, but this is not always the case. Late in the spring or after a heavy rain when the snowpack is saturated with water, it is possible for fairly large and destructive point release avalanches to occur.

Figure 4.9. Photo of Loose Snow Avalanche.

The much more dangerous avalanche that is responsible for the vast majority of fatalities is the slab avalanche. A slab avalanche is a cohesive layer of snow that fractures (breaks) within the snowpack and propagates (spreads) out as a unit, sliding on another layer of snow or the ground. Every time snow falls it adds a new layer to the winter pack. Over time, many of these layers will settle and become surprisingly stiff and brittle. If after every storm the new snow settles and bonds to the layer below it, the sheets become generally stable snowpack. If a layer of snow doesn't bond to the pack below, as it settles it becomes more brittle and successive snows add more weight. Unless something changes, eventually the added weight will cause the buried layer to break. Slab avalanches are generally much more dangerous than a point release.

[51] Wikipedia. "Avalanche". Wikimedia Foundation, Inc. March 2011. Available online at http://en.wikipedia.org/wiki/Avalanche.

A slab avalanche can range from less than a few cubic meters in size to massive catastrophic releases that destroy entire villages. The vast majority of avalanche fatalities are caused by a slab avalanche.

Figure 4.10. Photo of Slab Avalanche.

An avalanche can also come in either a dry or wet variety. As the name suggests, a dry avalanche involves snow that is dry and relatively cold (for snow). A dry avalanche can exceed 200km/hr and may produce a powder cloud as the avalanche gains speed. If there has been a significant amount of rain, or temperatures are regularly above freezing, then the snow will become moist, wet, or even saturated; this is a wet avalanche. A wet avalanche is different in that they tend to move more slowly, do not produce powder clouds, and they follow the natural terrain features such as gulleys or troughs more accurately. A wet avalanche also has more mass and an even greater destructive potential than a dry avalanche.[52]

Because avalanche conditions are the result of weather patterns and topography, it is extremely difficult to forecast the precise degree of danger for any specific feature or slope. Local weather variations can produce significant differences in the local avalanche hazard. It is; however, possible to identify general patterns and even particular slopes, aspects, and features of special concern. By monitoring the weather patterns of a given region throughout the winter and making regular field observations, it is possible to give a fairly accurate assessment of the avalanche danger. None of the slopes along the northern border of Lincoln County have been identified as having any avalanche danger on a regular basis. Most of the concern in this area would be associated with small slides along roadways after heavy snow falls. This area has a primarily northern aspect; thus, snow can accumulate throughout the winter if temperatures remain consistently below freezing.

Avalanches have killed more than 190 people in the past century in Washington State, exceeding deaths from any other natural hazard. One of the nation's worst avalanche disasters occurred in 1910 when massive avalanches hit two trains stopped on the west side of Stevens Pass; 96 people were killed. Avalanches kill one to two people, on average, every year in Washington, although many more are involved in avalanche accidents that do not result in fatalities. Avalanches occur in four mountain ranges in the state – the Cascade Range, which divides the state east and west, the Olympic Mountains in northwest Washington, the Blue Mountains in southeast Washington, and the Selkirk Mountains in northeast

[52] The Avalanche Site. "An Introduction to Avalanche Basics." Shadow Light Productions. Available online at http://www.virtualmountains.ca/. Accessed March 2011.

Washington. The potential avalanche season in Lincoln County begins in late November and continues until early spring.

Second-Order Hazard Events

Avalanche events are usually caused by a series of weather-related events, but other types of hazards can trigger an avalanche. The following chart outlines the interconnection between avalanche and other types of hazard events.

Table 4.9. Second-Order Hazards Related to Avalanche Events.

Related Causal Events	Related Effects
Severe Weather	Transportation System
Earthquakes	

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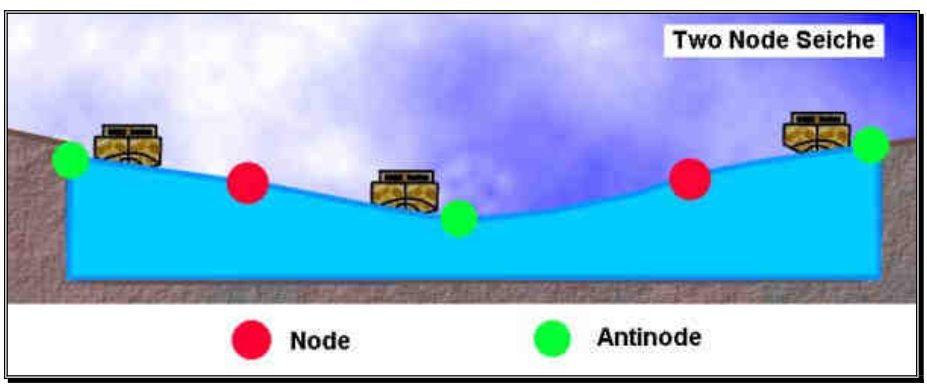
Seiche

While a true tsunami will never strike Lincoln County, the Lake Roosevelt shoreline on the northern fringe of the County, is subject to the danger presented by a seiche, a sudden, large wave that can cause loss of life and property damage. Seiches (pronounced "saysh") are similar to tsunamis, but are typically defined as standing waves on a closed or semi-closed body of water such as rivers, reservoirs, ponds, and lakes. Seiches are caused by seismic activity or storm fronts moving rapidly across a large body of water. The US Army Corp of Engineers definition of a seiche does not include landslides as a causal factor; however, when they occur on a closed or semi-closed body of water, landslide caused waves are often referred to as seiches rather than tsunamis.[53]

The effect of a seiche is caused by resonances in a body of water that has been disturbed by one or more of a number of factors, most often meteorological effects (wind and atmospheric pressure variations), seismic activity, or landslides. Gravity always seeks to restore the horizontal surface of a body of liquid water, as this represents the configuration in which the water is in hydrostatic equilibrium. Vertical harmonic motion produces an impulse that travels the length of the basin at a velocity that depends on the depth of the water. The impulse is reflected back from the end of the basin generating interference. Repeated reflections produce standing waves with one or more nodes, or points, that experience no vertical motion. The frequency of the oscillation is determined by the size of the basin, its depth and contours, and the water temperature.[54]

Figure 4.11. Illustration of a Two-Node Seiche.



Although highly sophisticated tsunami warning systems exist along the Pacific coast, inland seiches have the potential to cause extreme damage to waterways and shoreline communities due to their infrequency and the lack of a warning system. Residences, businesses, and other resources along the Lake Roosevelt shoreline where these localized events might occur may be severely damaged by a series of high waves.

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[53] Earthquide. "The Motion of a Seiche." University of California. April 2006. Available online at http://earthguide.ucsd.edu/earthguide/diagrams/waves/swf/wave_seiche.html.

[54] Wikipedia. "Seiche." Wikipedia Foundation, Inc. Available online at http://en.wikipedia.org/wiki/Seiche. Accessed March 17, 2011.

To date, seiches on Lake Roosevelt have exclusively been the result of landslides. Reports of these events suggest that only one wave hit the shoreline opposite of a landslide. The two major geologic parameters that affect the generation of a water wave from a landslide are the volume of the slide mass and the motion of the mass as it reaches the water.

Lake Roosevelt Seiches (Tsunamis)

Landslides into Lake Roosevelt generated numerous seiches (commonly recorded as tsunamis) from 1944 to 1953 after Grand Coulee Dam created the lake on the Columbia River. Most seiches on Lake Roosevelt have generated large waves (30 to 60 feet in height) that struck the opposite shore of the lake, with some waves observed miles from the source. At least seven seiches have been recorded on Lake Roosevelt since 1944[55], but only two reportedly caused damage.

> *February 23, 1951* – A 100,000 to 200,000 cubic yard landslide just north of Kettle Falls created a wave that picked up logs at the Harter Lumber Company Mill and flung them through the mill 10 feet above lake level.
>
> *October 13, 1952* – A landslide 98 miles upstream of Grand Coulee Dam created a wave that broke tugboats and barges loose from their moorings at the Lafferty Transportation Company six miles away. It also swept logs and other debris over a large area above lake level.[56]

Second Order Hazard Events

Seiches are always caused by some other type of hazard or weather event and, while they can be damaging, they do not trigger other types of hazard incidents. The following chart outlines the interconnection between seiches and other types of hazard events.

Table 4.10. Second-Order Hazards Related to Seiche Events.

Related Causal Events	Related Effects
Landslide	None
Severe Weather	
Earthquake	

[55] Sliding Thought Blog. Washington's Landslide Blog. Available online at http://slidingthought.wordpress.com/about/. April 2009.

[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.

Volcano

The Cascade Range of the Pacific Northwest has more than a dozen potentially active volcanoes. Cascade volcanoes tend to erupt explosively, and on average two eruptions occur per century—the most recent were at Mount St. Helens, Washington (1980–86 and 2004–8), and Lassen Peak, California (1914–17). On May 18, 1980, after 2 months of earthquakes and minor eruptions, Mount St. Helens, Washington, exploded in one of the most devastating volcanic eruptions of the 20th century. Although less than 0.1 cubic mile of molten rock (magma) was erupted, 57 people died, and damage exceeded $1 billion. Fortunately, most people in the area were able to evacuate safely before the eruption because public officials had been alerted to the danger by U.S. Geological Survey (USGS) and other scientists. To help protect the Pacific Northwest's rapidly expanding population, USGS scientists at the Cascades Volcano Observatory in Vancouver, Washington, monitor and assess the hazards posed by the region's volcanoes.[57]

There are no active volcanoes in Lincoln County; however, communities in this area could be directly affected by an eruption from any one of the Cascade volcanoes. During an eruption, such as the 1980 eruption of Mount St. Helens, Lincoln County is not likely to be directly affected by lava flows, pyroclastic flows, landslides, or lahars; however, this region may be indirectly impacted due to damming of waterways, reduced air and water quality, acid rain, and ash fallout.

An explosive eruption blasts solid and molten rock fragments (tephra) and volcanic gases into the air with tremendous force. The largest rock fragments (bombs) usually fall back to the ground within 2 miles of the vent. Small fragments (less than about 0.1 inch across) of volcanic glass, minerals, and rock (ash) rise high into the air, forming a huge, billowing eruption column.

Eruption columns can grow rapidly and reach more than 12 miles above a volcano in less than 30 minutes, forming an eruption cloud. The volcanic ash in the cloud can pose a serious hazard to aviation. During the past 15 years, about 80 commercial jets have been damaged by inadvertently flying into ash clouds, and several have nearly crashed because of engine failure. Large eruption clouds can extend hundreds of miles downwind, resulting in ash fall over enormous areas; the wind carries the smallest ash particles the farthest. Ash from the May 18, 1980, eruption of Mount St. Helens, Washington, fell over an area of 22,000 square miles in the Western United States. Heavy ash fall can collapse buildings, and even minor ash fall can damage crops, electronics, and machinery.

Volcanoes emit gases during eruptions. Even when a volcano is not erupting, cracks in the ground allow gases to reach the surface through small openings called fumaroles. More than ninety percent of all gas emitted by volcanoes is water vapor (steam), most of which is heated ground water (underground water from rain fall and streams). Other common volcanic gases are carbon dioxide, sulfur dioxide, hydrogen sulfide, hydrogen, and fluorine. Sulfur dioxide gas can react with water droplets in the atmosphere to create acid rain, which causes corrosion and harms vegetation. Carbon dioxide is heavier than air and can be trapped in low areas in concentrations that are deadly to people and animals. Fluorine, which in high concentrations is toxic, can be adsorbed onto volcanic ash particles that later fall to the ground. The

[57] Dzurisim, Dan, et al. "Living with Volcanic Risk in the Cascades." U.S. Geological Survey – Reducing the Risk from Volcano Hazards. USGS. Vancouver, Washington. 1997.

fluorine on the particles can poison livestock grazing on ash-coated grass and also contaminate domestic water supplies.[58]

The volcanoes of the Cascade Range, which stretches from northern California into British Columbia, have produced more than 100 eruptions, most of them explosive, in just the past few thousand years. However, individual Cascade volcanoes can lie dormant for many centuries between eruptions, and the great risk posed by volcanic activity in the region is therefore not always apparent.

When Cascade volcanoes do erupt, high-speed avalanches of hot ash and rock (pyroclastic flows), lava flows, and landslides can devastate areas 10 or more miles away; and huge mudflows of volcanic ash and debris, called lahars, can inundate valleys more than 50 miles downstream. Falling ash from explosive eruptions can disrupt human activities hundreds of miles downwind, and drifting clouds of fine ash can cause severe damage to jet aircraft even thousands of miles away. Erupting Cascade volcanoes are more prone than other U.S. volcanoes to explosive volcanic activity, resulting in pyroclastic flows. These are hot, often incandescent mixtures of volcanic fragments and gases that sweep along close to the ground at speeds up to 450 mph.

Because the population of the Pacific Northwest is rapidly expanding, the volcanoes of the Cascade Range in Washington, Oregon, and northern California are some of the most dangerous in the United States. Although Cascade volcanoes do not often erupt (on average, about two erupt each century), they can be dangerous because of their violently explosive behavior, their permanent snow and ice cover that can fuel large volcanic debris flows (lahars), and their proximity to various critical infrastructure, air routes, and populated areas.[59]

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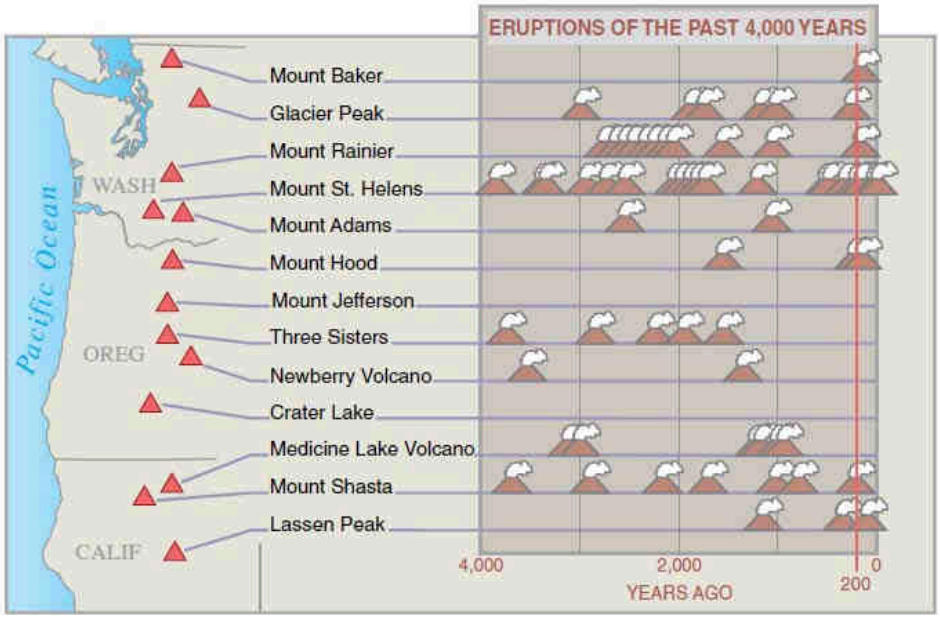
[58] Myers, Bobbie, et al. "What are Volcano Hazards?" U.S. Geological Survey. Vancouver, Washington. July 2004.

[59] Dzurisim, Dan, et al. "Living with Volcanic Risk in the Cascades." U.S. Geological Survey – Reducing the Risk from Volcano Hazards. USGS. Vancouver, Washington. 1997.

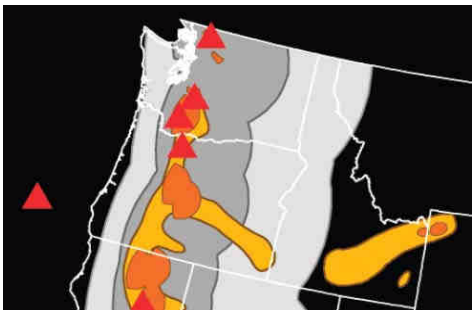
Figure 4.12. Record of Cascade Range Volcanic Eruptions.



Of the 13 potentially active volcanoes in the Cascade Range, 11 have erupted in the past 4,000 years. More than 100 eruptions have occurred during that period, making the volcanoes of the Cascade Range some of the most hazardous in the U.S. Each eruption symbol in the diagram represents from one to several eruptions closely spaced in time at or near the named volcano.

Washington

Mount Baker erupted in the mid-1800s for the first time in several thousand years. Activity at steam vents (fumaroles) in Sherman Crater, near the volcano's summit, increased in 1975 and is still vigorous, but there is no evidence that an eruption is imminent. **Glacier Peak** has erupted at least six times in the past 4,000 years. About 13,000 years ago, an especially powerful series of eruptions deposited volcanic ash at least as far away as Wyoming. **Mount Rainier** has produced at least ten eruptions and numerous lahars in the past 4,000 years. It is capped by more glacier ice than the rest of the Cascade volcanoes combined, and parts of Rainier's steep slopes have been weakened by hot, acidic volcanic gases and water. These factors make this volcano especially prone to landslides and lahars. **Mount St. Helens** is the most frequently active volcano in the Cascades. During the past 4,000 years, it has produced many lahars and a wide variety of eruptive activity, from relatively quiet outflows of lava to explosive eruptions much larger than that of May 18, 1980. **Mount Adams** has produced few eruptions during the past several thousand years. This volcano's most recent activity was a series of small eruptions about 1,000 years ago.



The red triangles are volcano locations. Dark orange areas have a higher volcanic hazard; light orange areas have a lower volcanic hazard. Dark gray areas have a higher ash fall hazard; light-gray areas have a lower ash fall hazard.

Oregon

Mount Hood last erupted about 200 years ago, producing pyroclastic flows, lahars, and a prominent lava dome (Crater Rock) near the volcano's summit. Most recently, a series of steam blasts occurred between 1856 and 1865. **Mount Jefferson** last erupted more than 20,000 years ago. However, eruptions nearby have produced several lava flows and small volcanic cones in the past 10,000 years. Three Sisters Volcanic Center in central Oregon includes five large volcanoes—**North Sister, Middle Sister, South Sister, Broken Top**, and **Mount Bachelor**. About 2,000 years ago, eruptions occurred on South Sister, as well as from several small volcanoes north of North Sister. Since 1997, a broad area centered 3 miles west of South Sister has domed upward by more than 8 inches. Scientists think that this doming reflects the ongoing accumulation of magma at a depth of 3 to 4 miles. The outcome of this activity is uncertain, but there is no evidence that an eruption is imminent. The USGS and its partners have increased monitoring efforts in the area to detect any changes that might warrant more concern. **Newberry Volcano**, a broad shield covering more than 500 square miles, is capped by Newberry Crater, a large volcanic depression (caldera) 5 miles across. Its most recent eruption was about 1,300 years ago. **Crater Lake** occupies a 6-mile-wide caldera formed 7,700 years ago when the summit of an ancient volcano (referred to as Mount Mazama) collapsed during a huge explosive eruption. More than 10 cubic miles of magma was erupted, 10 times as much as in any other eruption in the Cascades during the past 10,000 years. Smaller eruptions ending about 5,000 years ago formed Wizard Island and several submerged cones and lava domes on the lake floor.

After the 1980 eruption of Mount St. Helens, Congress provided increased funding that enabled the USGS to establish a volcano observatory for the Cascade Range. Located in Vancouver, Washington, the David A. Johnston Cascades Volcano Observatory (CVO) was named for a USGS scientist killed at a forward observation post by the May 18, 1980 eruption.

Scientists at CVO quickly recognized that it was not economically feasible to fully monitor all potentially active Cascade volcanoes. To address this and similar problems elsewhere in the United States and abroad, the USGS developed a suite of portable volcano-monitoring instruments—essentially, a portable volcano observatory. In the Pacific Northwest, when regional networks of earthquake sensors, operated in cooperation with the University of Washington's Pacific Northwest Seismic Network, detect unusual seismic activity at a volcano, CVO staff will rapidly deploy this portable equipment to evaluate the hazard and, if needed, provide timely warnings to local officials and the public.

CVO also uses remote sensing as an early-detection tool. A technique called interferometric synthetic-aperture radar (InSAR) allows scientists to measure subtle movements of the ground surface, using radar images obtained by Earth-orbiting satellites. The current ground doming at Three Sisters was first detected using this technique.[60]

Second-Order Hazard Events

Volcanic events can result in many other types of hazard-related incidents. While an eruption will most likely be the primary source of damages in the surrounding area, this type of event has a much larger

[60] Dzurisim, Dan, et al. "Living with Volcanic Risk in the Cascades." U.S. Geological Survey – Reducing the Risk from Volcano Hazards. USGS. Vancouver, Washington. 1997.

impact area. Volcanic events have often resulted in damages from ash fallout many miles away from the eruption. The following chart outlines the interconnection between volcanic eruptions and other types of hazard events.

Table 4.11. Second-Order Hazards Related to Volcanic Events.

Related Causal Events	Related Effects
Earthquake	Severe Weather
	Crop Loss
	Wildland Fire
	Transportation System
	Civil Unrest

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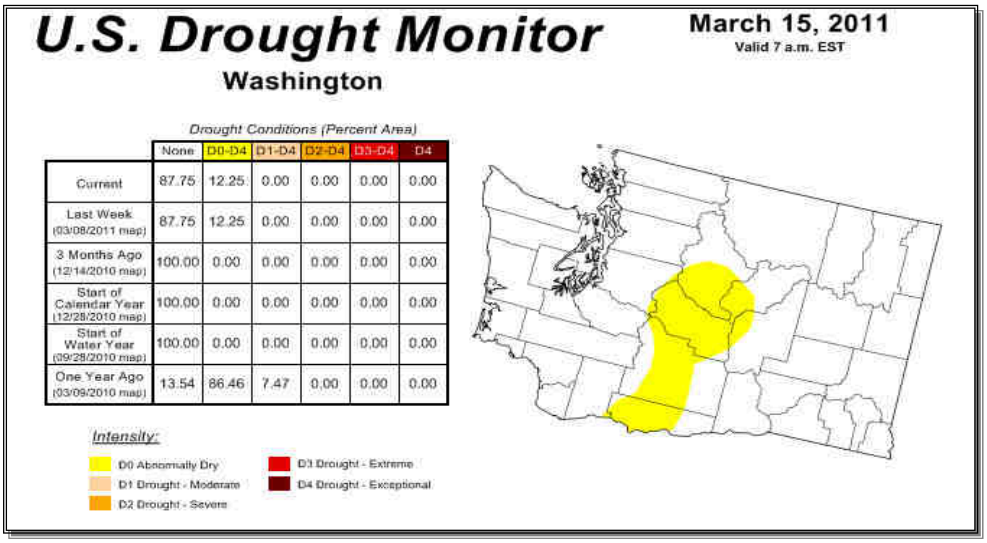
Drought

A drought is a long period of abnormally low precipitation that persists long enough to produce a serious hydrologic imbalance.[61] Drought is a normal part of virtually every climate on the planet, even relatively wet climates. It is the most complex of all natural hazards, and it affects more people than any other hazard. The impacts of drought are greater than the impacts of any other natural hazard. They are estimated to be between $6 billion and $8 billion annually in the United States[62] and occur primarily in agriculture, transportation, recreation and tourism, forestry, and energy sectors. With drought, there is an increase in wildfire potential, and trees are more susceptible to insects like the bark beetle. Social and environmental impacts are also significant, although it is difficult to quantify these impacts. Drought is typically measured in terms of water availability in a defined geographical area. It is common to express drought with a numerical index that ranks severity.

In the past century, Washington State has experienced a number of drought cycles including several that lasted for more than a single season (1928-32, 1992-94, and 1996-97). The most severe droughts occurred in 1977 and 2001. The most recent drought affecting eastern Washington counties occurred in 2005, but was less severe than the 2001 cycle. Drought can have a widespread impact on the environment and the economy, depending on its severity, although it typically does not result in loss of life or damage to property.

Figure 4.13. U.S. Drought Monitor Map for Washington.



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	87.75	12.25	0.00	0.00	0.00	0.00
Last Week (03/08/2011 map)	87.75	12.25	0.00	0.00	0.00	0.00
3 Months Ago (12/14/2010 map)	100.00	0.00	0.00	0.00	0.00	0.00
Start of Calendar Year (12/28/2010 map)	100.00	0.00	0.00	0.00	0.00	0.00
Start of Water Year (09/28/2010 map)	100.00	0.00	0.00	0.00	0.00	0.00
One Year Ago (03/09/2010 map)	13.54	86.46	7.47	0.00	0.00	0.00

Drought indices assimilate thousands of bits of data on rainfall, snowpack, streamflow, and other water supply indicators into a comprehensible big picture. A drought index value is typically a single number, far more useful than raw data for decision making. The U.S. Drought Monitor is a synthesis of multiple indices and impacts that represents a consensus of federal and academic scientists.[63]

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[61] Interagency Hazard Mitigation Team. 2000. State Hazard Mitigation Plan. Oregon State Police – Office of Emergency Management. Salem, Oregon.

[62] Wilhite, Donald A. *"Drought Management".* Water Encyclopedia – Science and Issues. 2011. Available online at http://www.waterencyclopedia.com/Da-En/Drought-Management.html.

[63] National Drought Mitigation Center. "U.S. Drought Monitor". Available online at http://drought.unl.edu/dm/monitor.html. February 2010.

Unlike most states, Washington has a statutory definition of drought, consisting of two parts:

1. An area has to be experiencing or projected to experience a water supply that is below 75 percent of normal.
2. Water users within those areas will likely incur undue hardships as a result of the shortage.[64]

Drought results from a deficiency of precipitation from statistically normal (long-term average) amounts that, when extended over a season or especially over a longer period of time, is insufficient to meet the demands of human activities. All types of drought originate from a deficiency of precipitation that results in water shortages for some activity (such as crop production) or for some group (such as farmers).

Droughts differ from one another in three essential characteristics: intensity, duration, and spatial coverage. Drought is normally grouped by type: meteorological, hydrological, agricultural, and socioeconomic. The impacts associated with drought usually take 3 months or more to develop, but this time period can vary considerably, depending on the timing of the initiation of the precipitation deficiency.

Meteorological - Meteorological drought is expressed solely on the basis of the degree of dryness in comparison to some normal or average amount and the duration of the dry period. Thus, intensity and duration are the key characteristics of this type of drought.

Agricultural - Agriculture is usually the first economic sector to be affected by drought because soil moisture content is often quickly depleted, especially if the period of moisture deficiency is associated with high temperatures and windy conditions. Agricultural drought links various characteristics of meteorological drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, and soil water deficits.

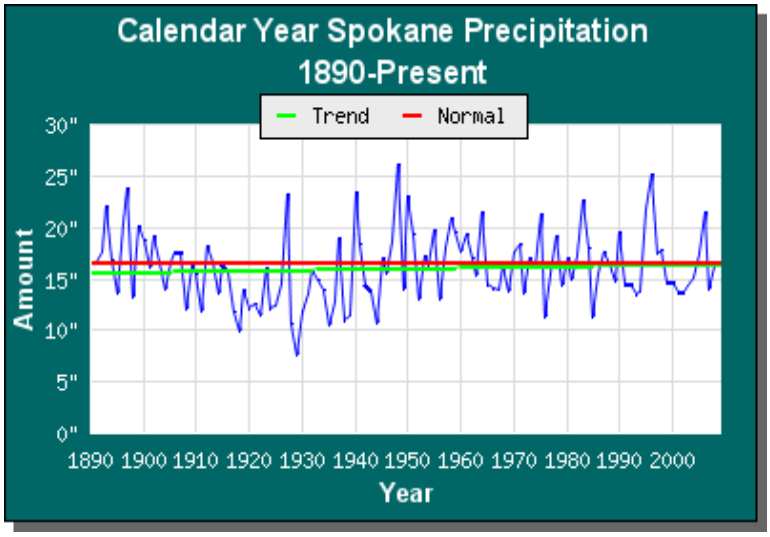
Hydrological - Hydrological droughts are associated with the effects of periods of precipitation shortfall on surface or subsurface water supply (e.g. streamflow, reservoir and lake levels, and ground water) rather than with precipitation shortfalls. Hydrological droughts usually lag the occurrence of meteorological and agricultural droughts because more time elapses before precipitation deficiencies are detected in reservoirs, groundwater, and other components of the hydrologic system. As a result, impacts of hydrological drought are out of phase with impacts of other drought types. Also, water in hydrological storage systems such as reservoirs, rivers, and groundwater often is used for multiple and competing purposes, further complicating the sequence and quantification of impacts. Water uses affected by drought can include purposes as varied as power generation, flood control, irrigation, drinking water, industry, and recreation.

Socioeconomic - Socioeconomic drought associates the supply and demand of some economic good or service with elements of meteorological, hydrological, and agricultural drought. In socioeconomic drought, deficiencies of precipitation are linked directly to the supply of some commodity or economic good (e.g. water, hay, or hydroelectric power). Increases in population can alter substantially the demand for these economic goods over time. The incidence of

[64] News Release. "Drought report looks at 2005, makes recommendations for future". Department of Ecology, State of Washington. February 9, 2006. Access Washington.

socioeconomic drought can increase because of a change in the frequency of meteorological drought, a change in societal vulnerability to water shortages, or both.[65]

Figure 4.14. Precipitation Record 1890 – Present.



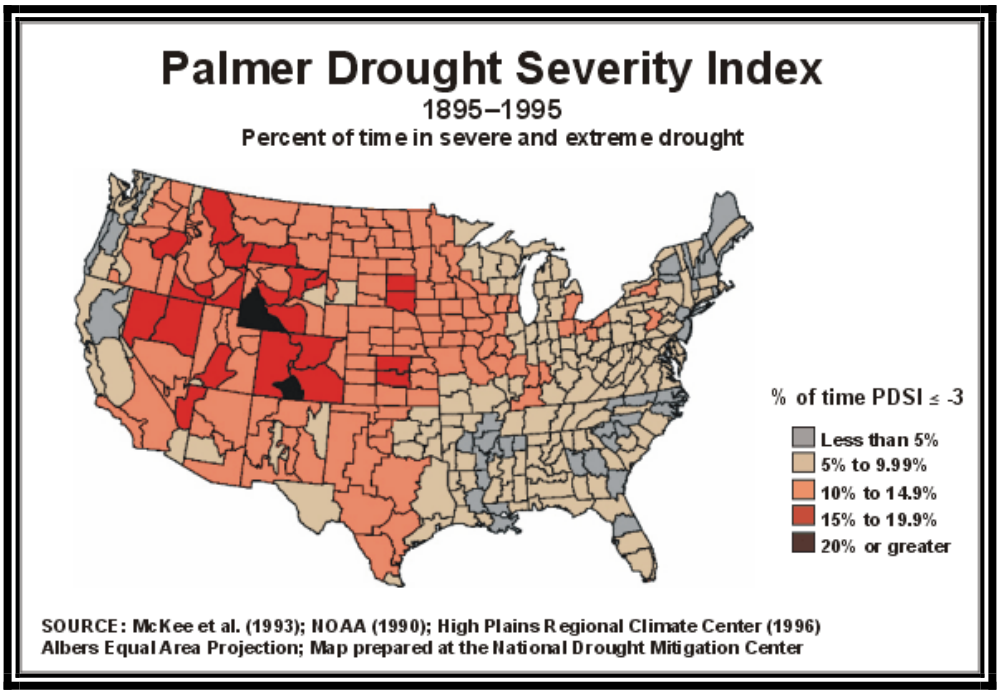
The major causes of droughts in Washington are either low snow accumulations from either low precipitation or warm winter temperatures; or by warm weather in the late winter-early spring that causes early melt of the snowpack. Most of the state's annual precipitation occurs during the winter. Precipitation in northeastern Washington is normally stored as snow that slowly melts during the spring and summer, maintaining stream and river flows. This is the primary source of water for irrigation and municipal use.

In 1965, W.C. Palmer developed an index to measure the departure of the moisture supply. Palmer based his index on the supply-and-demand concept of the water balance equation, taking into account more than just the precipitation deficit at specific locations. The objective of the Palmer Drought Severity Index (PDSI), as this index is now called, was to provide measurements of moisture conditions that were standardized so that comparisons using the index could be made between locations and between months. It is most effective at measuring impacts sensitive to soil moisture conditions, such as agriculture.[66]

[65] Wilhite, Donald A. *"Drought Management".* Water Encyclopedia – Science and Issues. 2011. Available online at http://www.waterencyclopedia.com/Da-En/Drought-Management.html.

[66] Hayes, Michael J. "Drought Indices." National Drought Mitigation Center. Available online at http://drought.unl.edu/whatis/indices.htm#pdsi. 2006.

Figure 4.15. Palmer Drought Severity Index Map.



At this time, reliable forecasts of drought are not attainable for temperate regions of the world more than a season in advance. However, based on a 100-year history with drought, the state as a whole can expect severe or extreme drought at least 5 percent of the time in the future. As the historical Palmer Drought Severity Index indicates, between 1895-1995, Lincoln County was in severe or extreme drought conditions 10-14.9% of the time. From 1985-95, the County was in severe or extreme drought conditions 20-30% of the time and from 1976-77, Lincoln County was in severe or extreme drought conditions 30-40% of the time.

Second-Order Hazard Events

Although droughts are not caused by other types of hazard events, they can result in other types of hazard incidents, especially long-term drought conditions. Wildland fire ignition potential and damage potential are much higher during periods of drought due to the lower moisture content in vegetation and generally lower relative humidity. The following chart outlines the interconnection between drought and other types of hazard events.

Table 4.12. Second-Order Hazards Related to Drought Events.

Related Causal Events	Related Effects
None	Structural/Urban Fire
	Crop Loss
	Wildland Fire
	Civil Unrest

Chapter 5

Jurisdictional Vulnerability Assessment

IN THIS SECTION:

- Lincoln County Annex
- City of Davenport Annex
- City of Sprague Annex
- Town of Almira
- Town of Creston
- Town of Harrington
- Town of Odessa
- Town of Reardan
- Town of Wilbur
- Lincoln Hospital District
- Odessa Memorial Healthcare Center

Chapter 5 – Hazard Assessments

Jurisdictional Risk and Vulnerability Assessments

The Lincoln 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 Lincoln County; thus, the hazards of flood, earthquake, landslide, severe weather, wildland fire, avalanche, seiche, and drought 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 Lincoln 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, Lincoln 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.

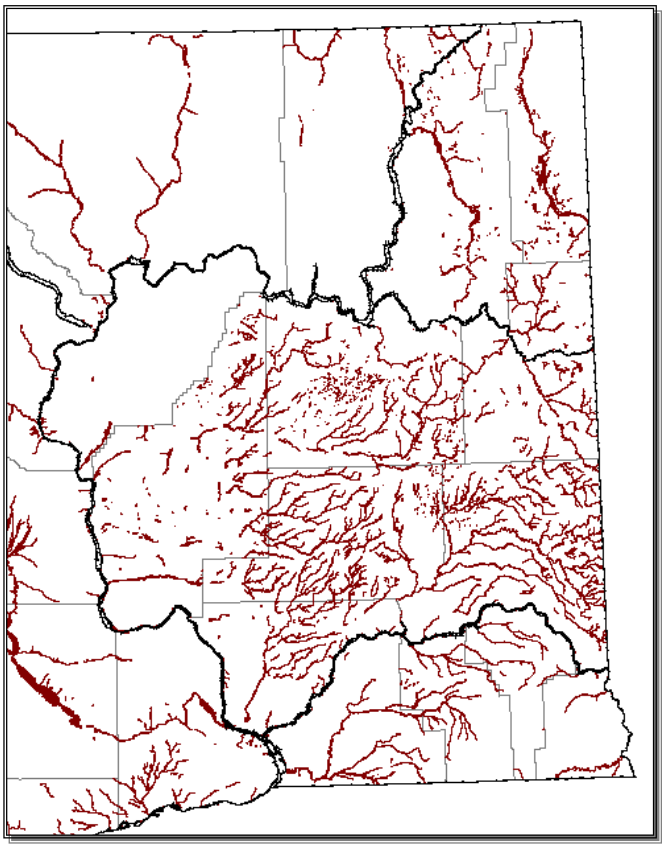
In order to be eligible for project funds under the Flood Mitigation Assistance (FMA) program authorized by the National Flood Insurance Act of 1968, as amended, communities are required under 44 CFR 79.6(d)(1) to have a mitigation plan that addresses flood hazards. On October 31, 2007, FEMA published 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.

Lincoln County Annex

Flood Profile

The flood history record in Lincoln County is limited to flash floods and relatively small riverine flooding along minor drainages. Although many areas of the county flood on a regular basis, no damages have occurred due to naturally functioning floodplains. Nearly all flood damages within Lincoln County have occurred within the incorporated communities. High intensity rainfall, rain-on-snow and rain-on-frozen soil events have been prominent causes for flooding through the hydrologic record. Floods in Lincoln County may occur at any time between November and June with flash floods from thunderstorms occurring most commonly during the summer months.

