TETON COUNTY

MULTI-HAZARD MITIGATION PLAN

Town of Jackson, Teton County, Teton Conservation District

Little Horsethief Fire, Wilson Canyon, 2012
Photo credit: Florence McCall

Prepared by Teton County Emergency Management
with assistance from
Beck Consulting, Amec Foster Wheeler

March 2016

U.S. Department of Homeland Security
Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267

FEMA

R8-MT

March 9, 2016

Barbara Allen, Chairwoman
Teton County Commission
P.O. Box 3594
Jackson, Wyoming 83001

Dear Chairwoman Allen:

We are pleased to announce the approval of the **Teton County Multi-Hazard Mitigation Plan** as meeting the requirements of the Stafford Act and Title 44 Code of Federal Regulations §201.6 for a local hazard mitigation plan. The plan approval extends to the following participating jurisdictions that have adopted the plan: **Teton County, the Town of Jackson, and the Teton Conservation District.**

The approved jurisdictions are eligible for FEMA Hazard Mitigation Assistance grant programs. All requests for funding will be evaluated individually according to the specific eligibility and other requirements of the particular program under which the application is submitted. Approved mitigation plans may be eligible for points under the National Flood Insurance Program Community Rating System.

This plan is approved through March 8, 2021. A local jurisdiction must revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five years to continue to be eligible for mitigation project grant funding.

We have provided comments and recommendations for the next plan update on the enclosed Plan Review Tool. We wish to thank the jurisdictions that participated in the planning process and commend your continued commitment to reducing future disaster losses. Please contact Melinda Gibson, State Hazard Mitigation Officer, at melinda.gibson@wyo.gov or (307) 777-4914 with any questions on the plan approval or mitigation grant programs.

Sincerely,

Jeanine D. Petterson

Jeanine D. Petterson
Mitigation Division Director

Enclosure: Plan Review Tool
cc: Melinda Gibson, State Hazard Mitigation Officer

LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Multi-jurisdiction Summary Sheet should be used to document contact information for each jurisdiction and if each met the requirements of the Plan, if a multi-jurisdictional plan.
- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: Teton County, WY Town of Jackson, Teton Conservation District	**Title of Plan: Teton County Multi-Hazard Mitigation Plan**	**Date of Plan:** **November 2015**
Local Point of Contact: Rich Ochs	**Address:** P.O. Box 4458 3240 South Adams Canyon Drive Jackson, WY 83001	
Title: Teton County Emergency Management Coordinator		
Agency: Teton County Emergency Management		
Phone Number: (307) 732-8594 office / (307) 413-5040	**E-Mail:** rochs@tetonwy.org	

State Reviewer: Melinda Gibson	**Title: State Hazard Mitigation Officer**	**Date: September 4, 2015**

FEMA Reviewer: Enessa James Nicole Aimone	**Title:** Mitigation Champion / Planner II, Resilience Action Partners Senior Community Planner	**Date:** 1/7/2016 1/15/2016
Date Received in FEMA Region VIII	**November 30, 2015**	
Plan Not Approved		
Plan Approvable Pending Adoption	**January 15, 2016**	
Plan Approved	**March 9, 2016**	

SECTION 1:
MULTI-JURISDICTION SUMMARY SHEET

MULTI-JURISDICTION SUMMARY SHEET									
#	Jurisdiction Name	Jurisdiction Type	Jurisdiction Contact	Email	Requirements Met (Y/N)				
					A. Planning Process	B. HIRA	C. Mitigation Strategy	D. Update Rqtms.	E. Adoption Resolution
1	Unincorporated Teton County	County	Rich Ochs	rochs@tetonwyo.org	Y	Y	Y	Y	Y
2	Town of Jackson	Town	Larry Pardee	lpardee@ci.jackson.wy.us	Y	Y	Y	Y	Y
3	Teton Conservation District	District	Robb Sgroi	robb@tetonconservation.org	Y	Y	Y	Y	Y
4									
5									
6									
7									
8									
9									
10									

SECTION 2:
REGULATION CHECKLIST

REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Chapter 1 (page 1.1-1.5) Appendix A	Y	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Chapter 1 (page 1.1-1.2) Appendix A	Y	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Chapter 1 (pages 1.3-1.4, 1.6-1.7) Appendix A	Y	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Chapter 1 (pages 1.1, 1.5, 1.7-1.9)	Y	
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Chapter 17 (page 17.3)	Y	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Chapter 17 (pages 17.1-17.3)	Y	
ELEMENT A: REQUIRED REVISIONS			
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Pages 2.1-15.2	Y	

REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Chapter 3 (pages 3.3-3.4, 3.6) Chapter 4 (pages 4.4-4.8, 4.12) Chapter 5 (pages 5.2-5.5, 6.27) Chapter 6 (pages 6.7-6.11, 6.19) Chapter 7 (pages 7.1-7.4, 7.6) Chapter 8 (pages 8.4-8.7) Chapter 9 (pages 9.4-9.10, 9.16) Chapter 10 (pages 10.1-10.7, 10.9) Chapter 11 (pages 11.1-11.6, 11.8) Chapter 12 (page 12.2, 12.3) Chapter 13 (pages 13.3-13.13, 13.21) Chapter 14 (pages 14.1-14.4, 14.7) Chapter 15 (page 15.1-15.2)	Y	
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Pages 3.6; 4.8-4.12; 5.14-5.27; 6.12-6.19; 7.5-7.6; 8.7; 9.11-9.16; 10.8-10.9; 11.6-11.8; 12.2-12.3; 13.14-13.21; 14.5-14.7; 15.1-15.2	Y	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Chapter 6 (pages 6.1, 6.5)	Y	
ELEMENT B: REQUIRED REVISIONS			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Chapter 1 (pages 1.11-1.13) Chapter 6 (pages 6.5-6.6) Chapter 9 (page 9.16) Chapter 13 (pages 13.1-13.3) Chapter 16 (page 16.13)	Y	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Chapter 6 (pages 6.5-6.6)	Y	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Chapter 16 (pages 16.1-16.11)	Y	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Chapter 16 (pages 16.2-16.11)	Y	

REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Chapter 16 (pages 16.2-6.13)	Y	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Chapter 17 (pages 17.2-17.3)	Y	
ELEMENT C: REQUIRED REVISIONS			
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Chapter 1 (pages 1.5; 1.11-1.13)	Y	
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Chapter 1 (pages 1.12-1.13) Appendix B	Y	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Chapter 16 (pages 16.1-16.2)	Y	
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))			
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	Pending, Appendix C (page C.1 – C.4)	X	
ELEMENT E: REQUIRED REVISIONS			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
F1.			

REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
F2.			
ELEMENT F: REQUIRED REVISIONS			

SECTION 3:
PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

This section describes the strengths of the plan document and includes recommendations for how the plan could be improved as part of the next plan update.

Element A: Planning Process

This planning process did a great job of public outreach throughout the mitigation plan development timeline. The use of multiple sources (i.e. Facebook, Twitter, Public Flyers, websites, etc.) and making all meetings open to the public are very beneficial to the community's hazard awareness. For the next plan update, evaluate what methods worked best for gathering input, educating the public, and identifying partnership opportunities. As demographics and technology change so will the appropriateness of your various outreach strategies.

Element B: Hazard Identification and Risk Assessment

The vulnerability assessment focuses almost exclusively on county-scale vulnerability. During the next plan update focus on developing a hazard vulnerability summary for each participating jurisdiction for every profiled hazard (estimated losses, land use and development trends, etc.). Try to identify differences in vulnerability factors between participating jurisdictions. Additionally, during the next plan update be sure to elaborate on and clearly describe the probability that each hazard will affect participating jurisdictions.

The risk assessment leverages appropriate data and analyses including WYGS Hazus earthquake studies and landslide risk data, FEMA Risk MAP flood risk products, and Teton County CWPP WUI boundaries.

Editorial Comments:
It would be helpful to include a description of the boundaries for the Teton Conservation District or add the Conservation District boundary to Figure 1.2: Teton County Map

Page numbering error: The page following 5.26 shows 6.27. The page number should be revised to 5.27 as it is related to earthquakes (Chapter 5)

Element C: Mitigation Strategy

The identified mitigation projects accurately reflect the capabilities of the participating jurisdictions and include a number of non-mitigation actions, which is acceptable. Ideally, the mitigation strategy should include an action plan for each mitigation project that includes potential funding sources and expected timeframes for completion. The mitigation strategy should include more of the ideas from the Risk MAP "areas of mitigation interest", but they may have considered them in their process and threw them out.

For the next plan update, consider elaborating on how participating communities can improve/strengthen their existing capacities. In what specific ways can local jurisdictions improve their zoning and subdivision ordinances, legal and regulatory capabilities, and administration/technical capacity to achieve their risk reduction goals? Do you need more staff?

Technical Assistance? A public education/awareness campaign? If possible, focus on improvements that are easily achievable and do not require much time or resources.

Element D: Plan Review, Evaluation, and Implementation (Plan Updates Only)

Throughout the plan review, evaluation, and implementation process, consider putting extra energy towards helping participating municipalities identify their un-tapped resources, engage local champions for mitigation projects, and implement their strategies for new and/or improved local risk-reduction policies and programs. Additionally, focus attention during the plan review process on identifying and/or recording the progress of your previously identified hazard mitigation actions. This will allow communities to provide more detailed information about the project status of previous mitigation actions and track their successes.

B. Resources for Implementing Your Approved Plan

The **Mitigation Ideas: A Resource for Reducing Risk from Natural Hazards** resource presents ideas for how to mitigate the impacts of different natural hazards, from drought and earthquakes, to severe winter weather and wildfire. The document also includes ideas for actions that communities can take to reduce risk to multiple hazards, such as incorporating a hazard risk assessment into the local development review process. http://www.fema.gov/library/viewRecord.do?id=6938

The **Integrating Hazard Mitigation Into Local Planning: Case Studies and Tools for Community Officials** resource provides practical guidance on how to incorporate risk reduction strategies into existing local plans, policies, codes, and programs that guide community development or redevelopment patterns. It includes recommended steps and tools to assist with local integration efforts, along with ideas for overcoming possible impediments, and presents a series of case studies to demonstrate successful integration in practice.
http://www.fema.gov/library/viewRecord.do?id=7130

Teton County
Multi-Hazard Mitigation Plan

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Executive Summary

Multi-Hazard Mitigation Plan

Teton County, the Town of Jackson, and the Teton Conservation District have updated this Multi-Hazard Mitigation Plan (MHMP)--adopted last in 2010. Using a grant from the Federal Emergency Management Agency (FEMA), the county retained Beck Consulting and Amec Foster Wheeler (AMEC-FW) to assist Teton County Emergency Management in updating the 2010 plan.

The overarching goal of the MHMP is to reduce the risks for injury, loss of life, property damage, and property loss due to natural disasters. Maintaining a current plan also ensures the jurisdictions are eligible for grant funds to complete mitigation projects and to receive post-disaster assistance in the event of a major natural disaster.

Building on the earlier plan, this update contains the results of research on past disasters including location, severity, and frequency, and uses models and the historical record to project potential damages from future natural disasters.

The natural hazards addressed in the plan include: dam failure, drought, earthquake, flood, landslides, hail, snow avalanches, tornadoes, wildland fire, and winter storms and blizzards. In addition, two human-related hazards, hazardous materials and terrorism, are addressed. The plan also contains a description and documentation of the planning process and who was involved in that process. Emergency Management, Town and County elected officials and staff, Teton Conservation District, Fire/EMS, Law Enforcement, Public Health, Industry, Bridger-Teton National Forest, Grand Teton National Park, and the public were all involved in the plan update process.

The plan has three goals and 46mitigation actions or projects. There is one goal for Teton County with 32 projects, one goal for the Town of Jackson with seven projects, and one goal for the Teton Conservation District with seven projects. At least one project is required of any jurisdiction wishing to adopt the plan. This MHMP update is consistent with existing local plans and the Land Development Regulations (LDR's.)

The types of projects under the three goals in the plan are diverse and include: education and awareness, emergency response, natural resource protection, prevention, property protection, and structural projects. Public and Local Emergency Planning Committee (LEPC) surveys indicated the strongest support for emergency response type projects. Together, the projects address all of the hazards either directly or through increasing the effectiveness of emergency response. Projects do not represent an unfunded mandate for local governments. Projects represent an identified need and will be undertaken if/when resources (personnel, funding, and technical expertise) is available.

Chapter I. Introduction

Specific Jurisdictions Represented in the Plan

The jurisdictions represented in this plan are Teton County, and the Town of Jackson, Wyoming. Jackson is the only incorporated community in the County. These two jurisdictions participated in and adopted the original MHMP in 2004 and the plan update in 2010. This plan update has one additional entity participating. The entity is the Teton Conservation District. The Conservation District intends to adopt the plan and have an active role in project implementation—specifically as relates to the flooding and wildland fire mitigation projects.

How the Jurisdictions Participated in the Plan Update

The two local jurisdictions and the Conservation District participated in the planning process. Participation occurred in the following ways:

- By providing key staff to participate in the Local Emergency Planning Committee (LEPC) meetings (the LEPC served as the Planning Team),
- By issuing news releases during the planning process,
- By identifying actions taken on projects from the 2010 plan,
- By providing information on critical infrastructure and facilities,
- By providing existing plans and documents,
- By providing maps and GIS information,
- By providing contacts for critical information,
- By meeting with the contractor one-on-one as requested,
- By providing feedback on draft goals,
- By posting project information on government websites,
- By providing specific project ideas,
- By reviewing and commenting on the draft plan, and
- By adopting the plan once FEMA approval is obtained.

Opportunity for Involvement by Other Interests

The Wyoming Office of Homeland Security posted notice about the update of this plan on its statewide emergency managers' webpage. By this means, the neighboring Wyoming counties of Lincoln, Sublette, Fremont, and Park were all notified that Teton County was undertaking a revision to the MHMP and invited to provide input, comments, and review the draft plan. The notice included information on the project, and contact information for questions and input.

The LEPC has membership from a broad cross-section of the community including health care, public works, emergency services, elected officials, media, all levels of government, and the schools. Individuals and key interests in the process who were not able to attend LEPC, public, or local government meetings were represented in the planning process through the LEPC attendees and their elected officials.

Central Wyoming Community College has a campus in Jackson. The Teton Science School and the public school district were made aware of the process through local print, radio, and social media.

The National Park Service (Grand Teton National Park) and the Bridger-Teton National Forest had representatives on the LEPC and attended LEPC meetings where the update was discussed. The times, dates, and agendas of the LEPC meetings are posted on the County's website and legal ads with all of the LEPC meetings for the year are posted semiannually.

Local non-profits and other organizations had opportunity to learn about and become involved in the process through traditional and social media. Information about the MHMP update was provided to the Chamber of Commerce. Direct messaging on public meetings and the availability of the draft plan for public review was made via Teton County Emergency Management's Nixle SMS/email notification system.

Process Followed to Update the Plan

Agendas, meeting summaries, and sign-in sheets for each of these meetings can be found in Appendix A documenting the planning process.

Upon award of a hazard mitigation planning grant, Teton County retained hazard mitigation planner, Beck Consulting of Red Lodge, Montana. Subcontractor to Beck Consulting, AMEC-FW prepared the Hazard Identification and Risk Assessment (HIRA.)

To kick-off the project, the contractor met with the County Emergency Management Coordinator in March 2015 to receive an orientation to the County and the emergency management program. The County provided a list of relevant local plans for review. The revision and meetings' schedule was finalized. Channels of communication were established for the project and the contractor was introduced to several key individuals.

Also in March 2015, the contractor presented the Briefing Paper and gave remarks about the plan and planning process to the Board of County Commissioners at a regularly-scheduled and noticed meeting.

Sub-contractor AMEC-FW then began the research to update the hazard profiles utilizing all customary sources including local media sources, state, and national data bases such as the National Climate Data Center, and the most recent Wyoming state hazard mitigation plan. Economic and demographic information for the county was obtained from the U.S. Census Bureau and the Headwaters Economics—EPS. Information sources are cited with the related text.

The Emergency Management Coordinator and the contractor first reviewed the projects in the 2010 plan to determine their status. This information was brought to the LEPC for validation. A determination was made as to whether the project/action had been accomplished, whether it was still an appropriate project, and/or whether the description was specific enough to understand the intent of the project. Those projects that had been accomplished were so noted and dropped unless they were of an on-going nature. The projects that were no longer relevant in the judgment of the Coordinator and LEPC were dropped as were projects too vague to understand the desired outcome.

The LEPC convened in May. The process followed to update the plan relied on the expertise of the LEPC. Membership of the committee is provided later in this chapter. Because many on the committee were new to the hazard mitigation planning process, the contractor provided an explanation of the reasons for and benefits of updating the plan,

outlined the schedule and process, and covered the roles of all involved—including the LEPC. The group reviewed the goals from the last plan update, identified development trends, and discussed examples of the types of projects that could go into this plan. The project status information for the 2010 plan projects is displayed in Appendix B.

Figure 1.1 - May 21, 2015 LEPC Meeting

The contractor and LEPC met again in July for a briefing of the information contained in the HIRA and to further refine the mitigation projects.

Just before release of the draft plan, the contractor met with and briefed all of the local elected officials from Jackson and Teton County. Representatives of the Conservation District also attended this meeting which was held in Jackson on August 3, 2015.

Single-purpose public meetings were scheduled after the project initiation and at the time of release of the draft. Notice of public meetings was through the Jackson Hole News and Guide, the Teton County Emergency Management web page, a Nixle text/email to subscribers (4,969 emails, 381 text messages), social media, and flyers.

Attendees at the public meetings identified numbers of project ideas and came away with increased awareness of the natural hazards in the County. Participants at the first public meeting filled out a brief survey to identify the hazards they were concerned about. Each person completing a survey received a one-person, one-day emergency kit.

The entire draft plan was posted on the County's website and its availability announced in the Jackson Hole News and Guide. Legal ads were purchased for two separate weeks in the News and Guide. Hard copies of the draft plan were made available at the Town Hall, County Administration building, Emergency Management, Teton County Library, and the Teton Conservation District building.

The public comment period was open from August 14 through September 18, 2015. Upon request, the comment period was extended approximately two weeks to allow for additional input.

Comments were received from seven individuals (by e-mail) and ranged from asking for better coordination with the community of Alta, to flooding, to landslide mapping, to dam failure, and earthquakes.

Comments received on the draft were reviewed by the County Emergency Management Coordinator and forwarded to the contractors. The contractors addressed the relevant comments in the plan—reviewing and incorporating information and references provided in the comments to the extent practicable.

How the Planning Team Reviewed and Analyzed the Existing Plan

The LEPC served as the planning team. The LEPC met three times to work on the MHMP update (May, July, and September of 2015) and performed the following functions; provided relevant plans, reviewed the 2010 Multi-Hazard Mitigation Plan, determined the status of projects listed in the 2010 plan, contributed information on natural hazards, identified new project ideas, reviewed and commented on draft goals and project ideas, and shared information about the process with other staff on their units. Following each of the LEPC meetings, the contractor documented the meetings and re-drafted products such as goals and projects as per the committee's guidance.

At the first meeting, the LEPC assisted the contractor in documenting the accomplishments and current status of projects in the 2010 plan. They then discussed development trends for the Town and County. Finally they discussed the types of projects that could go in the plan and generated new project ideas.

At the July LEPC meeting, the group received a briefing on the updated HIRA, went over the public survey results, reviewed input from the public meeting, and focused on proposed projects--refining the projects in the plan.

At the September meeting, The LEPC took a final look at the proposed mitigation projects included in the draft plan.

The draft plan was available for review by LEPC members. LEPC members integrated projects into the MHMP update that they were planning and budgeting for FY2016 within the various departments. LEPC membership is provided in Appendix C.

Local Emergency Planning Committee membership:

- Bridger-Teton National Forest
- Fire/EMS
- Law enforcement (Town and County)
- Emergency Management (Town and County)
- Public Health (County)
- Public Works (Town)
- Road and Levee (County)
- Red Cross
- National Park Service (Grand Teton National Park)
- Teton Conservation District
- U.S. Department of Homeland Security--TSA

How the Public Was Involved in the Update Process

Counting the LEPC meetings, a total of seven public meetings were held in Jackson over the course of the plan update. The meetings were a combination of elected official meetings, public, and LEPC meetings. All meetings were open to the public and the Town and County elected body meetings were broadcast on the internet.

- The first meeting was a briefing for the County Commissioners held on May 20. The public was able to listen to the briefing in person and on the internet, and ask questions.

- The second meeting was held at the public library on May 20. Use of the Nixle notification system, paper flyers, Facebook, Twitter, and a web site posting were responsible for attracting the 19 attendees (not counting the coordinator and the contractor.) Members of the public were briefed on the plan, generated problem statements, identified possible mitigation projects, and completed a brief survey.

- The third meeting was an LEPC meeting held on May 21, 2015. A description of meeting topics for this meeting is provided in the previous section.

- The fourth meeting was an LEPC meeting held on July 16, 2015. A description of meeting topics for this meeting is provided in the previous section.

- The fifth meeting was a Joint Information Meeting (JIM) of the Town and County elected officials. This meeting was held on August 3. At this meeting, the contractor presented the draft plan to the elected officials. This meeting was also open to the public and broadcast over the internet.

- The sixth meeting was a public meeting to present the draft plan for the public review and comment period, and to answer questions. This meeting occurred on August 3rd.

- The final meeting available to the public was the September LEPC meeting where the LEPC members and any other attendees had a chance to offer comments on the draft plan.

The plan was made available for a 4-week public review period which was subsequently extended for two weeks. Hard copies of the plan were placed at the Town, County, and Conservation District offices, and the public library. The plan was also available on the Town, County, and Conservation District websites.

In addition to the public meetings, the local radio station, KHOL, broadcast a live interview with the Emergency Management Coordinator about the plan update on May 19, 2015.

Products of the planning process were posted on the Emergency Management page of the County's website as they became available. The entire draft plan was posted on the Town, County, and Conservation District websites once it was completed.

Meeting attendance at the public meetings was average. There was difficulty in getting the local newspapers to print press releases or attend meetings early in the process, but

toward the end, newspaper coverage increased with at least 2 articles on the plan. Media releases from the Teton County Public Affairs Officer went not only to the newspapers and radio station, but also to the Chamber of Commerce, non-profit organizations, and state and federal agency contacts.

LEPC members were asked to take information about the planning process back to share with the agency/entities they represented. In this way, additional individuals and groups across the community that were not present at scheduled planning meetings became aware of the update process and had the opportunity to participate if they so desired.

Review and Incorporation of Existing Plans

A wide range of additional plans and data sources were consulted for the HIRA update. Those sources are cited with the related text. The local plans listed below were reviewed for consistency with the MHMP update and for project ideas.

Name	Date	Jurisdiction	Comments
Comprehensive Plan	2013	Jackson/Teton County	Goals to make the most ecologically suitable places for development the most desirable places to live, to direct the majority of growth into areas of existing infrastructure and services, and achieve the vision as a community set in a sensitive and dynamic natural environment.
Land Development Regulations	2014	Teton County Town of Jackson	Very comprehensive LDRs. Establishes zones and overlays including the Natural Resource Overlay. Requires physical development permits. Lists Physical Development Standards Applicable in All Zones (soils, steep slopes, avalanches paths, waterbody and wetland buffers, etc.) Restricts building on steep slopes, in floodplains. Requires building permits. Zones identify natural hazards to avoid. Requires grading, erosion control, and storm water management. Requires compliance of subdivisions with seismic, floodplain, and wildland urban interface standards.
Strategic Plan	2014	Teton Conservation District	Goal to cooperate with Teton Area Wildfire Protection Coalition. Provide technical assistance for implementing the LDR's. Provide technical assistance to the Flat Creek Water Improvement District. Implement a winter flood risk study on Flat Creek. Communicate with FEMA and the Floodplain Administrator for data sharing and gathering. Support

Name	Date	Jurisdiction	Comments
			US Army Corp of Engineers' projects regarding levee flood risk mitigation.
Community Health Needs Assessment	2015	Teton County	Lists housing situation as one of top health/safety concerns. Transportation associated with commuting major safety issue for population.
Emergency Operations Plan	2008	Teton County	Response plan
Community Wildfire Protection Plan	2014	Teton County, Forest Service, National Park Service	Reviewed for HIRA. Information incorporated into this plan.
Town/County Training and Exercise Plan	2015	Teton County Public Health	Annual plan for emergency community training and exercises.
Strategic National Stockpile Plan	2012	Teton County Public Health	
Town/County NIMS Training Plan	2013	Teton County Emergency Management	Outlines National Incident Management System training requirements for Jackson/Teton County government.

The following plans have either been initiated or are scheduled for development. They were not available for review. Emergency Management has a role in each of these plans and will help assure consistency with the MHMP.

Plan Title	Status, Responsible Entity
Town/County Recovery Plan	In development, Teton County Emergency Management (TCEM)
Town/County Debris Management Plan	In development, TCEM
Town/County Resource Inventory	In development, TCEM
Town/County Emergency Alert System (EAS) Plan	In development, TCEM
TCEM Continuity of Operations Plan (COOP)	In development, TCEM
Teton County EOC SOP's	To be developed, TCEM
Town/County Evacuation Plan	To be developed, TCEM, Sheriff
11 Levee System Emergency Action Plans	To be developed, TCEM, Road & Levee
Town/County Hazardous Materials Plan	To be developed, TCEM, Fire/EMS
Town/County Continuity of Government Plan (COG)	To be developed, TCEM

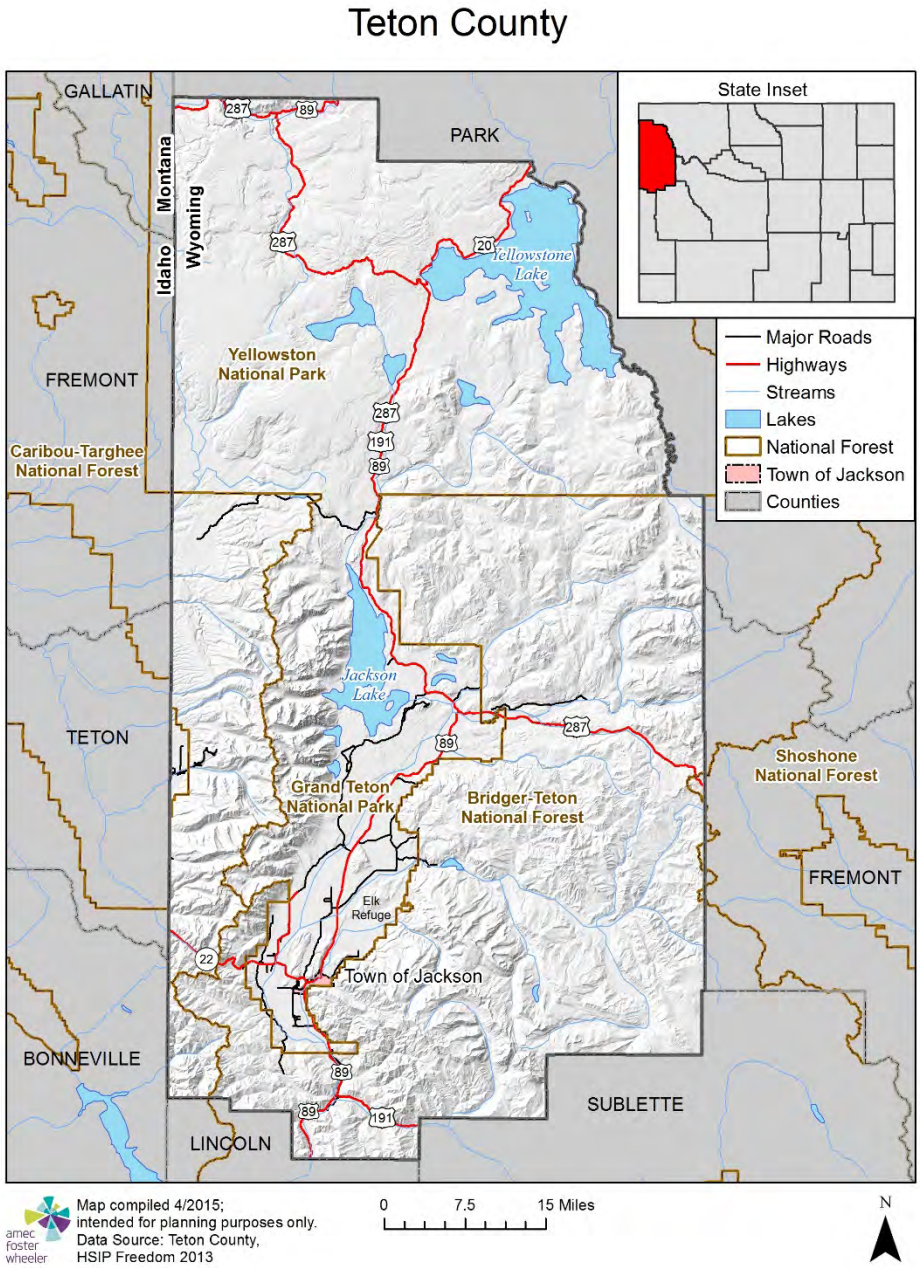


Figure 1.2 - Teton County Map

County Profile

Teton County encompasses approximately 4,008 square miles and is located in northwestern Wyoming. Approximately 97% of the County is publicly-owned. The County shares its western border with Idaho and in order to reach the unincorporated area of Alta, which lies in Teton County, one must travel through Idaho. "From an economic and demographic perspective, Jackson Hole is one community spanning two states—Wyoming and Idaho—and three counties: Teton, Wyoming, Teton, Idaho, and the Star Valley portion of Lincoln, Wyoming." (Jackson Hole Compass, 2015)

Within the County boundaries lie the Town of Jackson, Grand Teton National Park, and roughly the southern half of Yellowstone National Park. (Yellowstone National Park has exclusive jurisdiction and is not a part of this plan.) The topography is primarily mountainous and includes the dramatic Teton Range, portions of the Gros Ventre and Absaroka Ranges, and the Yellowstone Plateau. The County is the headwaters of the Snake River and contains Yellowstone and Jackson Lakes. Tourism and recreation is the main financial stay of the County.

The population of the County in 2010 was 21,294 which is an increase of 3,044 persons from the 2000 census (18,251). In 2010, 9,577 or approximately 45% of the individuals resided in the one incorporated community of Jackson. (http://factfinder.census.gov) The County has been experiencing sustained growth for several decades. Population change for Teton County from 1970-2013 was 356.4%, compared to 55.1% for the U.S. (Headwaters Economics-Economic Profile System.) The County has placed among the top growing counties in the Country for most of the current decade—largely because of quality of life--according to the Charture Institute. Not insignificantly, the estimated effective population of the County during the summer season of 2012 was 60,282. This creates demand on service providers far in excess of the year-round population which is approximately one-third this number. Teton County ranks ninth of Wyoming's 23 counties in population. (Jackson Hole Compass, 2015)

The median age of the population in 2010 was 36.9 years. There were 8,973 households and occupied housing units. The total number of housing units in the County according to the 5-Year American Community Survey was 12,917. (http://factfinder.census.gov)

The following facts were taken from Headwaters Economics--Economic Profile System (EPS) for Teton County, Wyoming. (http://headwaterseconomics.org)

- The 2014 annual unemployment rate for Teton County was 4.8%. This is lower than the 6.2% unemployment rate for the U.S. for the same period.
- Total personal income from non-labor sources in the County in 2013 was 57.1%. It was 35.9% in the U.S. for this same period.
- Total per capita income in Teton County in 2013 was $107,514. This is more than double the total per capita income for the U.S. at $45,481.
- Average earnings per job in Teton County in 2014 were $46,380 compared to national average earnings per job of $56,600.
- In 2013, 47.5% of the total number of jobs in the County were in travel and tourism. By contrast, less than 1% of the jobs in the County were in commodity production (timber, mining and agriculture.) The majority of these jobs were in agriculture.

Development Trends

Land use change and residential and commercial development are limited by both geography and land ownership. Because such a large percentage of the County is publicly-owned--97%--residential and commercial development is precluded over most of the County. And, unlike many Wyoming counties, Teton County does not produce fossil fuels. According to previous Teton County Planner, Jeff Daugherty, development has already occurred on all of the "easy ground" for development. Research from Headwaters Economics shows the percent change in private land area development between the years 2000 and 2010 at 84.7%.

Development proposals in the County typically have a list of complex concerns related to natural hazards that could include floodplain, faults, wildland fire, steep slopes, landslides, and/or rockslides. Largely a function of the fact that Teton County has so much public forestland, only 8.8% of the land considered wildland urban interface (defined for this study as forestlands within 500 meters of public forests) have been developed. (Headwaters Economics EPS)

Jackson/Teton County Long Range Planner, Alex Norton, reported that "the ten-year averages for residential, commercial, and industrial development are remarkably consistent. There are individual peaks and valleys, but no real trends to speak of." Building permit numbers for the first quarter of 2015 for both the Town (33 permits worth $8.82 million) and County (61 permits worth $3.32 million) were up over numbers for the previous year. The Town and County had issued 22 and 46 building permits respectively in 2014 for the same period. (Billings Gazette, April 5, 2015) Norton observed that the increase is likely signaling a recovery from lower recession numbers rather than a trend.

Norton points out one continuing trend. That trend is the increasing number of employees living elsewhere, working in Jackson, and commuting. Affordable housing for workers in the Jackson area--be they firefighters, law enforcement officers, teachers, nurses, lodging and food service, or other workers is a long-standing challenge for the Town and County further exacerbated by demographics of retiring baby boomers.

Developers are required to provide soils and geotechnical information with their applications in situations where there is a full review, such as a new subdivision. State law, however, exempts 35-acre and smaller parcels from full review so the County currently lacks the full breadth of authority in these situations. New construction and development is largely occurring with proper mitigation for natural hazards where known, but this is not true for all previous development.

Some major projects within the Town and County include:

Snow King, the Town's ski hill is undergoing extensive reconstruction six-days a week, 12 hours a day during the summer of 2015. Hillsides are being graded, foundations for new buildings and lift towers are being laid, and water, sewer, and storm sewers are being installed. Following the preparatory work, a new base lodge, ski lift, ski runs, mountain coaster, and ropes course will be built. The Bridger-Teton National Forest will also be looking to construct a new access road to the top of Snow King Mountain to access communications equipment. (Jackson Hole News and Guide, April 29, 2015)

The Bridger-Teton National Forest has offered for sale a 10-acre parcel of land within the Town of Jackson. The original intent of the sale was to use the proceeds from the sale for construction of a new Forest Supervisor's Office. The parcel is the largest developable tract of land in the Town. A mixed residential development had been envisioned on the property. In late May an anticipated sale was terminated. It is likely the parcel will sell and residential development will occur on the parcel during the five-year life of this plan. There are no specific design proposals at the current time. According to the Forest Service, they will retain an adjacent 5-acre tract on the north edge of Town and proceed with construction of the new Forest Supervisor's Office--regardless of when the 10-acre parcel is sold. (Jackson Hole News and Guide, June 3, 2015)

Teton County Commissioners approved a contract to proceed with Phase 2 of the Grove Housing affordable housing project in May 2015. Phase 2 calls for the construction of 24 units with a budget of over $9 million. The third and final phase of the Grove has not been finally designed. (Jackson Hole News and Guide, April 15, 2015) Jackson Hole Mountain Resort in partnership with Terra Resorts and Four Seasons is building extensive employee housing on Powderhorn Lane.

The Town of Jackson is preparing to revise its zoning. Town councilors reviewed a conceptual version of the changes in March. Zone boundaries may be redrawn in the process. Issues of concern include densities, redevelopment, commercial opportunity, housing, and boundaries related to lodging. The new zoning, originally scheduled for adoption in late May, has been delayed due to public input and deliberation by elected officials. (Jackson Hole News and Guide, May 6, 2015)

Smaller-scale residential and commercial projects—not detailed here--are being proposed continuously within the incorporated limits of Jackson. However, according to the Charture Institute's Executive Director, Jonathan Schechter, "we're running up against physical growth limits because we're running out of land on which to build." (Jackson Hole News and Guide, June 24, 2015)

The 990-acre historic Gros Ventre River Ranch located 27 air miles east of Jackson was recently gifted to the Trust for Public Land by owner and former Senator Herb Kohl. The ranch is the largest private inholding in the Gros Ventre River Valley. Following an inventory of the property it will pass to the Bridger-Teton National Forest. (Jackson Hole News and Guide, January 14, 2015) As a result, the property will not experience residential development in the future.

A pathway that will connect Jackson and Wilson via the newly-constructed Snake River Bridge is currently under construction. The County commissioners decided in May to move forward with plans to build a pathway tunnel beneath Highway 22 east of the Skyline Ranch subdivision. The existing tunnel called the "cattle tunnel" passes beneath Highway 22. "Engineers say it is falling apart and is unsuitable for long-term use." (Jackson Hole News and Guide, May 6, 2015)

The Wyoming Department of Transportation (WYDOT) has designed a highway improvement project for Highway 89 south of Jackson between Hoback Junction and South Park. The plans--approved in 2011--call for building 6.1 miles of five-lane, .5 miles of four-lane, and .6 miles of three-lane highway on this segment of Highway 89. There will also be a pathway and wildlife crossings. Local and state elected officials have asked WYDOT to scale back this project to three lanes. At the time of this writing, WYDOT had

recently informed Town and County officials they will either build the project as designed or not build the project at all. WYDOT cites traffic growth and safety concerns as the reason for the current design. Work on the highway project will commence in 2017 if it goes forward. (Jackson Hole News and Guide, June 24, 2015)

Town and County elected officials are considering adoption of a transportation plan. The primary goal of the plan would be to reduce single occupancy vehicles and increase alternative modes of transportation. One of the proposals in the plan would be to expand Highway 22 and add a connector road, named Tribal Trails. This project would provide a backup route in the event the Y at the intersection of Highways 22 and 89 became impassable. WYDOT reports that the intersection is already at capacity. (Jackson Hole News and Guide, July 6, 2015)

The comprehensive land use plan for the Town and County was adopted in 2013 after a lengthy process. During that process, planners developed maps depicting future land use. The land use plan projects a substantial amount of new construction along the high school road south of Town over the next five years. From five to 15 years out, additional lot development with a higher density of mixed uses is anticipated in South Park--also south of Town. Flat Creek flows through these areas. And, in South Park, the creek is controlled by non-certified levees.

Chapter 2. Hazards Identification and Risk Analysis

In collaboration with the Local Emergency Planning Committee, Teton County Emergency Management identified 20 potential hazards that could affect Teton County. Of these, 13 are considered to be significant and potentially life threatening. The local advisory committee asked that terrorism be added as a potential hazard during the 2008-09 revision and update of the plan.

Assessed Hazards
Dam Failure
Drought
Earthquake
Flood / Flash Flood
Hail
Hazardous Materials
Landslide
Lightning
Snow Avalanche
Terrorism
Tornado
Wildland Fire
Winter Storms / Blizzards
Considered Hazards
Expansive Soils
Land Subsidence
Liquefaction
Urban Fire
Windstorms
Windblown Deposits
Volcanism/Eruption

Thirteen hazards are assessed in the following sections. Those hazards that were considered but weren't included in the following sections were not assessed because they either were not likely to occur in the next hundred years, or did not have a historical record of impact on property or life safety. More information on those hazards is available in the Wyoming State Hazard Mitigation Plan.

Teton County is significantly vulnerable to an eruption of the Yellowstone Caldera due to its proximity to Yellowstone National Park. A large-scale eruption would have catastrophic global impacts. Because of the overly long expected occurrence of frequency (greater than 10,000 years) for explosive volcanism at Yellowstone, and the fact that a good response or mitigation plan is not possible for an event of this magnitude, it was not analyzed in this document.

Hazards Risk Analysis

Based on the histories and potential future occurrences of hazards that may cause significant impacts in Teton County, the following hazards are addressed in more detail in the hazard-specific chapters of this plan: dam failures, droughts, earthquakes, floods, hail, hazardous materials, landslides, lightning, snow avalanche, terrorism, tornadoes, wildland fire, and winter storms/blizzards.

At the end of each hazard-specific chapter is a summary of the risk to people and property for each hazard, as well as the probability of the hazard occurring. The Teton County Emergency Management Agency, along with the Teton County Local Emergency Planning Committee, generated a ranking of hazards to determine the most significant potential threats posed by natural and man-made hazards. The attached hazard analysis is based on a high, medium and low level of risk, as defined below, based on past history and the potential for future occurrence.

High: This ranking carries the highest threat. The potential of this hazard occurring in the assessment area is considered a matter of “when” it will occur, as opposed to “if” it will occur. The potential for damage is widespread. Hazards in this category may have already occurred in the past.

Medium: This ranking carries a moderate threat level to the general population. The potential of occurrence may be the same as the “high” ranking but the potential damage is more isolated and less costly than a more widespread disaster.

Low: The lowest ranking in the survey, the occurrence and potential cost of damage to life and property is minimal.

Jurisdiction(s) Affected: This indicates how widespread the hazard is within the county, and where the risk varies across the planning area.

Hazard Consequence Ranking

The hazards were given a cumulative weighted score based on severity and probability, and then were ranked as high, medium or low.

Table 2.1 – Hazard Consequences

Hazard	Severity	Probability	Cumulative	Ranking
Dam Failure	4	1	2.5	Medium
Drought	4	3	3.5	High
Earthquake	4	1	2.5	Medium
Expansive Soils	1	1	1	Low
Flood/flash flood	3	2	2.5	Medium
Hail	1	4	2.5	Medium
Hazardous Materials	3	2	2.5	Medium
Landslide/Avalanche	3	4	3.5	High
Land Subsidence	2	1	1.5	Low
Lightning	3	4	3.5	High
Liquefaction	4	1	2.5	Medium
Snow Avalanche	3	4	3.5	High
Terrorism	4	1	2.5	Medium
Tornado	4	1	2.5	Medium
Urban Fire	3	2	2.5	Medium
Windstorm	2	1	1.5	Low
Windblown deposit	0	1	0.5	Low
Wildland Fire	4	3	3.5	High
Winter Storms/Blizzards	3	4	3.5	High
Volcanism/Eruption	4	0	2	Medium

Severity
4 = Resulting in multiple deaths and/or extensive property damage
3 = Resulting in isolated deaths and/or isolated property damage
2 = Resulting in frequent injuries and/or limited property damage
1 = Resulting in infrequent injuries and/or property damage
0 = Resulting in no reported injuries on an annual or seasonal basis

Probability
4 = Frequent; likely to occur on an annual or seasonal basis
3 = Probable; likely to occur several times in an average lifetime
2 = Occasional; likely to occur at some point in an average lifetime
1 = Remote; unlikely, but possible once in an average lifetime
0 = Improbable; so unlikely that it can be assumed it will not occur

Cumulative Ranking: Greater than 3 = High, 2-3 = Medium, Less than 2 = Low

Chapter 3. Dam Failures

Dams and reservoirs serve a very important role for Wyoming residents and industry. Rarely, however, the dams fail, either completely or partially, and become a significant hazard for those downstream.

Dam failures can be classified into four classifications: overtopping, foundation failure, structural failure, and other unforeseen failures. Overtopping of a dam is often a precursor of dam failure. National statistics show that overtopping due to inadequate spillway design, debris blockage of spillways, or settlement of the dam crest account for approximately 34% of all U.S. dam failures. Earthen dams and older dams are more susceptible to overtopping failure. Foundation defects, including deformation, settlement, and slope instability, cause about 30% of all dam failures. Another 20% of U.S. dam failures have been caused by piping (internal erosion caused by seepage). Seepage often occurs around hydraulic structures, such as pipes and spillways; through animal burrows; around roots of woody vegetation; and through cracks in dams, dam appurtenances, and dam foundations. Other causes of dam failures include structural failure of the materials used in dam construction, sabotage, earthquakes, and inadequate maintenance.
(Source: http://www.damsafety.org)

In 1981, the U.S. Army Corps of Engineers completed an inspection program for nonfederal dams under the National Dam Inspection Act (P.L. 92-367). This was a four-year work effort and included compiling an inventory of about 50,000 dams and conducting a review of each state's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of dams. Part of the inspection included evaluating the dams and assigning a hazard potential based on the effects downstream should one of the dams fail. This classification is based on the consequences if a dam were to fail, not on the potential of failure, or the existing condition of the dam. The dams were rated (1) high, (2) significant, and (3) low hazard. The Corps of Engineers based the hazard potential designation on such items as acre-feet capacity of the dam, distance from nearest community downstream, population density of the community, and age of the dam. Dams assigned the low hazard potential classification are those where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property. Dams assigned the significant hazard potential classification are those dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure. Dams assigned the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life. *(Source: https://www.fema.gov/media-library/assets/documents/3909)*

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

There were 1,458 dams in Wyoming that were reviewed by the Corps of Engineers. There are currently 1,639 dams in Wyoming shown in the Corps of Engineers' National Inventory of Dams. (http://nid.usace.army.mil)

Teton County has 10 dams that are inspected by the Wyoming State Engineer's Office. Of the 10, two are considered high hazard, the rest are low hazard dams.
The high hazard dams are Jackson Lake (including Jackson Lake North and South Dikes) and Grassy Lake dams. The primary purpose of Jackson Lake is flood control, while the primary purpose of Grassy Lake is irrigation storage.

The high hazard dams are owned by the U.S. Bureau of Reclamation (USBR). Jackson Lake and the dikes are operated by USBR while Grassy Lake is operated by irrigators. USBR has Emergency Action Plans (EAP) for all of their high hazard dams. The most recent update to the Jackson Lake EAP is dated August 27, 2014. Teton County participates in the tabletop exercises for Jackson Lake, (coordinated by Megan McKay, USBR, emergency coordinator for this area). The Jackson Lake and Grassy Lake EAPs are on file with the USBR (Snake River Area office), Teton County Emergency Management, Teton County Sheriff's Office Dispatch and Teton Interagency Dispatch. (Rich Ochs, Teton County Emergency Management) Table 3.1 shows a summary of the dams located in Teton County.

Table 3.1 - High, Significant and Low Hazard Dams in Teton County

Name	Owner	River	Hazard Class	Nearest Down stream City	Distance to Nearest Downstream City (miles)	EAP *
Grassy Lake	USBR	Grassy Creek	H	St. Anthony, ID	53	Y
Jackson Lake	USBR	North Fork Snake River	H	Moose Unincorporated Community	23	Y
Bergman Lake	Ronald Bergman	Indian Creek	L	St. Anthony, ID	35	NR
Flat Creek Ranch	Homestead Company, LLC	Flat Creek	L	Jackson	14	NR
Indian Lake	Ronald Bergman	Indian Lake Basin	L	St. Anthony, ID	36	NR
Jackson Wastewater Treatment Plant	Town of Jackson	Snake River Off Stream	L	-	-	NR
Leidy Lake	Wyoming Game and Fish Department	Leidy Creek	L	Moose Unincorporated Community	42	NR
Porter	Porter Trust	Wallace Creek	L	Moose Unincorporated Community	22	NR
Tracy Lake	ANK Corporation	Randolph Creek	L	Moose Unincorporated Community	24	NR
Uhl Dam at Elk Ranch	Grand Teton Nat'l Park	Spread Creek	L	Moose Unincorporated Community	17	NR

* = EAP (Emergency Action Plan), NR (Not Required)

History

Teton County has one documented dam failure-type incident related to a landslide dam that resulted in the infamous Kelly Flood. On June 23, 1925, part of the northern face of Sheep Mountain became unstable after weeks of heavy rain and slid into the Gros Ventre River. The 50 million cubic yards of sedimentary rock formed a natural dam 200 feet high and 400 yards wide that created Lower Slide Lake. On May 18th, 1927, a portion of the natural dam broke during a spring with heavy runoff causing a flash flood to rush down the Gros Ventre River. The flood was at least 6 feet deep for at least 25 miles downstream, and wiped out the town of Kelly 6 miles downstream. Six people died, and many others lost everything they owned.

Fifteen miles downstream in Wilson 6 feet of water inundated the town and hundreds of farm animals died. There was heavy livestock loss, ranger buildings were destroyed, irrigation head gates were washed away, and a bridge was washed out ($75,000 to $150,000 damage). The American Red Cross had expenditures of $12,201. In narrower sections of the Snake River near Hoback, flood waters rose as much as 50 feet. The next day the waters reached Idaho Falls, Idaho and covered lowland sections there.

The American Red Cross, Wyoming State Government, Wyoming Governor Emerson, and the Highway Department responded. "When all was said and done, damages totaled $500,000. You can still see the bald rock on the north face of Sheep Mountain (Sleeping Indian) as a reminder of this tragic event." [http://www.tetonwyo.org/em/topics/flash-flood/201706 Accessed 4/28/15]

The LEPC also noted that a landslide dam was created on Crystal Creek by the Crystal Peak landslide in 2008 in an area that has seen recurring landslides in the Bridger-Teton National Forest.

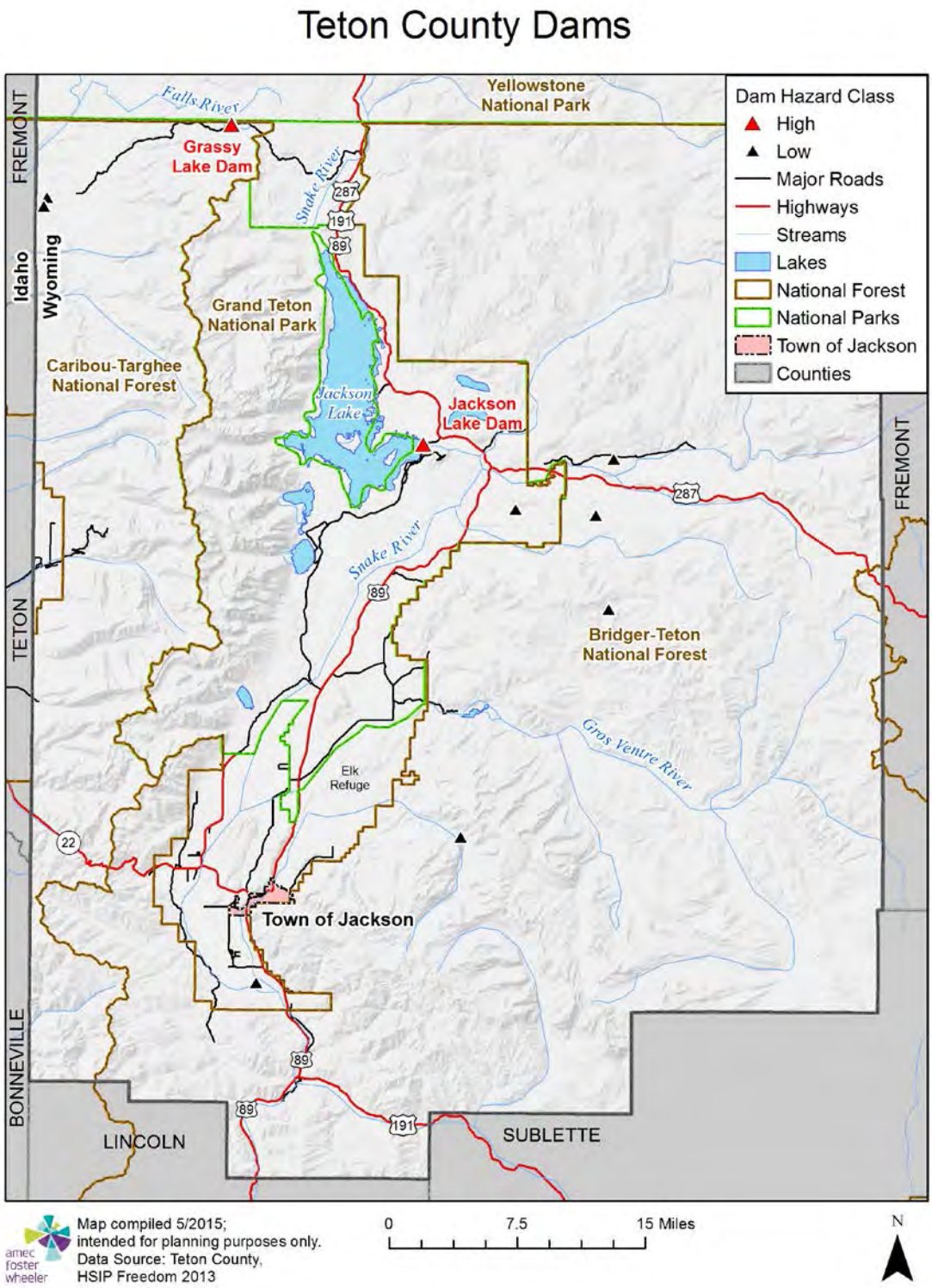


Figure 3.1 - Dams Located in Teton County

Impacts

The impact from Kelly flood incident in Teton County was significant, equivalent to $6.7 million in 2015 dollars. Lives lost in 1927 were partly due to attempts to save belongings or not heeding warnings.

An exposure analysis for the Jackson Lake Dam inundation indicates over $2.5 billion in property is exposed, mainly private property in unincorporated Teton County.

Table 3.2 – Dam Inundation Exposure

Jurisdiction (Unincorporated County)	Property Type	Property Count	Improved Value	Content Value	Total Value
Bridger-Teton National Forest	Agricultural	1	$219,767	$219,767	$439,534
	Commercial	4	$13,142,565	$13,142,565	$26,285,130
	Residential	25	$6,747,298	$3,373,649	$10,120,947
	Total	**30**	**$20,109,630**	**$16,735,981**	**$36,845,611**
Grand Teton National Park	Residential	6	$2,680,695	$1,340,348	$4,021,043
	Total	**6**	**$2,680,695**	**$1,340,348**	**$4,021,043**
Private	Agricultural	32	$11,988,077	$11,988,077	$23,976,154
	Commercial	74	$33,166,981	$33,166,981	$66,333,962
	Exempt	1	$445,616	$445,616	$891,232
	Residential	1,839	$1,625,674,625	$812,837,313	$2,438,511,938
	Total	**1,946**	**$1,671,275,299**	**$858,437,987**	**$2,529,713,286**
	Grand Total	**1,982**	**$1,694,065,624**	**$876,514,315**	**$2,570,579,939**

Future Impacts

With two high hazard dams in the county there is a possibility of dam failure in the future, with the potential for $2.5 billion or more in flood damages and probable loss of life. Development or future development along the Snake River could be at risk to dam failure flooding.

Summary:

PROPERTY AFFECTED: High
POPULATION AFFECTED: Medium
PROBABILITY: Low
JURISDICTION AFFECTED: Portions of unincorporated county, including the community of Wilson

Chapter 4. Drought

Of all the natural weather-related disasters, drought is by far the most costly to our society. It indirectly kills more people and animals than the combined effects of hurricanes, floods, tornadoes, blizzards, and wildfires. And, unlike other disasters that quickly come and go, drought's long-term unrelenting destruction has been responsible in the past for mass migrations and lost civilizations. The 1980 and 1988 droughts in the US resulted in approximately 17,500 heat-related deaths and an economic cost of over $100 billion. Drought occurs in four stages and is defined as a function of its magnitude (dryness), duration, and regional extent. Severity, the most commonly used term for measuring drought, is a combination of magnitude and duration.

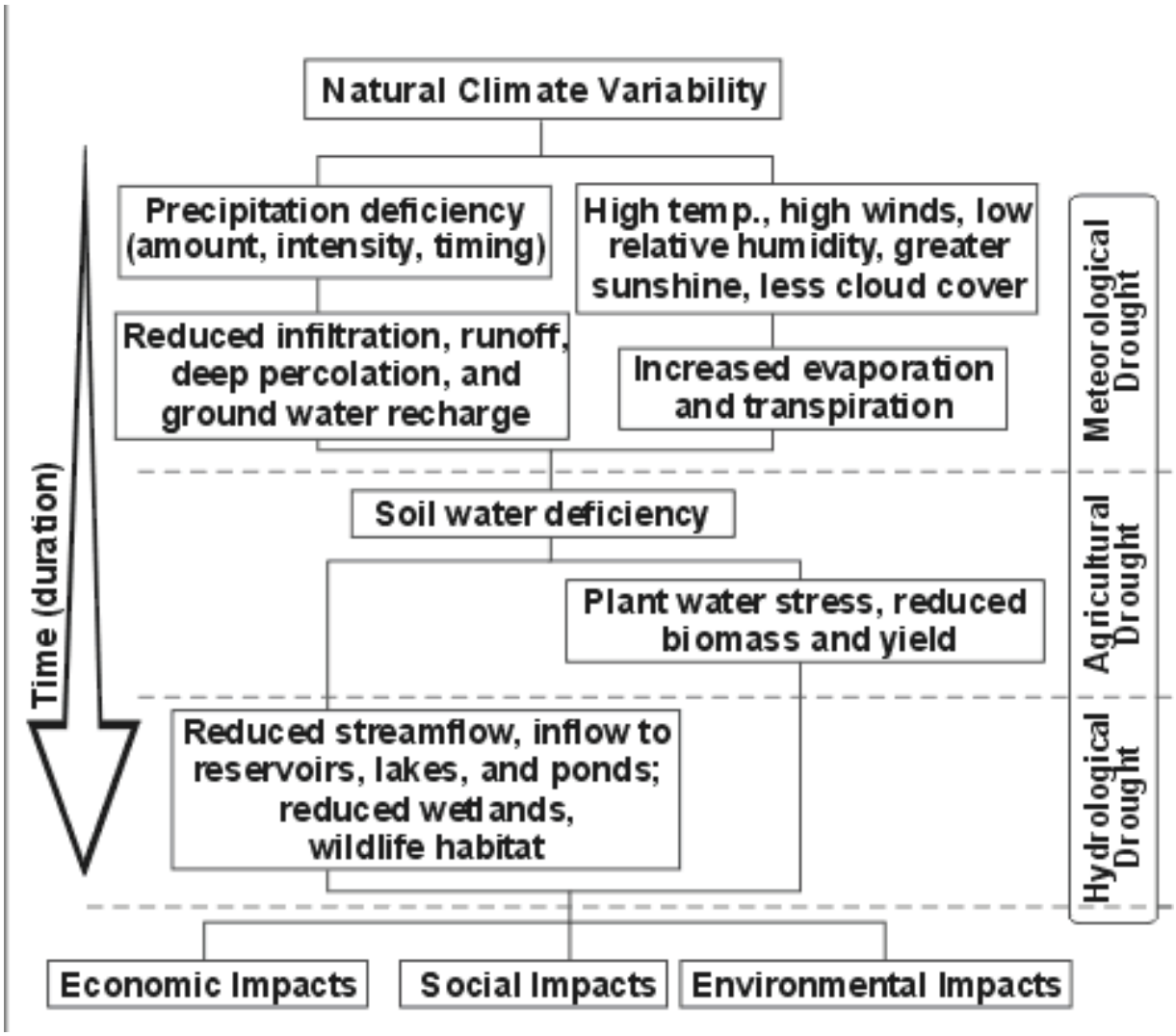


Figure 4.1– Drought Types and Impacts

The first stage of drought is known as a meteorological drought which results from precipitation shortfalls over a period of time, typically at least three months or longer. In

the mountain west much of the water supply comes from snowpack, so shortfalls in winter precipitation and low snowpack can be one of the first indicators of drought. The second stage is known as agricultural drought. Soil moisture is deficient to the point where plants are stressed and biomass (yield) is reduced. The third stage is the hydrological drought. Reduced stream flow (inflow) to reservoirs and lakes is the most obvious sign that a serious drought is in progress. The fourth stage is the socioeconomic drought. This final stage refers to the situation that occurs when physical water shortage begins to affect people.

As these stages evolve over time, the impacts to the economy, society, and environment converge into an emergency situation. Without reservoir water to irrigate farms, food supplies are in jeopardy. Without spring rains for the prairie grasslands, open range grazing is compromised. Without groundwater for municipalities, the hardships to communities result in increases in mental and physical stress as well as conflicts over the use of whatever limited water is available. Without water, wetlands disappear. The quality of any remaining water decreases due to its higher salinity concentration. There is also an increased risk of fires, and air quality degrades as a result of increased soil erosion in strong winds (blowing dust).

The U.S. Drought Monitor provides a general summary of current drought conditions.
The U.S. Department of Agriculture (USDA), the National Oceanic and Atmospheric Administration (NOAA), and the National Drought Mitigation Center (University of Nebraska-Lincoln) collaborate on this weekly product, which is released each Thursday. Multiple drought indicators, including various indices, outlooks, field reports, and news accounts are reviewed and synthesized. In addition, numerous experts from other agencies and offices across the country are consulted. The result is the consensus assessment presented on the USDM map. The image is color-coded for four levels of drought intensity. An additional category, “Abnormally Dry,” is used to show areas that might be moving into a drought, as well as those that have recently come out of one. The dominant type of drought is also indicated (i.e. agricultural and/or hydrological).
Source: http://droughtmonitor.unl.edu/

As of May 5, 2015, more than half of Teton County is designated in the Abnormally Dry category, as shown in Figure 4.2.

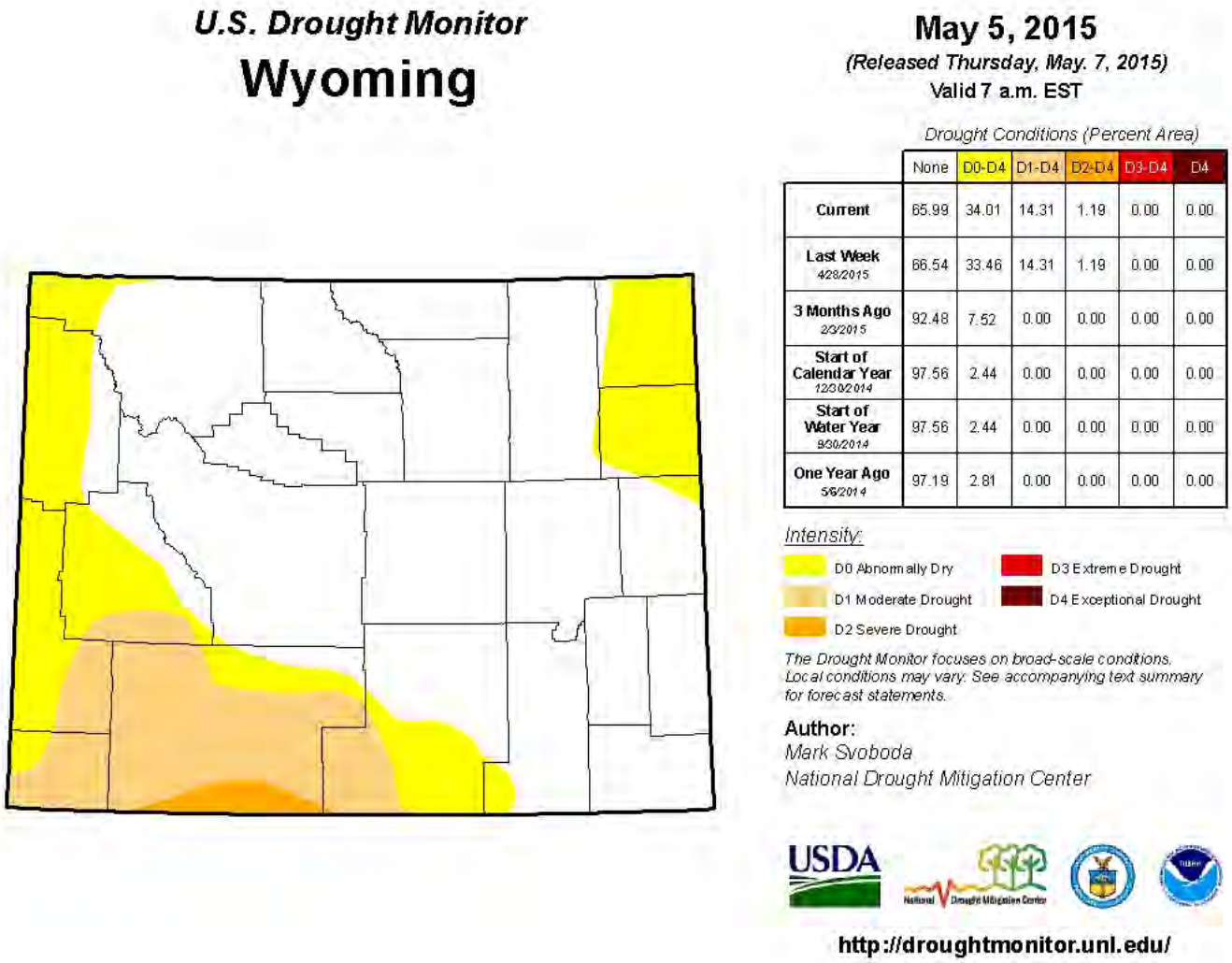
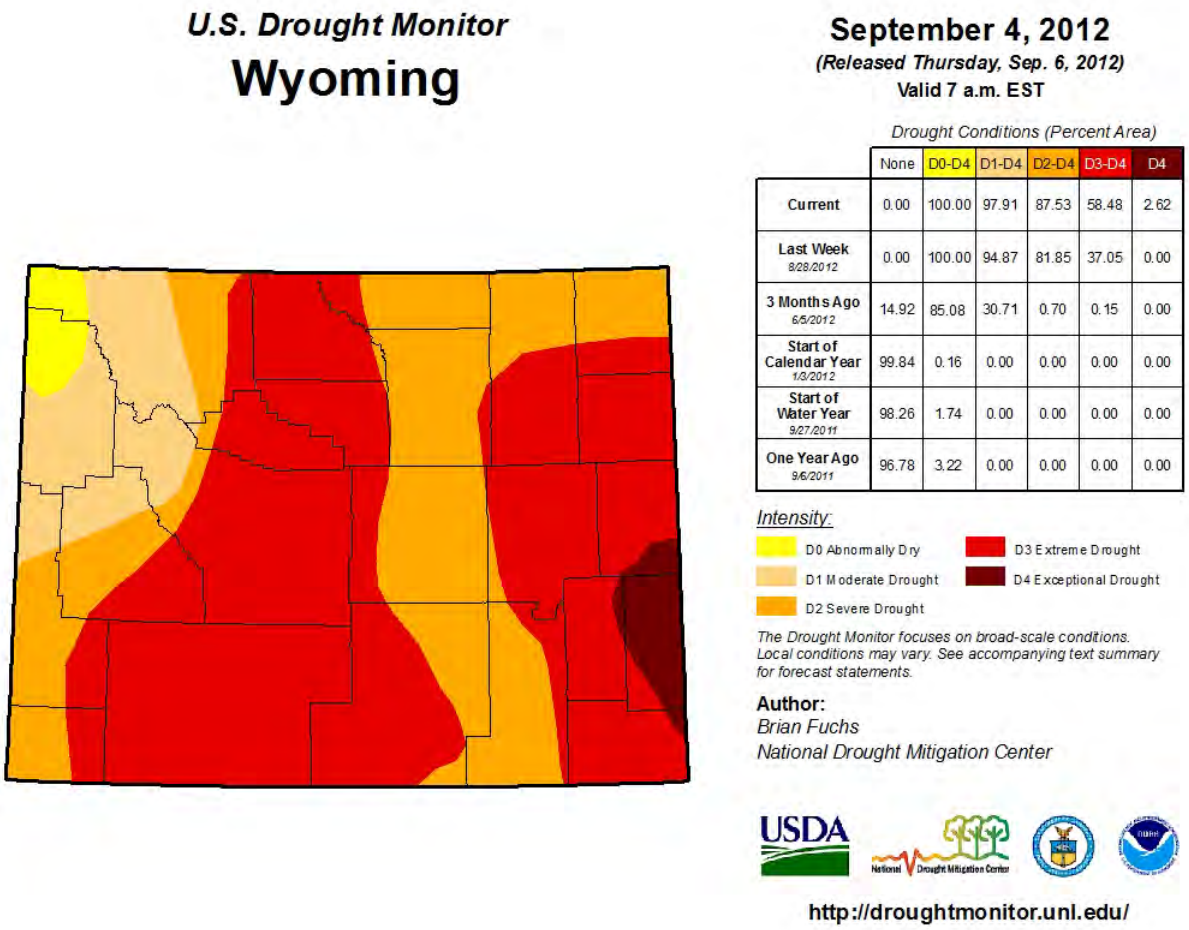


Figure 4.2 – Drought Conditions Teton County as of May 5, 2015

In comparison, Figure 4.3 shows drought conditions in the county during the peak of the 2012 drought.



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	97.91	87.53	58.48	2.62
Last Week 8/28/2012	0.00	100.00	94.87	81.85	37.05	0.00
3 Months Ago 6/5/2012	14.92	85.08	30.71	0.70	0.15	0.00
Start of Calendar Year 1/3/2012	99.84	0.16	0.00	0.00	0.00	0.00
Start of Water Year 9/27/2011	98.26	1.74	0.00	0.00	0.00	0.00
One Year Ago 9/6/2011	96.78	3.22	0.00	0.00	0.00	0.00

Figure 4.3 – Drought Conditions Teton County, September 4, 2012

History

Long periods of sustained dryness are part of Wyoming's climate. According to the Wyoming State Climate Office, Water Resources Data System, Wyoming is the 5th driest state in the Union, and drought is a constant threat. The most recent statewide drought started in 2012 and ended in the beginning of 2014. Prior to this drought, the multi-year drought beginning in 1999 and ending in 2009 is considered by many to be the most severe in collective memory. However, some old timers have indicated that they remember streams drying up in the 1930s and 1950s. According to instrument records, since 1895 there have been only seven multi-year (three years or longer) statewide droughts. Based on deficit precipitation totals (negative departures from the long term average), they are ranked statewide. Refer to Table 4.1 on the following page.

Table 4.1 - Wyoming's Recent Worst Multi-Year, Statewide Droughts

Drought Period	Average Annual Precipitation (Inches)	Percent of 1895-2006 Average Annual Precipitation (13.04")
1952-1956	10.65	81.69%
1900-1903	10.76	82.52%
1999-2004	11.07	84.89%
1987-1990	11.12	85.28%
1958-1964	11.67	89.49%
1974-1977	11.77	90.26%
1931-1936	11.79	90.41%

Widespread droughts in Wyoming, as determined from stream flow records, were most notable during three periods: 1929-1942, 1948-1962, and 1976-1982. Teton County–specific data are not available at this time.

Instrumentation Record

As a whole, Wyoming's precipitation record from 1895-2012 reveals that, for the first half of the 20th century (except for the Dust Bowl years of the 1930s), there was generally a surplus of moisture. During the second half of the century there was an increasing trend of increased periods of drought (Figure 4.4).

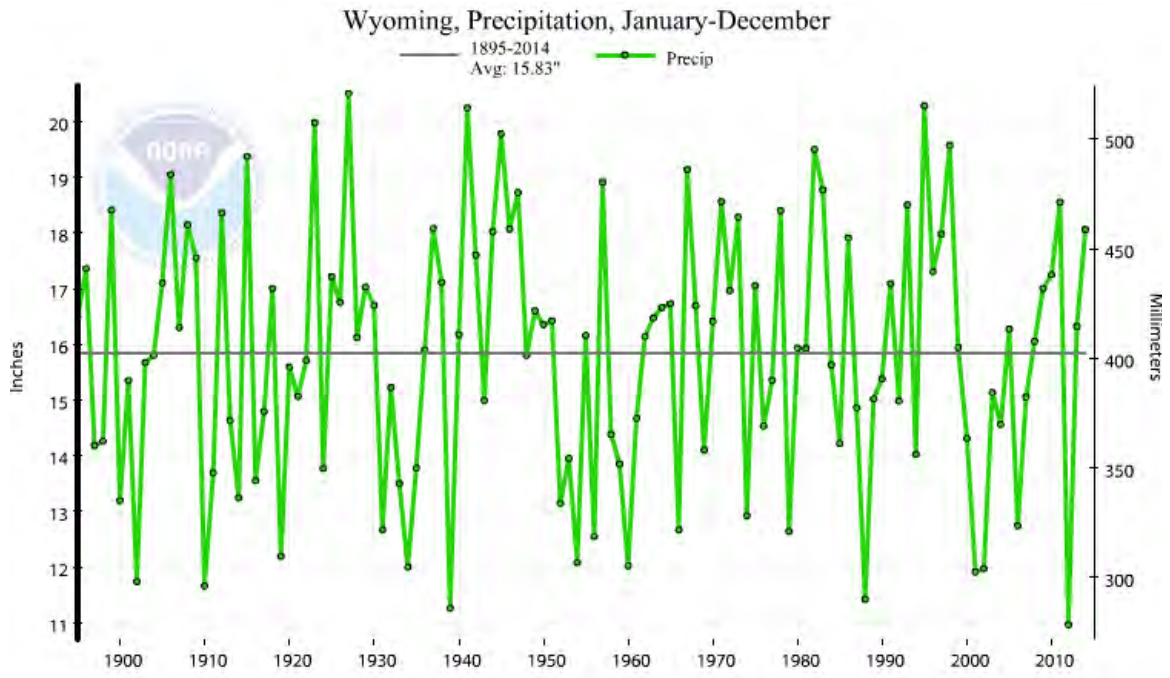


Figure 4.4 - Wyoming Annual Precipitation 1895-2012

Figure 4.5 illustrates the Historical Calendar Year Precipitation for the Snake River drainage basin from 1895 to 2013. While there have been some above average years of precipitation from 2008 through 2011, below average rainfall returned in 2012 and 2013, resulting in the 5-year running average to fall.

While a U.S. Department of Agriculture (USDA) drought disaster declaration occurred in 2012 for most Wyoming counties, it did not initially include Teton County. The County later qualified for assistance because it was contiguous to a primary county.

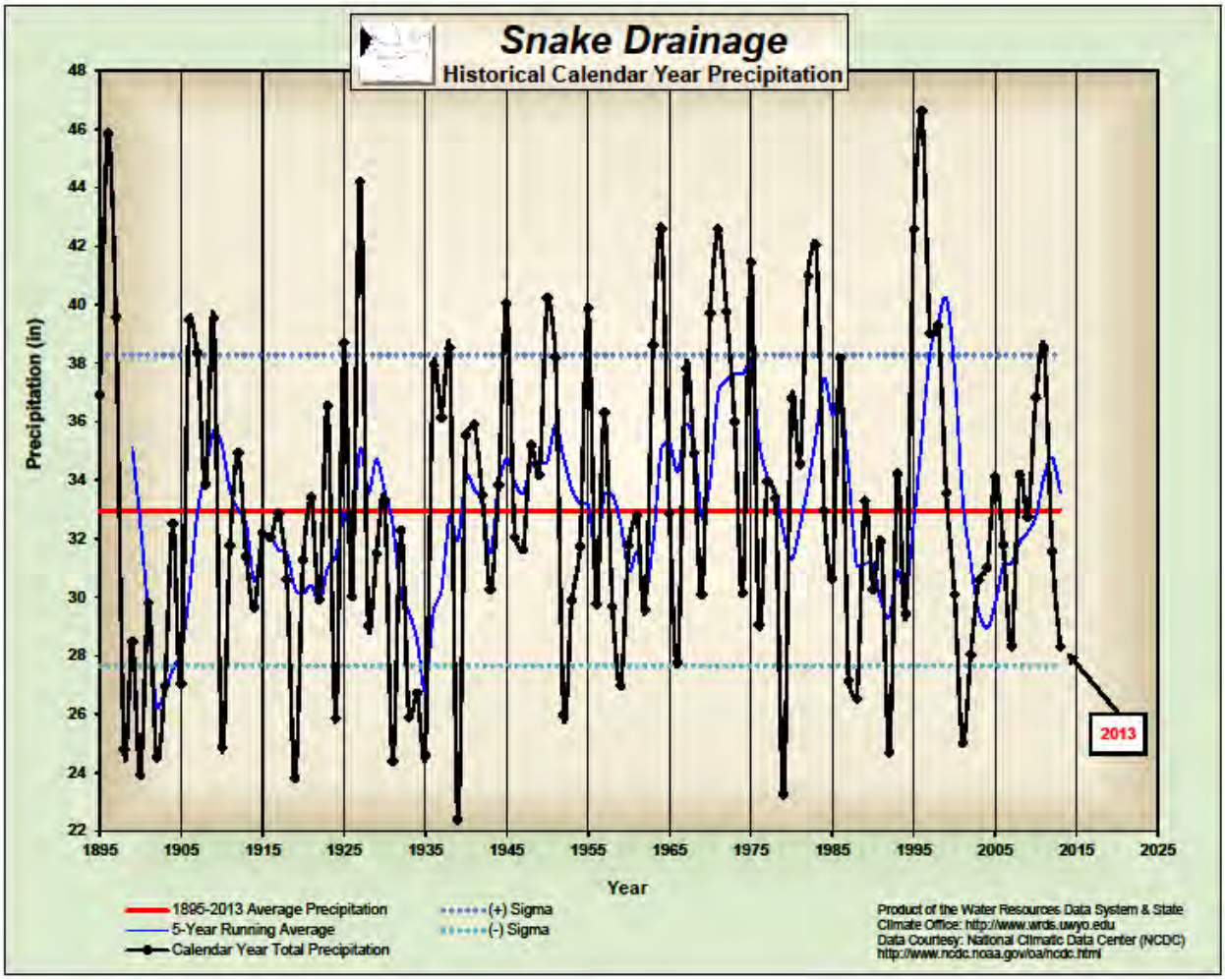


Figure 4.5 - Historical Calendar Year Precipitation 1895-2013 Snake River Drainage

Figure 4.6 shows the percent area of Wyoming falling into one of five U.S. drought monitor categories. This figure shows that at the peak of the 2012 drought a little over 10% of Wyoming fell in the "D4 – Exceptional" drought category, and 100% of Wyoming experienced at least "D0 – Abnormally Dry" conditions. The U.S. Drought Monitor data are not aggregated by county, so it is not possible to repeat this analysis for Teton County specifically.

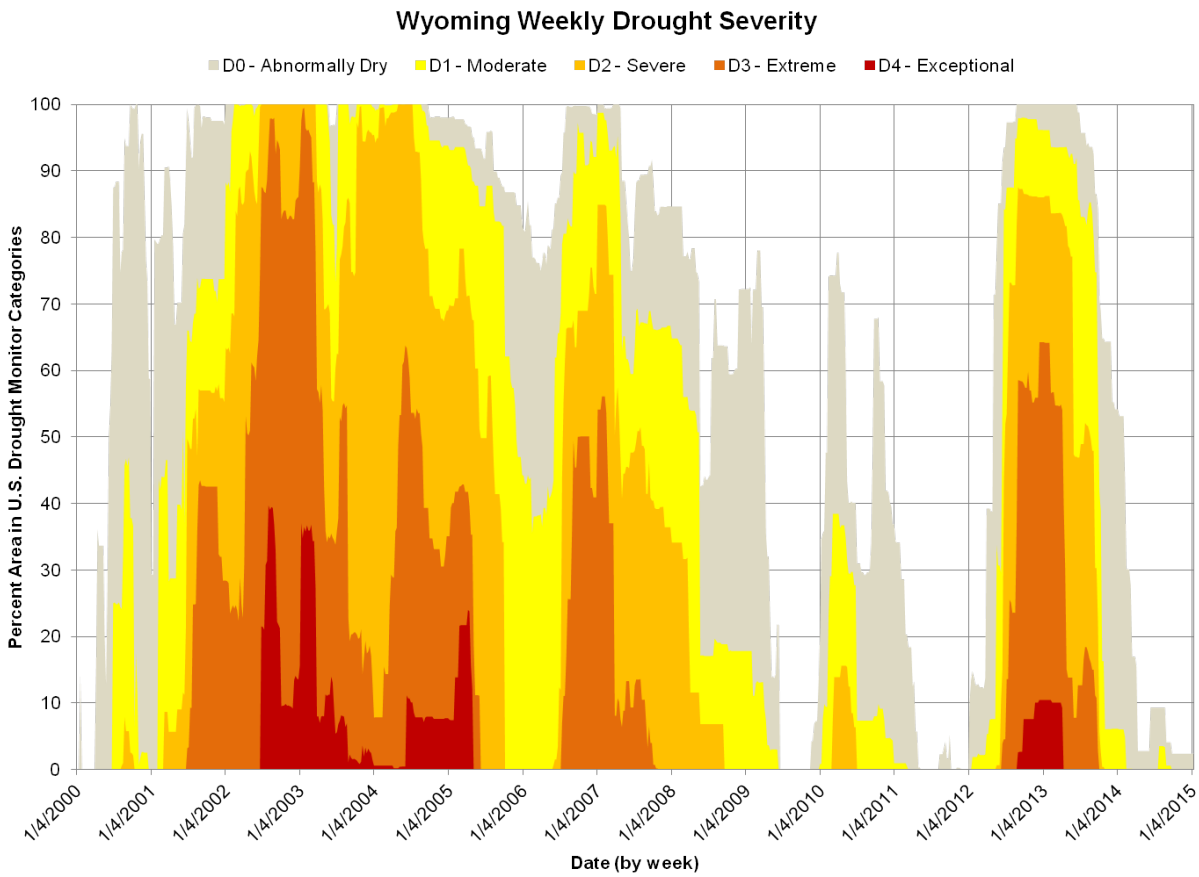


Figure 4.6 - Wyoming Weekly Drought Severity (2000-2015)[1]

Source: United States Drought Monitor, http://droughtmonitor.unl.edu/MapsAndData/DataTables.aspx

Impacts

Based upon Figures 4.4 and 4.6, the drought of 1999-2004 is as significant, if not more significant than any other droughts in the last 100 years for the entire state. The Jackson Hole News and Guide reported in August of 2007, that warm water temperatures caused by drought were affecting fish and causing mortality. The data have not been analyzed for Teton County. Data from the Wyoming Climate Atlas, indicates that the most significant droughts in the last century, in terms of precipitation deficit, were in 1952-1956 and 1999-2003.

Table 4.2 - Peak Commodity Production Changes
From Pre-Drought (1994-1998) to Drought (1999-2003) Statewide

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	Lowest Production During Drought (1999-2003)	Year of Lowest Production	Percent Change
Alfalfa Hay	1581	1,000 tons	1150	2002	-27%
Other Hay	817	1,000 tons	450	2002	-45%
Cattle/ Calves Inventory	1552	1,000 head	1320	2002	-15%

Drought impacts to the Wyoming agricultural community were greater in the 1999-2003 drought than in the 1952-1956 drought. With the exception of dry beans, all commodities in the worst years of the 1999-2002 drought showed a greater percentage decline in production than in the 1952-1956 drought. As a result, the 1999-2003 drought will be used as the drought of historic record to calculate dollar impacts.

Dollar Impacts

Dollar impacts of drought are derived from The US Department of Agriculture's National Agricultural Statistics Service (NASS) Quick Stats. Data is provided at the county level for production and the state level for value.
(http://www.nass.usda.gov/Quick_Stats/index.php)

Drought impacts to agriculture in Teton County would be found primarily in hay and livestock production. The data below represent changes in production value for crops and changes in inventory value for cattle and calves. The data should be considered impact value versus loss value. For example, with cattle and calves (Tables 4.3 through 4.8) the inventory has decreased during the drought. Therefore the value of inventory on hand has decreased. The inventory decreased, however, because of the sale of the cattle and calves. The sales resulted in an increase in cash receipts to the farming and ranching community. The net result, however, is a decrease in inventory value, which is a negative drought impact.

Table 4.3 - 1999 Production and Inventory Value Impact Teton County

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	1999 Production	Value (USD)	Production and Inventory Value Impact (USD)
Alfalfa Hay	17.6	1,000 tons	16.4	67.00/ton	-80,400
Other Hay	15.2	1,000 tons	25.1	60.00/ton	+ 590,000
Cattle/Calves Inventory	12	1,000 head	11	770.00/head	-770,000
TOTAL					**-$260,400**

Table 4.4 - 2000 Production and Inventory Value Impact Teton County

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2000 Production	Value (USD)	Production and Inventory Value Impact (USD)
Alfalfa Hay	17.6	1,000 tons	17.4	85.00/ton	- 17,000
Other Hay	15.2	1,000 tons	11.4	80.00/ton	- 304,000
Cattle/Calves Inventory	12	1,000 head	10	780.00/head	-1,560,000
TOTAL					**- $1,881,000**

Table 4.5 - 2001 Production and Inventory Value Impact Teton County

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2001 Production	Value (USD)	Production and Inventory Value Impact (USD)
Alfalfa Hay	17.6	1,000 tons	13	110.00/ton	- 506,000
Other Hay	15.2	1,000 tons	10.5	105.00/ton	- 493,500
Cattle/Calves Inventory	12	1,000 head	10	780.00/head	- 1,560,000
TOTAL					**- $2,559,500**

Table 4.6 - 2002 Production and Inventory Value Impact Teton County

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2002 Production	Value	Production and Inventory Value Impact
Alfalfa Hay	17.6	1,000 tons	10	$111.00/ton	- 843,600
Other Hay	15.2	1,000 tons	13.5	$106.00/ton	- 180,200
Cattle/Calves Inventory	12	1,000 head	9	$760.00/head	- 2,280,000
TOTAL					**- $3,303,800**

Table 4.7 - 2003 Production and Inventory Value Impact Teton County

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2003 Production	Value (USD)	Production and Inventory Value Impact
Alfalfa Hay	17.6	1,000 tons	20.5	80.00/ton	- 232,000
Other Hay	15.2	1,000 tons	11.5	73.00/ton	- 270,100
Cattle/Calves Inventory	12	1,000 head	5	890.00/head	- 6,230,000
TOTAL					**- $6,732,100**

Table 4.8 - Production and Inventory Value Impact for Worst Year of Drought Teton County

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	Worst Yearly Production Of Drought	Year	Value (USD)	Production and Inventory Value Impact (USD)
Alfalfa Hay	17.6	1,000 tons	10	2002	111.00/ton	- 843,600
Other Hay	15.2	1,000 tons	10.5	2001	105.00/ton	- 493,500
Cattle/Calves Inventory	12	1,000 head	5	2003	890.00/head	- 6,230,000
TOTAL						**- $7,567,100**

While a multi-year drought as severe as the 1999-2003 period has not occurred since then, a particularly dry year in 2012 resulted in one year production values lower than any single year of the 1999-2003 period. Table 4.9 shows the impact on the county.

Table 4.9 - 2012 Production and Inventory Value Impact Teton County

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	2012 Production	Value (USD)	Production and Inventory Value Impact
Alfalfa Hay	17.6	1,000 tons	6	210.00/ton	- 2,436,000
Other Hay	15.2	1,000 tons	9.7	193.00/ton	- 1,061,500
Cattle/Calves Inventory	12	1,000 head	3	1,340.00/head	- 13,400,000
TOTAL					**- $16,897,500**

Future Potential Impacts

The 1999-2003 drought can be shown to be the drought of historic record. There have been significant impacts on the agricultural industry from this drought. The worst-case year of the multi-year drought was 2002, with a negative dollar impact of $6,732,100 countywide. The drought impact in Teton County for the years 1999-2003, was over $14.7 million. Single year droughts can also have a large impact on the County as shown in 2012 with an estimated impact of almost $16.9 million.

This estimation does not take into account economic losses to the tourism industry upon which Teton County's economy is largely based. Drought could have significant impacts to the skiing, rafting, fishing and hunting industries within the county. Wildfire concerns may lead to fire bans and public land area closures, with an additional resulting loss in tourism and recreation revenue.

Summary

PROPERTY AFFECTED: High
POPULATION AFFECTED: High
PROBABILITY: High
JURISDICTION AFFECTED: All

Chapter 5. Earthquakes

An earthquake is generally defined as a sudden motion or trembling in the Earth caused by the abrupt release of slowly accumulated strain. The most common types of earthquakes are caused by movements along faults and by volcanic forces, although they can also result from explosions, cavern collapse, and other minor causes not related to slowly accumulated strains.

Historically, earthquakes have occurred in every county in Wyoming (Figure 5.1). The first was reported in Yellowstone National Park in 1871. Yellowstone National Park is one of the more seismically active areas in the United States.

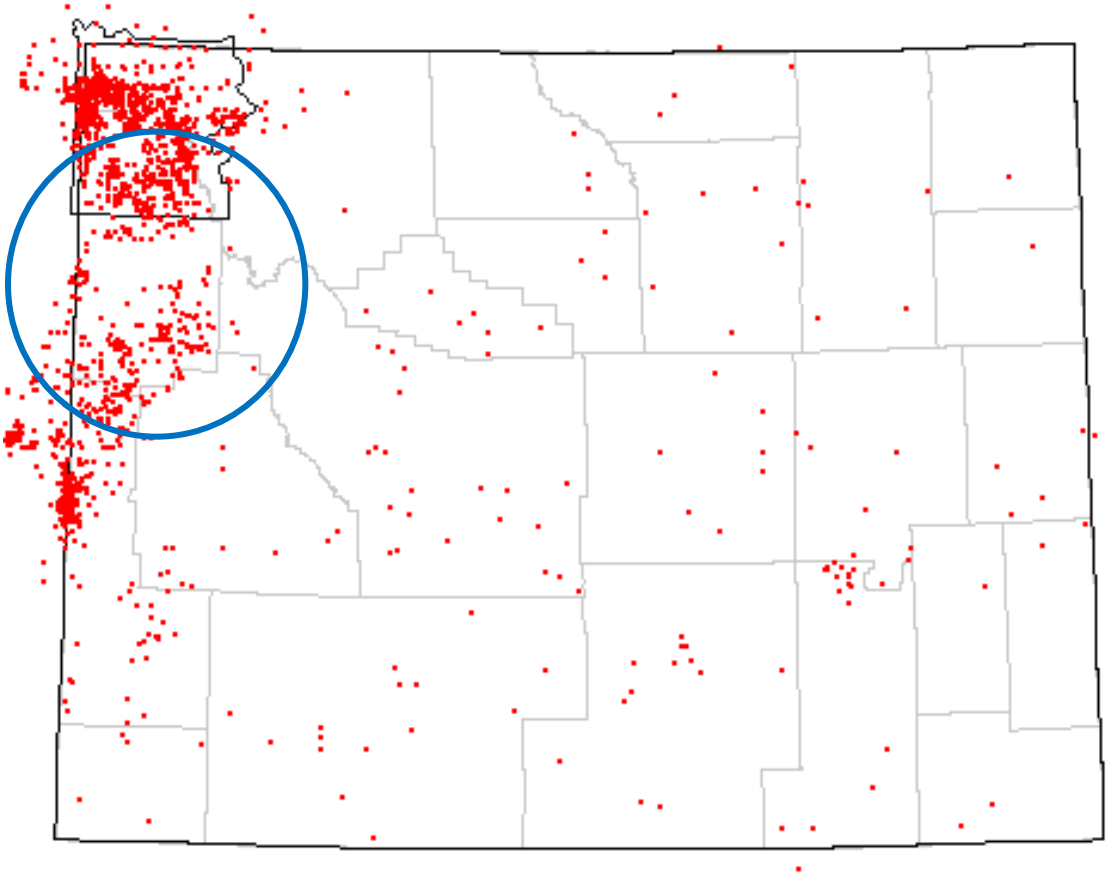


Figure 5.1 - Historical Earthquakes in Wyoming, 1871-2014
Teton County circled in blue

Source: http://www.wrds.uwyo.edu/wrds/wsgs/hazards/quakes/quake.html

Figure 5.1 shows the locations of the epicenters of earthquakes greater than magnitude 2.5 as of 2014.

Historical Seismicity in Teton County

Hundreds of magnitude 2.0 and greater earthquakes have been recorded in Teton County since 1906. The top ten earthquakes greater than magnitude 4.1 or Intensity IV are listed in Table 5.1 below. Additional details on the top ten and other historical earthquakes are included in Appendix A.

Table 5.1 - Top Ten Historical Earthquakes in Teton County

Date	Magnitude	Intensity	Approximate Location
3/24/1923	N/A	V	13 miles northeast of Jackson
3/26/1932	N/A	VI	4 miles northeast of Jackson
1/14/1936	5.0 (est)	VI	19 miles southwest of the south entrance to Yellowstone National Park
2/23/1948	5.0 (est)	VI	13 miles west of Jackson
12/20/1983	4.5	IV	10 miles south of Jackson
12/28/1993	4.7	V	34 miles east of Jackson
8/27/1995	4.5		Vicinity of Joy Park and Enos Lake
6/20/1998	4.7		3.5 miles southeast of Hoback Junction
7/21/2004	5.0		Gros Ventre Area
8/5/2010	4.8		Gros Ventre Area

Recent Regional Seismicity

An earthquake swarm in the Madison Plateau area began on January 15, 2010. Activity continued through April 2010, making this swarm the second largest Yellowstone swarm in terms of both duration and number of earthquakes in recorded history. A total of 2,347 earthquakes were recorded, with 16 events having a magnitude greater than 3.0. The two largest events were a magnitude 3.7 and magnitude 3.8 quake, large enough to be felt in Wyoming, Montana, and Idaho communities surrounding Yellowstone. Figure 5.2 illustrates the locations of the individual events in blue and red dots. The green dots represent swarm earthquakes that occurred between 1995 and 2009. (Yellowstone Volcano Observatory, USGS Volcano Hazards Program, 2010). Figure 5.3 depicts the intensity and shake map for the magnitude 3.8 event. Shaking was weak to light and caused little to no damage.

The Teton Seismic Network is a relatively new, state of the art network created by a partnership between local geologists, Teton County, the State of Wyoming, the Wyoming State Geological Survey and the USGS. The network detects and records seismic activity in the interest of public safety. Additionally, seismic sensors have been placed around Jackson Hole, and in Yellowstone National Park around the Yellowstone Caldera; these initiatives are ongoing, and increase the ability for seismic monitoring.

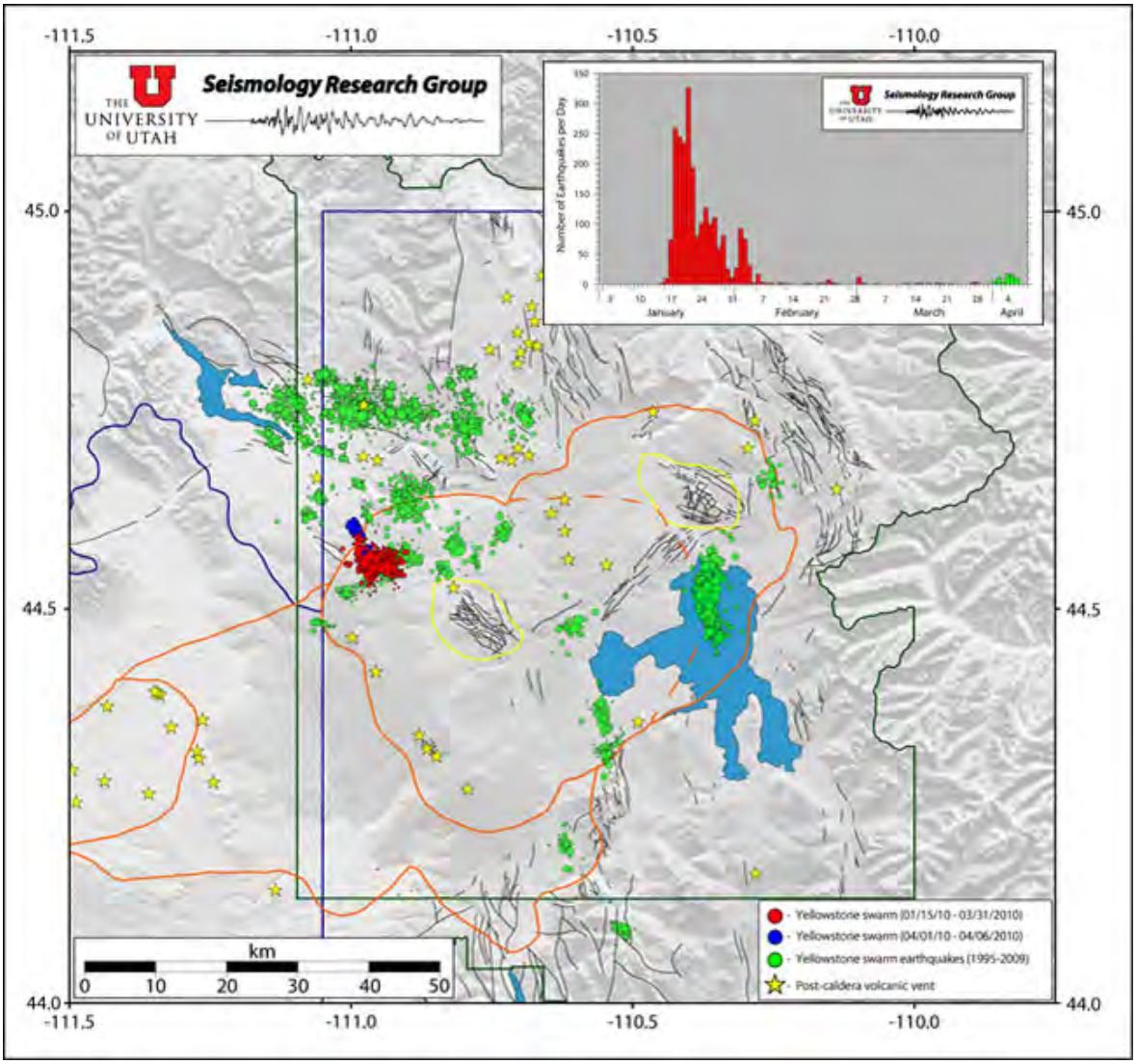


Figure 5.2 - Location of Madison Plateau Earthquake Swarm Events

Source: USGS, University of Utah Seismology Research Group

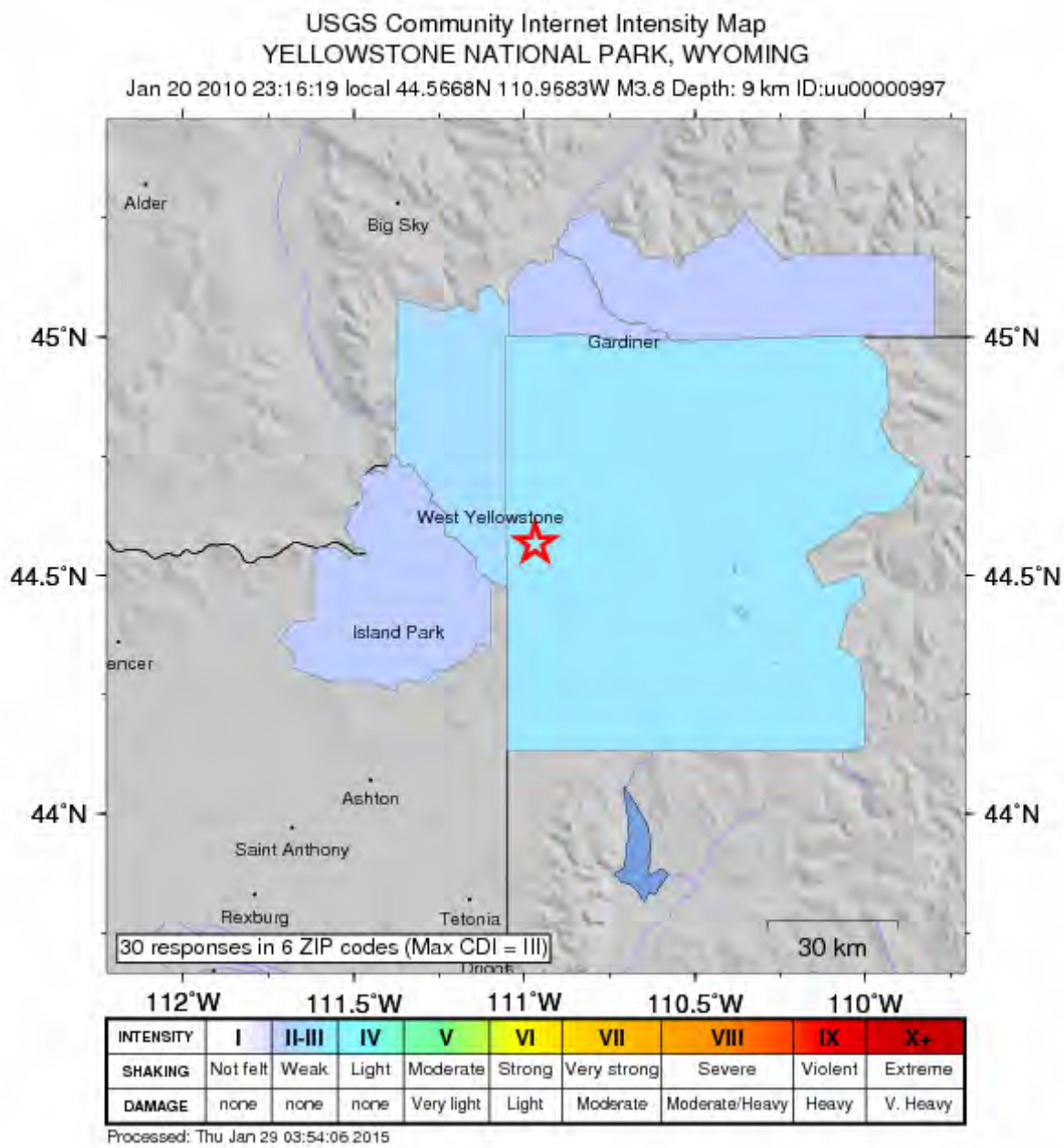


Figure 5.3 - Intensity and Shake Map for Magnitude 3.8 Earthquake Event in the Madison Plateau Swarm

Source: USGS

Floating or Random Earthquake Sources

Federal regulations require analysis of the earthquake potential where active faults are not exposed, and earthquakes are tied to buried faults without surface expression. Regions with a uniform potential for the occurrence of such earthquakes are called tectonic provinces. Within a tectonic province, earthquakes associated with buried faults are assumed to occur randomly, and can theoretically occur anywhere within that area of uniform earthquake potential. In reality, that random distribution may not be the case, as all earthquakes are associated with specific faults. If all buried faults have not been

identified, however, the distribution has to be considered random. “Floating earthquakes” are earthquakes that are considered to occur randomly in a tectonic province.

It is difficult to accurately define tectonic provinces when there is a limited historic earthquake record. When there are no nearby seismic stations that can detect small-magnitude earthquakes, which occur more frequently than larger events, the problem is compounded. Under these conditions, it is common to delineate larger, rather than smaller, tectonic provinces.

The U.S. Geological Survey identified tectonic provinces in a report titled “Probabilistic Estimates of Maximum Acceleration and Velocity in Rock in the Contiguous United States” (Algermissen and others, 1982). In that report, Teton County was classified as being in a tectonic province with a “floating earthquake” maximum magnitude of 6.1. Geological consulting firm Geomatrix (1988b) suggested using a more extensive regional tectonic province, called the “Wyoming Foreland Structural Province”, which is approximately defined by the Idaho-Wyoming Thrust Belt on the west, 104° West longitude on the east, 40° North latitude on the south, and 45° North latitude on the north. Geomatrix (1988b) estimated that the largest “floating” earthquake in the “Wyoming Foreland Structural Province” would have a magnitude in the 6.0 – 6.5 range, with an average value of magnitude 6.25.

Federal or state regulations usually specify if a “floating earthquake” or tectonic province analysis is required for a facility. Usually, those regulations also specify at what distance a floating earthquake is to be placed from a facility. For example, for uranium mill tailings sites, the Nuclear Regulatory Commission requires that a floating earthquake be placed 15 kilometers from the site. That earthquake is then used to determine what horizontal accelerations may occur at the site. A magnitude 6.25 “floating” earthquake, placed 15 kilometers from any structure in Teton County, would generate horizontal accelerations of approximately 17%g at the site. That acceleration would be adequate for designing a uranium mill tailings site, but may be too large for less critical sites, such as a landfill. Critical facilities, such as dams, usually require a more detailed probabilistic analysis of random earthquakes. Based upon probabilistic analyses of random earthquakes in an area distant from exposed active faults (Geomatrix, 1988b), however, placing a magnitude 6.25 earthquake at 15 kilometers from a site will significantly underestimate the ground acceleration that may actually occur in Teton County.

Probabilistic Seismic Hazard Analyses

The U.S. Geological Survey (USGS) publishes probabilistic acceleration maps for 500-, 1000-, and 2,500-year time frames. The maps show what accelerations may be met or exceeded in those time frames by expressing the probability that the accelerations will be met or exceeded in a shorter time frame. For example, a 10% probability that acceleration may be met or exceeded in 50 years is roughly equivalent to a 100% probability of exceedance in 500 years.

The USGS has recently generated new probabilistic acceleration maps for Wyoming (Case, 2000). Copies of the 500-year (10% probability of exceedance in 50 years), 1000-year (5% probability of exceedance in 50 years), and 2,500-year (2% probability of exceedance in 50 years) maps are attached. Until recently, the 500-year map was often used for planning purposes for average structures, and was the basis of the most current

Uniform Building Code. The new International Building Code, however, uses a 2,500-year map as the basis for building design. The maps reflect current perceptions on seismicity in Wyoming. In many areas of Wyoming, ground accelerations shown on the USGS maps can be increased due to local soil conditions. For example, if fairly soft, saturated sediments are present at the surface, and seismic waves are passed through them, surface ground accelerations will usually be greater than would be experienced if only bedrock was present. In this case, the ground accelerations shown on the USGS maps would underestimate the local hazard, as they are based upon accelerations that would be expected if firm soil or rock were present at the surface. Intensity values can be found in Table 5.1.

Although 2,500-year probabilistic acceleration maps are adequate for designing most structures, a more conservative estimate of ground acceleration is usually necessary for dams and associated reservoirs. Wong and others (2000) developed 10,000-year (0.5% probability of exceedance in 50 years) and 50,000-year (0.1% probability of exceedance in 50 years) acceleration models for eastern Idaho and western Wyoming. Because of Jackson Lake Dam's close proximity to the Teton fault, these more conservative 10,000-year and 50,000-year acceleration models will be used to determine peak horizontal ground accelerations that could occur at Jackson Lake Dam.

Based on Figure 5.4, there is a 2% probability of exceedance in 50 years of PGA ranging from 0.2 to 0.4 g in Teton County. Based on the 500-year map in Figure 5.5 (10% probability of exceedance in 50 years), the estimated peak horizontal acceleration in Teton County ranges from approximately 12%g in the southeast to greater than 25%g in the southwest, north-central, and northeast areas. These accelerations are roughly comparable to intensity VI earthquakes (9.2%g – 18%g) and intensity VII earthquakes (18%g – 34%g). Intensity VI earthquakes can result in fallen plaster and damaged chimneys. Intensity VII earthquakes can result in slight to moderate damage in well-built ordinary structures, and considerable damage in poorly built or badly designed structures, such as unreinforced masonry. Chimneys may be broken. Jackson would be subjected to accelerations of over 25%g or intensity VII.

Based upon the 1000-year map (5% probability of exceedance in 50 years) (Figure 5.6), the estimated peak horizontal acceleration in Teton County ranges from approximately 17%g in the southeastern portion of the county to over 40%g in the southwestern, south-central, and central portions of the county. These accelerations are roughly comparable to intensity VI earthquakes (9.2%g – 18%g), intensity VII earthquakes (18%g – 34%g), and intensity VIII earthquakes (34%g – 65%g). Intensity VI earthquakes can result in fallen plaster and damaged chimneys. Intensity VII earthquakes can result in slight to moderate damage in well-built ordinary structures, and considerable damage in poorly built or badly designed structures, such as unreinforced masonry. Chimneys may be broken. Intensity VIII earthquakes can result in considerable damage in ordinary buildings and great damage in poorly built structures. Panel walls may be thrown out of frames. Chimneys, walls, columns, factory stacks may fall. Heavy furniture may be overturned. Jackson would be subjected to accelerations of approximately 40%g or intensity VIII.

Based upon the 2500-year map (2% probability of exceedance in 50 years) (Figure 5.7), the estimated peak horizontal acceleration in Teton County ranges from nearly 30%g in the southeastern corner of the county to over 60%g in the central portions of the county. These accelerations are roughly comparable to intensity VII earthquakes (18%g – 34%g), intensity VIII earthquakes (34%g – 65%g), and possibly intensity IX earthquakes (65%g-

124%g). Intensity VI earthquakes can result in fallen plaster and damaged chimneys. Intensity VII earthquakes can result in slight to moderate damage in well-built ordinary structures, and considerable damage in poorly built or badly designed structures, such as unreinforced masonry. Chimneys may be broken. Intensity VIII earthquakes can result in considerable damage in ordinary buildings and great damage in poorly built structures. Panel walls may be thrown out of frames. Chimneys, walls, columns, factory stacks may fall. Heavy furniture may be overturned. Intensity IX earthquakes can cause considerable damage in specially designed structures and great damage and partial collapse in substantial buildings. Well-designed frame structures could be thrown out of plumb. Buildings can be shifted off their foundations. The ground can crack and underground pipes could be broken. Jackson would be subjected to accelerations of approximately 60%g, or intensity VIII, with local accelerations perhaps justifying an intensity IX designation.

Based upon the 10,000-year probabilistic peak horizontal acceleration model (Wong et al., 2000), Jackson Lake Dam would be subjected to accelerations of approximately 89%g, or intensity IX. Intensity IX earthquakes can cause considerable damage in specially designed structures and great damage and partial collapse in substantial buildings. Well-designed frame structures could be thrown out of plumb. Buildings can be shifted off their foundations. The ground can crack and underground pipes could be broken.

Based upon the 50,000-year probabilistic peak horizontal acceleration model (Wong et al., 2000), Jackson Lake Dam would be subjected to accelerations of approximately 119%g, or intensity IX to X. Intensity IX earthquakes can cause considerable damage in specially designed structures and great damage and partial collapse in substantial buildings. Well-designed frame structures could be thrown out of plumb. Buildings can be shifted off their foundations. The ground can crack and underground pipes could be broken. Intensity X earthquakes can destroy some well-built wooden structures and most masonry and frame structures with foundations. Railroad rails can be bent. Considerable landslides on riverbanks and steep slopes may occur. Sand and mud can shift, and water may splash out over riverbanks.

As the historic record is limited, it is nearly impossible to determine when a 2,500-year, a 10,000-year, or a 50,000-year event last occurred in the county. Because of the uncertainty involved, and based upon the fact that the new International Building Code utilizes 2,500-year events for building design, it is suggested that the 2,500-year probabilistic maps be used for most Teton County analyses. The 10,000-year and 50,000-year probabilistic models should be use for an analysis of Jackson Lake Dam and Reservoir. This conservative approach is in the interest of public safety.

Table 5.2 - Modified Mercalli Intensity and Peak Ground Acceleration (PGA)

Modified Mercalli Intensity	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
I	<0.17	Not felt	None
II	0.17 – 1.4	Weak	None
III	0.17 – 1.4	Weak	None
IV	1.4 – 3.9	Light	None
V	3.9 – 9.2	Moderate	Very Light
VI	9.2 – 18	Strong	Light
VII	18 – 34	Very Strong	Moderate
VIII	34 – 65	Severe	Moderate to Heavy
IX	65 – 124	Violent	Heavy
X	>124	Extreme	Very Heavy
XI	>124	Extreme	Very Heavy
XII	>124	Extreme	Very Heavy

Source: Wald, et al 1999

Abridged Modified Mercalli Intensity Scale

Intensity value and description:

I Not felt except by a very few under especially favorable circumstances.

II Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.

III Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing automobiles may rock slightly. Vibration like passing of truck. Duration estimated.

IV During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing automobiles rocked noticeably.