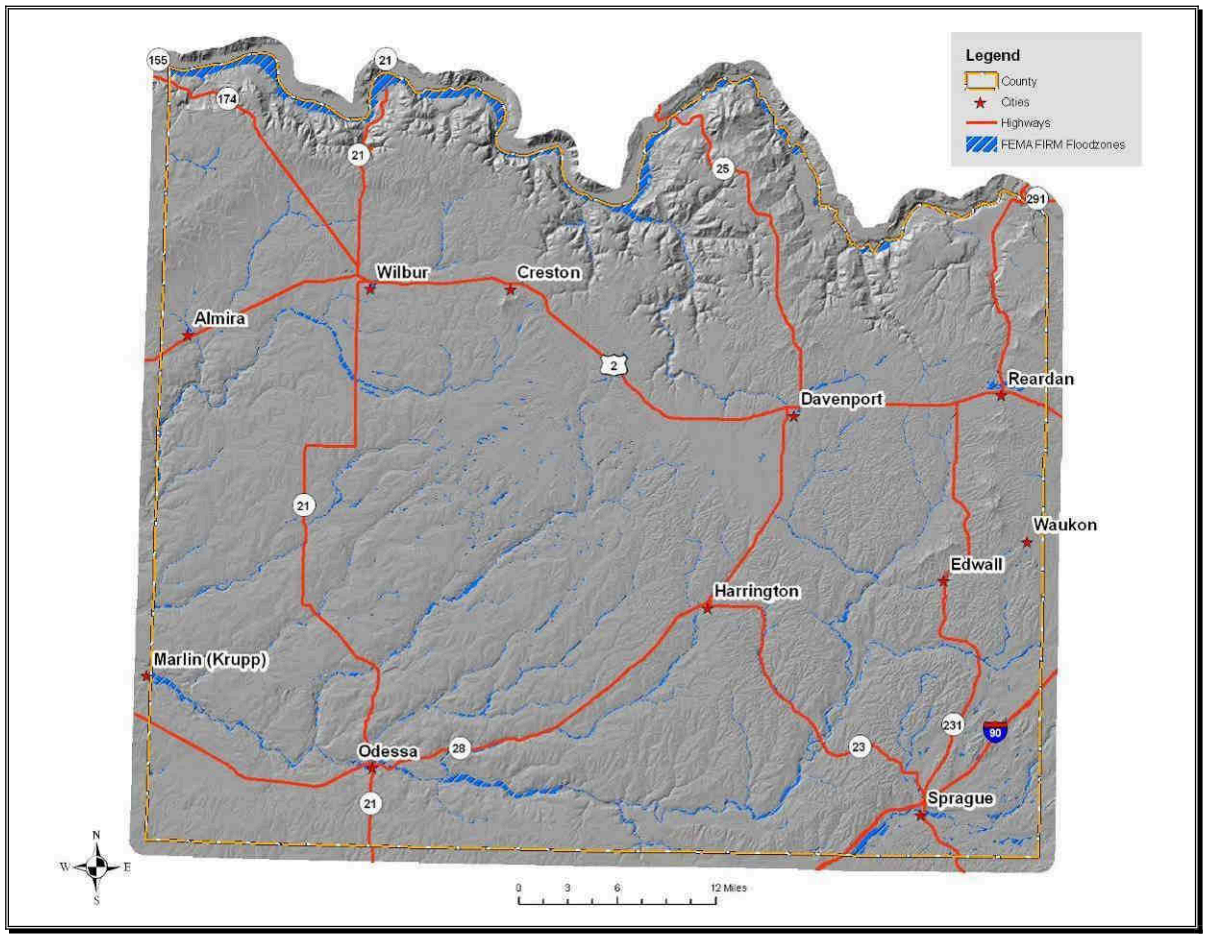
Figure 5.1. FEMA 100 Year Riverine Flood Hazard Areas in Eastern Washington.



The only major watershed in Lincoln County is the Columbia River which delineates the northern border of the County. There is very little risk of flooding along the Columbia River as this area is part of the Lake Roosevelt Reservoir. The water level of Lake Roosevelt is monitored and highly regulated for the purposes of providing not only irrigation water to the surrounding agricultural developments and hydroelectric power, but also to provide flood control for communities along this major drainage.

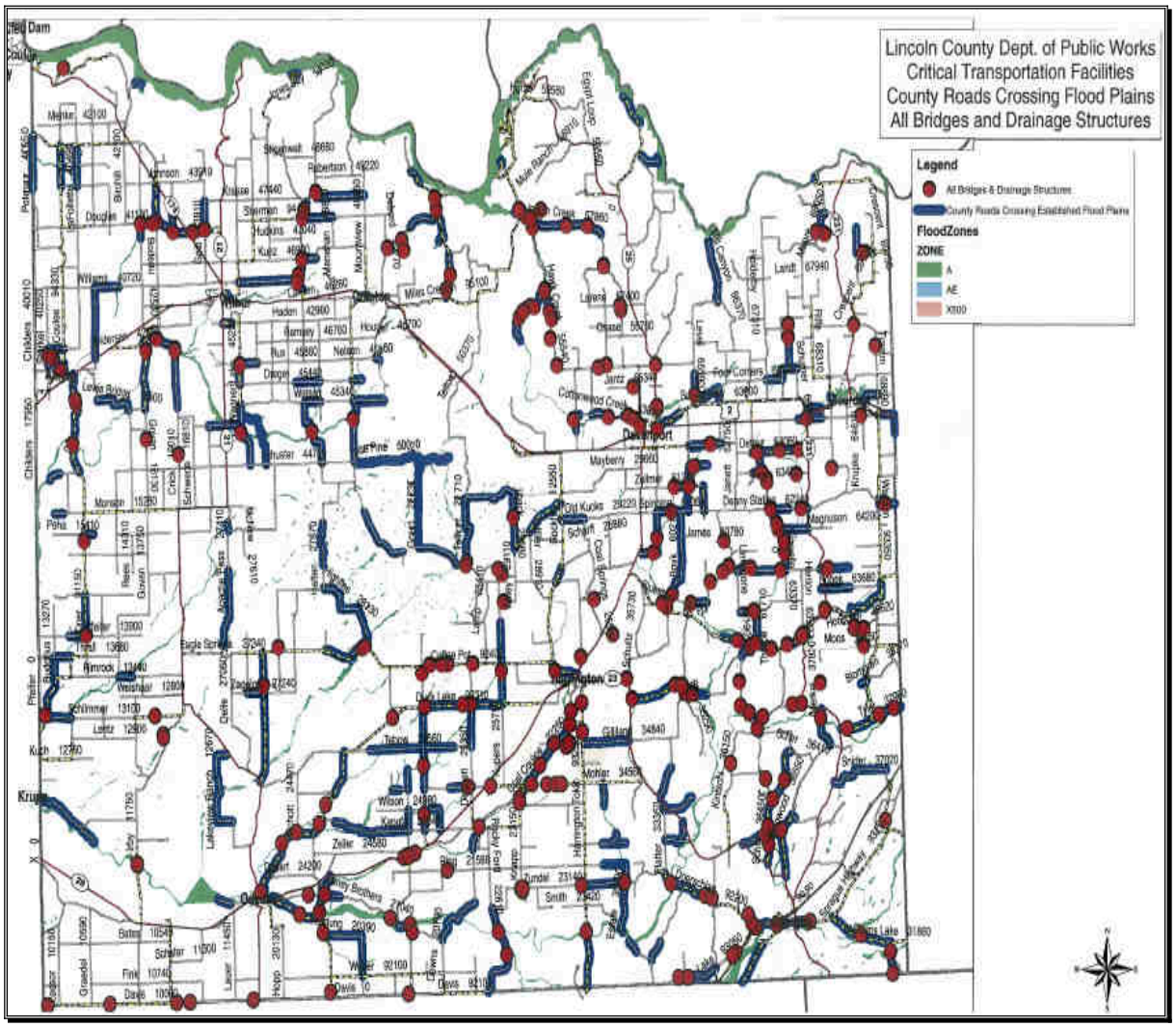
Lincoln County does; however, contain multitudes of small tributaries that meander through mostly large, flat floodplains. These drainages are highly susceptible to flash flood events resulting from thunderstorms, rain-on-snow events, or rapid snowmelt. Riverine flooding is also a common occurrence. Because most of these waterways are shallow, channels are often breached with floodwaters occupying wide floodplains for days at a time. Some of the more significant of these drainages include Lake Creek, Crab Creek, Sinking Creek, Wilson Creek, Hawk Creek, Duck Creek, Rock Creek, and Bluestem Creek. Most of these watersheds originate in Lincoln County and eventually drain into the Columbia River (either on the north end of the County or to the west in Grant County) or Moses Lake. Hundreds of secondary tributaries drain into these waterways.

Figure 5.2. FEMA Floodplains in Lincoln County, Washington.



Any magnitude flood event may cause damage or blockages at drainage structures or to road segments. These types of events are difficult to anticipate; however, Lincoln County does maintain a prioritized list of all road segments and infrastructure within established floodplain areas. The transportation infrastructure in Lincoln County has been categorized by priority and significance in the event of natural or man-caused disasters. The first priority for repairs or maintenance in an emergency event is given to roads, bridges, and structures on minor arterials (FFC 6), major collectors (FFC 7), and local access routes serving areas of rural residential development (FFC 8). Second priority infrastructure may become first priorities during a localized event. Lincoln County maintains its transportation infrastructure inventory and priority classification system as a GIS database at the Public Works office.

Figure 5.3. Critical Transportation Facilities Crossing Designated Floodplains.



Sediment has built up in many of the stream channels in Lincoln County. This buildup and subsequent vegetative growth has narrowed channels and restricted the capacity of the stream. These channel restrictions can prevent the stream from following its natural meandering course, which can contribute to changes in the floodplain.

Figure 5.4. FEMA Floodplain in Unincorporated Community of Edwall.

Structures and critical infrastructure in the community of Edwall in unincorporated Lincoln County.

Edwall is a small unincorporated community in northeastern Lincoln County. The floodplain in Edwall is caused by a small tributary of Crab Creek. The stream flows in a southwesterly direction through the middle of the community. This stream has caused minor flood damages in the past due to rapid runoff caused by rain-on-snow or major storm events and channel blockages.

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 7/31/2010 in Lincoln County.						
Community Name	Policies In-Force	Insurance In-Force	Written Premium In-Force	FIRM Effective Date	Floodplain Ordinance/ Manager	CRS Ranking
Lincoln County (unincorporated	14	$1,740,600	7,458	9/30/1988	Yes/Yes	-
Almira	-	-	-	9/30/1988	No/No	-
Creston	-	-	-	9/30/1988	Yes/Yes	-
Harrington	2	$490,000	629	9/30/1988	Yes/Yes	-
Odessa	33	$3,563,500	24,918	9/30/1988	Yes/Yes	-
Sprague	12	$1,482,900	12,509	9/30/1988	Yes/Yes	-
Wilbur	27	$3,095,700	19,688	9/30/1988	Yes/Yes	-
Reardan	-	-	-	-	No/No	-
Davenport	-	-	-	-	No/No	-

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

February 1996 Flood - One of the top 10 weather events in Washington during the 20th Century, according to National Weather Service, Seattle Forecast Office. Heavy rainfall, mild temperatures and low-elevation snowmelt caused flooding 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 Yakima Indian Reservation. Mudslides occurred throughout the State. Traffic was shut down for several days in most directions. Damage throughout the Pacific Northwest was estimated at $800 million.

December 1996 –January 1997 Flood – Saturated ground combined with snow, freezing rain, rain, rapid warming, and high winds within a five day period caused heavy flooding. Lincoln County was one of many areas impacted across the State. There were 24 deaths statewide, an estimated $140 million in insured losses, and 250,000 people lost power.

March 1997 Flooding – Heavy rainfall and low-elevation mountain snowmelt caused significant flooding in the counties of Grays Harbor, Jefferson, King, Kitsap, Lincoln, Mason, Pacific, Pierce, Pend Oreille,and Stevens

January 2006 Flood - Declared by Governor Gregoire on 12 January 2006, this event was the climax of a month of steady rainfall beginning in mid-December. Initially involving counties in the Puget Sound Basin and Spokane, the declaration eventually was extended to all 39 counties. Flooding, landslides and mudflows seriously impacted state and local transportation infrastructure across the state as well as damaging homes and businesses.

July 2010 Flash Flood – Officials reported flash flooding on Highway 23 between Harrington and Sprague from a thunderstorm predicted to produce ½ inch of rain.

Probability of Future Occurrence

The probability of flood events occurring in Lincoln 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.

Lincoln 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 Lincoln County has 0 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.[67]

Impacts of Flood Events

Due to the lack of large, swift bodies of water in Lincoln County, 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 Lincoln County residents.

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[67] 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. January 2008.

The continuity of operations for Lincoln 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 Lincoln 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 Lincoln 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 Lincoln 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 114 structures totaling an estimated $8.5 million within the FEMA-identified floodplains (100- and 500-year) in unincorporated areas of Lincoln County. The per structure value is based on a countywide average home estimate of $74,296 and does not reflect the replacement cost of a structure. According to Lincoln County Emergency Management and the State Hazard Mitigation Plan, there are currently no repetitive loss properties within Lincoln County. The average damage to structures was estimated based on the parcel's location as either completely within or out of the flood zone. The estimated value of contents is ½ the value of the improvements equating to an additional $4.2 million in potential losses. 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.

Critical infrastructure located within the identified floodplain for unincorporated areas includes numerous road segments, 52 bridges or other drainage structures, the Lincoln Hill boat launch, the Seven Bays boat launch and marina, the Fort Spokane boat launch, the Detillion boat launch, and the Keller Ferry. The replacement value of a bridge in Lincoln County averages $1 million while other types of drainage structures typically average $500,000 according to Lincoln County Public Works.

Earthquake Profile

Based on historical records, Lincoln County has not experienced any seriously damaging earthquakes in recorded history. Several distant earthquakes produced intensities strong enough to be felt in eastern Washington, but no earthquake epicenters were recorded for the region.[68] All earthquakes in eastern Washington have been shallow and most are at depths less than 6 kilometers. The largest earthquake in eastern Washington since 1969 was a shallow, magnitude 4.4 event northwest of Othello on December 20, 1973. Some of the most active earthquake areas in eastern Washington 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.[69]

Probability of Future Occurrence

There are at least seven known geologic folds in the western part of Lincoln County. These folds reach into the County from the west 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 5.5, much of the western third of Lincoln County has 10% chance of exceeding a 7-8% pga in the next 50 years. This probability trends downwards to a 6-7% pga on the eastern two-thirds of the County.[70] No specific jurisdictions or special districts were identified as having differing issues or levels of risk associated with this hazard.

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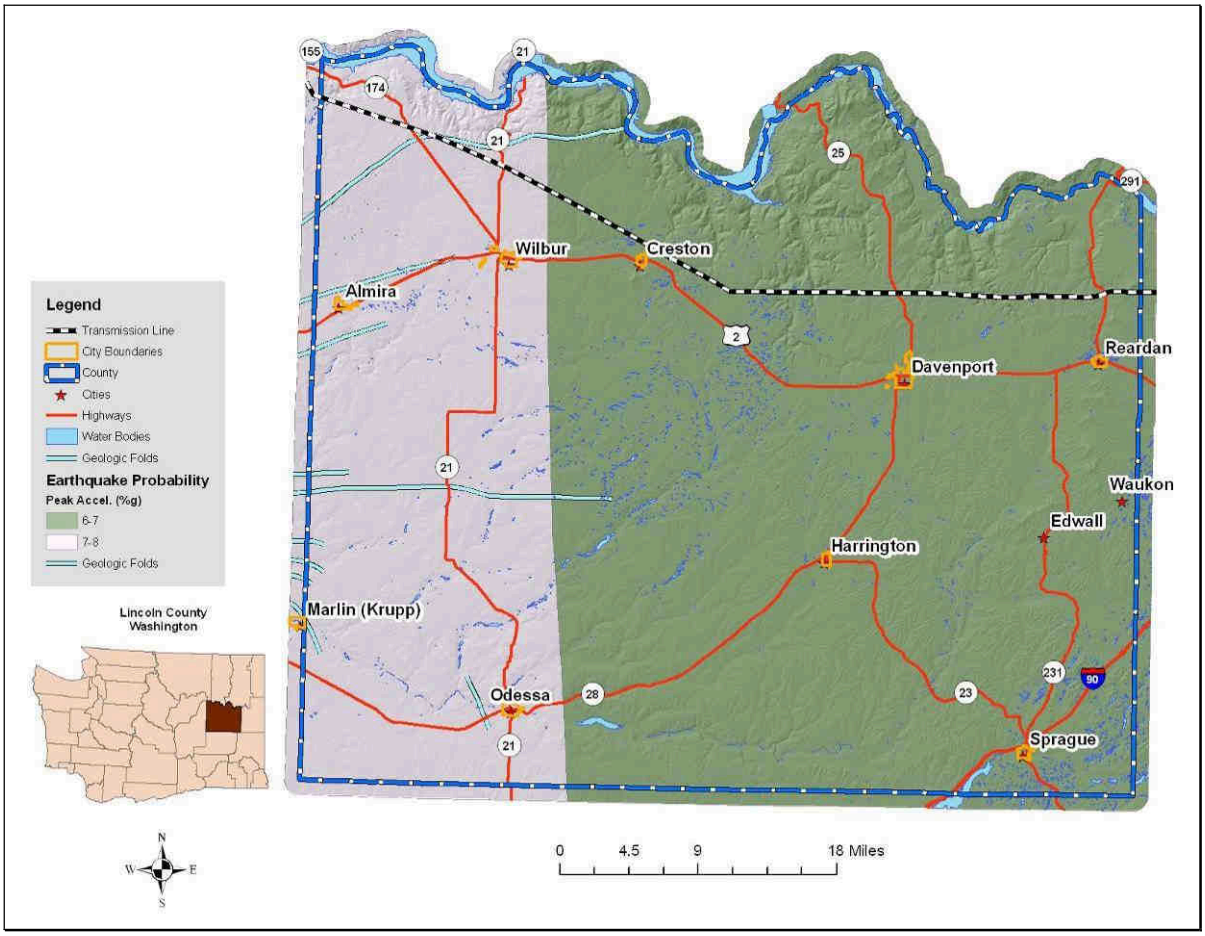
[68] Noson, Linda Lawrance, et al. Washington State Earthquake Hazards. Washington Division of Geology and Earth Resources Information Circular 85. Olympia, Washington. 1988.

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

[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 5.5. Regional Earthquake Probability Map.



Impacts of Earthquake Events

Past events suggest that an earthquake in the Lincoln 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 Lincoln 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 Lincoln, 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 Lincoln 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[71] 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 Lincoln County, HAZUS was used to model a scenario based on the parameters of the nearest historic epicenter. The modeled earthquake occurred near Chelan, 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 Lincoln 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 8,000 buildings in Lincoln County with a total building replacement value (excluding contents) of $773 million. Approximately 94% of the buildings and 72% of the building value is associated with residential housing. The software also reported that 4 residential structures would be moderately damaged and 20 would be slightly damaged. Only 1 commercial building is expected to incur slight damages. The majority of residential structures expected to be damaged are manufactured homes.

The replacement value of the transportation and utility lifeline systems is estimated to be $3.4 million and $267 million, 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.

Figure 5.6. Summary of Utility System Pipeline Damage from HAZUS.

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	5,581	7	2
Waste Water	3,348	3	1
Natural Gas	2,232	1	0
Oil	0	0	0

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

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 Lincoln County. HAZUS estimated that there would be approximately $30,000 in economic losses attributed to bridge repairs, $70,000 in economic losses from repairs to airport facilities, and $10,000 in economic losses from repairs to the Keller Ferry facility. Minor economic losses are also expected due to repair of potable water distribution lines ($30,000), wastewater facilities and distribution lines ($40,000), natural gas distribution lines ($10,000), and electrical power facilities ($40,000).

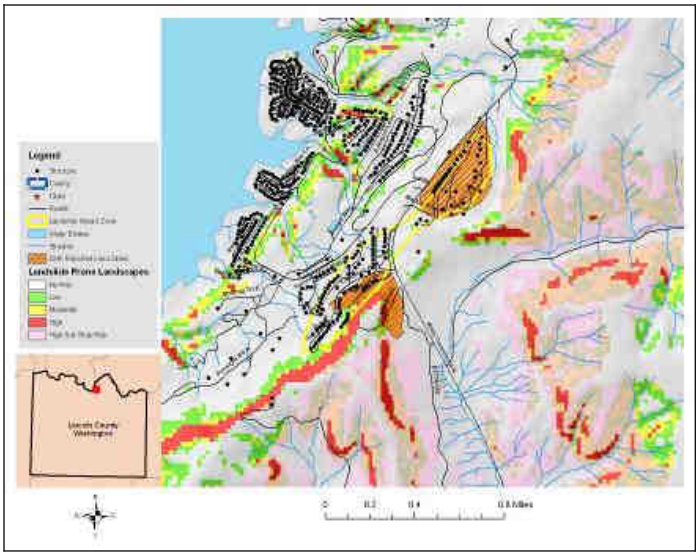
The only known publicly accessible unreinforced masonry structure in unincorporated Lincoln County is the Guardhouse at Fort Spokane. This building is a historical structure built in the late 1800s by the Army and is currently used as a Visitor's Center from May to September. The value of this structure is not determinable.

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

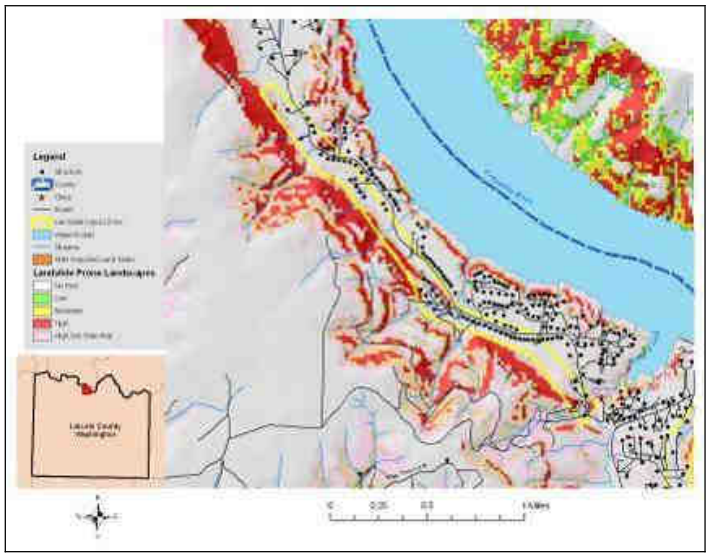
To date, there is no recorded history of major landslides occurring in Lincoln County; however, there is evidence of past landslides along the Columbia River on the northern edge of Lincoln County. The probability of a major landslide event in Lincoln County is moderate to low. Nevertheless, there are some areas in Lincoln County that have specific landslide concerns. 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



Seven Bays Landslide Impact Zone

The only major landslide potential in Lincoln County occurs along the Columbia River drainage. While ancient alluvial fans provide evidence of historic landslides, 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

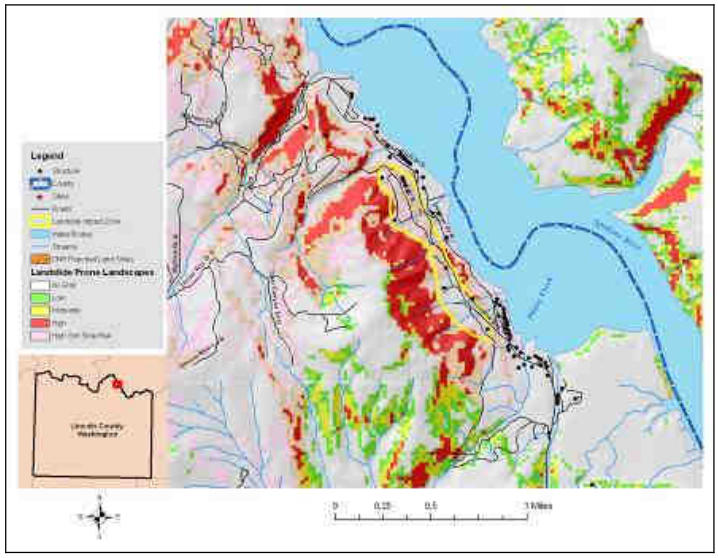


Sterling Valley Landslide Impact Zone

and/or reactivate and extend old ones. Some of the landslide complexes extend for thousands of feet along the lakeshore, 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 waves generated by fast-moving landslide masses.

The majority of the population in Lincoln 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 Clearwater 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°



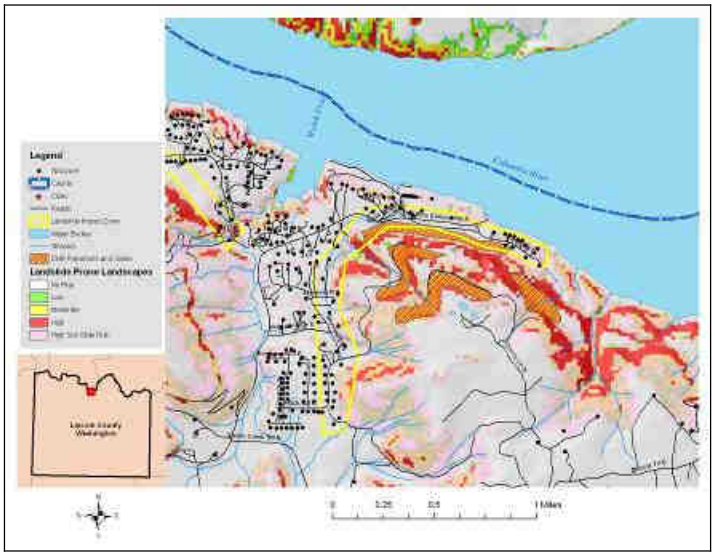
Porcupine Bay Landslide Impact Zone

(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.[72]

The Seven Bays, Porcupine Bay, Sterling Valley, and Redwine Canyon Landslide Impact Zones encompass relatively large population clusters along the Lake Roosevelt shoreline. In addition to the residences, landslides in these Impact Zones may affect several of county access roads. In many cases, there is only one well-maintained access route into the residential areas; thus, a closure or temporary delay could cause serious traffic concerns and possibly isolated some residents for an extended period of time.

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 Washington Department of Natural Resources has mapped areas of past landslide events in the Seven Bays and Redwine Canyon Impact Zones. 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, they can result in significant damage to buildings and infrastructure, disrupt travel, reduce water quality, and jeopardize safety.



Redwine Canyon Landslide Impact Zone

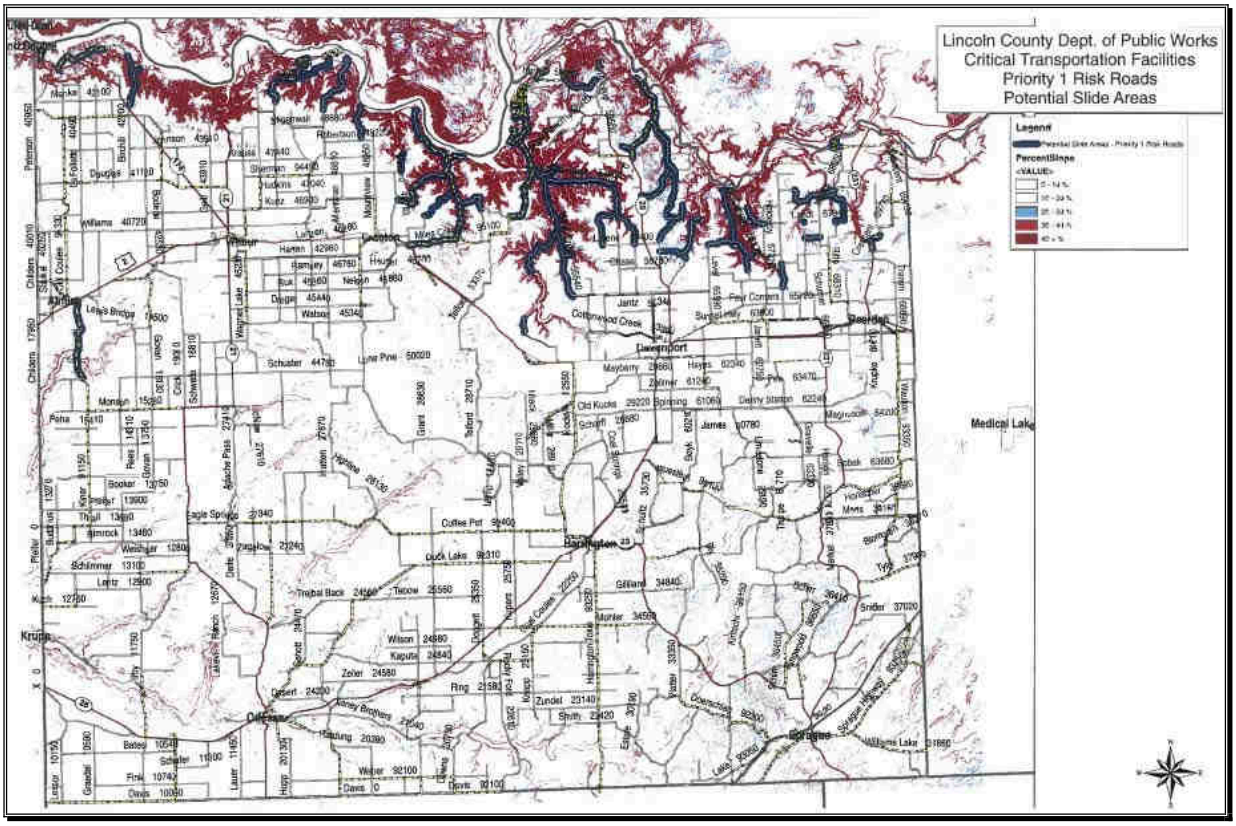
[72] McClelland, D.E., et al. 1977. Assessment of the 1995 and 1996 floods and landslides on the Clearwater National Forest Part 1: Landslide Assessment. Northern Region U.S. Forest Service. December 1977.

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.

Lincoln County has classified the transportation infrastructure by priority and significance in the event of a natural or man-caused disaster. The first priority for repairs or maintenance in an emergency event is given to roads, bridges, and structures on minor arterials (FFC 6), major collectors (FFC 7), and local access routes serving areas of rural residential development (FFC 8). Lincoln County maintains its transportation infrastructure inventory and priority classification system as a GIS database at the Public Works office.

Figure 5.7. Critical Transportation Facilities in Higher Potential Landslide Areas.



Local Event History

July 1949 Landslide – A two to three million cubic yard landslide near the mouth of Hawk Creek created a 65-foot wave that crossed the lake about 35 miles above Grand Coulee Dam.

January 2009 Landslide – Property owners in the Spokane Arm of Lake Roosevelt were swamped by a huge wave caused by a 17 acre landslide near Mill Canyon northeast of Davenport. The resulting wave reached 30 feet above the full pool mark across the lake at Breezy Bay. Private docs and vessels were destroyed or damaged up to 1.5 miles downstream. The water reached one residence before receding and came up to the foundations of several others.

Probability of Future Occurrence

The majority of the landslide potential in Lincoln County occurs in the steep canyons along the Columbia River. The canyons associated with Columbia River and Lake Roosevelt have a high propensity for slides based on the steeper slopes, unstable soils, and history of occurrence. Wildfires and/or severe storms that saturate the soils could lead to major slide events in these areas.

Nevertheless, not all of the Lake Roosevelt shoreline is at risk to landslides and development has only occurred in specific areas rather than along the entire extent of the shore. The probability of occurrence of major, high velocity landslide events in this area, including those caused by severe local storms, is moderate. The probability of other areas in Lincoln County experiencing a landslide event is very low.

Impacts of Landslide Events

In Lincoln County, minor landslides along toe-slopes and roadways occur annually with minimal impact to local residents. Major landslides in northern Lincoln County 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 Lincoln 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 5.2. Landslide Impact Zones in Lincoln County.		
Landslide Impact Zone	**Number of Structures**	**Value of Structures at Risk**
Seven Bays	90	$6,686,612
Porcupine Bay	10	$742,956
Sterling Valley	52	$3,863,375
Redwine Canyon	44	$3,269,010
Total	**196**	**$14,561,955**

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.

Severe Weather

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

All of Lincoln 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 areas along the Lake Roosevelt shoreline 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. Lincoln County is not considered to be one of the counties most vulnerable to winter storms and blizzards in Washington according to the Washington State Hazard Mitigation Plan.[73]

Lincoln County Road in Winter 2009

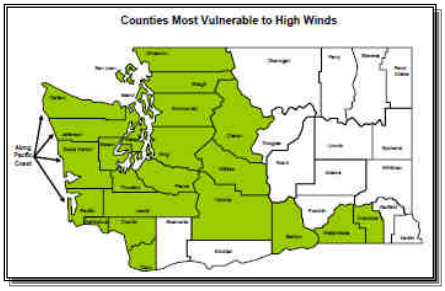
In Lincoln County, ice storms occur when a layer of warm air is between two layers of cold air. Frozen precipitation melts while falling into the warm air layer, and then proceeds to refreeze in the cold layer above the ground. If the precipitate is partially melted, it will land on the ground as sleet. However, if

[73] 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.

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 freeze, forming a thin film of ice that can build up on trees, utilities, roads, and other structures, infrastructure, and personal property.[74]

Due to their relative frequency and minimal severity, severe thunderstorms are not well documented in Lincoln 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 Lincoln 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 Lincoln 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 Lincoln 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

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

slopes, and portions of the Columbia Basin. Lincoln County is not considered to be one of the most vulnerable to high winds in Washington State according to the Washington State Hazard Mitigation Plan.[75]

Lincoln 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 Lincoln 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[76] and the National Climatic Data Center[77], there were 6 reports of tornadoes in Lincoln County between 1880 and 2000. They occurred in May 1957 (F0), April 1972 (F3), August 1978 (F1), May 1979 (F1), May 1997 (F1), and June 2009 (F0-1). There were 5 separate funnel clouds in the Davenport and Creston areas associated with the June 2009 event. The 1972 tornado was recorded as an F3 on the Fujita Tornado Scale, which correlates to approximately 158 to 206 mile per hour winds. This storm caused 1 injury.

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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[75] 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.

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

[77] National Climatic Data Center. 2010. *Storm Events Database*. NOAA Satellite and Information Service. U.S. Department of Commerce. Available online at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms.

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.

June 2009 Tornadoes near Creston

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.

June 2009 Tornadoes – The tornadoes in grain fields south or U.S. Highway 2 between Creston and Wilbur caused limited damage and were classified at the lowest level, zero, on the Enhanced Fujita Scale (EF0). Under the scale, wind gusts could reach 65 to 85 mph. The thunderstorm was centered northwest of Sprague in Lincoln County. It dropped hail of one inch in diameter at the west side of Sprague Lake and caused flooding across a rural highway northwest of Sprague.

January 2009 Ice Storm – Freezing fog caused power lines and tree limbs to snap throughout Lincoln County. More than 1,600 electrical customers were without power. The Sheriff's dispatch center had to switch to generators for power. Early estimates indicated that the recent ice damage, snow storms, and flooding in the Spokane area left $100 million in damages.

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.[78]

Probability of Future Occurrence

The probability of Lincoln 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 Lincoln County during the winter months. Severe and damaging ice storms have occurred in Lincoln County twice in the last 5 years. The probability of this type of event is moderate to high annually.

Wind events are also common in Lincoln 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 Lincoln County each year between April and September; however, these types of events rarely cause serious damage.

Lincoln 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 Lincoln 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 Lincoln 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 Lincoln 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

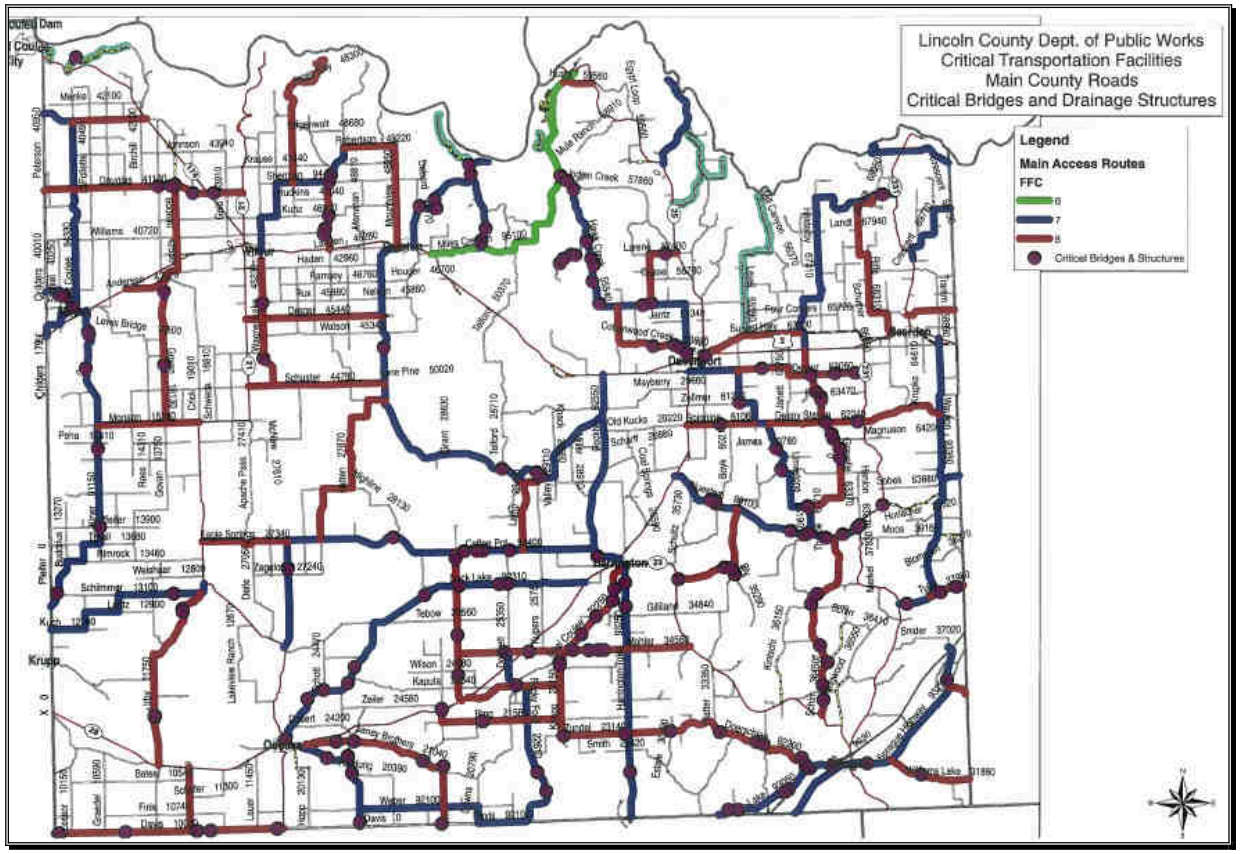
[78] FEMA. 2009. *Severe Winter Storm and Record and near Record Snow*. FEMA 1825-DR. Available online at http://www.fema.gov/pdf/news/pda/1825.pdf.

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.

Lincoln 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.

Many types of severe weather events tend to impact transportation routes and related infrastructure, especially snow and thunderstorms. Lincoln County has classified the transportation infrastructure by priority and significance in the event of a natural or man-caused disaster. The first priority for repairs or maintenance in an emergency event is given to roads, bridges, and structures on minor arterials (FFC 6), major collectors (FFC 7), and local access routes serving areas of rural residential development (FFC 8). Lincoln County maintains its transportation infrastructure inventory and priority classification system as a GIS database at the Public Works office.

Figure 5.8. Critical Transportation Facilities in Lincoln County.



Wind usually accompanies snow storms in Lincoln County; thus, large accumulations are not common as much of the snow is blown away. Commonly, heavy drifting is the cause of disruptions to normal commuting activities (delays and inability to plow roads and driveways). High wind events during the spring and summer months could lead to crop damages as well.

The potential impacts of a severe hail storm in Lincoln 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 Lincoln 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 Lincoln 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 Lincoln 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. Additionally, due to the lack of significant topographic features, the wind tends to blow much of the snow accumulation away. Snow plowing in Lincoln 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. Lincoln 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 Lincoln 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. Lincoln 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 Lincoln 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 Lincoln 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 Lincoln 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 Lincoln 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 4,861 total structures in unincorporated Lincoln County with a total value of approximately $361.2 million. 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 $5.4 million. The estimated damage to roofs is approximately $729,000.

Wildland Fire Profile

The Lincoln County Community Wildfire Protection Plan[79] provides a comprehensive analysis of the wildland fire risks and recommended protection and mitigation measures for all jurisdictions in Lincoln County. The information in the "Wildland Fire" sections of this Lincoln County Annex is excerpted from that more detailed document.

Lincoln County is located in northeast Washington. The county encompasses approximately 2,311 square miles and has an elevation range of 980 to 3,500 feet above sea level. Land is owned by private individuals, corporations, the state of Washington, and the federal government. Federal lands are managed by the Bureau of Land Management, National Park 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. Lincoln, the seventh largest county in the state, is bordered on the west by Grant County, to the south by Adams and Whitman County, to the east by Spokane County, and to the north by Stevens County, Ferry County, and a small part of Okanogan County. Lincoln 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 connected by Lake Creek and Crab Creek on the southern and eastern side of the county. The terrain is predominantly flat with alternating rolling hills and shallow canyons or coulees. Along the northern boundary the topography becomes steep as it plunges into wide valleys formed by the Spokane and Columbia Rivers. The mild climate, abundance of sunshine and low annual precipitation results in an environment that is potentially very prone to wildland fire. Although much of the native grasslands have been converted for agricultural purposes, there are many areas of native vegetation and fallow farm land that cures early in the summer and remains combustible until winter. If ignited, theses areas burn rapidly, potentially threatening people, homes, and other valued resources.

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 earths surface leaving areas of deep rich soil interspersed with rocky canyons 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.

Lincoln County has four predominant landscapes types that exhibit distinct terrain and wildland fuels: agricultural lands, channeled scablands, western river breaks, and eastern river breaks. 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 dominates Lincoln County facilitates extensive 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

[79] King, Tera and V. Bloch. 2008. Lincoln County Community Wildfire Protection Plan. Northwest Management, Inc.. Moscow, Idaho.

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 canyons and river breaks on sloping terrain less favorable to clearing for agricultural development. A patchwork of ponderosa pine and Douglas-fir stands occupy sheltered areas on favorable soil where moisture is not a limiting factor. 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.

Development is rapidly occurring along the Spokane and Columbia River breaks on the north side of the county. Many people have purchased small tracts of land in this location and built dwellings amongst the trees and shrubland. Scenic vistas and rolling topography with close proximity to Lake Roosevelt National Recreation Area make this area 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 Lincoln County Fire Districts. Using the data on past fire extents and ignition, the occurrence of wildland fires in the region of Lincoln County has been evaluated.

The Washington Department of Natural Resources database used in this analysis includes ignition and extent data from 2004 through 2008 for wildfires occurring on DNR protected lands, which are located primarily north of Highway 2 in Lincoln County. An analysis of the DNR reported wildfire ignitions in Lincoln County reveals that during this period over 25,000 DNR-protected acres burned as a result of 36 wildfire ignitions. The Miscellaneous ignition source category resulted in both the most number of ignitions and by far the most acres burned. However, the majority of the acres burned in this category occurred in 2008 as a result the Swanson Lake Fire (19,096 acres). Fires ignited by lightning and equipment contributed to a

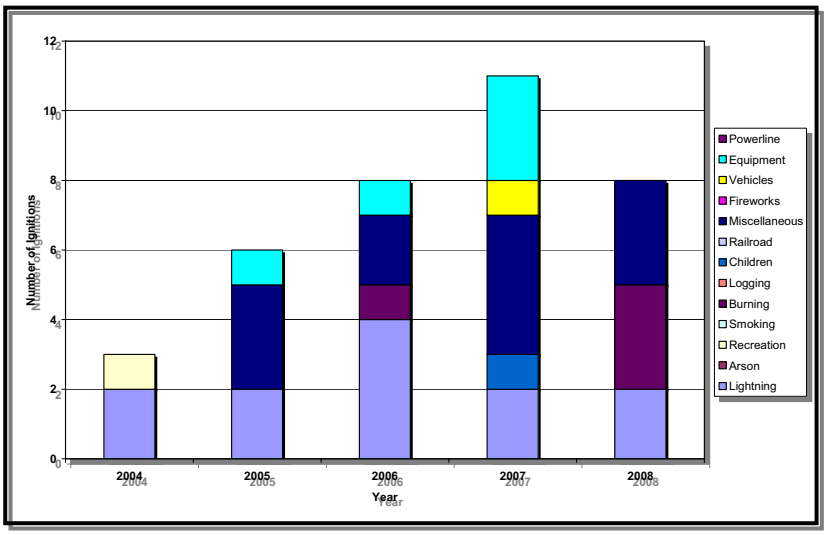
significant amount of ignitions and total acres burned. An average of 7 fires and 5,100 acres burned per year was recorded during this period.

Table 5.3. Summary of ignitions in Lincoln County from Washington DNR database 2004-2008.

Cause	Acres Burned	Percent	Number of Ignitions	Percent
Lightning	29	0%	12	33%
Arson	-	0%	0	0%
Recreation	150	1%	1	3%
Smoking	-	0%	0	0%
Burning	39	0%	4	11%
Logging	-	0%	0	0%
Children	3	0%	1	3%
Railroad	-	0%	0	0%
Miscellaneous	22,847	89%	12	33%
Fireworks	-	0%	0	0%
Vehicles	1	0%	1	3%
Equipment	2,661	10%	5	14%
Powerline	-	0%	0	0%
Total	**25,729**	**100%**	**36**	**100%**

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 5.9. Washington DNR Recorded Ignitions 2004-2008.

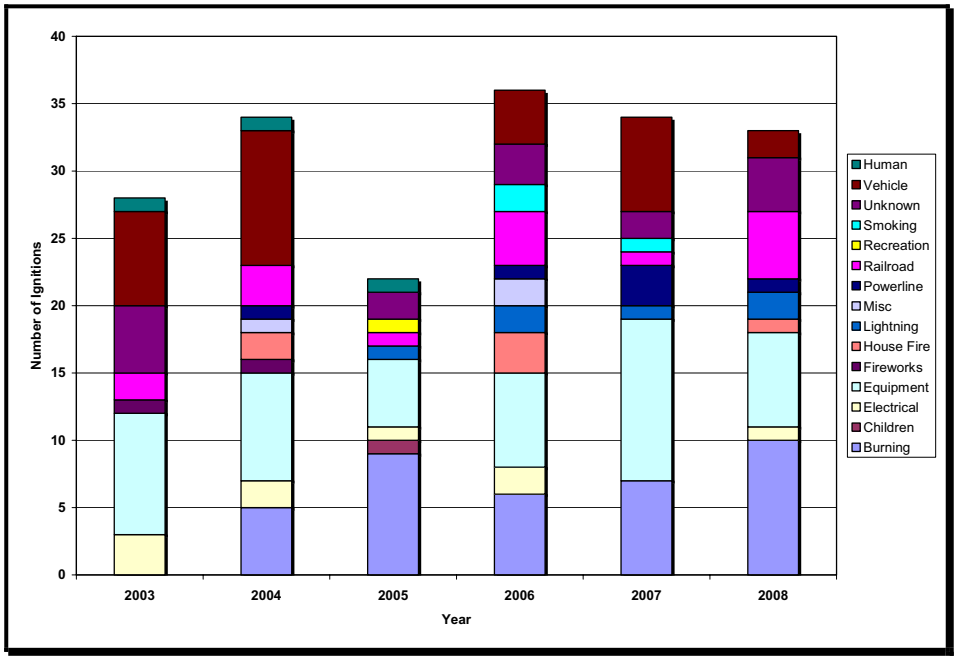


In order to capture the full breadth of the wildfire ignitions in Lincoln County, ignition and extent data was compiled from most of the local fire district's records. This database includes ignition and extent data from Lincoln County Fire District #1, #6, #7, #8, and #9 from 2003 through 2008. Although this data helps to more accurately describe the wildland fire potential in the County, many of the fires may have been reported by more than one district resulting in duplicated entries. Additionally, many of these fires are also included in the Washington DNR database.

Table 5.4. Summary of Ignitions in Lincoln County Reported by Local Fire Districts 2003-2008.				
Cause	**Acres Burned**	**Percent**	**Number of Ignitions**	**Percent**
Burning	294	1%	37	20%
Children	1	0%	1	1%
Electrical	14	0%	9	5%
Equipment	9,170	18%	48	26%
Fireworks	9	0%	2	1%
House Fire	130	0%	6	3%
Lightning	19,205	37%	6	3%
Miscellaneous	2	0%	3	2%
Powerline	46	0%	6	3%
Railroad	50	0%	16	9%
Recreation	1,000	2%	1	1%
Smoking	3	0%	3	2%
Unknown	2,642	5%	16	9%
Vehicle	7,376	14%	30	16%
Human	12,051	23%	3	2%
Total	**51,992**	**100%**	**187**	**100%**

This database augments the DNR's data by showing that lightning, equipment, and vehicle fires are significantly contributing to the number of acres burned each year while burning, equipment, and vehicles are accountable for the most number of ignitions.

Figure 5.10. Ignition Data Recorded by Local Fire Districts 2003-2008.



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.[80] The fires burned from 1 to 47 years apart, with most at 5- to 20-year intervals.[81] With infrequent return intervals, plant communities tended to burn more severely and be replaced by vegetation different in composition, structure, and age.[82] 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 Lincoln 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 provide a general picture of the level of wildland-urban interface fire risk for Lincoln County overall. Based on the historical information available, Lincoln County has a very high probability of wildland fires occurring on an annual basis, with larger fires occurring every 2 to 5 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 Lincoln County.

Impacts of Wildland Fire Events

Wildland fires, big and small, are dangerous to both Lincoln 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 Lincoln 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.

Lincoln 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,

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

[81] 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.

[82] 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.

triggering health problems. In areas heavily impacted by smoke, people with breathing problems might need additional services from doctors or emergency rooms.

Commerce in Lincoln 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 Lincoln 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.

Lincoln 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 Lincoln 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.

Avalanche Profile

There have been no reported damages or lives lost due to an avalanche in Lincoln County. The northern border of the County along Lake Roosevelt has the highest propensity for avalanches due to the steeper terrain; however, this area rarely accumulates a significant amount of snow. Any avalanche danger in this area would most likely be associated with drifts or other small accumulations sliding onto a road. There are currently no avalanche mitigation programs occurring in Lincoln County.

Probability of Future Occurrence

The probability of an avalanche along the northern border of Lincoln County is low. The most significant risk is associated with small slides along roadsides, which occurs occasionally, but with little impact.

Impacts of Avalanche Events

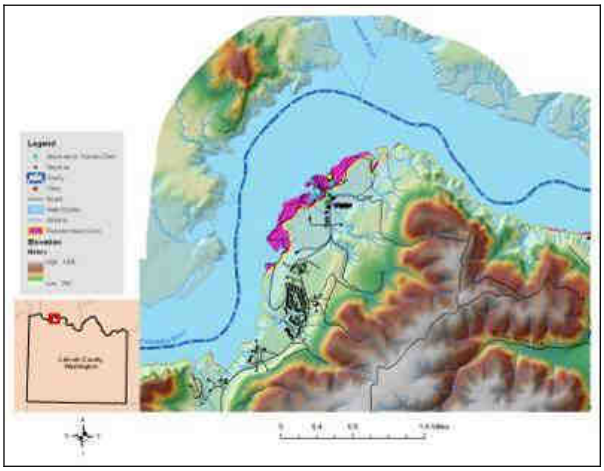
It is unlikely that residents of Lincoln County would experience any significant impact from an avalanche. Damage to cut or fill slopes along roads in the northern fringe of the County may occur due to small snow slides carrying debris. Slides onto roads would likely require removal by Lincoln County Public Works, but pose very little danger.

Value of Resources at Risk

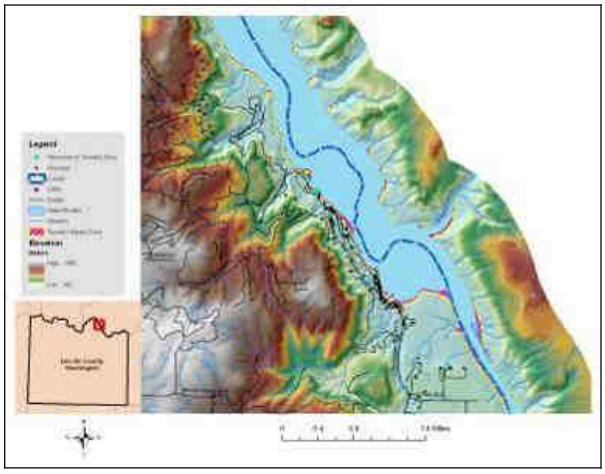
Lincoln County has no assets at significant risk of avalanches due to the topography and low snow accumulations.

Seiche Profile

The northern border of Lincoln County is formed by the Columbia River. There is a moderate probability of landslides causing localized seiches in this vicinity. The shores of Lake Roosevelt have been subject to several hundred landslides since the reservoir was filled during construction of Grand Coulee Dam in the 1930's and early 1940's. The greatest percentage of landslide activity occurred during initial filling of the reservoir, but many slope failures also have been caused by intermittent drawdown of the reservoir level. In addition, occasional slope failures have occurred as natural phenomena, related more to wet winters than to fluctuations of the reservoir.[83]

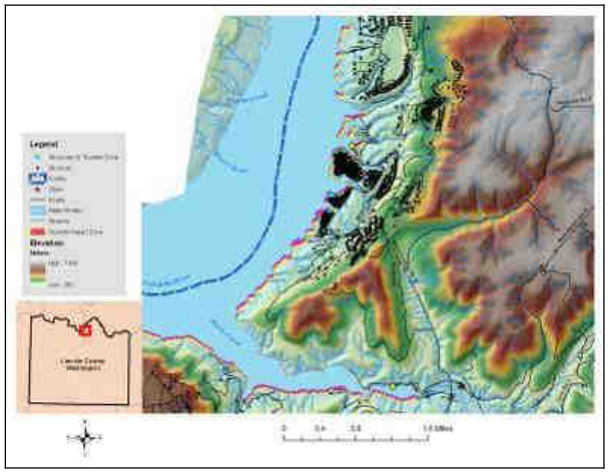


Keller

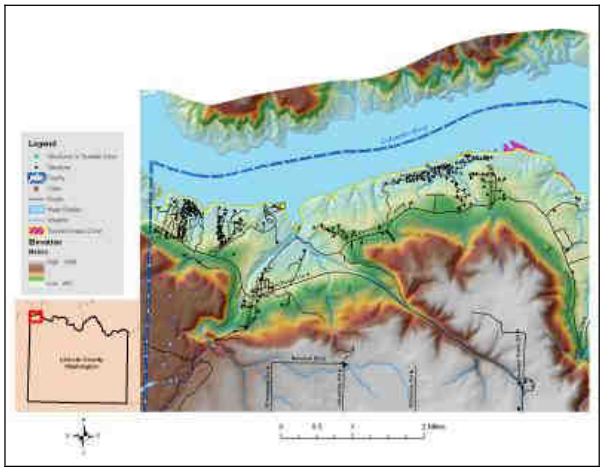


Porcupine Bay

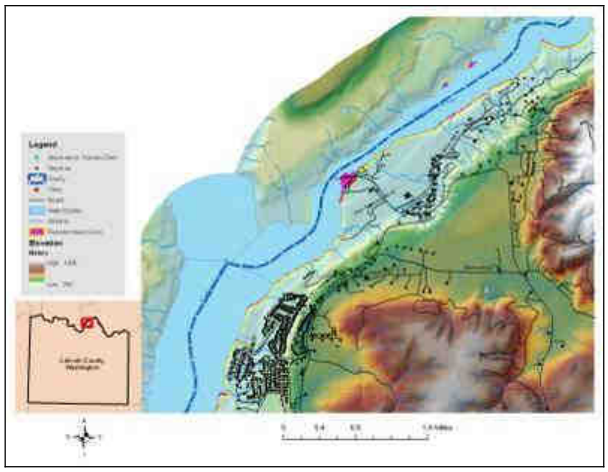
[83] Highland, Lynn M. and Robert L. Schuster. *"Significant Landslide Events in the United States."* U.S. Geologic Survey. Available online at http://landslide.usgs.gov/docs/faq/significantls_508.pdf.



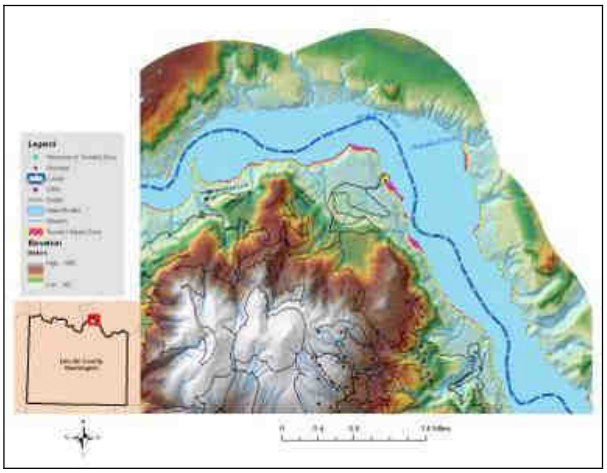
Seven Bays



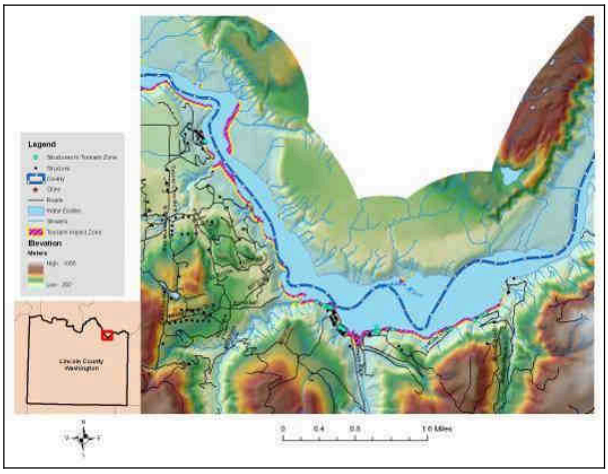
Spring Canyon



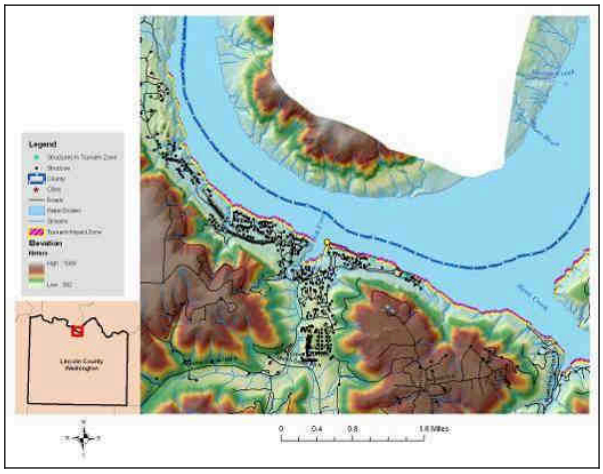
Fort Spokane



Detillion



Arrowhead Bay



Hawk Creek

Based on past events, it was determined that most of the landslides along Lake Roosevelt had produced a 30 foot or less wave on the opposite shore. For the purposes of this document, the Lincoln County shoreline was evaluated to determine where and what type of development or resources were in this potential Impact Zone. The Seiche Impact Zone is based on a 32.8 foot (10 meter) wave hitting above the Lake Roosevelt full pool level. The maps above depict the Impact Zone in areas with significant development or infrastructure at risk.

Local Event History

1944-1953 Seiches – Massive landslides generated a number of inland seiches in Lake Roosevelt after Grand Coulee Dam created the lake on the Columbia River. Most seiches generated large waves (30 to 60 feet in height) that struck the opposite shore of the lake, with some waves observed miles from the source.

January 2009 Seiche - Property owners in the Spokane Arm of Lake Roosevelt were swamped by a huge wave caused by a 17 acre landslide near Mill Canyon northeast of Davenport. The resulting wave reached 30 feet above the full pool mark across the lake at Breezy Bay. Private docks and vessels were destroyed or damaged up to 1.5 miles downstream. The water reached one residence before receding and came up to the foundations of several others.

August 2009 Seiche Damage

August 2009 Seiche – A large landslide occurred near the Blue Creek drainage on the Spokane Indian Reservation side of the Spokane Arm of Lake Roosevelt. This resulted in a 12 foot wave hitting Porcupine Campground on the southern shores less than a thousand yards across the Lake. Numerous people were in the water at Porcupine Bay during the event. Damage to National Park Service facilities including log booms, docks, and a swim platform was estimated at $250,000.

Probability of Future Occurrence

The probability of a seiche causing a direct impact on Lincoln County is unknown, but is believed to be moderate based on recent events. The probability of landslides continuing to occur along Lake Roosevelt as a function of saturated soils, changing land uses, or fluctuations in the reservoir level is high; however, the location of these slides is difficult to predict. Additionally, the size of the landslide will determine the size of the wave and the potential impact on the opposite shore.

Impacts of Seiche Events

Due to the lower population density and the lack of infrastructure within approximately 30 feet of the Lake Roosevelt shoreline, it is unlikely that a seiche would cause significant damages within the County. However, depending on the location, direction that the wave propagates, time of day, and time of year, property damages, casualties, and possibly fatalities from a seiche could be high within an impacted area, particularly if a seiche wave collides directly with an intensely populated recreational area.

Boat and other watercraft that happen to be impacted by seiche may be toppled, but this is unlikely. Smaller vessels have a higher risk of being overturned by a large wave. Nevertheless, boats in the direct vicinity of a landslide, may be severely damaged or sunk by falling debris and outwash. This would also be very dangerous for persons on board and would likely result in injuries or even death.

Value of Resources at Risk

Currently, there are 55 structures with an approximate total value of $4.1 million based on the County Assessor's data. Individual crops, structures, or docks may be damaged, but widespread losses are unlikely. Most of the infrastructure within the Impact Zone is recreational facilities including the National Park Service's Spring Canyon facility, Lincoln Hill launch ramp, Hawk Creek launch ramp, Seven Bays launch ramp and marina, Fort Spokane launch ramp, Detillion launch ramp, and the Porcupine Bay launch ramp. The Keller Ferry facility is also at risk. All of these recreational sites are valued in the millions.

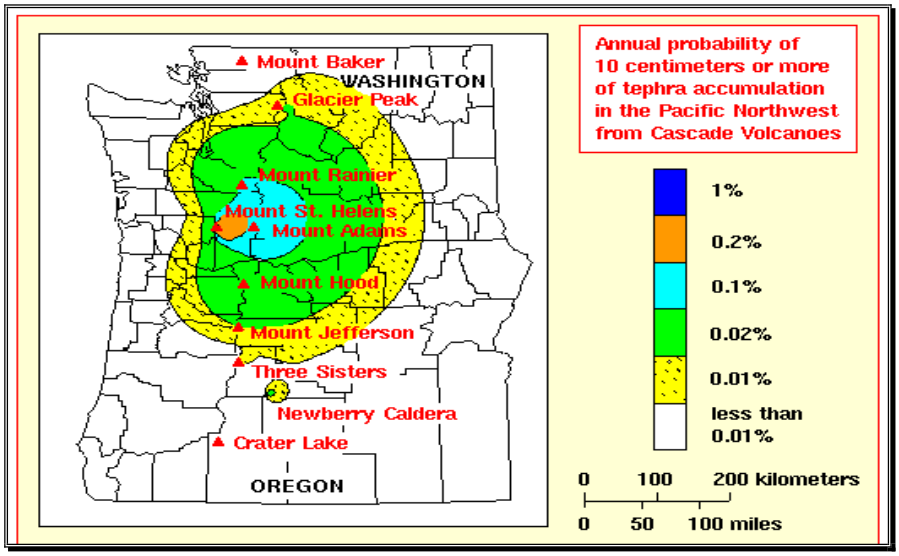
Volcanic Eruption Profile

Lincoln County is not directly at risk of experiencing a volcano; however, there is a high probability that ash and other particulates from an eruption in western Washington or Oregon would be carried to and deposited within the County. The Mount St. Helens eruption in 1980 deposited several inches of ash causing widespread damages to vehicles and other equipment in Lincoln County. The airborne particulates can also cause respiratory problems for both people and animals. These affects are particularly notable for populations already dealing with respiratory illnesses.

The most serious ash fallout risk in Lincoln County is due to Mount St. Helens, the most prolific producer of tephra (solid material thrown into the air by volcanic eruption) in the Cascades during the past few thousand years. Figure 5.11. provides estimates of the annual probability of tephra fall affecting the region, based on the combined likelihood of tephra-producing eruptions occurring at Cascade volcanoes, the relationship between thickness of a tephra-fall deposit and distance from its source vent, and regional wind patterns. Probability zones extend farther east of the range because winds blow from westerly directions most of the time. The map shows probabilities for a fall of 10 centimeters (about 4 inches) or greater. Even though Mount Adams is a meager tephra producer, the region around Mount Adams has the highest

probability of tephra fall of anywhere in the western conterminous United States, owing to its location just downwind of Mount St. Helens.[84]

Figure 5.11. Annual Probability of 10cm or more of Tephra Accumulation.



Probability of Future Occurrence

The geologic history is fragmented for most of the volcanoes in the Cascade Range, thus, the probability of one of these volcanoes entering a new period of eruptive activity is difficult to estimate. In general, the annual probability that Lincoln County will be significantly affected by a volcanic eruption is very low.

Impacts of Volcanic Eruptions

Lincoln County, like most areas, has sensitive populations, such as elderly residents and children, who may be affected by air quality during ash fall. Ash fall can severely degrade air quality, triggering health problems. In areas with considerable ash fall, people with breathing problems might need additional services from doctors or emergency rooms.

Volcanic eruptions can also disrupt the normal flow of commerce and daily human activity without causing severe physical harm or damage. Ash that is a few inches thick can halt traffic, cause rapid wear of machinery, clog air filters, block drains, creeks, and water intakes, and impact agriculture. Removal and disposal of large volumes of deposited ash can also have significant impacts on government and business.

The interconnectedness of the region's economy can be disturbed after a volcanic eruption. Roads, railroads, and bridges nearest the volcano can be damaged from lahars and mudflows, which will have an affect on intra-state travel and commerce. In addition, the movement of goods via the Columbia River can also be halted due to debris in the river and tephra in the air. The Mount St. Helens event in May 1980 cost

[84] *W.E. Scott, R.M. Iverson, J.W. Vallance, and W. Hildreth, 1995, Volcano Hazards in the Mount Adams Region, Washington: U.S. Geological Survey Open-File Report 95-492.*

the trade and commerce industry an estimated $50 million in only two days, as ships were unable to navigate the Columbia.

Local accounts of the Mount St. Helens eruption did not indicate that the ash deposition adversely affected crops. In fact, some noted that the addition of volcanic ash increased the water retention properties of the soil.

Clouds of ash often cause electrical storms that start fires and damp ash can short-circuit electrical systems and disrupt radio communication. Volcanic activity can also lead to the closure of recreation areas, particular along the Columbia River in Lincoln County, as a safety precaution.

Value of Resources at Risk

Lincoln County has no assets at direct risk of being impacted by a volcanic eruption. However, the secondary effects of ash and airborne particulates may have varying degrees of negative effects within the County. Damages to property will likely be limited to vehicles and cleanup costs. Additionally, residents of Lincoln County will be at risk to health problems associated with the respiratory effects of breathing airborne particulates.

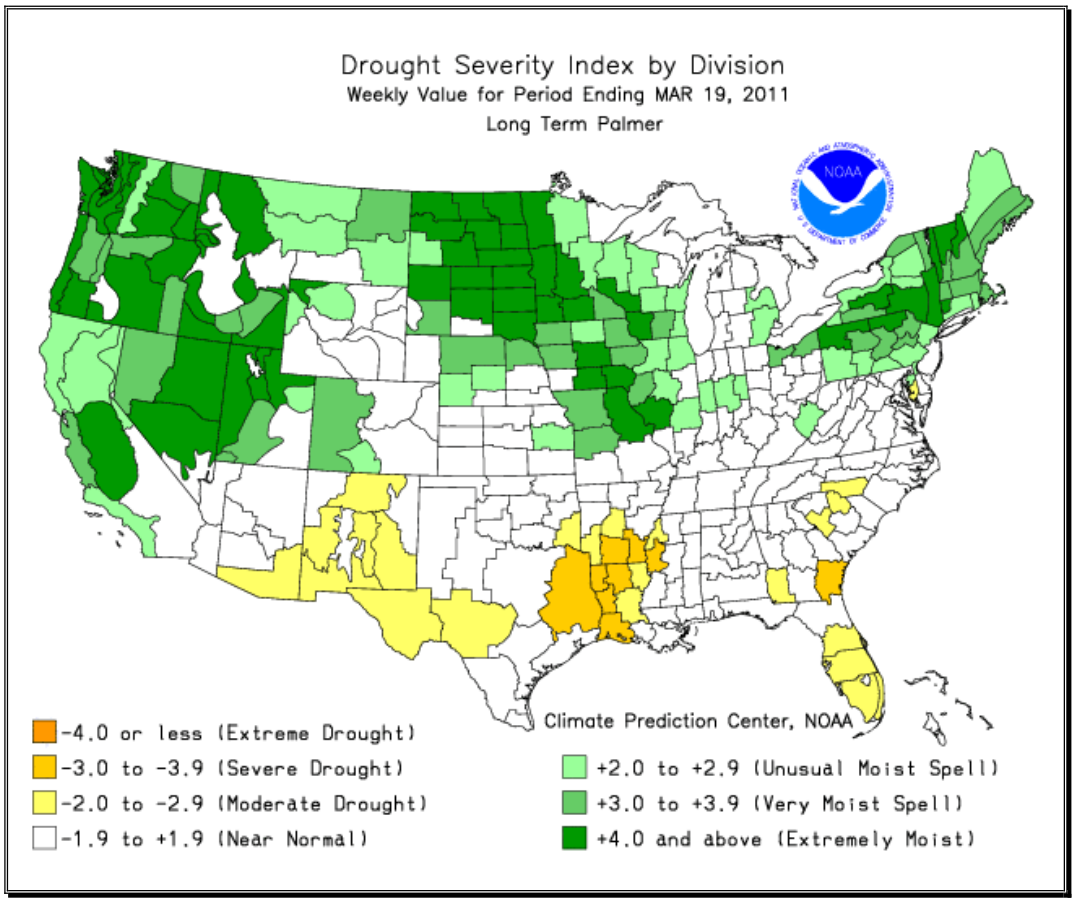
Drought Profile

Drought is a condition of climatic dryness that is severe enough to reduce soil moisture and water below the minimum necessary for sustaining plant, animal, and human life systems. [85] The Washington State Legislature in 1989 gave permanent drought relief authority to the Department of Ecology and enabled them to issue orders declaring drought emergencies. Nearly all areas of the State are vulnerable to drought. In every drought, agriculture is adversely impacted, especially in non-irrigated areas such as the dry land farms and rangelands in Lincoln County. Droughts impact individuals (farm owners, tenants, and farm laborers), the agricultural industry, and other agriculture-related sectors.

The severity of drought is measured by the Palmer Index in a range of 4 (extremely wet) to -4 (extremely dry). The Palmer Index incorporates temperature, precipitation, evaporation and transpiration, runoff and soil moisture when designating the degree of drought.

[85] Washington Military Department. 2008. Washington State Enhanced Hazard Mitigation Plan. Washington Military Department, Emergency Management Division. Camp Murray, Washington. Available online at http://www.emd.wa.gov/plans/washington_state_hazard_mitigation_plan.shtml.

Figure 5.12. Palmer Drought Severity Index for March 2011.



Drought affects water levels for use by industry, agriculture, and individual consumers. Water shortages affect fire fighting capabilities through reduced flows and pressures. Drought also affects power production. Much of Washington State's power is produced by hydro-electric dams. When water levels drop, electric companies cannot produce enough power to meet demand and are forced to buy electricity from other sources

Oftentimes, drought is accompanied by extreme heat. When temperatures reach 90 degrees and above, people are vulnerable to sunstroke, heat cramps, and heat exhaustion. Pets and livestock are also vulnerable to heat-related injuries. Crops can be vulnerable as well. In the past Washington State droughts, wheat has been scorched, apples have sunburned and peeled, and yields were significantly lessened.

Drought increases the danger of wildland fires. In Lincoln County, fires in rangeland areas are particularly dangerous due to typically high rates of spread and the scattered nature of structures and infrastructure that could potentially be affected.

High quality agricultural soils exist in much of Lincoln County. Many areas of the county sustain dry land crops such as wheat that are dependent upon moisture through the winter and spring and dry arid conditions in the summer. According to the 2007 Census of Agriculture, Lincoln County had 798 farms totaling 1,090,178 acres. The market value of these farms was reportedly $126,216,000 with government

payments totaling $15,371,000.[86] While Lincoln County does experience droughts, on the whole, they are mild and do not cause long term damage.

Local Event History

2001 Drought – While November and December 2000 were unusually dry, most experts assumed the typical heavy snow and rainfall levels would begin again in January 2001. However, my mid-March, Lincoln County was in a water supply deficit. On March 14th, 2001, then Governor Gary Locke authorized a statewide drought emergency. The August 2001 Palmer Drought Index shows that northeastern Washington, including Lincoln County, was considered in an "extreme drought" condition.

2005 Drought – The winter of 2004-05 were abnormally warm and a mid-January storm removed much of the remaining snowpack. On March 10, 2005, Governor Christine Gregoire authorized the Department of Ecology to declare a statewide drought emergency, which remained in effect until December 2005. The U.S. Drought Monitor showed Lincoln County as under a "severe drought" condition in May of 2005.

Probability of Future Occurrence

The Washington State Hazard Mitigation Plan does not consider Lincoln County to be one of the counties most vulnerable to drought in Washington. Lincoln County was in a severe drought condition 10-15% of the time between 1895 and 1995, 20-30% of the time between 1985 and 1995, and 30-40% of the time between 1976 and 1977.

It is critical that the people inhabiting each geographic region understand their exposure to the drought hazard: for example, the probability of drought occurrence at various severity levels. However, the risks associated with drought for any region are products of both the region's exposure to the event and the vulnerability of its society to a drought at that point in time. Vulnerability, unlike the natural event, is determined by varied social factors. Examples include:

- Population changes;
- Population shifts (region to region and rural to urban);
- Demographic characteristics;
- Environmental awareness (or lack thereof);
- Level of technology;
- Wisdom and applicability of government policies;
- Land management practices; and
- Social behavior.

These factors change over time and thus vulnerability is likely to increase or decrease in response to these changes. Subsequent droughts in the same region will have different effects, even if they are identical in

[86] Washington State Homeland Security Region 9. "Regional Threat/Risk Assessment and Vulnerability Analysis Report". Spokane, Washington. January 2011.

intensity, duration, and spatial characteristics, because societal characteristics will have changed. However, much can be done to lessen societal vulnerability to drought through the development of preparedness plans that emphasize risk management and the adoption of appropriate mitigation actions and programs.

Impacts of Drought Events

The impacts of drought are diverse and often ripple through the economy. Thus, impacts are often referred to as either direct or indirect. A loss of yield resulting from drought is a direct or first-order impact of drought. However, the consequences of that impact (for example, loss of income, farm foreclosures, and government relief programs) are secondary or even tertiary impacts.

The impacts of drought in Lincoln County can be classified into one of three principal types: economic, environmental, and social.

Economic Losses - Economic impacts range from direct losses in the broad agricultural and agriculturally related sectors (including forestry and fishing), to losses in recreation, transportation, banking, and energy sectors. Other economic impacts would include added unemployment and loss of revenue to local, state, and federal government.

Environmental Impacts - Environmental losses include damages to plant and animal species, wildlife habitat, and air and water quality; forest and range fires; degradation of landscape quality; and soil erosion. These losses are difficult to quantify, but growing public awareness and concern for environmental quality has forced public officials to focus greater attention on them.

Impacts on Society - Social impacts mainly involve public safety, health, conflicts between water users, and inequities in the distribution of impacts and disaster relief programs. As with all natural hazards, the economic impacts of drought are highly variable within and between economic sectors and geographic regions, producing a complex assortment of winners and losers with the occurrence of each disaster.