V Felt by nearly everyone, many awakened. Some dishes, windows, and so on broken; cracked plaster in a few places; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.

VI Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster and damaged chimneys. Damage slight.

VII Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving cars.

VIII Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving cars disturbed.

IX Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.

X Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed, slopped over banks.

XI Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.

XII Damage total. Waves seen on ground surface. Lines of sight and level distorted. Objects thrown into the air.

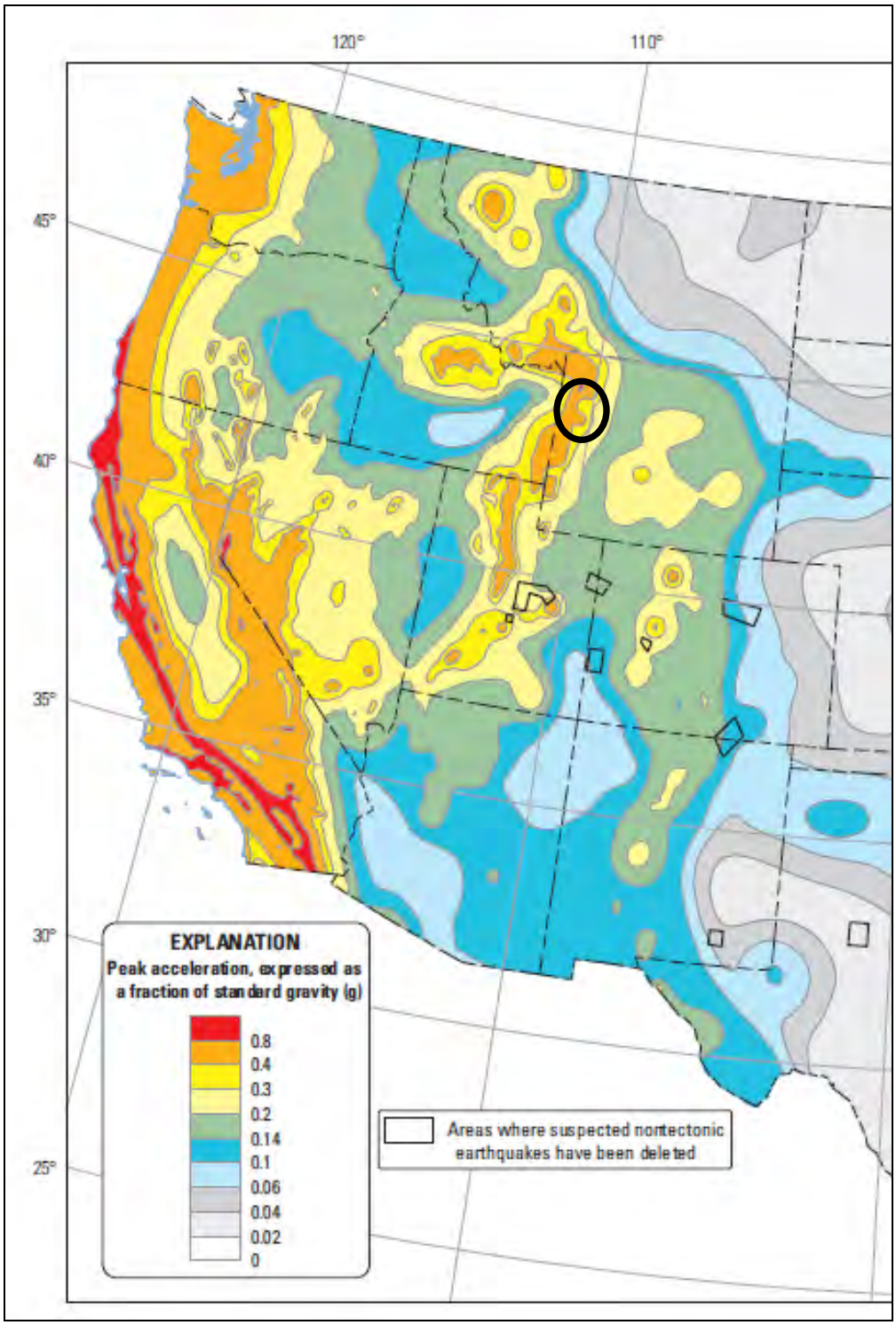


Figure 5.4 - Two percent probability of exceedance in 50 years map of peak ground acceleration, Western United States (Teton County area circled in black)

Source: Petersen et al., 2014

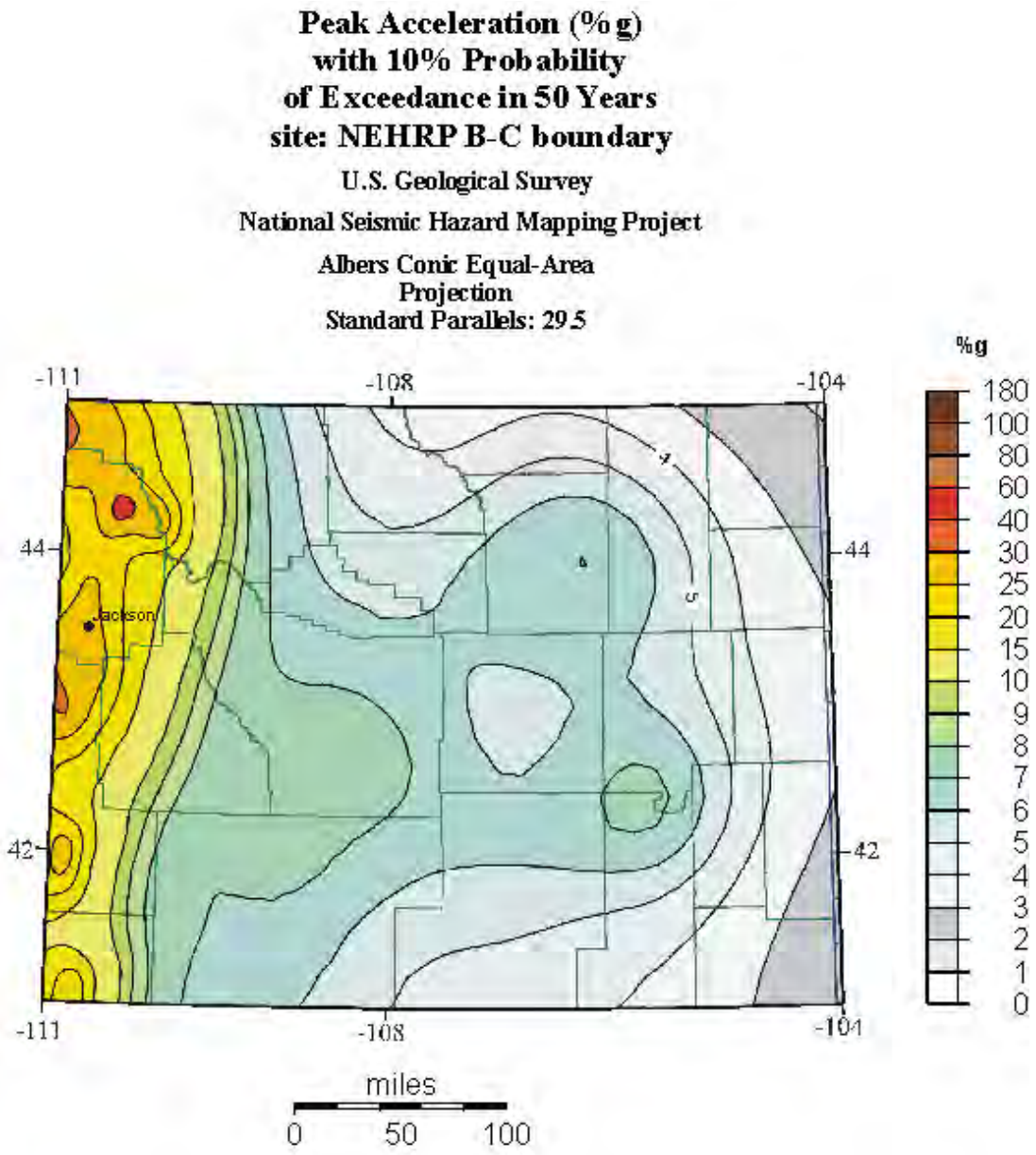


Figure 5.5 - 500-Year Probabilistic Acceleration Map
State of Wyoming 10% Probability of Exceedance in 50 Years

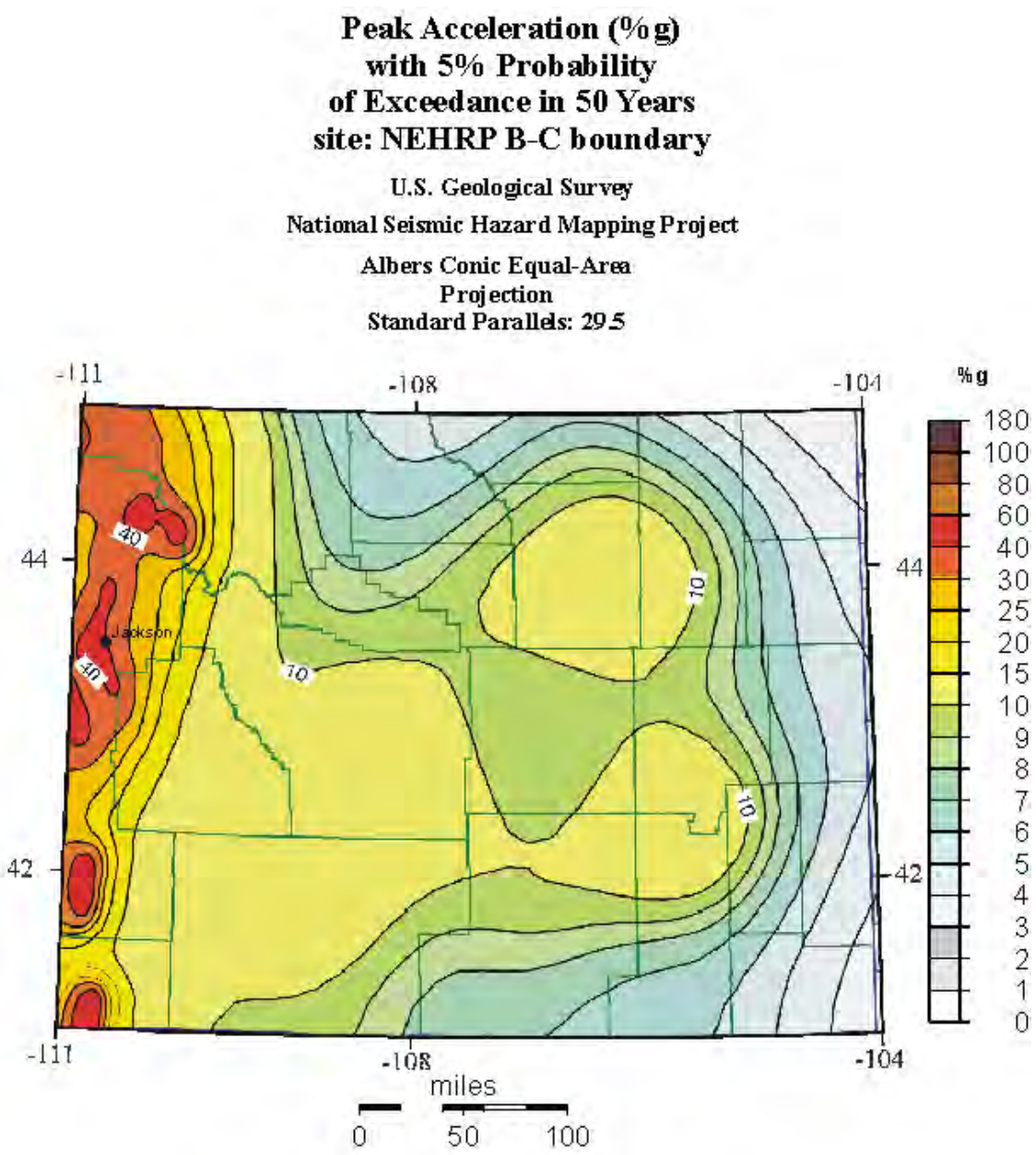


Figure 5.6 - 1,000-Year Probabilistic Acceleration Map
State of Wyoming 5% Probability of Exceedance in 50 Years

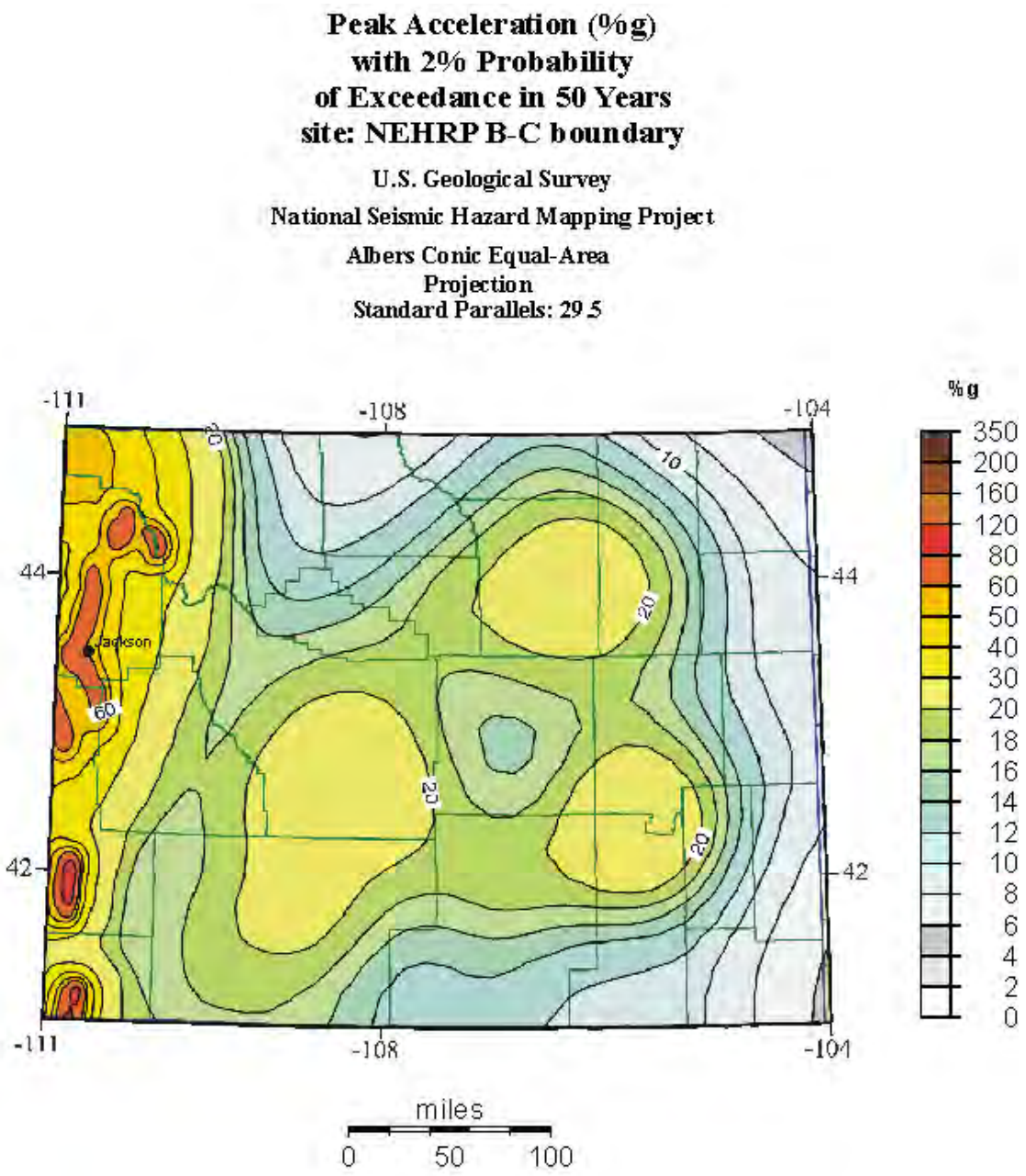


Figure 5.7 - 2,500-Year Probabilistic Acceleration Map
State of Wyoming 2% Probability of Exceedance in 50 Years

Impacts

There have been numerous historic earthquakes with a magnitude greater than 2.0 recorded in and near Teton County. Because of the limited historic record, it is possible to underestimate the seismic hazard in Teton County if historic earthquakes are used as the sole basis for analysis. Earthquake and ground motion probability maps and specific fault analyses give a more reasonable estimate of damage potential in Teton County.

Current earthquake probability maps that are used in the newest building codes suggest a scenario that would result in moderate to heavy damage to buildings and their contents, with damage increasing from the southeast to the west and north-central. More specifically, the probability-based or fault activation-based worst-case scenario could result in the following damage at points throughout the county:

Intensity X Earthquake Areas

Jackson Lake Dam

Intensity X earthquakes can destroy most masonry and frame structures with foundations and some well-built wooden structures. Railroad rails can be bent. Considerable landslides on riverbanks and steep slopes may occur. Sand and mud can shift, and water may splash out over riverbanks.

Intensity IX Earthquake Areas

Hoback Junction
Jackson (in certain areas)
Jenny Lake
Moose
Teton Village
Wilson

Intensity IX earthquakes can cause considerable damage in specially designed structures and great damage and partial collapse in substantial buildings. Well-designed frame structures could be thrown out of plumb. Buildings can be shifted off their foundations. The ground can crack and underground pipes could be broken.

Intensity VIII Earthquake Areas

Kelly
Jackson
Moran Junction

Intensity VIII earthquakes can result in considerable damage in ordinary buildings and great damage in poorly built structures. Panel walls may be thrown out of frames. Chimneys, walls, columns, factory stacks may fall. Heavy furniture may be overturned.

Potential Future Damage Impacts

In 2011, the Wyoming State Geological Survey (WSGS) conducted an earthquake study involving 16 scenarios around the state using HAZUS. Twelve HAZUS scenarios were based on fault systems across Wyoming suspected of having potential to produce earthquakes. The remaining four studies were based on historic earthquake events, including the 1882 Estes Park earthquake. The authors of the study point out that the odds of an earthquake occurring in the exact same location are very low. However, areas that have experienced seismicity in the past are identified as a potential source of future earthquakes.

Of the 16 studies, seven scenarios resulted in damages in Teton County. These scenarios were HAZUS deterministic scenarios for the Teton Fault, Upper Yellowstone Valley Fault System, Hoback Fault, Greys River Fault System, Grand Valley Fault System, East Mount Sheridan Fault System, and Eagle Bay Fault System. A full description of HAZUS is provided in the following section. The scenario magnitude was 7.2 for the Teton Fault, 6.5 for the Upper Yellowstone Valley Fault System, 6.6 for the Hoback Fault, 7.05 for the Greys River Fault System, 7.1 for the Grand Valley Fault System, 6.4 for the East Mount Sheridan Fault System, and 6.8 for the Eagle Bay Fault System. The seven scenarios are summarized in the following paragraphs.

The Teton Fault is located entirely within Teton County. The modeled earthquake scenario for this fault system caused damage in Fremont, Lincoln, Park, Sublette and Teton counties. Table 5.3 summarizes the damage probability and functionality of structures in Teton County as a result of this scenario. The study notes that the Grand Teton National Park (GTNP)/Moose Fire Department, Jackson Hole Airport Fire Department, Saint John's Medical Center in Jackson, and Moran Elementary would experience the most extensive damage. Functionality for these facilities would be significantly compromised; Saint John's Medical Center would be at 6.7% functionality on the day of the earthquake, the GTNP/Moose Fire Department would be at 1.6% functionality, and the Jackson Hole Airport Fire Department would be at 3.7% functionality. Several other fire departments, hospitals, and law enforcement buildings would have less than 50% functionality. Between 30 and 40 people would require hospitalization in this scenario, depending on the time of day. Only 33 hospital beds would be available for patients, including people injured in the earthquake and those already in the hospital. The loss of functionality for EMS and medical care could prevent the injured from being treated promptly, making more injuries life-threatening.

Following review of the model results by the LEPC its was noted that GTNP/Moose Fire Department, St. John's Hospital and the park HQ at Moose have also had significant structural remodels since 2010. Thus the model likely overestimates damage and loss of function for these facilities. The LEPC noted that the National Fish Hatchery has had a seismic upgrade too.

Table 5.3 – Percent Damage Probability and Functionality for Structures
Teton County – Teton Fault Scenario

Name	County	PGA (%g)	Structural Damage			Functionality		
			Slight Damage	Moderate Damage	Extensive Damage	Day 1	Day 7	Day 30
GTNP/Moose FD	Moose	56.00%	98.37%	88.68%	39.43%	1.60%	11.00%	60.50%
Jackson Hole Airport FD	Jackson	52.00%	96.22%	79.93%	24.73%	3.70%	19.60%	75.20%
Jackson Hole Fire/EMS Station 2 Wilson	Wilson	40.00%	77.09%	45.61%	11.38%	22.90%	53.60%	88.50%
Jackson Hole Fire/EMS Station 6 Teton Pines	Wilson	32.00%	60.08%	27.47%	4.95%	39.90%	71.70%	95.00%
Jackson Hole Fire/EMS Station 1 Jackson	Jackson	32.00%	52.74%	20.60%	1.77%	47.20%	78.60%	98.20%
Jackson Hole Fire/EMS Administration	Jackson	32.00%	52.74%	20.60%	1.77%	47.20%	78.60%	98.20%
Jackson Hole Fire/EMS Station 5 Alta(unused)	Alta	16.00%	8.24%	1.20%	0.01%	91.70%	98.60%	99.90%
Jackson Hole Fire/EMS Station 3 Hoback	Jackson	12.00%	3.49%	0.38%	0.00%	96.50%	99.50%	99.90%
Saint John's Medical Center	Jackson	32.00%	93.24%	80.14%	30.98%	6.70%	19.50%	69.00%
Jackson PD HQ	Jackson	32.00%	52.74%	20.60%	1.77%	47.20%	78.60%	98.20%
Teton County SO	Jackson	32.00%	52.74%	20.60%	1.77%	47.20%	78.60%	98.20%
C-Bar-V Ranch	Wilson	40.00%	70.46%	19.98%	8.38%	28.60%	61.20%	92.70%

Table 5.3 – Percent Damage Probability and Functionality for Structures
Teton County – Teton Fault Scenario (cont.)

Name	City	PGA (%g)	Structural Damage			Functionality		
			Slight Damage	Moderate Damage	Extensive Damage	Day 1	Day 7	Day 30
Journeys School of the Tetons	Wilson	36.00%	71.36%	38.02%	7.20%	29.50%	78.80%	91.60%
Wilson Elementary	Wilson	32.00%	60.08%	27.47%	4.95%	39.90%	71.70%	95.00%
Jackson Elementary	Jackson	32.00%	58.66%	24.89%	2.15%	41.30%	74.30%	97.80%
Montessori Cooperative Preschool	Jackson	32.00%	53.18%	6.64%	0.98%	42.10%	67.10%	74.60%
Summit High School	Jackson	32.00%	46.64%	16.74%	1.50%	46.80%	92.20%	99.00%
Moran Elementary	Jackson	28.00%	57.83%	32.23%	25.30%	53.30%	82.50%	98.40%
Jackson Hole Middle School	Jackson	28.00%	39.92%	12.40%	0.36%	55.80%	95.40%	99.90%
Jackson Hole Christian Academy	Jackson	28.00%	44.15%	3.56%	0.01%	59.70%	86.40%	99.10%
Colter Elementary	Jackson	28.00%	40.25%	12.88%	0.81%	59.70%	86.40%	99.10%
Jackson Hole High School	Jackson	28.00%	40.25%	12.88%	0.81%	60.00%	86.90%	99.60%
Red Top Meadows	Wilson	20.00%	25.21%	1.06%	0.02%	74.70%	98.30%	99.90%
Alta Elementary	Alta	16.00%	5.62%	0.71%	0.01%	92.10%	99.60%	99.90%
Kelly Elementary	Kelly	16.00%	7.88%	0.12%	0.00%	94.30%	99.10%	99.90%
Teton Youth and Family Services Van Vleck House	Jackson	28.00%	79.62%	56.65%	12.06%	20.30%	42.80%	87.90%

The study estimates Teton County would experience over $370 million in direct economic losses for buildings. The majority of transportation losses for Teton County, estimated at $43 million, would be from damage to highway bridges and segments, and airport facilities. Economic loss to utilities was estimated at nearly $3.5 million in damages to potable water, wastewater, and natural gas pipelines, and wastewater and natural gas facilities.

The Hoback Fault is located entirely within southern Teton County, just north of Hoback. The earthquake scenario was modeled at magnitude 6.6. Table 5.5 summarizes the damage probability to structures in Teton County as a result of this scenario. The impacts of this event would be less severe than the Teton Fault scenario, though several fire/EMS stations, healthcare centers, and schools would still have low functionality the day of the earthquake.

Table 5.4 - Percent Damage Probability and Functionality for Structures
Teton County – Hoback Fault Scenario

Name	City	PGA (%g)	Structural Damage			Functionality		
			Slight Damage	Moderate Damage	Extensive Damage	Day 1	Day 7	Day 30
Jackson Hole Fire/EMS Station 3 Hoback	Jackson	48.44%	70.39%	35.00%	2.57%	29.60%	64.10%	97.40%
Jackson Hole Fire/EMS Administration	Jackson	31.20%	56.96%	27.12%	9.55%	43.00%	72.10%	90.40%
Jackson Hole Fire/EMS Station 1 Jackson	Jackson	31.08%	56.41%	26.71%	9.46%	43.50%	72.60%	90.50%
Jackson/Teton/Wilson 2	Wilson	24.52%	48.08%	25.45%	15.87%	51.90%	74.00%	84.10%
Jackson/Teton/Wilson Station 2	Wilson	23.44%	42.61%	22.09%	14.43%	57.30%	77.40%	85.50%
Jackson Hole Airport FD	Jackson	14.88%	8.42%	1.23%	0.01%	91.50%	98.50%	99.90%
GTNP/Moose Fire	Moose	10.64%	2.27%	0.22%	0.00%	97.70%	99.70%	99.90%
Jackson Hole Fire/EMS Station 5 Alta (unused)	Alta	7.08%	0.40%	0.03%	0.00%	99.50%	99.90%	99.90%

Table 5.4 - Percent Damage Probability and Functionality for Structures
Teton County – Hoback Fault Scenario (cont.)

Name	City	PGA (%g)	Structural Damage			Functionality		
			Slight Damage	Moderate Damage	Extensive Damage	Day 1	Day 7	Day 30
Saint John's Medical Center	Jackson	28.84%	75.79%	52.71%	15.22%	24.20%	46.70%	84.70%
Teton County SO	Jackson	31.00%	55.98%	26.40%	9.40%	44.00%	72.90%	90.50%
Jackson PD HQ	Jackson	30.84%	55.42%	25.99%	9.29%	44.50%	73.30%	90.60%
Colter Elementary	Jackson	43.04%	87.93%	61.11%	17.12%	11.90%	38.10%	82.80%
Jackson Hole High School	Jackson	42.88%	88.01%	61.25%	17.17%	12.00%	38.20%	82.80%
Jackson Hole Christian Academy	Jackson	41.08%	83.01%	23.65%	0.35%	15.80%	68.10%	89.60%
Red Top Meadows	Wilson	40.32%	84.17%	30.64%	10.29%	16.90%	74.90%	99.60%
Jackson Hole Middle School	Jackson	40.20%	81.01%	47.93%	5.19%	18.90%	51.30%	94.70%

Table 5.4 - Percent Damage Probability and Functionality for Structures
Teton County – Hoback Fault Scenario (cont.)

Name	City	PGA (%g)	Structural Damage			Functionality		
			Slight Damage	Moderate Damage	Extensive Damage	Day 1	Day 7	Day 30
Summit High School	Jackson	31.60%	58.47%	28.27%	9.85%	29.60%	59.40%	63.80%
Moran Elementary	Jackson	31.20%	70.31%	39.84%	36.16%	41.50%	71.00%	90.10%
Jackson Elementary	Jackson	29.96%	52.43%	23.83%	8.69%	46.50%	70.30%	82.50%
Montessori Cooperative Preschool	Jackson	28.88%	49.82%	11.12%	7.53%	47.50%	75.50%	91.30%
Journeys School of the Tetons	Wilson	25.68%	53.42%	29.09%	17.44%	50.10%	87.90%	92.40%
Wilson Elementary	Wilson	23.96%	45.25%	23.68%	15.12%	54.70%	75.80%	84.80%
C-Bar-V Ranch	Wilson	23.36%	39.41%	15.38%	14.14%	60.50%	84.00%	85.80%
Kelly Elementary	Kelly	7.20%	0.46%	0.00%	0.00%	99.50%	99.90%	99.90%
Alta Elementary	Alta	6.96%	0.37%	0.03%	0.00%	99.60%	99.90%	99.90%
Teton Youth and Family Services Van Vleck House	Jackson	31.92%	84.77%	65.42%	22.50%	15.20%	34.10%	77.40%

The study estimates Teton County would experience $285.5 million in direct economic losses for buildings and $3.653 million in damages to highway segments, bridges, and airport facilities. Economic loss to utilities was estimated at $4.537 million and comes from damages to wastewater and natural gas pipelines and facilities.

The East Mount Sheridan Fault System is located entirely within Teton County about five miles south of West Thumb. The earthquake scenario was modeled at magnitude 6.4. Table 5.5 summarizes the damage probability to structures in Teton County as a result of this scenario. This scenario projects little to no damage to critical facilities in Teton County. Two fire/EMS stations and one school would experience minimal impacts, remaining at or near 100% functionality the day of the earthquake. No healthcare centers would be impacted.

Table 5.5 - Percent Damage Probability and Functionality for Structures in Teton County – East Mount Sheridan Fault System Scenario

Name	City	PGA (%g)	Structural Damage			Functionality		
			Slight Damage	Moderate Damage	Extensive Damage	Day 1	Day 7	Day 30
Jackson Hole Fire & EMS	Alta	4.84%	0.02%	0.00%	0.00%	99.9%	99.9%	99.9%
Grand Teton NP/Moose	Moose	0.00%	0.00%	0.00%	0.00%	100.0%	100.0%	100.0%
Alta Elementary	Alta	4.80%	0.02%	0.00%	0.00%	99.9%	99.9%	99.9%

The study estimates Teton County would experience $3.2 million in direct economic losses for buildings and $300,000 in damages to highway bridges. Economic loss to utilities was estimated at $4.23 million and comes from damages to wastewater and natural gas pipelines and facilities.

The Eagle Bay Fault System is located in the northeast corner of Teton County, running partially under Yellowstone Lake. The earthquake scenario was modeled at magnitude 6.8. No critical facilities in Teton County would be impacted. The study estimates Teton County would experience $1.74 million in direct economic losses for buildings and $201,000 in damages to highway bridges. Economic loss to utilities was estimated at $11 million and comes from damages to wastewater and natural gas pipelines and facilities.

The Grand Valley Fault System is primarily located in Lincoln County, with smaller faults in Idaho. The earthquake scenario was modeled at magnitude 7.1. The estimated intensity ranges from V to VI in southern Teton County. Residents in this area would likely feel the earthquake but damages would be minimal. The Jackson Hole Fire/EMS Station 3 Hoback fire station would experience very slight damage, but no other critical facilities in Teton County would be impacted. The fire station would remain at nearly 100% functionality on the day of the quake. The study for this scenario does not list any direct economic losses for buildings, transportation, or utilities in Teton County.

The Greys River Fault system is located in the Lincoln County panhandle near the border with Sublette County. The scenario was modeled at magnitude 7.05. The estimated intensity for this scenario ranges from V to VI in southern Teton County, similar to the Grand Valley Fault System scenario. However, this scenario is projected to cause more damage in Teton County than the Grand Valley Fault System. The study estimates Teton County would experience $65,000 in economic losses to utilities, including damages to wastewater and natural gas pipelines and facilities. The direct economic losses for buildings and transportation were both estimated at $0.

Other HAZUS Studies

HAZUS (Hazards U.S.) is a nationally standardized, GIS-based, risk assessment and loss estimation computer program that was originally designed in 1997 to provide the user with an estimate of the type, extent, and cost of damages and losses that may occur during and following an earthquake. It was developed for the FEMA by the National Institute of Building Sciences (NIBS). There have been a number of versions of HAZUS generated by FEMA, with HAZUS-MH (HAZUS – Multi-Hazard) being the most recent release. HAZUS-MH incorporates a flood and wind module with the previously existing earthquake module. Hazus-99 (1999 version) was previously used by the Wyoming State Geological Survey (WSGS).

HAZUS was originally designed to generate damage assessments and associated ground motions based largely upon analysis at the census-tract level. Census tracts average 4,000 inhabitants, with the tract boundaries usually representing visible features. HAZUS-99 calculated a ground motion value for the centroid of a census tract, and applied that value to the entire tract. The calculations are based on United States Geological Survey National Seismic Hazard Maps. In many of the western states, census tracts are very large, and parts of the tracts may be subjected to ground shaking that is considerably different than the value at the centroid. FEMA Region VIII and their subcontractor on

HAZUS, PBS&J from Atlanta, have worked closely with the Wyoming State Geological Survey (WSGS) to develop a census-block-based analysis for HAZUS-MH in Wyoming. In fact, Wyoming is the national pilot project for the census-block-based analysis. The block-level analysis is a significant improvement. Census blocks are a subdivision of census tracts. Many blocks correspond to individual city blocks bounded by streets, but blocks – especially in rural areas – may include many square miles and may have some boundaries that are not streets. Ground motion values for Wyoming are now calculated at the centroid of census blocks.

As part of the development of the 2014 State of Wyoming Multi-Hazard Mitigation Plan a HAZUS probabilistic scenario was run for every Wyoming County. The scenario used a 2,500 year return period, and uses the USGS ground shaking data represented in Figure 5.7. The probability of such an event is 2% in 50 years. Teton County used a driving Magnitude of 7.5 associated with the scenario. The results are presented in Table 5.6.

Following review of the model results by the LEPC it was noted that GTNP/Moose Fire Department, St. John's Hospital and the park HQ at Moose have also had significant structural remodels since 2010. Thus the model likely overestimates damage and loss of function for these facilities. The LEPC noted that the National Fish Hatchery has had a number of structural upgrades as well.

There are two methods to rank the counties to determine where earthquake impacts may be the greatest. Either the loss ratios or total damage figures can be used. The loss ratio is determined by dividing the sum of the structural and non-structural damage by the total building value for the county. The loss ratio is a better measure of impact for a county as it gives an indication of the percent of damage to buildings. The total damage figure by itself does not reflect the percentage of building damage. Small damage to a number of valuable buildings may result in a higher total damage figure that may be found in a county with fewer, less expensive buildings, with a higher percentage of damage. Teton County is ranked second behind Lincoln County for loss ratio, and ranked first for total damage.

Table 5.6 – Earthquake Potential Losses, Wyoming Counties

County	Capital Stock Losses (Thousands of Dollars)				Loss Ratio (%)	Income Losses (Thousands of Dollars)				Total Loss (Thousands of Dollars)
	Structural	Non-structural	Contents	Inventory		Relocation	Capital-Related	Wages	Rental	Loss
Albany	9,714	36,865	13,946	151	2.32	276	2,717	3,198	4,210	71,078
Big Horn	3,470	12,203	4,647	65	2.43	84	533	694	963	22,660
Campbell	5,116	20,093	9,419	282	1.37	144	1,484	2,013	1,592	40,144
Carbon	7,140	26,320	10,480	170	3.08	190	2,120	2,700	1,810	50,920
Converse	6,054	24,172	9,787	185	4.15	152	984	1,303	1,845	44,482
Crook	836	2,640	896	17	1.04	21	107	139	211	4,867
Fremont	14,890	61,030	24,640	460	3.75	380	2,920	3,940	3,190	111,450
Goshen	2,168	6,982	2,543	69	1.13	57	392	528	623	13,364
Hot Springs	3,038	10,871	4,176	52	4.2	82	799	1,149	969	21,136
Johnson	3,293	13,062	5,514	94	3.4	86	557	648	1,066	24,320
Laramie	13,605	47,839	17,577	233	1.25	406	3,926	4,402	4,976	92,963
Lincoln	65,670	225,594	64,429	2,538	31.08	1,211	8,579	10,359	15,347	391,727
Natrona	36,764	137,379	57,269	1,149	3.99	981	9,890	13,033	12,245	268,911
Niobrara	423	1,585	617	12	1.2	12	72	83	132	2,935
Park	11,430	42,694	15,289	429	2.98	285	5,173	6,217	4,487	86,004

Table 5.6 – Earthquake Potential Losses, Wyoming Counties (cont.)

County	Capital Stock Losses (Thousands of Dollars)				Loss Ratio (%)	Income Losses (Thousands of Dollars)				Total Loss (Thousands of Dollars)
	Structural	Non-structural	Contents	Inventory		Relocation	Capital-Related	Wages	Rental	Loss
Platte	1,875	6,894	2,697	36	1.6	51	326	418	554	12,850
Sheridan	7,830	29,154	12,057	233	2.09	213	1,898	2,402	2,636	56,423
Sublette	9,654	30,667	9,436	222	8.24	206	2,438	3,052	2,665	58,340
Sweetwater	12,782	50,213	20,753	542	2.84	313	2,180	2,514	3,719	93,017
Teton	**92,477**	**359,169**	**110,323**	**2,402**	**24.72**	**1,821**	**37,784**	**43,975**	**34,030**	**681,981**
Uinta	39,912	135,111	38,841	1,007	15.84	782	5,888	8,741	11,004	241,284
Washakie	4,115	13,761	5,656	134	3.54	99	904	1,019	1,236	26,925
Weston	897	3,016	1,085	21	0.96	26	147	266	302	5,760

In summary, Teton County is one of the, if not the most at-risk county in Wyoming when it comes to earthquakes due to the number of potentially active faults within and near the County. It is estimated that if a worst-case event occurred in Teton County, $681 million in combined capital stock and income losses could occur. HAZUS estimates that 3,222 buildings (64% of the total in the county), would be at least moderately damaged, and an estimated 379 buildings would be completely destroyed. The probability of such an event is 2% in 50 years, which is why this hazard has a 'medium' cumulative consequence rating. In addition to damage to buildings, infrastructure such as roads and utilities could also suffer damage, cutting off routes for emergency response and evacuation, and severing utility services. The topographic and geologic setting of Jackson Hole, including the Town of Jackson, can amplify the ground shaking from an earthquake due to basin effects. Future updates to this plan will incorporate new science and research, where applicable, related to the further characterizing the earthquake hazard in the region.

Summary

PROPERTY AFFECTED:	High
POPULATION AFFECTED:	High
PROBABILITY:	Medium
JURISDICTION AFFECTED:	County; Jackson

Chapter 6. Floods

A flood, as defined by the National Flood Insurance Program, is a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from: overflow of waters; unusual and rapid accumulation or runoff of surface waters from any source; or, a mudflow. Floods can be slow or fast rising, but generally develop over a period of many hours or days. Sources of flooding in Teton County include the Snake River, Gros Ventre River, Hoback River, Cache Creek, Flat Creek, and other small creeks and drainages. Floods can also occur with little or no warning and can reach full peak in only a few minutes. Such floods are called flash floods. A flash flood usually results from intense storms dropping large amounts of rain within a brief period. Floods can occur for reasons other than precipitation or rapidly melting snow. They can also occur because of ice jams and frazil ice formation. Levees typically provide protection from flooding but can be overtopped or fail and result in flood losses.

National Flood Insurance Program Participation and Flood Hazard Identification and Mapping

Teton County has 35 map panels plus a map index and a county-wide Flood Insurance Study (FIS) dated August 5, 2010 that includes the town of Jackson. Both the 100-year and 500-year floodplain boundaries are mapped and a 1-ft floodway. Digital Flood Insurance Rate Maps (DFIRM) are available online as part of the town and county GIS system. Users can select various map layers including aerial photos and floodplain maps and view most areas of the county moving around geographically and zooming in and out as desired. The DFIRMs were updated in 2014-2015 with associated flood risk products as described further in this section. The Department of Homeland Security (DHS), Federal Emergency Management Agency's (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) program provides states, tribes, and local communities with flood risk information and tools that they can use to increase their resilience to flooding and better protect their citizens. By pairing accurate floodplain maps with risk assessment tools and planning and outreach support, Risk MAP has transformed traditional flood mapping efforts into an integrated process of identifying, assessing, communicating, planning for, and mitigating flood-related risks. Earthquake and landslide risk data and discussion are included in the Flood Risk Report as well as in the accompanying database, map, and online viewer.

A Flood Risk Report has been prepared for Teton County and was issued in June 2015. (https://data.femadata.com/Region8/RiskMAP/States/Wyoming/TetonCounty/Non%20Regulatory%20Products/). This Flood Risk Report provides non-regulatory information to help local officials, planners, emergency managers, floodplain managers, and others better understand their risk to hazards, take steps to mitigate those risks, and communicate those risks to their citizens and local businesses. The Flood Risk Report is not intended to be regulatory or the final authoritative source of all flood (or earthquake or landslide) risk data in the project area. Rather, it should be used in conjunction with other data sources to provide a comprehensive picture of risk to natural hazards within the project area.

The Flood Risk Map displays overall flood risk by community, Changes Since Last FIRM (CSLF), and specific Areas of Mitigation Interest (AOMI). Figure 6.1 shows a thumbnail image of the map.

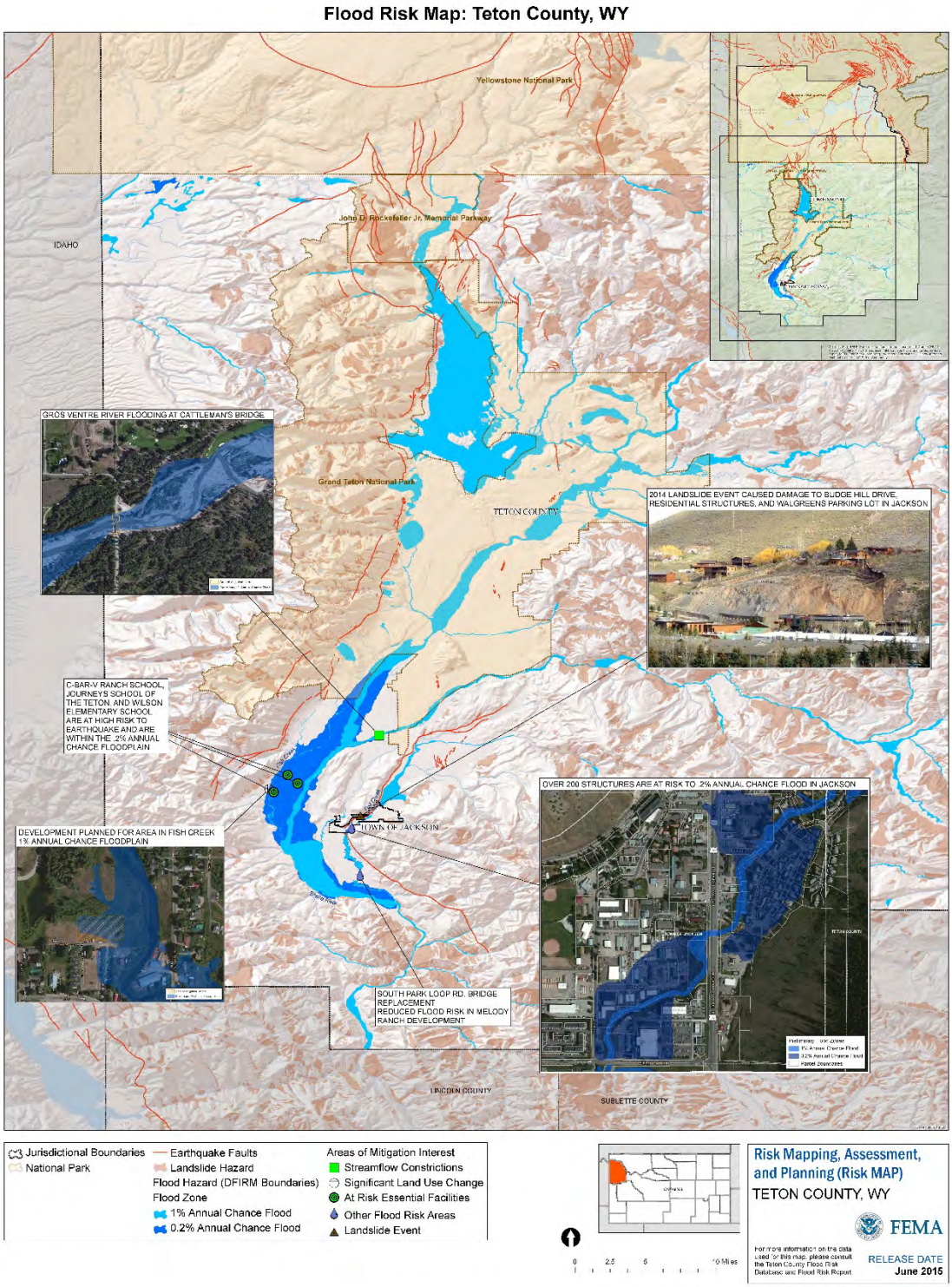


Figure 6.1 Teton County Flood Risk Map (June 2015)

The Snake and the Gros Ventre Rivers run west and north of the Town of Jackson. Fish Creek runs through the census-designated place Wilson and Flat Creek runs through Jackson. These drainages are located in the Snake Headwaters, Greys-Hoback, and Gros Ventre Watersheds.

The FIS attributes flooding in the county to snowmelt. High flows may occur for several days while the snowpack is rapidly melting. Cache Creek enters the Town of Jackson from the southeast, draining portions of the Gros Ventre Range. Cache Creek has occasionally caused flooding in the town and additional drainage work is needed to pass flood waters from Cache Creek through the town to minimize damage.

The streams studied by detailed methods are the Snake and Gros Ventre Rivers; Flat, Fish, Teton, Lake, Cache, and Spring Creeks; and Buffalo Fork. Two FIS revisions have occurred since the 1989 study. The 2006 study incorporated new detailed flood hazard information for Flat Creek and Spring Creek. Cache Creek was also re-delineated during this revision. No modifications were made to the hydrology. The hydraulic models were modified to reflect updated topography and the addition of bridges constructed since the effective model was created. The second revision, effective August 5, 2010, incorporated new detailed flood hazard information for Flat Creek within Teton County. Snake River was re-delineated in the vicinity of the confluence with Flat Creek during this revision based on updated topography. The Federal levee portion of the Snake River levee system was certified by the USACE in January 2010.

Preliminary DFIRM floodplain boundaries are dated May 13, 2014. The FIRM effective date will be September 16, 2015. Stream reaches on the Snake River, Fish Creek, and Lake Creek were revised with updated hydraulic analysis and remapped for the following return periods: 10-year, 25-year, 50-year, 100-year, and 500-year. All reaches including Fish Creek, Gros Ventre River, Lake Creek, and Snake River are located in the unincorporated areas of the County. The study reaches represent approximately 30 miles of new study information. Portions of Horse Creek and the Snake River below the Highway 89 were re-delineated using topographic data submitted by Teton County. Additional DFIRM Zone A refinements were made to reaches of Horse Creek and the Lower Snake River.

There are levees along the Snake River that extend approximately 15.4 miles, from 4.2 miles below the Wilson Bridge to 11.2 miles above the Wilson Bridge. There are also levees on the Gros Ventre River. On the southern side of the channel, a levee extends from the confluence with the Snake River approximately 2.5 miles to above Spring Gulch Rd. On the northern side of the Gros Ventre River, a levee extends from 1.3 river miles above the confluence with the Snake River for 1 mile, to just above Spring Gulch Rd.

These levees on the Snake and Gros Ventre rivers provide the community with some degree of protection from flooding. The Gros Ventre River Levees have not been demonstrated by the community or levee owner to meet the requirements of Section 65.10 of the NFIP regulations in 44 CFR as it relates to the levee's ability to provide 1% annual chance flood protection. The subject areas are identified on the preliminary FIRM panels (panels 56039C2685E, 56039C2695E, 56039C2705E, and 56039C2715E with notes and bounding lines) and in the preliminary FIS report as potential areas of flood hazard data changes, based on further review. The Gros Ventre River levee was mapped with a 'seclusion' boundary, which allowed the mapping project to move forward while FEMA finalized a new levee analysis and mapping approach (LAMP) guidance. The levees are

shown in the figure below along with the seclusion boundary. This flood hazard data should be utilized until FEMA returns to update the FIRM panel as part of a Levee Assessment project on the Gros Ventre River levee or until the community certifies the levee in accordance with CFR 65.10 (whichever comes first).

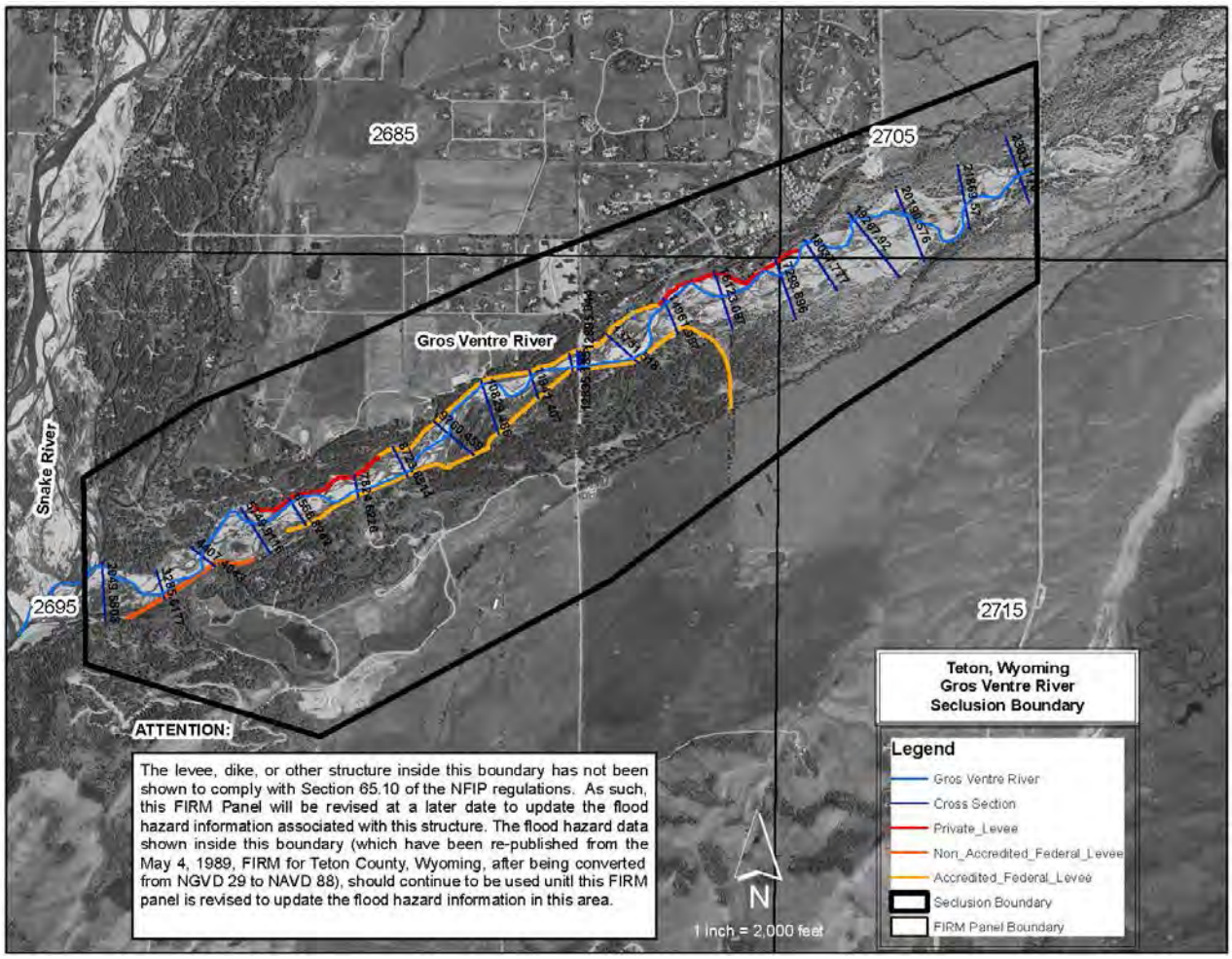


Figure 6.2 – Levees and Levee Seclusion Area, Gros Ventre River

Source: Flood Risk Report, Teton County and Town of Jackson, Wyoming draft 4/1/2015

Table 6.1. NFIP Status

Community	Date of Entry into Program	Current Effective Map Date
Teton County Unincorporated. Areas	5/4/89	8/5/2010
Jackson	5/4/89	8/5/2010

According to statistics from the National Flood Insurance Program (http://www.fema.gov/policy-claim-statistics-flood-insurance/policy-claim-statistics-flood-insurance/policy-claim-13) there have been a total of 19 flood insurance claims (1 in Jackson and 18 in the county) filed between 1/1/1978 and 12/31/2014. The total of the payments made on these claims was $32,405. As of December 31, 2014, there were 69 flood insurance policies in force in the town of Jackson for a total coverage of $19,961,500 and 407 policies in unincorporated areas of Teton County for a total coverage of $131,979,200.

According to Mr. Kim Johnson, State of Wyoming National Flood Insurance Program Coordinator, there are no repetitive loss structures in Teton County. These are defined as an NFIP-insured structure that has had at least two paid flood losses of more than $1,000 each in any 10-year period since 1978.

Floodplain Management

Teton County has a floodplain ordinance that was revised in October 2010 to adopt the current effective floodplain mapping. The ordinance is available on the county's website and provides for a floodplain administrator, requires development permits, and provides penalties for non-compliance. The floodplain manager processes floodplain permits and enforces the county ordinance. The ordinance requires construction to be a minimum of one foot above the base flood (aka 1% annual chance or 100 year flood) elevation. In addition to the floodplain regulations the county Land Development Regulations require all physical development and use to be setback from rivers and streams anywhere from 50 feet minimum up to 150 feet. The county currently has a contract floodplain administrator.

Land development regulations guide all development within the Town of Jackson and require a general building permit or floodplain development permit if applicable. The town's floodplain administrator, Shawn O'Malley, reported in 2015 that the exposure to flood risk has not changed since the last plan was prepared in 2010 because the lands along Flat Creek are either owned by the town or were developed years ago. Possibly two lots in the floodplain have the potential for development. The most recent FIS has not modified the floodplain boundary in the Town.

The County conducts annual flood season meetings, coordinated by the County Emergency Management Coordinator. Participants vary from year to year, but they typically include:

- Teton County Emergency Management,
- US Bureau of Reclamation (Upper Snake River Field Office),
- US Army Corps of Engineers (Walla Walla Office),
- Wyoming Office of Homeland Security,
- Wyoming State Engineer's Office,
- Grand Teton National Park,
- Bridger-Teton National Forest
- Teton County Engineer's Office,
- Teton County Road & Levee,
- Teton County Commissioners,
- Teton County Administrator,
- Teton County Public Information Officer,
- Teton County Sheriff's Office Dispatch,
- Teton County Sheriff's Office,
- Teton Interagency Dispatch Center,
- Teton County Public Health,
- Teton County Search & Rescue,
- Jackson Police Department, and
- American Red Cross

Topics of discussion include the hydrologic outlook and the potential for flooding, Jackson Lake Dam operations during the runoff season, levee areas of concern and the flows that trigger levee inspection, Town of Jackson flooding potential, resources available for flood response, and the roles and responsibilities of agencies during a flood event.