Value of Resources at Risk

The 2001 and 2005 drought years in Washington caused only minor damages and crop losses. There were no threats to any critical facilities. Thus, a minor to moderate drought has a low probability of affecting the County's economy directly due to the availability of irrigation waters. An extreme and prolonged drought could result in limited availability of irrigation water; thus causing severe crop losses countywide.

In the event of an extended drought cycle, water shortages may lead to crop failures, or at the least, the necessity to plant lower value crops that are less water-dependent. The majority of the population is employed either directly by the agriculture industry or to a service industry dependent on agriculture. Crop losses resulting from extended droughts would likely be considered a disaster for Lincoln County. Lower water levels may also affect the County's ability to efficiently transport crops to available markets. Barging of goods on the Columbia River could be reduced due to lower water levels.

Domestic and municipal water shortages are also likely to occur during an extended drought. Efforts to conserve water resources, including public education on conservation techniques, are encouraged by Lincoln County during the summer months.

City of Davenport Annex

Flood Profile

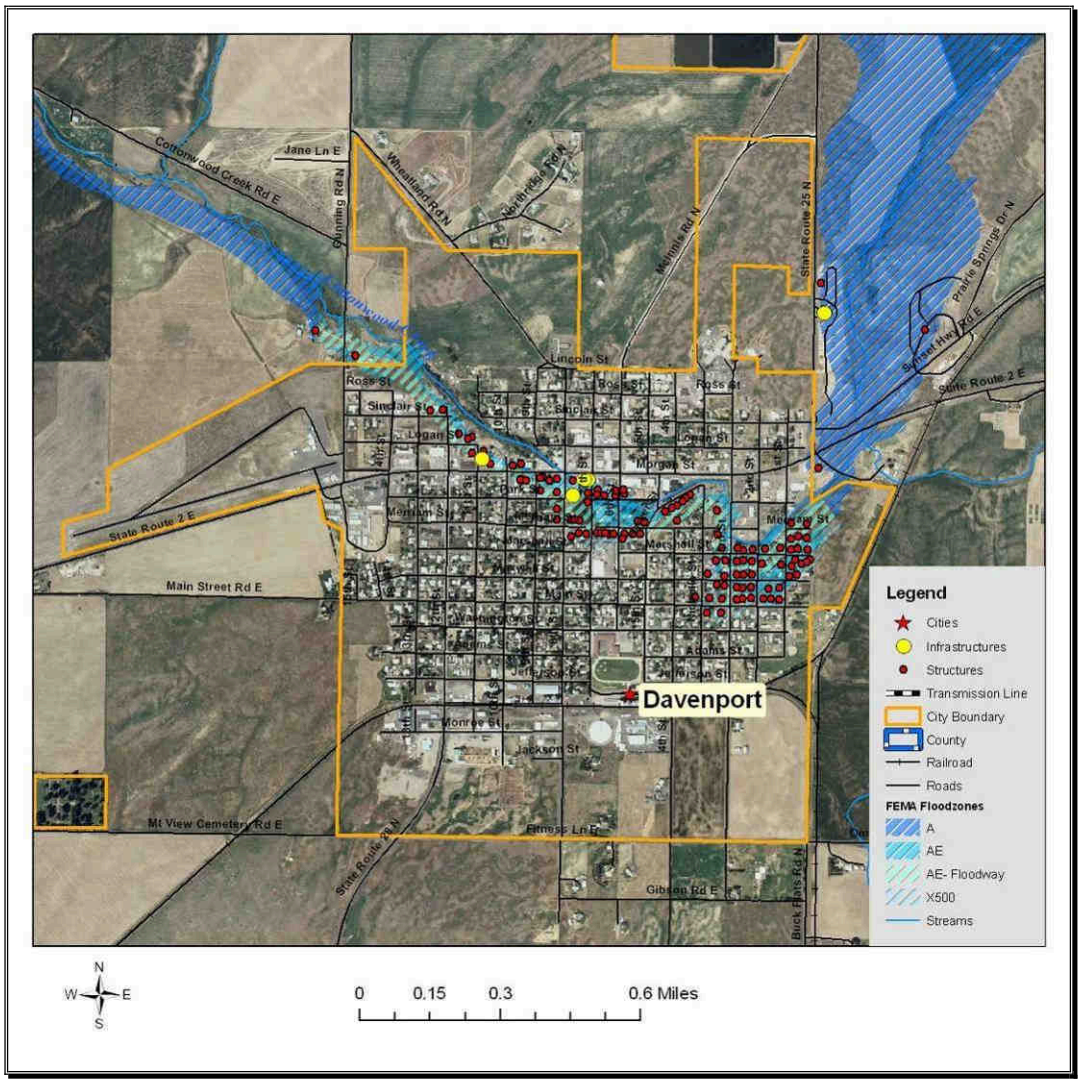
The main channel of Cottonwood Creek, a tributary to Hawk Creek, runs directly through the city of Davenport entering near State Highway 25 on the northeast corner of town and exiting along the western boundary. Within Davenport, flooding is generally limited to large rain-on-snow events such as occurred in 1996-1997 and most recently in 2009-10. 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. Flash floods are also a concern as numerous small tributaries feed Cottonwood Creek. These smaller streams typically have shallow channels with large floodplains draining hundreds of acres. Cottonwood Creek collects much of this runoff before entering the relatively narrow channel through downtown Davenport. Jams can also cause localized flooding as debris or ice get caught at bridge abutments and other obstructions causing the channel to become constricted and floodwaters to back up.

Davenport's municipal water system is supplied by several wells in the area. Flooding as well as several other hazards and numerous potential non-point sources could cause contamination of the water supply or affect the capacity of the system. All of the homes and businesses in Davenport are fed by the municipal system; thus, the impact of these events could affect the majority of the population including the hospital and schools.

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. City of Davenport FEMA Flood Insurance Rate Map.



Probability of Future Occurrence

The probability of flood events occurring in Davenport is moderate to high. Low magnitude flood events can be expected several times each year, particularly within the wider floodplain just north of the city limits. 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 Davenport. Minor flash floods are common on the numerous small tributaries feeding Cottonwood Creek near the community, but are not likely to have an impact on the Cottonwood Creek channel within the city center.

Impacts of Flood Events

The potential impacts from flooding in Davenport are very similar to the impacts described for Lincoln 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 Davenport 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 Cottonwood Creek 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 Davenport. 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. Cottonwood Creek 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

There are approximately 291 parcels and 108 structures within the FEMA-identified floodplains (100- and 500-year) in Davenport, yielding a total structure value of $8 million. The per structure value is based on a countywide average of $74,296 and does not reflect the replacement cost of a structure. The average damage to structures was estimated based on the parcel's location as either completely within or out of the flood zone. The estimated value of contents is ½ the value of the improvements equating to an additional $4 million in potential losses. 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.

Critical infrastructure located within the identified floodplain for Davenport includes the fire station, the police station, and the Inland Power and CenturyTel communication towers. Currently, there are no repetitive loss properties in Davenport.

Earthquake

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

Probability of Future Occurrence

The City has 10% chance of exceeding a 6-7% pga in the next 50 years.[87]

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 Davenport 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 Davenport, nearly all of the downtown structures are assumed to be unreinforced masonry including the police and fire station, city Library, city hall, and nearly all original buildings located on Morgan Street (SR2). 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 Davenport is unknown, but estimated to include at least 100 buildings.

Landslide Profile

The city of Davenport 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

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

Severe Weather Profile

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

[87] 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.

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. Lincoln 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 Davenport 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 Davenport. 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 Davenport 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 Davenport 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 802 total structures in Davenport with a total value of approximately $59.6 million. Using the criteria outlined above an estimate of the impact of high winds in Davenport has been made. The potential wind and tornado damage to all buildings is estimated at approximately $2.1 million. The estimated damage to roofs is approximately $120,000.

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 community of Davenport is surrounded by agricultural crops and pasture. Vast areas of deep, rich soil deposits provide for extensive agriculture development. Lincoln County is the second highest wheat and barley producing county in the state. Other crops include grass seed, oats, hay and potatoes as well as extensive areas of fallow land set aside in the CRP. Most of these crops are vulnerable to wildfire at certain times of the year. New development occurs primarily near the community and along major roads. Occasionally farmland is subdivided between family members for new home sites or for development of new farming facilities.

Wildfire potential in the agricultural fields near Davenport 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 Davenport. 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 Davenport 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.

Lincoln County Fire District #5 protects the community of Davenport. The fire district provides structural fire protection as well as wildland fire protection. 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 north of Highway 2 in Lincoln County. 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 Lincoln 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 Davenport 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

The potential impacts from a wildfire in Davenport are very similar to the impacts described for Lincoln 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 Davenport 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 Davenport 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.

Avalanche Profile

The city of Davenport will not be directly impacted by this type of localized event due to the gentle topography and low snow accumulations.

Impacts and Value of Resources at Risk

The city of Davenport will not be impacted and has no assets at risk to avalanches.

Seiche Profile

Although Lincoln County's northern border has a moderate risk of being impact by a seiche on Lake Roosevelt, the city of Davenport will not be directly impacted by this type of localized event.

Impacts and Value of Resources at Risk

The city of Davenport will not be impacted and has no assets at risk to seiches.

Volcanic Eruption Profile

The city of Davenport does not have any differing levels of risk associated with this hazard than Lincoln County as a whole.

Impacts and Value of Resources at Risk

The city of Davenport has no assets at direct risk of being impacted by a volcanic eruption. However, the secondary effects of ash and airborne particulates may have varying degrees of negative effects. Damages to property will likely be limited to vehicles and cleanup costs. Additionally, residents of Davenport will be at risk to health problems associated with the respiratory effects of breathing airborne particulates.

Drought Profile

The city of Davenport does not have any differing levels of risk associated with this hazard than Lincoln County as a whole. However, the city does have its own policies concerning water conservation practices during emergency drought conditions. Additionally, the city may further develop programs to deal with residents and businesses significantly impacted by drought if necessary. Year-round water conservation ideas are regularly being offered to citizens to reduce consumption.

Impacts and Value of Resources at Risk

The city of Davenport has no assets directly at risk to drought; however, the economic impacts of a drought or a wildland fire caused by extended dry periods would have a great impact on the community. The majority of the population is employed either directly by the agriculture industry or to a service industry dependent on agriculture. Crop losses resulting from extended droughts would likely be considered a disaster for the community.

City of Sprague Annex

Flood Profile

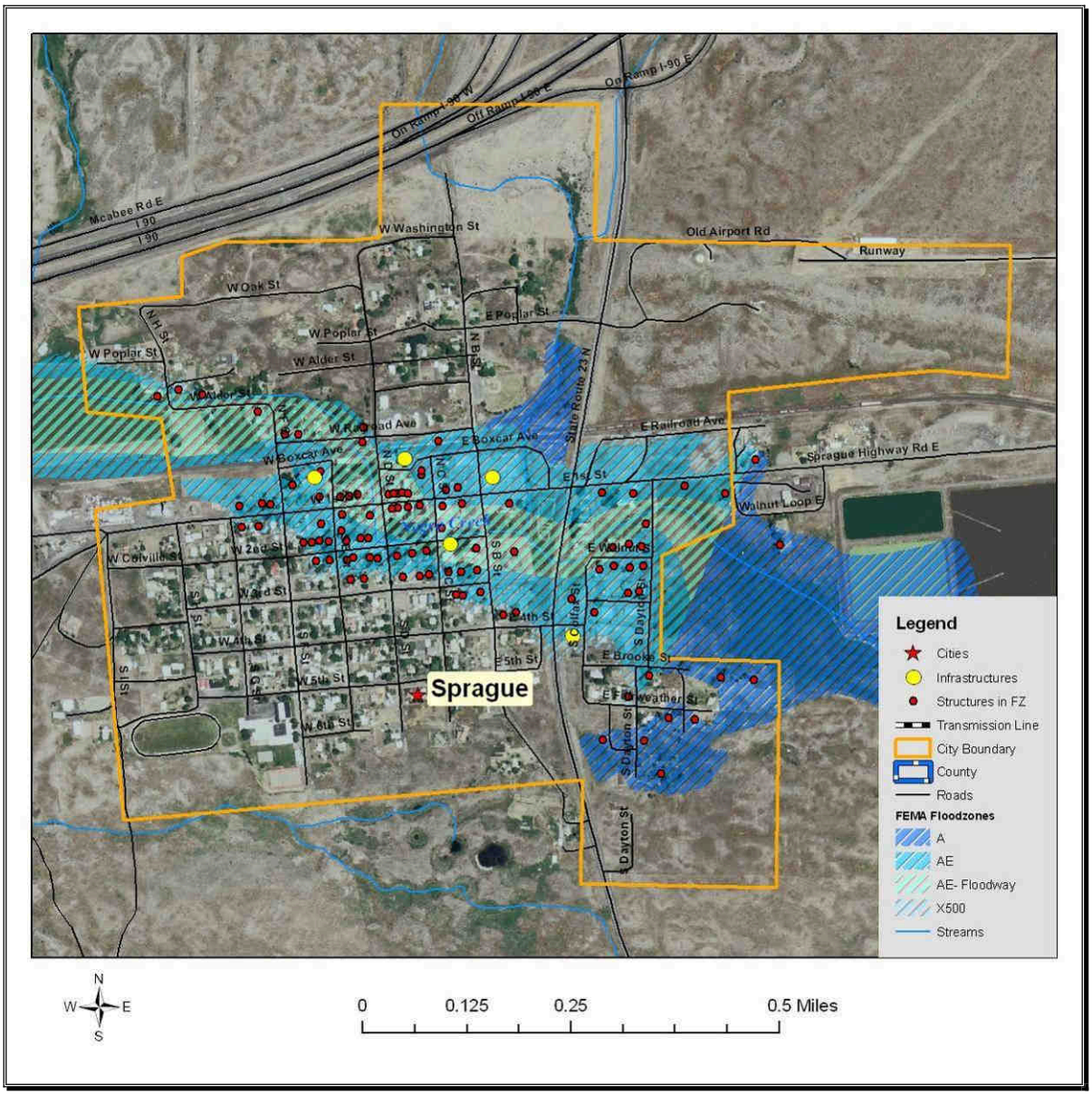
The city of Sprague is bisected by the main channel of Negro Creek, the feeder stream for Sprague Lake. Additionally, two small unnamed springs flow out of the north and drain into Negro Creek at Sprague. Much of Sprague's downtown area as well as several residential neighborhoods fall within the floodplain of this drainage.

Negro Creek is extremely prone to flash flooding from localized weather events. Negro Creek drains hundreds of acres to northeast before passing through the community. 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.

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. City of Sprague FEMA Flood Insurance Rate Map.



Probability of Future Occurrence

The probability of flood events occurring in Sprague 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 Sprague as a result of rain-on-snow events or rapid runoff. Minor flash floods are also common on Negro Creek and several of the small tributaries feeding the main channel near the community.

Impacts of Flood Events

The potential impacts from flooding in Sprague are very similar to the impacts described for Lincoln 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 Sprague are the restricted use of several streets, commercial, and residential areas. There are numerous bridge and culvert crossings over Negro Creek 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 Sprague 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 Negro Creek in the Sprague 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

The County's parcel layer for Sprague is incomplete, but it is estimated that there are approximately 100 structures within the FEMA-identified floodplains (100- and 500-year) in Sprague, yielding a total structure value of $7.4 million. The per structure value is based on a countywide average of $74,296 and does not reflect the replacement cost of a structure. The average damage to structures was estimated based on the parcel's location as either completely within or out of the flood zone. The estimated value of contents is ½ the value of the improvements equating to an additional $3.7 million in potential losses. 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.

Critical infrastructure located within the identified floodplain for Sprague includes the agricultural chemical plant, the city hall/fire station, a gas station, and two grain elevators. Also, a portion of the city's wastewater treatment facility just east of the city limits is within the floodplain. Currently, there are no repetitive loss properties in Sprague.

Earthquake

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

Probability of Future Occurrence

The City has 10% chance of exceeding a 6-7% pga in the next 50 years.[88]

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 Sprague, nearly all of the downtown structures are assumed to be unreinforced masonry including Kathy's Market, Carrie's Beauty Salon, Rae-Lynn's Oasis, and Sprague City Hall. 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 Sprague is unknown, but estimated to include at least 30 buildings.

Landslide Profile

The city of Sprague has a very low probability of experiencing damaging landslides. The mild south aspect slope on the north side of town is generally less than 35% and presents little risk. However, because building and road construction have likely weakened the stability of the hillside, it is possible that small slides could occur when the soils are saturated or as a result of additional construction undermining the toeslope.

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. 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

There are no structures directly at risk from landslides within the city of Sprague. Small slumps may occur along State Route 23, Oak Street, North D Street, or other secondary roads. In many cases, this will cause temporary sediment delivery into nearby streams and/or plug culverts. These types of events are cleaned up by county or city road departments with little complications. Road slumps are generally reported as regular maintenance; thus, there are few records associated with these events.

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[88] 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 city of Sprague does not have any differing levels of risk associated with this hazard than Lincoln County as a whole. The probability of a severe weather event occurring in Sprague on an annual basis is very high. However, the impacts to the community are usually minimal and are the same as those described for Lincoln 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 Sprague. 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. Lincoln 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 Sprague 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 Sprague. 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 Sprague 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 Sprague 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 271 total structures in Sprague with a total value of approximately $20.1 million. Using the criteria outlined above an estimate of the impact of high winds in Sprague has been made. The potential wind and tornado damage to all buildings is estimated at approximately $697,180. The estimated damage to roofs is approximately $42,000.

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

Channeled scablands are the dominant landscape feature surrounding Sprague. 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. New development is occurring primarily near the community and along major roads.

Sprague has a moderate to high wildfire potential due to a characteristically high occurrence of shrubby fuels mixed with grass and sloping terrain. Large expanses of open rangeland or pasture in the surrounding area provide a continuous fuel bed that could, if ignited, threaten structures and infrastructure under extreme weather conditions. Cattle grazing will often reduce fine, flashy fuels reducing a fire's rate of spread; however, high winds increase the rate of fire spread and intensity of rangeland fires. A wind-driven fire in the dry, native fuel complexes produces a rapidly advancing, very intense fire with larger flame lengths, which enables spotting ahead of the fire front.

Wildfire risk near Sprague is at its highest during summer and fall when daily temperatures are high and relative humidity is low. 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. Fields enrolled in conservation programs or managed for wildlife habitat, can burn very intensely due to an increased amount of fuel build-up from previous years' growth. Fires in this fuel type are harder to extinguish completely due to the dense

duff layer, which often leads to hold-over fires that may reemerge at a later date causing additional fire starts.

Residents living in Sprague 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. 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.

Lincoln County Fire District #1 protects the community of Sprague. The fire district provides structural fire protection as well as wildland fire protection. Mutual aid agreements between fire districts supplement the wildland fire protection response 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 north of Highway 2 in Lincoln County. The DNR does not provide structural fire suppression, but it does provide wildfire protection on non-forested land that threatens DNR-protected lands. BLM provides wildfire protection on their lands within Lincoln 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 Sprague on an annual basis is high. Homes and other structures located in the scablands 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

The potential impacts from a wildfire in Sprague are very similar to the impacts described for Lincoln 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 Sprague to other communities; thus, travel and commerce may be interrupted.

Value of Resources at Risk

It is difficult to estimate potential losses in Sprague 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 Sprague 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.

Avalanche Profile

The city of Sprague will not be directly impacted by this type of localized event due to the gentle topography and low snow accumulations.

Impacts and Value of Resources at Risk

The city of Sprague will not be impacted and has no assets at risk to avalanches.

Seiche Profile

Although Lincoln County's northern border has a moderate risk of being impact by a seiche on Lake Roosevelt, the city of Sprague will not be directly impacted by this type of localized event.

Impacts and Value of Resources at Risk

The city of Sprague will not be impacted and has no assets at risk to seiches.

Volcanic Eruption Profile

The city of Sprague does not have any differing levels of risk associated with this hazard than Lincoln County as a whole.

Impacts and Value of Resources at Risk

The city of Sprague has no assets at direct risk of being impacted by a volcanic eruption. However, the secondary effects of ash and airborne particulates may have varying degrees of negative effects. Damages to property will likely be limited to vehicles and cleanup costs. Additionally, residents of Sprague will be at risk to health problems associated with the respiratory effects of breathing airborne particulates.

Drought Profile

The city of Sprague does not have any differing levels of risk associated with this hazard than Lincoln County as a whole. However, the city does have its own policies concerning water conservation practices during the dry months. Additionally, the city may develop programs to deal with residents and businesses significantly impacted by drought if necessary.

Impacts and Value of Resources at Risk

The city of Sprague has no assets directly at risk to drought; however, the economic impacts of a drought or a wildland fire caused by extended dry periods would have a great impact on the community. The majority of the population is employed either directly by the agriculture industry or to a service industry dependent on agriculture. Crop losses resulting from extended droughts would likely be considered a disaster for the community.

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Town of Almira Annex

Flood Profile

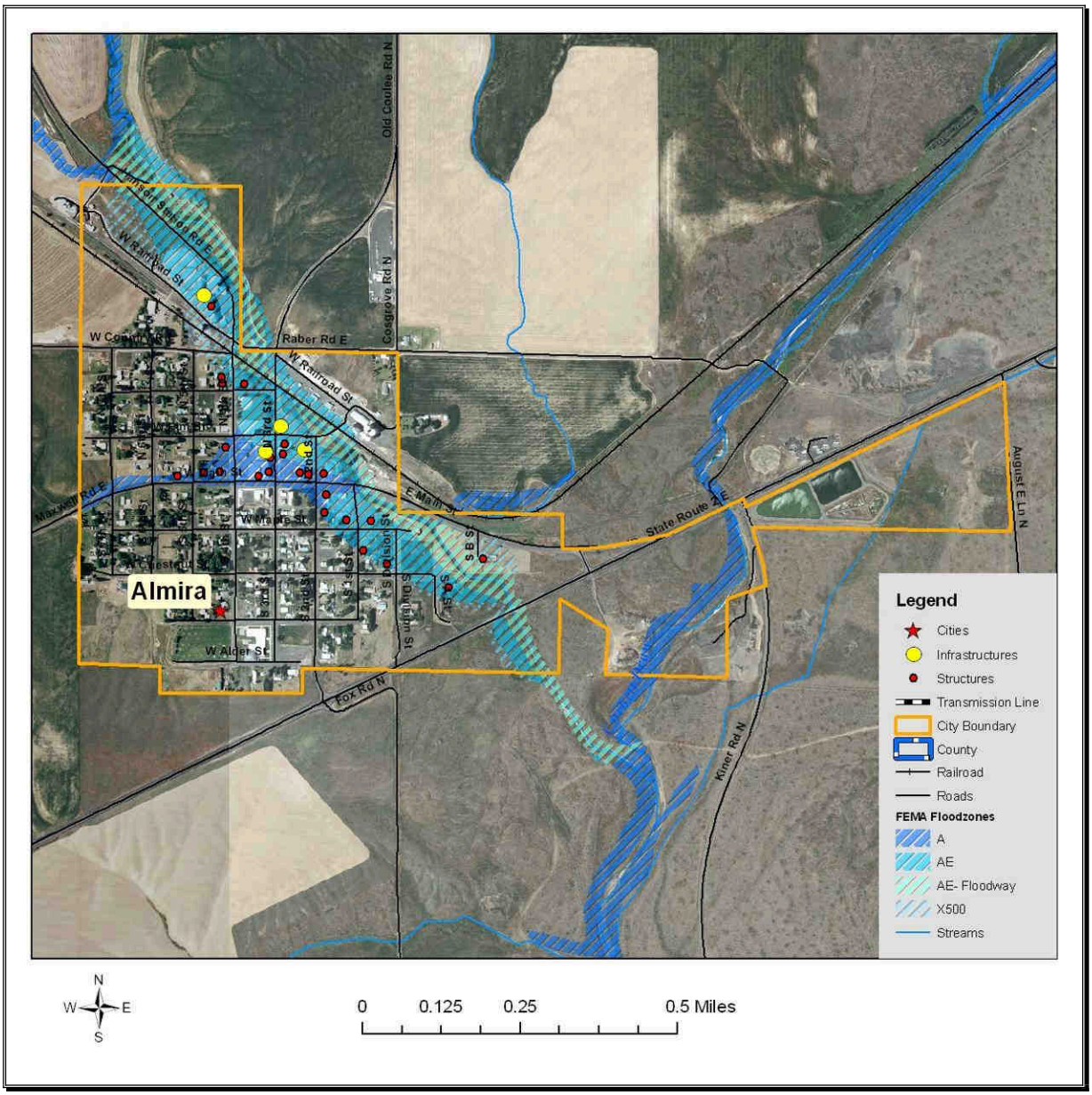
The town of Almira is affected by the floodplain of several small feeder tributaries of Wilson Creek. Water flowing out of Corbett and Childers Draw to the northeast passes through the town just east of the town center. Additionally, a larger unnamed tributary flows through a portion of the downtown area. This stream enters the community near the railroad tracks in the northwest corner and exits along the southern town boundary crossing U.S. Highway 2, Main Street, and several other secondary roads. Two additional small springs flow into this collector stream at Almira; one from the north and the other from the west. All of these tributaries create the headwaters of the Wilson Creek drainage and are relatively small at Almira. During the summer months, particularly in dry years, these contributing waterways are likely dry.

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.

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 5.15. Town of Almira FEMA Flood Insurance Rate Map.



Probability of Future Occurrence

The probability of flood events occurring in Almira 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 Almira as a result of rain-on-snow events or rapid runoff.

Impacts of Flood Events

The potential impacts from flooding in Almira are very similar to the impacts described for Lincoln 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 Almira 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 Almira. 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 Almira 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

There are approximately 305 parcels and 28 structures within the FEMA-identified floodplains (100- and 500-year) in Almira, yielding a total structure value of $2.1 million. The per structure value is based on a countywide average of $74,296 and does not reflect the replacement cost of a structure. The average damage to structures was estimated based on the parcel's location as either completely within or out of the flood zone. The estimated value of contents is ½ the value of the improvements equating to an additional $1 million in potential losses. 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.

Critical infrastructure located within the identified floodplain for Almira includes the fire station, the post office, town hall, and a grain elevator. Currently, there are no repetitive loss properties in Almira.

Earthquake

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

Probability of Future Occurrence

The Town has 10% chance of exceeding a 7-8% pga in the next 50 years.[89]

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 Almira 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 Almira, 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 Almira is unknown, but estimated to include at least 20-40 buildings.

Landslide Profile

The town of Almira 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 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. 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

There are no structures directly at risk from landslides within the town of Almira. Small slumps may occur along U.S. Highway 2 or other secondary roads. In many cases, this will cause temporary sediment delivery into nearby streams and plugged culverts. These types of events are cleaned up by county or town road departments with little complications. Road slumps are generally reported as regular maintenance; thus, there are few records associated with these events.

Severe Weather Profile

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

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[89] 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 Almira. 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. Lincoln 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 Almira 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 Almira. 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 Almira 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 Almira 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 176 total structures in Almira with a total value of approximately $13.1 million. Using the criteria outlined above an estimate of the impact of high winds in Almira has been made. The potential wind and tornado damage to all buildings is estimated at approximately $185,737. The estimated damage to roofs is approximately $27,000.

Power failure often accompanies severe storms. More rural parts of the County like Almira 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

Almira is surrounded by an agricultural landscape. Vast areas of deep, rich soil deposits provide for extensive agriculture development. Lincoln County is the second highest wheat and barley producing county in the state. Other crops include grass seed, oats, hay and potatoes as well as extensive areas of fallow land set aside in the CRP. Most of these crops are vulnerable to wildfire at certain times of the year. New development occurs primarily near the community and along major roads. Occasionally farmland is subdivided between family members for new home sites or for development of new farming facilities.

Wildfire potential in Almira is moderate in the rural farmland and moderate to high in the shrubby draws and waterways, pastures, and scattered patches of scabland. 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. 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 Almira 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.

Lincoln County Fire District #8 protects the community of Almira. The fire district provides structural fire protection as well as wildland fire protection. 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 north of Highway 2 in Lincoln County. 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 Lincoln 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 Almira 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

The potential impacts from a wildfire in Almira are very similar to the impacts described for Lincoln 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 Almira to other communities; thus, travel and commerce may be interrupted.

Value of Resources at Risk

It is difficult to estimate potential losses in Almira 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 Almira 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.

Avalanche Profile

The town of Almira will not be directly impacted by this type of localized event due to the gentle topography and low snow accumulations.

Impacts and Value of Resources at Risk

The town of Almira will not be impacted and has no assets at risk to avalanches.

Seiche Profile

Although Lincoln County's northern border has a moderate risk of being impact by a seiche on Lake Roosevelt, the town of Almira will not be directly impacted by this type of localized event.

Impacts and Value of Resources at Risk

The town of Almira will not be impacted and has no assets at risk to seiches.

Volcanic Eruption Profile

The town of Almira does not have any differing levels of risk associated with this hazard than Lincoln County as a whole.

Impacts and Value of Resources at Risk

The town of Almira has no assets at direct risk of being impacted by a volcanic eruption. However, the secondary effects of ash and airborne particulates may have varying degrees of negative effects. Damages to property will likely be limited to vehicles and cleanup costs. Additionally, residents of Almira will be at risk to health problems associated with the respiratory effects of breathing airborne particulates.

Drought Profile

The town of Almira does not have any differing levels of risk associated with this hazard than Lincoln County as a whole. However, the town does have its own policies concerning water conservation practices during the dry months. Additionally, the town may develop programs to deal with residents and businesses significantly impacted by drought if necessary.

Impacts and Value of Resources at Risk

The town of Almira has no assets directly at risk to drought; however, the economic impacts of a drought or a wildland fire caused by extended dry periods would have a great impact on the community. The majority of the population is employed either directly by the agriculture industry or to a service industry dependent

on agriculture. Crop losses resulting from extended droughts would likely be considered a disaster for the community.

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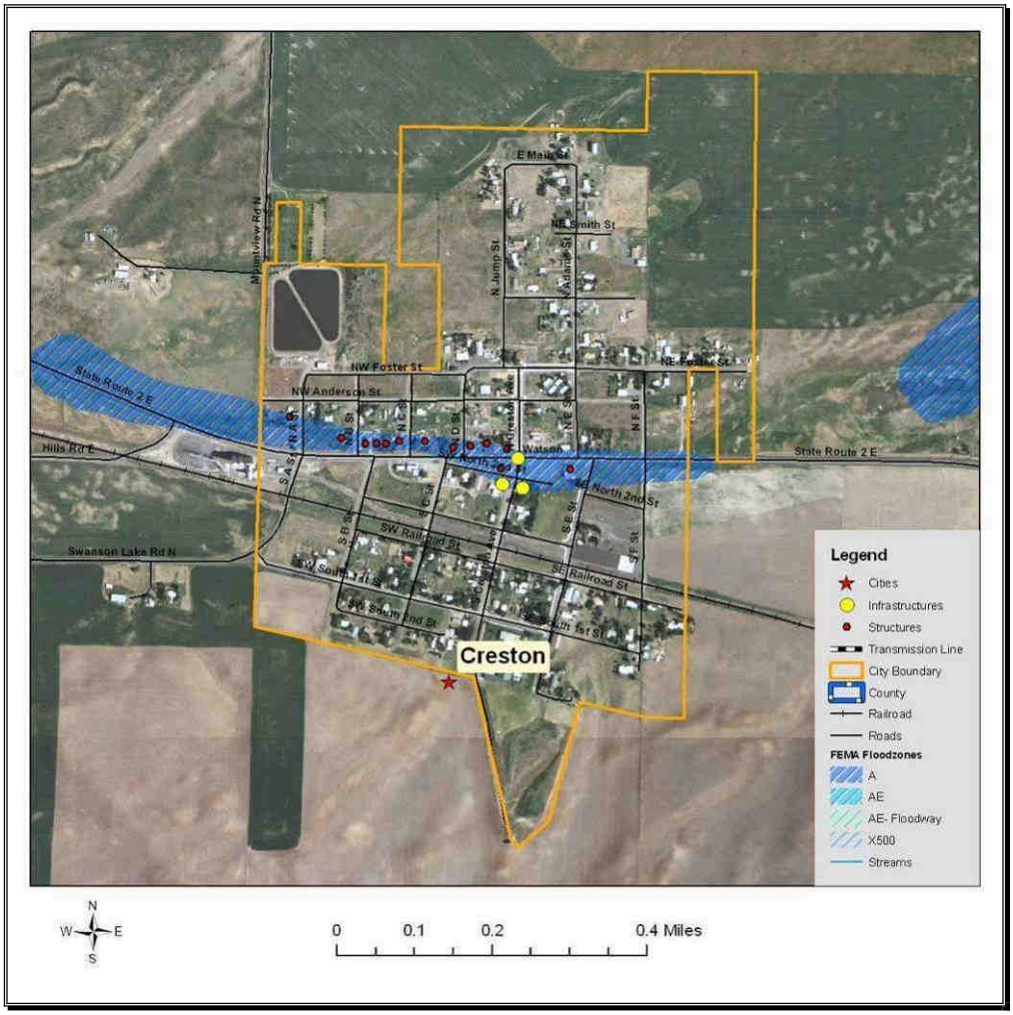
Town of Creston Annex

Flood Profile

The town of Creston is affected by a small floodplain caused by a high water table. During wet years, water collects in this area and becomes a tributary to Sinking Creek to the south. Within the community, the floodplain primarily affects U.S. Highway 2 and SW North 2nd Street and crosses North D, North C, North B, and North A Streets. Most of this area is residential; however, a few commercial and public buildings could also be impacted.

Creston is most at risk to rain-on-snow and rapid spring runoff events that causes water to collect in this area. 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 Creston FEMA Flood Insurance Rate Map.



Probability of Future Occurrences

The probability of flood events occurring in Creston is low to moderate. Creston is only at risk to flooding during extremely wet months when the water table is high. Prolonged rain and soil saturation may lead to localized pooling and flooding in Creston. Low magnitude flood events can be expected several times each year, particularly in the spring. Flash floods are not likely to occur in this area. Larger magnitude and high impact flood events have occurred, but are not likely in any given year.

Impacts of Flood Events

The potential impacts from flooding in Creston are very similar to the impacts described for Lincoln 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. Creston's risk of the town's water supply becoming contaminated by flood waters may be higher than in other areas, due to the high water table. 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 Creston. 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 not likely to occur in Creston.

Value of Resources at Risk

The County's parcel layer for Creston is incomplete, but it is estimated that there are approximately 15 structures within the FEMA-identified floodplains (100- and 500-year) in Creston, yielding a total structure value of $1.1 million. The per structure value is based on a countywide average of $74,296 and does not reflect the replacement cost of a structure. The average damage to structures was estimated based on the parcel's location as either completely within or out of the flood zone. The estimated value of contents is ½ the value of the improvements equating to an additional $557,217 in potential losses. 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.

Critical infrastructure located within the identified floodplain for Creston includes the post office and town hall. Currently, there are no repetitive loss properties in Creston.

Earthquake

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

Probability of Future Occurrence

The Town has 10% chance of exceeding a 6-7% pga in the next 50 years.[90]

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 Creston 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 Creston, 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 Creston is unknown, but estimated to include at least 20-40 buildings.

Landslide Profile

The town of Creston has a very low probability of experiencing damaging landslides. Slopes in and around the community are generally less than 35%. 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.

Impacts and Value of Resources at Risk

There are no structures or infrastructure directly at risk from landslides within the town of Creston.

Severe Weather Profile

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

Local Event History

January 2009 Ice Storm – Creston experienced an episode of freezing fog lasting for 10 days. A total of 32 trees within the town limits had up to 2 inches of ice buildup resulting in breakage, cracking, and bending limbs that were determined to be an immediate threat to public health and safety.

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[90] 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 Creston. 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. Lincoln 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 Creston 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 Creston. 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 Creston 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 Creston 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 140 total structures in Creston with a total value of approximately $10.4 million. Using the criteria outlined above an estimate of the impact of high winds in Creston has been made. The potential wind and tornado damage to all buildings is estimated at approximately $148,590. The estimated damage to roofs is approximately $21,000.

Power failure often accompanies severe storms. More rural parts of the County like Creston 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

Creston is surrounded by an agricultural landscape. Vast areas of deep, rich soil deposits provide for extensive agriculture development. Lincoln County is the second highest wheat and barley producing county in the state. Other crops include grass seed, oats, hay and potatoes as well as extensive areas of fallow land set aside in the CRP. Most of these crops are vulnerable to wildfire at certain times of the year. New development occurs primarily near the community and along major roads. Occasionally farmland is subdivided between family members for new home sites or for development of new farming facilities.

Wildfire potential in Creston is moderate in the rural farmland. 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. Under extreme weather conditions, escaped fires in these fuels could threaten individual homes or a town site; 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 Creston 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.

Lincoln County Fire District #7 protects the community of Creston. The fire district provides structural fire protection as well as wildland fire protection. 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 north of Highway 2 in Lincoln County. 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 Lincoln 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

The potential impacts from a wildfire in Creston are very similar to the impacts described for Lincoln 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 Creston to other communities; thus, travel and commerce may be interrupted.

Value of Resources at Risk

It is difficult to estimate potential losses in Creston 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 Creston 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.

Avalanche Profile

The town of Creston will not be directly impacted by this type of localized event due to the gentle topography and low snow accumulations.

Impacts and Value of Resources at Risk

The town of Creston will not be impacted and has no assets at risk to avalanches. .

Seiche Profile

Although Lincoln County's northern border has a moderate risk of being impact by a seiche on Lake Roosevelt, the town of Creston will not be directly impacted by this type of localized event.

Impacts and Value of Resources at Risk

The town of Creston will not be impact and has no assets at risk to seiches.

Volcanic Eruption Profile

The town of Creston does not have any differing levels of risk associated with this hazard than Lincoln County as a whole.

Impacts and Value of Resources at Risk

The town of Creston has no assets at direct risk of being impacted by a volcanic eruption. However, the secondary effects of ash and airborne particulates may have varying degrees of negative effects. Damages to property will likely be limited to vehicles and cleanup costs. Additionally, residents of Creston will be at risk to health problems associated with the respiratory effects of breathing airborne particulates.

Drought Profile

The town of Creston does not have any differing levels of risk associated with this hazard than Lincoln County as a whole. However, the town does have its own policies concerning water conservation practices during the dry months. Additionally, the town may develop programs to deal with residents and businesses significantly impacted by drought if necessary.

Impacts and Value of Resources at Risk

The town of Creston has no assets directly at risk to drought; however, the economic impacts of a drought or a wildland fire caused by extended dry periods would have a great impact on the community. The majority of the population is employed either directly by the agriculture industry or to a service industry

dependent on agriculture. Crop losses resulting from extended droughts would likely be considered a disaster for the community.

Town of Harrington Annex

Flood Profile

The town of Harrington is affected by the floodplain from two tributaries of Coal Creek, which eventually flows into Sylvan Lake to the southwest. The primary collector stream flows in a southerly direction along the western edge of town paralleling State Highway 28. A smaller tributary enters the community along its eastern boundary and forms a confluence near the culmination of North 4th Street.

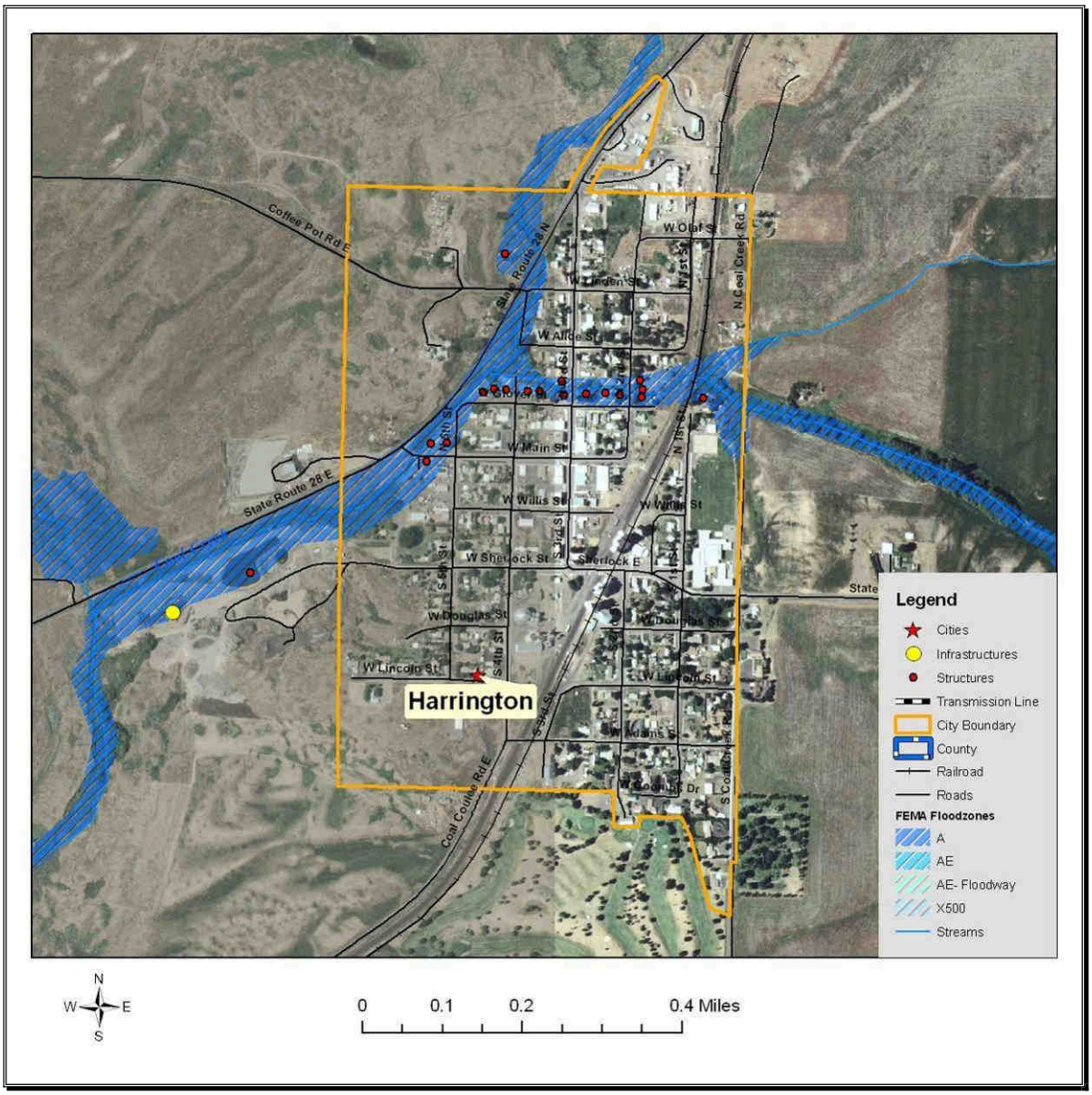
All of these waterways are extremely prone to flash flooding from localized weather events due to typically shallow channels and wide floodplains. Rain-on-snow events can also have a significant effect on this watershed. Warm rains result in a significantly increased rate of snowmelt. Often this melting 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.

A flood drainage channel runs from the eastern city limits westward through town and drains into the Coal Creek tributary near State Route 28. The Main Street Bridge is a 6 foot by 25 foot culvert that was designed to handle a large flood event. Additionally, there are two large culverts on State Route 28 that provide for passage of peak flows.

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.

An elevated 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. Debris has accumulates in these channels and is periodically removed to prevent plugged culverts and bridges at several locations.

Figure 5.17. Town of Harrington FEMA Flood Insurance Rate Map*.



**The 1988 edition of the FIRM shown here is not the current floodplain map used in Harrington. With FEMA's written permission, the city uses the 1985 version of the FIRM. The "Value of Resources at Risk" section is based on the 1985 FIRM.*

Probability of Future Occurrence

The probability of flood events occurring in Harrington is relatively high. Low magnitude flood events can be expected several times each year. Minor flash flooding is a common occurrence, particularly in the small channel entering the community from the east; 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. Larger magnitude and high impact flood events have occurred, but are not likely in any given year. Flood issues in previous years have been mitigated by the construction of a flood channel and larger culverts in potentially high velocity areas. These types of flood events have the

highest probability of occurrence in the winter or early spring in Harrington as a result of rain-on-snow events or rapid runoff.

Impacts of Flood Events

The potential impacts from flooding in Almira are very similar to the impacts described for Lincoln 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 major impacts from flooding in Harrington are the restricted use of several streets including State Highways 23 and 28, commercial areas along State Highway 23, and several residential areas that are above the corrected Flood Zone A designation. There are numerous bridge and culvert crossings both within the Town and in the surrounding area. Traffic delays on any of the State highways as a result of flooding could cause issues for inter and intra-county traffic; however, in most cases, alternative routes are available.

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 Harrington except in extreme circumstances such as a 100-year plus flood event. 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 Harrington 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

There are approximately 10 parcels and 2 structures within the corrected FEMA-identified floodplains (100- and 500-year) in Harrington, yielding a total structure value of $100,000. The per structure value is based on a countywide average of $74,296 and does not reflect the replacement cost of a structure. The estimated value of contents is ½ the value of the improvements equating to an additional $50,000 in potential losses. 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. In most cases, damages could be prevented by minor sandbagging.

The sewer lagoons are the only critical infrastructure within the floodplain in Harrington and these are protected by a flood drainage channel. Currently, there are no repetitive loss properties in Harrington.

Earthquake

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

Probability of Future Occurrence

The Town has 10% chance of exceeding a 6-7% pga in the next 50 years.[91]

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 Harrington in addition to the 35-40 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 Harrington, nearly all of the 25 downtown structures are assumed to be unreinforced masonry including the Opera Hall and City Hall. These structures were built prior to the inclusion of articles for seismic stability in the Uniform Building Codes in 1972. The value of structures in the downtown district is unknown. There are approximately 18 unreinforced masonry homes and 35-40 homes with masonry chimneys in Harrington. The value of URM homes is estimated at $1.3 million using an average improvement value of $74,296.

Landslide Profile

The town of Harrington has a very low probability of experiencing damaging landslides. Slopes in and around the community are generally less than 30%. While small, low angle slumps may occur on eyebrows of surrounding rolling hills, particularly those to the west of town, these will be infrequent and likely the result of water saturation or freeze/thaw cycles. It is 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

There are no structures directly at risk from landslides within the town of Harrington. Small slumps may occur along State Route 28 or other secondary roads. In many cases, this will cause temporary sediment delivery into nearby streams and plug culverts. These types of events are cleaned up by county or town road departments with little complications. Road slumps are generally reported as regular maintenance; thus, there are few records associated with these events.

Severe Weather Profile

The town of Harrington does not have any differing levels of risk associated with this hazard than Lincoln County as a whole. The probability of a severe weather event occurring in Harrington on an annual basis is

[91] 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.

very high. However, the impacts to the community are usually minimal and are the same as those described for Lincoln 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 Harrington. 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. Lincoln 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 Harrington 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 Harrington. 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 Harrington 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 Harrington 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 247 total structures in Harrington with a total value of approximately $18.4 million. Using the criteria outlined above an estimate of the impact of high winds in Harrington has been made. The potential wind and tornado damage to all buildings is estimated at approximately $260,032. The estimated damage to roofs is approximately $36,000.

Power failure often accompanies severe storms. More rural parts of the County like Harrington 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

Harrington is surrounded by an agricultural landscape. Vast areas of deep, rich soil deposits provide for extensive agriculture development. Lincoln County is the second highest wheat and barley producing county in the state. Other crops include grass seed, oats, hay and potatoes as well as extensive areas of fallow land set aside in the CRP. Most of these crops are vulnerable to wildfire at certain times of the year. New development occurs primarily near the community and along major roads. Occasionally farmland is subdivided between family members for new home sites or for development of new farming facilities.

Wildfire potential in the agricultural landscape is moderate in the rural farmland. 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. Under extreme weather conditions, escaped fires in these fuels could threaten individual homes or a town site; 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 in these areas.

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 Harrington 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.

Lincoln County Fire District #6 protects the community of Harrington. The fire district provides structural fire protection as well as wildland fire protection. 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 north of Highway 2 in Lincoln County. 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 Lincoln 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 Harrington 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

The potential impacts from a wildfire in Harrington are very similar to the impacts described for Lincoln 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 Harrington 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 Harrington 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.

Avalanche Profile

The town of Harrington will not be directly impacted by this type of localized event due to the gentle topography and low snow accumulations.

Impacts and Value of Resources at Risk

The town of Harrington will not be impacted and has no assets at risk to avalanches.

Seiche Profile

Although Lincoln County's northern border has a moderate risk of being impact by a seiche on Lake Roosevelt, the town of Harrington will not be directly impacted by this type of localized event.

Impacts and Value of Resources at Risk

The town of Harrington will not be impacted and has no assets at risk to seiches.

Volcanic Eruption Profile

The town of Harrington does not have any differing levels of risk associated with this hazard than Lincoln County as a whole.

Impacts and Value of Resources at Risk

The town of Harrington has no assets at direct risk of being impacted by a volcanic eruption. However, the secondary effects of ash and airborne particulates may have varying degrees of negative effects. Damages to property will likely be limited to vehicles and cleanup costs. Additionally, residents of Harrington will be at risk to health problems associated with the respiratory effects of breathing airborne particulates.

Drought Profile

The town of Harrington does not have any differing levels of risk associated with this hazard than Lincoln County as a whole. However, the town does have its own policies concerning water conservation practices during the dry months. Additionally, the town may develop programs to deal with residents and businesses significantly impacted by drought if necessary.

Impacts and Value of Resources at Risk

The town of Harrington has no assets directly at risk to drought; however, the economic impacts of a drought or a wildland fire caused by extended dry periods would have a great impact on the community. The majority of the population is employed either directly by the agriculture industry or to a service industry dependent on agriculture. Crop losses resulting from extended droughts would likely be considered a disaster for the community.

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Town of Odessa Annex

Flood Profile

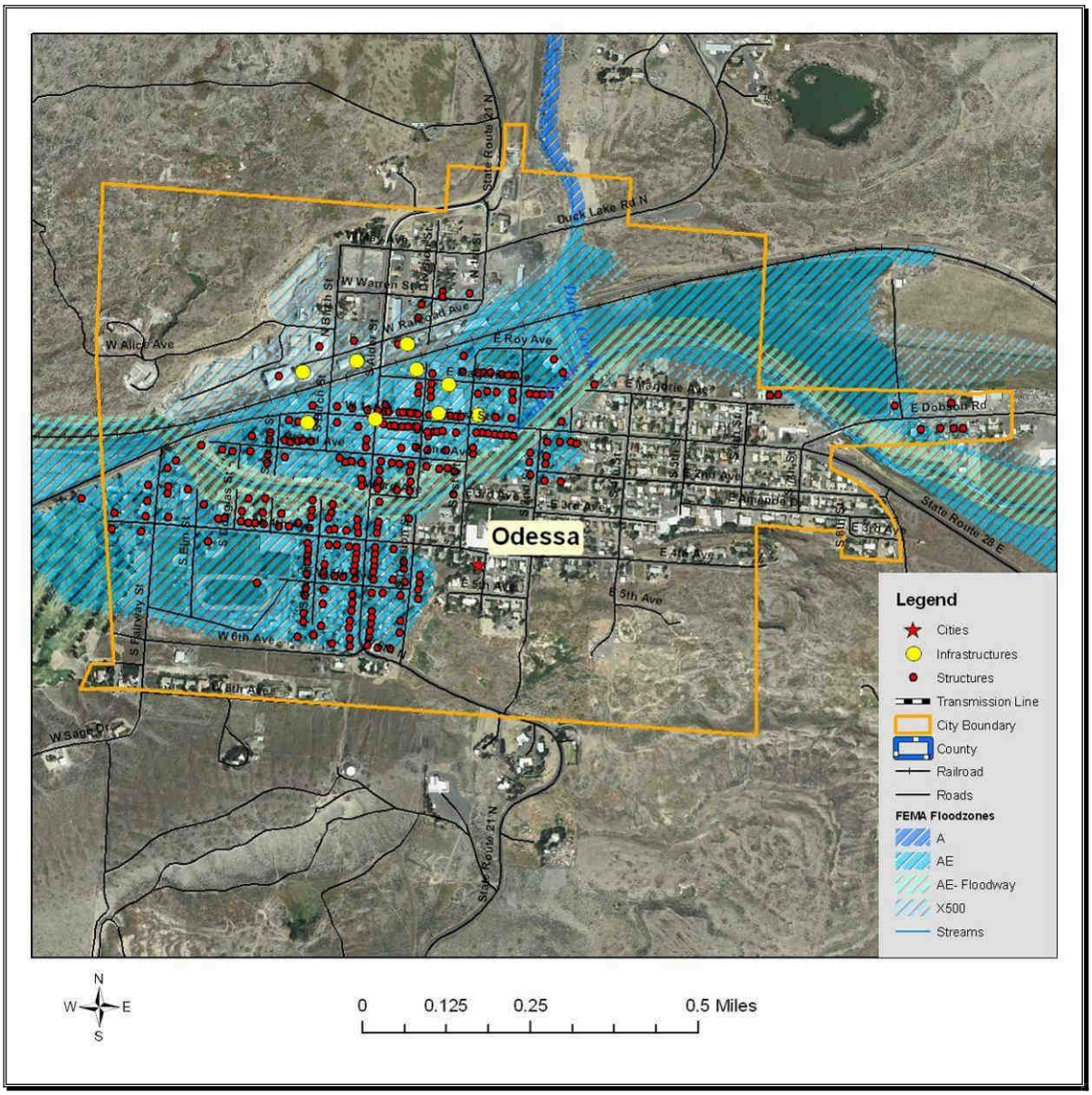
Most of the western half of Odessa is affected by the floodplain of Crab Creek. This collector stream flows into the community at its eastern border near State Highway 28, passes through the downtown area, and exits near the railroad tracks on the western edge of town. Duck Creek increases the floodplain area as it drains into Crab Creek near the corner of East Marjorie Avenue and South 3rd Street.

Duck Creek and Crab Creek are prone to flash flooding from localized weather events due to typically shallow channels and wide floodplains as well as less water permeable soils. Additionally, both of these watersheds drain thousands of acres in Lincoln County. Rain-on-snow events and rapid spring runoff 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.

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 Odessa FEMA Flood Insurance Rate Map.



Probability of Future Occurrence

The probability of flood events occurring in Odessa is high. Low magnitude flood events can be expected within the Crab Creek watershed, including Odessa, several times each year. Due to the flat topography and drainage infrastructure within the community, much of the impacts of these events have been mitigated. Nevertheless, floodwaters occasionally cause minor and temporary traffic issues as a result of plugged culverts or obstructions in the stream channel. Larger magnitude and high impact flood events have also 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 Odessa. Minor flash floods are common on Duck Creek and the numerous small tributaries feeding Crab Creek near the community and may result in high water events on the Crab Creek channel within the city limits. Flash flooding resulting from rain-on-snow events are more likely to cause flooding on Crab Creek than summer thunderstorms.

Impacts of Flood Events

The potential impacts from flooding in Odessa are very similar to the impacts described for Lincoln 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 Odessa are the restricted use of several streets, particularly State Highway 28. This route crosses Crab Creek in two places; one on each side of downtown Odessa. Restriction of the channel due to debris or ice jamming at these crossings could lead to water backing up and substantial flooding within the community. A significant number of commercial (most of the business district), industrial (rail yard and grain elevators), and residential properties would also be heavily impacted. The town of Odessa maintains a cache of sand, sandbags, and other equipment available during a 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 Odessa. 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 Odessa. Crab Creek 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

There are approximately 698 parcels and 267 structures within the FEMA-identified floodplains (100- and 500-year) in Odessa, yielding a total structure value of $19.8 million. The per structure value is based on a countywide average of $74,296 and does not reflect the replacement cost of a structure. The average damage to structures was estimated based on the parcel's location as either completely within or out of the flood zone. The estimated value of contents is ½ the value of the improvements equating to an additional $9.9 million in potential losses. 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.

Critical infrastructure located within the identified floodplain for Odessa includes the fire station, police station, three grain elevators, the post office, the town hall/library, and central control for Centurylink. Currently, there are no repetitive loss properties in Odessa.

Earthquake

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

Probability of Future Occurrence

The Town has 10% chance of exceeding a 7-8% pga in the next 50 years.[92]

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 Odessa 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 Odessa, nearly all of the downtown structures are assumed to be unreinforced masonry including two churches, a hospital/nursing home, and the Odessa schools complex. 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 Odessa is unknown, but estimated to include at least 50 brick construction homes and approximately 385 residences with masonry chimneys.

Landslide Profile

The town of Odessa has a very low probability of experiencing damaging landslides. Due to the geologic history of the area, there is very little topsoil or unstable slopes. Slopes in and around the community are generally less than 35%. While small, low angle slumps may occur on eyebrows of the surrounding hills, these will be infrequent and likely the result of rocks coming loose due to the freeze/thaw cycle or a major disturbance such as an earthquake or road construction.

Impacts and Value of Resources at Risk

There are no structures directly at risk from landslides within the town of Odessa. Small slumps may occur along State Route 21, Duck Lake Road, or other secondary roads. In many cases, this will cause temporary sediment delivery into nearby streams and plugged culverts. These types of events are cleaned up by county or town road departments with little complications. Road slumps are generally reported as regular maintenance; thus, there are few records associated with these events.

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[92] 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 Odessa does not have any differing levels of risk associated with this hazard than Lincoln County as a whole. The probability of a severe weather event occurring in Odessa on an annual basis is very high. However, the impacts to the community are usually minimal and are the same as those described for Lincoln 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 Odessa. 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. Lincoln 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 Odessa 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 Odessa. 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 Odessa 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 Odessa 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 560 total structures in Odessa with a total value of approximately $41.6 million. Using the criteria outlined above an estimate of the impact of high winds in Odessa 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 $84,000.

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

Odessa is surrounded by channeled scablands 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. New development is occurring primarily near the community and along major roads.

The channeled scablands landscape has a moderate to high wildfire potential due to a characteristically high occurrence of shrubby fuels mixed with grass, sloping terrain and somewhat limited access. Large expanses of open rangeland or pasture provide a continuous fuel bed that could, if ignited, threaten structures and infrastructure under extreme weather conditions. Cattle grazing will often reduce fine, flashy fuels reducing a fire's rate of spread; however, high winds increase the rate of fire spread and intensity of rangeland fires. A wind-driven fire in dry, native fuel complexes on variable terrain produces a rapidly advancing, very intense fire, which often enables spotting ahead of the fire front.

Wildfire risk near Odessa is at its highest during summer and fall when daily temperatures are high and relative humidity is low. 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. Fields enrolled in conservation programs or managed for wildlife habitat, can burn very intensely due to an increased amount of fuel build-up from previous years' growth. Fires in this fuel type are harder to extinguish completely due to the dense

duff layer, which often leads to hold-over fires that may reemerge at a later date causing additional fire starts.

Residents living in Odessa 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. 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.

Lincoln County Fire District #3 protects the community of Odessa. The fire district provides structural fire protection as well as wildland fire protection. Mutual aid agreements between fire districts supplement the wildland fire protection response 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 north of Highway 2 in Lincoln County. The DNR does not provide structural fire suppression, but it does provide wildfire protection on non-forested land that threatens DNR-protected lands. BLM provides wildfire protection on their lands within Lincoln 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 Odessa on an annual basis is high. Homes and other structures located in the range and 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

The potential impacts from a wildfire in Odessa are very similar to the impacts described for Lincoln 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 Odessa 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 Odessa 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.

Avalanche Profile

The town of Odessa will not be directly impacted by this type of localized event due to the gentle topography and low snow accumulations.

Impacts and Value of Resources at Risk

The town of Odessa will not be impacted and has no assets at risk to avalanches.

Seiche Profile

Although Lincoln County's northern border has a moderate risk of being impact by a seiche on Lake Roosevelt, the town of Odessa will not be directly impacted by this type of localized event.

Impacts and Value of Resources at Risk

The town of Odessa will not be impacted and has no assets at risk to seiches.

Volcanic Eruption Profile

The town of Odessa does not have any differing levels of risk associated with this hazard than Lincoln County as a whole.

Impacts and Value of Resources at Risk

The town of Odessa has no assets at direct risk of being impacted by a volcanic eruption. However, the secondary effects of ash and airborne particulates may have varying degrees of negative effects. Damages to property will likely be limited to vehicles and cleanup costs. Additionally, residents of Odessa will be at risk to health problems associated with the respiratory effects of breathing airborne particulates.

Drought Profile

The town of Odessa does not have any differing levels of risk associated with this hazard than Lincoln County as a whole. However, the town does have its own policies concerning water conservation practices during the dry months. Additionally, the town may develop programs to deal with residents and businesses significantly impacted by drought if necessary.

Impacts and Value of Resources at Risk

The town of Odessa has no assets directly at risk to drought; however, the economic impacts of a drought or a wildland fire caused by extended dry periods would have a great impact on the community. The majority of the population is employed either directly by the agriculture industry or to a service industry dependent on agriculture. Crop losses resulting from extended droughts would likely be considered a disaster for the community.

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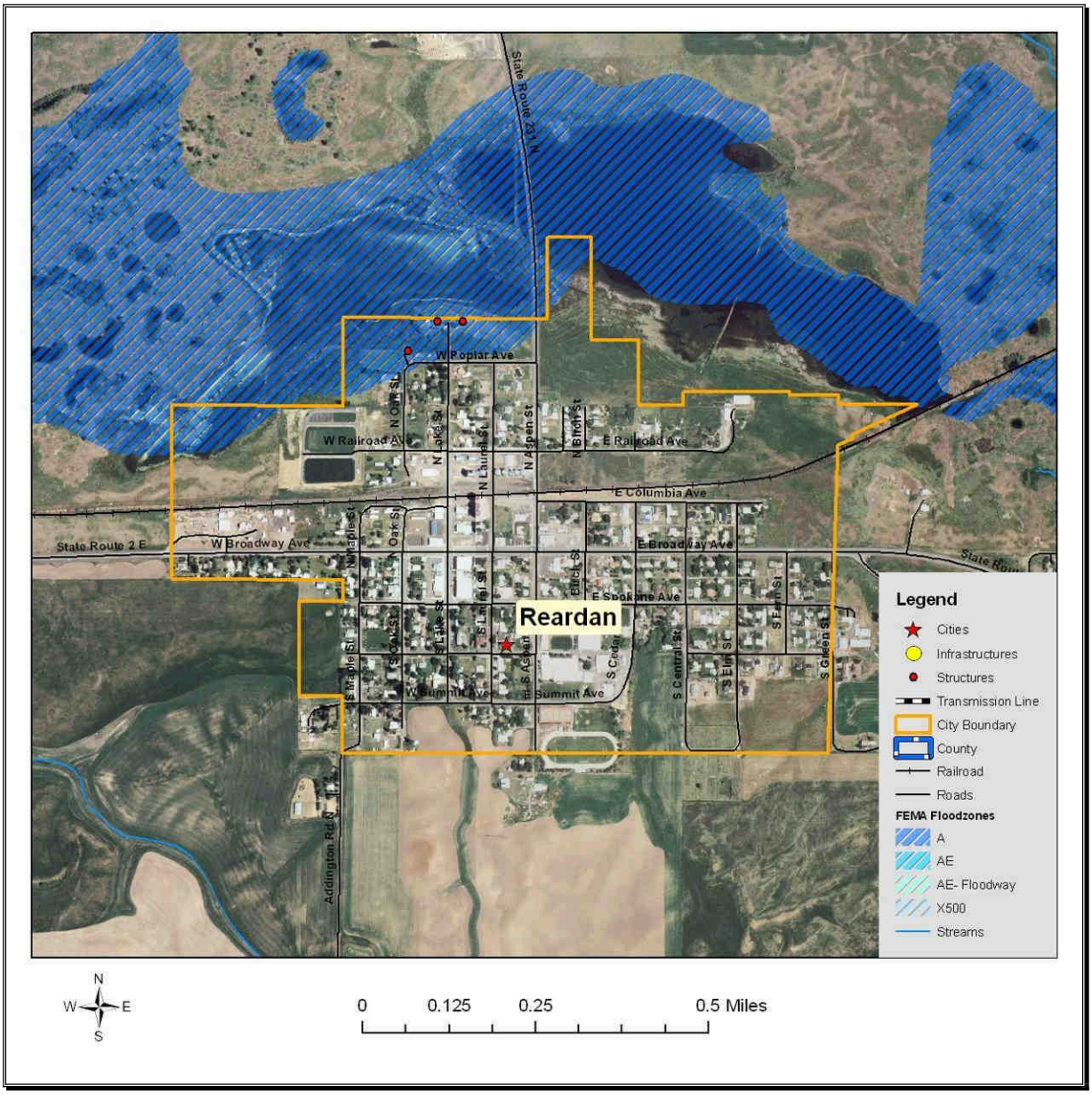
Town of Reardan Annex

Flood Profile

Two large and numerous small potholes-type lakes north of Reardan create a large floodplain that could have a limited impact on a few residential properties in the community. This area is most affected by rain-on-snow and heavy spring runoff events as water would tend to accumulate in this area. Low velocity flooding occurs in several of the nearby tributaries almost annually during the spring runoff period.

Figure 5.19. Town of Reardan FEMA Flood Insurance Rate Map.



Probability of Future Occurrences

The probability of flood events occurring in Reardan is low. A small section of Reardan is at risk to flooding only during extremely wet months when the water table is high. Prolonged rain and soil saturation may lead to localized pooling and rejuvenation of wetland areas north of town. Low magnitude flood events can be expected several times each year, particularly in the spring. Flash floods are not expected to occur in this area.

Impacts of Flood Events

The potential impacts from flooding in Reardan are very similar to the impacts described for Lincoln 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. Reardan's risk of the town's water supply becoming contaminated by flood waters may be higher than in other areas, due to the high water table. 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 Reardan. While individual homes may incur damages as a result of a flood, particularly those with basements on the north fringes of town, 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 approximately 123 parcels and 3 structures within the FEMA-identified floodplains (100- and 500-year) in Reardan, yielding a total structure value of $222,887. The per structure value is based on a countywide average of $74,296 and does not reflect the replacement cost of a structure. The average damage to structures was estimated based on the parcel's location as either completely within or out of the flood zone. The estimated value of contents is ½ the value of the improvements equating to an additional $111,443 in potential losses. 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.

There is no critical infrastructure located in Reardan's floodplain. Currently, there are no repetitive loss properties in Reardan.

Earthquake

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

Probability of Future Occurrence

The Town has 10% chance of exceeding a 6-7% pga in the next 50 years.[93]

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 Reardan 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 Reardan, nearly all of the downtown structures are assumed to be unreinforced masonry including the R-Store, Bubba's Bar & Grill, Spokane Chimney, and the Red Rooster. 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 Reardan is unknown, but estimated to include 100+ buildings.

Landslide Profile

The town of Reardan 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.

Impacts and Value of Resources at Risk

There are no structures or infrastructure directly at risk from landslides within the town of Reardan.

Severe Weather Profile

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

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[93] 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.

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. Lincoln 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 Reardan 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 Reardan. 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 Reardan 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 Reardan 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 284 total structures in Reardan with a total value of approximately $21.1 million. Using the criteria outlined above an estimate of the impact of high winds in Reardan has been made. The potential wind and tornado damage to all buildings is estimated at approximately $784,327. The estimated damage to roofs is approximately $42,000.

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

Reardan is surrounded by an agricultural landscape. Vast areas of deep, rich soil deposits provide for extensive agriculture development. Lincoln County is the second highest wheat and barley producing county in the state. Other crops include grass seed, oats, hay and potatoes as well as extensive areas of fallow land set aside in the CRP. Most of these crops are vulnerable to wildfire at certain times of the year. New development occurs primarily near the community and along major roads. Occasionally farmland is subdivided between family members for new home sites or for development of new farming facilities.

Wildfire potential in the agricultural landscape is moderate in the rural farmland. 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. 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 Reardan 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.

Lincoln County Fire District #4 protects the community of Reardan. The fire district provides structural fire protection as well as wildland fire protection. 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 north of Highway 2 in Lincoln County. 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 Lincoln 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 Reardan 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

The potential impacts from a wildfire in Reardan are very similar to the impacts described for Lincoln 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 Reardan 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 Reardan 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.

Avalanche Profile

The town of Reardan will not be directly impacted by this type of localized event due to the gentle topography and low snow accumulations.

Impacts and Value of Resources at Risk

The town of Reardan will not be impacted and has no assets at risk to avalanches.

Seiche Profile

Although Lincoln County's northern border has a moderate risk of being impact by a seiche on Lake Roosevelt, the town of Reardan will not be directly impacted by this type of localized event.

Impacts and Value of Resources at Risk

The town of Reardan will not be impacted and has no assets at risk to seiches.

Volcanic Eruption Profile

The town of Reardan does not have any differing levels of risk associated with this hazard than Lincoln County as a whole.

Impacts and Value of Resources at Risk

The town of Reardan has no assets at direct risk of being impacted by a volcanic eruption. However, the secondary effects of ash and airborne particulates may have varying degrees of negative effects. Damages to property will likely be limited to vehicles and cleanup costs. Additionally, residents of Reardan will be at risk to health problems associated with the respiratory effects of breathing airborne particulates.

Drought Profile

The town of Reardan does not have any differing levels of risk associated with this hazard than Lincoln County as a whole. However, the town does have its own policies concerning water conservation practices during the dry months. Additionally, the town may develop programs to deal with residents and businesses significantly impacted by drought if necessary.

Impacts and Value of Resources at Risk

The town of Reardan has no assets directly at risk to drought; however, the economic impacts of a drought or a wildland fire caused by extended dry periods would have a great impact on the community. The majority of the population is employed either directly by the agriculture industry or to a service industry dependent on agriculture. Crop losses resulting from extended droughts would likely be considered a disaster for the community.

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Town of Wilbur Annex

Flood Profile

The town of Wilbur is affected by the floodplain of Goose Creek, which enters the community just north of U.S. Highway 2 on the eastern edge of town, flows through the downtown area, and exits along the western border. Goose Creek has a well defined channel in Wilbur with trees and other vegetation along its banks.

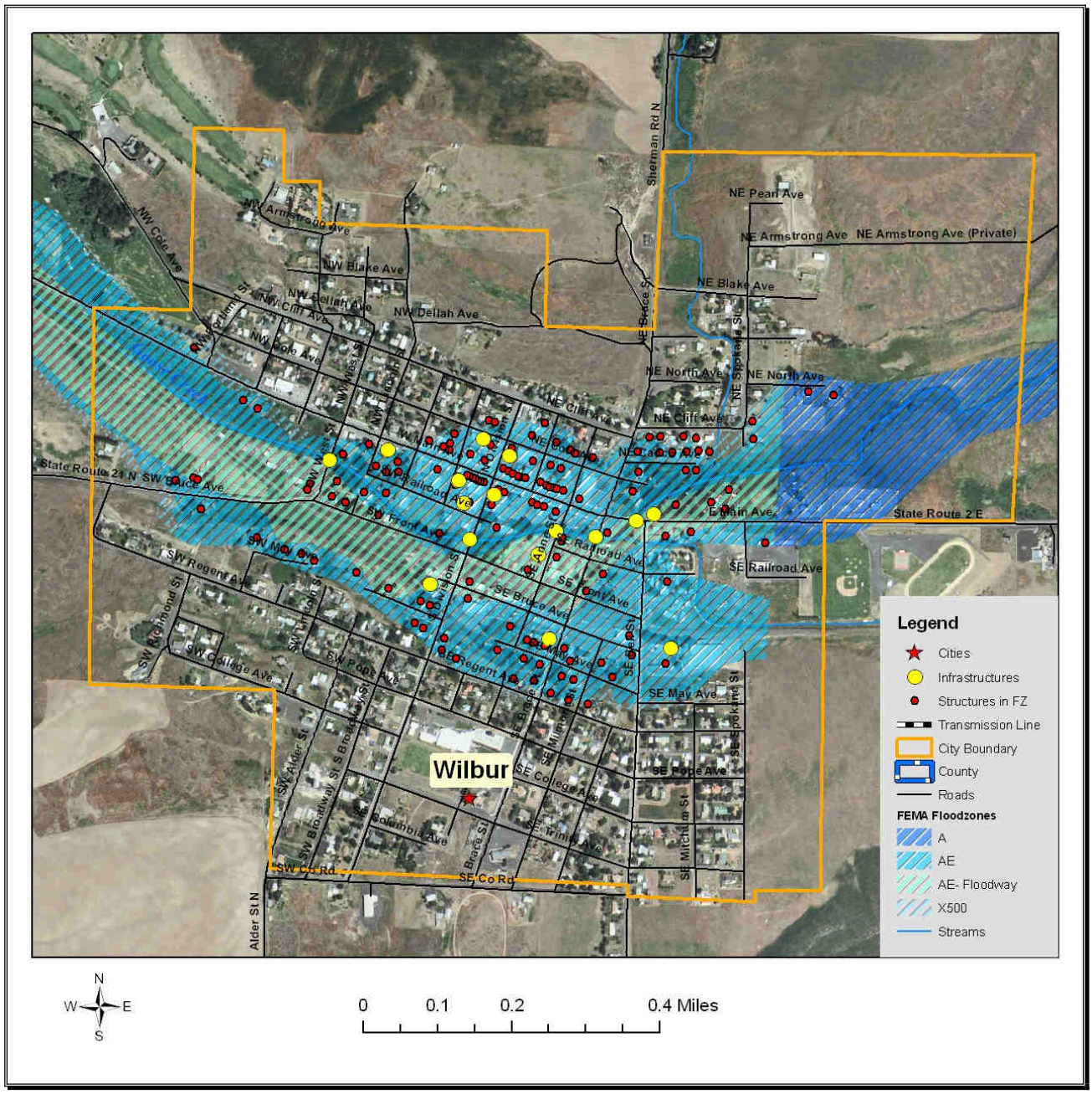
Goose Creek is extremely prone to flash flooding from localized weather events. Rain-on-snow events can also have a significant effect on this watershed. Warm rains result in a significantly increased rate of snowmelt. Often this melting occurs while the ground is frozen and the water cannot be absorbed 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.

In 2010, Goose Creek within the town limits of Wilbur was dredged to remove built up sediments and accumulated debris in order to reduce the flood risk. The town determined that there are currently five sections of the Creek that are becoming narrower and posing additional flood risks to sections of residential and commercial properties. The town of Wilbur has proposed constructing a dam on Goose Creek to assist with flood control as well as provide irrigation water to nearby agricultural operations.

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 5.20. Town of Wilbur FEMA Flood Insurance Rate Map.



Probability of Future Occurrence

The probability of flood events occurring in Wilbur is high. Low magnitude flood events can be expected along Goose Creek several times each year. Due to the flat topography, drainage infrastructure, and recent dredging of the channel within the community, much of the risk and potential impacts of these events have been mitigated. Nevertheless, floodwaters occasionally cause minor and temporary traffic issues as a result of plugged culverts or obstructions in the stream channel. Larger magnitude and high impact flood events have also occurred, but are not likely in any given year. The 2010 dredging of the channel helped reduce vegetation along the banks and built-up sediments within the channel, which were exacerbating the

potential for higher impact flood events. Larger flood events have the highest probability of occurrence in the winter or early spring in Wilbur. Minor flash floods are common on Goose Creek and the numerous small tributaries feeding this drainage near the community. Flash flooding resulting from rain-on-snow events are more likely to cause flooding on Goose Creek than summer thunderstorms.