Ice-Jams/Frazil-Ice

An additional concern to the Town of Jackson is the development of frazil-ice during the winter and the resultant flood damage. Frazil ice occurs when water becomes super cooled in shallow, turbulent creeks. The super cooled water encourages the formation of small ice crystals (frazil ice). Although ice generally floats, frazil ice crystals are not buoyant and attach to the bottom of the channel. Because the ice builds up from the bottom of the creek bed, it displaces the water flow, raising the water level, and can cause damming and flooding. This phenomenon is very rare, occurring in only a handful of waterways in North America.

During the summer of 2000 the Town installed three water wells along Flat Creek to assist in the mitigation of ice removal during periods of frazil ice. These wells pumped water into Flat Creek during the winter of 2000-2001. During this time, it became apparent that these wells only mitigated the formation of frazil ice in limited areas of Flat Creek, had little impact on the overall icing problem, and potentially added to the amount of water flowing/flooding downstream to properties within the Town but also to properties outside of Town limits. Since then the Town has operated the thaw wells in many different ways, but ice build-up was still a problem.

In 2001, the Town contracted with the Army Corp of Engineers, Cold Regions Research and Engineering Lab, to complete a detailed study of Flat Creek and the frazil ice

phenomenon. The purpose of this study was to determine if specific improvements could be made within Flat Creek to reduce the formation and occurrence of frazil ice. This study recommended three alternatives which consisted of the installation of several boom systems in various locations for manual removal of ice, the installation of additional water wells to add warmer water to prevent frazil ice, and the completion of rock weir systems throughout the creek to avoid frazil ice situations.

The Town pursued the option of installing rock weir systems. Due to the fact that the rock weirs and other measures greatly enhance the cutthroat trout, waterfowl habitat, and the overall health of Flat Creek, the Town, since 2003, has continued to partner with the Teton Conservation District to construct a series of weir systems. The combination of the thaw wells and the rock weirs have not been completely effective towards mitigation of the historical ice flooding that occurs along sections of the creek, and private properties continue to be threatened. The Town and the Teton Conservation District are exploring the best approach for dealing with this exceptionally unusual natural phenomenon. In support of this effort, the Flat Creek Water Improvement District has been formed. Although primarily assembled to raise tax funds and address winter frazil ice flooding on Flat Creek from Karns Meadow to High School Rd, it can also address spring snowmelt flooding on Flat Creek in that area, although cases of that are rare.

History: Floods

The documented flood history for Teton County is limited and extends back to 1927. The abbreviated flood history in Table 6.2 below was in large part derived from the monthly Storm Data reports generated and released by the National Oceanic and Atmospheric Administration's National Climate Center. Other sources are unpublished reports from the Wyoming Office of Homeland Security, newspaper accounts, and periodicals from public libraries. The table represents floods that have caused damage, injuries, or loss of life.

Probably the most infamous flash flood in Teton County's recorded history is the Kelly Flood. On June 23, 1925, part of the northern face of Sheep Mountain became unstable after weeks of heavy rain and slid into the Gros Ventre River. The 50 million cubic yards of sedimentary rock formed a natural dam 200 feet high and 400 yards wide that created Lower Slide Lake. On May 18th, 1927, a portion of the natural dam broke causing a flash flood to rush down the Gros Ventre River. The flood was at least 6 feet deep for at least 25 miles downstream, and wiped out the town of Kelly which was 6 miles downstream. Six people died, and many others lost everything they owned.

Fifteen miles downstream in Wilson, WY, 6 feet of water inundated the town and hundreds of farm animals died. In narrower sections of the Snake River near Hoback, flood waters rose as much as 50 feet. The next day the waters reached Idaho Falls, ID and covered lowland sections there. When all was said and done, damages totaled $500,000 (Windows Into the Earth; Smith and Siegel, 2000).

The flash flood that occurred on July 26th, 2007 in Jensen Canyon up Fish Creek Road in Wilson, WY washed out a private road and overturned two vehicles. The National Weather Service office in Riverton had issued a small stream flood warning for west central Teton County and estimated that 2 to 3 inches of rain fell over the area in three hours. No one was injured.

The revised FIS states that flows in the Snake exceeded 20,000 CFS in the years 1894, 1904, 1910-1914, 1917-1918, 1927-1928, and 1943.

History: Ice Jams/Frazil-Ice Floods

An ice jam is a stationary accumulation of ice that restricts flow. Ice jams can cause considerable increases in upstream water levels, while at the same time downstream water levels may drop. Types of ice jams include freeze up jams, breakup jams, or combinations of both. (US Army Corps of Engineers, 1994) When an ice jam releases, the effects downstream can be similar to that of a flash flood or dam failure. Flooding concerns due to the formation of Frazil ice blocking water flow during the winter has been a reoccurring problem for the Town of Jackson. Table 6.3 shows the recorded ice jams from the Corps of Engineers Ice-Jam database. (http://icejams.crrel.usace.army.mil/) The first recorded mention of frazil ice in the database occurred in December, 2013:

> "Emergency management reported the Flat Creek south of Jackson was out of its banks causing minor flooding near Berger Lane due to buried frazil ice. This flooding, if it gets worse, could begin to affect businesses along flat creek mainly near Berger lane. The Jackson hole community pathway could be inundated with water and ice in this area."

Table 6.2 – Teton County Flood History Data

County	Location	Start Date	Deaths	Injuries	Property Damage	Crop Damage	Total Damage	Information
Teton	Jackson	13-Aug-14	0	0	Unknown	Unknown	Unknown	Local law enforcement reported localized street flooding. Water one foot deep at some intersections.
Teton	Jenny Lake	13-Aug-14	0	0	$10,000	$0	$10,000	Rainfall of one-half to one inch fell in 20 to 30 minutes in the steep terrain of Paintbrush Canyon. A National Park Service backcountry trail crew working in the canyon reported hearing a rumbling sound before witnessing a large mudslide. The slide washed out multiple sections of the popular Paintbrush Canyon trail. The crew sought higher ground and all were safe, but the slide did destroy some gear and equipment.
Teton	Jackson	22-Dec-11	0	0	$15,000	$0	$15,000	An ice jam on Flat Creek in the southwest part of Jackson caused localized flooding of structures in two areas. The creek was flooded from the Snow King Avenue bridge to High School Road. Several homes had basement and garage flooding near Crabtree Lane and Shelby Lane. Also affected was an automotive repair shop on Berger Lane.
Teton	Jackson Hole	14-May-11	0	0	$500,000	$0	$500,000	Mud and debris began flowing onto US Highway 26/89 near milepost 127 in the Snake River Canyon on Saturday morning, May 14, as a result of rapid snowmelt in the area of Double Draw. The Wyoming Department of Transportation closed the highway late that evening as the massive flow became too much to keep up with. The slide covered the roadway at a rate of a couple of feet each hour. By Monday, May 16, debris covered the road to a depth of more than 40 feet and was well over 100 feet wide. The debris flow, eventually estimated at over 2,000 feet in length, deposited approximately 200,000 cubic yards of debris on the road. More debris slipped over the roadway and down a steep embankment to the Snake River. The flow left a trench 30 feet wide and more than 7 feet deep in the road surface. The thoroughfare was opened on Sunday, May 29, following installation of a large culvert to allow water to flow under the road.

Table 6.2 – Teton County Flood History Data

County	Location	Start Date	Deaths	Injuries	Property Damage	Crop Damage	Total Damage	Information
Teton	Jackson	18-Aug-07	0	0	$20,000	$0	$20,000	Flash flood caused by one inch of rainfall in less than one hour three miles S-SW of Jackson caused street flooding east of Town Square and flooded one basement.
Teton	Hoback Junction	17-Aug-07	0	0	$10,000	$0	$10,000	Heavy rain (1-1.5 inches/hour) caused at least nine mud and rock slides. Closed US191 around Sublette-Teton County line. Guard rail destroyed. Mud 3-5 feet deep.
Teton	Jensen Canyon	26-Jul-07	0	0	$50,000	$0	$50,000	Flash flood from heavy rain in Jensen Canyon closed Fish Creek Road and left at least one man stranded in his house. Road closed to traffic and an Incident Command Center was set up. Earth and debris including trees, boulders, and mud were transported enveloping one house. Private road to the house was washed out and two cars tipped over. Flooding caused by 2-3 inches of rain in three hours.
Teton	Jackson	7-Jul-98	0	0	$0	$0	Unknown	Urban, small stream flood. Localized street flooding. Water one foot deep at some intersections.
Teton	Countywide, Upper Snake River	1-Jun-81	0	0	$290,000	$0	$290,000	One bridge and part of road damaged; levee erosion; dam estimated at $290,000; total damages prevented by local flood protection projects
Teton	Gros Ventre River	18-May-27	6	Unknown	Unknown	Unknown	Unknown	Natural earthen dam formed by earlier slide gave way. Water inundated the town of Kelly and killed six individuals.
Teton	Gros Ventre River	23-Jun-25	0	Unknown	Unknown	Unknown	Unknown	Heavy prolonged rainfall plus snowmelt, river cutting, and saturated soils caused a massive slide that moved an estimated 50 million cubic yards of material. The slide formed a 225-foot high dam across the Gros Ventre River creating a lake behind it.

Note: The National Climatic Data (NOAA, NCDC) does not list any floods in the county between 1950 and 1998.

Table 6.3 Teton County Recorded Ice Jams 2001-2014

Date	Location
12-Dec-2013	Jackson, Flat Creek
13-Dec-2011	Jackson, Flat Creek
2-Dec-2011	Jackson, Cache Creek
2-Dec-2010	Jackson, Flat Creek
5-Dec-2009	Jackson, Cache Creek
10-Dec-2009	Jackson, Flat Creek
22-Dec-2008	Jackson, Flat Creek
13-Dec-2005	Jackson, Flat Creek
16-Dec-2003	Jackson, Cache Creek
31-Oct-2002	Jackson, Cache Creek
8-Dec-2001	Jackson, Flat Creek

Impacts

The flood history above shows that damaging floods occur on average every 10 years in Teton County, and that flood mitigation has helped reduce losses. Dams and levees on the Snake River have largely addressed flooding of the Snake River in the valley bottom. In the Town of Jackson, winter flooding due to frazil ice formation has been an annual problem

Portions of the levee system along the Gros Ventre River have yet to be certified. FEMA has updated levee analysis and mapping protocols, but until such time as FEMA is able to initiate a new flood risk project to apply the new protocols, the flood hazard information on the preliminary FIRM panels that are affected by the Gros Ventre River Levees are a snapshot of the prior effective information presented on the August 5, 2010 FIRMS and FIS. The 2015 FIRM panels and the FIS will need to be revised to update the flood hazard information associated with the Gros Ventre River Levees. The mapping may be revised to reflect additional flood prone areas if the levees can't be certified. Future updates to this plan should revise the discussion of flood risk accordingly.

Flash floods with associated debris flows remain the primary concern in the county. Fortunately, there has been no loss of life or any significant injury caused by floods in the county, with the exception of the Gros Ventre Slide dam failure incident discussed in the Dam Failure section. Little documentation exists on damages from flooding in the county.

Flood of Record for Future Impacts

The June 1, 1981 flood, as the most damaging event recorded, can be considered the flood of record for Teton County. As a result of adjusting the dollar losses to a 2015 equivalent, the damage sum is $784,000, which can be used as an estimate of the expected damages for future major flood events in Teton County. There is potential for larger floods to occur in the region.

Flood Vulnerability Analysis: Maps and Results

The preliminary DFIRM 1% Annual Chance and .2% Annual Chance from the 2014 Risk MAP study are represented on the Flood Hazards map at both the county scale and for the town. Figures 6.1 and 6.2 show the preliminary FEMA floodplain boundary for the County and the Town of Jackson

As part of the 2015 update to this plan a series of analyses were compiled for Teton County to quantify the value of improved structures within the floodplain. Tables 6.4 and 6.5 show the results of the estimated building exposure for the County and Town. These exposure estimates have been grouped by jurisdiction to demonstrate how the risk varies across the county.

According to the analysis, Teton County's exposure to flooding in a 1% annual chance flood exceeds $392 million to 229 properties. The vast majority of this exposure, over $390 million to 217 properties, is in the Unincorporated County.

Table 6.6 shows the estimated population at risk in the 1% and 0.2% annual floods. Values are based on the count of improved residential parcels in the flood zones and use 2010 census data

assumptions of 2.39 persons per household for the Town of Jackson and 2.34 persons per household for the county.

Table 6.4 Estimated Exposure to 1% Annual Chance Flood Zone Summary

Jurisdiction	Property Count	Improved Value	Content Value	Total Exposure Value
Town of Jackson	12	$1,495,989	$747,995	$2,243,984
Unincorporated County	217	$196,646,696	$194,078,455	$390,725,151
Total	**229**	**$198,142,685**	**$194,826,449**	**$392,969,134**

Table 6.5 Estimated Exposure to 0.2% Annual Chance Flood Zone Summary

Jurisdiction	Property Count	Improved Value	Content Value	Total Exposure Value
Town of Jackson	191	$47,960,144	$31,617,551	$79,577,695
Unincorporated County	1,807	$1,398,748,091	$721,813,662	$2,120,561,753
Total	**1,998**	**$1,446,708,235**	**$753,431,213**	**$2,200,139,448**

Table 6.6 Population Exposed to Flooding

	1% Annual Chance		0.2% Annual Chance	
Jurisdiction	**Improved Residential Parcels**	**Population**	**Improved Residential Parcels**	**Population**
Town of Jackson	12	29	154	368
Unincorporated County	183	428	1,706	3,992
Total	**195**	**457**	**1,860**	**4,360**

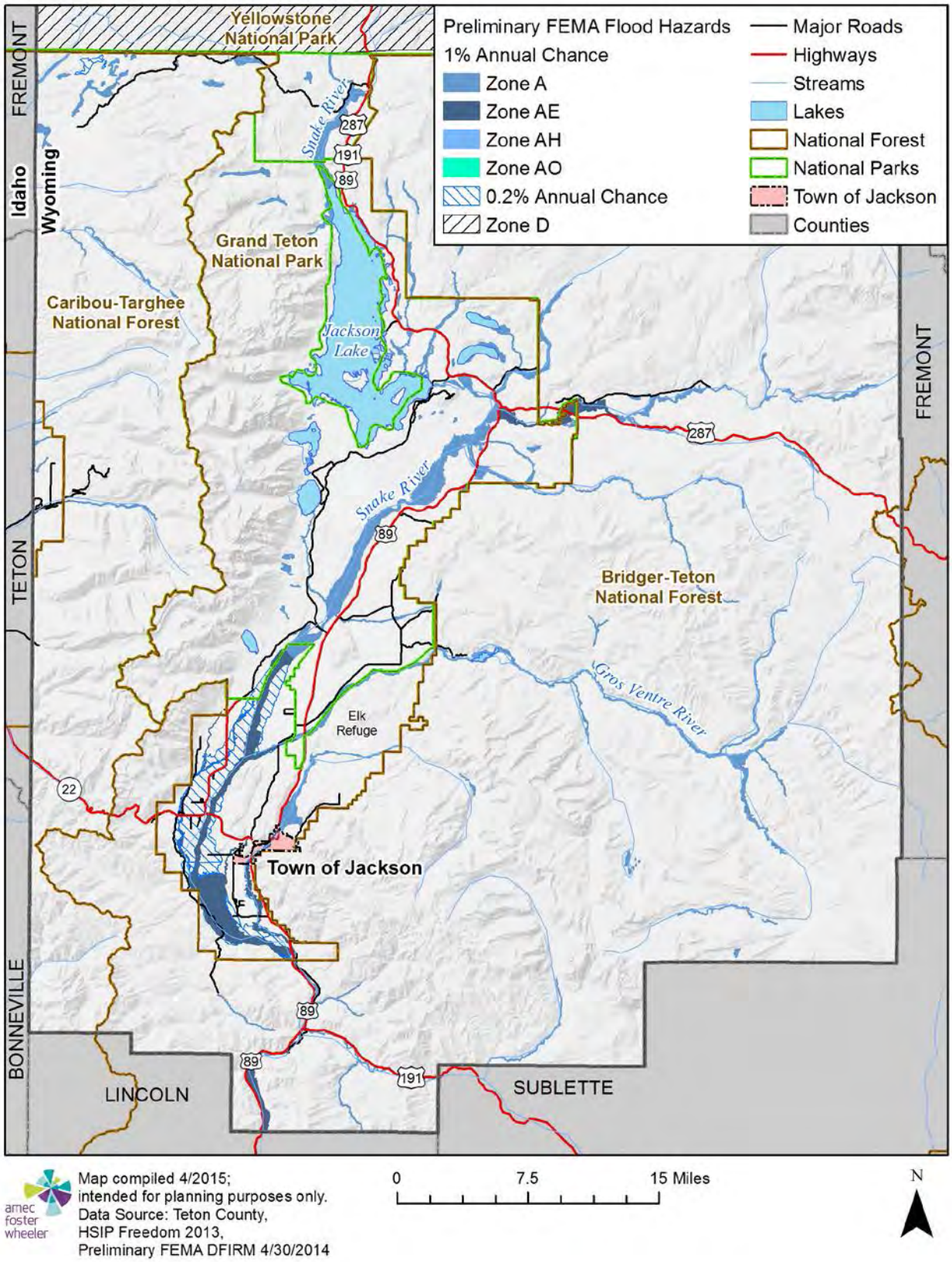
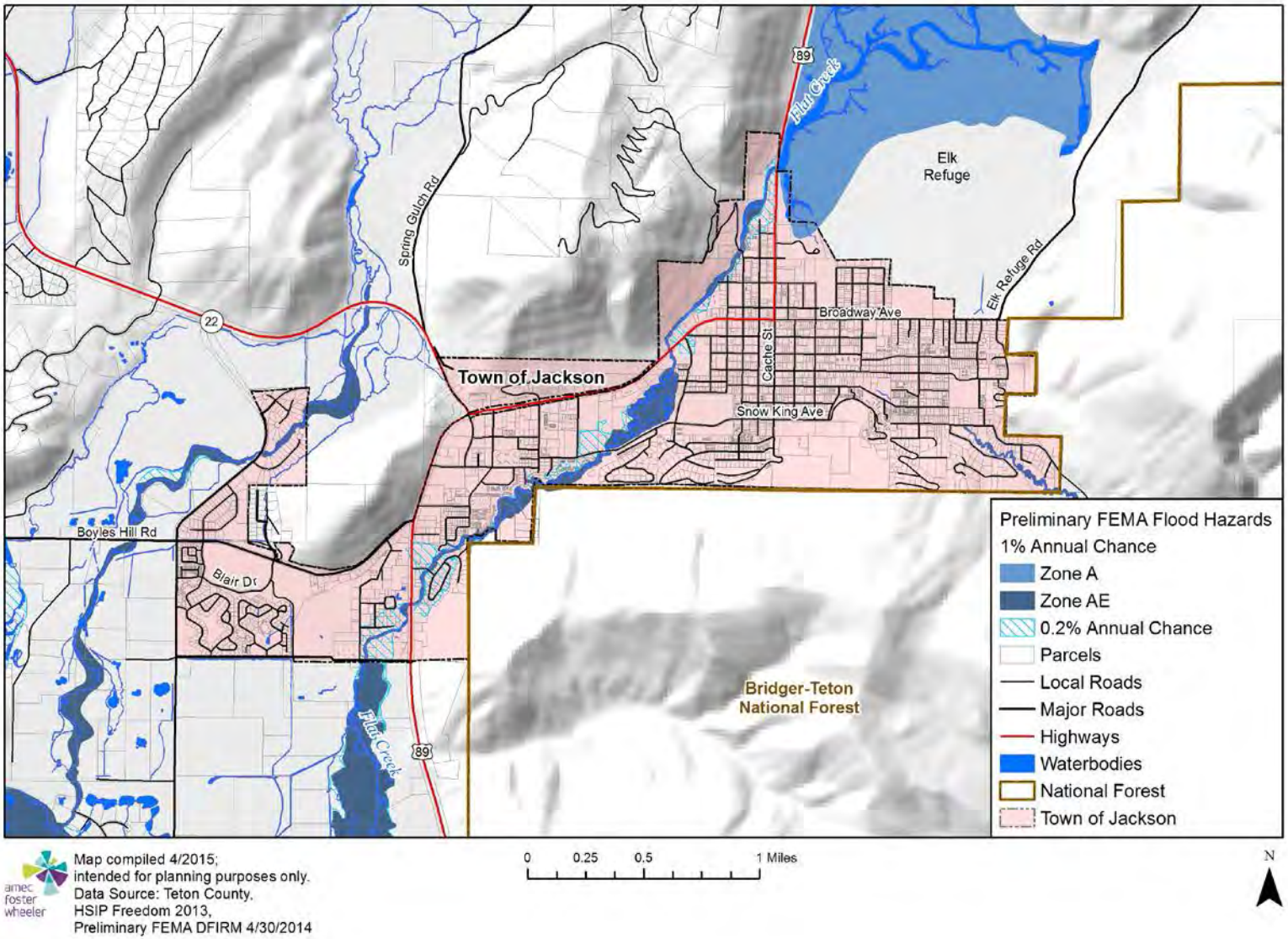


Figure 6.1 Teton County Preliminary FEMA Floodplain



Map compiled 4/2015;
intended for planning purposes only.
Data Source: Teton County,
HSIP Freedom 2013,
Preliminary FEMA DFIRM 4/30/2014

Figure 6.2 Teton County Preliminary FEMA Floodplain – Town of Jackson

Critical Facility Exposure

The FEMA Risk MAP study assessed potential risk to critical facilities. Fire stations, police stations, schools, hospitals, and Emergency Operation Centers (EOCs) were overlaid with the 1% and 0.2% annual chance flood to identify at-risk facilities. Critical facility exposure is included as Areas of Risk and Mitigation Interest in the Database, Map and Viewer. The following schools and fire stations are in the 0.2% annual chance floodplain, as shown in Figure 6.3.

- C-Bar-V Ranch School, 3850 N. Wilderness Dr.
- Journeys School of the Tetons, 2150 Moose Wilson Rd.
- Wilson Elementary, 5200 HHR Ranch Rd.
- Jackson Hole Fire/EMS Station 6 Teton Pines, 2505 N. Moose-Wilson Rd.
- Jackson Hole Fire/EMS Station 2 Wilson, 1315 N. West St.

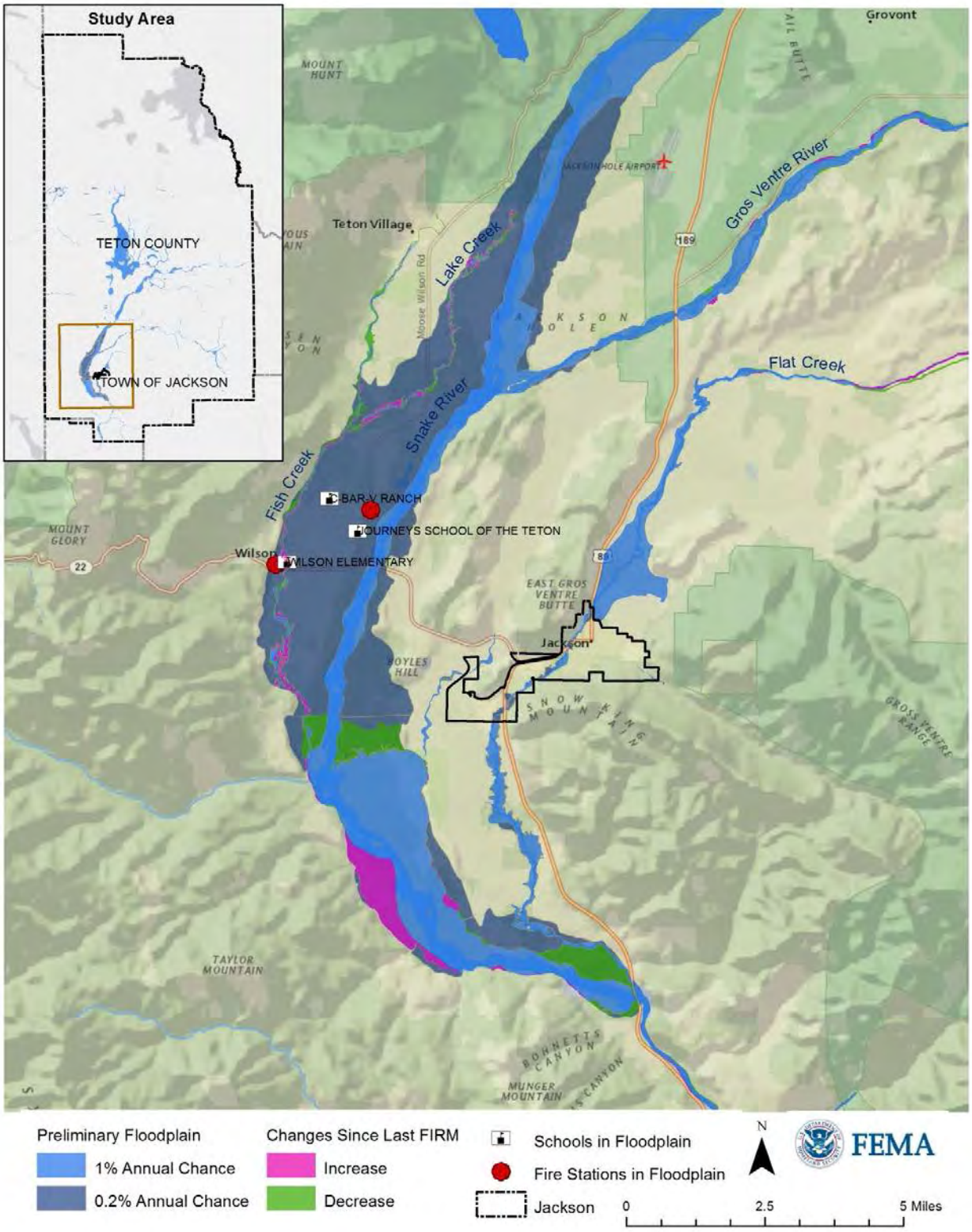


Figure 6.3 Project Area Flood Risk

Source: Flood Risk Report

Table 6.7 Critical Bridges Located in Floodplain

Asset	Waters	Jurisdiction
Cache Creek Drive bridge	Cache Creek	Jackson
Fish Creek Road bridge	Fish Creek	Teton County
Main Street bridge—Wilson	Fish Creek	Teton County
Highway 22 bridge	Fish Creek	State of Wyoming
Highway 89 bridge	Flat Creek	State of Wyoming
High School Road bridge	Flat Creek	State of Wyoming
Bike Trail bridges	Flat Creek	Jackson
Snow king bridge	Flat Creek	Jackson
Highway 189/191 bridges	Hoback River	State of Wyoming
Highway 26/89/191 bridge	Gros Ventre River	State of Wyoming
Spring Gulch Road	Gros Ventre River	Teton County
Teton Valley Ranch Road bridge	Gros Ventre River	Teton County
Highway 22 bridge	Snake River	State of Wyoming
Highway 26/89/191 bridges (4)	Snake River	State of Wyoming
Moose-Wilson Road bridge	Snake River	Teton County
Moose Junction bridge	Snake River	National Park Service
Highway 26/287 bridge	Snake River	State of Wyoming

The Flood Risk Report states the Cattleman's Bridge at Spring Gulch Road is undersized, creating frequent flooding of the Gros Ventre River just upstream of the bridge. There are commercial structures currently in the floodplain in this area and residential structures less than 400 feet from the floodplain boundary.

In addition to the transportation infrastructure, the wastewater treatment ponds for Jackson are located within Shaded Zone X (0.2% annual chance zone) of the Snake River.

Flood Loss Estimation

The preliminary Flood Risk Report provides expected flood losses based on Hazus and the current DFIRM. The 1- percent annual chance loss estimates were derived using Hazus v2.2 with a flood depth grid from a nationwide FEMA Level 1 study and updated dasymetric inventory data. Hazus census blocks containing inventory data have been clipped to areas known to be urbanized in order to increase the accuracy of the building loss estimation. Loss estimates include business disruption loss and building and content loss for residential, commercial, and other building occupancy types. Dollar losses at the census block level are included in Flood Risk Database in thousands of dollars.

Total potential losses to the 1% annual chance flood event for Teton County and the Town of Jackson are shown in Table 6.8, Hazus-Generated Flood Loss Estimates. Highest loss occurs in northern and western Jackson along Flat Creek and at the convergence of the Gros Ventre and Snake River.

Table 6.8 Hazus-Generated Flood Loss Estimates

Teton County (Unincorporated)	Town of Jackson
$54.7 million	$36.4 million

Future Impacts

Small floods are likely to occur in Teton County, mostly in the unincorporated areas, and the Town of Jackson does experience recurring flood problems from frazil-ice. The result of the exposure analysis summarizes the values of properties at risk in the floodplain. Based on the Flood Risk Report HAZUS analysis, Teton County has potential for $91 million in possible flood losses. When a flood does occur, the event seldom causes total destruction.

Future Development

Future development at risk for flooding is not anticipated in the town limits. Future development at risk for flooding is not anticipated in the unincorporated areas of the county because of the floodplain permitting process. The Town of Jackson and unincorporated areas of Teton County have ordinances regulating development in and around floodplain areas. The town and county floodplain administrators share information and work together as needed.

Summary

PROPERTY AFFECTED: High
POPULATION AFFECTED: Low
PROBABILITY: Low
JURISDICTION AFFECTED: Jackson, unincorporated areas of the county

Chapter 7. Hail

According to the National Climatic Data Center, a significant hail event is any that includes and frozen precipitation ¾ inch or larger in diameter. Any hail event that includes property damage, crop damage or casualties also falls under this definition.

Hail causes more than a billion dollars of property damage nationally each year, mostly to crops. The southeast corner of Wyoming lies within the nation's "Hail Alley". While Teton County is not in "Hail Alley", damaging hail storms have still occurred.

History

There have been three damaging hail storms in Teton since 1959, which equates to a damaging hail storm about every 15 years. Table 7.1 presents a history of documented, damaging hail storms. The data were derived from the monthly Storm Data reports generated and released by the National Oceanic and Atmospheric Administration's National Climate Center. Other sources include unpublished reports from the Wyoming Office of Homeland Security, newspaper accounts, and periodicals from public libraries. The table represents hail storms that have caused damage, injuries, or loss of life, plus more recent storms without documented damage. Fortunately, there has been no documented loss of life caused by hail in Teton County.

Table 7.1 - Damaging Hail Storms

County	Location	Start Date	Deaths	Injured	Estimated Damage Property	Estimated Damage Crops	Character of Storm	Information
Teton	Jackson	15-Aug-60			$27,500	$27,500	Hail	
Park and Teton	Yellowstone Park	20-Jun-77	0	0	$275,000	$0	Hail	Hail up to 1.25 inches diameter and up to 4 inches deep in the Hayden Valley area caused damage to campers, trailers, tents, etc.
Teton	Teton Village	21-Jul-87	0	0	$27,500	$0	Hail	Some unusually severe thunderstorms swarmed over northwest Wyoming during the afternoon. One of the first indications of these severe thunderstorms was the 60 MPH wind gusts reported by a radio station in Jackson at 1300 MST. As these severe thunderstorms moved northeast additional reports of hail between 1 and 2.25 inches in diameter were observed along with winds gusting above 58 MPH. Also, torrential rains were noted from Jackson northeast to Cody. When these severe thunderstorms moved northeast of Jackson over the Teton Wilderness Area it spawned the highest elevation F4 tornado ever documented. The devastating winds from the tornado produced a massive blow down of 15,000 acres of mostly mature lodge pole pines which ranged from 80 to 100 feet tall. The massive blow down stretched slightly over 24 miles from Box Creek Trailhead, 10 miles east-northeast of Moran Junction, on the south to beyond the Yellowstone River on the north and was about 1 to 2 miles wide, 2.5 miles at the widest. An eyewitness to the blow down stated, "You could look up a hillside where there had been a dense forest and count the trees left standing." Later, as these severe thunderstorms moved over the East Entrance of Yellowstone National Park, torrential rains produced mudslides which closed highways for a few hours. The Park County sheriff reported that some of these mudslides buried about 50 yards of highway to a depth of 2 feet.

Table 7.1 - Damaging Hail Storms (cont.)

County	Location	Start Date	Deaths	Injured	Estimated Damage Property	Estimated Damage Crops	Character of Storm	Information
Teton	Jackson	14-Jun-06	0	0	Unknown	0	Hail	Golf-ball size hail fell on Jackson. Damaged numerous cars, ripped tree limbs and leaves. Blocked storm drains causing minor flooding.
Teton	Jackson	5-Aug-07	0	0	0	0	Thunder-storm with hail	Thunderstorm produced 1-inch diameter hail in Jackson. No reported damages.
Teton	Jackson	18-Aug-07	0	0	0	0	Hail	Hail fell on South Park area for 10 minutes. No damages reported.
Teton	Teton Village	1-Jul-08	0	0	0	0	Thunder-storm with hail	A lone thunderstorm over Teton County produced large hail. Hail of 1 inch in diameter fell near Teton Village. No damages reported.
Teton	Alta	1-Jul-08	0	0	0	0	Thunder-storm with hail	A lone thunderstorm over Teton County produced large hail. Nickel-sized hail was recorded by a cooperative observer near Alta. No damages reported.
Teton	Jenny Lake	22-Jul-08	0	1	0	0	Thunder-storm with hail	Afternoon and evening thunderstorms dropped nickel to quarter-sized hail at Jenny Lake in Grand Teton National Park. One person received lacerations, and several people had welts.
Teton	Moran	6-Aug-08	0	0	0	0	Thunder-storm with hail	Nickel-sized hail and wind gusts approaching 50 mph were reported..

Table 7.1 - Damaging Hail Storms (cont.)

County	Location	Start Date	Deaths	Injured	Estimated Damage Property	Estimated Damage Crops	Character of Storm	Information
Teton	Yellowstone – South Entrance	9-Aug-08	0	0	0	0	Thunder-storm with hail	Severe thunderstorms developed over higher terrain and tracked over the adjacent valleys. National Park Service estimated penny-sized hail at the South Entrance of Yellowstone National Park.
Teton	Wilson	12-Jun-13	0	0	0	0	Thunder-storm with hail	Pea-sized to nickel-sized hail reported.
Teton	Moose	7-Jul-13	0	0	0	0	Thunder-storm with hail	Nickel-sized hail reported.
Teton	Jackson	7-Jul-13	0	0	0	0	Thunder-storm with hail	Penny to nickel-sized hail reported.
Teton	Colter Bay Village	31-May-14	0	0	0	0	Hail	Nickel to quarter-sized hail reported.
		TOTAL	**0**	**1**	**$330,000**	**$27,500**		

Impacts

Hail storms have occurred in every county in Wyoming, although damage caused by hail has only occurred in twenty-one of Wyoming's twenty-three counties. Sublette and Uinta counties have no recorded hail damage. Figure 7.1 below shows the distribution of the number of hail storms, number of deaths and injuries, and amount of crop and property damage in reported dollars. The total documented hail damage for Teton County is $82,500 in year of damage dollars and $491,675 in 2015 dollars.

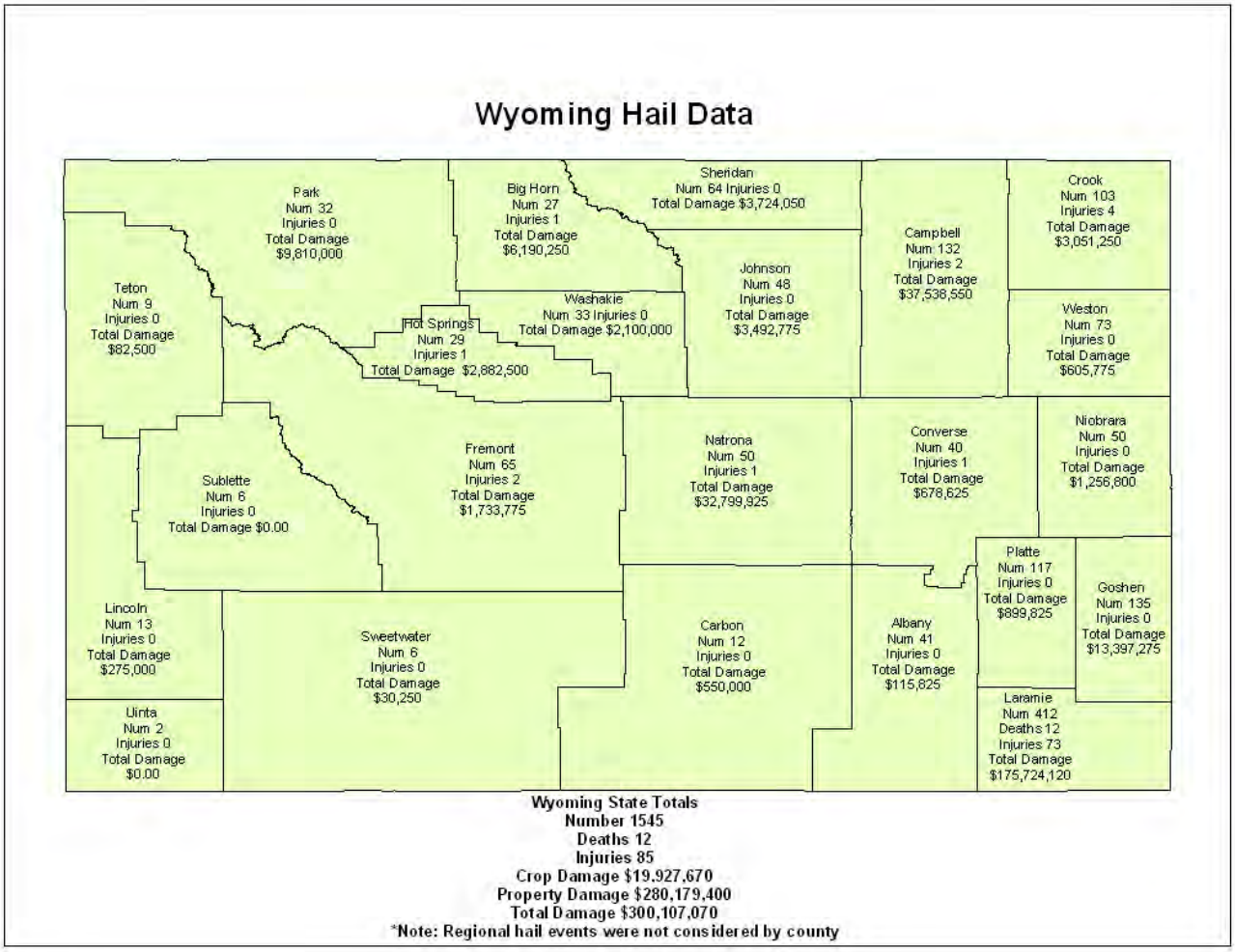


Figure 7.1 - Hail Damages by County

Table 7.2 - Hail Damage (2015 Dollars)

County	Hail Dollar Damage: 2015 Dollars
Teton	$491,675
State total	$695,483,470

Future Impacts

Teton County, based on past events, will continue to occasionally experience damaging events, based on a recurrence interval of every 15 years. Based on the past documented storm damage (August 15, 1960 - $55,000) converted to 2015 dollars, it is suggested that $438,735, at a minimum, be used as the potential cost of the worst-case future hail storm in Teton County. Future hail storms could impact private and public property such as cars, roofs, equipment, buildings, hay crops, and livestock.

Summary

PROPERTY AFFECTED: Medium
POPULATION AFFECTED: Medium
PROBABILITY: Low
JURISDICTION AFFECTED: All

Chapter 8. Hazardous Materials

For the purposes of this assessment, a hazardous material is defined as a substance or combination of substances which because of its quantity, concentration, or physical, chemical or infectious characteristics, may either (1) cause, or significantly contribute to, an increase in mortality or an increase in serious, irreversible, or incapacitating reversible, illness; or (2) pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported, disposed of or otherwise managed.

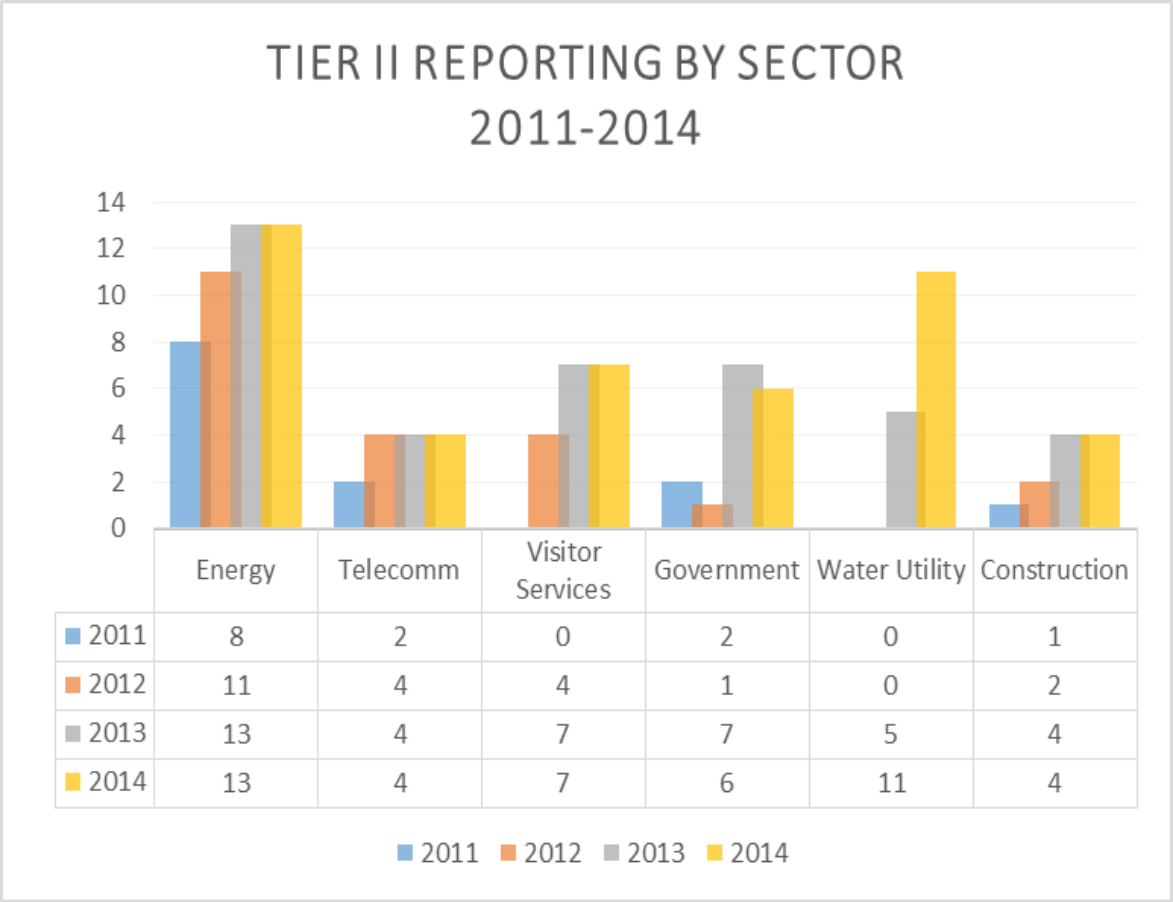
The U.S. Department of Transportation (U.S. DOT) regulates hazardous materials that are transported for commerce. The U.S. Environmental Protection Agency (U.S. EPA) regulates hazardous materials that have the potential to be released through fixed facilities. The Occupational Safety and Health Administration (OSHA), regulates the storage and use of toxic and hazardous substances as they relate to worker health and safety.

EPCRA

The Emergency Planning and Community Right-to-Know Act (EPCRA) requires certain regulated entities to report information about hazardous chemicals and substances at their facilities to federal, state, and local authorities. The objective is to improve the facilities, or government agency's ability to plan for and respond to chemical emergencies, and to give citizens information about chemicals present in their communities. EPCRA mandates the creation of two organizations - a State Emergency Response Commission (SERC) for each state, and Local Emergency Planning Committees (LEPC) at the local level. In Wyoming, each county is designated as an LEPC. EPCRA requires facilities to submit material safety data sheets and Tier II forms (lists of hazardous chemicals on-site above threshold quantities) to the SERCs, the LEPC, and local fire departments on an annual basis for use in emergency response planning.

Hazardous Materials in Teton County

The Teton County LEPC switched to an electronic database system for Tier II reporting in 2011. The county targeted a Tier II reporting awareness campaign toward government agencies that were non-compliant in 2013, and in 2014 the LEPC focused its awareness campaign on water treatment facilities storing chlorine. The LEPC has seen a noticeable rise in facility reporting since as these campaigns have been rolled out. In 2014, the Teton County LEPC received Tier II reports for 45 separate facilities. The facilities fall under six major sectors – energy, telecommunications, visitor services, government, water utility and construction. As evidenced by the table below, energy has the highest number of reporting facilities in Teton County.

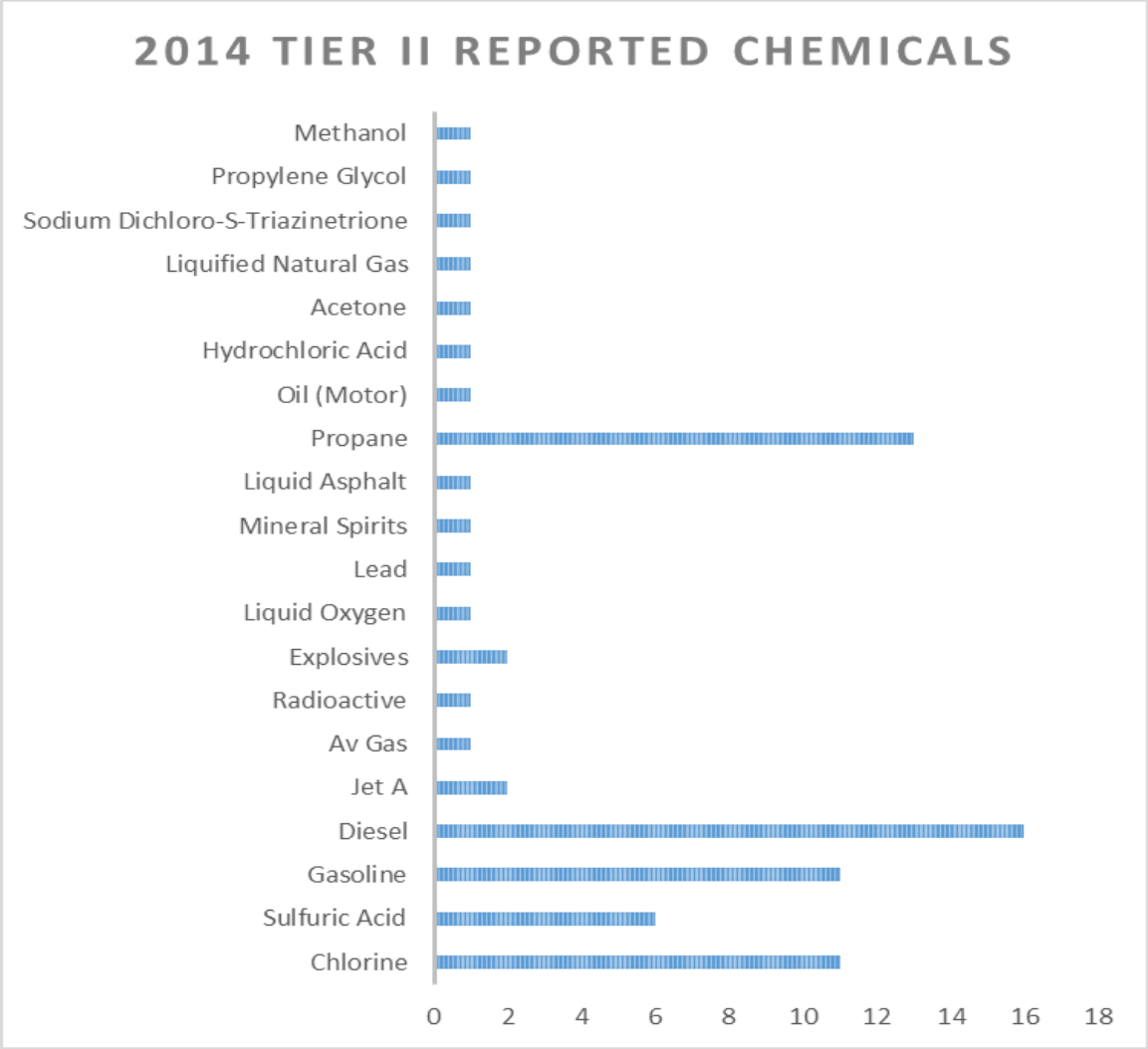


	Energy	Telecomm	Visitor Services	Government	Water Utility	Construction
2011	8	2	0	2	0	1
2012	11	4	4	1	0	2
2013	13	4	7	7	5	4
2014	13	4	7	6	11	4

Source: Teton County LEPC

Figure 8.1 – Tier II Reporting by Sector
Teton County 2011 - 2014

In 2014, at least 20 different chemicals were reported under Tier II reporting to the Teton County LEPC:



Source: Teton County LEPC

Figure 8.2 - 2014 Tier II Reported Chemicals

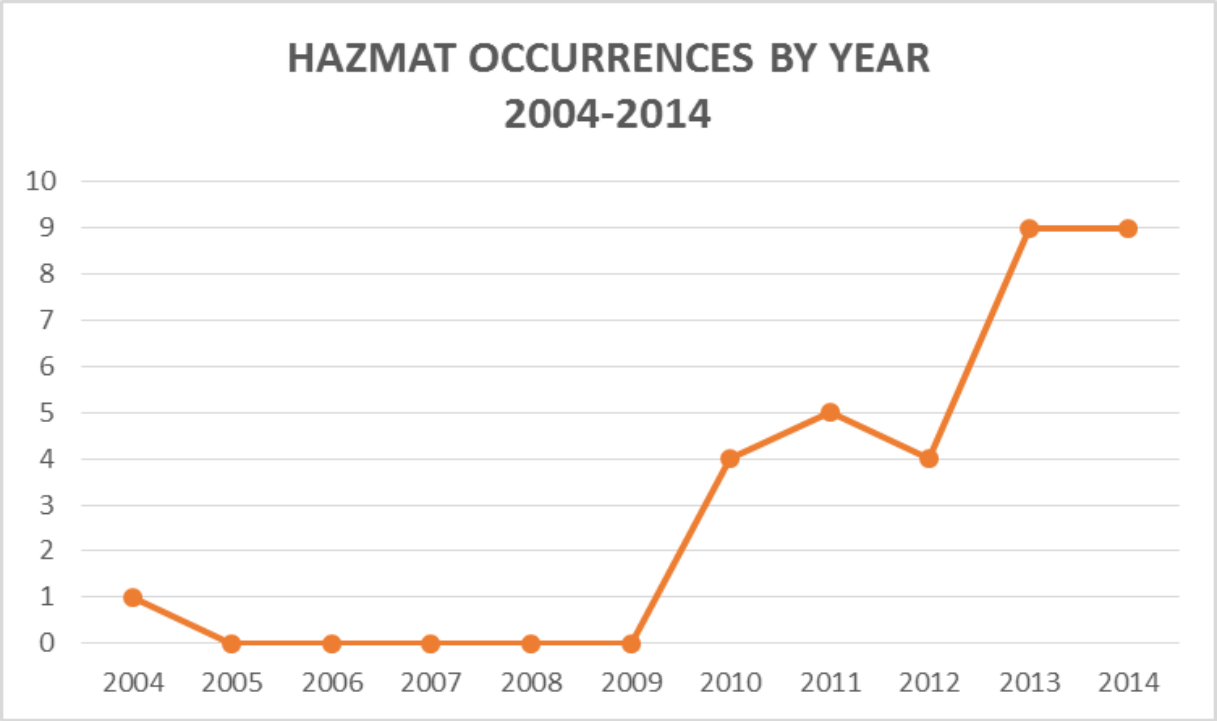
Currently, there are no Risk Management Plan facilities present in Teton County, and only two types of Extremely Hazardous Substances (EHSs) reported, which are Chlorine and Sulfuric Acid.

Teton County does not have designated hazardous materials routes. With the limited access to the county, a large hazardous materials incident on any ingress route could have a significant negative economic and life safety impact. It is not generally known when hazardous materials are passing through the county, or what the hazardous materials are.

Teton County receives hazardous materials incident response from a resident Regional Emergency Response Team, specifically RERT 8, and also provides coverage for Yellowstone National Park.

According to the Teton County LEPC, hazardous materials accidents involving the release of chlorine are by far the biggest threat, with potential to impact large areas of the county. Vulnerable facilities to a chlorine threat include other Tier II facilities, electrical substations, water systems, ranger stations, emergency operations centers, law enforcement facilities, fire stations, medical facilities, adult care facilities, juvenile facilities, childcare facilities and schools.

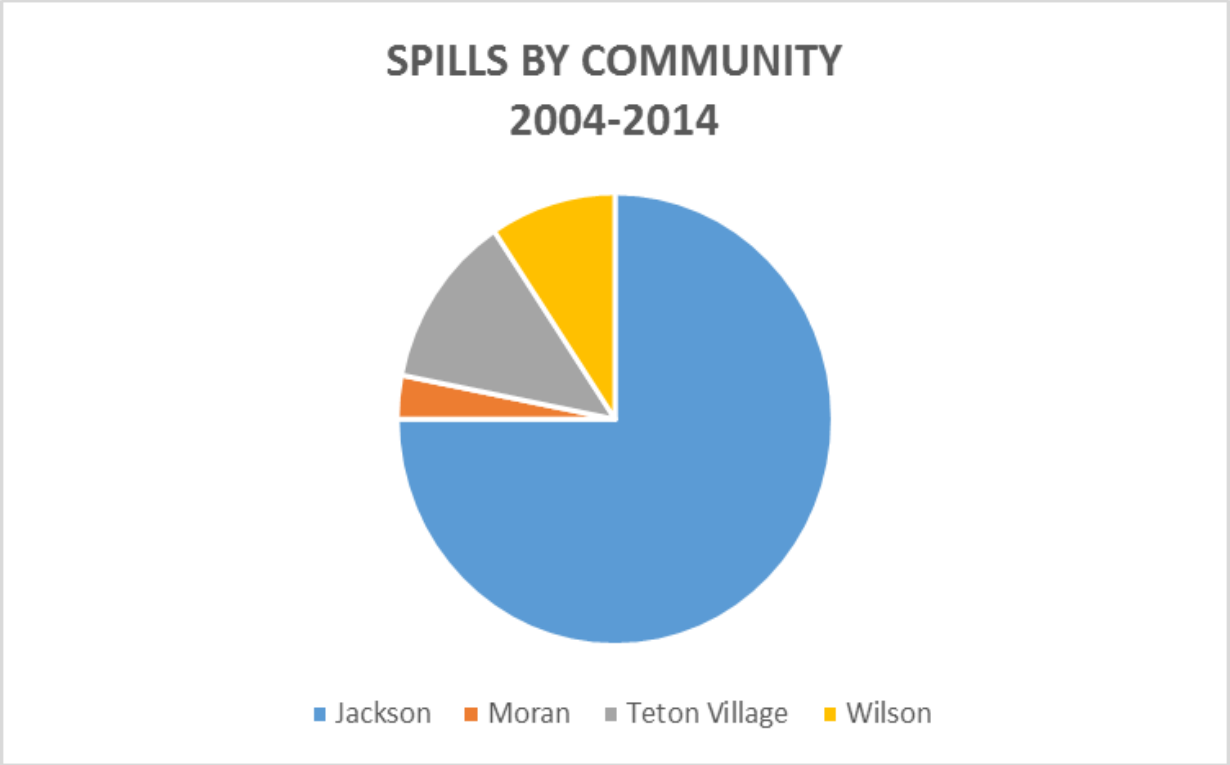
History



Source: Amec Foster Wheeler based on Teton County Data

Figure 8.3 - Hazmat Occurrences by Year 2004 - 2014

Data provided by Teton County Emergency Management shows that there were 32 total hazardous materials incident responses between 2004 and 2014, with the vast majority occurring between 2010 and 2014, with a general upward trend in the number of incidents per year. All of these incidents reported involved either natural gas (13 incidents) or propane (19 incidents). The incidents occurred in 4 different communities in the county – Jackson (24), Moran (1), Teton Village (4) and Wilson (3), with the majority occurring in Jackson.