Impacts of Flood Events

The potential impacts from flooding in Wilbur are very similar to the impacts described for Lincoln 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 Wilbur are the restricted use of several streets, particularly U.S. Highway 2/Main Street. Numerous commercial and residential areas as well as public facilities could also be impacted by flood events. There are several 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 Wilbur. 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 public works and city shop may lead to temporary economic hardships within the community. However, 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 Wilbur. Goose Creek 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

There are approximately 1,309 parcels and 146 structures within the FEMA-identified floodplains (100- and 500-year) in Wilbur, yielding a total structure value of $10.8 million. The per structure value is based on a countywide average of $74,296 and does not reflect the replacement cost of a structure. The average damage to structures was estimated based on the parcel's location as either completely within or out of the flood zone. The estimated value of contents is ½ the value of the improvements equating to an additional $5.4 million in potential losses. 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.

Critical infrastructure located within the identified floodplain for Wilbur includes the fire station, the public works building, two grain elevators, the post office, the Wilbur Clinic, the police station, the County shop, the community center, a gas station, and 5 bridges. Currently, there are no repetitive loss properties in Wilbur.

Earthquake

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

Probability of Future Occurrence

The Town has 10% chance of exceeding a 7-8% pga in the next 50 years.[94]

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 Wilbur 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 Wilbur, 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 Wilbur is unknown, but estimated to include at least 25-50 buildings.

Landslide Profile

The town of Wilbur 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.

Impacts and Value of Resources at Risk

There are no structures or infrastructure directly at risk from landslides within the town of Wilbur.

Severe Weather Profile

The town of Wilbur does not have any differing levels of risk associated with this hazard than Lincoln County as a whole. The probability of a severe weather event occurring in Wilbur on an annual basis is very

[94] 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.

high. However, the impacts to the community are usually minimal and are the same as those described for Lincoln 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 Wilbur. 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. Lincoln 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 Wilbur 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 Wilbur. 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 Wilbur 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 Wilbur 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 476 total structures in Wilbur with a total value of approximately $35.5 million. Using the criteria outlined above an estimate of the impact of high winds in Wilbur has been made. The potential wind and tornado damage to all buildings is estimated at approximately $1.2 million. The estimated damage to roofs is approximately $72,000.

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

Wilbur is surrounded by an agricultural landscape. Vast areas of deep, rich soil deposits provide for extensive agriculture development. Lincoln County is the second highest wheat and barley producing county in the state. Other crops include grass seed, oats, hay and potatoes as well as extensive areas of fallow land set aside in the CRP. Most of these crops are vulnerable to wildfire at certain times of the year. New development occurs primarily near the community and along major roads. Occasionally farmland is subdivided between family members for new home sites or for development of new farming facilities.

Wildfire potential in the agricultural landscape is moderate in the rural farmland. 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. 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 Wilbur 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.

Lincoln County Fire District #7 protects the community of Wilbur. The fire district provides structural fire protection as well as wildland fire protection. 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 north of Highway 2 in Lincoln County. 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 Lincoln 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 Wilbur 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

The potential impacts from a wildfire in Wilbur are very similar to the impacts described for Lincoln 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 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.

Avalanche Profile

The town of Wilbur will not be directly impacted by this type of localized event due to the gentle topography and low snow accumulations.

Impacts and Value of Resources at Risk

The town of Wilbur will not be impacted and has no assets at risk to avalanches.

Seiche Profile

Although Lincoln County's northern border has a moderate risk of being impact by a seich on Lake Roosevelt, the town of Wilbur will not be directly impacted by this type of localized event.

Impacts and Value of Resources at Risk

The town of Wilbur will not be impacted and has no assets at risk to seiches.

Volcanic Eruption Profile

The town of Reardan does not have any differing levels of risk associated with this hazard than Lincoln County as a whole.

Impacts and Value of Resources at Risk

The town of Reardan has no assets at direct risk of being impacted by a volcanic eruption. However, the secondary effects of ash and airborne particulates may have varying degrees of negative effects. Damages to property will likely be limited to vehicles and cleanup costs. Additionally, residents of Reardan will be at risk to health problems associated with the respiratory effects of breathing airborne particulates.

Drought Profile

The town of Wilbur does not have any differing levels of risk associated with this hazard than Lincoln County as a whole. However, the town does have its own policies concerning water conservation practices during the dry months. Additionally, the town may develop programs to deal with residents and businesses significantly impacted by drought if necessary.

Impacts and Value of Resources at Risk

The town of Wilbur has no assets directly at risk to drought; however, the economic impacts of a drought or a wildland fire caused by extended dry periods would have a great impact on the community. The majority of the population is employed either directly by the agriculture industry or to a service industry dependent

on agriculture. Crop losses resulting from extended droughts would likely be considered a disaster for the community.

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Lincoln Hospital District Annex

Flood Profile

The main Lincoln Hospital facility is located in Davenport on the northeast side of town. The compound is completely outside of any floodplains. However, the Wilbur Clinic operated by the Lincoln Hospital District is within a floodplain. In the event of a major flood event on Goose Creek in Wilbur, the Clinic would likely be impacted.

Probability of Future Occurrence

The probability of flood event on occurring in Wilbur is high, but the probability of a flood impacting the Wilbur Clinic is moderate. Low magnitude flood events can be expected along Goose Creek several times each year. Due to the flat topography, drainage infrastructure, and recent dredging of the channel within the community, much of the risk and potential impacts of these events have been mitigated. Nevertheless, floodwaters occasionally cause minor and temporary traffic issues as a result of plugged culverts or obstructions in the stream channel. Larger magnitude and high impact flood events have also occurred, but are not likely in any given year. The 2010 dredging of the channel reduced vegetation along the banks and built-up sediments within the channel, which were exacerbating the potential for higher impact flood events. Larger flood events have the highest probability of occurrence in the winter or early spring in Wilbur. Minor flash floods are common on Goose Creek and the numerous small tributaries feeding this drainage near the community, but are not likely to impact the Wilbur Clinic. Additionally, during a flood event, the Wilbur Clinic would be a high priority for emergency flood control measures.

Impacts of Flood Events

The District may see an increase in injuries as a result of flood events. All of the Lincoln Hospital District's facilities are dependent on municipal water systems. A flood event may impact or contaminate the community's water supply; thus impacting the Hospital and its clinics directly.

The Wilbur Clinic may be impacted by a high magnitude flood event on Goose Creek in Wilbur. Damages would include structural damages to the Clinic itself, but may also include contamination of medical equipment and supplies. Services provided by the Clinic may be temporarily interrupted; however, citizens would be able to travel to the nearby Lincoln Hospital in Davenport to receive care if necessary.

Value of Resources at Risk

The Wilbur Clinic may be impacted by Goose Creek flood events. This facility and its contents are valued at approximately $500,000.

Earthquake

There are no recorded occurrences of earthquakes significantly impacting the Lincoln Hospital District and it does not have any differing issues or levels of risk associated with this hazard than Lincoln County as a whole. However, in the event of a damaging earthquake, Lincoln Hospital would likely experience an influx of injuries resulting from the quake. In the event that the Hospital structure or associated equipment was

damaged, patients would require transport to other nearby medical facilities. Longer wait times may lead to more serious injuries or even deaths.

Probability of Future Occurrence

The area in which the District is located has a 10% chance of exceeding a 6-7% pga in the next 50 years.

Impacts and Value of Resources at Risk

The Lincoln Hospital in Davenport does have masonry components; however, the structure was built for use as a bomb shelter; thus it is likely well reinforced and not at significant risk to earthquakes. Nevertheless, severe damage to the building would likely result in closure of the hospital due to safety issues until repairs could be made. Additionally, structural damage may, in turn, cause damage or complete loss of much of the medical equipment within the building due to collapses or contamination.

Landslide Profile

The Lincoln Hospital is located in the northeastern corner of Davenport. The surrounding area is nearly flat. The Hospital does not have any differing levels of risk associated with this hazard than Lincoln County as a whole. However, in the event of a significant landslide, the Lincoln Hospital would likely assist with any injuries.

Impacts and Value of Resources at Risk

The Lincoln Hospital facility in Davenport is not at risk to landslides due to its location in a relatively flat, developed area. The District has no other known assets or other resources at risk to landslides.

Severe Weather Profile

The Lincoln Hospital District does not have any differing levels of risk associated with this hazard than Lincoln County as a whole. However, any injuries, including traffic accidents, resulting from severe storms would likely be treated at the hospital. The probability of a severe weather event occurring in Lincoln County on an annual basis is very high.

Impacts and Value of Resources at Risk

Lincoln Hospital will not likely incur major structural damages from severe weather events; however, damage to roofing, windows, or other structural components could result in closure of the hospital due to safety issues until repairs could be made. Additionally, structural damage may, in turn, cause damage or complete loss of much of the medical equipment within the building due to collapses or contamination.

Wildland Fire Profile

The Lincoln Hospital District does not have any differing levels of risk associated with this hazard than Lincoln County as a whole.

Impacts and Value of Resources at Risk

Due to its facilities' locations within developed communities, the Hospital District has a very low risk of being directly impacted by wildland fire; however, any injuries resulting from a wildfire, including smoke inhalation and heat exhaustion, would likely be treated at the hospital in Davenport.

Avalanche Profile

The Lincoln Hospital District will not be directly impacted by this type of localized event due to the gentle topography and low snow accumulations.

Impacts and Value of Resources at Risk

The Lincoln Hospital District will not be impacted and has no assets at risk to avalanches.

Seiche Profile

Although Lincoln County's northern border has a moderate risk of being impact by a seiche on Lake Roosevelt, the Lincoln Hospital District will not be directly impacted by this type of localized event.

Impacts and Value of Resources at Risk

The Lincoln Hospital District has no assets at risk to seiches; however, any injuries resulting from a seiche event would be routed to the District's medical facilities in Davenport.

Volcanic Eruption Profile

Lincoln Hospital District does not have any differing levels of risk associated with this hazard than Lincoln County as a whole.

Impacts and Value of Resources at Risk

The Lincoln Hospital District facilities do not have any direct risk to volcanoes; however, there may be damage to the structures and cleanup costs associated with the ash fallout. Furthermore, any injuries resulting from a volcano, including the respiratory effects caused by ash inhalation, would likely be treated at the hospital.

Drought Profile

The Lincoln Hospital District does not have any differing levels of risk associated with this hazard than Lincoln County as a whole.

Impacts and Value of Resources at Risk

The Lincoln Hospital District does not have any assets directly at risk to drought.

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Odessa Memorial Healthcare Center Annex

The Odessa Memorial Healthcare Center is also known as the Lincoln County Public Hospital District No.1.

Flood Profile

The Odessa Memorial Healthcare Center is located in Odessa on the southeast side of town. The hospital facilities are outside of any floodplains.

Probability of Future Occurrences

The Odessa Memorial Healthcare Center is not at any direct risk of future flood events; however, indirect impacts to the facility from flooding within the community are expected infrequently. The probability of flood events impacting the Memorial Healthcare Center is the same as that described for the town of Odessa.

Impacts of Flood Events

The Healthcare Center may see an increase in injuries as a result of flood events. In addition, the hospital facilities are dependent on Odessa's municipal water system. A flood event may impact or contaminate the community's water supply.

During normal operations, the Healthcare Center has approximately 25 available beds. Relocating individuals from this facility as a result of a flood or other hazard event would be very difficult.

Value of Resources at Risk

Odessa Memorial Healthcare Center has no known assets or other resources at direct risk to flooding.

Earthquake

There are no recorded occurrences of earthquakes significantly impacting the Odessa Memorial Healthcare Center and it does not have any differing issues or levels of risk associated with this hazard than Lincoln County as a whole. However, in the event of a damaging earthquake, Odessa Memorial Healthcare Center would likely experience an influx of injuries resulting from the quake. In the event that the Hospital structure or associated equipment was damaged, patients would require transport to other nearby medical facilities. Longer wait times may lead to more serious injuries or even deaths.

Probability of Future Occurrence

The area in which the District is located has a 10% chance of exceeding a 7-8% pga in the next 50 years.

Value of Resources at Risk

The Odessa Memorial Healthcare Center is an unreinforced masonry structure valued at approximately $11,500,000. Significant damage to the building would likely result in closure of the hospital until repairs are made due to safety issues. Additionally, structural damage may, in turn, cause damage or complete loss of much of the medical equipment within the building due to collapses or contamination.

Landslide Profile

The Odessa Memorial Healthcare Center is located on the southwestern edge of Odessa. This area did not show a moderate or high risk in the Landslide Prone Landscapes model; however, there is some potential for slumps or rolling rocks in this area. The development along the base of this slope did not alter the hillside; thus, it is unlikely that the slope is unstable. During a severe storm or a prolonged freeze/thaw period, small-scale slumps or loose rocks may deliver mud and other debris into the Hospital parking lot. In extreme events, slide debris could damage the Hospital structure. The probability of this type of event is extremely low.

Impacts and Value of Resources at Risk

The Odessa Memorial Healthcare Center structure as well as surrounding parking and travel ways may have a limited risk of experiencing a small slide originating on the slope to the south of facility. It is unlikely that there would be significant damages to the Hospital; however, there would be cleanup costs associated with a slide event.

Severe Weather Profile

The Odessa Memorial Healthcare Center does not have any differing levels of risk associated with this hazard than Lincoln County as a whole. However, any injuries, including traffic accidents, resulting from severe storms would likely be treated at Memorial Healthcare Center in Odessa. The probability of a severe weather event occurring in Odessa on an annual basis is very high.

Impacts and Value of Resources at Risk

Memorial Healthcare Center will not likely incur major structural damages from severe weather events; however, damage to roofing, windows, or other structural components could result in closure of the hospital due to safety issues until repairs could be made. Additionally, structural damage may, in turn, cause damage or complete loss of much of the medical equipment within the building due to collapses or contamination.

Wildland Fire Profile

The Odessa Memorial Healthcare Center does not have any differing levels of risk associated with this hazard than Lincoln County as a whole.

Impacts and Value of Resources at Risk

Due to its facilities' locations within developed communities, the Hospital has a very low risk of being directly impacted by wildland fire; however, any injuries resulting from a wildfire, including smoke inhalation and heat exhaustion, would likely be treated at the hospital in Odessa.

Avalanche Profile

The Odessa Memorial Healthcare Center will not be directly impacted by this type of localized event due to the gentle topography and low snow accumulations.

Impacts and Value of Resources at Risk

The Odessa Memorial Healthcare Center will not be impacted and has no assets at risk to avalanches.

Seiche Profile

Although Lincoln County's northern border has a moderate risk of being impact by a seiche on Lake Roosevelt, the Odessa Memorial Healthcare Center will not be directly impacted by this type of localized event.

Impacts and Value of Resources at Risk

The Odessa Memorial Healthcare Center has no assets at risk to seiches; however, some injuries resulting from a seiche event may be routed to the District's medical facilities in Odessa if the Lincoln Hospital District in Davenport is overwhelmed or unable to receive additional patients.

Volcanic Eruption Profile

The Odessa Memorial Healthcare Center does not have any differing levels of risk associated with this hazard than Lincoln County as a whole.

Impacts and Value of Resources at Risk

The Odessa Memorial Healthcare Center facilities do not have any direct risk to volcanoes; however, there may be damage to the structures and cleanup costs associated with the ash fallout. Furthermore, any injuries resulting from a volcano, including the respiratory effects caused by ash inhalation, would likely be treated at the hospital.

Drought Profile

The Odessa Memorial Healthcare Center does not have any differing levels of risk associated with this hazard than Lincoln County as a whole.

Impacts and Value of Resources at Risk

The Odessa Memorial Healthcare Center does not have any assets directly at risk to drought.

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Chapter 6

Mitigation Strategy

IN THIS SECTION:

- Lincoln County Annex
- City of Davenport Annex
- City of Sprague Annex
- Town of Almira Annex
- Town of Creston Annex
- Town of Harrington Annex
- Town of Odessa Annex
- Town of Reardan Annex
- Town of Wilbur Annex
- Lincoln Hospital District Annex
- Odessa Memorial Healthcare Center Annex

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 Lincoln 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.

Lincoln County and the incorporated cities, 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.

All risk assessments were made based on the conditions existing during 2010, 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.

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 Lincoln 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. Lincoln 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. Lincoln 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 Lincoln 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 item 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.

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Jurisdictional Mitigation Strategies

Lincoln County Annex

Table 6.1. Lincoln County Mitigation Strategies.

Hazard	Action Item	Goals Addressed	Responsible Departments or Organizations	Projected Completion Year
General	Install an amateur radio tower to provide additional coverage of the Sprague-Odessa area.	Goal #2, 3, 4, 5, and 8 Priority Ranking: High	**Partnership:** Lincoln County Emergency Management and Amateur Radio Group	2 years
	Work with local organizations to develop a sheltering plan for people affected by hazardous events in the Reardan and Edwall area.	Goal #1, 3, 4, 5, and 8 Priority Ranking: Moderate	**Partnership:** Lincoln County Emergency Management and Lincoln County Fire District #4	3 years
	Provide representation and resources as needed to the Homeland Security Region 9 Regional All Hazard Coordination Group, the Regional Working Groups, and the Central Sub-Regional Group.	Goal #2, 5, and 7 Priority Ranking: High	**Partnership:** Lincoln County Emergency Management and incorporated communities	Ongoing
	Develop an alternative emergency access route for the subdivision in Hawk Creek canyon.	Goal #2, 3, 4, 5, and 8 Priority Ranking: High	Lincoln County Land Services and private developers	3 years
	Integrate the mission, goals, and strategies outlined in the Homeland Security Region 9 All Hazards Emergency Preparedness Strategic Plan into local planning mechanisms and emergency management functions.	Goal #2, 5, and 7 Priority Ranking: High	**Partnership:** Lincoln County Emergency Management and incorporated communities	Ongoing
	Assess ingress and egress routes accessing rural subdivisions and develop a prioritized list for developing alternative emergency access routes.	Goal #2, 3, 4, and 8 Priority Ranking: High	Lincoln County Commission	1 year

Table 6.1. Lincoln County Mitigation Strategies.				
Hazard	**Action Item**	**Goals Addressed**	**Responsible Departments or Organizations**	**Projected Completion Year**
	Install emergency communications system updates to provide interoperability with all emergency services throughout the County.	Goal #2, 3, 4, and 8 Priority Ranking: High	Lincoln County Emergency Management	2 years
	Continue to update the County's road inventory and assessment to further identify deficiencies.	Goal #2, 3, 4, and 8 Priority Ranking: Moderate	Lincoln County Public Works	3 years
	Obtain funding to address high priority road and other infrastructural improvements throughout Lincoln County.	Goal #2, 3, 4, and 8 Priority Ranking: High	Lincoln County Public Works	Annual
	Actively participate on the Region 9 All Hazard Coordinating Group in order to implement the "Regional Prioritized Strategies" outlined in the Homeland Security Region 9 All Hazards Emergency Preparedness Strategic Plan.	Goal #2, 5, and 7 Priority Ranking: High	**Partnership:** Lincoln County Emergency Management and incorporated communities	Ongoing
	Address problems with arsenic levels in public water supplies.	Goal #2, 3, 5, and 8 Priority Ranking: High	Lincoln County Public Health	2 years
	Develop an alternative access point from Edwall northbound connecting to State Route 231 in order to circumvent Burlington Northern blockages of existing routes.	Goal #2, 3, 4, 5, and 8 Priority Ranking: High	**Partnership:** Washington Department of Transportation, community of Edwall, and Burlington Northern Railroad	7 years
Flood	Construct a dam or other flood control infrastructure on Crab Creek upstream of Edwall to reduce the flood risk from both seasonal flood events and 100 year events.	Goal #2, 3, 4, 5, and 8 Priority Ranking: High	Lincoln County Commission	5 years

Table 6.1. Lincoln County Mitigation Strategies.				
Hazard	**Action Item**	**Goals Addressed**	**Responsible Departments or Organizations**	**Projected Completion Year**
	Encourage homeowners in flood prone areas to participate in the National Flood Insurance program.	Goal #1, 2, 3, and 8 Priority Ranking: Moderate	Lincoln County Emergency Management	Ongoing
Severe Weather	Develop a fund to be used for emergency plowing of secondary roads in unincorporated communities during high snow accumulation events.	Goal #2, 3, 6, and 8 Priority Ranking: Moderate	**Partnership:** Lincoln County Emergency Management and unincorporated communities	2 years
Wildland Fire	Continue to work on action items and proposed projects identified in the Lincoln County Community Wildfire Protection Plan.	Goal #1, 2, 3, 5, 7, and 8 Priority Ranking: High	**Partnership**: CWPP stakeholders	Ongoing

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City of Davenport

Table 6.2. City of Davenport Mitigation Strategies.				
Hazard	**Action Item**	**Goals Addressed**	**Responsible Departments or Organizations**	**Projected Completion Year**
General	Construct airport runway improvements to allow larger aircraft access for emergency deliveries or staging of supplies and to relieve safety concerns.	Goal #1, 3, 5, and 8 Priority Ranking: High	**Partnership**: Federal Aviation Administration, State of Washington, and Davenport City Council	3 years
	Coordinate with Lincoln County Emergency Management in order to provide the necessary information, representation, and resources for the Homeland Security Region 9 All Hazards Coordinating Group and its established goals and strategies.	Goal #2, 4, and 5 Priority Ranking: High	**Partnership:** Davenport City Council and Lincoln County Emergency Management	Ongoing
	Construct an aircraft hangar to be used by regional emergency personnel as a staging area, command post, and storage facility.	Goal #1, 3, 5, and 8 Priority Ranking: Moderate	**Partnership**: Davenport City Council, State of Washington, and Lincoln County	4 years
	Construct an addition to the Airport Lounge to be used as a command center for air assault operations and briefing area for pilots and staff.	Goal #1, 2, 4, and 5 Priority Ranking: Moderate	**Partnership**: Davenport City Council , State of Washington, and Lincoln County	5 years
Earthquake	Rebuild or reinforce masonry buildings subject to damage by earthquake, specifically the fire station, the library, and the well house.	Goal #1, 2, 5. 7, and 8 Priority Ranking: High	Davenport City Council	6 years
Flood	Dredge Cottonwood Creek channel and remove vegetation to allow better flow during high water events.	Goal #1, 2, and 5 Priority Ranking: Moderate	Davenport City Council	1 year

Table 6.2. City of Davenport Mitigation Strategies.				
Hazard	**Action Item**	**Goals Addressed**	**Responsible Departments or Organizations**	**Projected Completion Year**
	Encourage homeowners in flood prone areas to participate in the National Flood Insurance program.	Goal #1, 2, 3, 5, 6, and 7 Priority Ranking: Moderate	Davenport City Council	Ongoing
Severe Weather	Install backup generators on all major water sources and storage facilities.	Goal #1, 2, 5, and 8 Priority Ranking: High	Davenport City Council	4 to 10 years
Wildland Fire	Continue to work on action items and proposed projects identified in the Lincoln County Community Wildfire Protection Plan.	Goal #1, 2, 3, 4, 5, and 7 Priority Ranking: Moderate	**Partnership**: CWPP stakeholders	Ongoing

City of Sprague

Table 6.3. City of Sprague Mitigation Strategies.

Hazard	Action Item	Goals Addressed	Responsible Departments or Organizations	Projected Completion Year
General	Plan and install a communication system at City Hall to alert the community that there has been a disaster situation and provide instructions. System may include a siren and public address system.	Goal #1, 2, and 3 Priority Ranking: High	Sprague City Council and Public Works Department	2 years
	Work with local organizations to develop a sheltering plan for people affected by hazardous events.	Goal #1, 2, 3, and 4 Priority Ranking: High	**Partnership:** Lincoln County Fire District #1, Sprague Chamber of Commerce, Sprague School District, and local churches	1 year
	Obtain and install a permanent backup generator for city well #3.	Goal #1 and 2 Priority Ranking: High	Sprague City Council and Public Works Department	1 year
	Coordinate with Lincoln County Emergency Management in order to provide the necessary information, representation, and resources for the Homeland Security Region 9 All Hazards Coordinating Group and its established goals and strategies.	Goal #2 and 3 Priority Ranking: High	**Partnership:** Sprague City Council and Lincoln County Emergency Management	Ongoing
	Obtain three portable backup generators to provide power at emergency shelters or wherever needed.	Goal #1, 2, and 4 Priority Ranking: Moderate	Sprague City Council and Public Works Department	1 year
	Upgrade 500 feet of 4 inch water main to 6 inch pipe to supply 2 fire hydrants.	Goal #1 and 2 Priority Ranking: Moderate	Sprague City Council and Public Works Department	3 years

Table 6.3. City of Sprague Mitigation Strategies.				
Hazard	**Action Item**	**Goals Addressed**	**Responsible Departments or Organizations**	**Projected Completion Year**
	Upgrade the booster pump on the north side to improve water pressure to fire hydrants in that area.	Goal #1 and 2 Priority Ranking: Low	Sprague City Council and Public Works Department	5 years
Flood	Construction of a dam above Negro Creek, east of the City, to be used only during a high water flooding situation.	Goal #1, 2, and 3 Priority Ranking: Low	Davenport City Council and Lincoln County Commission	5 years
	Encourage homeowners in flood prone areas to participate in the National Flood Insurance program.	Goal #1, 2, and 3 Priority Ranking: Moderate	Sprague City Council and Public Works Department	Ongoing
	Clear obstructing vegetation from the Negro Creek channel.	Goal #1 and 2 Priority Ranking: Low	Sprague Public Works Department	1 year
Severe Weather	Establish an emergency snow plowing fund to assist in an extreme snow season.	Goal #1 and 2 Priority Ranking: Low	Sprague City Council and Public Works Department	1 year
Wildland Fire	Continue to work on action items and proposed projects identified in the Lincoln County Community Wildfire Protection Plan.	Goal #1, 2, and 3 Priority Ranking: Low	**Partnership**: CWPP stakeholders	Ongoing

Town of Almira

Table 6.4. Town of Almira Mitigation Strategies.

Hazard	Action Item	Priority Ranking Goals Addressed	Responsible Departments or Organizations	Projected Completion Year
General	Work with local organizations to develop a sheltering plan for people affected by hazardous events in the Almira area.	Goal #1 and 4 Priority Ranking: Moderate	**Partnership:** Lincoln County Fire District #8 and Lincoln County Emergency Management	3 years
	Install emergency communications system updates to provide interoperability with all emergency services throughout the County.	Goal #1 and 4 Priority Ranking: High	**Partnership: Almira Town Council and** Lincoln County Emergency Management	2 years
	Coordinate with Lincoln County Emergency Management in order to provide the necessary information, representation, and resources for the Homeland Security Region 9 All Hazards Coordinating Group and its established goals and strategies.	Goal #1 Priority Ranking: High	**Partnership:** Almira Town Council and Lincoln County Emergency Management	Ongoing
	Develop an alternative access point from Almira northbound in order to circumvent Burlington Northern blockages of existing routes.	Goal #4 Priority Ranking: High	**Partnership:** Washington Department of Transportation, Almira Town Council, and Burlington Northern Railroad	10 years
	Conduct an inventory and assessment of town-maintained roads to determine deficiencies/inadequacies and develop a prioritized improvement schedule.	Goal #4 Priority Ranking: Moderate	**Partnership:** Almira Town Council	3 years
	Address problems with arsenic levels in public water supply.	Goal #1, 2, 3, and 4 Priority Ranking: High	**Partnership: Almira Town Council and** Lincoln County Public Health	2 years

Table 6.4. Town of Almira Mitigation Strategies.				
Hazard	**Action Item**	**Priority Ranking** **Goals Addressed**	**Responsible Departments or Organizations**	**Projected Completion Year**
Flood	Construct a dam or other flood control infrastructure on the Wilson Creek tributary upstream of Almira to reduce the flood risk from both seasonal flood events and 100 year events.	Goal #4 Priority Ranking: High	Lincoln County Commission	5 years
	Encourage homeowners in flood prone areas to participate in the National Flood Insurance program.	Goal #1 and 4 Priority Ranking: Moderate	Almira Town Council	Ongoing
Severe Weather	Develop a fund to be used for emergency plowing of secondary roads in unincorporated communities during high snow accumulation events.	Goal #2 and 4 Priority Ranking: Moderate	**Partnership:** Almira Town Council and Lincoln County Emergency Management	2 years
Wildland Fire	Continue to work on action items and proposed projects identified in the Lincoln County Community Wildfire Protection Plan.	Goal #1, 2, and 4 Priority Ranking: High	**Partnership**: CWPP stakeholders	Ongoing

Town of Creston

Table 6.5. Town of Creston Mitigation Strategies.

Hazard	Action Item	Goals Addressed	Responsible Departments or Organizations	Projected Completion Year
General	Continue to establish the Town's Green House Gas Reduction Emission Policy to monitor the efficiency of the pumps in water and sewer systems and maintain them at peak efficiency.	Goal #2 and 4 Priority Ranking: Moderate	Creston Town Council and Maintenance Operators	1 year
	Coordinate with Lincoln County Emergency Management in order to provide the necessary information, representation, and resources for the Homeland Security Region 9 All Hazards Coordinating Group and its established goals and strategies.	Goal #1 Priority Ranking: High	**Partnership:** Creston Town Council and Lincoln County Emergency Management	Ongoing
	Replace 4,400 existing 50+ year old 4" steel and AC water mains with 8" PVC water mains and approximately 30 water meters that have been identified to be in poor condition.	Goal #1 and 4 Priority Ranking: High	Creston Town Council, Varella, and Associates Engineering, and private contractors	1 year
	Replace obsolete/substandard fire hydrants that cannot convey adequate fire flow at eight locations.	Goal #1 and 4 Priority Ranking: High	Creston Town Council, Varella, and Associates Engineering, and private contractors	1 year
Flood	Identification, classification, and regulation of Critical Areas inundated by 100 year flood by the Dep. of Urban and Region Planning at EWU.	Goal #1 and 4 Priority Ranking: Moderate	Creston Town Council, Eastern Washington University Department of Urban and Region Planning, and others	Ongoing
	Encourage homeowners in flood prone areas to participate in the National Flood Insurance program.	Goal #1, 2, and 4 Priority Ranking: Low	Creston Town Council	Ongoing

Table 6.5. Town of Creston Mitigation Strategies.				
Hazard	**Action Item**	**Goals Addressed**	**Responsible Departments or Organizations**	**Projected Completion Year**
Severe Weather	Work with local jurisdictions as well as FEMA to mitigate and lessen impacts of severe weather events, particularly prolonged freezing and ice storms.	Goal #1, 2, 3, 4, and 5 Priority Ranking: Moderate	Creston Town Council	Ongoing
Wildland Fire	Continue to work on action items and proposed projects identified in the Lincoln County Community Wildfire Protection Plan.	Goal #1, 2, 3, and 4 Priority Ranking: Moderate	**Partnership**: CWPP stakeholders	Ongoing

Town of Harrington

Table 6.6. Town of Harrington Mitigation Strategies.

Hazard	Action Item	Goals Addressed	Responsible Departments or Organizations	Projected Completion Year
General	Re-line and repaint the city's water storage tank.	Goal #1 Priority Ranking: High	Harrington Town Council	2012
	Coordinate with Lincoln County Emergency Management in order to provide the necessary information, representation, and resources for the Homeland Security Region 9 All Hazards Coordinating Group and its established goals and strategies.	Goal #3 Priority Ranking: High	**Partnership:** Harrington Town Council and Lincoln County Emergency Management	Ongoing
	Assess the school facilities and Memorial Hall for sheltering capabilities and inventory needed equipment and supplies.	Goal #1 and 3 Priority Ranking: Moderate	Harrington Town Council	2011
	Continue to enforce ordinances and regulations related to building in hazard areas.	Goal #2, 3, and 4 Priority Ranking: High	Harrington Town Council	Ongoing
Flood	Encourage homeowners in flood prone areas to participate in the National Flood Insurance program.	Goal #3 Priority Ranking: Low	Harrington Town Council	Ongoing
	Work with FEMA to adopt the 1985 FEMA flood insurance rate map as the official floodplain for the town.	Goal #3 Priority Ranking: Low	Harrington Town Council	2015
Wildland Fire	Continue to work on action items and proposed projects identified in the Lincoln County Community Wildfire Protection Plan.	Goal #3 Priority Ranking: Moderate	**Partnership**: CWPP stakeholders	Ongoing

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Town of Odessa

Table 6.7. Town of Odessa Mitigation Strategies.

Hazard	Action Item	Goals Addressed	Responsible Departments or Organizations	Projected Completion Year
General	Obtain and install backup generator for Community Center.	Goal #1 and 2 Priority Ranking: High	Odessa Administration and Public Works	4 years
	Coordinate with Lincoln County Emergency Management in order to provide the necessary information, representation, and resources for the Homeland Security Region 9 All Hazards Coordinating Group and its established goals and strategies.	Goal #1 and 2 Priority Ranking: High	**Partnership:** Odessa Town Council and Lincoln County Emergency Management	Ongoing
	Obtain and install backup generators on Well #3 and #4.	Goal #1 and 2 Priority Ranking: High	Odessa Administration and Public Works	5 years
Flood	Clear obstructing vegetation from the Crab Creek channel.	Goal #1 and 2 Priority Ranking: High	**Partnership**: Odessa Administration and Public Works and FEMA	1 year
	Encourage homeowners in flood prone areas to participate in the National Flood Insurance program.	Goal #1 and 2 Priority Ranking: High	Odessa Town Council	Ongoing
Severe Weather	Obtain and install backup generator at Public Works and Police Department building.	Goal #1 and 2 Priority Ranking: Moderate	Odessa Administration and Public Works	6 years
Wildland Fire	Continue to work on action items and proposed projects identified in the Lincoln County Community Wildfire Protection Plan.	Goal #1 and 2 Priority Ranking: Moderate	Partnership: CWPP stakeholders	Ongoing

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Town of Reardan

Table 6.8. Town of Reardan Mitigation Strategies.

Hazard	Action Item	Goals Addressed	Responsible Departments or Organizations	Projected Completion Year
General	Secure a portable generator that could power the town's primary well or the emergency well.	Goal #2 Priority Ranking: High	Reardan Town Council	2 years
	Coordinate with Lincoln County Emergency Management in order to provide the necessary information, representation, and resources for the Homeland Security Region 9 All Hazards Coordinating Group and its established goals and strategies.	Goal #2 Priority Ranking: High	**Partnership:** Reardan Town Council and Lincoln County Emergency Management	Ongoing
	Modify town wells to in order to be compatible with portable power sources.	Goal #2 Priority Ranking: High	Reardan Town Council	2 years
	Establish emergency sheltering plan to coordinate the Community Hall, Fire Station, Churches, and High School and Grade School facilities.	Goal #1and 2 Priority Ranking: Moderate	Reardan Town Council, School District, Fire District #4, Community Hall Association, and Church Administrations	Ongoing
	Replace approximately 8,000 feet of 50+ year old steel pipe with C-900 or equivalent plastic pipe.	Goal #2 Priority Ranking: Moderate	Reardan Town Council	5 years
Earthquake	Organize sheltering, medical aid, and food preparation and distribution plans.	Goal #1 and 2 Priority Ranking: Low	Reardan Town Council, Lincoln County Fire District #4, and Reardan Health Clinic	2 years

Table 6.8. Town of Reardan Mitigation Strategies.				
Hazard	**Action Item**	**Goals Addressed**	**Responsible Departments or Organizations**	**Projected Completion Year**
Flood	Draft a emergency plan containing evacuation options and possible sand bagging locations.	Goal #1 and 2 Priority Ranking: Low	Reardan Town Council and Lincoln County Fire District #4	1 year
	Encourage homeowners in flood prone areas to participate in the National Flood Insurance program.	Goal #2 Priority Ranking: Low	Reardan Town Council	Ongoing
Severe Weather	Develop town and school district communication systems.	Goal #2 Priority Ranking: High	Reardan Town Council, School District, Fire District #4, and Lincoln County Sheriff	5 years
	For severe winter conditions, organize plan to handle heating outages due to prolonged power and/or natural gas outages.	Goal #1 and 2 Priority Ranking: High	Reardan Town Council, School District, Lincoln County Fire District #4, Community Hall Association, Avista, and Church Administrations.	2 years
	Organize options for emergency medical transport and access to life critical medical supplies and medications.	Goal #2 Priority Ranking: Moderate	Reardan Town Council, Lincoln County Fire District #4, Med Star, Reardan Clinic, Lincoln County Sheriff, and Washington Department of Transportation.	3 years
Wildland Fire	Continue to work on action items and proposed projects identified in the Lincoln County Community Wildfire Protection Plan.	Goal #1 and 2 Priority Ranking: Moderate	**Partnership**: CWPP stakeholders	Ongoing

Town of Wilbur

Table 6.9. Town of Wilbur Mitigation Strategies.

Hazard	Action Item	Goals Addressed	Responsible Departments or Organizations	Projected Completion Year
General	Drill a well near the airport to provide adequate water supplies for the existing population as well as for future industrial growth and fire suppression.	Goal #2 and 3 Priority Ranking: Moderate	Wilbur Town Council	1 year
	Coordinate with Lincoln County Emergency Management in order to provide the necessary information, representation, and resources for the Homeland Security Region 9 All Hazards Coordinating Group and its established goals and strategies.	Goal #2 Priority Ranking: High	**Partnership:** Wilbur Town Council and Lincoln County Emergency Management	Ongoing
Flood	Construct a dam on Goose Creek to assist with flood control and provide irrigation water.	Goal #2 and 3 Priority Ranking: High	Wilbur Administration and Grants & Contracts	2 years
	Encourage homeowners in flood prone areas to participate in the National Flood Insurance program.	Goal #1 and 2 Priority Ranking: High	Wilbur Town Council	Ongoing
	Remove obstructions for the Goose Creek stream channel to improve water flow and help prevent flooding.	Goal #2 and 3 Priority Ranking: High	Wilbur Public Works	1 year
Severe Weather	Obtain three portable backup generators to power town wells and the community center or an alternative emergency shelter during severe weather events.	Goal #2 and 3 Priority Ranking: High	Wilbur Public Works	1 year

Table 6.9. Town of Wilbur Mitigation Strategies.				
Hazard	**Action Item**	**Goals Addressed**	**Responsible Departments or Organizations**	**Projected Completion Year**
	Obtain a permanent backup generator for town well #1.	Goal #2 and 3 Priority Ranking: High	Wilbur Public Works	2 years
Wildland Fire	Continue to work on action items and proposed projects identified in the Lincoln County Community Wildfire Protection Plan.	Goal #1, 2, and 3 Priority Ranking: Moderate	**Partnership**: CWPP stakeholders	Ongoing

Lincoln Hospital District

Table 6.10. Lincoln Hospital District Mitigation Strategies.

Hazard	Action Item	Goals Addressed	Responsible Departments or Organizations	Projected Completion Year
General	Move and remodel Emergency Room from a 2 bed setup to a six bed setup with one bay designed as a temporary isolation/quiet room.	Goal #1, 2, and 3 Priority Ranking: High	Lincoln Hospital Facilities Management and Finance	4 years
	Build an addition off of the Operating Room area creating recovery rooms for surgery patients and an enhanced Operating Room	Goal #1, 2, and 3 Priority Ranking: High	Lincoln Hospital Facilities Management, Finance, and Operating Room	8 years
	Build a secured refrigerated area off the end of the new proposed Operating Room area to serve as a Region 9 disaster mortuary storage facility.	Goal #1, 2, and 3 Priority Ranking: Moderate	Lincoln Hospital Facilities Management, Finance, and Region 9 Hospital Planning Committee	8 to 40 years
Severe Weather	Wire proposed new construction projects (above) into the generator emergency power grid providing additional sheltering capabilities during severe weather events.	Goal #1, 2, and 3 Priority Ranking: High	Lincoln Hospital Facilities Management, Finance, and Operating Room	4 to 8 years
Wildland Fire	Continue to work on action items and proposed projects identified in the Lincoln County Community Wildfire Protection Plan.	Goal #1, 2, and 3 Priority Ranking: Low	**Partnership**: CWPP stakeholders	Ongoing

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Odessa Memorial Healthcare Center

Table 6.11. Odessa Memorial Healthcare Center Mitigation Strategies.

Hazard	Action Item	Goals Addressed	Responsible Departments or Organizations	Projected Completion Year
General	Maintain and periodically test the backup generator for the hospital building.	Goal #1 and 2 Priority Ranking: High	Odessa Memorial Healthcare Center Environmental Services Department	At least annually
	Work with the city of Odessa to improve sheltering capacity within the community.	Goal #1, 2, 3, 4, and 5 Priority Ranking: High	Odessa Memorial Healthcare Center	Ongoing
	Continuously improve the Hospital's emergency operations plans and procedures by conducting interagency trainings and working collaboratively with other public agencies.	Goal #1, 3, and 4 Priority Ranking: High	Odessa Memorial Healthcare Center	At least annually
Severe Weather	Wire any new construction projects into the emergency power grid in order to provide additional sheltering capabilities during severe weather events.	Goal #1, 2, 4, and 5 Priority Ranking: High	Odessa Memorial Healthcare Center Environmental Services Department	Ongoing
Wildland Fire	Continue to work on action items and proposed projects identified in the Lincoln County Community Wildfire Protection Plan.	Goal #1, 4, and 6 Priority Ranking: Low	**Partnership**: CWPP stakeholders	Ongoing

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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
- Record of Published Articles
- Public Meeting Slideshow
- Potential Funding Sources

Chapter 7 – Appendices

Supporting Information

List of Tables

List of Figures

Record of Local Adoption

Each participating jurisdiction formally adopted the Lincoln 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.

Lincoln County Resolution of Adoption

City of Davenport Resolution of Adoption

City of Sprague Resolution of Adoption

Town of Almira Resolution of Adoption

Town of Harrington Resolution of Adoption

Town of Creston Resolution of Adoption

Town of Odessa Resolution of Adoption

Town of Reardan Resolution of Adoption

Town of Wilbur Resolution of Adoption

Lincoln Hospital District Resolution of Adoption

Odessa Memorial Healthcare Center Resolution of Adoption

Planning Committee Minutes

June 30th, 2010 – Lincoln County Courthouse

Agenda Item #1 – Introduction:

Wade Magers, Lincoln County Emergency Management/Sheriff, began the meeting by asking for introductions and providing some background on the project.

Agenda Item #2 – NMI Presentation:

Tera gave a brief background of the process and explained the purpose of the Multi-Hazard Mitigation Plan and the integration of the Community Wildfire Protection Plan. Critical sections of the CWPP will be included in the MHMP to satisfy new requirements. After NMI explained the ramifications, the committee determined that the County and cities would be the only participating jurisdictions for now; however, there may be a few additional special districts. NMI also asked that the committee provide any hazard information, pertinent planning documents, hazard photos, etc. that may be useful in the development of the risk assessments.

Agenda Item #3 – Phase I Hazard Assessment:

NMI led the committee through an exercise to help determine their perspective on the potential severity of each hazard within the county. Each hazard was scored for its frequency and potential impact and placed in a matrix to show how each hazard ranked relative to each other. The results of the assessment are given below.

		Magnitude		
		Low	**Medium**	**High**
Frequency	**Low**	**Avalanche**	**Landslide** **Seiche**	**Earthquake** **Volcano**
	Medium	**Flood**	**Drought**	
	High		**Wildland Fire** **Severe Weather**	

Agenda Item #4 – Mission and Goals Statements:

Each jurisdiction needs to complete a goals statement per new requirements. NMI provided examples and a fill-in goals worksheet that will also be distributed electronically. Tera asked that each jurisdiction complete their statement by the next meeting.

Agenda Item #5– Critical Facilities:

Tera handed out the critical facilities survey form. She explained how to fill it out based on communities or jurisdictions. All of the lists will be combined and used in the hazard assessments. Tera asked that the committee return the completed lists by July 14th for inclusion in the draft assessments prepared for the next meeting.

Agenda Item #6 – Press Release:

Tera handed out a draft press release announcing the start of the planning project. She asked the committee to review and send her any comments by July 9th.

Agenda Item #7 – Task List:

Information can be sent to Tera King at king@consulting-foresters.com .*

1. Complete Goals Statements by the next meeting – County and Cities
2. Send committee electronic copies of handouts – Tera
3. Send NMI revisions to press release by July 9th – Committee
4. Send NMI critical facilities forms by July 14th – County and Cities

Agenda Item #8 – Adjournment:

The Lincoln County MHMP update planning committee meeting was adjourned at 8 pm. The next meeting will be held on July 28th, 2010 at 6 pm in the Courthouse, Commissioners Chambers.

July 28th, 2010 – Lincoln County Courthouse

Agenda Item #1 – Introduction:

Wade Magers, Lincoln County Emergency Management/Sheriff, began the meeting by asking for introductions and providing some background on the project.

Agenda Item #2 – Old Business:

Tera gave a brief background on the purpose and scope of the planning project. Several items were left over from the last meeting, so Tera went through the tasks that NMI was still needing help with. Most of the jurisdictions had not yet returned their goals statements. These area a requirement; thus, Tera asked that representatives send them in right away. Vaiden has been working on the critical facilities list to be used in the hazard assessments. The most recent version of the list was handed out and Tera asked that committee review, make edits, and fill in missing info. In order to establish a historical record, Tera also ask that committee members send NMI any records, photos, etc of past hazard events as well as any pertinent planning documents that should be reviewed.

Agenda Item #3 – Flood and Landslide Hazards:

Vaiden has completed the modeling and mapping of the FEMA-identified floodplains and the landslide prone landscapes. Tera asked that the committee review the maps for accuracy as well as add any proposed projects and mark any existing problem areas. Phil noted that Public Works would be supplying a GIS layer of the main access roads as well as problem areas and projects.

Agenda Item #4 – Earthquake and Tsunami Hazards:

On one of the maps, Tera also asked that committee members also mark any significant infrastructure or high population areas along the Lake Roosevelt shoreline that would be impacted by a large wave (inland tsunami).Additionally, Tera asked that the committee start putting together estimates of unreinforced masonry within their respective jurisdictions. She needs this broken down by public buildings and private residences and other structures.

Agenda Item #5– Draft Review:

NMI handed out draft chapters 1-4 for committee review. Tera briefly explained the contents of the document and asked that the committee provide edits by August 18th.

Agenda Item #6 – Public Involvement:

Tera handed out a rough draft of the public meeting flyer for review. Public meeting dates were tentatively set for the week of September 27th.

Agenda Item #7 – Task List:

Information can be sent to Tera King at king@consulting-foresters.com .*

1. Complete Goals Statements asap – County and Cities
2. Send committee electronic copies of handouts – Tera
3. Send NMI revisions and additions to the critical facilities list immediately – Committee
4. Send NMI edits to draft chapters 1-4 by Aug 18th – Committee
5. Send NMI revisions to public meeting flyer by Aug 18th – Committee
6. Send NMI photos and other records of hazard events - Committee

Agenda Item #8 – Adjournment:

The Lincoln County MHMP planning committee meeting was adjourned at 8 pm. The next meeting will be held on August 25th, 2010 at 6 pm in the Courthouse, Commissioners Chambers.

August 25th, 2010 – Lincoln County Courthouse

Agenda Item #1 – Old Business:

Tera discussed the status of the goals statements received from the adopting jurisdictions. She also noted that NMI had not received any revisions to the draft Chapters 1.4 handed out at the last committee meeting. The committee was also reminded to send NMI any pictures or documentation of past hazard events.

Agenda Item #2 – Draft Review:

Tera handed out the partial draft of Chapter 5, which covers the hazard vulnerabilities for each jurisdiction. NMI is still working on the maps and GIS analysis for several of the hazards, but many of the sections were presented for review.

Tera also handed out the draft mitigation strategies for each jurisdiction. The projects and action items that NMI had received to date were included, but she asked that the jurisdictions review the section pertaining to them and add projects and ideas to it. This information needs to be justified in the risk assessment narratives and will be discussed at the public meetings.

Tera asked that the committee review and provide edits on both the draft chapter 5 and the mitigation strategy sections by September 17th.

Agenda Item #3 – Public Involvement:

The committee reviewed the public meeting flyer and press release. Public meetings will be scheduled for the week of September 27th in Reardan, Wilbur, Davenport, and Odessa. Tera will be working on making the arrangement and will send out the revised flyer and press release for final review.

Agenda Item #4 – Task List:

Information can be sent to Tera King at king@consulting-foresters.com .*

1. Complete Goals Statements asap – County and Cities
2. Send committee electronic copies of handouts – Tera
3. Send NMI edits to draft chapters 1-4 by immediately – Committee
4. Send NMI revisions to public meeting flyer immediately – Committee
5. Send NMI photos and other records of hazard events – Committee
6. Review and provide edits on draft Chapter 5 by September 17th – Committee
7. Review and provide additions to draft mitigation strategies by September 17th - Committee

Agenda Item #5 – Adjournment:

The Lincoln County MHMP planning committee meeting was adjourned at 7pm. The next meeting will be held on September 29th at 7pm at the Memorial Hall in conjunction with the public meeting in Davenport.

September 29th, 2010 – Lincoln County Courthouse

Agenda Item #1 – Old Business:

Vaiden discussed the information that was still missing from several jurisdictions. Sheriff Magers asked NMI to forward the forms and he would send them out to the committee. He will also coordinate with Tera to contact the jurisdictions and remind them of the information by phone, in person, or otherwise.

Agenda Item #2 – Draft Review:

Vaiden handed out the updated draft Chapter 5 indicating that the information in the Flood, Earthquake, Landslide, Severe Weather, and Tsunami annexes was new. After pointing out where some of the gaps were, he asked that the committee send in their comments and revisions by October 15th.

Vaiden also presented the draft Chapter 6. This chapter contains the mitigation strategies for each jurisdiction. Each section lists the action items currently recorded, their priority ranking, the organization responsible for implementation, and a timeline. At least one action item is required for each jurisdiction. The Lincoln Hospital District section is a good example of a completed list. Vaiden asked that each jurisdiction review or complete their respective lists and send the information to Tera by October 15th.

Agenda Item #3 – Public Involvement:

The committee reviewed the press release announcing the public comment period for the draft document. The public comment period will begin as soon as all the information can be collected from each jurisdiction. The target start date is November 1st.

Agenda Item #4 – Task List:

Information can be sent to Tera King at king@consulting-foresters.com .*

1. Complete Goals Statements asap – County and Cities
2. Send committee electronic copies of handouts – Tera

3. Send NMI edits to draft chapter 5 by October 15th – Committee
4. Send NMI revisions to draft chapter 6 (mitigation strategies) by October 15th – Committee

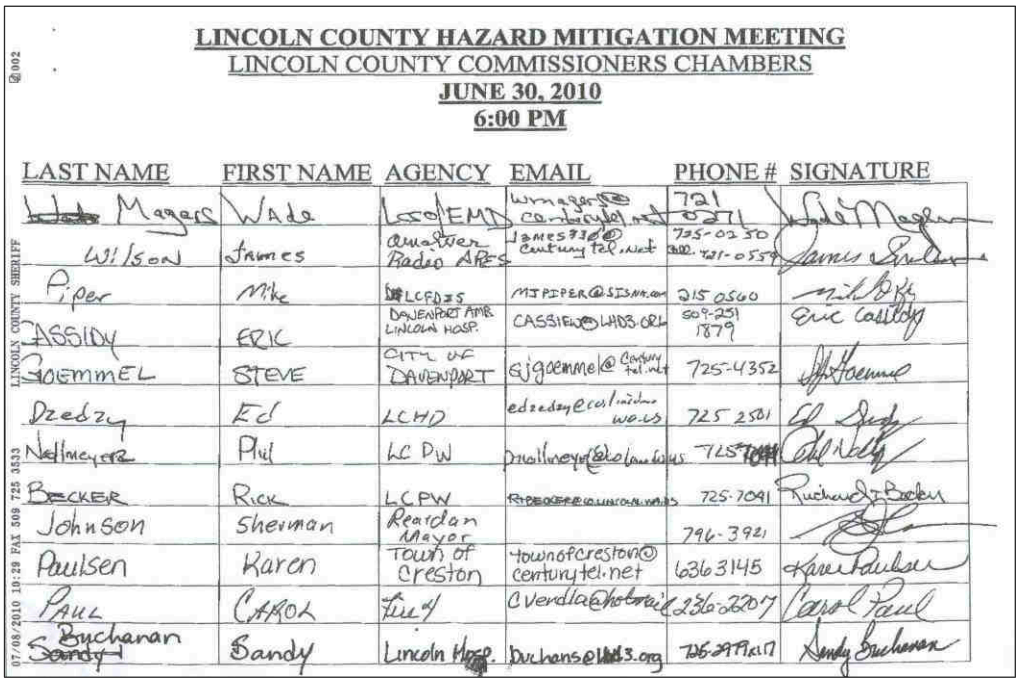
Agenda Item #5 – Adjournment:

The Lincoln County MHMP planning committee meeting was adjourned at 8 pm and followed by the Davenport public meeting. The next meeting is TBD as is necessary.

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 June 30th, 2010.



LINCOLN COUNTY HAZARD MITIGATION MEETING
LINCOLN COUNTY COMMISSIONERS CHAMBERS
JUNE 30, 2010
6:00 PM

LAST NAME	FIRST NAME	AGENCY	EMAIL	PHONE #	SIGNATURE
Magers	Wade	LCOEMD	wmagers@centurytel.net	721 0271	
Wilson	James	Amateur Radio ARES	James933@centurytel.net	725-0250 cell. 721-0559	
Piper	Mike	LCFD#5	MJPIPER@SISNA.com	215 0560	
Cassidy	Eric	Davenport AMB Lincoln Hosp.	CASSIEL@LHDS.ORG	509-251 1879	
Goemmel	Steve	City of Davenport	sjgoemmel@centurytel.net	725-4352	
Dzedzy	Ed	LCHD	edzedzy@co.lincoln.wa.us	725 2501	
Nellmeyer	Phil	LC PW	pnellmeyer@co.lincoln.wa.us	725-7091	
Becker	Rick	LCPW	rbecker@co.lincoln.wa.us	725-7091	
Johnson	Sherman	Reardan Mayor		796-3921	
Paulsen	Karen	Town of Creston	townofcreston@centurytel.net	6363145	
Paul	Carol	Fire	cverdia@hotmail	236-2207	
Buchanan	Sandy	Lincoln Hosp.	Buchans@lhd3.org	725-2717	
Finkbeiner	Brian	Odessa Ems	finkbeb@omhc.org	509-988-0433	
Strobeck	Don	Odessa Fire	dons@odessatrading.com	509-988-0433	
Hutsell	Scott	Lincoln County	shutsell@co.lincoln.wa.us	509-725-3101	
Huseman	Marty	National Park Service	marty_huseman@nps.gov	509-633-9441, ext. 123	

PLEASE DO NOT SEND LARGE FILES! OR GIVE ME 1 DAY'S NOTICE SO I CAN ARCHIVE

Figure 7.2. Committee Meeting Sign-in Sheet for July 28th, 2010.

Lincoln County, Washington
Multi-Hazard Mitigation Plan
Sign In Sheet for July 28th, 2010 Committee Meeting

****Please Print Clearly!****

Name	Affiliation	Email Address
Vaiden Bloch	NMI	bloch@nmi2.com
DOUG PLINSKI	ODESSA MAYOR	mayor@odessaoffice.com
Wade Magers	Sheriff/DEM	wmagers@co.lincoln.wa.us
ERIC CASSIDY	LINCOLN HOSPITAL/DAV AMB	CASSIDEW@LHD3.ORG
Dave Ayres	Avista Utilities	dave.ayres@avistacorp.com
Mike Piper	LCFD#5 Commissioner	mikepiper@SISNA.COM
STEVE GOEMMEL	CITY OF DAVENPORT	sgoemmel@centurytel.net
Rob Coffman	Town of Wilbur/Lincoln 7 asst. Chief	coffmans@centurytel.net
Bill Wadlington	Creston Schools	wwadlington@creston.wednet.edu
PAUL M GILLILAND	City of Harrington MAYOR	paulg85@gmail.com
Phil Nollmeyer	Lincoln County Public Works	pnollmeyer@co.lincoln.wa.us
Arletta Hoffman	City of Sprague	ahoffman@co.lincoln.wa.us
Sherman Johnson	Reardan Mayor	reardan@centurytel.net
CRAIG HADEN	Fire Chief - Town of Wilbur Fire Chief Lincoln Fire #7	schaden@centurytel.net
Lynn McWhorter	City Council Wilbur	mcwhorter2877@msn.com
SCOTT HUTSELL	LINCOLN COUNTY	SHUTSELL@CO.LINCOLN.WA.US.
MARTY HUSEMAN	N.P.S.	marty_huseman@nps.gov

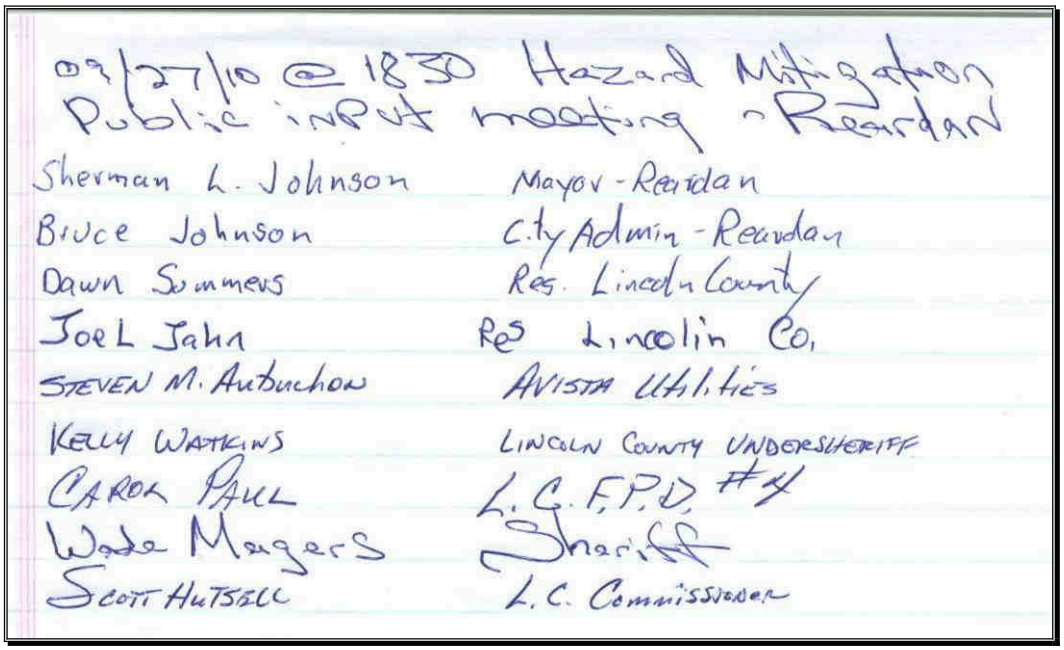
Figure 7.3. Committee Meeting Sign-in Sheet for August 25th, 2010.

Lincoln County, Washington
Multi-Hazard Mitigation Plan
Sign In Sheet for August 25th, 2010 Committee Meeting

****Please Print Clearly!****

Name	Affiliation	Email Address
Tera R. King	NMI	same
Lynn McWhorter	Town of Wilbur	
Sherman L. Johnson	Mayor - Reardan	
SCOTT HUTSELL	LINCOLN COUNTY	
Carol Paul	L.C. Fire 4	

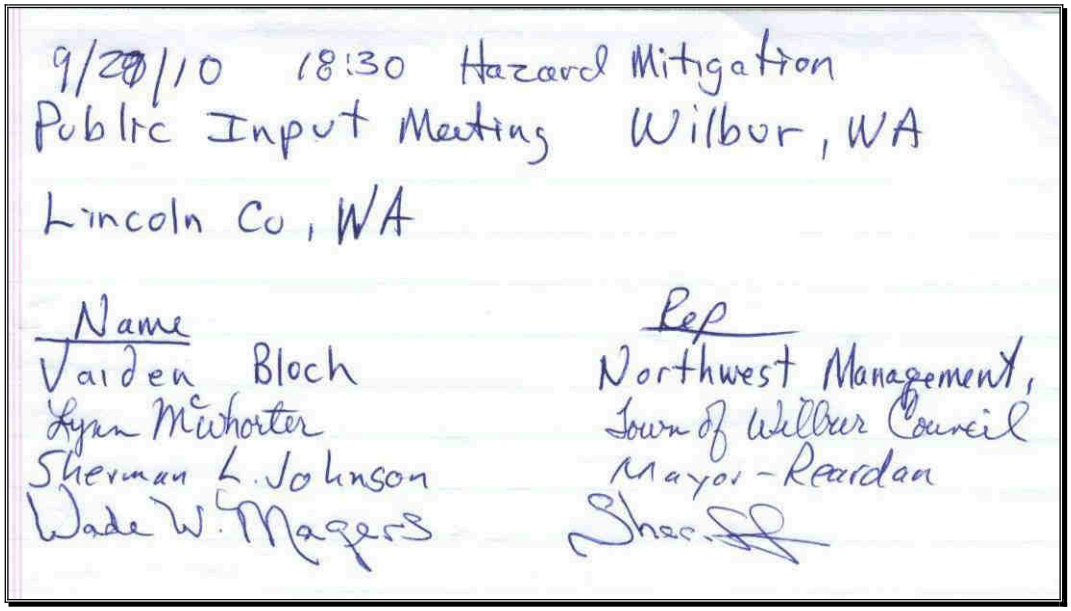
Figure 7.4. Reardan Public Meeting Sign-in Sheet on September 27th, 2010.



09/27/10 @ 1830 Hazard Mitigation
Public input meeting - Reardan

Sherman L. Johnson	Mayor - Reardan
Bruce Johnson	City Admin - Reardan
Dawn Summers	Res. Lincoln County
Joel Jahn	Res Lincolin Co.
STEVEN M. Aubuchon	AVISTA Utilities
KELLY WATKINS	LINCOLN COUNTY UNDERSHERIFF
CAROL PAUL	L.C.F.P.D. #4
Wade Magers	Sheriff
SCOTT HUTSELL	L.C. Commissioner

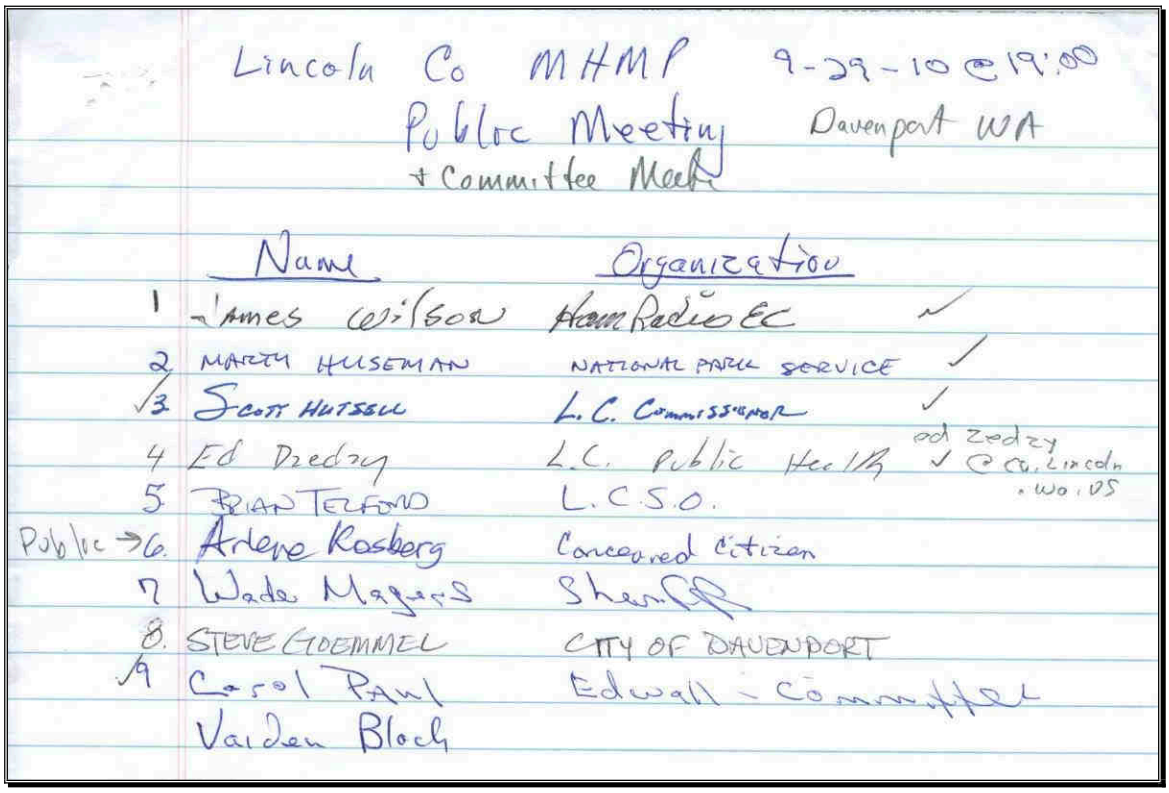
Figure 7.5. Wilbur Public Meeting Sign-in Sheet on September 28th, 2010.



9/28/10 18:30 Hazard Mitigation
Public Input Meeting Wilbur, WA
Lincoln Co, WA

Name	Rep
Vaiden Bloch	Northwest Management,
Lynn McWhorter	Town of Wilbur Council
Sherman L. Johnson	Mayor - Reardan
Wade W. Magers	Sheriff

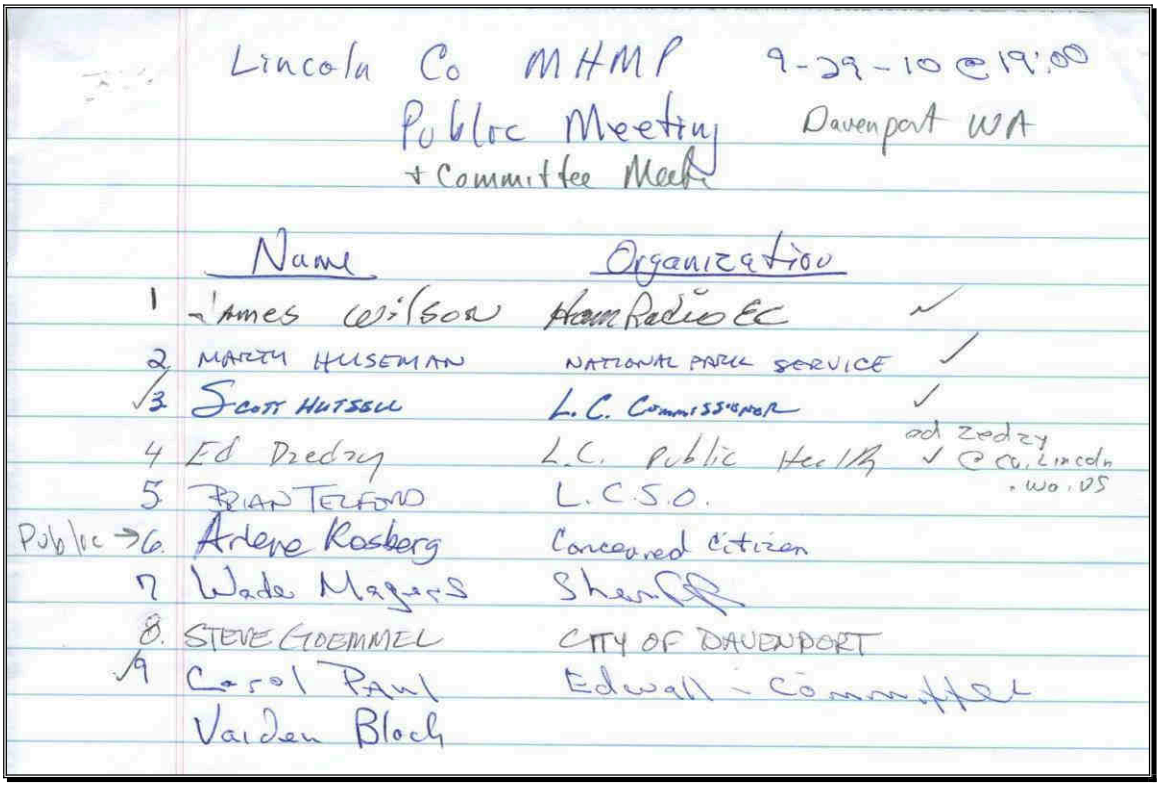
Figure 7.6. Committee Meeting Sign-in Sheet for September 29th, 2010.



Lincoln Co MHMP 9-29-10 @ 19:00
Public Meeting Davenport WA
+ Committee Meeting

	Name	Organization
1	James Wilson	Ham Radio EC ✓
2	MARTY HUSEMAN	NATIONAL PARK SERVICE ✓
✓3	SCOTT HUTSELL	L.C. COMMISSIONER ✓
4	Ed Dredzy	L.C. Public Health ✓ ed zedzy @ co.lincoln.wa.us
5	BRIAN TELFORD	L.C.S.O.
Public → 6.	Arlene Rosberg	Concerned Citizen
7	Wade Magers	Sheriff
8.	STEVE GOEMMEL	CITY OF DAVENPORT
✓9	Carol Paul	Edwall - Committee
	Vaiden Block	

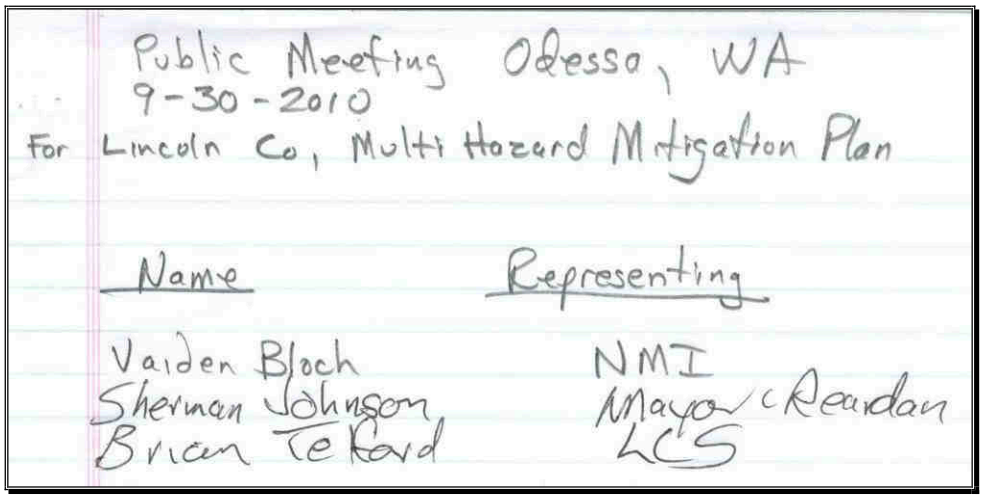
Figure 7.7. Davenport Public Meeting Sign-in Sheet on September 29th, 2010.



Lincoln Co MHMP 9-29-10 @ 19:00
Public Meeting Davenport WA
+ Committee Meeting

	Name	Organization
1	James Wilson	Ham Radio EC ✓
2	MARTY HUSEMAN	NATIONAL PARK SERVICE ✓
✓3	SCOTT HUTSELL	L.C. COMMISSIONER ✓
4	Ed Dredzy	L.C. Public Health ✓ ed zedzy @ co.lincoln.wa.us
5	BRIAN TELFORD	L.C.S.O.
Public → 6.	Arlene Rosberg	Concerned Citizen
7	Wade Magers	Sheriff
8.	STEVE GOEMMEL	CITY OF DAVENPORT
✓9	Carol Paul	Edwall - Committee
	Vaiden Block	

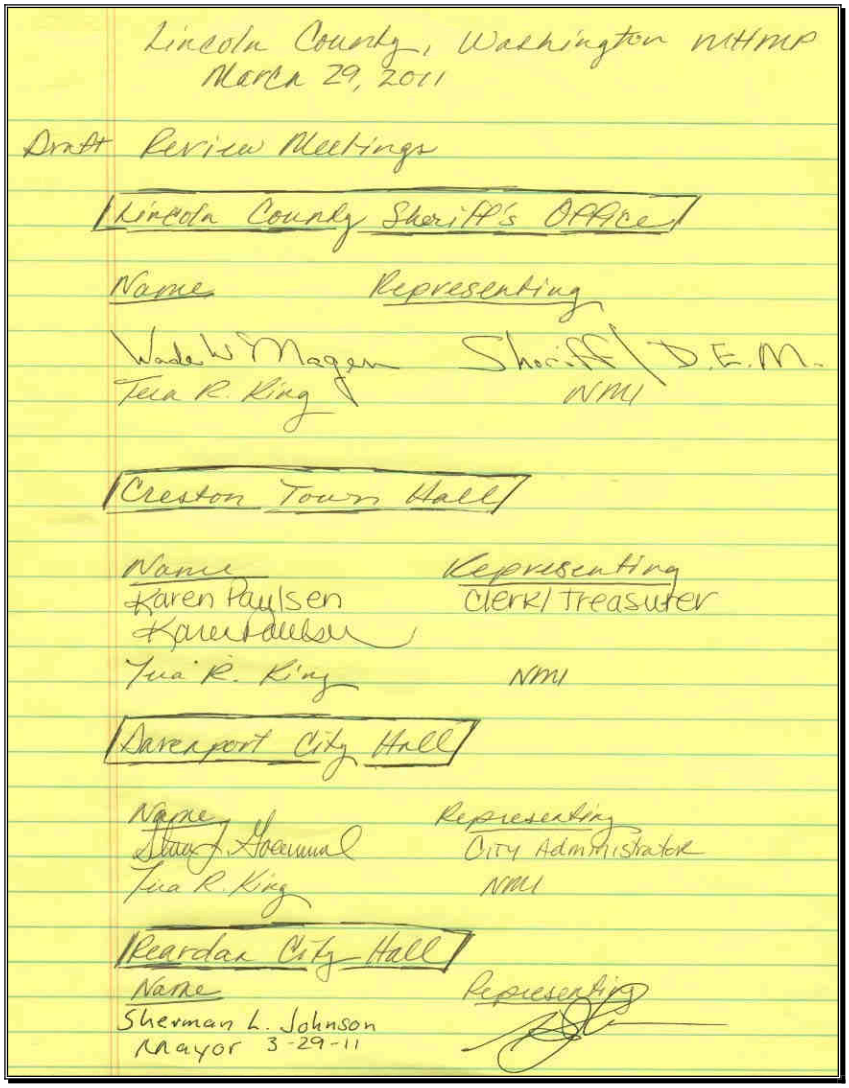
Figure 7.8. Odessa Public Meeting Sign-in Sheet on September 30th, 2010.



Public Meeting Odessa, WA
9-30-2010
For Lincoln Co, Multi Hazard Mitigation Plan

Name	Representing
Vaiden Bloch	NMI
Sherman Johnson	Mayor Reardan
Brian Tekard	LCS

Figure 7.9. Individual Draft Review Meetings Sign-in Sheet for March 29th, 2011.