Source: Amec Foster Wheeler based on Teton County Data

Figure 8.4 – Total Spills by Community, Teton County 2004 – 2014

Table 8.1 – Hazardous Materials Incidents, Teton County 2004 - 2014

YEAR	COMMUNITY	CHEMICAL
2004	Jackson	Propane
2010	Jackson	Natural Gas
2010	Jackson	Natural Gas
2010	Jackson	Natural Gas
2010	Jackson	Propane
2011	Moran	Propane
2011	Jackson	Natural Gas
2011	Jackson	Propane
2011	Jackson	Natural Gas
2011	Jackson	Propane
2012	Jackson	Natural Gas
2012	Teton Village	Propane
2012	Teton Village	Propane
2012	Wilson	Propane
2013	Jackson	Propane
2013	Wilson	Propane
2013	Jackson	Propane
2013	Jackson	Propane
2013	Jackson	Natural Gas
2013	Jackson	Natural Gas
2013	Wilson	Propane
2013	Jackson	Natural Gas
2014	Jackson	Natural Gas
2014	Jackson	Propane
2014	Teton Village	Propane
2014	Jackson	Natural Gas
2014	Jackson	Natural Gas
2014	Jackson	Natural Gas
2014	Jackson	Propane
2014	Jackson	Propane
2014	Teton Village	Propane

Source: Teton County Emergency Management

Impacts

Depending on the chemical spilled and the specifics of the incident, hazardous materials incidents can have many impacts, including roadway closures, evacuations/shelter in place orders, injuries, fatalities and long-term health impacts, damage to buildings, homes and other property. These impacts are not unprecedented in Teton County; four incidents between 2004 and 2014 required the evacuation of several hotels, two required road closures and one resulted in injury to a first responder at the scene.

Data on response and cleanup costs for hazardous materials incidents in Teton County is not readily available. It is estimated that the costs of cleaning up a serious spill could be many tens of thousands of dollars.

Future Impacts

Some sort of hazardous materials incident occurs almost every year in Teton County, and there is no reason to believe that the county won't continue to experience hazardous material spills into the future. Data provided by Teton County Emergency Management shows an upward trend in hazardous materials incidents over the past

Summary

PROPERTY AFFECTED:	Low
POPULATION AFFECTED:	Medium
PROBABILITY:	Medium
JURISDICTION AFFECTED:	Jackson and County

Chapter 9. Landslides

Landslides are one of the most common geologic hazards in Wyoming, with some of the highest landslide densities in the country found in the State. The figure below shows mapped landslides in Wyoming.

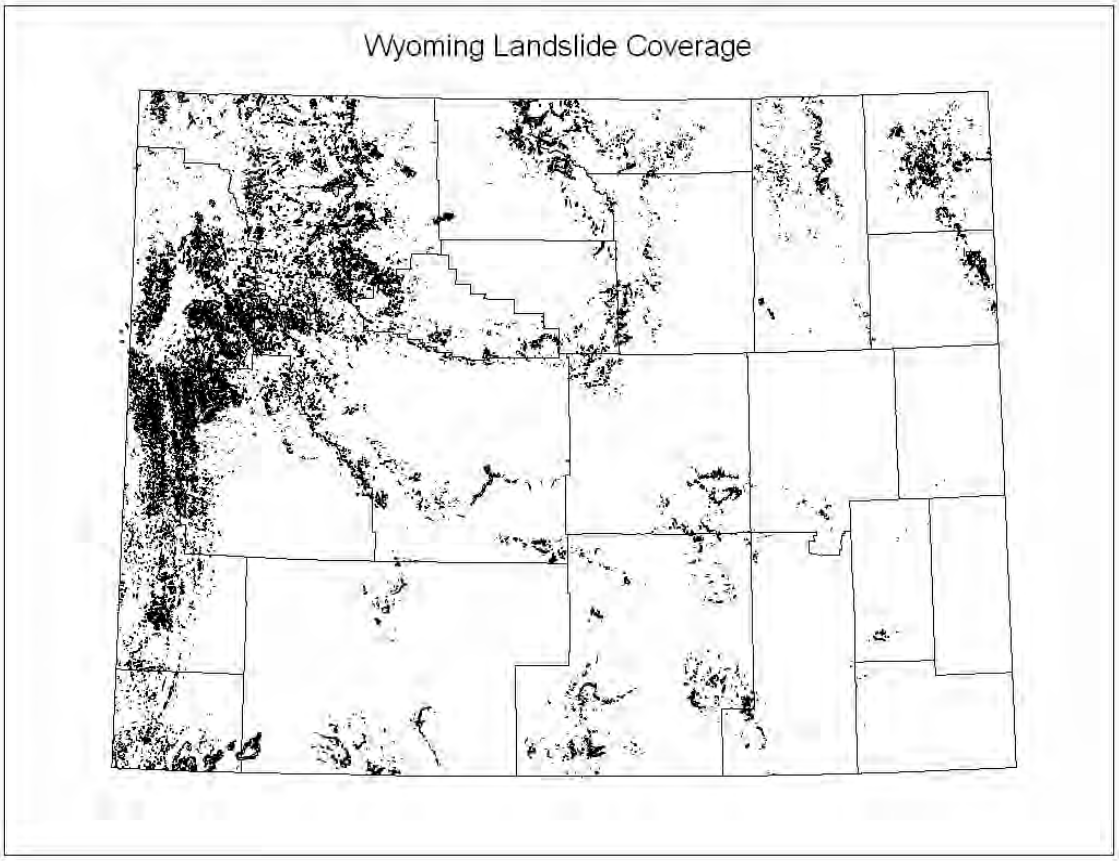


Figure 9.1. Mapped Landslides in Wyoming

There are many types of landslides present in Wyoming. In order to properly describe landslide type, the Geologic Hazards Section developed a landslide classification modified from Varnes (1978) and Campbell (1985). As can be seen in Figure 9.2 there are five basic types of landslides that occur in three types of material. Falls, topples, slides, lateral spreads, and flows can occur in bedrock, debris, or earth. While individual landslide types can occur in nature, most landslides are complex, or composed of combinations of basic types of landslides.

Falls and topples are easy to visualize. In a fall, material detached form a steep slope or cliff descends through the air, and may bounce and roll. In a topple, a mass rotates forward on a pivot point. If a toppling mass pivots far enough, a fall may result.

Slides are characterized by shear displacement along one or several surfaces. Two general types of slides are recognized: rotational and translational. In a rotational slide, the surface of rupture is concave upward, and the mass rotates along the concave shear surface. Rotational slides are usually called slumps, and they can occur in bedrock,

debris, or earth. In a translational slide, the surface of rupture is a planar or gently undulatory surface. In bedrock and earth, translational slides are usually called block slides if an intact mass slides down the slope. If rock fragments or debris slide down a slope on a distinct shear plane, the movements are called rock slides or debris slides. It is easy to see that confusion can result by applying the term “slide” to all types of landslides.

Lateral spreads are characterized by lateral extension movements in a fractured mass. Lateral spread movements may occur in bedrock and soil as a result of liquefaction or plastic flow of subjacent materials, or in bedrock without a well-defined basal shear surface or zone of plastic flow. Lateral spreads in bedrock without a well-defined zone of shearing or flow, usually occur on ridge crests.

In general, a flow is a moving mass that has differential internal movements that are distributed throughout the mass. While most flows occur in debris and earth, one type of flow, gravitational sagging, does occur in bedrock. Flows in debris and earth can be cohesive or non-cohesive. Both cohesive and non-cohesive flows are further subdivided by water content and material properties.

Cohesive flows in debris include soil creep, solifluction, block streams, talus flows, and rock glaciers. Soil creep is an imperceptibly slow deformation that continues under constant stress. Solifluction is a slow flow in soil that is often observed in areas with perennially or permanently frozen ground. Block streams are slow moving tongues or rocky debris on steep slopes, and are often fed by talus cones. Talus flows are slow flows that occur in the basal portions of talus slopes. Rock glaciers are not true landslides, but have been included in the classification scheme because they are mass movements composed of coarse debris. Interstitial ice between debris fragments plays a role in the movement of rock glaciers, which are similar in form to a true glacier.

Cohesive flows in earth include soil creep, solifluction, earth flows, and debris laden earth flows. Soil creep and solifluction in earth are similar to those in debris. Earth flows are very slow compared to rapid flows that have a distinct source area, a main flow track, and a lobate depositional area. Debris laden earth flows are flows that appear to be earth flows but are composed of debris. Standard classifications do not recognize debris laden earth flows, but many have been observed in Wyoming. Many of the landslides present in Wyoming have an earth flow component.

Non-cohesive flows in debris include rock fragment flows and debris flows. Rock fragment flows are extremely rapid flows composed of dry to moist rock debris. This type of flow can be initiated by a rock fall, by seismic activity, or by other processes. In some cases, it appears that rock debris has moved on a cushion of air, although other mechanisms may have dominated the process. Rock fragment flows can cause significant destruction in a short period of time. Debris flows are a slurry flow composed of debris and a significant amount of water. They are usually associated with unusually heavy precipitation or with rapid snowmelt. Debris flows commonly follow preexisting drainage ways, and commonly form debris levees along their main flow track.

Debris flows are a significant component of alluvial fans in mountainous areas with the main debris flow deposit having a broad, fairly flat, fan shape. Debris flows are very common in the mountainous areas of Wyoming. Non-cohesive flows in earth include loess flows, dry sand flows, wet sand flows, rapid earth flows, and mud flows. Loess flows and

dry sand flows are rapid to very rapid flows of dry material. Loess flows are usually initiated by seismic activity, and are a fluid suspension of silt in air. Fortunately, none have yet been identified in Wyoming. Dry sand flows usually occur along shorelines or in Aeolian deposits. In Wyoming, most dry sand flows are very small. Wet sand flows occur along river banks or shorelines composed of saturated clean sand. The destabilized sand usually flows into an adjacent body of water. Wet sand flows are not common in Wyoming. Rapid earth flows, also called quick clay flows, are very rapid flows that involve the liquefaction of subjacent material and the entire slide mass. They usually initiate in sensitive materials, such as quick clay, and are not common in Wyoming. Mud flows are slurry flows composed of earth and a significant amount of water. They differ from debris flows only in the size of their component materials.

Most landslides mapped in Wyoming are classified as being complex. For example, many landslides in the state are slump/earth flow complexes. That type of landslide is composed of a slump at its head, with the main body and deposit being an earth flow. Block slides often grade into rock slides, which can further grade into earth flows or debris laden earth flows. Such a movement would be classified as a block slide/rock slide/flow complex.

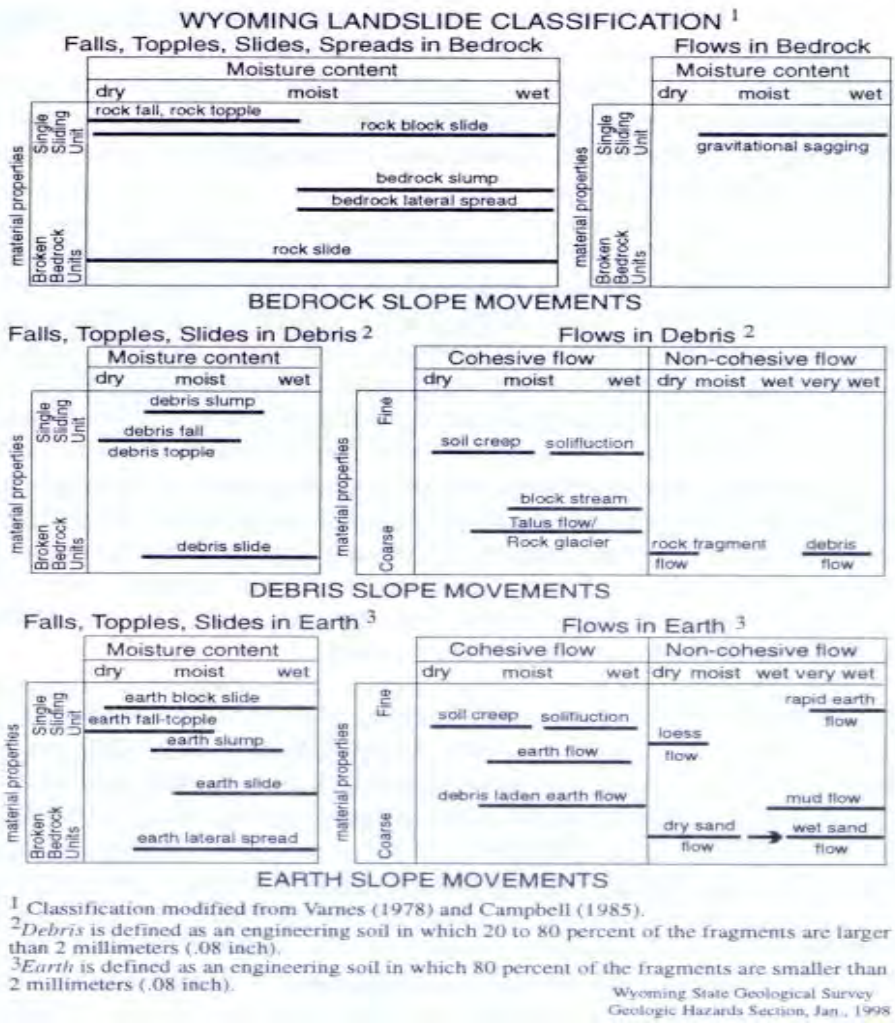


Figure 9.2 Wyoming Landslide Classification

Landslide History and Distribution

Numerous landslides are present in Teton County. Specifically, landslides are present on the following quadrangles:

Angle Mountain
Bailey Lake
Blue Miner Lake
Bull Creek
Burnt Mountain
Cache Creek
Camp Davis
Cave Falls
Clause Peak
Colter Bay
Crater Lake
Crystal Peak
Darwin Peak
Davis Hill
Doubletop Peak
Driggs
Grand Teton
Granite Basin

Granite Falls
Gravel Mountain
Green Mountain
Grizzly Lake
Gros Ventre Junction
Hominy Peak
Huckleberry Mountain (15')
Jackson
Jenny Lake
Joy Peak
Lava Mountain
Mc Renolds Reservoir
Moose
Moran
Mosquito Lake
Mount Baird
Mount Bannon
Mount Hancock (15')
Mount Leidy
Mount Moran
Munger Mountain
Observation Peak
Ouzel Falls
Palisades Peak
Pine Creek
Rammel Mountain
Ranger Peak
Rendezvous Peak
Rosies Ridge
Shadow Mountain
Sheridan Pass
Survey Peak
Teton Pass
Teton Village
Togwotee Pass
Tripod Peak
Turquoise Lake
Two Ocean Lake
Two Ocean Pass (15')
Upper Slide Lake
Victor
Warm River Butte (15')
Whetstone Mountain

The Wyoming State Geological Survey examined all quadrangles, and the following areas were determined to pose a potential hazard to homes, roads, or other facilities.

Angle Mountain Quadrangle: U.S. Highway 26/287 passes by or through several landslides, including blockslide/rockslide/flow, alluvial fan/debris flow, debris flow/flow, and slump/flow complexes. If these landslides destabilize, damage could occur to the highway. Secondary roads off the highway are also at risk of being damaged if the nearby slump/flow, rockslide/flow, flow, and blockslide/flow complexes destabilize. Buffalo Fork River, South Buffalo Fork River, Black Rock Creek, and the North Fork Spread Creek could be dammed by the, slump/flow, blockslide/flow, blockslide/ rockslide/flow, rockslide/flow, blockslide/rockslide/ flow/debris flow, or debris flow/Quaternary alluvium complexes that are present on the south side of the rivers. Heavy periods of precipitation or significant development could have an effect on slope stability.

Blue Miner Lake Quadrangle: Flat Creek could potentially be dammed by the debris flow/alluvial fan, debris flow/talus flow, rockslide/flow, debris flow/flow, blockslide/rockslide/flow/Quaternary terrace, and talus flow/flow/debris flow complexes that are present along the creek. In addition, Flat Creek Ranch is located on a talus flow/flow/debris flow complex. If this landslide destabilizes, damage could occur to ranch structures. Heavy periods of precipitation or significant development could have an effect on slope stability.

Bull Creek Quadrangle: U.S. Highway 187/189 passes through several landslides in the southwestern portion of the quadrangle. If these landslides (which include rockslide/Quaternary terrace, Quaternary terrace/rockslide/debris flow, rockslide/flow, rockslide/debris flow, blockslide/slump/flow, rockslide/debris flow/alluvial fan, and rockslide/flow/debris flow complexes) destabilize, damage could occur to the highway, either directly or by flooding if the landslides dam the Hoback River. Although the southeast corner of the quadrangle is in Sublette County, landslide dams or a damaged/destroyed highway in that area would have a significant impact on Teton County. Hoback Campground structures could also be damaged if the landslides in this

area destabilize. In addition, the secondary road in the east-central portion of the quadrangle could be damaged if the nearby debris flow/surface wash, debris flow/Quaternary alluvium, rockslide/flow, or debris flow/alluvial fan complexes reactivate. Finally, Bull Creek, Granite Creek, and Little Granite Creek could be dammed if any of the landslides along the creeks destabilize. This could damage structures near Little Granite Creek in T39N R114W Section 27. Heavy periods of precipitation or significant development could have an effect on slope stability.

Cache Creek Quadrangle: Flow, slump/flow, and colluvium/rockslide/flow complexes are present in the northwestern corner of the quadrangle near the town of Jackson (T41N R116W Sections 34 and 35). If these landslides destabilize, damage could occur to structures and roads in Jackson, some of which have been built on top of these landslides. Cache Creek could also be dammed if the colluvium`/rockslide/flow, rockslide/slump/flow, blockslide/rockslide/flow, rockslide/flow, or debris flow/alluvial fan landslide complexes located along the creek reactivate. A rupture of a landslide dam could, in turn, cause flooding in Jackson. Several landslides, including slump/flows, flow, and blockslides are present in the southwestern corner of the quadrangle (T40N R116W Section 34; T39N R116W Section 3). If these landslides reactivate, damage could occur to U.S. Highway 26/89 or the secondary road, either directly or by flooding if the landslides dam the Snake River. Heavy periods of precipitation or significant development could have an effect on slope stability.

Camp Davis Quadrangle: Numerous landslides are present on this quadrangle. If any of the landslides along U.S. Highway 26/89 or U.S. Highway 187/189 destabilize, damage could occur to the highways, secondary roads, and structures along the highways, either directly or by flooding if the landslides dam the Hoback or Snake Rivers. A large blockslide/slump/flow complex is located in the southeastern corner of the quadrangle. If this landslide destabilizes, damage could occur to Camp Davis (T38N R115W Section 5), nearby structures, and nearby secondary roads. Heavy periods of precipitation or significant development could have an effect on slope stability.

Colter Bay Quadrangle: A slump/flow complex is present in the northern portion of the quadrangle. U.S. Highway 89/287 passes through this landslide. If the landslide were to reactivate, damage could occur to the highway. Heavy periods of precipitation or significant development could have an effect on slope stability.

Crystal Peak Quadrangle: Numerous rockslide/flow, rockslide/flow/debris flow, debris flow/alluvial fan, and rockslide/alluvium complexes are present along Granite Creek. If any of the landslides destabilize, they could dam the creek. Heavy periods of precipitation or significant development could have an effect on slope stability.

Darwin Peak Quadrangle: A rockslide/flow complex is present along the Gros Ventre River near Chateau Lake. If it destabilizes, it could dam the Gros Ventre River. Heavy periods of precipitation or significant development could have an effect on slope stability.

Davis Hill Quadrangle: A slump/flow complex is located in T45N R114W Section 25. If this landslide destabilizes, damage could occur to U.S. Highway 26/287. Damage could also occur to the Buffalo Valley road in T45N R113W Sections 22 and 23 if the blockslide/terrace or rockslide/flow complexes in these sections destabilizes. In addition, if the large blockslide/rockslide/slump/flow, rockslide/flow, flow, and slump/flow complexes in the southern portion of the quadrangle destabilize, they could dam Spread Creek. Heavy periods of precipitation or significant development could have an effect on slope stability.

Granite Basin Quadrangle: Several landslides, including debris flow/alluvial cone and blockslide/rockslide/flow/debris flow complexes are present along Teton Creek in the southern portion of the quadrangle. If these landslides activate, damage could occur to the nearby road. Campgrounds in this area may also be at risk of being damaged. Heavy periods of precipitation or significant development could have an effect on slope stability.

Granite Falls Quadrangle: Numerous slump/flow, debris flow/alluvial fan, debris flow/flow/alluvial fan, flow/alluvial fan, slump, debris flow, debris flow/alluvial cone, slump/flow/debris flow/alluvial cone, and rockslide/talus flow/flow complexes are present along Granite Creek. If any of these landslides destabilize, damage could occur to the road that parallels Granite Creek, and which crosses through several of the landslides. The Granite Creek campground could also sustain damage if the debris flow/alluvial fan complex on which it is built destabilizes. In addition to being directly damaged, the road and campground could be flooded if the landslides dam Granite Creek. Heavy periods of precipitation or significant development could have an effect on slope stability.

Grizzly Lake Quadrangle: Several landslides, including slump/flow, slump, rockslide/flow, debris flow/alluvial fan/surface wash, blockslide/rockslide/flow, rockslide/flow, and flow complexes are present in the northern portion of the quadrangle. If any of these landslides activate, damage could occur to the road and/or campgrounds near the Gros Ventre River. If any of the landslides dam the Gros Ventre River, the road and campground structures could also be flooded. Heavy periods of precipitation or significant development could have an effect on slope stability.

Gros Ventre Junction Quadrangle: A blockslide and a blockslide/flow complex are present in T41N R116W Sections 10 and 15. If these landslides destabilize, damage could occur to U.S. Highway 26/89/187. In addition, a road passes through the debris flow/alluvial fan/Quaternary alluvium complex in T41N R116W Section 23 and 24. If this landslide destabilizes, damage could occur to the road. Heavy periods of precipitation or significant development could have an effect on slope stability.

Huckleberry Mountain 15' Quadrangle: Blockslide/flow, blockslide/slump/flow, and slump/flow complexes are present along U.S. Highway 89/287. If these landslides destabilize, damage could occur to the highway and/or structures at Flagg Ranch. If the landslides near the south entrance to Yellowstone National Park dam the Snake River, flooding could also affect the highway and/or Flagg Ranch. If the flows, rockslide/flow, and slump/flow complexes around Jackson Lake activate, they could pose a hazard to tourists, fishermen, or boaters. Heavy periods of precipitation or significant development could have an effect on slope stability.

Jackson Quadrangle: Several landslides are present near the town of Jackson. If the alluvial fan/debris flow complex in T41N R116W Section 33 destabilizes, damage could occur to U.S. Highway 26/89/187 and nearby structures. If the landslide dams Flat Creek, flooding could affect the highway and structures in Jackson. Structures in Jackson could also be damaged if the rockslide/flow, slump/flow, and loess/slump/flow complexes in T41N R116W Sections 33 and 34 activate. In addition, if the debris flows in T40N R116W Section 8 and the Quaternary alluvium/debris flow complex in T40N R116W Sections 21 and 28 activate, U.S. Highway 26/89/187 could again be damaged. Heavy periods of precipitation or significant development could have an effect on slope stability.

Jenny Lake Quadrangle: Debris flow/Quaternary alluvium, rock fall/Quaternary terrace, and rockslide/Quaternary terrace complexes are present on the west side of Jenny Lake. If these landslides activate, damage could occur to tourist-frequented trails in the area. Heavy periods of precipitation or significant development could have an effect on slope stability.

Lava Mountain Quadrangle: A large blockslide/slump/flow complex is present in the northern part of the quadrangle on the Teton County-Fremont County border. If this landslide destabilizes, damage could occur to U.S. Highway 26/287, a secondary road, and a picnic area, all of which are located within the landslide complex. Heavy periods of precipitation or significant development could have an effect on slope stability.

Moran Quadrangle: Blockslide/slump, blockslide, and blockslide/slump/flow complexes are present in T44N R114W Sections 16, 17, and 20. If these landslides activate, damage could occur to U.S. Highway 26/89/187 and/or a secondary road in Section 20. Heavy periods of precipitation or significant development could have an effect on slope stability.

Mount Hancock Quadrangle: If the blockslide/rockslide/flow complex in the south-central portion of the quadrangle destabilizes, damage could occur to the Gravel Creek Patrol Cabin. Heavy periods of precipitation or significant development could have an effect on slope stability.

Mount Leidy Quadrangle: Several landslides, including debris flow/Quaternary alluvium, flow, slump, and slump/flow complexes, are present in the southwestern corner of the quadrangle. If these landslides destabilize, damage could occur to the nearby road or the Gros Ventre River could be dammed. There are also a number of flow/debris flow, blockslide, rockslide/flow, and rockslide/slump/flow complexes along Slate Creek. If any of the landslides destabilize, they could dam the creek. Heavy periods of precipitation or significant development could have an effect on slope stability.

Munger Mountain Quadrangle: Blockslide/rockslide/flow, rockslide/flow, flow, blockslide/slump, alluvial fan/debris flow, debris flow/alluvial fan, and debris flow/Quaternary alluvium complexes are present near the Snake River in the east-central portion of the quadrangle. If these landslides activate, damage could occur to U.S. Highway 26/89 or to the road on the south side of the Snake River. U.S. Highway 26/89 could also be damaged if the slump/flow/debris flow complex through which it passes in the south-central portion of the quadrangle destabilizes. Heavy periods of precipitation or significant development could have an effect on slope stability.

Ouzel Falls Quadrangle: Large blockslide/rockslide/flow, rockslide/flow, and slump/flow complexes are present along the Gros Ventre River. If these landslides destabilize, the Gros Ventre River could be dammed. Heavy periods of precipitation or significant development could have an effect on slope stability.

Rendezvous Peak Quadrangle: State Highway 22 passes through several landslides in the southern portion of the quadrangle. If any of these rockslide/debris flow/alluvial fan, blockslide/rockslide/slump, Quaternary alluvium/rockslide/debris flow, avalanche/rockslide, rockslide, and debris flow/alluvial fan complexes destabilize, damage could occur to the highway. A transmission line in the southwestern corner of the quadrangle could also be damaged if the landslides in this area destabilize. Heavy periods of precipitation or significant development could have an effect on slope stability.

Rosies Ridge Quadrangle: Slump/flow, flow, and debris flow/alluvial fan complexes are present in the northern portion of the quadrangle. If these landslides destabilize, damage could occur to the road that passes through the flow. Several landslides, including debris flow/flow, rockslide/flow, flow, blockslide, talus flow/debris flow/flow, slump/flow, and blockslide/slump/flow complexes, are also present along U.S. Highway 26/89 and Black Rock Creek. If these landslides activate, Black Rock Creek could be dammed, and damage could occur to the highway, a ranger

station, and/or a secondary road in T45N R113W Section 36. In addition, flow, flow/surface wash, rockslide/flow, slump/flow, and rockslide/slump/flow complexes are present along Flagstaff Creek in the southeastern portion of the quadrangle. If these landslides destabilize, damage could occur to the nearby road. Numerous rockslide/slump, rockslide/flow, flow, and rockslide complexes are present along Spread Creek and the North and South Forks of Spread Creek in the southern part of the quadrangle. If any of these landslides activate, the creeks could be dammed. Heavy periods of precipitation or significant development could have an effect on slope stability.

Shadow Mountain Quadrangle: The southern portion of this quadrangle is well known for the Gros Ventre Slide that occurred on June 23, 1925. A large blockslide/rockslide/rock fragment flow/flow complex activated and dammed the Gros Ventre River, creating Lower Slide Lake. Local seismic activity may have contributed to the landslide. This area contains numerous other landslides, including debris flow/flow/Quaternary alluvium, debris flow/alluvial cone, blockslide/rockslide/flow, rockslide/flow, blockslide/flow, slump/flow, slump/rockslide/flow, slump/blockslide/flow, and flow complexes. If any of these landslides were to activate, the Gros Ventre River could again be dammed. In addition to flooding problems, the Gros Ventre Road, the Atherton Creek campground, and other local structures could be damaged directly by a landslide. Rockslide/flow and slump/flow complexes are also present in T43N R115W Sections 24 and 25. If these landslides destabilize, damage could occur to the nearby road. Finally, structures at the Lost Creek Ranch (T44N R114W Section 30; T44N R115W Section 36) could be damaged if the nearby rockslide/flow and rockslide/blockslide/flow complexes destabilize. Heavy periods of precipitation or significant development could have an effect on slope stability.

Teton Pass Quadrangle: Slump/rockslide/flow, avalanche/rockslide, slump/flow, and debris flow/alluvial fan complexes are present in the northern portion of the quadrangle. If these landslides destabilize, damage could occur to State Highway 22, which passes through several of the landslides, and/or to structures at Trail Creek Ranch. Also, the road paralleling Mosquito Creek in the center of the quadrangle could be damaged if any of the nearby slump/flow, rockslide/flow, or blockslide/flow complexes activate. Heavy periods of precipitation or significant development could have an effect on slope stability.

Teton Village Quadrangle: Rockslide/debris flow/alluvial fan and debris flow/alluvial fan complexes are present in the western portion of the quadrangle in T42N R117W Section 35 and T41N R117W Section 2. If these landslides activate, damage could occur to the nearby road. Heavy periods of precipitation or significant development could have an effect on slope stability.

Togwotee Pass Quadrangle: Large blockslide/rockslide/flow, slump/flow, and blockslide/slump/flow complexes are present in the southwestern portion of the quadrangle. If these landslides destabilize, damage could occur to U.S. Highway 26/287. A remote chance also exists that the rockslide/flow complex in the northern portion of the quadrangle could deflect South Buffalo Fork. Heavy periods of precipitation or significant development could have an effect on slope stability.

Two Ocean Lake Quadrangle: Landslides are present along the edges of Two Ocean Lake and Emma Matilda Lake. If these landslides activate, they may pose a risk to tourists, fishermen, or boaters. Heavy periods of precipitation or significant development could have an effect on slope stability.

Upper Slide Lake Quadrangle: Upper Slide Lake in this quadrangle was formed when a large blockslide/rockslide/flow complex activated and dammed the Gros Ventre River. Other large blockslide/rockslide/flow, rockslide/flow, alluvial fan/debris flow, and slump/flow complexes are

present along the Gros Ventre River. If these landslides activate, the Gros Ventre River could be dammed again. The road that parallels the river could also be damaged, either directly or by flooding. Heavy periods of precipitation or significant development could have an effect on slope stability.

Whetstone Mountain Quadrangle: Several landslides, including slump/flow, rockslide/blockslide/slump/flow, and rockslide/flow complexes are present on the west and northwest side of Pacific Creek. If these landslides destabilize, damage could occur to Pacific Creek Road, which passes through some of the landslides. Activated landslides could also damage the Wilderness Ranch. Blockslide/slump/flow, rockslide/slump/flow, and blockslide/flow complexes are present near the confluence of Pacific Creek and Whetstone Creek. If any of the landslides destabilize, they could dam either of the creeks. Heavy periods of precipitation or significant development could have an effect on slope stability.

Impacts

Several damaging landslides have occurred in Teton County in recent years. In May 2011, a landslide hit Highway 89 in the Snake River canyon, shutting down the road. Multiple smaller slides were reported along the Granite Creek and Gros Ventre drainages in 2011. (Casper Star Tribune, May 19, 2011)

Landslide activity in 2008 and 2009 in the vicinity of Crystal Peak created a landslide dam on Crystal Creek. This has formed a lake and caused a hiking trail in the Bridger-Teton National Forest to be re-routed.

One man was seriously injured by a rockslide on Nez Perce Peak in August 2013. The climber was caught and buried by the slide and had to be flown by helicopter to a hospital. Rain in the days prior to the event increased the chances for rockslides or landslides. (Jackson Hole News & Guide, August 28, 2013)

The Budge Drive landslide in Jackson became problematic in 2014. Worry over this slow-moving landslide increased in early April 2014, when cracks began appearing on East Gros Ventre Butte between the houses on the bluff on Budge Drive and the Walgreens on West Broadway in Jackson. The Town had been monitoring the area for signs of movement for several years, but the landslide didn't present imminent danger prior to April. On April 9, 2014, residents along Budge Drive were ordered to evacuate their homes. Days later, a home was progressively torn in two as the slide advanced. By the end of April the slide had moved over 10 feet. The cause of this event is thought to result from a combination of construction and development at the base of the landslide and natural causes. Emergency construction of buttresses helped slow the slide, though issues have continued into 2015 while the slide continues to move half an inch to an inch each month. The cost of stabilizing the area and repairing the damage is estimated at $10 million. (Jackson Hole News & Guide)

Table 9.1 summarizes landslide exposure in Teton County. During the 2015 update of this plan a GIS analysis of exposure to landslide hazard areas was performed, utilizing a Wyoming Geological Survey landslide hazard layer. There are 200 properties in landslide hazard zones based on this analysis. Most of these properties are residential. Table 9.2 further breaks down the analysis for unincorporated Teton County, summarizing the exposure by federal land ownership. Bridger-Teton National Forest has the highest exposure to landslide among federal land owners in the County.

Mapped landslides for Teton County are shown in the figures below. Figure 9.3 shows an overview of landslide hazards in the entire county, while Figure 9.4 provides a zoomed-in view of the County excluding Yellowstone National Park. Figure 9.5 shows landslide hazards in Jackson. Several parcels in the southeastern corner of the Town lie within landslide hazard areas. It should be noted that the maps were developed using available WSGS data and that other potential landslide hazard areas may not be mapped. Limitations in that data have been recognized, including the lack of hazard mapping in the Budge Drive area, and more complete maps can be developed once the data is improved.

Table 9.1 Landslide Exposure in Teton County by Jurisdiction and Property Type

Jurisdiction	Property Types	Property Count	Improved Value	Content Value	Total Value
Town of Jackson	Commercial	4	$5,269,874	$5,269,874	$10,539,748
	Residential	84	$39,562,604	$19,781,302	$59,343,906
	Total	**88**	**$44,832,478**	**$25,051,176**	**$69,883,654**
Unincorporated County	Agricultural	3	$500,142	$500,142	$1,000,284
	Commercial	2	$820,949	$820,949	$1,641,898
	Residential	107	$32,411,544	$16,205,772	$48,617,316
	Total	**112**	**$33,732,635**	**$17,526,863**	**$51,259,498**
Grand Total		**200**	**$78,565,113**	**$42,578,039**	**$121,143,152**

Source: Teton County Assessor's Office and Wyoming State Geological Survey

Table 9.2 Landslide Exposure by Adjacent Federal Land and Property Type Unincorporated Teton County

Jurisdiction	Property Types	Property Count	Improved Value	Content Value	Total Value
Bridger-Teton National Forest	Agricultural	2	$403,139	$403,139	$806,278
	Residential	70	$14,882,591	$7,441,296	$22,323,887
	Total	**72**	**$15,285,730**	**$7,844,435**	**$23,130,165**
Grand Teton National Park	Residential	16	$12,644,568	$6,322,284	$18,966,852
	Total	**16**	**$12,644,568**	**$6,322,284**	**$18,966,852**
National Elk Refuge	Commercial	1	$248,054	$248,054	$496,108
	Residential	2	$237,765	$118,883	$356,648
	Total	**3**	**$485,819**	**$366,937**	**$852,756**
No Adjacent Federal Lands	Agricultural	1	$97,003	$97,003	$194,006
	Commercial	1	$572,895	$572,895	$1,145,790
	Residential	19	$4,646,620	$2,323,310	$6,969,930
	Total	**21**	**$5,316,518**	**$2,993,208**	**$8,309,726**
	Grand Total	**112**	**$33,732,635**	**$17,526,863**	**$51,259,498**

Source: Teton County Assessor's Office and Wyoming State Geological Survey

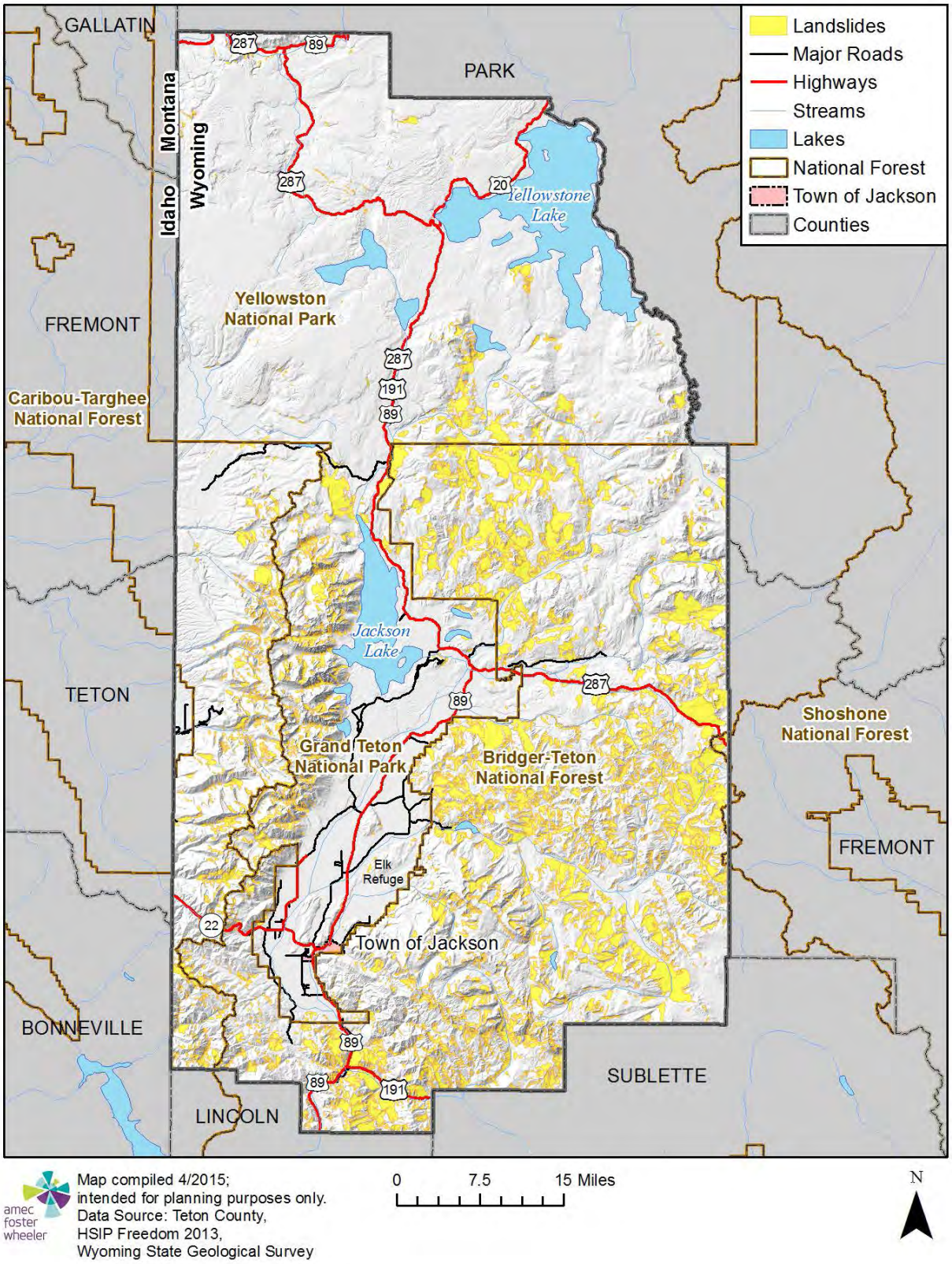


Figure 9.3 Teton County Landslide Map

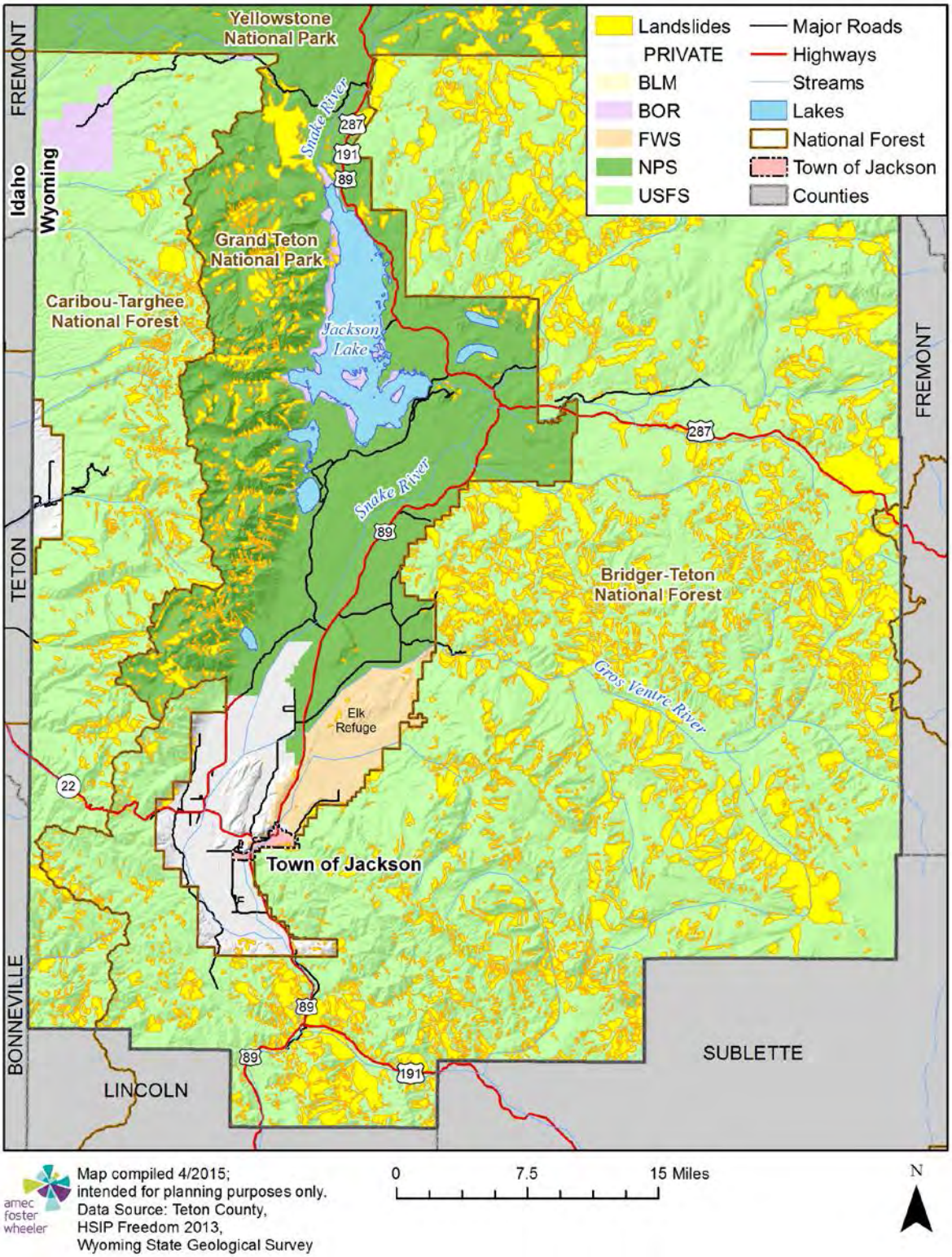


Figure 9.4 Teton County Landslide Hazards South of Yellowstone National Park

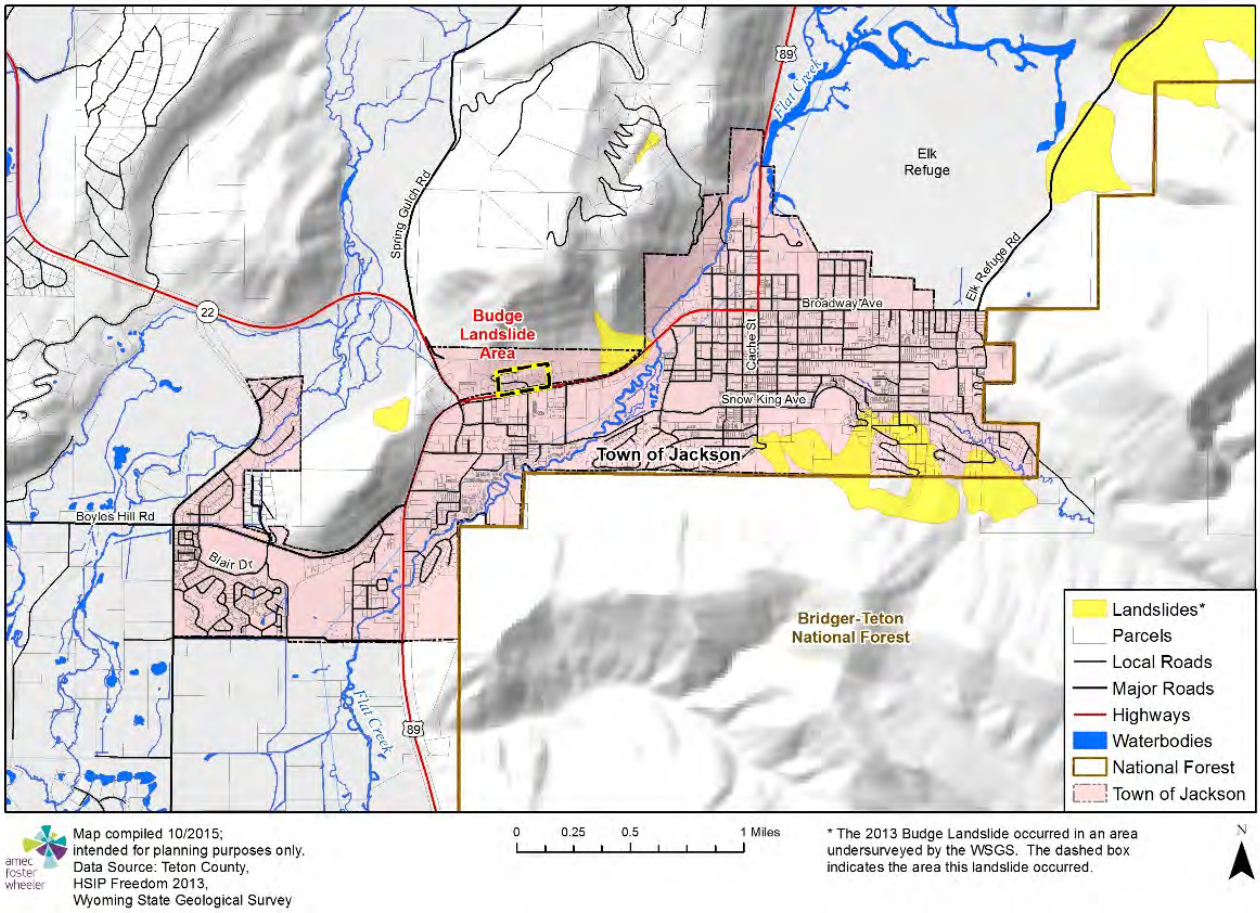


Figure 9.5 Jackson Landslide Hazards

Future Impacts

There are three measures of future landslide impacts – historic dollar damages, estimated yearly damages, and building exposure values. There are not enough current data to estimate historic or average annual dollar damages.

GIS was used to conduct a landslide exposure analysis. The analysis found that 200 properties with a total value (contents value and improved value combined) of $121,143,152 are potentially at risk to landslide. Most of the value is attributed to residential properties, but nine commercial and agricultural properties are also exposed. It is unlikely that the entire inventory would be affected by landslides at any one time, but it does give an upper end to the range of possible landslide damage in Teton County. Based on geologic studies, future impacts are likely to affect transportation corridors (major roads), reservoirs, transmission lines, campgrounds, pipelines, and occasional structures. There is also a possibility that many smaller creeks within the county could be dammed by landslide activity. This could create a flash flood hazard downstream if the landslide dam fails or is overtopped, and has been the cause of one of the most damaging floods in the County (see discussion of Gros Ventre Slide in Dam Failure Section). Heavy periods of precipitation or significant development could have an effect on slope stability

in the mapped hazard areas. Both the Town of Jackson and Teton County have adopted land development restrictions based on slope percentages as a tool to reduce future landslide damage potential.

Summary

PROPERTY AFFECTED:	High
POPULATION AFFECTED:	Low
PROBABILITY:	Medium
JURISDICTION AFFECTED:	Jackson, unincorporated areas of the county

Chapter 10. Lightning

Lightning is a sudden electrical discharge released from the atmosphere that follows a course from cloud to ground, cloud to cloud, or cloud to surrounding air, with light illuminating its path. Lightning's unpredictable nature causes it to be one of the most feared weather elements.

Anyone that is caught in an exposed area during a thunderstorm could be at risk to a lightning strike. In Wyoming, outdoor enthusiasts venturing to high and exposed areas such as the Teton Range should be especially cautious because rapid thunderstorm development with associated lightning can place even the most experienced climbers in jeopardy without warning. Hikers and climbers above the timberline (including areas of Grand Teton and Yellowstone National Parks and the Bridger-Teton National Forest) should be off exposed mountain tops and ridges by 1400 MST during the summer months to avoid being struck by lightning unless proper shelter is available (Wyoming Climate Atlas). Wyoming is #1 in the nation in lightning deaths per capita.

History

U.S. statistics show that one in 345,000 lightning flashes results in a death and one in 114,000 results in an injury. According to meteorologists at Vaisala, Inc., the odds for an American being hit by lightning sometime in the course of an 80-year lifespan is about 1 in 3,000. Wyoming ranks 36th in number of lightning fatalities, 33rd in injuries, and 40th in property damage from 1959 to 1994 according to the National Oceanic and Atmospheric Administration, National Severe Storms Laboratory (NOAA, NSSL). From 1959 to 2003 lightning has been responsible for 26 deaths, 103 injuries, over $3.2 million in property damage, and $22,750 in crop damage in Wyoming. Dollar damage estimates may include damage from associated severe weather, including precipitation and wildland fire. Table 10.1 includes Wyoming lightning events that have caused deaths, injuries, and damage in Teton County. Lightning has caused death, injuries, and sparked numerous wildfires within the county. According to the data in the table, a damaging lightning event occurs about every 1.6 years in the county.

Table 10.1 – Teton County Lightning History 1967 – Present

County	Location	Date	Number killed	Number injured	Estimated property damage	Total estimated damage (2015 USD)	Information
Teton	Jackson 10 S	11-Sep-67	0	2	$0		Lightning struck two road construction workers causing minor injuries.
Teton	Yellowstone Park	7-Aug-75	1	0	$0		Man struck by lightning while canoeing on Lewis Lake, thrown into water and either killed by lightning or drowned.
Teton		7-Aug-77	1	1	$0		A boy, 8 years old, was killed and a young lady, 26, injured while on a hiking trip 15 miles northeast of Jackson on the Gros Ventre River drainage.
Teton		30-Aug-85	0	0	$140,000	$307,218	A blaze sparked by a lightning strike burned 1080 acres in Grand Teton National Park, destroying 10 cabins and inflicting an estimated $140,000 worth of damage.
Teton	Jackson (27NE)	9-Jun-87	0	0	$350,000	$727,479	Lightning strikes near the Gros Ventre River destroyed a $350,000 home.

Table 10.1 – Teton County Lightning History 1967 – Present (cont.)

County	Location	Date	Number killed	Number injured	Estimated property damage	Total estimated damage (2015 USD)	Information
Teton	Jackson 8S	21-Jul-87	0	0	$2,750	$5,716	Some unusually severe thunderstorms swarmed over northwest Wyoming during the afternoon. One of the first indications of these severe thunderstorms was the 60 mph wind gusts reported by a radio station in Jackson at 1300 MST. As these severe thunderstorms moved northeast additional reports of hail between 1 inch and 2.25 inches in diameter were observed along with winds gusting above 58 mph. Also, torrential rains were noted from Jackson northeast to Cody. When these severe thunderstorms moved northeast of Jackson over the Teton Wilderness Area it spawned the highest elevation F4 tornado ever documented. The devastating winds from the tornado produced a massive blowdown of 15,000 acres of mostly mature lodgepole pines which ranged from 80 to 100 feet tall. The massive blowdown stretched slightly over 24 miles from Box Creek Trailhead, 10 miles east-northeast of Moran Junction, on the south to beyond the Yellowstone River on the north and was about 1 to 2 miles wide, 2.5 miles at the widest. An eyewitness to the blowdown stated, "You could look up a hillside where there had been a dense forest and count the trees left standing." Later, as these severe thunderstorms moved over the East Entrance of Yellowstone National Park, torrential rains produced mudslides which closed highways for a few hours. The Park County sheriff reported that some of these mudslides buried about 50 yards of highway to a depth of 2 feet.

Table 10.1 – Teton County Lightning History 1967 – Present (cont.)

County	Location	Date	Number killed	Number injured	Estimated property damage	Total estimated damage (2015 USD)	Information
Park, Teton, Carbon, Sweetwater, and Natrona		1-Jul-88	0	0	$364,430	$727,378	During the month of July, at least 59 fires were started by lightning from mostly high-based thunderstorms that produced little rainfall. These included very large forest fires such as the Clover Mist Blaze in Yellowstone National Park and the Lost Fire over the Big Horn Mountains of northern Wyoming. On a week-by-week basis, the breakdown of lightning fire is as follows. Before and including the 2nd, fourteen lightning fires were started. During the 10th through the 16th, 18 such fires were reported. From the 17th through the 23rd, there were eight fires. Between the 24th and 30th, ten lightning blazes occurred. Finally, on the 31st, there were four fires. According to the BLM for Wyoming, 3,644.3 acres were torched with an estimated lost resource value of $364,430. This does not include the fires started by lightning in Yellowstone National Park because this information is not available.
Park, Teton, Sweetwater, Sheridan, Natrona, Fremont, Albany, Laramie, Crook, and Johnson		3-Jul-88	0	0	Same as 1 July 1988		See 1 July 1988 description

Table 10.1 – Teton County Lightning History 1967 – Present (cont.)

County	Location	Date	Number killed	Number injured	Estimated property damage	Total estimated damage (2015 USD)	Information
Park, Teton, Sweetwater, Fremont, Johnson, Laramie, Washakie, Converse and counties		10-Jul-88	0	0	Same as 1 July 1988		See 1 July 1988 description
Park, Teton, Fremont, Sweetwater, Washakie and Natrona		17-Jul-88	0	0	Same as 1 July 1988		See 1 July 1988 description
Park, Teton, Uinta, Johnson, and Sublette		24-Jul-88	0	0	Same as 1 July 1988		See 1 July 1988 description
Park and Teton		31-Jul-88	0	0	Same as 1 July 1988		See 1 July 1988 description
Park, Teton, Campbell, Crook, Natrona, Sweetwater and Weston		1-Aug-88	0	0	$415,900	$830,109	See 1 July 1988 description

Table 10.1 – Teton County Lightning History 1967 – Present (cont.)

County	Location	Date	Number killed	Number injured	Estimated property damage	Total estimated damage (2015 USD)	Information
Park, Teton, Converse, Sweetwater, Lincoln and Carbon		7-Aug-88	0	0	Same as 1 August 1988		See 1 July 1988 description
Teton, Park, Sweetwater, Lincoln, Fremont, Washakie and Hot Springs		14-Aug-88	0	0	Same as 1 August 1988		See 1 July 1988 description
Teton, Park and Sweetwater		21-Aug-88	0	0	Same as 1 August 1988		See 1 July 1988 description
Teton	Moose	28-Aug-94			$60,000	$95,595	Lightning started the Mormon Row fire in the Antelope Flats area on the 28th and the fire grew quickly to 3200 acres by the end of the month.
Teton	19 NNW Jackson	20-Jul-99	0	1			Person struck by lightning on Table Mountain.
Teton	10 NNW Jackson Airport	5-Aug-99	0	2			Two people struck by lightning on the Grand Teton.
Teton	3 W Moran	22-Jun-02	0	5			A boat was hit by lightning. The lightning blasted a hole in the boat floor.

Table 10.1 – Teton County Lightning History 1967 – Present (cont.)

County	Location	Date	Number killed	Number injured	Estimated property damage	Total estimated damage (2015 USD)	Information
Teton	20 N Jackson	26-Jul-03	1	5			One person died and five were seriously injured when they were struck by lightning while climbing Grand Teton.
Teton	3 S Moose	10-Aug-03	0	0			The Blacktail Wildfire was started by lightning on August 10. On August 11, Gros Ventre Campground had to be evacuated as the fire approached. Smoke impacted air traffic at Jackson Airport and Highway 26/89/91 was temporarily closed on August 12. The fire burned 2,650 acres.
Teton	10 E Fishing Bridge	11-Aug-03	0	0			The East Wildfire, located near the East Entrance of Yellowstone National Park, was started on August 11 by lightning. Thirty-one residences and 43 commercial buildings need protection as gusty winds caused rapid fire growth. The wildfire burned four private vehicles. On August 15, the East Entrance of Yellowstone National Park was closed, only to be opened temporarily, 3 hours in the morning and 3 hours in the afternoon, from August 29-31. The fire burned 23,500 acres. The estimated cost of fighting the fire was $6.6 million.
Teton	Fishing Bridge	21-Jun-05	0	11	0	0	Lightning struck 15 yards from boardwalk at Old Faithful. 11 by-standers injured.
Teton	Moose	24-Jul-07	0	1	0	0	Lightning struck a climber on Grand Teton. Climber was able to get down.
Teton	Old Faithful	1-Jun-10	0	9	0	0	A single lightning bolt injured nine visitors at Old Faithful in Yellowstone National Park.
Teton	Jenny Lake	21-Jul-10	1	17	0	0	Midday thunderstorms peppered Grand Teton Mountain with lighting, causing 17 injuries among three separate climbing parties.
TOTALS			**4**	**52**	**$1,333,080**	**$2,693,495**	

Impacts

Based on the lightning data for Teton County, lightning has caused 4 fatalities, injured 51 persons and been associated with $2,693,495 in property damage (2015 dollars) since 1967. Nationwide lightning strikes are routinely monitored by Vaisala, Inc. with accuracies to within a 0.625-mile (1 kilometer) resolution. The Wyoming annual lightning strike frequency is depicted in Figure 10.1 for the period of 2005 through 2014. Clearly the eastern plains have more than three times the cloud to ground lightning strikes as the western half of the state. Teton County's flash density is relatively low, ranging from 0.75 to 3 flashes per square mile per year across most of the planning area. A few isolated spots have slightly higher flash densities. Despite annual variation, the locations of maximum and minimum strikes do not change much from year to year. In 1998 the state's precipitation average was well above normal, in 1999 near normal, and in 2000 was below normal (Wyoming Climate Atlas).

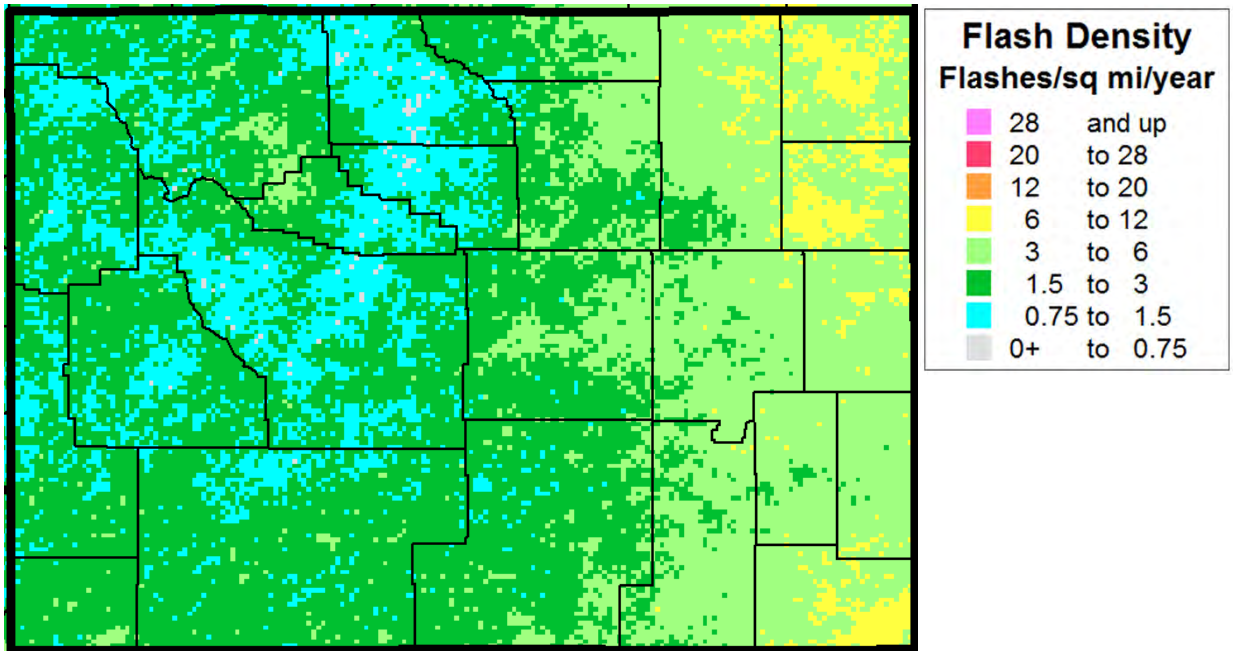


Figure 10.1 — Average annual lightning flash density (flashes/sq. mi./year) 2005-2014 over Wyoming. Illustration courtesy of Vaisala Inc.

Future Impacts

Future impacts from lightning are difficult to determine because of the erratic nature of storms. Because of Teton County's location in western Wyoming, and its mountainous terrain, it will remain susceptible to lightning strikes for the foreseeable future. A damaging lightning event occurs every 1.6 years on average in the county. Impacts to persons and property have been significant in Teton County. Outdoor workers and outdoor enthusiasts and livestock will remain susceptible to lightning strikes. Lightning caused wildland fires may result in more extensive damage. Current trends in climate change may also affect the frequency of lighting; researchers at the University of Berkeley conducted a study that found that for every one degree Celsius rise in the average global temperature, there will be a 12 percent increase in the amount of lightning strikes.

(Source: Science Magazine, http://www.sciencemag.org/content/346/6211/851.abstract;)

Summary

PROPERTY AFFECTED:	Medium
POPULATION AFFECTED:	Medium
PROBABILITY:	High
JURISDICTION AFFECTED:	All

Chapter 11. Snow Avalanches

An avalanche is defined as a large mass of snow, ice, earth, rock, or other material in swift motion down a mountainside or over a precipice (Merriam-Webster). In the case of this evaluation, avalanche medium refers to snow. Wyoming is one of the top-ranking states for avalanche hazards because of its rural character, snowpack, terrain, and mountain recreation. Skiers, snowboarders, and snowmobile operators are most commonly at risk from avalanche hazards; however, motorists and others not engaging in recreation are also at risk of being caught in an avalanche.

An avalanche occurs when the stress (from gravity) trying to pull the snow downhill exceeds the strength (from bonds between snow grains) of the snow cover. There are four ingredients of an avalanche: steep slope, snow cover, weak layer in the snow cover, and a trigger. About 90% of all avalanches start on slopes of 30-45 degrees; about 98% of all avalanches occur on slopes of 25-50 degrees. Earthquakes during the winter months could also trigger avalanches, potentially affecting even lower angled slopes and having widespread impacts depending on the level of ground shaking. Avalanches release most often on slopes above timberline that face away from prevailing winds (leeward slopes collect snow blowing from the windward sides of ridges.) Avalanches can run, however, on small slopes well below timberline, such as gullies, road cuts, and small openings in the trees. Very dense trees can anchor the snow to steep slopes and prevent avalanches from starting; however, avalanches can release and travel through a moderately dense forest.

The Teton and Gros Ventre Mountain ranges in Teton County, due to their steep terrain, high elevations, and winter snows, experience avalanches every winter. Generally, the avalanches occur in remote areas and have little impact, except when unwary backcountry travelers get caught and buried. Highway 22 over Teton Pass traverses the run-out zones of several avalanche paths and is often closed in winter for avalanche control work.

History

Avalanche fatalities provide the best indicator of locations where events occur that can impact humans, and thus what populations are most threatened. According to the U.S. Forest Service, Utah Avalanche Center, Wyoming ranks fifth among the eight states with the most avalanche fatalities. Wyoming fatalities composed 10% of total avalanche deaths in the U.S. from winter 2004/2005 through winter 2013/2014.

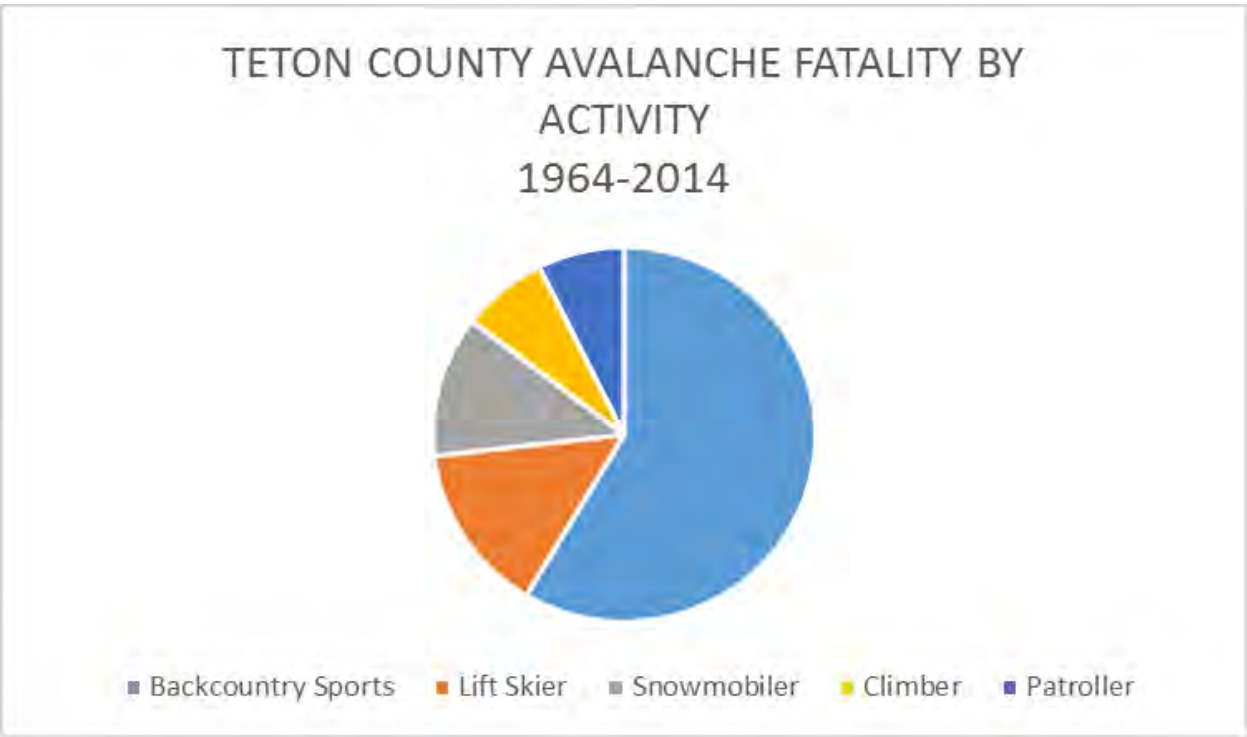


Figure 11.2 - Teton County Avalanche Fatality by Activity 1964 – 2014

Since 1964, there have been 41 fatalities from avalanches in Teton County. The majority of these have resulted from individuals partaking in mountain recreation, most predominantly backcountry skiers. Although deaths occur primarily in the backcountry, motorists, residents, and workers in high angle, avalanche-prone terrain must be aware of the dangers posed by this hazard. The majority of avalanche fatalities in the State occurred in western Wyoming, in particular the Teton area. Teton County includes a higher than average population of outdoor enthusiasts engaging in backcountry winter sports. Decisions to recreate after heavy snowfalls on high angle, avalanche-prone terrain can have deadly consequences.

While less likely, avalanches have impacted developed areas in the County. An avalanche at the Jackson Hole Mountain Resort on December 29, 2008, caught or buried seven ski patrollers and hit the Bridger Restaurant on the mountain. According to the News and Guide (December 31, 2008) the avalanche tore the railing and glass shields off the restaurant deck, burst through doors and windows, and piled snow eight feet deep inside the building. A 1986 avalanche at the same site—prior to construction of the restaurant--moved between 8,000 and 15,000 tons of snow down the mountain. The deck of the $11 million restaurant constructed in 2007 was designed for an avalanche to flow across.

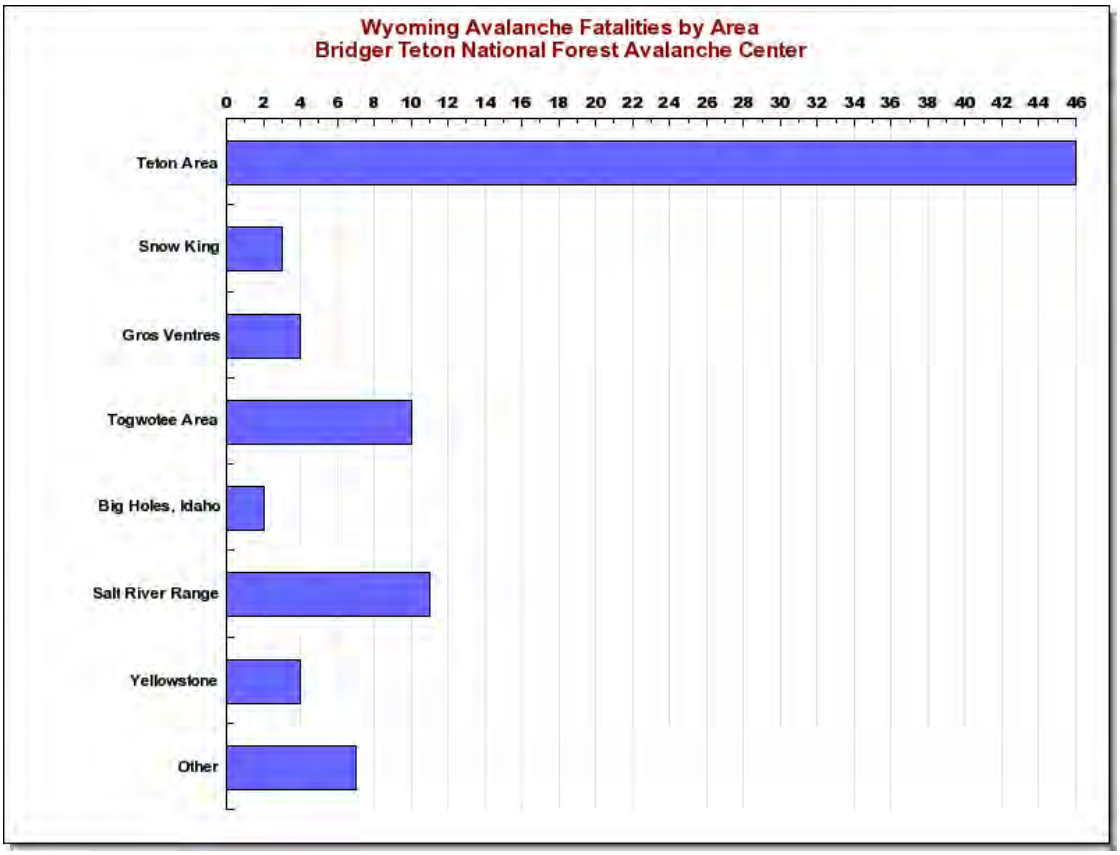


Figure 11.1—Wyoming avalanche fatalities by location (1913 – 2014)

Source: Bridger-Teton National Forest Avalanche Center

Western Wyoming and Teton County in particular have achieved notoriety nationwide for their avalanche hazard susceptibility. In the past 50 years, Teton County has had 43 avalanche fatalities, averaging a deadly avalanche every 2.2 years. These events are summarized by location, date, and activity in Table 11.4.

Table 11.4 – Teton County Avalanche Fatalities 1964 – 2015

County	Location	Date	Activity/travel	Number of Fatalities
Teton	Snow King Mountain	12-Mar-64	Patroller	1
Teton	Glacier Gulch, Teton Range	16-Jan-74	Backcountry Skier	1
Teton	Glacier Gulch, Teton Range	16-Jan-74	Backcountry Skier	1
Teton	Glacier Gulch, Teton Range	16-Jan-74	Backcountry Skier	1
Teton	South Leigh Canyon, Teton Range	20-Mar-76	Backcountry Skier	1
Teton	Grand Teton, Teton Range	26-Apr-79	Climber	1
Teton	Grand Teton, Teton Range	26-Apr-79	Climber	1
Teton	Ferrin's Slide, Snow King Mt	16-Feb-84	Lift Skier Out of Area	1
Teton	Mt Wister, Teton Range	3-Feb-85	Climber	1
Teton	Rendezvous Mountain, Teton Range	2-Dec-85	Patroller	1
Teton	Rendezvous Mountain, Teton Range	17-Feb-86	Patroller	1
Teton	Dry Ridge, Teton Range	28-Feb-92	Snowmobiler	1
Teton	Simpson Peak, Togwotee Pass	28-Dec-92	Backcountry Skier	1
Teton	Taylor Mountain, Teton Range	19-Apr-95	Backcountry Skier	1
Teton	Factory Hill, Yellowstone	3-Mar-97	Backcountry Skier	1
Teton	Factory Hill, Yellowstone	3-Mar-97	Backcountry Skier	1
Teton	Dry Lake Creek, Togwotee Pass	4-Jan-99	Snowmobiler	1
Teton	Rendezvous Mountain, Teton Range	19-Jan-99	Lift Skier	1
Teton	Glory Bowl, Teton Range	1-Dec-00	Backcountry Snowboarder	1
Teton	Titmouse Ridge, Teton Pass	9-Dec-00	Backcountry Skier	1

Table 11.4 – Teton County Avalanche Fatalities 1964 – 2015 (cont.)

County	Location	Date	Activity/travel	Number of Fatalities
Teton	South Badger Creek, Teton Range	25-Dec-00	Backcountry Skier	1
Teton	Rock Springs, Teton Range	6-Feb-01	Lift Skier Out of Area	1
Teton	Granite Canyon, Teton Range	23-Feb-01	Lift Skier Out of Area	1
Teton	Grove Creek, Big Hole Range	12-Mar-02	Snowmobiler	1
Teton	Near Ski Lake, Teton Range	4-Jan-03	Backcountry Snowboarder	1
Teton	Kettle Creek, Togwotee Pass	25-Jan-03	Snowmobiler	1
Teton	Avalanche Bowl, Teton Pass	27-Jan-03	Backcountry Snowboarder	1
Teton	Hourglass Couloir, Teton Range	10-Feb-03	Lift Skier Closed Area	1
Teton	S Fork of Darby Canyon	11-Mar-07	Backcountry Skier	1
Teton	Rock Springs Bowl	5-Jan-07	Backcountry Skier	1
Teton	Jackson Hole Mountain Resort	27-Dec-08	Lift Skier	1
Teton	South Teton, Grand Teton NP	21-Feb-09	Backcountry Skier	1
Teton	Garnet Canyon, Grand Teton NP	16-Apr-11	2 Backcountry Skiers	2
Teton	Grand Teton NP, Ranger Peak, Waterfall Canyon	7-Mar-12	2 Backcountry Skiers	2
Teton	Jackson, Hoback Canyon, Cliff Creek, Clause Creek	27-Jan-13	Backcountry Skier	1
Teton	Grand Teton National Park, Survey Peak	27-Jan-13	Backcountry Skier	1
Teton	Grand Teton National Park, Prospectors Mountain, Apocalypse Couloir	1-Mar-13	Backcountry Skier	1

Table 11.4 – Teton County Avalanche Fatalities 1964 – 2015 (cont.)

County	Location	Date	Activity/travel	Number of Fatalities
Teton	Jackson, Pucker Face	26-Dec-13	Backcountry Skier	1
Teton	Togwotee Pass	18-Feb-14	Snowmobiler	1
Teton	Mt Moran	17-May-15	Backcountry Skiers	2
TOTAL				**43**

Source: Bridger Teton National Forest Avalanche Center

Impacts

Avalanches cause two primary impacts hazards in Teton County: road blocks and risk to human life. Fatalities are the most-documented impact related to avalanches. Time is of the essence when a person is buried in an avalanche, as victims buried more than 30 minutes rarely survive. Most that do survive are dug out within 15-30 minutes, and these survivors are often aided by personal locator beacons and prepared backcountry partners that are also equipped with shovels and beacons. Furthermore, there are costs and risks associated with search, rescue, and removal of the injured or deceased.

Road blockages are another major concern where roads intersect an avalanche path. The major costs associated with road blocks are snow removal and traffic diversion, which both necessitate the use of personnel and equipment and can lead to economic impacts if the roads are blocked for lengthy periods of time. Another less frequent issue is the cost associated with rescuing motorists if they were involved in an avalanche. Finally, avalanche mitigation efforts may necessitate periodic disruptions of traffic.

Impacts to property are also possible, as was the case in the December 2008 avalanche at Jackson Hole Mountain Resort. Damages from that event totaled $500,000 ($545,097 in 2015 USD). According to the U.S. Geological Survey, the city of Jackson is vulnerable to multiple areas of avalanche. It is important to note that this data is from 1973; digital information for the Jackson area was not available.

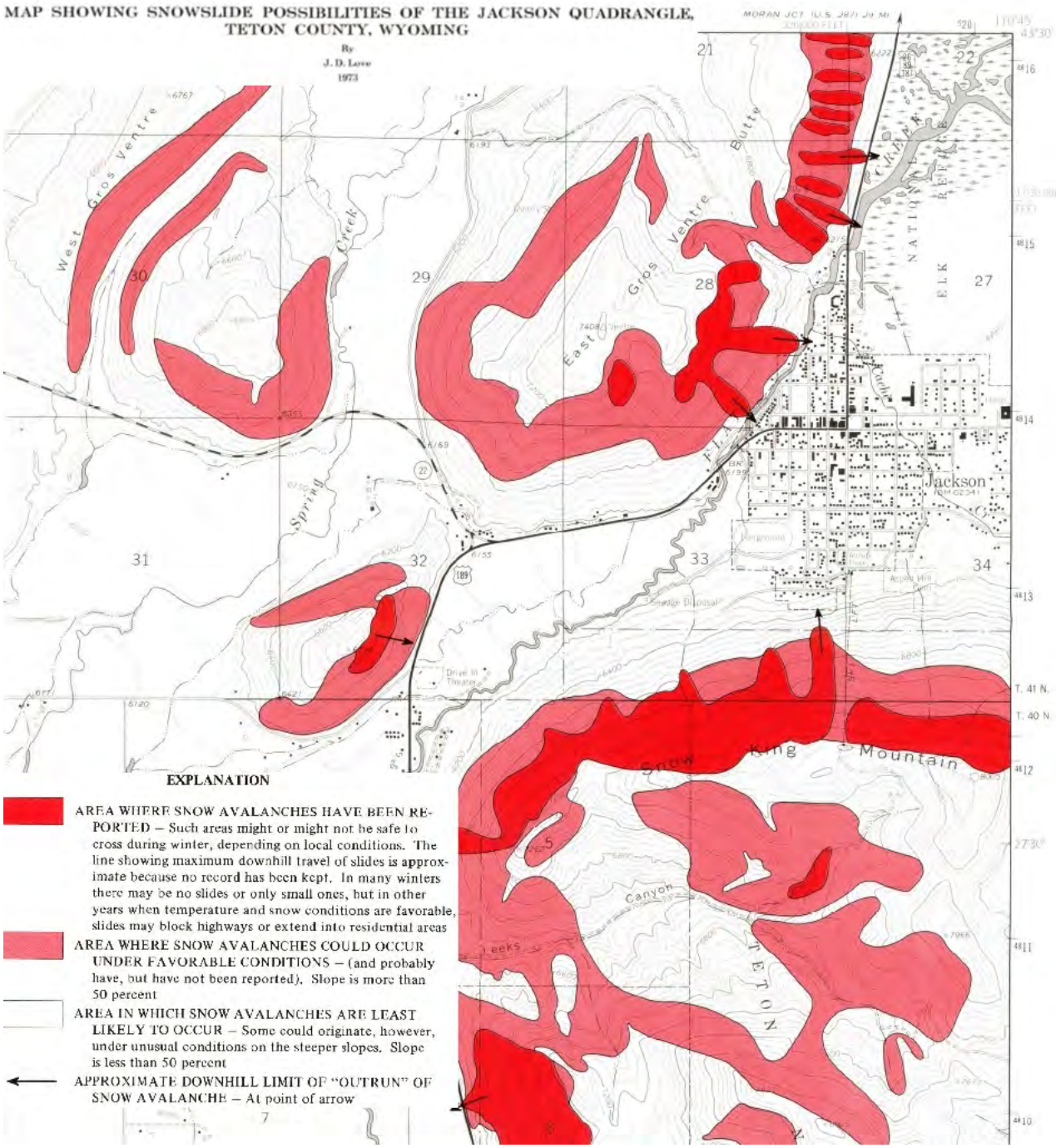


Figure 11.5 – Snow slide Possibilities of Jackson Quadrangle
Teton County, Wyoming

Future Impacts

Given the popularity of winter recreational activities, it is likely that backcountry travelers will continue to encounter avalanches in Teton County, primarily within the Teton Range. Based on historic events, avalanche fatalities in the county occur once every 2.2 years on average. The Wyoming Department of Transportation has mapped the slide prone areas associated with state highways in the county. This allows them to anticipate and monitor areas that will need heavy equipment and personnel, prioritize, and respond rapidly when avalanches do occur. This pre-planning may help minimize loss and damage.

Summary

PROPERTY AFFECTED:	Low
POPULATION AFFECTED:	Low
PROBABILITY:	High
JURISDICTION AFFECTED:	Unincorporated areas; Highway 22 over Teton Pass.

Chapter 12. Tornadoes

A tornado is a violently rotating column of air extending from a thunderstorm to the ground. Tornadoes are the most intense storm on earth, having been recorded at velocities exceeding 315 mph. The phenomena results in a destructive rotating column of air ranging in diameter from a few yards to greater than a mile, usually associated with a downward extension of cumulonimbus cloud. Tornadoes are classified by their intensity by using the Fujita (F) Scale, with F0 being the least intense and the F5 being the most intense.

In February 2007, the Enhanced Fujita scale replaced the original Fujita scale in all tornado damage surveys in the United States. Table 12.1 compares the estimated winds in the original F-scale with the operational EF-scale that is currently in use by the NWS.

Tornado statistics, especially prior to the 1970s, must be viewed as incomplete, since many twisters occurred without being witnessed. Wyoming's open rangelands experience little if any damage from these storms, so many go unreported. In the 1990s, the Internet and Doppler radar increased the public's awareness of tornadoes, and increased the potential of more tornadoes being observed and reported. However, the trend in annual tornadoes has decreased by one-third since 1976, and appears to have coincided with a major hemispheric weather pattern shift, despite the increased reporting based on Doppler radar vortex (circulation) signatures (excerpted from the Wyoming Climate Atlas).

Table 12.1 – Fujita/Enhanced Fujita Scales of Tornado Intensity

FUJITA SCALE			OPERATIONAL EF-SCALE	
F Number Fastest	**Fastest 1/4 – mile (mph)**	**3 Second Gust (mph)**	**EF Number**	**3 Second Gust (mph)**
0	40-72	45-78	0	65-85
1	73-112	79-117	1	86-110
2	113-157	118-161	2	111-135
3	158-207	162-209	3	136-165
4	208-260	210-261	4	166-200
5	261-318	262-317	5	Over 200

Teton County has a network of outdoor warning sirens in populated areas as part of a comprehensive warning system for those outside to seek shelter immediately.

History

According to the National Oceanic and Atmospheric Administration's (NOAA) National Climactic Data Center (NCDC), the Wyoming Climate Atlas, and the Wyoming Office of Homeland Security, there has been one recorded damaging tornado events in Teton County. Damage is defined by those events that resulted in loss of property or life. Table 12.2 describes the one tornado that caused damage in Teton County - a rare high altitude F4 event that caused $2.5 million (1987 dollars) in forest damage on July 21, 1987. On the afternoon of July 21st, unusually severe thunderstorms moved northeast through northwest Wyoming and spawned the highest elevation F4 tornado ever documented. The tornado touched down in the Teton Wilderness Area about 10 miles east-northeast of Moran Junction and created a massive blowdown of trees as it traveled north-northeast a distance of 24.3 miles before ending along the Yellowstone River in the southeast corner of Yellowstone National Park. The path averaged 1.5 miles in width, reached a maximum width of 2.5 miles, and contained 15,000 acres of mostly mature lodgepole pines that were snapped, uprooted, or in some cases pulled from the ground and carried a considerable distance by the tornado's winds. Fortunately, tornadoes are rare in mountainous environments such as Teton County. When they do occur, tornadoes are most likely to occur in May, June, or July.

Table 12.2 - Teton County Tornado Data Totals (1907-2014)

County	Events	Date	Fatalities	Injuries	Property Damage (USD 2015)	Crop Damage (USD 2015)	Total Damage (USD 2015)
Teton	1	7/21/87	0	0	$5,196,281	$0	$5,196,281
Total	**1**		**0**	**0**	**$5,196,281**	**$0**	**$5,196,281**

Impacts

Impacts from a tornado include damage to the environment and infrastructure, personal property, and a high risk of injuries or death to anyone caught in the tornado's path. Debris created by the initial destruction oftentimes causes secondary damage. Tornadoes can cause fires, damage utilities, and cause gas leaks. While unlikely in Teton County, an F5 tornado can level anything in its path.

Future Impacts

Historical data demonstrates that while a tornado can be a devastating event, tornadoes are rare in Teton County. The county has a few geographic advantages when it comes to tornadoes, including the rareness of tornadoes developing in mountainous regions, and wide open space that wouldn't suffer significant damage and/or financial impact if a tornado did touch down.

Tornadoes rarely occur in Teton County and there are not enough historic records to calculate a statistically significant recurrence interval. The only documented damaging tornado caused $2,500,000 in damage 1987, or $5,196,281 in 2015 dollars. This should be considered as an indicator of damage from a future event, but the potential for more damaging tornadoes exists if the tornado hits a developed area. Because of the random nature of tornadoes, it is difficult to predict where the next one will hit, or how damaging it will be.

Summary

PROPERTY AFFECTED:	Medium
POPULATION AFFECTED:	Medium
PROBABILITY:	Low
JURISDICTION AFFECTED:	Teton County; Jackson

Chapter 13. Wildland Fires

Teton County, because of its semi-arid climate, available fuels and rural character, is vulnerable to catastrophic wildland fires, and, of all the fires in Wyoming, over 50% involve wildland areas. As defined by the National Interagency Fire Center (NIFC), a “wildland fire” is any non-structure fire, other than prescribed fire, that occurs in the wildland. Before discussing wildland fire hazard in Teton County, some key terms should be identified. The term “wildland/urban interface” or WUI is widely used within the wildland fire management community to describe any area where man-made buildings are constructed close to or within a boundary of natural terrain and fuel, where high potential for wildland fires exists. “Aspect” refers to the direction in which a slope faces. “Fuel” consists of combustible material, including vegetation, such as grass, leaves, ground litter, plants, shrubs, and trees that feed a fire.

A number of factors have resulted in an increase in the risk of wildland fire to life and property. As the population and the wildland/urban interface in Wyoming increases, the more significant the risk of wildland fire hazard. The past 100 years of wildland fire suppression has led to heavy vegetation growth and thus has greatly increased the potential fuel-load for a wildfire to burn. As the wildland/urban interface has grown into these densely packed forests, the potential for catastrophic wildland fires has increased as well. In addition, many areas of the west including Teton County have recently experienced large scale mountain pine beetle infestations; the rate of infestations is on the decline. Pine beetle causes timber stand mortality, providing yet more fuel, but studies have shown that the fire risk decreases over time. Insect infestations are cyclical and the Western Spruce Budworm outbreak in 2015 is increasing the number of dead and dying trees, which may increase the fire danger for the next few years. Various fungi have been threatening aspen trees in the region, exacerbated by the over-maturity of local aspen forests. As of 2015 fungi has not yet affected areas to the east of the Tetons. Aspens tend to be more fire resistant, however standing dead trees can pose a risk to firefighters and backcountry users, particularly during wind events. Finally, climate change has had the effect of lengthening the fire seasons, with fires starting earlier and the season lasting longer.

Wyoming’s Forest Action Plan identifies fire in the WUI as a threat that is significant and expanding. Fire in the WUI impacts suppression strategies, tactics, costs, and also potentially firefighter and public safety. Lands in the WUI are often desirable for housing development due to amenities such as forests or other vegetation, which in turn present a hazard to the development. The Forest Action Plan also identifies strategies and tactics to help reduce the risk of wildfire in the WUI. Increased areas of WUI are prompting policy makers, fire management organizations and private landowners to respond to the need to mitigate wildfire risk.

Wyoming wildland fires are managed and supported to varying extents through cooperative efforts by the:

- Bureau of Land Management (BLM) Wyoming Fire Program
- Geospatial Multi-Agency Coordination (GeoMAC) Wildland Fire Support Maps
- Wyoming Fire Academy
- Wyoming Wildland Fire Plan Action Team
- National Park Service (NPS) Fire Management Program
- US Fish and Wildlife Service (FWS) Fire Management Branch
- National Interagency Fire Center (NIFC)
- Bureau of Indian Affairs (BIA) Fire and Aviation Management – NIFC

- USDA Forest Service (USFS) Fire and Aviation Management
- Wyoming State Fire Marshalls Office
- Wyoming Office of Homeland Security (WOHS)
- Wyoming State Forestry Division
- County and Local Fire Departments/Districts

Currently, the Wyoming Forest Action Plan and the Western Wildfire Risk Assessment are considered the primary strategic plans that address wildland fire management in the state. Additionally, the Wyoming Interagency Cooperative Fire Management and Stafford Act Response Agreement outline areas of cooperation and coordination with respect to fire prevention, readiness, detection, fuels management, suppression, information sharing, communications, and reimbursement for shared resources. The agreement is produced through a joint venture of the U.S. Bureau of Land Management (BLM); National Park Service (NPS), Intermountain Region; Bureau of Indian Affairs (BIA), Rocky Mountain Region; Fish and Wildlife Service (FWS), Mountain Prairie Region; U.S. Department of Agriculture (USDA), Forest Service Rocky Mountain and Intermountain Regions; and the Wyoming State Board of Land Commissioners, Office of State Lands and Investments, Wyoming State Forestry Division.

There are two agreements to support local interaction and sharing. They are the “Interagency Agreement for Wildland Fire Management” (2011-2015), among the Bureau of Land Management (BLM), Bureau of Indian Affairs, the National Park Service (NPS) and the Nation Forest Service (USFS) and the “Interagency Cooperative Fire Management and Stafford Act Response Agreement – Wyoming” (2012) among the Department of the Interior, Bureau of Land Management-Wyoming, National Park Service-Intermountain Prairie Region, Forest Service-Rocky Mountain and Intermountain Regions and Wyoming State Forestry Division.

Under the authority of the Wyoming Cooperative Agreement, Annual Operating Plans are entered into among local cooperators, further describing how fire management activities will be coordinated. In Teton County, this is covered by the “Wildland Fire Management Annual Operating Plan” for District 4 of the Wyoming State Forestry Division.

Teton County completed its first collaborative Community Wildfire Protection Plan (CWPP) in 2005 with Forest Service, National Park, and State Forester partners. The Teton Area Wildfire Protection Coalition (TAWPC), an interagency working group, determined in 2013 the original document needed revision. The 2014 Teton County CWPP document completely replaces the 2005 CWPP. Current government partners involved in TAWPC include Teton County, Town of Jackson, Jackson Hole Fire/EMS, Bridger-Teton Nation Forest, Grand Teton National Park, Caribou-Targhee National Forest, Wyoming State Forestry Division, National Elf Refuge, Wyoming Game and Fish Department, Bureau of Land Management, Teton County Weed & Pest District, and Teton Conservation District.

The CWPP identifies and prioritizes areas for hazardous fuel reduction treatments and recommends types and methods of treatments that will protect at-risk communities and essential infrastructures. The 2014 CWPP utilizes a new approach to prioritizing fuels management at a county level where new projects can be proposed by any individual which will help accomplish more mitigation work within the county. This new prioritization process focuses on defensible space as the highest priority and builds from there, noting the benefits of mutual fuels management efforts on adjacent lands. The CWPP does not aim to stop fires but to mitigate fuels where necessary to protect identified values while allowing fire to play its role in the natural environment.

There are three priority areas identified in the CWPP. Priority 1 areas are composed of all private lands within the CWPP's mapped WUI and defensible space around federal structures within the WUI. Proper defensible space is the highest priority for protecting structures as well as protecting ingress and egress routes. Priority 2 areas include outlying properties beyond the 300 feet of the structure's defensible space to property lines or subdivision boundaries and federal lands adjacent to private lands and federal structures. Priority 3 areas are defined as the remainder of the CWPP's mapped WUI. Priority 3 areas are adjacent to a particular property or subdivision that fire may reach within 1 burn period.

The CWPP identified and mapped WUI areas in the county and ranked them according to priority for mitigation work. Notification and evacuation triggers were developed for each interface area. Each WUI area is described with respect to hazard level, fuels, and existing infrastructure. The CWPP also contains appendix material helpful for property owners who wish to mitigate the threat of wildland fire to their property.

Jackson Hole Fire/EMS reviews plans to all new or altered subdivisions, all new structures to be built in the interface, and alterations to existing structures in the interface. Teton County has adopted codes and regulations to protect life and property from fire. Jackson Hole Fire/EMS enforces the International Fire Code, the International Urban-Wildland Fire Code, and the Teton County Fire Protection Resolution for New Subdivisions. The Department also publishes a helpful Fire Evacuation Plan document to assist residents in planning and preparing for evacuation due to a fire. The Department is a combined paid staff and volunteer organization. There are 105 volunteer fire fighters and EMTs. Fourteen positions are paid. The Department has six fire stations. Grand Teton National Park and the Bridger-Teton National Forest also have paid fire fighters and fire apparatus. Additional agencies may have fire apparatus required for specific operations in the county and adjacent federal lands.

History

The wildland fire history for the State of Wyoming has been compiled in the Wyoming Multi-Hazard Mitigation Plan from various state and federal sources. Wildland fires often span multiple counties, and impacts specific to Teton County are often not available. Wyoming has had damaging fire seasons, often coinciding with times of drought. One of the worst fire seasons occurred during 1988, when fifty fires started in Yellowstone National Park. These fires, along with other natural and human-caused fires that began outside the Park boundaries eventually burned more than a third of the Park, nearly 800,000 acres. Another 700,000 acres outside the Park also burned. Approximately 25,000 firefighters worked to put out the fires. The costs exceeded $120 million. Table 13.1 includes recent wildland fire incidents in Teton County based on lightning-caused fires recorded in a National Weather Service severe weather database.

Table 13.1 – Wildfire Events in Teton County 1985 - Present

County	Location	Date	Num. killed	Num. injured	Est. property damage (year of damage USD)	Suppress. Cost (year of damage USD)	Total est. damage (year of damage USD)	Total est. damage (2015 USD)	Information
Teton		30-Aug-85	0	0	$140,000	Unknown	$140,000	$305,400	A blaze sparked by a lightning strike burned 1080 acres in Grand Teton National Park, destroying 10 cabins and inflicting an estimated $140,000 worth of damage.
Park, Teton, Carbon, Sweetwater, and Natrona		1-Jul-88	0	0	$364,430	Unknown	$364,430	$723,074	During the month of July, at least 59 fires were started by lightning from mostly high- based thunderstorms that produced little rainfall. These included very large forest fires such as the Clover Mist Blaze in Yellowstone Before and including the 2nd, fourteen lightning fires were started. During the 10th through the 16th, 18 such fires were reported. From the 17th through the 23rd, there were eight fires. Between the 24th and 30th, ten lightning blazes occurred. Finally, on the 31st, there were four fires. According to the BLM for Wyoming, 3,644.3 acres were torched with an estimated lost resource value of $364,430. This does not include the fires started by lightning in Yellowstone National Park because this information is not yet available. National Park and the Lost Fire over the Big Horn Mountains of northern Wyoming. On a week-by-week basis, the breakdown of lightning fire is as follows.
Park, Teton, Sweetwater, Sheridan, Natrona, Fremont,		3-Jul-88	0	0	Same as 1 July 1998	Unknown	$0		See 1 July 1988 description
Albany, Laramie, Crook, and Johnson									

Table 13.1 – Wildfire Events in Teton County 1985 – Present (cont.)

County	Location	Date	Num. killed	Num. injured	Est. property damage (year of damage USD)	Suppress. Cost (year of damage USD)	Total est. damage (year of damage USD)	Total est. damage (2015 USD)	Information
Park, Teton, Sweetwater, Fremont, Johnson, Laramie, Washakie, Converse and counties		10-Jul-88	0	0		Unknown	$0		See 1 July 1988 description
Park, Teton, Fremont, Sweetwater, Washakie and Natrona		17-Jul-88	0	0	Same as 1 July 1998	Unknown	$0		See 1 July 1988 description
Park, Teton, Uinta, Johnson, and Sublette		24-Jul-88	0	0	Same as 1 July 1998	Unknown	$0		See 1 July 1988 description
Park and Teton		31-Jul-88	0	0	Same as 1 July 1998	Unknown	$0		See 1 July 1988 description
Park, Teton, Campbell, Crook, Natrona, Sweetwater and Weston		1-Aug-88	0	0	$415,900	Unknown	$415,900	$825,197	See 1 July 1988 description

Table 13.1 – Wildfire Events in Teton County 1985 – Present (cont.)

County	Location	Date	Num. killed	Num. injured	Est. property damage (year of damage USD)	Suppress. Cost (year of damage USD)	Total est. damage (year of damage USD)	Total est. damage (2015 USD)	Information
Teton, Park and Sweetwater		21-Aug-88	0	0	Same as 1 August 1988	Unknown	$0		See 1 July 1988 description
Teton	Moose	28-Aug-94			$60,000	Unknown	$60,000	$95,029	Lightning started the Mormon Row fire in the Antelope Flats area on the 28th and the fire grew quickly to 3200 acres by the end of the month
Teton	Jackson	21-Jul-01	0	0	$0	Unknown	$0	$0	The Green Knoll Fire was started by an unattended camp fire. The fire burned 4,620 acres and was not fully contained by the end of July. The fire received national media attention due to its proximity to multi-million dollar homes. Green Knoll received a fire management assistance declaration on July 26, 2001.
Teton	3 S Moose	10-Aug-03	0	0	Unknown	Unknown	Unknown	Unknown	The Blacktail Wildfire was started by lightning on August 10. On August 11, Gros Ventre Campground had to be evacuated as the fire approached. Smoke impacted air traffic at Jackson Airport and Highway 26/89/91 was temporarily closed.

County	Location	Date	Num. killed	Num. injured	Est. property damage (year of damage USD)	Suppress. Cost (year of damage USD)	Total est. damage (year of damage USD)	Total est. damage (2015 USD)	Information
Teton	10 E Fishing Bridge	11-Aug-03	0	0	Unknown	$6,600,000	$6,600,000	$8,419,376	The East Wildfire, located near the East Entrance of Yellowstone National Park, was started on August 11 by lightning. Thirty-one residences and 43 commercial buildings need protection as gusty winds caused rapid fire growth. The wildfire burned four private vehicles. On August 15, the East Entrance of Yellowstone National Park was closed, only to be opened temporarily, 3 hours in the morning and 3 hours in the afternoon, from August 29-31. The fire burned 23,500 acres. The estimated cost of fighting the fire was $6.6 million.
Teton	Gros Ventre Drainage	Aug. 4, 2006	0	0	Unknown	Unknown	Unknown	Unknown	Purdy Fire burned approx. 8,000 acres in Bridger-Teton and Shoshone National Forests. Plans made for evacuations on Dubois side of fire.
Teton	Yellowstone National Park	9-Aug-07	0	0	Unknown	Unknown	Unknown	Unknown	Lightning sparked the Columbine Wildfire over the eastern portion of Yellowstone National Park beginning on August 9. The fire made additional advances east over the next three days, twice closing the East Several resort areas just to the east of the national park boundary along U.S. Highway 14-16-20 had been threatened by the blaze. Approximately 18,255 acres were torched. Entrance to Yellowstone National Park closed because of dense smoke. Total acreage burned within Yellowstone National Park totaled 16,523 with the remainder being in the Shoshone NF.
Teton	Yellowstone National Park	30-Jul-08	0	0	Unknown	Unknown	Unknown	Unknown	Power line running through a utility corridor initiated the LeHardy Fire three miles north of Fishing Bridge in Yellowstone NP. The fire began on July 30. Gusty southwest wind pushed it east across the road and the Yellowstone River quickly torching over 500 acres. The fire began near Grand Loop Road prompting road closure through July between Fishing Bridge and Canyon.

Table 13.1 – Wildfire Events in Teton County 1985 – Present (cont.)

County	Location	Date	Num. killed	Num. injured	Est. property damage (year of damage USD)	Suppress. Cost (year of damage USD)	Total est. damage (year of damage USD)	Total est. damage (2015 USD)	Information
Teton	Yellowstone National Park	1-Aug-08	0	0	Unknown	$1,350,000	$1,350,000	$1,471,761	Traffic on the Grand Loop Road between Fishing Bridge and Mud Volcano south of Canyon reopened to traffic at noon Friday, August 1 as the threat from the LeHardy Wildfire waned. A fire line was secured near the road, but the wildfire continued to burn actively to the northeast. Gusty wind and low humidity enabled the fire to increase by over 2,500 acres in size on Saturday, August 2. Total acreage burned was about 9,300. Cost to fight the fire was estimated at around $1.35 million.
Teton	Yellowstone National Park	13-Sep-09	0	0		Unknown	Unknown	Unknown	Lightning ignited the Arnica wildfire on September 13 in old-growth lodgepole timber west of Bridge Bay in Yellowstone National Park. The fire was not detected until September 23 when it was four acres. Warm, dry, and windy conditions allowed the fire to grow over the next week, enabling it to burn within 3.5 miles of Lake Village. Burnt trees fell to the ground on the Grand Loop Road between Fishing Bridge and West Thumb as fire swept across the road. At its peak, the fire burned actively along a 1.5 mile stretch of the road. Over 200 people and five helicopters actively fought the fire and protected structures. The fire charred approximately 10,700 acres of land.

Table 13.1 – Wildfire Events in Teton County 1985 – Present (cont.)

County	Location	Date	Num. killed	Num. injured	Est. property damage (year of damage USD)	Suppress. Cost (year of damage USD)	Total est. damage (year of damage USD)	Total est. damage (2015 USD)	Information
Teton	TETON & GROS VENTRE MOUNTAINS	28-Sep-12	0	0	Unknown	$9,000,000	$9,000,000	$9,201,015	The Horsethief Canyon wildfire started on Saturday September 8, 2012. Burning within Teton County and on the Jackson Ranger District of the Bridger Teton Forest. A man burning trash 5 miles south of Jackson ignited a wildfire that rapidly spread to the north and northeast toward Jackson. The fire came within 1 mile of Snow King Ski Area and Resort on September 9. The fire closed several recreational trails to the south of Jackson. Spread of the fire was slowed significantly by September 13 when all evacuation orders were lifted. Almost full containment was reported by September 18. The fire burned 3,373 acres and also burned one county fire engine. The cost to fight the fire was estimated at almost $9 million.
Teton	Teton Wilderness Area	24-Aug-12	0	0	Unknown	Unknown	Unknown	Unknown	The North Buffalo Fire started on August 24 in the Teton Wilderness Area. The 28,800- acre fire, located 14-miles northeast of Moran, Wyoming, was a human caused fire. Fuel for the fire consisted of mixed conifer and beetle-killed trees.

Table 13.1 – Wildfire Events in Teton County 1985 – Present (cont.)

County	Location	Date	Num. killed	Num. injured	Est. property damage (year of damage USD)	Suppress. Cost (year of damage USD)	Total est. damage (year of damage USD)	Total est. damage (2015 USD)	Information
Teton	Yellowstone National Park	14-Aug-13	0	0	Unknown	Unknown	Unknown	Unknown	Lightning caused the Alum Fire in a remote area south of Hayden Valley in Yellowstone National Park. The fire was first seen on Wednesday morning, August 14. By Tuesday, August 20, the fire was close enough to threaten several tourist attractions, including Mud Volcano and LeHardy Rapids, and the Grand Loop Road. The proximity of the fire caused the closure late Tuesday afternoon of a seven and a half mile section of the road from near Mud Volcano to Hayden Valley. At one point the fire came within 200 yards of the road. The fire topped-out around 7,100 acres in size by August 24, before beneficial thunderstorm rains dampened fire activity over the last week of August

Table 13.2 – Total Estimated Acres Burned by Year in Teton County 1931-2014

County	Year	Total Estimated Acres Burned
Teton	1931-1959	52,884*
Teton	1960-1969	1,121*
Teton	1970-1979	2,568*
Teton	1980	46
Teton	1981	119
Teton	1982	2
Teton	1983	0
Teton	1984	0
Teton	1985	1,076
Teton	1986	1
Teton	1987	3,949
Teton	1988	658,153
Teton	1989	2
Teton	1990	20
Teton	1991	6,264
Teton	1992	24
Teton	1993	0
Teton	1994	4,848
Teton	1995	474
Teton	1996	2,087
Teton	1997	4,716
Teton	1998	3,052
Teton	1999	4,247
Teton	2000	28,281
Teton	2001	17,400
Teton	2002	7,624
Teton	2003	10,745

Table 13.2 – Total Estimated Acres Burned by Year in Teton County 1931-2014 (cont.)

County	Year	Total Estimated Acres Burned
Teton	2004	213
Teton	2005	333
Teton	2006	45,884
Teton	2007	6,955
Teton	2008	10,730
Teton	2009	17,250
Teton	2010	8,220
Teton	2011	17,098
Teton	2012	33,556
Teton	2013	2,260
Teton	2014	457
	Total	**952,659**

* Estimates only, minimal detail available on exact dates.

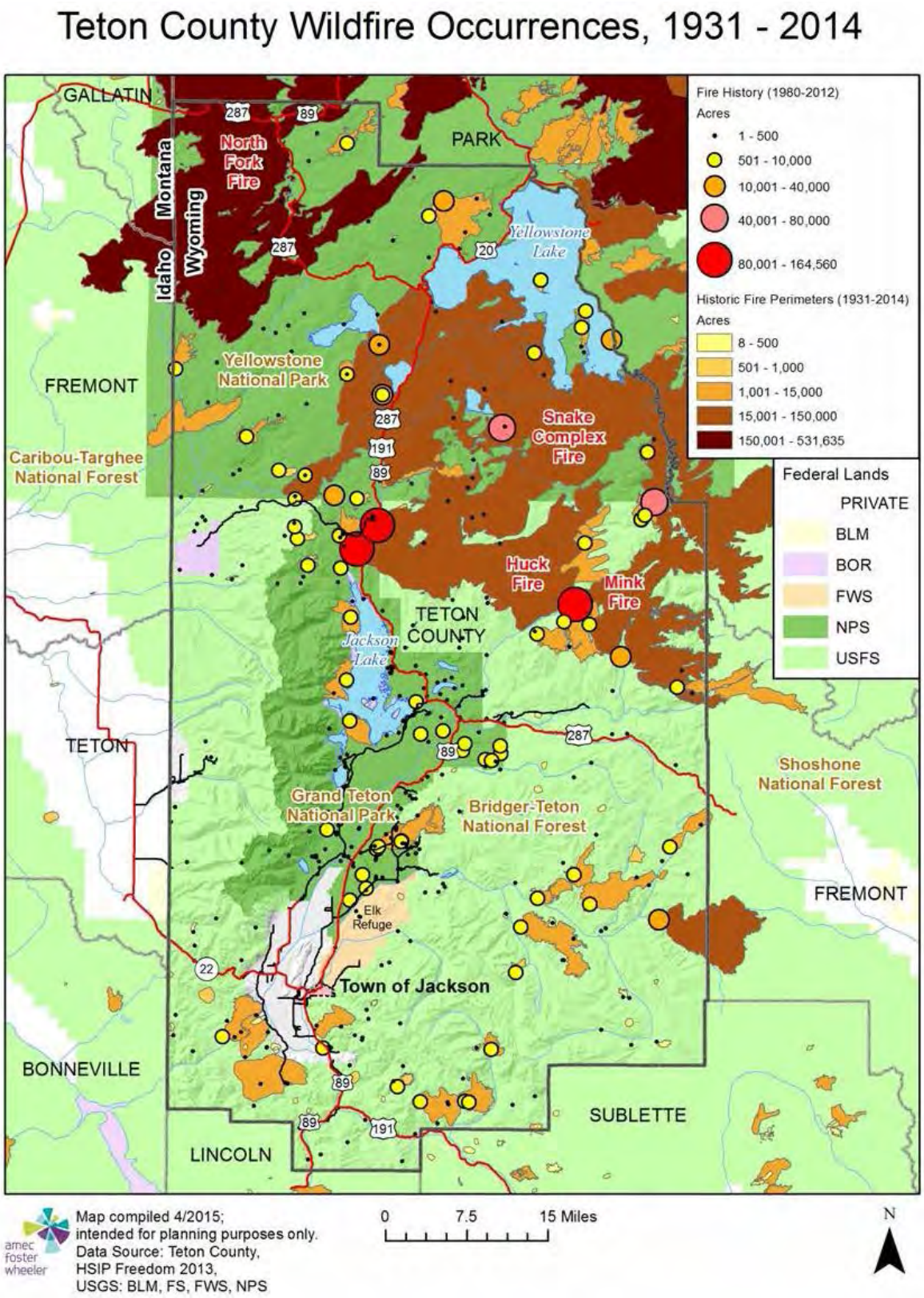


Figure 13.1 Teton County Wildfire Occurrences 1931-2014

Impacts

GIS is a tool that is used to compare, capture, input, output, store, manipulate, analyze, model, and display spatial data. In the case of determining the Wildland Urban Interface the following is from Teton County's CWPP:

The WUI boundary for Teton County was developed by the Teton Area Wildfire Protection Coalition comprised of local land management agencies, land trust and conservation organizations, and contractors directly involved in wildland fire protection projects as well as citizens who represent the interests of the community. Capital improvements, houses, private land, significant utility and transportation corridors and communication sites are examples of structures and human developments this group is collectively concerned about in the event of a wildfire. The existence and vulnerability of these values relative to the surrounding landscape shape the WUI boundary. The vulnerability of identified lands within the WUI boundary is based on fuels, topography, weather patterns, natural barriers and lessons learned from historic fires. In general, areas within the WUI boundary have the potential to support a wildland fire posing a direct threat* to the values mentioned above.

*Direct threat = land that has the potential to support a wildland fire that could reach values within 1 burn period under at least VERY HIGH weather/fuel conditions as determined by the National Fire Danger Rating System and remote automated weather stations in the surrounding area. The "reach" of a fire during a burn period is determined by subject matter experts utilizing: experience, historic weather and fire data, and fire modeling assessments completed in Teton County, WY.