Lincoln County, Washington MHMP
March 29, 2011

Draft Review Meetings

Lincoln County Sheriff's Office

Name	Representing
Wade W Magen	Sheriff / D.E.M.
Tina R. King	NMI

Creston Town Hall

Name	Representing
Karen Paulsen	Clerk/Treasurer
Tina R. King	NMI

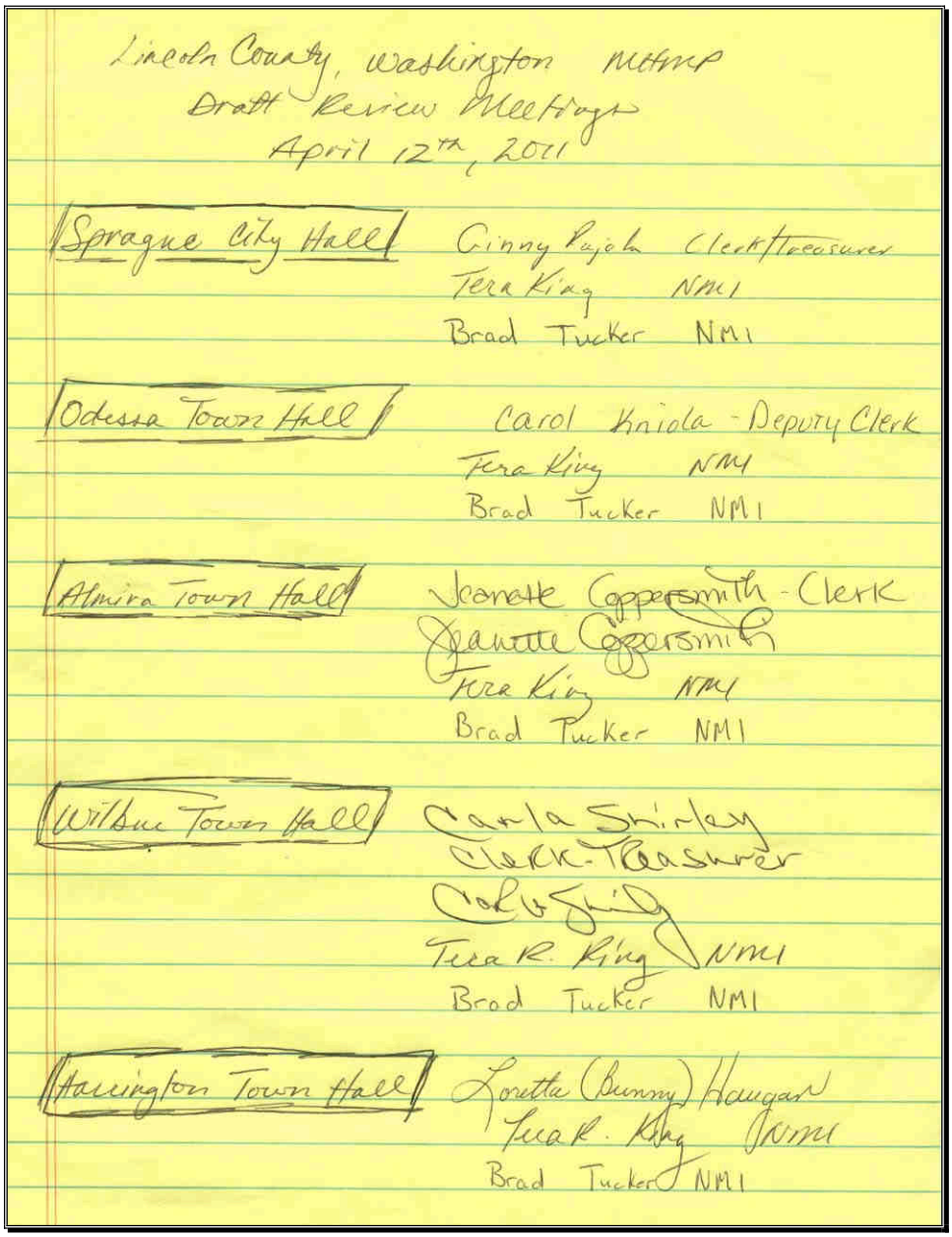
Davenport City Hall

Name	Representing
[illegible]	City Administrator
Tina R. King	NMI

Reardan City Hall

Name	Representing
Sherman L. Johnson Mayor 3-29-11	

Figure 7.10. Individual Draft Review Meetings Sign-in Sheet for April 12th, 2011.



Lincoln County, Washington MHMP
Draft Review Meetings
April 12th, 2011

Sprague City Hall
Ginny Pajola Clerk/Treasurer
Tera King NMI
Brad Tucker NMI

Odessa Town Hall
Carol Kniola - Deputy Clerk
Tera King NMI
Brad Tucker NMI

Almira Town Hall
Jeanette Coppersmith - Clerk
Jeanette Coppersmith
Tera King NMI
Brad Tucker NMI

Wilbur Town Hall
Carla Shirley
Clerk-Treasurer
Carla Shirley
Tera R. King NMI
Brad Tucker NMI

Harrington Town Hall
Loretta (Bunny) Haugan
Tera R. King NMI
Brad Tucker NMI

Record of Email Correspondence

The following is a record of the email correspondence that took place throughout the Multi-Hazard Mitigation Planning process. Email communication was one of the methods used to establish the goals of each jurisdiction, develop a critical infrastructure list, draft risk assessments, and develop mitigation strategies. Ideas and information developed outside of regularly schedule committee meetings were always discussed at the group forum as well to determine consensus.

Table 7.1. Record of Email Correspondence.

Date	From	Recipient	Subject
June 8, 2010	Wade Magers	Invitees	Invitation to participate
June 28, 2010	Wade Magers	Invitees	Reminder for kickoff meeting
June 30, 2010	Wade Magers	Invitees	Reminder for kickoff meeting
July 1, 2010	Wade Magers	Invitees/Planning Committee	Invitation to participate and 2nd meeting announcement
July 12, 2010	Tera King thru Wade Magers	Planning Committee	Distribution of goals worksheets, critical facilities checklist, draft press release, meeting minutes, and task list for committee review.
July 19, 2010	Ed Dzedzy thru Wade Magers	Tera King	Critical facilities checklist
July 19, 2010	James Wilson thru Wade Magers	Tera King	Participation of Amateur Radio Group
July 19, 2010	Marty Huseman thru Wade Magers	Tera King	Fort Spokane and Spring Canyon critical facilities checklists
July 19, 2010	Phil Nollmeyer thru Wade Magers	Tera King	Public Works critical facilities checklist
July 19, 2010	Rick Becker thru Wade Magers	Tera King	Harrington's critical facilities checklist
July 19, 2010	Ryan Rettowski thru Wade Magers	Tera King	Fire District #4's critical facilities checklist
July 19, 2010	Steve Goemmel thru Wade Magers	Tera King	Davenport's goals worksheet and critical facilities checklist
July 19, 2010	Wade Magers	Planning Committee	Reminder - distribution of goals worksheets, critical facilities checklist, draft press release, meeting minutes, and task list for committee review.
July 19, 2010	Wade Magers	Tera King	Lincoln County critical facilities checklist
July 20, 2010	Town of Odessa thru Wade Magers	Tera King	Odessa's critical facilities checklist
July 21, 2010	Wade Magers	Tera King	Information regarding the RACES program
July 21, 2010	Tera King	Wade Magers	Summary of plans, ordinances, codes, etc. required for review and integration
July 21, 2010	Tera King	Media Outlets	Submission of press release announcing the MHMP planning process
July 21, 2010	Tera King	Public Works and Wade Magers	Clarification of critical facilities checklist and request for additional information from Public Works
July 26, 2010	Wade Magers	Planning Committee	Reminder regarding July committee

			meeting
July 28, 2010	Sandy Buchanon thru Wade Magers	Tera King	Lincoln Hospital's critical facilities checklist and goals worksheet
July 29, 2010	Tera King thru Wade Magers	Planning Committee	Distribution of July meeting minutes, goals worksheet, draft critical facilities list, and draft chapters 1-4 for committee review.
August 2, 2010	Jeanette Coppersmith thru Wade Magers	Tera King	Almira's critical facilities checklist
August 2, 2010	Wade Magers	Tera King	Creston's critical facilities checklist
August 2, 2010	Wade Magers	Tera King	Lincoln County's CEMP
August 11, 2010	Carla Shirley thru Wade Magers	Tera King	Wilbur's critical facilities checklist
August 23, 2010	Tera King thru Wade Magers	Planning Committee	Reminder to send goals worksheets and Distribution of draft chapters 1-4
August 24, 2010	Tera King	Wade Magers	Lincoln County goals statements
August 24, 2010	Carla Shirley thru Wade Magers	Tera King	Wilbur's goals statements
August 30, 2010	Town of Odessa thru Wade Magers	Tera King	Odessa's goals worksheet and critical facilities checklist
August 30, 2010	Karen Paulsen thru Wade Magers	Tera King	Creston's goals statement
September 1, 2010	Tera King thru Wade Magers	Planning Committee	Distribution of August meeting minutes, partial draft chapter 5, and partial mitigation strategies outline for committee review.
September 1, 2010	Karen Paulsen thru Wade Magers	Tera King	Question regarding mitigation strategy for Creston
September 9, 2010	Tera King	Wade Magers	Draft press release and flyer for public meetings
September 9, 2010	Wade Magers	Planning Committee	Distribution of public meeting flyer
September 10, 2010	Tera King	Media Outlets	Submission of press release regarding public meetings
September 13, 2010	Karen Paulsen thru Wade Magers	Tera King	Creston's goals statement
September 28, 2010	Wade Magers	Planning Committee	Notification of change in venue for Davenport public meeting
October 4, 2010	Tera King thru Wade Magers	Planning Committee	Distribution of September meeting agenda, draft chapter 5, draft mitigation strategies, and missing information task list for committee review.
October 18, 2010	Tera King	City of Sprague	Request for additional information
October 18, 2010	Tera King	Town of Reardan	Request for additional information
October 18, 2010	Tera King	Town of Wilbur	Request for additional information
October 18, 2010	Tera King	Town of Creston	Request for additional information

October 18, 2010	Tera King	Odessa Hospital	Request for additional information
October 18, 2010	Tera King	Wade Magers	Summary and update regarding jurisdictional information and minutes from September meeting.
October 18, 2010	Tera King	City of Davenport	Request for additional information
October 18, 2010	Tera King	Town of Odessa	Request for additional information
October 19, 2010	Steve Goemmel	Tera King	Davenport's review and revision of risk assessment and mitigation strategy information.
October 20, 2010	Doug Plinski	Tera King	Odessa's review of draft document, additional information for risk assessment, and revision of mitigation strategy.
October 22, 2010	Tera King	Judy Boutain	Clarification of mitigation strategy and prioritization process
October 25, 2010	Karen Paulsen	Tera King	Creston's review of draft plan and questions regarding mitigation strategy
October 29, 2010	Lynn McWhorter	Tera King	Revision of Wilbur's mitigation strategy
November 2, 2010	Arletta Hoffman	Tera King	Sprague's goals statements and revisions to draft document
November 8, 2010	Tera King	Town of Almira	Request for additional information
November 8, 2010	Tera King	Wade Magers	Request for additional contact information
November 8, 2010	City of Sprague	Tera King	Request for Sprague's prioritization of mitigation strategies
November 8, 2010	Town of Reardan	Tera King	Request for review of risk assessment and mitigation strategy
November 8, 2010	Tera King thru Wade Magers	Planning Committee	Notification of missing information and minutes from September meeting.
November 12, 2010	Jeanette Coppersmith	Tera King	Almira's review of risk assessment and mitigation strategy and completion of goals statement
November 15, 2010	Wade Magers	Odessa Hospital	Notification of missing information
November 19, 2010	Wade Magers	City of Harrington	Notification of missing information
December 8, 2010	Wade Magers	Odessa Hospital	Notification of missing information and timeline for completion
December 10, 2010	Tera King	Odessa Hospital	Request for additional information
December 18, 2010	Carol Schott	Tera King	Odessa Hospital's review of risk assessment and mitigation strategy
December 20, 2010	Tera King	Wade Magers	Update on missing information and timeline for completion
December 21, 2010	Tera King	City of Harrington	Reminder to send additional information

December 27, 2010	Tera King	Wade Magers	Draft press release announcing public comment period
December 28, 2010	Tera King	Wade Magers	Preparation for public comment period
December 29, 2010	Tera King	Wade Magers	Submittal of the draft pdf for posting on County website
December 29, 2010	Tera King	Media Outlets	Submission of press release announcing public comment period
December 29, 2010	Tera King thru Wade Magers	Planning Committee	Notification of public comment period
January 4, 2011	Phill Nollmeyer thru Wade Magers	Tera King	Revision of mitigation strategy and additional information from Public Works
January 31, 2011	Tera King	Wade Magers	Summary of public comments
January 31, 2011	Wade Magers	Tera King	Permission to submit to EMD for review
March 8, 2011	Heather Kowalski thru Wade Magers	Tera King	Initial EMD review of draft document
March 8, 2011	Tera King	Heather Kowalski	Request for additional information regarding EMD's comments on draft plan
March 10, 2011	Tera King	Wade Magers	Action plan for EMD's comments on draft plan
March 10, 2011	Wade Magers	Tera King	Action plan for EMD's comments on draft plan
March 16, 2011	Tera King	Wade Magers	Published newspaper articles
March 17, 2011	Wade Magers	Darrell Ruby	Regional Capability Assessment
March 17, 2011	Darrell Ruby	Wade Magers	Regional Capability Assessment
March 25, 2011	Tera King	Darrell Ruby	Regional Capability Assessment
March 28, 2011	Darrell Ruby	Tera King	Regional Capability Assessment

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, Lincoln 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 7.9. Davenport Times: Front Page – September 16th, 2010

Thursday, September 16, 2010
Davenport, Washington
127th Year, No. 17
75 cents
Lower rates by subscription

Davenport TIMES

Serving Davenport, Edwall, Harrington, Reardan, Sprague and Surrounding Communities

Hazards focus of upcoming meetings

County asks for public input on mitigation plan being developed

Four public meetings to discuss the Lincoln County multi-hazard mitigation plan currently in development have been scheduled during the last week of this month.

The schedule: Monday, Sept. 27, in the Reardan Community Hall; Tuesday, Sept. 28, in the Wilbur Senior Center; Wednesday, Sept. 29, in the Davenport Memorial Hall; and Thursday, Sept. 30, in Odessa's Old Town Hall.

A 6:30 p.m. start time is planned for all of the meetings except Davenport's, which will begin at 7.

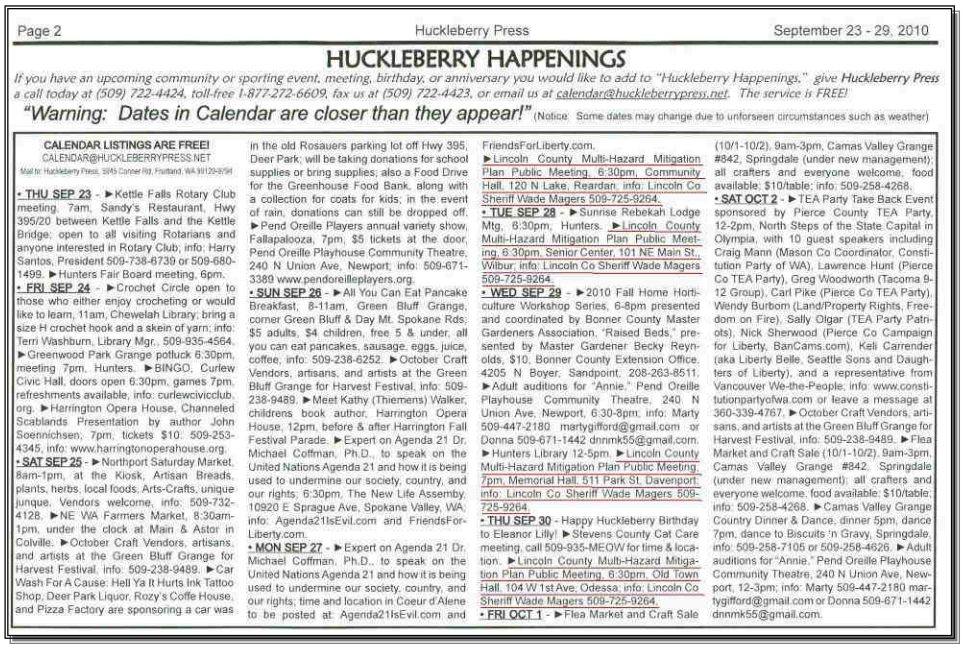
Each session will last about an hour, Sheriff Wade Magers explained, and is designed to provide information about hazards and potential mitigation projects identified by a planning team – followed by an opportunity for citizens to discuss their priorities for how local communities may best reduce the impacts of such events as floods, landslides, severe weather, wildland fire, earthquake, avalanche, inland tsunami, volcano and drought.

"Public input is being sought in order to better frame the region's efforts for hazard reduction projects, resource enhancements and emergency preparedness," Magers said.

A slideshow presentation from Northwest Management, Inc., also will be featured.

Magers has more information about the plan at 725-9264.

Figure 7.10. Huckleberry Press – September 23rd – 29th, 2010.



Page 2 Huckleberry Press September 23 - 29, 2010

HUCKLEBERRY HAPPENINGS

If you have an upcoming community or sporting event, meeting, birthday, or anniversary you would like to add to "Huckleberry Happenings," give **Huckleberry Press** *a call today at (509) 722-4424, toll-free 1-877-272-6609, fax us at (509) 722-4423, or email us at calendar@huckleberrypress.net. The service is FREE!*

"Warning: Dates in Calendar are closer than they appear!" (Notice: Some dates may change due to unforseen circumstances such as weather)

CALENDAR LISTINGS ARE FREE!
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Mail to: Huckleberry Press, 5845 Corner Rd, Fruitland, WA 99129-9798

• **THU SEP 23** - ►Kettle Falls Rotary Club meeting, 7am, Sandy's Restaurant, Hwy 395/20 between Kettle Falls and the Kettle Bridge; open to all visiting Rotarians and anyone interested in Rotary Club; info: Harry Santos, President 509-738-6739 or 509-680-1499. ►Hunters Fair Board meeting, 6pm.
• **FRI SEP 24** - ►Crochet Circle open to those who either enjoy crocheting or would like to learn, 11am, Chewelah Library; bring a size H crochet hook and a skein of yarn; info: Terri Washburn, Library Mgr., 509-935-4564. ►Greenwood Park Grange potluck 6:30pm, meeting 7pm, Hunters. ►BINGO, Curlew Civic Hall, doors open 6:30pm, games 7pm, refreshments available, info: curlewcivicclub.org. ►Harrington Opera House, Channeled Scablands Presentation by author John Soennichsen; 7pm, tickets $10: 509-253-4345, info: www.harringtonoperahouse.org.
• **SAT SEP 25** - ►Northport Saturday Market, 8am-1pm, at the Kiosk, Artisan Breads, plants, herbs, local foods, Arts-Crafts, unique junque, Vendors welcome, info: 509-732-4128. ►NE WA Farmers Market, 8:30am-1pm, under the clock at Main & Astor in Colville. ►October Craft Vendors, artisans, and artists at the Green Bluff Grange for Harvest Festival, info: 509-238-9489. ►Car Wash For A Cause: Hell Ya It Hurts Ink Tattoo Shop, Deer Park Liquor, Rozy's Coffe House, and Pizza Factory are sponsoring a car was in the old Rosauers parking lot off Hwy 395, Deer Park; will be taking donations for school supplies or bring supplies; also a Food Drive for the Greenhouse Food Bank, along with a collection for coats for kids; in the event of rain, donations can still be dropped off. ►Pend Oreille Players annual variety show, Fallapalooza, 7pm, $5 tickets at the door, Pend Oreille Playhouse Community Theatre, 240 N Union Ave, Newport; info: 509-671-3389 www.pendoreilleplayers.org.
• **SUN SEP 26** - ►All You Can Eat Pancake Breakfast, 8-11am, Green Bluff Grange, corner Green Bluff & Day Mt. Spokane Rds; $5 adults, $4 children, free 5 & under, all you can eat pancakes, sausage, eggs, juice, coffee, info: 509-238-6252. ►October Craft Vendors, artisans, and artists at the Green Bluff Grange for Harvest Festival, info: 509-238-9489. ►Meet Kathy (Thiemens) Walker, childrens book author, Harrington Opera House, 12pm, before & after Harrington Fall Festival Parade. ►Expert on Agenda 21 Dr. Michael Coffman, Ph.D., to speak on the United Nations Agenda 21 and how it is being used to undermine our society, country, and our rights; 6:30pm, The New Life Assemby, 10920 E Sprague Ave, Spokane Valley, WA; info: Agenda21IsEvil.com and FriendsForLiberty.com.
• **MON SEP 27** - ►Expert on Agenda 21 Dr. Michael Coffman, Ph.D., to speak on the United Nations Agenda 21 and how it is being used to undermine our society, country, and our rights; time and location in Coeur d'Alene to be posted at: Agenda21IsEvil.com and FriendsForLiberty.com.
►Lincoln County Multi-Hazard Mitigation Plan Public Meeting, 6:30pm, Community Hall, 120 N Lake, Reardan; info: Lincoln Co Sheriff Wade Magers 509-725-9264.
• **TUE SEP 28** - ►Sunrise Rebekah Lodge Mtg, 6:30pm, Hunters. ►Lincoln County Multi-Hazard Mitigation Plan Public Meeting, 6:30pm, Senior Center, 101 NE Main St., Wilbur; info: Lincoln Co Sheriff Wade Magers 509-725-9264.
• **WED SEP 29** - ►2010 Fall Home Horticulture Workshop Series, 6-8pm presented and coordinated by Bonner County Master Gardeners Association, "Raised Beds," presented by Master Gardener Becky Reynolds, $10, Bonner County Extension Office, 4205 N Boyer, Sandpoint, 208-263-8511. ►Adult auditions for "Annie," Pend Oreille Playhouse Community Theatre, 240 N Union Ave, Newport, 6:30-8pm; info: Marty 509-447-2180 martygifford@gmail.com or Donna 509-671-1442 dnnmk55@gmail.com. ►Hunters Library 12-5pm. ►Lincoln County Multi-Hazard Mitigation Plan Public Meeting, 7pm, Memorial Hall, 511 Park St, Davenport; info: Lincoln Co Sheriff Wade Magers 509-725-9264.
• **THU SEP 30** - Happy Huckleberry Birthday to Eleanor Lilly! ►Stevens County Cat Care meeting, call 509-935-MEOW for time & location. ►Lincoln County Multi-Hazard Mitigation Plan Public Meeting, 6:30pm, Old Town Hall, 104 W 1st Ave, Odessa; info: Lincoln Co Sheriff Wade Magers 509-725-9264.
• **FRI OCT 1** - ►Flea Market and Craft Sale (10/1-10/2), 9am-3pm, Camas Valley Grange #842, Springdale (under new management); all crafters and everyone welcome, food available; $10/table; info: 509-258-4268.
• **SAT OCT 2** - ►TEA Party Take Back Event sponsored by Pierce County TEA Party, 12-2pm, North Steps of the State Capital in Olympia, with 10 guest speakers including Craig Mann (Mason Co Coordinator, Constitution Party of WA), Lawrence Hunt (Pierce Co TEA Party), Greg Woodworth (Tacoma 9-12 Group), Carl Pike (Pierce Co TEA Party), Wendy Burbom (Land/Property Rights, Freedom on Fire), Sally Olgar (TEA Party Patriots), Nick Sherwood (Pierce Co Campaign for Liberty, BanCams.com), Keli Carrender (aka Liberty Belle, Seattle Sons and Daughters of Liberty), and a representative from Vancouver We-the-People; info: www.constitutionpartyofwa.com or leave a message at 360-339-4767. ►October Craft Vendors, artisans, and artists at the Green Bluff Grange for Harvest Festival, info: 509-238-9489. ►Flea Market and Craft Sale (10/1-10/2), 9am-3pm, Camas Valley Grange #842, Springdale (under new management); all crafters and everyone welcome, food available; $10/table; info: 509-258-4268. ►Camas Valley Grange Country Dinner & Dance, dinner 5pm, dance 7pm, dance to Biscuits 'n Gravy, Springdale, info: 509-258-7105 or 509-258-4626. ►Adult auditions for "Annie," Pend Oreille Playhouse Community Theatre, 240 N Union Ave, Newport, 12-3pm; info: Marty 509-447-2180 martygifford@gmail.com or Donna 509-671-1442 dnnmk55@gmail.com.

Figure 7.11. Davenport Times: Front Page – September 23rd, 2010

Davenport TIMES

Thursday, September 23, 2010
Davenport, Washington
127th Year, No. 18

75 cents
Lower rates by subscription

Serving Davenport, Edwall, Harrington, Reardan, Sprague and Surrounding Communities

The Week Ahead

Monday, Sept. 27
Lincoln County Commissioners,
9 a.m., courthouse basement.
Davenport Middle School groundbreaking,
6:15 p.m., enter at football field east gate.
Hazard Mitigation Plan meeting,
6:30 p.m., Reardan Community Hall.
Davenport School Board,
7 p.m., high school library.

Wednesday, Sept. 29
Hazard Mitigation Plan meeting,
7 p.m., Davenport Memorial Hall.
Reardan-Edwall School Board,
7 p.m., high school library.

Figure 7.12. Davenport Times: Front Page – January 6th, 2011.

Davenport TIMES

Thursday, January 6, 2011
Davenport, Washington
127th Year, No. 33

75 cents
Lower rates by subscription

Serving Davenport, Edwall, Harrington, Reardan, Sprague and Surrounding Communities

Sheriff completes draft of hazard mitigation plan

Lincoln County's Multi-Hazard Mitigation Plan has been completed in draft form and is available to the public for review and comment at the Clerk's Office in the county courthouse and city halls in Davenport, Reardan, Odessa, Harrington, Almira, Creston, Wilbur and Sprague.

Electronic copies may be viewed in pdf format at http://www.co.lincoln.wa.us/. The public review phase of the planning process will continue until Jan. 24, Sheriff Wade Magers reports.

The plan's purpose is to reduce the impact of hazards such as floods, landslides, severe weather, wildfire, earthquakes and drought on Lincoln County residents, landowners, businesses, communities, local governments, as well as state and federal agencies, while maintaining appropriate emergency response capabilities and sustainable natural resource management policies.

It identifies high risk areas as well as structures and infrastructure that may have an increased potential for loss due to a hazard event. Specific projects are recommended that may help prevent disasters from occurring altogether or at least lessen their impact on residents and property. The plan is being developed by a committee of city and county elected officials and departments, local and state emergency response representatives, land managers, hospital and school district representatives and others.

The plan includes risk analysis at the community level with predictive models for where disasters are likely to occur. It will enable the county and its communities to be eligible for grant dollars to implement projects and mitigation actions identified by the committee. Although not regulatory, the plan will provide valuable information for future planning.

Comments must be submitted to WMagers@co.lincoln.wa.us or mailed to Lincoln County Emergency Management, P.O. Box 367, Davenport, WA 99122 by the close of business on Jan. 24. More information is available from Magers at 725-9264 or Tera King of Northwest Management at (208) 883-4488 ext. 133.

Figure 7.13. Lincoln Advertiser – January 19th, 2011.

Lincoln Advertiser — January 19, 2011

Lincoln County Hazard Plan Available for Public Review

The Lincoln County Multi-Hazard Mitigation Plan has been completed in draft form and is available to the public for review and comment at the Clerk's office in the Lincoln County Courthouse and the city halls in Davenport, Reardan, Odessa, Harrington, Almira, Creston, Wilbur, and Sprague. Electronic copies may be viewed in pdf format at http://www.co.lincoln.wa.us/. The public review phase of the planning process will be open from January 3rd, 2011 thru January 24th, 2011.

The purpose of the Lincoln County Multi-Hazard Mitigation Plan (MHMP) is to reduce the impact of hazards such as floods, landslides, severe weather, wildfire, earthquakes, and drought on Lincoln 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 identifies high risk areas as well as structures and infrastructure that may have an increased potential for loss due to a hazard event. The document also recommends specific projects that may help prevent disasters from occurring altogether or, at the least, lessen their impact on residents and property. The MHMP is being developed by a committee of city and county elected officials and departments, local and state emergency response representatives, land managers, hospital and school district representatives, and others.

Comments on the MHMP must be submitted to the attention of Sheriff Magers, Lincoln County Emergency Management, at WMagers@co.lincoln.wa.us or mailed to Lincoln County Emergency Management, PO Box 367, Davenport, Washington 99122 by close of business on January 24th, 2011. For more information on the Lincoln County Multi - Hazard Mitigation Plan process, contact Sheriff Magers at 509-725-9264 or Tera King, Northwest Management, at 208-883-4488 ext 133.

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.

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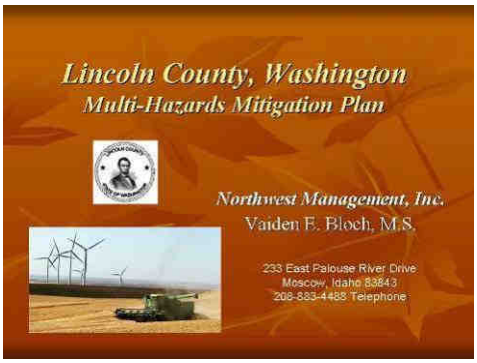

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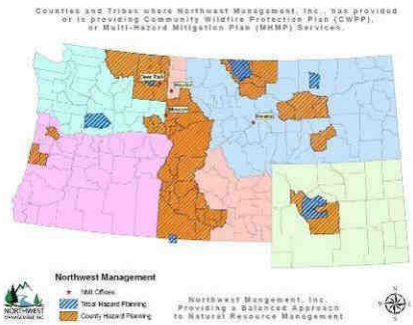

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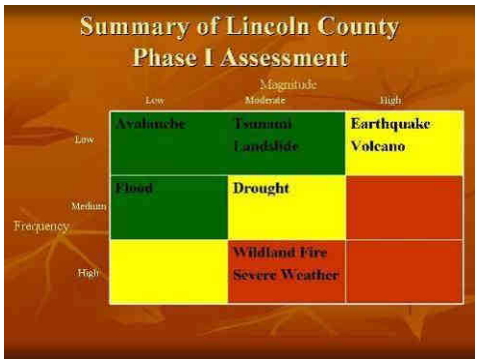

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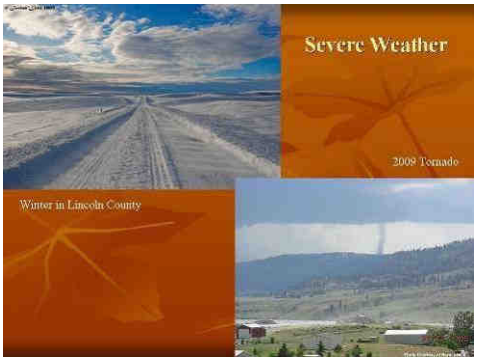

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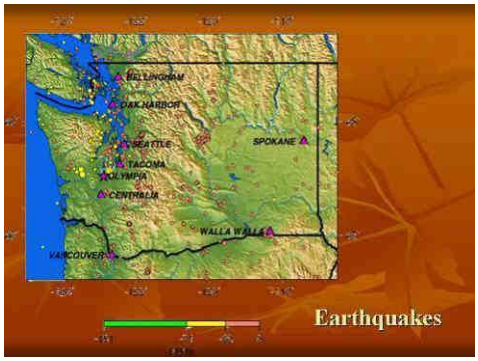

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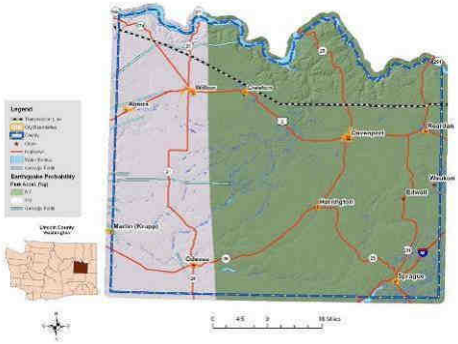

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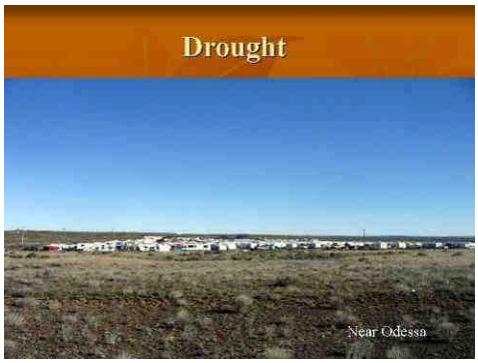

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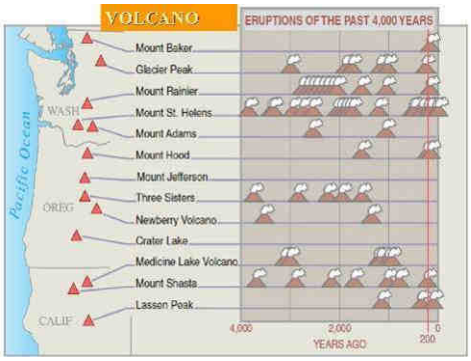

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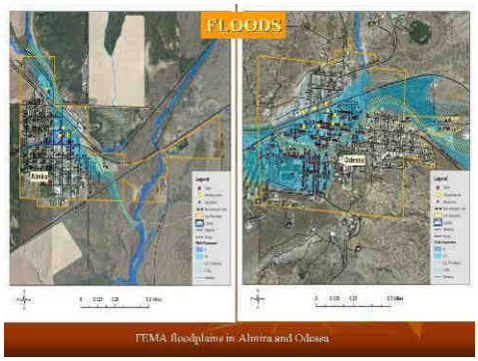

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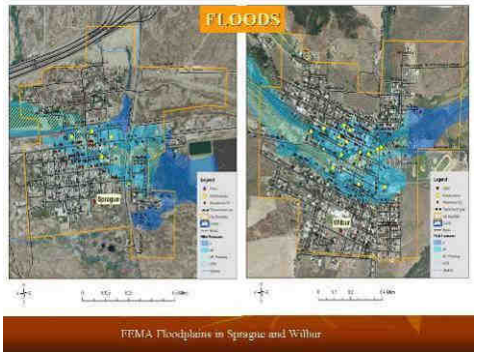

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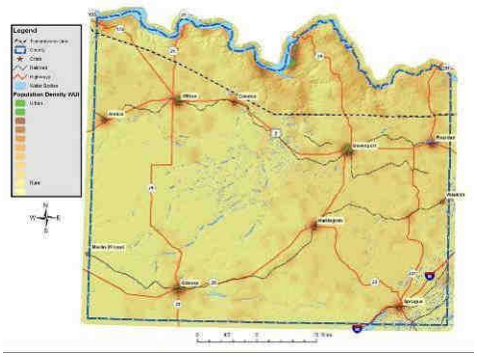

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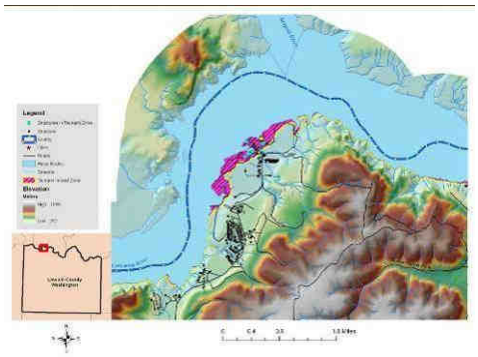

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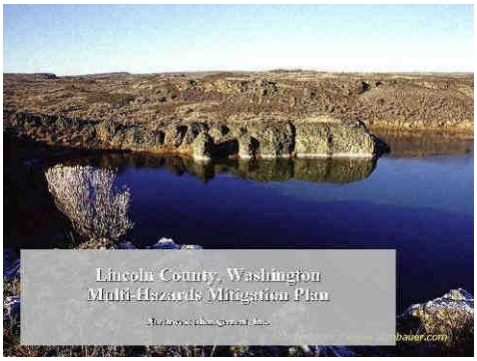

Potential Funding Sources

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

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:

Program: **State Fire Assistance**
Source: US Forest Service
Description: USFS grants to state foresters through state and private grants, under authority of Cooperative Forestry Assistance Act. Grant objectives are to maintain and improve protection efficiency and effectiveness on non-federal lands, training, equipment, preparedness, prevention and education.
More info: www.fireplan.gov and www.fs.fed.us

Program: **State Fire Assistance Hazard Mitigation Program**
Source: National Fire Plan
Description: These special state Fire Assistance funds are targeted at hazard fuels treatment in the wildland-urban interface. Recipients include state forestry organizations, local fire services, county emergency planning committees and private landowners.
More info: www.fireplan.gov and www.fs.fed.us

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: www.fs.fed.us/fire/partners/vfa

Program: **Forest Land Enhancement Program**
Source: US Forest Service
Description: The 2002 Farm Bill repealed the Forestry Incentives Program (authorized in 1978) and Stewardship Incentive Program (1990) cost share programs and replaced it with a new Forest Land Enhancement Program (FLEP). FLEP purposes include 1) Enhance the productivity of timber, fish and wildlife habitat, soil and water quality, wetland, recreational resources, and aesthetic values of forest land through landowner cost share assistance, and 2) Establish a coordinated, cooperative federal, state and local sustainable forestry program to establish, manage, maintain, enhance and restore forests on non-industrial private forest land.
More info: www.usda.gov/farmbill

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:

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:

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.fema.gov

Program: **Fire Management Assistance Grant Program**

Source: Readiness, Response and Recovery Directorate, FEMA

Description: Program provides grants to states, tribal governments and local governments for the mitigation, management and control of any fire burning on publicly (nonfederal) or privately owned forest or grassland that threatens such destruction as would constitute a major disaster. The grants are made in the form of cost sharing with the federal share being 75 percent of total eligible costs. Grant approvals are made within 1 to 72 hours from time of request.

More info: www.fema.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

Program: **Boise State University Wildland Fire Academy**.

Source: Partnership between BSU and SWIFT (Southwest Idaho Fire Training, a group including the BLM, Forest Service, and the Idaho Department of Lands).

Description: Provides a full range of fire training classes during one week in June at the Selland College of Technology on the BSU campus. Tuition is required. Open to federal, state, local fire fighters, contractors, and the public. Housing is available on campus. (Separate from, but in conjunction with, this academy, BSU recently began offering an associate degree program in fire science.)

More info: BLM training officer at 208-384-3403 or BSU's Selland College at 208-426-1974.

This plan was developed by Northwest Management, Inc. under contract with Lincoln County Emergency Management.

Copies of this Plan can be obtained by contacting:

Lincoln County Emergency Management Director, Sheriff Wade Magers
Lincoln County Emergency Management Department
PO Box 367 or 404 Sinclair
Davenport, Washington 99122
Phone: 509-725-9264

Citation of this work:

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