Staff from the National Forest Service (Bridger-Teton National Forest) performed the fire behavior modeling using FlamMap, a spatial fire behavior mapping and analysis program. The modeling was used to inform the process and then the team picked logical/identifiable features on the map near where the "one burn period" extent would be on the landscape to draw the boundaries. The team was made up of subject matter experts including wildland fire management officers, fuels specialists and the county staff. Figures 13.2 and 13.3 show the county WUI.

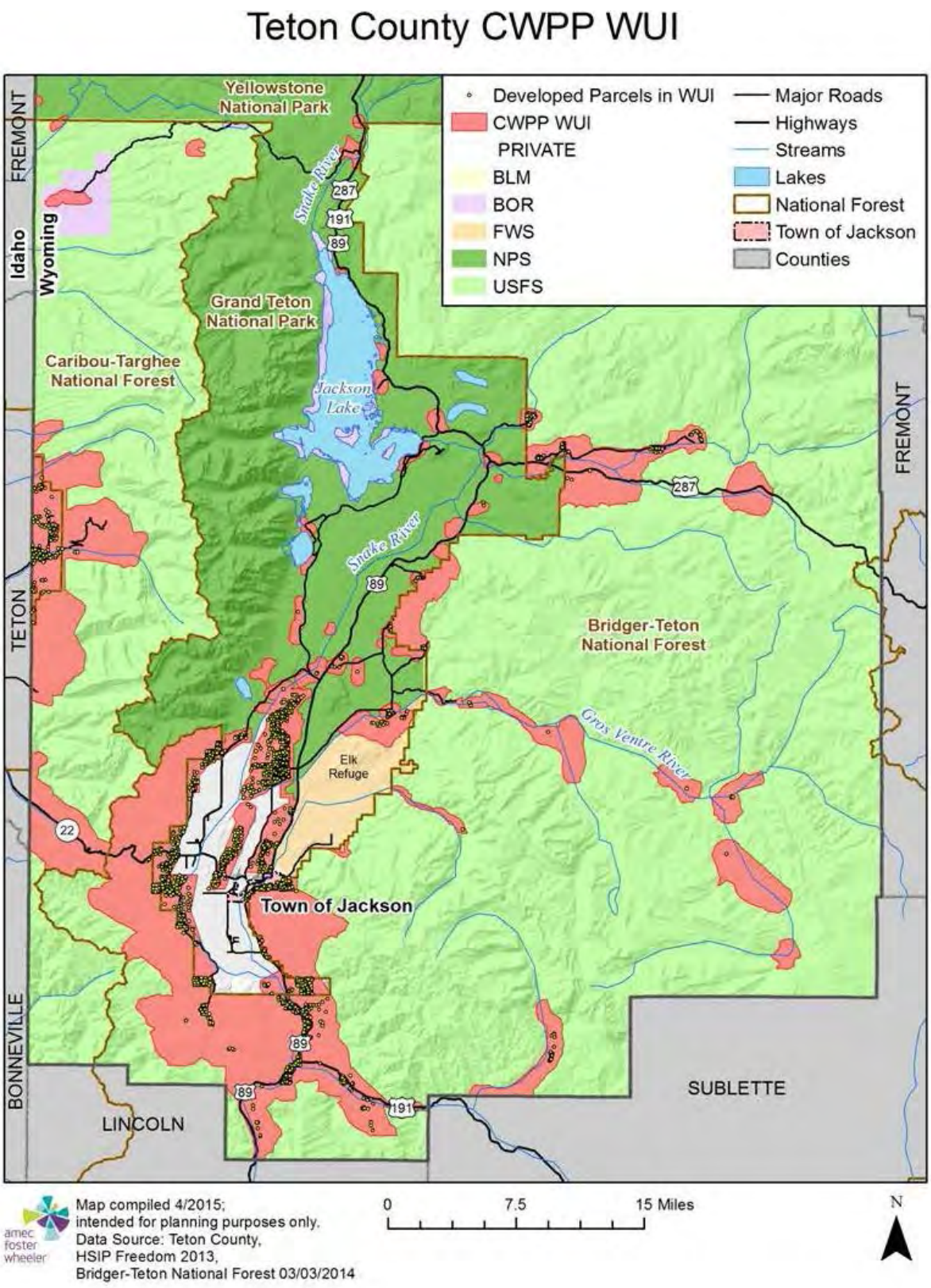


Figure 13.2 Teton County WUI (South of Yellowstone NP)

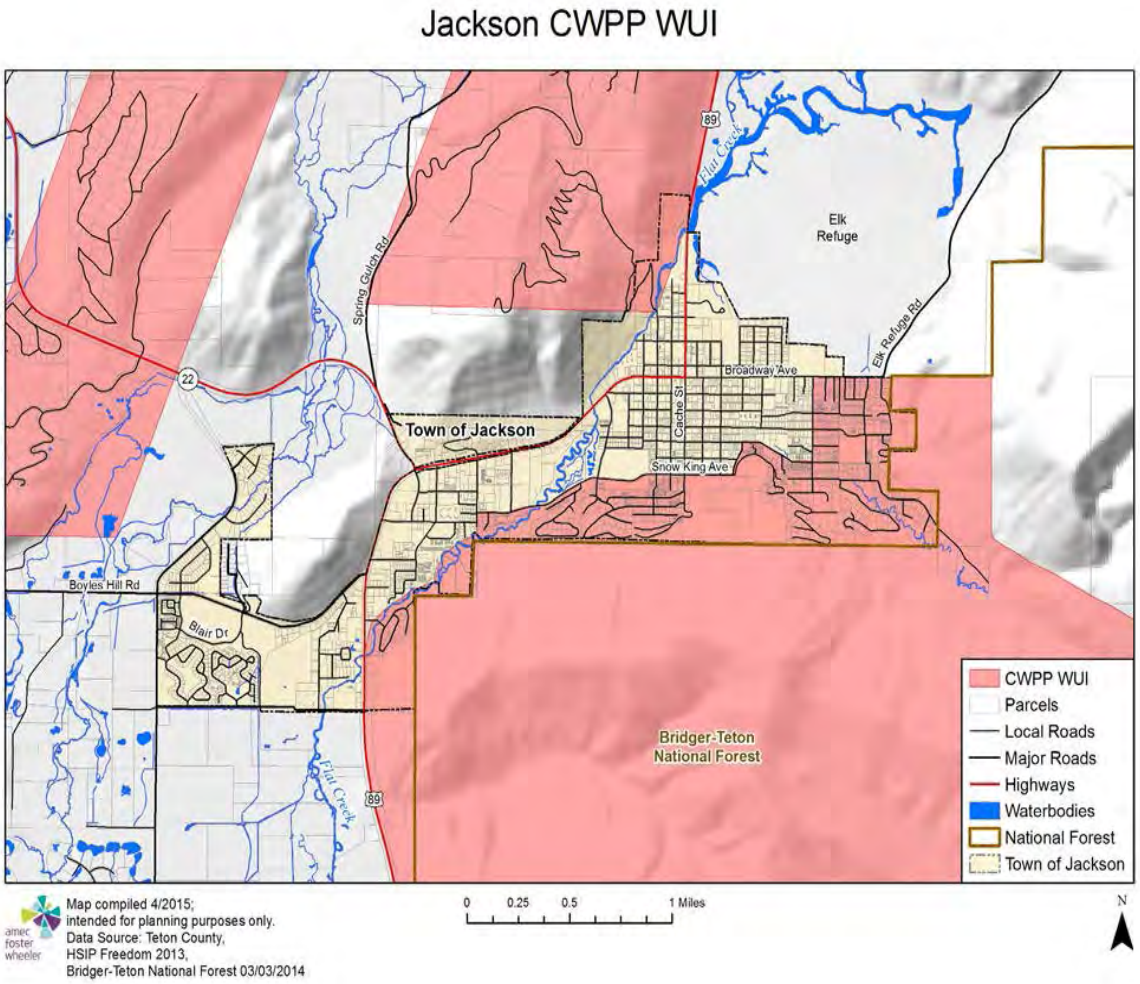


Figure 13.3 Town of Jackson WUI

Per the State of Wyoming Hazard Mitigation Plan (2014), Wyoming has less developed wildland urban interface than most western states. The areas of highest existing risk from wildfire (number of square miles of the wildland urban interface with homes now) mainly occur within Park, Teton and northern Lincoln Counties. Combined, these three counties have more than 3,000 homes spread across 10 miles of wildland urban interface.

Teton County is the top ranked county in the state for existing risk based on the number of square miles of developed land in the wildland interface. It is ranked 5th in the state based on the number of undeveloped square miles in the WUI. Of an estimated
35.5 square miles of land in the WUI, 5.6 square miles are developed (16%), with 2,060 homes, 23% of which are second homes.

Wildland fire building exposure value is the value of buildings that can be potentially damaged by wildland fire. The CWPP WUI layer was used in GIS to analyze the areas at risk based on the number of improved parcels and estimated contents values. The methodology utilized is similar to that used to model flood exposure described in the flood chapter. Properties with an improved

value greater than zero were assumed to have a structure for the purpose of this modelling. The amount of improved properties, values and estimated content values within the WUI were grouped by jurisdiction and adjacent federal lands.

The results indicate that approximately $4.9 billion in property value and 4,911 structures are potentially exposed to wildland fire hazards in the county. The Town of Jackson has nearly to $600 million in property value and 1,198 structures in the WUI. As shown on Figure 13.3, only a limited portion of the Town is in the WUI where it abuts the Bridger-Teton National Forest. The unincorporated county area WUI development was further analyzed by adjacent federal lands. Analysis was performed in GIS using map layers obtained from National Atlas of the United States of America, and the national forests obtained from the Forest Service. Tables 13.3 and 13.4 summarize the potential exposure on property in the county.

Table 13.3 – WUI Exposure by Jurisdiction and Property Type

Jurisdiction	Property Type	Property Count	Improved Value	Content Value	Total Value
Town of Jackson	Commercial	48	$41,450,522	$41,450,522	$82,901,044
	Exempt	5	$788,823	$788,823	$1,577,646
	Residential	1,145	$343,022,873	$171,511,437	$514,534,310
	Total	**1,198**	**$385,262,218**	**$213,750,782**	**$599,013,000**
Unincorporated County	Agricultural	94	$47,248,360	$47,248,360	$94,496,720
	Com Vacant Land	1	$807,677	$807,677	$1,615,354
	Commercial	242	$176,451,178	$176,451,178	$352,902,356
	Exempt	9	$3,933,648	$3,933,648	$7,867,296
	Residential	3,367	$2,546,341,569	$1,273,170,785	$3,819,512,354
	Total	**3,713**	**$2,774,782,432**	**$1,501,611,648**	**$4,276,394,080**
	Grand Total	**4,911**	**$3,160,044,650**	**$1,715,362,429**	**$4,875,407,079**

Table 13.4 WUI Exposure Unincorporated Area by Adjacent Federal Land and Property Type

Jurisdiction		Property Type	Property Count	Improved Value	Content Value	Total Value
Unincorporated County	Bridger-Teton National Forest	Agricultural	41	$23,553,549	$23,553,549	$47,107,098
		Commercial	189	$120,213,714	$120,213,714	$240,427,428
		Exempt	5	$1,643,179	$1,643,179	$3,286,358
		Residential	1,424	$896,893,757	$448,446,879	$1,345,340,636
		Total	**1,659**	**$1,042,304,199**	**$593,857,321**	**$1,636,161,520**
	Caribou-Targhee National Forest	Agricultural	7	$617,519	$617,519	$1,235,038
		Commercial	1	$6,921,430	$6,921,430	$13,842,860
		Residential	17	$3,959,458	$1,979,729	$5,939,187
		Total	**25**	**$11,498,407**	**$9,518,678**	**$21,017,085**
	Grand Teton National Park	Agricultural	2	$3,826,867	$3,826,867	$7,653,734
		Commercial	1	$1,227,279	$1,227,279	$2,454,558
		Residential	140	$50,021,584	$25,010,792	$75,032,376
		Total	**143**	**$55,075,730**	**$30,064,938**	**$85,140,668**
	National Elk Refuge	Agricultural	1	$310,812	$310,812	$621,624
		Commercial	5	$2,373,285	$2,373,285	$4,746,570
		Residential	55	$47,890,664	$23,945,332	$71,835,996
		Total	**61**	**$50,574,761**	**$26,629,429**	**$77,204,190**
	Not adjacent to federal lands	Agricultural	43	$18,939,613	$18,939,613	$37,879,226
		Commercial	47	$46,523,147	$46,523,147	$93,046,294
		Exempt	4	$2,290,469	$2,290,469	$4,580,938
		Residential	1,731	$1,547,576,106	$773,788,053	$2,321,364,159
		Total	**1,825**	**$1,615,329,335**	**$841,541,282**	**$2,456,870,617**
		Grand Total	**3,713**	**$2,774,782,432**	**$1,501,611,648**	**$4,276,394,080**

Critical infrastructure in Teton County includes public safety and government buildings, physical infrastructure, water supply systems, wastewater treatment, power infrastructure, and schools. Table 13.5 summarizes the critical facilities in the WUI, broken out by the Town of Jackson and the adjacent federal lands.

Table 13.5 Critical Facilities by Jurisdiction and Adjacent Federal Lands in Designated WUI Areas

Jurisdiction	Facility Type	Facility Count
Town of Jackson	Bridge	1
	City Facility	1
	Daycare	2
	HAZMAT	1
	Total	**5**
Bridger-Teton National Forest	Bridge	14
	Clinic	1
	Communications	8
	Dam	2
	Daycare	1
	Emergency Facility	8
	EOC	1
	Fire Station	3
	HAZMAT	8
	Helipad	2
	Power Station	1
	School	1
	Shelter	1
	Total	**51**
Caribou-Targhee National Forest	Communications	2
	Daycare	1
	Total	**3**
Grand Teton National Park	Bridge	8
	Clinic	1
	Emergency Facility	3
	Fire Station	4
	HAZMAT	10
	Helipad	2
	School	3
	Shelter	2
	Total	**33**

Jurisdiction	Facility Type	Facility Count
John D. Rockefeller Jr. Memorial Parkway	Bridge	1
	Communications	1
	Total	**2**
No adjacent federal land	Bridge	19
	Daycare	2
	Emergency Facility	1
	Fire Station	2
	HAZMAT	6
	School	2
	Total	**32**
Yellowstone National Park	Clinic	2
	Emergency Facility	5
	HAZMAT	5
	Total	**12**
	Grand Total	**138**

Future Impacts

Small wildfires occur within the county every year. Large fires are less frequent, but there is evidence that climate change may result in longer fire seasons, longer and larger fires, and more extreme fire behavior. Based on GIS analysis performed, Teton County has approximately $4.9 billion in building value potentially at risk to wildland fires. Based on observations in wildland-urban interface fires, structures and contents are often completely destroyed, thus the estimated total value also represents potential dollar losses. Though it is not likely the areas at risk will simultaneously face a completely destructive event, this figure provides the upper end of what could be affected. Future wildfires could damage forests and watersheds within the County, and contribute to soil erosion and deposition problems. Future losses could result from property loss and damage, loss of natural resources such as timber and forage, forfeited recreation and tourism revenues to the local economy, medical costs related to smoke and burns, and fire suppression costs.

Future Development

Throughout Wyoming there remains potential for future home construction in more than 400 square miles of undeveloped, forested private lands adjacent to fire-prone public lands. Teton County has 29.9 square miles that meet this definition (2014 Wyoming Multi-Hazard Mitigation Plan, pg. 207). Building homes in these high-risk areas would put lives and property in the path of wildfires. Codes and regulations in place for new subdivisions will minimize the potential for increased risk from new development in the interface areas.

Summary

PROPERTY AFFECTED:	High
POPULATION AFFECTED:	High
PROBABILITY:	High
JURISDICTION AFFECTED:	Unincorporated Areas; Jackson

Chapter 14. Winter Storms and Blizzards

Western Wyoming has a rich history of winter weather, and Teton County is no exception. Historical data on winter storms in Teton County extends back to 1886, with impacts varying in severity as technology and storm impact mitigation and response techniques improved. Severe winter storms generally have a large footprint, and commonly include heavy snow accumulation, high winds, and low temperatures. Impacts include poor visibility, drifting snow and dangerous cold. These storms can make travel difficult, isolate communities, and cause both animal and human fatalities. Winter storms directly affect the avalanche danger in Teton County. Avalanche impacts are addressed in the avalanche chapter.

Most winter storms occur between September and April, although at higher elevations, these storms can occur at any time of year.

The National Climatic Data Center uses set parameters in its tracking of winter storm and blizzard data. All data since 1996 is measured against this metric, which provides a baseline for the incident. According the NCDC, the following criteria must be met to qualify as a winter storm or blizzard event:

Winter Storm – A winter weather event which has more than one significant hazard (i.e. heavy snow and blowing snow; snow and ice; snow and sleet; sleet and ice; or snow, sleet and ice) and meets or exceeds locally/regionally defined 12 and/or 24 hour warning criteria for at least one of the precipitation elements, on a widespread or localized basis.

Blizzard – A winter storm which produces the following conditions for 3 hours or longer: (1) sustained winds or frequent gusts 30 knots (35 mph) or greater, and (2) falling and/or blowing snow reducing visibility frequently to less than ¼ mile, on a widespread or localized basis.

History

Winter storm history in Teton County extends from 1886 to present. There have been a few winter storms in the county that have caused great damage, economic impact, and brought about change in livestock practices.

Table 14.1 provides a historical look at winter storms on an annual basis since 1996, as defined by the National Climatic Data Center (NCDC). While almost every year had at least one winter storm, it was rare for a winter storm to significantly damage livestock or property during this timeframe, or at least for that damage to be reported. One injury was recorded, to a stranded climber. A new monthly snowfall record occurred in December of 2008 when two storms pushed the monthly total to 47.5 inches, exceeding the 1978 record of 37 inches.

It is important to note that storm locations are separated by NCDC zone. Figure 14.2 shows the footprint of each of the NCDC zones that include Teton County.

Table 14.1 – Teton County Winter Storms by Year 1996 to Present

County	Location (By NCDC Zone)	Timeframe	Deaths	Injuries	Estimated Property Damage (2015 Dollars)	Estimated Crop Damage (2015 Dollars)	Character of Storm	Information
Teton	Yellowstone National Park Jackson Hole Teton and Gros Ventre Mountains	1996	0	0	$75,245	$0	Winter Storm	Four events. Storms dropped anywhere from six to 24 inches of snow in 24-hour timeframe. In some cases, problems were exacerbated by high winds and extremely cold temperatures.
Teton	Yellowstone National Park	1997	0	0	$0	$0	Winter Storm	One event. Storm spanned three days. Snowfall amounts approached 36 inches in some locations across Wyoming.
Teton	Yellowstone National Park	1998	0	0	$1,448,583	$0	Winter Storm	Five events. Heavy snow (up to 24 inches), and whiteout conditions.
Teton	N/A	1999	-	-	-	-	Winter Storm	N/A
Teton	Yellowstone National Park	2000	0	0	$0	$0	Winter Storm	Two events. Up to 24 inches of snow fell in western Wyoming.
Teton	N/A	2001	-	-	-	-	N/A	No events
Teton	Yellowstone National Park	2002	0	0	$0	$0	Winter Storm	Two events. Snowfall from 1-2 feet, exacerbated by strong winds.
Teton	Yellowstone National Park Jackson Hole Teton and Gros Ventre Mountains	2003	0	1	$0	$0	Winter Storm	Five events. Heavy snowfall and high winds. Injury incurred by hiker climbing Grand Teton.
Teton	N/A	2004	N/A	N/A	N/A	N/A	N/A	N/A
Teton	Jackson Hole Teton and Gros Ventre Mountains	2005	0	0	$0	$0	Winter Storm	One event. Snowfall from 15 to 25 inches. Exacerbated by wind gusts and near-zero visibility.
Teton	Yellowstone National Park Jackson Hole Teton and Gros Ventre Mountains	2006	0	0	$0	$0	Winter Storm	Two events. Heavy snow accumulation.
Teton	Yellowstone National Park Jackson Hole Teton and Gros Ventre Mountains	2007	0	0	$0	$0	Winter Storm	Four events. Snow accumulation of anywhere from 6 to 17 inches.
Teton	Yellowstone National Park Jackson Hole Teton and Gros Ventre Mountains	2008	0	0	$0	$0	Winter Storm	Eleven events. Heavy snow accumulation, high winds and visibility issues. Monthly snow record broken in December of this year.
Teton	Yellowstone National Park Jackson Hole Teton and Gros Ventre Mountains	2009	0	0	$0	$0	Winter Storm	Eight events. Up to two feet of snowfall, high winds and visibility issues.
Teton	Yellowstone National Park Jackson Hole Teton and Gros Ventre Mountains	2010	0	0	$0	$0	Winter Storm	Eighteen events. Heavy snow accumulation.

Table 14.1 – Teton County Winter Storms by Year 1996 to Present (cont.)

County	Location (By NCDC Zone)	Timeframe	Deaths	Injuries	Estimated Property Damage (2015 Dollars)	Estimated Crop Damage (2015 Dollars)	Character of Storm	Information
Teton	Yellowstone National Park Jackson Hole Teton and Gros Ventre Mountains	2011	0	0	$0	$0	Winter Storm	Nine events. Heavy snow accumulation across Teton County – up to two feet.
Teton	Yellowstone National Park Jackson Hole Teton and Gros Ventre Mountains	2012	0	0	$0	$0	Winter Storm	Nine events. Heavy snow accumulation.
Teton	Yellowstone National Park Jackson Hole Teton and Gros Ventre Mountains	2013	0	0	$0	$0	Winter Storm	Two events. Up to two feet of snow accumulation, heavy winds and dangerously low wind chills.
Teton	Yellowstone National Park Jackson Hole Teton and Gros Ventre Mountains	2014	0	0	$0	$0	Winter Storm	Fourteen events. Heavy snow accumulation and high winds
TOTALS			**0**	**1**	**$1,523,858**	**$0**		

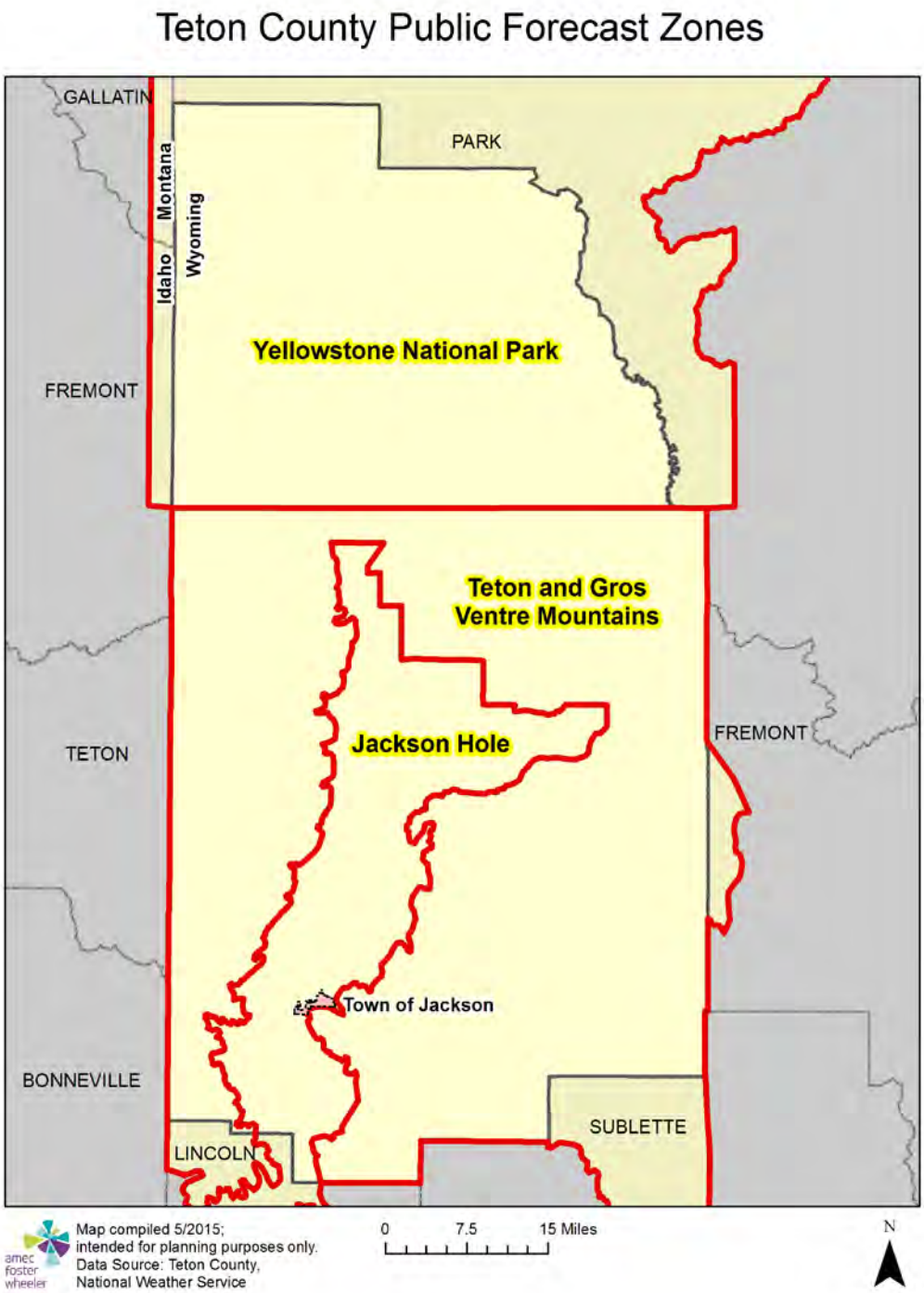


Figure 14.1 – Teton County Public Forecast Zone

Impacts

When they occur, winter storms usually cover a significant part of the state, and as such are difficult to describe on a Teton-specific basis. Since 1996, the economic impact of winter storms to the three forecast zones that encompass Teton County is $1,523,858 (2015 dollars). The actual impacts might be much greater because of the effects on transportation and tourism, and because of loss of life and injuries; additionally, because of the frequency with which Teton County sees winter weather events each year, there may be a reluctance to report impacts.

Between 1996 and 2014, NCDC did not record any fatalities in the three forecast zones in Teton County, and only one injury related to Winter Storms. However, it is important to note that this data does not take into account vehicle accident injuries and fatalities. Specific data tying road accidents to the storms listed above does not exist; however, with the hazards caused to motorists by snowy and icy conditions, it can be assumed that winter storms elevate risk factors for driving.

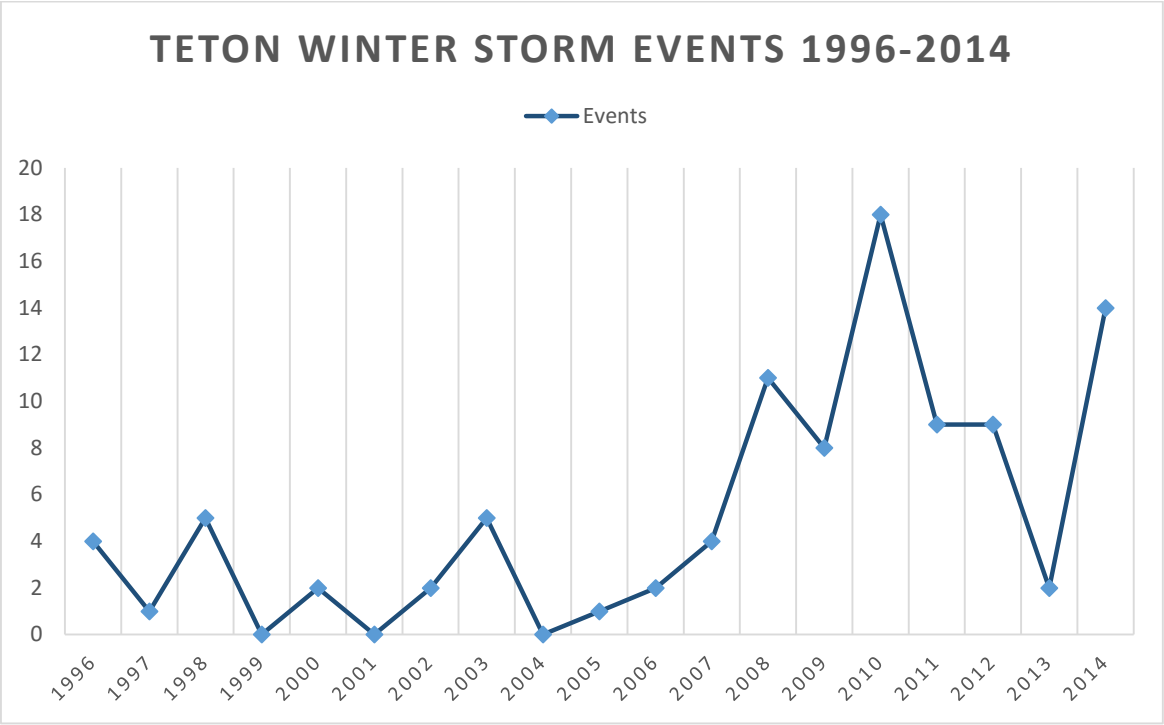


Figure 14.2 – Teton County Winter Storm Events 1996 – 2014

Winter storms can be catalysts for other cascading hazards. As an example, heavy snow accumulation exponentially increases the risk of an avalanche. Data for any cascading hazards caused or exacerbated by winter storms is included in their specific hazard sections.

Prior to 1996, datasets based on a uniform definition of the winter storm hazard are not available. However, anecdotal evidence does exist all the way back to 1886 that shows that Teton County's experience with winter storms hasn't changed.

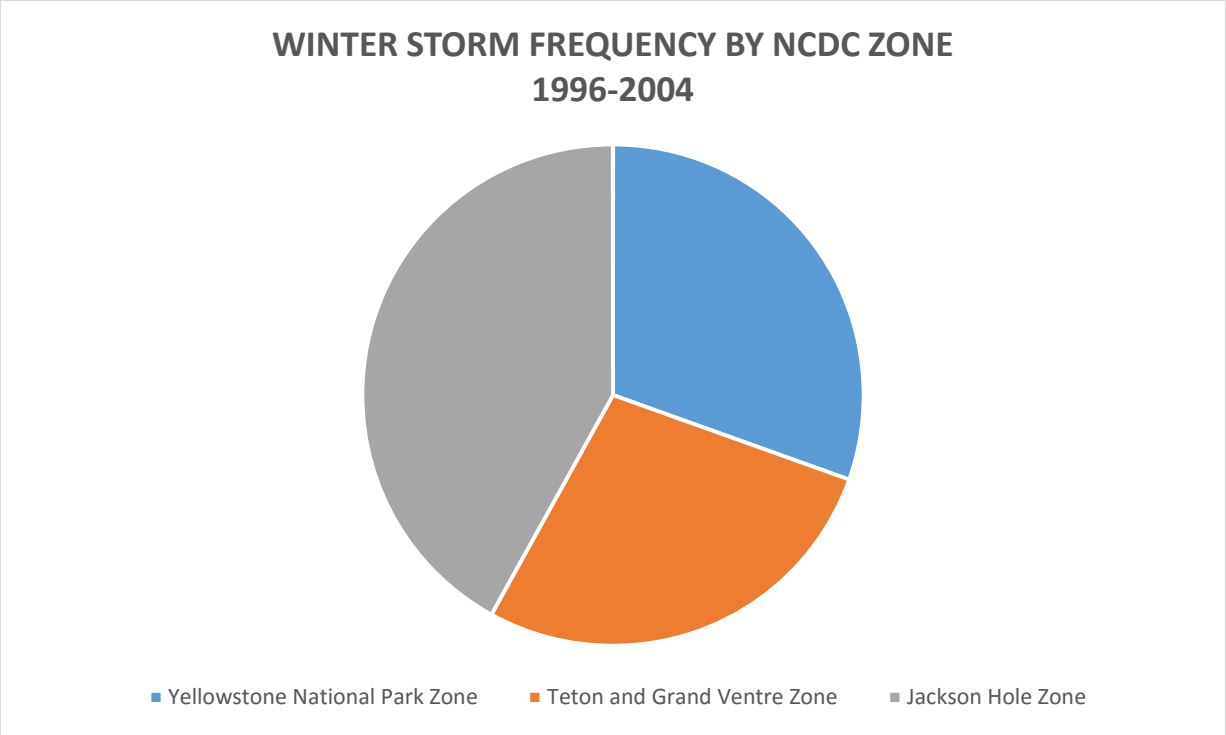


Figure 14.3 – Winter Storm Frequency by NCDC Zone 1996-2004

Since 1996, Teton County has a slight rise in the number of winter storms per year as recorded by the NCDC, although this is admittedly a small sample size. During that time, 2010 had the highest number of recorded storms at 18. No storm events were recorded in 1999, 2001, or 2004. Storms were characterized by heavy snow accumulation, high winds and extreme cold. Between 1996 and 2014, the three NCDC forecast zones that include Teton County experienced 174 combined winter storm events. Between the three zones, Teton and Gros Ventre Mountain Range zone had the highest number of winter storm incidents, with 73. The Yellowstone National Park zone had 53, and the Jackson Hole zone had 48. It is important to note that some of these storms overlapped.

Future Impacts

Since 1996, Teton County has averaged 4.5 winter storms on an annual basis. While the number of recorded winter storms seems to be increasing, this may be an anomaly based on the small sample size. Based on the history of winter storms over the past 20 years, Teton County will continue to experience these events an average of 4.5 times per year, and could follow the national trend line of winter storms that are more severe and more frequent. Based on the worst-case regional event that involved Teton County (1982) the dollar impacts—not counting loss of human life--could be in excess of $1.6 million (assuming an equal distribution of the total losses of $12.8 million, in 2015 dollars, across the 8 counties involved in the 1982 event), enough power lines could be toppled that emergency intervention could be required, significant property damage could occur, and the livestock industry could be severely impacted. Life safety will continue to be a concern for motorists, outdoor enthusiasts, or ranchers stranded by winter storms. Injuries and deaths will likely continue to occur in storm-related vehicle accidents.

Summary

PROPERTY AFFECTED:	Medium
POPULATION AFFECTED:	High
PROBABILITY:	High
JURISDICTION AFFECTED:	Countywide; Jackson

Chapter 15. Terrorism

Terrorism is the use of force or violence against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion, or ransom. Terrorists often use threats to create fear among the public, try to convince citizens that their government is powerless to prevent terrorism, and to get immediate publicity for their cause. Terrorism has been used throughout history to intimidate, coerce, and bring harm to populations. Terrorism can be propagated by foreigners, and also U.S. citizens hostile towards the government or other entities.

There are many different types of terrorism, and the United States has had many incidents of terrorism over the past century. Most terrorist attacks include a CBRNE component - chemical, biological, radiological, nuclear and/or explosives. Armed attacks are also a concern, and a growing mechanism for terrorism is cyberterrorism – the use of hacking to attack computer networks and systems.

Following the 2001 bombing of the World Trade Center in New York, Teton County completed a threat and risk assessment for potential terrorist attacks, identifying approximately 30 potential targets. The National Park Service has conducted separate threat assessments on both Yellowstone National Park and Grand Teton National Park.

History

New York's World Trade Center has been targeted twice and the Federal Building in Oklahoma City once. Both of these attacks resulted in a large number of fatalities. Americans have also been killed in other terrorist aircraft incidents. A number of attempts have been stopped. In addition to these high profile cases, domestic terrorists have targeted entities such as laboratories, resort development, and auto dealerships – making statements in favor of environmental protection. None of these types of attacks has occurred in Teton County. However, both the National Parks and individuals who live in or frequent the county could be potential targets for terrorism.

Impacts

Teton County has identified certain assets and infrastructure as critical to the daily life of county residents; the targeting or loss of one or more of these assets could have severe consequences, depending on the specifics of an attack. Impacts of a terrorist attack in Teton County could include fear and panic, civil unrest, property loss and damage, damage or destruction of infrastructure, loss of life, and interruption of communications, business and/or general commerce.

There is no history upon which to develop a dollar loss estimate for Teton County. Losses would depend on the type, location and severity of the terrorist action.

Future Impacts

Future impacts would be tied to the type of attack and target, but most impacts from terrorist attacks include injuries, fatalities, economic disruption, environmental concerns, and fear. The attack may also have a cascading effect - if a dam was targeted for example, flooding could also occur.

Summary

PROPERTY AFFECTED:	Medium
POPULATION AFFECTED:	Medium
PROBABILITY:	Low
JURISDICTION AFFECTED:	All

CHAPTER 16. Hazard Mitigation Goals and Projects

Development of Goals and Projects

This plan contains three goals to help protect people and property in Teton County from natural and human-caused disasters. The Town of Jackson, Teton County, and Teton Conservation District each have their own individual goal. Projects to address a range of hazards are listed under each of the goal statements. This allows each jurisdiction and the public to easily see and track the projects that will protect their citizens and property, and for which the jurisdiction will take the lead.

A total of 47 mitigation projects were identified as follows;

- Projects from the 2009 plan were reviewed for status and carried forward as appropriate,
- The LEPC revisited their 2009 disaster scenarios and discussed vulnerabilities to specific hazards,
- Teton County Emergency Management suggested project ideas,
- The contractor reviewed other local plans and brought forward needs and projects in those plans that related to hazard mitigation,
- Town/County staff suggested project ideas,
- The contractor met with elected officials from the local jurisdictions for specific project ideas, and
- The public was queried for project ideas.

Once a draft list of projects was compiled, the LEPC and the Emergency Management Coordinator prioritized those projects. The draft projects were presented to the Teton County LEPC and the elected officials for validation. The project list was finalized and incorporated into the draft plan, then presented at a public meeting in Jackson and made available for public comment.

Project Costs

Costs for mitigation actions will fall within three ranges: low, medium, or high.

- Low Cost Projects: from $0 to $5,000
- Medium Cost Projects: from $5,001 to $25,000
- High Cost Projects: Over $25,000

Project Priorities

Priority rankings of High, Medium, or Low were also assigned. Generally, the jurisdictions will initiate and depending on the complexity, try to accomplish the High priority projects within two years, the time frame for Medium priority projects will be three to four years, and Low priority projects will be accomplished by the five-year anniversary of this plan if feasible. All projects were initially ranked by the contractor based on the following criteria.

The LEPC and Emergency Management Coordinator adjusted and finalized the rankings which were made available to the elected officials for review.

- Perceived cost effectiveness and feasibility of obtaining funding,
- Level of risk to life and property posed by hazard which project addresses,
- Reasonableness of project and extent to which it provides a long-term solution,
- Potential consequences of not implementing,
- Support from the public and elected officials, and
- Compatibility with other plans and policies.

The county commissioners, the mayors and elected bodies have the ability to adopt additional plans, policies, ordinances and regulations as needed within state statutes.

Project Types

A range of types of mitigation actions or projects were identified by the participants in the planning process. Examples of a range of types of projects from other counties were provided. This was done to assist the elected officials, LEPC, and other participants in understanding the types of projects that could logically fall under a hazard mitigation plan.

Table 16-1: Project Types by Jurisdiction

Goal	Project Types
Goal One—Teton County	Education and Awareness, Emergency Services, Natural Resource Protection, Prevention, Property Protection, Structural
Goal Two—Jackson	Emergency Services, Natural Resource Protection, Prevention, Property Protection, Structural
Goal Three—Teton CD	Education and Awareness, Natural Resource Protection, Prevention, Property Protection, Structural

Table 16.2 - Goal One Projects

GOAL ONE: Mitigate natural and hazardous material hazards to reduce the potential for property loss or damage, injury and loss of life for Teton County

#	Description	Benefits	Priority	Cost	Type	Hazard	Project Status	Responsible agency for implementation, coord.
1.1	Update quake island mapping	Enhance response Ability to better plan ahead	High	$5,000 - $25,000	PP	E	New	TCEM, Geologists of JH
1.2	Upgrade Hoback Fire Station #3	Enhance response and fire fighter safety	High	$25,000+	ER, PP	All	New	JH Fire/EMS; ESF#04-Firefighting
1.3	Cooperate with USBR on dam safety for Jackson Lake Dam	Improve warning situation Save lives	High	$5,000-$25,000	NRP, PP	Dam Failure	New	TCEM, USBR
1.4	Upgrade Fire Station #4 at Moran Junction	Enhance response and fire fighter safety	Low	$25,000+	ER, PP	All	New	JH Fire/EMS; ESF#04-Firefighting
1.5	Identify critical infrastructure most at risk from earthquake and flooding	Identify highest priority infrastructure for protection	High	Less than $5,000	P, PR, PP, S, NRP	E, F	Carry over	FEMA Mitigation Specialist; WOHS Coordinator; TC Building Official; TC Planning; TC Floodplain Administrator; Owners

Table 16.2 - Goal One Projects (cont.)

#	Description	Benefits	Priority	Cost	Type	Hazard	Project Status	Responsible agency for implementation, coord.
1.6	Identify locations in County for hosting large-scale incident operations. Reconcile with locations selected for continuity of government.	Enhance emergency response. Continue operations of critical government functions.	High	Less than $5,000	ER	All	New	TCEM, JH Fire/EMS, TC Sheriff, Forest Service, National Park Service, ESF#07-Resource Support
1.7	Use MHMP as a platform to raise awareness and encourage individual responsibility and action.	Reduced potential for prop damage, business interrupt.	High	Less than $5,000	P, PR, PP, EA, S	E, F	Ongoing	TCEM Coordinator
1.8	Complete work to participate in the NFIP Community Rating System.	Reduce effects of flood events; lower insurance rates for property owners in the floodplain	High	Less than $5,000	P, PP	F	Carry over	TC Engineer; TCEM Coordinator; WOHS Coordinator; TC Floodplain Administrator
1.9	Review and upgrade security access to critical infrastructure and facilities (including IT)	Improve building security; reduce effects of man-made disaster including cyber	High	$25,000+	PR, S	T	Ongoing	TC Sheriff IT, Town of Jackson IT, TC IT, ESF#13-Public Safety and Security
1.10	Offer one CERT course/year	Raised awareness, response capability	High	$5,000 - $25,000	P, EA	All	Ongoing	TCEM, Teton County CERT

#	Description	Benefits	Priority	Cost	Type	Hazard	Project Status	Responsible agency for implementation, coord.
1.11	Renovate West Bank/ Wilson Fire Station #2	Enhance response and fire fighter safety	Medium	$25,000+	ER, PP	All	New	JH Fire/EMS; ESF#04-Firefighting
1.12	Renovate Teton Pines Fire Station #6	Enhance response and fire fighter safety	Medium	$25,000+	ER, PP	All	New	JH Fire/EMS; ESF#04-Firefighting
1.13	Identify and pursue fund sources for hazard mitigation projects as needed	Increase disaster-resistance. Save lives and property.	Medium	Less than $5000	C	E	Ongoing	TCEM Coordinator; WOHS Coord; FEMA Mitigation Specialist
1.14	Offer 1-2 weather spotter courses/year	Raised awareness, better data	Medium	Less than $5000	P, EA	B, F, H, Lt,	Ongoing	TCEM; NWS Riverton Warning Coordination Meteorologist
1.15	Outreach to encourage public sign-up with Nixle, FEMA phone app and raise awareness of Emergency Alert System	Citizens warned and better informed during disasters	Medium	Less than $5000		All	Ongoing	TCEM

#	Description	Benefits	Priority	Cost	Type	Hazard	Project Status	Responsible agency for implementation, coord.
1.16	Continue to offer Bullex fire extinguisher training to public and responders	Raised awareness, response capability	Medium	$5000 - $25000	EA, PP, NRP	Fire	Ongoing	JH Fire/EMS; Teton County CERT
1.17	Develop and run general preparedness public service announcements	Individuals better able to help themselves	Medium	$5000 - $25000	P	All	Ongoing	TCEM
1.18	Improve emergency management website to update preparedness outreach and provide emergency information to the public	Individuals better able to prepare and provide reliable source of emergency information during incidents	Medium	$5,000 - $25,000	P	All	New	TCEM
1.19	Rank bridges based on quake island analysis. Perform structural retrofitting of vulnerable bridges	Improve resilience of the county's transportation system	Medium	$25,000+	P, PR, NRP, S	E	Carry over	FEMA Mitigation Specialist; WYDOT Engineer, FHWA Engineer; TC Road and Levee; TOJ Public Works, Geologists of JH, WY State Geological Survey, ESF#01-Transportation

#	Description	Benefits	Priority	Cost	Type	Hazard	Project Status	Responsible agency for implementation, coord.
1.20	Reinstitute automated dam monitoring and alert notification, Jackson Lake Dam	Provide greater response time. Reduce potential for loss of life and property damage	Medium	$25,000+	PP, NRP	F	New	TC Commissioners; National Park Service; US Bureau of Reclamation
1.21	Work with rural subdivisions at risk for flood and wildland fire to develop their own plans.	Reduce potential for loss of lives.	Medium	Less than $5,000	PR	All	New	TCEM, JH Fire/EMS, TC Sheriff; TC Floodplain Administrator
1.22	Train and exercise post-earthquake structural assessment capability.	Reduce potential for loss of life, property damage	Medium	$5,000-$25,000	PP	E	New	TCEM, Geologists of JH, LEPC
1.23	Identify secondary routes out of single-access subdivisions	Reduce potential for loss of life	Medium	$5,000-$25,000	PR, PP	E, F, W	New	TC Road and Levee, ESF#01-Transportation, Homeowners
1.24	Map critical facilities with back-up power. Obtain/ install generators for those without.	Enhanced response, sheltering, and continuity of government	Medium	$25,000+	P, ER	All	New	TCEM, Teton County School District, American Red Cross, Teton County Facilities Department, ESF#12-Energy

#	Description	Benefits	Priority	Cost	Type	Hazard	Project Status	Responsible agency for implementation, coord.
1.25	Plan and conduct joint emergency exercises with Teton County, ID	Better coordinated responses. Reduce potential for loss of life	Medium	Less than $5,000	P	All	New	TCEM, Teton Co, ID EM
1.26	Increase reporting to LEPC on Hazmat transportation routes	Better preparation, response to Hazmat incident	Medium	Less than $5,000	P, NRP	Hazmat	New	TCEM, Tier II Reporters, ESF#10-Hazardous Materials Response, TC LEPC
1.27	Create map of IT infrastructure and points of failure	Maintain or more quickly restore communications during disaster	Medium	$5,000-$25,000	ER	All	New	TC IT, TC Sheriff IT, Town of Jackson IT, TC Library IT, TCEM, ESF#02-Communications
1.28	Study/quantify comprehensive impacts of snow avalanches	Be better prepared, Reduce economic impacts	Medium	$5,000-$25,000	PP	A	New	TCEM, Geologists of Jackson Hole, WY DOT

Table 16.2 - Goal One Projects (cont.)

#	Description	Benefits	Priority	Cost	Type	Hazard	Project Status	Responsible agency for implementation, coord.
1.29	Identify and map avalanche paths	Prevent slides, protect lives and property	Low	Less than $5,000	PP	A	New	TCEM, WY DOT
1.30	Integrate hazard information into County GIS and make available to the public through County website	Prevent future property damage by ensuring development doesn't occur in hazard areas	Low	Less than $5,000	PR, PP, NRP, C	All	New	TOJ Planner; TC Planner; TC Engineer; TCEM; WOHS Coordinator, WY State Geological Survey; TC GIS Coordinator
1.31	Conduct commodity flow study to determine type and amount of hazmat moving through the county	Determine risk; improve response capability	Low	$5,000 - $25,000	PR	Ha	Carry over	TC LEPC; ESF#10-Hazardous Materials Response
1.32	Fully implement WyoLink in Jackson and Teton County	Enhance emergency response	Low	$25,000+	PP, NRP, ER	All	New	TCEM, Elected officials, WY Public Safety Communications Commission; ESF#02-Communications

Table 16.3 – Goal Two Projects
GOAL TWO: Mitigate natural and hazardous material hazards to reduce the potential for property loss or damage, injury and loss of life in the Town of Jackson.

#	Description	Benefits	Priority	Cost	Type	Hazard	Status	Responsible agency for implementation coordination
2.1	Complete renovation of Fire/Rescue Station #1	Enhance response and fire fighter safety	High	$25,000+	ER, PP	All	New	JH Fire/EMS; ESF#04-Firefighting
2.2	Consider natural hazards when creating/updating community development plans	Risk reduction is incorporated at the community level.	High	None	PR, C	All	New	TC Planner; TOJ Planner; TOJ Town Council; Town of Jackson Floodplain Administrator
2.3	Monitor Budge Drive and South Park Loop Road slide areas.	Save lives by closing roads as necessary; Identify repetitive slide areas.	High	$5,000-$25,000	PR, NRP	L	Ongoing	TOJ Public Works
2.4	Map potential landslide areas in the Town	Reduce potential loss of life/property damage	High	$5,000-$25,000	PR, NRP, PP	L	New	Planning, Geol of JH, Town Engineer, WYDOT, WYGS
2.5	Review and upgrade security access to critical infrastructure and facilities (including IT)	Improve building security; reduce effects of man-made disaster including cyber	High	$25,000+	PR, S	T	New	JPD; Town of Jackson IT; ESF#13-Public Safety and Security
2.6	Rank bridges based on quake island analysis. Perform structural retrofitting of vulnerable bridges	Identify vulnerabilities and prioritize for structural retrofitting	Medium	$5,000-$25,000	P, PR, NRP, S	E, F	New	TOJ Public Works; WYDOT; ESF#01-Transportation
2.7	Continue the Town of Jackson's hazard tree reduction program	Limit the secondary effects of severe weather (wind, snow)	Low	$5,000 - $25,000	P, PP, S	B, To	Ongoing	TC Parks and Recreation; TOJ Public Works

Table 16.4 – Goal Three Projects
GOAL THREE: Mitigate natural hazards to protect soil and water resources.
(Lead: Teton Conservation District)

#	Description	Benefits	Priority	Cost	Type	Hazard	Status	Responsible agency for implementation coordination
3.1	Work with Flat Creek Water Improvement District (WID) to prevent flooding from frazil ice. Finalize development of WID. Develop a fund for mitigation work, obtain access, implement.	Mitigate repetitive property loss and damage from ice-jam flooding	High	$5,000 - $25,000	PP, NRP	F	New	Teton CD; TOJ Engineer; WID; Town of Jackson Floodplain Administrator
3.2	Fire fuel reduction; provide education, assessments, and resources to public for fuel reduction projects.	Lowered effects of fire in the wildland urban interface.	High	$25,000+	P, PP	W	Ongoing	Teton Area Wildfire Protection Coalition (TAWPC)
3.3	Conduct fire hazard mitigation education	Save lives and property from wildland fire	High	Less than $5,000	P, PR, PP, EA	W	Ongoing	TAWPC
3.4	Rehabilitate the Flat Creek drainage. Assess, plan and implement flood prevention measures.	Reduced flood potential in town; Prevent property loss and damage from flood	Medium	$25,000+	P, PR, NRP, S	F	Ongoing	FEMA NFIP Coordinator; Teton CD; WID, WOHS Coordinator; TOJ Engineer; Town of Jackson Floodplain Administrator
3.5	Cooperate with WY Water Improvement Study for Upper Snake River drainage	Prevent flood potential. Protect lives and property	Medium	Less than $5,000	EA, PP, NRP	F	New	Teton County, Teton CD
3.6	Conduct flood risk analysis for Flat Creek	Prevent flood potential. Protect lives and property	Low	$5,000 - $25,000	P, PP, EA	F	New	Teton CD, WOHS, FEMA, Town of Jackson Floodplain Administrator, TC Floodplain Administrator
3.7	Educate residents about benefits of purchasing flood insurance	Enable economic recovery from flooding	Low	Less than $5,000	EA	F	New	TCEM, Teton CD

Abbreviations used in table

Project Types

- Coordination
- EA: Education and Awareness
- ER: Emergency Response
- NRP: Natural Resource Protection
- P: Prevention
- PP: Property Protection
- S: Structural

Hazards

- A: Avalanche
- B: Blizzards and Winter Storms
- D: Dam Failure
- E: Earthquake
- F: Flood
- H: Hail
- Ha: Hazmat
- L: Landslide
- Li: Lightning
- T: Terrorism
- To: Tornado
- W: Wildland Fire

Action Plan

The above projects will be worked on pending adequate resources (personnel and funding.) Some of the projects are ongoing or already underway—for example offering weather spotter training and monitoring the Budge Slide. Other projects will be selected based on priority, availability of resources, timeliness, and the opportunity to complete. The initial priorities assigned with this update are expected to shift somewhat over the course of the five-year planning period based on the needs of the individual jurisdictions and resources available to them and perhaps in response to a significant disaster or new hazard.

For projects not requiring outside expertise or funding and located exclusively within one local jurisdiction, the Town of Jackson, for example, the Town may select and proceed with projects they wish to complete.

As described in Chapter 17, the County Emergency Management Coordinator will place the MHMP on the LEPC agenda once annually. Each of the signatories to the plan has the opportunity—and does have--representation on the LEPC. The Coordinator and LEPC will discuss the list of projects in the plan to see if any changes in overall priorities are desired. The discussion will include any direction or emphases from the local governing bodies, WOHS, or FEMA; incidents which have occurred during the previous year that could affect mitigation project priorities; and local resources and funding available to accomplish projects. The County Commissioners may direct, or the LEPC may hold a vote, if and when they wish to pursue grant funds for work on mitigation projects.

Figure 16.1 - May 2015 Public Meeting

Use of Cost-Benefit Analysis

In cases where grants are being sought, the applicant will complete a cost/benefit analysis before submitting any funding requests.

The county can also make available information regarding the STAPLEE method for evaluating and prioritizing mitigation actions. The method looks at social, technical, administrative, political, legal, economic, and environmental aspects of projects to weigh pros and cons of implementing specific projects. Information on this analysis method can be found in FEMA's Developing the Mitigation Plan (FEMA 386-3).

The jurisdictions applying for funds will need to consider compatibility with goals and objectives in the state's plan, compatibility with goals in this plan, impacts of the project on other jurisdictions, costs and benefits, funding priorities, and compatibility with other plans and programs--when selecting projects to implement.

Existing Authorities, Policies, Programs and Resources for Implementation

Generally projects will be accomplished under county leadership either by the Emergency Management Coordinator, volunteers (firefighters, emergency medical personnel, and elected officials) or through contractors funded by grants.

The Emergency Management Agency currently has one full-time coordinator. Teton County Commissioners have approved advertising and filling one additional part-time position. The Teton County-Town of Jackson combined Fire/EMS Department (JH Fire/EMS) has both paid and volunteer staff. Please see the wildland fire chapter of this plan for specific numbers of paid and volunteer staff.

Jackson and Teton County share a number of staff—including some in the Planning and Development Department. The county has six employees that enforce the LDRs and the Town has four doing this same work. There are an additional 2.5 full-time equivalents that work in policy development. The work of this Department is important to ensure development occurring now will not be at risk from natural hazards in the future.

The Teton Conservation District has four paid staff. The District's Conservation Programs Coordinator has been involved in the update of the MHMP and will be aligning programs of the District with wildland fire and flooding projects in Goal Three of this plan, pursuing grant funds, and administering grants and projects consistent with Goal Three.

Communities in Wyoming do have statutory authority to engage in planning and the Town of Jackson and Teton County have historically demonstrated their willingness to consider policies and programs in the interest of public safety and property protection.

CHAPTER 17. Plan Monitoring, Maintenance, Revision and Coordination

Responsible Parties

The Teton County Commissioners in cooperation with the Mayor of the Town of Jackson and the Chair of the Teton Conservation District Board of Supervisors are responsible for ensuring that the MHMP is kept current. With adoption of the plan, the responsible officials designate the Teton County Emergency Management Coordinator—with the assistance of the Local Emergency Planning Committee—as the lead in accomplishing the on-going responsibilities.

Plan Monitoring and Evaluation

There are two types of plan monitoring and evaluation; effectiveness and implementation. Effectiveness monitoring looks at whether the plan has addressed needed items. Implementation monitoring looks at whether projects in the plan are being undertaken and completed. The county's Emergency Management Coordinator with the help of the LEPC will ask the following questions to evaluate the effectiveness and implementation of the plan.

- Have any potential hazards developed that were not addressed in the plan?
- Have any natural disasters occurred that were not addressed in the plan?
- Has any unanticipated development occurred that is vulnerable to hazards?
- Are there any additional mitigation ideas that need to be incorporated?
- Have projects been initiated and/or completed?
- What are the barriers to completing projects identified in the plan?

Each fall following the year of adoption of this plan, the LEPC will meet to ask and answer the questions listed above. The discussion will be documented so that when the plan is revised, the findings of the monitoring can be incorporated into the revision. The Teton County Emergency Management Coordinator will request that the LEPC Chairman convene the LEPC for this purpose.

Plan Update Review Triggers

Any of the following three situations could trigger a review and update of the plan.

- Occurrence of a major natural disaster in or near Teton County,
- Passage of five years, or
- Change in state or federal regulations which must be complied with.

Revision Procedures

Should a major natural disaster occur in Teton County, the LEPC shall meet following the disaster to determine whether a review of the MHMP is warranted. In the absence of a major natural disaster, the five-year review will take place during the six-month period preceding the FEMA approval anniversary date.

Following proper public notice, the Teton County Emergency Management Coordinator will request the LEPC Chairman to convene the LEPC and with their assistance and/or the assistance of the WOHS or a contractor as determined necessary, carry out the following tasks;

1. Review the Hazard Mitigation Plan Review Tool comments from WOHS and FEMA during their most recent review of the plan (2015.)

2. Examine and revise the risk assessment data as needed to ensure it is current.

3. Update the mitigation strategies to incorporate completion of actions and add any needed strategies or projects.

4. Identify problems that may be hindering or affecting implementation of the plan, and recommend actions for resolving those problems.

5. Recommend any necessary revisions to the MHMP.

6. Comply with all applicable regulations and statutes.

So that the public will have an opportunity to become involved in and comment on the revision, one public meeting will be scheduled in Jackson. This meeting may occur as a regularly-scheduled county commissioner and/or town council meeting. The meeting will be publicized.
Forty-five days prior to the five-year anniversary date, a final draft of the revised plan will be submitted to the WOHS.
An annual review will be conducted by the Teton County Emergency Management Coordinator for the purpose of summarizing the status and effectiveness of the plan mitigation goals or strategies.

Incorporation into Other Plans

Teton County and the Town of Jackson recently completed a joint land use plan (Jackson/Teton County Comprehensive Plan). Land Development Regulations (LDRs) have been updated to reflect the new plan and are very comprehensive with regard to addressing potential natural hazards. It is unlikely that there will be any additional updates of the land use plan or LDRs during the five-year life of this plan.

Teton Conservation District prepared a strategic planning document in March 2015. The projects listed in this MHMP are projects they are already pursuing and intend to continue pursuing. The District may update their work plans annually and the staff involved with the update of the MHMP will ensure the contents of this plan are considered during annual work planning.

Zoning regulations for the Town of Jackson are currently under review for an update. The County/Town Development Director is aware of this MHMP and the Teton County Emergency Management Coordinator is following the discussions of the zoning updates. The county commissioners are considering adopting a Transportation Plan (Jackson/Teton County Integrated Transportation Plan).

The County Emergency Management Coordinator is following discussions of this plan and will provide input as appropriate.

As noted in the Local Plans Reviewed section of Chapter I, the Emergency Management Coordinator is responsible for updating a number of emergency management related plans. He has been directly involved in this update and will coordinate development of those plans consistent with this MHMP.

Opportunity for Continued Public Involvement

In addition to the procedures for including the public in the five-year updates described above, to ensure the public will have the opportunity to remain involved in the implementation and annual updates of the plan, the following will take place.

1) The Teton County Emergency Management Coordinator will provide a brief annual summary report to the three governing bodies on what has been accomplished during the previous year and to receive guidance from the elected officials on their priorities for the coming year.

2) Each year following a fall LEPC meeting called for the purpose of reviewing the status of the plan, Emergency Management will make information available to the public on the accomplishments of the previous year and allow comment for any revisions.

Teton County is home to an active engaged citizenry. Many of these individuals have professional credentials in fields related to hazard mitigation planning. The Geologists of Jackson Hole are an example of a group with tremendous local expertise. During subsequent updates, the county may choose to more deeply investigate certain hazards--for example landslide, avalanche, or earthquake potential and impacts, or changing climatic conditions--as new information becomes available.

APPENDIX A: Chronological Planning Process Documentation

Teton County Multi-Hazard Mitigation Plan
Briefing Paper—March 2015

What is a multi-hazard mitigation plan (MHMP) and why do we need one?

The existing MHMP--adopted in 2010--is being updated to make Teton County and the Town of Jackson more disaster-resistant and less vulnerable to property damage and loss of life from a natural disaster, hazmat or terrorism. The plan update is being funded through a grant from FEMA and Teton County. Updating the plan ensures the county will remain eligible to compete for funds to carry out the projects in the plan and will also be eligible for assistance after a disaster, if requested. Adoption of the updated plan is voluntary, but the town and county will need to adopt the updated plan to remain eligible for grant funds and post-disaster assistance.

What is in the plan?

Assessments of natural hazards that describe historical occurrences and vulnerability to each hazard are found in the original plan and will be updated with new information. The plan will estimate the potential losses and impacts should a disaster occur. Goals, objectives and projects will also be updated as part of the plan. Projects to help protect lives, property, or infrastructure can be identified by local governments, emergency responders, and/or members of the public.

How will the plan be prepared?

The update process has been initiated by retaining a contractor, Beck Consulting, to work with the Teton County Emergency Management, Teton County Board of Commissioners, Town of Jackson elected officials, Town and County staff, the Teton County Conservation District, emergency responders, and the public. The contractor will hold public meetings, work with interested parties to gather project ideas, update existing information in the plan, and complete the plan update. The contract team will coordinate most closely with the Local Emergency Planning Committee (LEPC) and the county emergency management coordinator. A draft of the plan will be prepared and made available for public review and comment in the early summer of 2015. Copies of the draft will be available at the town, county, and conservation district offices, and through the county's website. Following the comment period, the contractor will finalize the plan update. The plan will be reviewed by the State of Wyoming and the Federal Emergency Management Agency (FEMA.) Following this review, Teton County, the Town of Jackson, and the Teton County Conservation District may adopt the plan.

How do we offer input?

Input is encouraged at any time during the process until the updated plan is adopted by the governing bodies in the fall of 2015. Meetings during the planning process will be noticed and open to the public. Information announcing meeting times, dates, and locations, and the availability of the draft plan update will be submitted to The Jackson Hole News and Guide and posted on the county's website www.tetonwyo.org/em. If you have any comments or questions, please contact either Barb Beck at (406) 446-3628, barbbeck@bresnan.net or Rich Ochs at (307) 732-8594, rochs@tetonwyo.org.

Notification to all Wyoming County Emergency Management Coordinators that update is underway, invitation to comment, and contact information.

Plan Update Kick-off Meeting Notes
Jackson, WY.
March 9, 2015

Participants: TCEM, Rich Ochs, Contractor, Barb Beck

Schedule: LEPC meets next on May 21 at 0830. Rich will put Barb on the agenda. The LEPC will meet next after that in July. Barb will attend both of these meetings. The LEPC will serve as the Local Planning Team for purposes of the MHMP update. Barb will plan to hold a public meeting on May 20 at either the county commissioners' chambers or the library.

Review of the Status of the 2009 Projects

Barb and Rich went through all of the projects in the 2009 plan. Barb will update the project table with this information. This will become part of the plan update. There are a few projects Rich would like to ask the LEPC about. We will do this at the May meeting.

2015 Update Projects

Rich identified some of the 2009 projects that should be included in the 2015 update and some ideas for new projects. Based on this discussion, Barb will produce a new draft table of projects that can serve as the starting point for the LEPC discussion of projects for the 2015 plan.

Local Plans

Rich identified the following local town and county plans to be reviewed to ensure consistency with the MHMP update.

Existing Plans

- Town/County EOP (TCEM)
- Town/County MHMP (TCEM)
- Town/County Training & Exercise Plan (TC Public Health)
- Town/County Comprehensive Plan (Town/County Planning)
- CWPP (JH Fire/EMS)
- Strategic National Stockpile Plan (TC Public Health)
- Town/County NIMS Training Plan (TCEM)

Plans in Draft/Development

- Town/County Recovery Plan (TCEM)
- Town/County Debris Management Plan (TCEM)
- Town/County Resource Inventory (TCEM)
- Town/County Emergency Alert System (EAS) Plan (TCEM)
- TCEM Continuity of Operations Plan (COOP)

Plans to be Developed

- Teton County EOC SOPs
- Town/County Evacuation Plan
- 11 Levee System Emergency Action Plans (EAPs)
- Town/County Hazardous Materials Plan
- Town/County Continuity of Government (COG)

Contacts

- Local Media: Charlotte Reynolds is the county's public affairs contact
- Joint Information Meetings of Town and County: Charlotte will have schedule for these
- Town Public Works: Larry Pardee
- Town and County Planning: Tyler Sinclair
- Town Administrator: Bob McLaurin (coordinate with Bob on whether to get on council agenda)
- County Administrator: Alyssa Watkins
- County Road and Levee: Dave Gustafson
- County GIS: Rich Greenwood (contractor)
- County Fire Chief: Willy Watsabaugh (unified town and county)
- Conservation District: Rob
- Grand Teton National Park Fire: Tracy Weaver

Misc

Rich will set up a Google site to share photos and maps.

Teton County Board of Commissioners

Voucher Meeting Agenda

200 S. Willow, Jackson, Wyoming

Monday, March 9, 2015, 9:00 a.m.

PLEASE SILENCE ELECTRONIC DEVICES DURING THE MEETING

CALL TO ORDER

ADOPT AGENDA

PUBLIC COMMENT

ACTION ITEMS:

1. Consideration of Payment of County Vouchers

DISCUSSION ITEMS: *(Subject matter will be listed if known)*

1. **Matters from Commissioners**
   A. Calendar review
   B. Liaison reports / Commission updates
      1) Barbara Allen
      2) Mark Newcomb
      3) Paul Vogelheim
      4) Smokey Rhea
      5) Melissa Turley *(absent)*
   C. BCC Administrator - Alyssa Watkins

2. **Matters for Discussion / Updates**
   A. Known Matters for Discussion
      1) Rich Ochs – Emergency Management
         a) introduce Barb Beck our Mitigation Plan contractor
         b) brief synopsis of process
      2) ~~Stacy Stoker – update on The Grove~~ w/p
      3) Alex Norton - Rural LDR Rollout Presentation REQUESTED AT LEAST 15 MINUTES = 11:15
   B. Other Matters for Discussion

EXECUTIVE SESSION

ADJOURN

JHNAG Meeting Notice: 2-25-2015

AGENDA, COUNTY COMMISSIONER BRIEFING ON MHMP PLAN UPDATE
March 9, 2015

Commissioners Weisman, Allen, Newcomb, Vogelheim, and Rhea present.
County Staff Reynolds, Dagle, Watkins, Birdshaw, and Ochs present.
Two members of the public present.
Barb Beck, Beck Consulting present.

Introduce contractor team, past experience in Wyoming and Montana

- Quality of emergency management program in Teton County

Briefing Paper

- Explain reasons for updating plan, go over information in paper
- Hazards Teton County is vulnerable to
- Plan contents
- HIRA
- Goals and Projects-- original plan had 4 goals and 40 projects

Roles—who is doing what?

- County, County EM
- Teton CD
- Town of Jackson
- LEPC
- Contractors
- Public
- WOHS and FEMA

Planning Process

- Draft plan this summer, final in the fall
- WOHS and FEMA review
- Adoption by local jurisdictions

Questions and discussion?

- Discussion about financial assistance for Budge Slide remediation.
- Discussion about lack of county-wide coverage by Wyolink Project and fractured communications.

How to contact me, welcome to call or e-mail at any time

Thank you for your time!

Excerpt from Teton County Commissioner Briefing Meeting Notes- March 9, 2015

DISCUSSION ITEMS:

1. Matters for Discussion / Updates

Rich Ochs – Emergency Management Mitigation Plan. He spoke to the Multi-Hazard Mitigation Plan in place and that it is five years old and in need of update. Updating the plan allows the County to apply for hazard mitigation project funds through FEMA to lessen the impact of natural disasters, and to qualify for higher amounts in other FEMA-based funding projects. Recently, the Board approved a consultant to perform the update and he introduced Ms. Beck.

Barb Beck of Beck Consulting addressed the Board. Five years ago, she produced the County's current mitigation plan and will be doing the update. The plan will analyze dam failure, drought, earthquake, floods and flash floods, hail, hazardous material spills, releases and landslide, lightening, winter storm and blizzards, terrorism, tornado and wildland fire. Historical events will be analyzed to build a profile identifying project needs.

The update will be a transparent process including public meetings and involvement in order to draft a plan, due this summer, that will be posted for further public comment. Any revisions would be made and then submitted to both Homeland Security and FEMA for approval before being presented to the County for adoption. The County, Town of Jackson, and Teton Conservation District will have opportunity to adopt the plan.

Best,

Sandy Birdyshaw
Deputy Clerk assigned to
the County Commissioners
Teton County Clerk's Office
PO Box 1727, Jackson WY 83001
Direct 307-732-8488, Fax 739-8681

Email correspondence to and from employees of Teton County, in connection with any transaction of public business, is subject to the Wyoming Public Records Act and may be disclosed to third parties.

From: Charlotte Reynolds, Teton County Public Information Officer

The PIO list are my counterparts at other area agencies. The media list is just that, my list of media, or related contacts. The news release went to both of these groups as well as two subscription listserves- the local businesses through the Chamber of Commerce list and the nonprofits through the Community Foundation of JH list

Media Distribution List

Contact Group Name: Teton County PIO Distribution List

Members:

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From: Charlotte Reynolds

Sent: Wednesday, March 11, 2015 4:23 PM

To: Charlotte Reynolds

Cc: Rich Ochs ; barbbeck@bresnan.net

Subject: Teton County Launches Hazard Mitigation Plan Update

MEDIA RELEASE

Contact: Charlotte Reynolds
Phone: 307-732-5786
Fax: 307-733-4451
Email Address: creynolds@tetonwyo.org

For Immediate Release
Shake, Rattle, and Roll

March 11, 2015 –Jackson, WY- While the shaking would be better left to Elvis, the natural beauty of the Teton Valley is directly linked to the potential for earthquakes, landslides, flooding, and other natural disasters. With the goal of keeping everyone and their property safe from natural hazards and hazardous material spills, Teton County Emergency Management has initiated the update of the hazard mitigation plan. According to Emergency Manager, Rich Ochs, "This plan will examine the kinds of natural hazards that Teton County and the Town of Jackson are vulnerable to and propose ways to lessen the chances for loss of life and property damage. We're all about keeping people as safe as possible."

Contractor, Beck Consulting from Red Lodge, Montana has been retained to update the plan which was first completed in 2009. "The natural hazards we'll be looking at in depth include dam failure, drought, earthquake, flooding, hail, lightning, tornadoes, wildland fire, winter storms and blizzards. And although the focus of the plan is natural hazards, we'll also be addressing hazardous material spills and terrorism" said Barb Beck. She continued, "Obviously, many natural disasters are not preventable, but in some cases by preparing ahead of time, we can lessen their impacts."

Ochs and Beck recently briefed the Board of County Commissioners on the project being undertaken on behalf of the county, town, and the Teton County Conservation District. Working closely with the Local Emergency Planning Committee (LEPC), the contractors will produce a draft plan by the summer. The draft plan will be presented to the community for comment, with public meetings announced as they are scheduled on the county's website and through local media. To read a briefing paper on the project, please visit www.tetonwyo.org. For more information, please contact Barb Beck at 406 446-3628 or barbbeck@bresnan.net.

###

Teton County Hazard Mitigation Plan Update
Public Meeting Plan
May 20, 2015

Objectives

1) Raise awareness about natural hazards
2) Explain plan update process and how to stay involved
3) Administer survey and give out kits
4) Learn what hazards people are most concerned about and gather ideas to address them

AGENDA

Time	Topic	Who
6:00	Welcome Sign-in, hand out surveys and briefing papers Explain meeting format	Beck, Ochs
6:15	What is a MHMP and why do we need one? Natural hazards Teton County is vulnerable to Schedule for this process and how to stay involved	Beck
6:30	Participants view exhibits and make comments (see below)	All, Beck and Ochs visit one on one with participants
6:30-8:00	Give out kits as people depart and turn in surveys	Ochs
8:00	Adjourn—thanks for attending! (if we still have people, we could go around to the charts and debrief everyone on the input)	Beck

Materials and prep:

- Copies of survey, copies of briefing paper with list of types of projects that can go in plan on reverse side (Barb unless County wants local match for this)
- Prize kits (Rich)
- Coffee and cookies (?)
- Four mounted poster photos of earthquake, flooding, landslide, and wildland fire (Rich provide photos, printing and mounting??)
- Flip charts and pens next to each of the above hazard posters with 2-column headers to organize input (Column 1. Problems I see related to this hazard, Column 2. What I believe could be done to prevent or address this problem for this hazard) (Barb)
- Flip charts with titles for remaining hazards and comment columns (Barb)
- Put up flyers ahead of meeting (Rich by May 11)
- Submit news release through Charlotte (Barb by May 8)

Note: Rich Ochs did a live air interview on KHOL 89.1 Jackson Hole Community Radio on May 19, 2015.

PUBLIC MEETING

May 20, 2015, 6:00 – 8:00 p.m.

TETON COUNTY

HAZARD MITIGATION PLAN

Jackson Lake Dam over 100% capacity, June 2010

Anyone with an interest is encouraged to drop in!

The first 40 participants to complete a short survey will receive a 1-person one day emergency kit!

Welcome back, Richard Ochs | Logout | Switch Agency

nixle

Home | My Account | Support | View Plan Upgrades

Teton County Emergency Management

Overview | Message Center | Groups | Collect Contacts | Tipping | Nixle 360 | Reporting

New Message | Sent Messages | Scheduled Messages | Email Template | Message Widgets | Rebroadcasts

« Back | Full Message

Published as web message (Deactivate | Stop Calls | Send Update | Send Cancellation)

Edit Message

Message Type

Community

Sent To:

Public Groups:
Nixle Wire, Public Individual Registration

Private Groups:
Teton County CERT, Warning & Disaster Fanout Group Primary, Warning & Disaster Fanout Grp Alternate, Special Needs Populations, Pre-School/Daycare Facilities, Schools (K-12), Higher Education (12+), Houses of Worship/Churches, Teton County VOAD, Teton VOAD Board, EOC Support Staff, Teton VOAD Members, Adventist Donations Management Group, Teton County DART, Teton County PIO Team

Message Details:

Entered by:
Teton County Emergency Management

Entered on:
Monday, May 11 2015 :: 2:26 p.m. MDT

Contact:
Richard Ochs
Teton County Emergency Management
rochs@tetonwyo.org

Teton County Emergency Management
3240 S Adams Canyon Dr Jackson, WY 83001 | 307-733-9572

SMS Message:

Statistics:

Delivery Statistics

	SMS	Email
Sent	381	4,969
Start Time	05/11 14:27:39	05/11 14:24:38
Finish Time	05/11 14:27:39	05/11 14:25:46
Forwards	0 0%	0 0%
Unsubscribes	0 0%	0 0%

Social Media Shares

Facebook : 0 Twitter : 0

Reports

Notification Summary Report

Images:

Flyer May Public Mtg.pdf

« Previous | Image 1 of 2 | Next »

Public Meeting Notes
Teton County MHMP Update
Public Library, Jackson, WY.
May 20, 2015

Welcome

Participants signed in and received two handouts-- a survey and a briefing paper. Rich Ochs, Teton County Emergency Management Coordinator welcomed participants to the meeting, explaining that he wanted this to be a community conversation. He asked participants to fill out the surveys and turn them in before leaving. Each person completing the survey was given a one-person one-day survival kit. Rich introduced contractor Barb Beck.

Beck reviewed the information in the briefing paper about what a MHMP is and the benefits of updating the current plan. She listed the hazards that Teton County could be vulnerable to (see below.) She then ran through the roles of various entities in updating the plan, including the public.

The format for the meeting was explained. A set of flip charts, each with the heading of one of the hazards was placed on the meeting room walls. Markers were available at each flip chart station. Each of the charts had two columns. One column was for listing an issue or concern about that particular hazard. The second column asked for potential mitigation measures to address the specific concern. People were encouraged to write down their concerns on the flip charts whether or not they had a suggestion for mitigating that concern. Rich also had the FEMA Risk Map displayed on a screen with a projector. People were invited to talk with Rich to see on the map where their property is situated with respect to floodplain boundaries.

Rich and Barb explained that once any questions had been asked and answered, the participants were encouraged to visit the charts and record their ideas. The input will be captured and Barb and Rich will look at the existing projects to see if the issues/concerns have already been covered. If not, new ideas will be developed for projects (and discussed with the LEPC) to address them in the 2015 update.

Question and Answer

Emergency Coordinator, Ochs, fielded a number of questions from the participants. Topics addressed:

- Public access to FEMA's new Risk Map,
- Probability and severity of a Yellowstone Caldera eruption,
- Availability of CERT training for the community (70 active, 60 on waiting list, over 300 trained)
- The hazmat hazard—mostly flammable materials, Idaho National Energy Lab and air quality,
- Hoback Canyon natural gas line,
- Earthquake hazard—effect on Teton Dam, Teton Fault and predictions of future activity,
- Levees—county developing plans, integrity in an earthquake (can handle up to intensity 5)
- Levee locations—11 systems on Snake and Gros Ventre, 5.0 earthquake would trigger monitoring,
- Warning and evacuation time windows for dam failure of Teton Dam (Moose 5 hours, Wilson 8 hours),
- Army Corp of Engineers' inundation maps of Wilson area relative to levee breach,

- Monitoring of Jackson Lake Dam (not automated, monitoring frequency based on river flows),
- Warning of subdivisions that are unable to receive Nixle notification (e.g. Red Top Mountain),
- Emergency shelter locations (Red Cross responsibility)—working with schools and VOAD,
- Vulnerable individuals (seniors and others)-difficulty of and issues with maintaining registry,
- Evacuation and sheltering of pets and animals during disasters, and
- Public awareness of what to do during a disaster, where to get information.

Public Input Recorded by Participants on Flip Charts

See below for summary of comments.

Next Steps

The contractors will be updating the hazard profiles and working with the LEPC to identify projects. Materials will be posted on the county's website. A draft plan will be available for public review late in the summer. Contact information provided.

Participants were thanked for their attendance and ideas.

Public Input Recorded by Participants on Flip Charts

Hazard and Issue or Concern	Potential Mitigation for Concern
DAM FAILURE	
Levees breaching and flooding	Monitor levees, set up communication networks, Phone calling chains?
Bridge and utility damage	
Flooding potable water supplies	
Damage to wastewater treatment plant	
Panic/timing/traffic	Knowledge to prepare for the worst
Fear—before, during and after event	Increased education of locals and tourists
Cascade effect downstream to bridges	
DROUGHT	
Increased wildland fire risk	Education, warnings, proactive risk management
Potable water supply loss	
Flooding when it does rain, increased landslide risk	Saving water
EARTHQUAKE	
Neighbor's above ground fuel storage tanks	
Risk assessment of bridges to determine vulnerability	Evaluate Teton County bridges (WYDOT or consultant)
Dams or levees breaching and flooding	
Damage to fiber networks	
Damage/dangerous consequences to homes and schools	Information to be prepared
May cause avalanches	
Trigger for flooding, landslides, fire, power outages, loss of homes	Education and information
Effects on dam floodgates, ability to regulate flow	
FLOOD	
Warning people who can't receive Nixle messages	Work with homeowners' associations (Red Top) Preplanned routes and signage, public education Action plans for various scenarios
Damage to infrastructure and homes	Limit building on floodplain
Evacuations and sheltering	Education, more CERT involvement
Maintaining key access roads and bridges	Plan alternate routes for vulnerable roads
Flood risk from irrigation ditches not assessed	Investigate?
HAIL	
Seen hail but never big enough for real damage	Info on what to do when it becomes dangerous
Roof damage, cell tower damage	
Horses, wildlife, cattle	?
Home and auto insurance covers it?	
Being caught in open recreating during large hail storm	NWS warnings?
HAZMAT	
Large mixed loads	Route through canyons not pass. Adequate teams
Polluting water sources	
Domestic animals, livestock, wildlife, pollution of water sources	Personal plans, access to public plans, awareness
Non-disclosure, disclosure not required	Disclosure, support to personnel compiling info.
County officials don't take serious enough. Rich is only one person. More support if requested.	Increase personnel and support for existing personnel.

Hazard and Issue or Concern	Potential Mitigation for Concern
LANDSLIDES	
Damage to infrastructure and homes	Limit buildings in high risk areas
Damage to roads and bridges	
Daming of rivers, flooding	Awareness, preparedness
LIGHTNING	
Vulnerability during outdoor recreation	Nixle, NWS warnings
Fires and cell/radio tower damage	
Home covered by insurance for lightning?	Education, personal preparedness
Wildfires	
SNOW AVALANCHE	
WYDOT worker and car safety	Increase skier awareness, esp. out of town visitors
Lack of date for avalanche forecast in late spring	Extend forecast beyond current timeline
TERRORISM	
Potable water supply	
WY is a state with a lot of homeland and security military facilities. Creating chaos.	
Dam-well enough protected?	Education
Military facilities used against US by terrorists	
Random acts by definition: of concern	
Risk varies depending on visitors and season	Communicate, monitor with WOHS, law enforcmt
TORNADO	
How to recognize dangerous weather conditions	Educated public
What to do if you see funnel, shelter locations?	Education to recognize risks, what to do, where to go
Do we have them in this part of the state?	
WILDLAND FIRE	
Adequate fire breaks in development	Enforce space requirements
Resources needed are located elsewhere	
Fuel build-up	More prescribed burns
WINTER STORMS AND BLIZZARDS	
Long-term road closures limiting supply chain	Store food and water for community
Long-term power outages	Key back-up power locations
People on roads trying to get home, blocking all traffic	
Panic, people making not great decisions	Education
Animals left outside	Planning

Teton County Multi-Hazard Mitigation Plan
Public Meeting, Jackson, WY.
May 20, 2015

	Name	Representing	E-mail
	Kyle Carmichael	CERT	kyle_carm@yahoo.com
CERT interest	Sue Myers		sue.myers@me.com
	Dick Smith	Myself	[illegible]
	Jackie Montgomery	[illegible]	[illegible]
	Adam VanSickle	TPL	[illegible]
	Ellie Kinwood	Cert Self	elinwood@aol.com
	Janice Baker	C-V Ranch	jbaker@bocs5.org
	Armond Acri	self	aacri-wy@msn.com
	Kelly Price	Valley Wide Cooperative	K.Price@valleywidecoop.com
	Anthony Owens	Valley wide coop	Anthony.Owens@valleywidecoop.com
	Anna Wussel	CERT	awussel@gmail.com
CERT	Patty Talley	G-V Ranch	ptalley@bocs5.org
	PAUL DIVJAK	BAR-B-BAR	PHDIVJAK@AOL.COM

Teton County Multi-Hazard Mitigation Plan
Public Meeting, Jackson, WY.
May 20, 2015

Name	Representing	E-mail
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Lorna M. Miller		Lornamiller@live.com
SARAH W. HOFFMAN	CERT	sarahDsarah, whoffman.com
Robbie Farrow	CERT	rfarrow@teton
PAUL DIVJAK	CERT	PHDIVJAK@RCL.com
BRIAN LENZ	CERT SELF	btlenz@gmail.com
Rich Ochs	Teton County EM	
Barb Beck	Beck Consulting	

May 21, 2015 Teton LEPC Meeting

Time: 0830

Location: Station 1, 60 E. Pearl Ave., Jackson, WY

Agenda:

I. Call to Order

II. Approval of Minutes

III. Nomination of an industry Representative to LEPC (Rich Ochs – 5 min)

IV. Multi-Hazard Mitigation Plan Brief (Barb Beck & Beck Consulting – 45 min)

V. Around the Table

VI. Adjourn

Next Meeting – July 16, 2015 - Station 1 Firehouse

Teton County Multi-Hazard Mitigation Plan Update
LECP Meeting Agenda
Jackson—May 21, 2015

Welcome and introductions

What is a MHMP? (briefing paper handout)

- Role of LEPC and others
- Timeframes

Hazards to be analyzed in Teton County

Goals and Projects from 2009 Plan

- Overview
- Follow-up questions for a couple of the 2009 projects

Development Trends (what and where?)

Development of Problem Statements

Projects

- Types of projects that can be included in the plan (handout with examples)
- Preliminary project ideas for problems identified above

Next steps

Next LEPC meeting—
hazard profile research results
discussion to refine project ideas

Adjourn

Teton County MHMP Update
Notes from LEPC Meeting
Jackson, May 21, 2015

Participants: See sign-in sheets attached.

Welcome

Participants introduced themselves. The group had broad representation from law enforcement, coroner, fire/EMS, emergency management, the hospital, public health, Town of Jackson Public Works, the Forest Service, National Park Service, Transportation Safety Administration, Wyoming Department of Transportation, Teton Conservation District, industry and community representatives.

Participants received several handouts—a briefing paper, a list of examples of the types of projects that can be included in a hazard mitigation plan, a survey, a copy of the problem scenarios developed for the previous plan, and a first draft of projects for the update. The first draft of projects for the update was developed based on projects to be carried over from the 2009 plan, a meeting with the conservation district, and input from emergency management.

Contractor Beck went over the briefing paper explaining the reasons and benefits for updating the plan. The briefing paper refers to the hazards in the plan as "natural" yet there are two person-caused hazards that are also profiled. There was a request to clarify this. Beck explained the roles of various entities in the update—including the LEPC. She explained the contents of the plan, specifically the hazard profiles and listed the hazards that would be looked at in depth for Teton County.

2009 Plan

Beck provided an overview of the goals and projects in the 2009 plan. There were four goals and 45 projects in the previous plan. Of the 45 projects, 18 had been accomplished and many are ongoing. The status of several of these projects was unknown to the contractor so she asked the LEPC for an update on those. This added to the number of projects that had been accomplished. With the added information from the LEPC, the contractors now have updated status for all of the 2009 projects. This information will be included as an appendix in the update.

The other handout from the 2009 plan included the problem statements developed at that time. The LEPC chose to identify three possible disaster scenarios (earthquake, winter storm, and a hazmat incident) and the problems that would be created under those scenarios. From this, goals and projects were developed for the 2009 plan. The LEPC read through the list of problems and had some discussion. Some of the points made included:

- Emergency management talks in terms of the first 24 hours of a disaster, but disasters often last longer than that. Bad decisions can easily be made due to fatigue. Responders need backfill for longer duration disasters (48 hours or more.)
- Housing for responders (and others) was identified as a problem in 2009. This is gotten worse.
- Dam failure profile needs to include dam failure from Crystal Lake-a dam created by a landslide
- The Forest Service assesses all of their own bridges and closes them as needed
- Cattleman's Bridge has been closed by the county

- Red Top Bridge (over Fall Creek) has been fixed
- Law enforcement information needs good security

2015 Draft of Projects

The LEPC was asked to review the first draft between this meeting and the July meeting. But the following capital projects for Fire/EMS were identified for inclusion. They are provided in priority order;

1) Complete the renovation of Station 1 including a seismic retrofit, and to meet needs related to housing, training, apparatus storage, and separation of fuel from personnel.
2) Upgrade of Hoback Station to address seismic issues, fuel separation from personnel, and planning and operational space for managing an incident.
3) Renovation of West Bank/Wilson Station for seismic issues and to provide housing. Fire service is turning away needed volunteers due to housing situation.
4) Upgrade Station 4 at Moran.

(Note: A smaller meeting with the Teton Conservation District representative followed the LEPC meeting. Projects related to flooding and wildland fire were discussed and identified to be included in the second draft of projects for the July LEPC meeting.)

Development Trends

The group brainstormed development trends in the government sector. Barb will be visiting with the planning department about residential and commercial development.

- The hospital has several capital projects planned (long-term elder care on and off campus, cancer facility, new daycare)
- New master plan for Teton Village to include a school, fire station, and more
- Expansion of Mercill child learning center
- New Forest Service Supervisor's Office and employee housing
- New Forest Service Road up Snow King to communications sites
- New facilities at the county transfer station, expansion of the recycling center
- START Phase 2 maintenance shops
- Improved checked bag and screening at the airport
- Upcoming 100-year anniversary of the National Park Service, expect increased visitation at Grand Teton NP
- There has been a huge increase in commercial and residential construction

Next Steps

The contractors will be refining the hazard profiles, other local plans will be reviewed for consistency (the CWPP, the Community Needs Assessment, the Conservation District Strategic Plan), and the list of projects will be updated to address issues raised at the public and LEPC meetings.

Draft products will be posted on the county emergency management web page. The contractors expect to make a draft of the entire plan available for public review in late summer. After that WOHS and FEMA will review the plan. Upon completion of the reviews, the Town of Jackson, Teton County, and Teton Conservation District will be able to adopt the plan. Barb and Rich encouraged anyone with ideas or comments to contact either one of them.

Teton County Multi-Hazard Mitigation Plan
LEPC Meeting, Jackson, WY.
May 21, 2015

Name	Representing	E-mail
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[illegible]	[illegible]	[illegible]
Dave Deiter	US Forest Service	[illegible]
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Teton County Multi-Hazard Mitigation Plan
LEPC Meeting, Jackson, WY.
May 21, 2015

Name	Representing	E-mail
[illegible]	[illegible]	[illegible]
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[illegible]	Grand Teton National Park	[illegible]
Kathy Clay	JH Fire/EMS	kclay@tetonwyo.org
Ross Sgro	Teton Conservation District	robb@tetonconservation.org
Kent Jasperson	Teton County Solid Waste	Kjasperson@tetonwyo.org
Slade Ross	Teton County Sheriff's Office	[illegible]
Barb Beck	Beck Consulting	
Rich Ochs	Teton Co. EM.	

TETON COUNTY
Multi-Hazard Mitigation Plan Survey
May 2015
32 respondents

1. Where do you live? *(Please check one answer only.)*

- ☐ In Jackson (14)
- ☐ In Teton Co, not in a town (13)
- ☐ In Lincoln County, WY. (1)
- ☐ In Teton County, ID. (4)
  Public had 10 from Jackson, the LEPC only had 4 from Jackson.

2. Which of the following steps has your household taken to prepare for a natural hazard event? *(Please check all that apply.)*

- ☐ Received first aid/CPR training 23
- ☐ Made a fire escape plan 15
- ☐ Designated a meeting place 11
- ☐ Identified utility shutoffs 21
- ☐ Received Community Emergency Response Training 9
- ☐ Prepared a disaster supply kit 14
- ☐ Purchased flood insurance 7
- ☐ Stored food and water 21
- ☐ Stored flashlights and batteries 29
- ☐ Stored a battery-powered radio 16
- ☐ Stored a fire extinguisher 27
- ☐ Stored medical supplies (first aid kit, medications) 25
- ☐ Other: supplemental heat source, sleeping bags, pet plan, emergency response equipment in vehicle_____

3. How confident are you that your household would know what to do in a natural or manmade hazard event? *(Please check one answer only.)*

☐ Not at all confident	☐ Somewhat confident	☐ Very confident
5-all members of the public	9 public, 10 LEPC	3 public, 5 LEPC

4. How concerned are you about the following hazards to your home, business, and neighborhood? Please indicate whether you are NOT concerned, SOMEWHAT concerned, or VERY concerned.

(Please circle one answer for each hazard or leave it blank if you don't know.)

- Dam failure ..... Not Somewhat Very
- Drought ..... Not Somewhat Very
- Earthquake ..... Not Somewhat Very
- Flood ..... Not Somewhat Very
- Hail ..... Not Somewhat Very
- Hazardous materials spill ..... Not Somewhat Very
- Landslide ..... Not Somewhat Very
- Lightning ..... Not Somewhat Very
- Terrorism ..... Not Somewhat Very
- Tornado ..... Not Somewhat Very
- Winter storm/blizzard ..... Not Somewhat Very
- Wildland Fire ..... Not Somewhat Very
- Snow Avalanche ..... Not Somewhat Very

5. Which of the following methods would help you receive information during a disaster?
(Check all that apply.)

- ☐ Television
- ☐ Radio
- ☐ Amateur radio
- ☐
- ☐ Siren system
- ☐ At your workplace
- ☐ Internet
- ☐
- ☐ Facebook posting
- ☐ Twitter feeds
- ☐ Newspaper
- ☐ Email notice
- ☐ Directly from police/fire personnel
- ☐ By word of mouth
- ☐ Other: _____

6. A number of activities can reduce our risk from natural hazards. In general, these activities fall into one of the following six broad categories. Please tell us how important you think each one is for your community or the county to consider pursuing. *(Please check one answer for each or leave it blank if you don't know.)*

	Very Important	Somewhat Important	Not Important
▶ Prevention: Actions to influence land and building development. Examples include planning and zoning, building codes, and floodplain regulations.	☐ 26	☐ 7	☐ 0
▶ Property Protection: Actions involving existing buildings to reduce hazard risk. Examples include acquisition, relocation, elevation, and structural retrofits.	☐ 15	☐ 16	☐ 6
▶ Natural Resource Protection: Examples include floodplain protection, slope stabilization, and forest management.	☐ 17	☐ 13	☐ 0
▶ Structural Projects: Examples include dams, levees, detention/retention basins, channel modification, retaining walls, and storm sewers.	☐ 23	☐ 8	☐ 5
▶ Emergency Services: Examples include warning systems, evacuation planning, emergency response training, and protection of critical emergency facilities or systems.	☐ 32	☐ 3	☐ 6
▶ Public Education and Awareness: Actions to inform citizens about hazards and techniques they can use to protect themselves and their property.	☐ 25	☐ 7	☐ 3

7. Which of the following types of hazards would you like to have more information about? *(Please check all that apply.)*

- ☐ Dam failure
- ☐ Drought
- ☐
- ☐ Flood
- ☐ Hail
- ☐ Hazmat spill
- Landslide
- ☐ Lightning
- ☐ Snow Avalanche
- ☐ Terrorism
- ☐ Tornado
- ☐ Winter storm/blizzard
- ☐ Wildland Fire 14
- ☐ Other:

Optional: Name:_____, E-mail or phone:_____

E-mail Notice

July 6, 2015

Hello Teton LEPC Members and Tier II Submitters,

Just a reminder that our next LEPC Meeting will be on Thursday, July 16th at 8:30am at the Station 1 Firehouse on E Pearl Ave in Jackson. This meeting will once again focus on our ongoing Town/County/Conservation District Multi-Hazard Mitigation Plan, and your presence and input is important. Our plan contractor Barb Beck will go over some initial findings from the Hazard Identification Risk Assessment for Teton County, discuss the results of the Mitigation Survey that was distributed to the LEPC and the public, and talk about draft mitigation projects to ensure that we are on the right track. Please make a point to attend this meeting, or send an authorized representative.

Most of the meeting will be taken up with Mitigation Planning items, but if anyone has items they need added to the agenda please forward them to me as soon as possible. Thanks!

Rich Ochs, CEM, MEP
Coordinator, Teton County Emergency Management
Chairman, Teton County Local Emergency Planning Committee (LEPC)
PO Box 4458
3240 S Adams Canyon Dr
Jackson, WY 83001
o: (307) 732-8594
c: (307) 413-5040
f: (307) 732-5799
rochs@tetonwyo.org
www.tetonwyo.org/em

July 16, 2015 Teton LEPC Meeting

Time: 0830

Location: Station 1, 60 E. Pearl Ave., Jackson, WY

Agenda:

I. Call to Order

II. Approval of May LEPC Meeting Minutes (R. Ochs – 5 min)

III. September JH Airport Exercise (R. Knepper – 5 min)

IV. Training and Exercise Calendar Update (R. Levitz, 5 min)

V. Mitigation Plan (B. Beck – 45 Minutes)

VI. Around the Table

VII. Adjourn

Next Meeting – September 17, 2015 - Station 1 Firehouse

Teton County MHMP Update
LEPC Meeting Agenda
July 16, 2015

Handouts: Briefing paper, HIRA Quiz, Mitigation Projects Table, Public Meeting Notes

Hazard Identification and Risk Assessment Research

- Quiz to take together with some key facts

Public and LEPC Survey Results

Public Meeting Hazard Concerns and Project Ideas

Draft mitigation projects

- Review and edit projects
- Review project priorities

Next Steps

- Meet with JIM
- Public meeting on draft
- Release draft and public comment period
- September LEPC—comment on draft

Teton County MHMP Update
LEPC Meeting Agenda
July 16, 2015

Hazard Identification and Risk Assessment Research
LEPC members took the hazard quiz together.

Public and LEPC Survey Results
Contractor, Barb Beck presented the results of the public and LEPC survey. Thirty-two individuals took the survey in May. Respondents were almost equally split between Jackson and Teton County. Four respondents lived in Teton County, Idaho. One respondent lived in Lincoln County, Wyoming. Most of the members of the public lived in Jackson. Most of the LEPC members lived outside of Jackson.

Stored flashlights and batteries was the most common step people had taken to prepare for a natural hazard event, followed by storing a fire extinguisher and storing medical supplies. In response to the question about confidence in knowing what to do during a disaster, five members of the public said they were not at all confident, 19 members of the public and LEPC said they were somewhat confident, and eight members of the public and LEPC said they were very confident they would know what to do. The hazards people were most concerned about were wildland fire and winter storms and blizzards. People were least concerned about drought, hail, and tornadoes. Nixle followed by phone and radio were the most common methods by which people expected to receive information during a disaster. Emergency Services projects were the project type most highly supported, followed by Prevention, and Public Education and Awareness. Survey respondents indicated they would like to have more information about earthquakes and dam failures.

Public Meeting Hazard Concerns and Project Ideas
The LEPC revisited the concerns identified at the May public meeting. The review resulted in new project ideas and/or modifying projects already contained in the draft.

Draft mitigation projects
The LEPC then went through each project in the draft list of mitigation projects and assigned priorities (high, medium or low) to each project. Contractor, Beck, will take this input and revise the draft project list.

Next Steps
Rich and Barb will brief the elected officials at their August 3 Joint Information Meeting. Any input will be included in the draft plan. The plan will be released for public comment by or before August 14—available on the web and in hard copy. The LEPC may make comments on the draft at their regularly scheduled meeting in September. The plan will then be reviewed by WOHS and FEMA and finally adopted by the three jurisdictions.

Hazards Quiz--July 2015
Teton County, Wyoming

Fill in the blanks with your answers.

1) This occurs when water becomes super cooled in shallow, turbulent creeks. _____
2) In a worst case event of this disaster, Teton County could experience $681 million in capital stock and income losses. An estimated 379 buildings would be completely destroyed. What is this hazard? _____
3) How many damaging hail storms have there been in Teton County since 1959? _____
4) Teton County has had 43 fatalities from this hazard in the past 50 years, averaging one deadly event every 2.2 years. What is this hazard? _____
5) Ten million is the estimated cost of stabilizing the area and repairing the damage from this natural disaster. _____
6) What is by far the most costly natural hazard to our society? _____
7) There has only been one documented damaging event of this hazard in the County. It produced damages equivalent to over $5 million in 2015 dollars. What is this hazard? _____
8) $4.9 billion and 4,911 structures are at risk from this hazard. What is this hazard? _____
9) In a scenario where the Teton Fault generated a 7.2 magnitude earthquake, direct economic losses to buildings in the County were estimated to be _____ and damages to transportation infrastructure (primarily bridges and the airport) were estimated to be _____.
10) What are the high hazard dams in Teton County? _____
11) What natural hazard has caused four fatalities, 51 injuries, and over $2.6 million in property damage in Teton County since 1967? _____
12) There were 32 hazardous material incident responses in the County between 2004 and 2014. Which two materials were the cause of all of these incidents? _____
13) Since 1996, Teton County has averaged 4.5 of these events per year. What is this hazard?_____
14) Which Fire Station will be at 47.2% functionality on Day 1 of a 7.2 magnitude earthquake of the Teton Fault? _____ . Which Fire Station will be at 1.6% functionality on Day 1 of a 7.2 magnitude earthquake of the Teton Fault? _____
15) On December 31, 2014, the Town had 69 federal flood insurance policies in effect. How many federal flood insurance policies did the County have in effect on that date? _____
16) How many properties in Teton County are located in a landslide hazard area according to a WY. Geological Survey map? _____ The dollar exposure of these properties is $121 million.
17) Damaging floods occur on average once every _____ years in Teton County.
18) A disaster from this hazard would probably cause loss of life and up to $2.5 billion in damages. What is this hazard? _____
19) Teton County has the potential for up to _____ in flood losses from a 100-year flood.
20) The drought impact in Teton County over the years 1999-2003 was over $_____not counting impacts to the tourism industry.

Teton County Multi-Hazard Mitigation Plan
LEPC Meeting, Jackson, WY.
July 16, 2015

Name	Representing	E-mail
Rich Ochs	Teton EMA	rochs@ tetonwyo.org
Barb Beck	Beck Consulting	barbbeck@ bresnan.net
Robb Sorel	Teton Conservation District	robb@ tetonconservation.org
Michael Nash	Grand Teton National Park	michael_nash@ nps.gov
Charlotte Reynolds	T.C. PIO	creynolds@tetonwyo.org
Rachael Levitz	TCPH	rachael.levitz@wyo.gov
Mary Lou Klene	Red Cross	[illegible]
Bill Barnett	Teton [illegible]	[illegible]
Ahren Schlthers	Aspens Water/Sewer	wwtp1@wyom.net
Jess King	TCSO SAR	jking@ teton sheriff.org
Joseph Sebastian	TSA	Joseph.sebastian@ PHS.GOV
Steve Markason for Dale Deiter	BTNF	smarkason@ fs.fed.us
Lloyd Funk	TCSO	lfunk@tetonsheriff.org
FRED WHISSEL	CERT	fredwhissel@bresnan.net

Teton County Multi-Hazard Mitigation Plan
LEPC Meeting, Jackson, WY.
July 16, 2015

Name	Representing	E-mail
ALYSSA WATKINS	COUNTY COMMISSIONERS / TOWN	AWATKINS@TETONWYO.org
BRIAN CARR	JH F/EMS, RERT #8	bcarr@tetonwyo.org
Michael Kuhar	Suburban Propane	
Eric Lynes	TC IT	
Brian Coe	JH F/EMS, RERT 8	
Kelli Fennessey	JH Fire/EMS	
Jon Bishop	TUFD / JHMR	jon.bishop@jacksonhole.com

BOARD OF COUNTY COMMISSIONERS

TOWN COUNCIL

JOINT INFORMATION MEETING
AGENDA DOCUMENTATION

PREPARATION DATE: 7/29/2015
MEETING DATE: 8/3/2015

SUBMITTING DEPARTMENT: Emergency Management
DEPARTMENT DIRECTOR: Rich Ochs, Coordinator
PRESENTER: Barb Beck, Beck Consulting

SUBJECT: Draft Hazard Mitigation Plan Presentation

STATEMENT/PURPOSE

To provide the Jackson Town Council and Teton County Commissioners with the current status of the 2015 Multi-Hazard Mitigation Plan (MHMP) update.

BACKGROUND/ALTERNATIVES

In order to be eligible for FEMA mitigation grant funds, a jurisdiction must have a MHMP that is approved by local officials, the State, and finally by FEMA. This plan must be updated at least once every 5 years to remain current. The Town and County's last MHMP expired in February of 2015, and we are currently in the midst of the plan update. The Town and County both signed Letters of Support (attached) in 2013 when the County applied for a Pre-Disaster Mitigation Grant through FEMA to defray the costs of the plan update.

The MHMP is a proactive plan, which can result in cost savings if disasters are mitigated or avoided altogether. The MHMP is also the plan that can be of most use to the general public and local businesses, since the first half is made up of a Hazard Identification and Risk Assessment (HIRA) that gives a snapshot of historical and potential hazards in Teton County, their associated risks, and their probabilities. This information can be used to help individuals and businesses better plan and prepare for disasters, ensuring a resilient, whole-community recovery process.

The 2015 plan update is unique in that Emergency Management has worked to bring in a third signatory to the plan, the Teton Conservation District. By bringing in this new partner, we introduce a higher level of expertise in areas of wildfire and flood mitigation, and also give the Conservation District the opportunity to apply directly for hazard mitigation funds through FEMA for projects that help lessen the impact of natural disasters throughout Teton County and the Town of Jackson.

JOINT INFORMATION MEETING

Special Town Council & County Commissioner Meetings

Monday, August 3, 2015 ~ START AT 2:30PM

County Chambers ~ Chairing: Barbara Allen

PLEASE SILENCE ALL ELECTRONIC DEVICES DURING THE MEETING

I. Roll Call and Announcements

II. Public Comment

This section of the agenda is designated for questions and comments from the public on items that are not on today's agenda.

III. Meeting Minutes

A. July 6, 2015 regular JIM

IV. Discussion / Action items

A. 2:30 Draft Hazard Mitigation Plan Presentation – Rich Ochs, 15 mins

B. 2:45 Comp Plan Annual Indicators (continued) – Alex Norton, 40 mins

C. 3:25 Integrated Transportation Plan – Tyler Sinclair / Sean O'Malley, 75 mins

D. 4:40 Community Priorities Fund – Bob McLaurin & Alyssa Watkins, 20 mins

V. Matters from Council, Commission, or Staff

VI. Set Agenda for the Next Joint Information Meeting

a. 8/10 SLIB TE Grant Application to replace a START bus – Michael Wackerly, 15 mins

b. 8/10 Parks & Recreation Board interviews – 90 mins

c. 9/14 Review of Joint Powers Agreements – Roxanne Robinson, 15 mins

d. 9/14 Recreation Center RFP – Steve Ashworth, 20 mins

VII. Adjourn

Joint Information Meeting
Teton County/Town of Jackson
Multi-Hazard Mitigation Plan Update
August 3, 2015

Participants: County Commissioners, Jackson Town Councilors, Teton Conservation District, Emergency Management Coordinator, MHMP Contractor, Town and County Staff (planners, clerk, etc.) and 37 members of the public. (The County does not use sign-in sheets for the JIM meetings.)

Teton County Emergency Management Coordinator, Rich Ochs, introduced contractor Barb Beck who provided the following information. (Members of the county commission, Jackson Town Council, and Teton Conservation District had been provided a packet of information the previous week that included a Staff Report, the Executive Summary, the Hazard Quiz, and the draft mitigation projects table.)

- Overview of MHMP—why prepare it, what's in it?

Beck explained the overall purpose for preparing/updating the MHMP. This is to help keep citizens safer by reducing the potential for natural disasters and to reduce the impacts to life and property when they do occur. Updating the MHMP will also ensure the jurisdictions can compete for project funds and also receive post-disaster assistance. Barb listed the hazards that are being profiled for Teton County.

- Role of Local Government/Elected Officials

Local governments have a number of roles in the process.

1. Contribute to the local match for obtaining the grant to update the plan,
2. Providing information, plans, and access to staff,
3. Providing staff to participate in the planning process,
4. Identifying project needs,
5. Assisting in priority setting for the mitigation projects,
6. Making the draft available (website and hard copies),
7. Reviewing draft materials and providing input, and
8. Adopting the plan once completed, and implementing the projects.

Beck explained that each jurisdiction that wishes to adopt the plan must have at least one mitigation project in the plan. These projects are needs that have been identified. Listing them in the plan does not require the jurisdiction to accomplish them. They are to be accomplished if/when resources (funds, staff time, and/or technical expertise) are available.

- Executive Summary (handout)

- Hazard Quiz (handout)

Several of the questions—primarily focused on costs—were selected from the quiz. The questions were asked and the answers provided as a means to educate and underscore the values at risk and show how costly natural disasters can be. The information supports how important it is to do this planning ahead of time.

- Overview of Projects (Hand out project table)

Beck gave an overview of the mitigation projects that have been developed. The projects have been identified from the previous plan, the LEPC, the public, town and county staff, emergency management, and elected officials. There are three goals, one for each local jurisdiction. The county has 28 projects, Jackson has six, and the Conservation District has five. Each goal has a variety of projects that address one of the natural hazards identified for Teton County and/or enhances emergency response for any or all of the hazards. Beck and Ochs invited the elected officials to provide feedback at any time in the process on projects they would like to see added, projects they were not comfortable with, or priorities assigned to the projects by the LEPC.

- Next Steps—release of draft, WOHS and FEMA reviews, adoption

The draft plan will come out for a 4-week public comment period no later than August 14. It will be sent to WOHS for a concurrent review. Following those reviews, comments will be addressed and then the plan will go to FEMA for a final review. Once FEMA completes its review, the local jurisdictions can adopt the plan. This is expected to be in late fall or early winter.

- Questions and Discussion

How does the plan address climate change?

Answer: The plan addresses all potential natural hazards regardless of the cause. FEMA has instituted a requirement that state mitigation plans will need to begin addressing climate change in 2017. Wyoming's plan will be updated in 2016. There is no requirement for local plans to address climate change.

Town of Jackson is concerned about landslide hazard. How many and where are the structures at risk? Answer: Planners propose moving up the priority on this issue from FY 2018-19 to FY 2015-16. *(Note: The elected bodies decided later in the meeting to schedule a joint workshop to discuss this issue.)*

Some of these projects are costly. Where will the funding come from?

Answer: Some of the funding can potentially come from grants. Other funds may come from local governments.

Comment: It's good to understand that accomplishing projects in the plan is dependent on available resources.

The elected officials thanked Rich and Barb for the thorough briefing and raised several issues paraphrased below.

EXECUTIVE SUMMARY
Multi-Hazard Mitigation Plan
August 3, 2015

Teton County, the Town of Jackson, and the Teton Conservation District are in the process of updating the Multi-Hazard Mitigation Plan (MHMP) adopted in 2010. Using a grant from the Federal Emergency Management Agency (FEMA), the county retained Beck Consulting and AMEC Foster Wheeler to assist Teton County Emergency Management in updating the 2010 plan.

The overarching goal of the MHMP is to reduce the risks for injury, loss of life, property damage, and property loss due to natural disasters. Maintaining a current plan also ensures the jurisdictions are eligible for grant funds to complete mitigation projects and to receive post-disaster assistance in the event of a major natural disaster.

Building on the earlier plan, this update contains the results of research on past disasters including location, severity, and frequency, and uses models and the historical record to project potential damages from future natural disasters.

The natural hazards addressed in the plan include; dam failure, drought, earthquake, flood, landslides, hail, snow avalanches, tornadoes, wildland fire, and winter storms and blizzards. In addition, two human-related hazards, hazardous materials and terrorism are addressed. The plan also contains a description and documentation of the planning process and who was involved in that process. Emergency Management, Town and County elected officials and staff, Teton Conservation District, Fire/EMS, Law Enforcement, Public Health, Industry, Bridger-Teton National Forest, Grand Teton National Park, and the public were all involved in the plan update process.

The plan has three goals and 41 mitigation actions or projects. There is one goal for Teton County with 28 projects, one goal for the Town of Jackson with six projects, and one goal for the Teton Conservation District with seven projects. At least one project is required of any jurisdiction wishing to adopt the plan. This MHMP update is consistent with existing local plans and the Local Development Regulations (LDR's.)

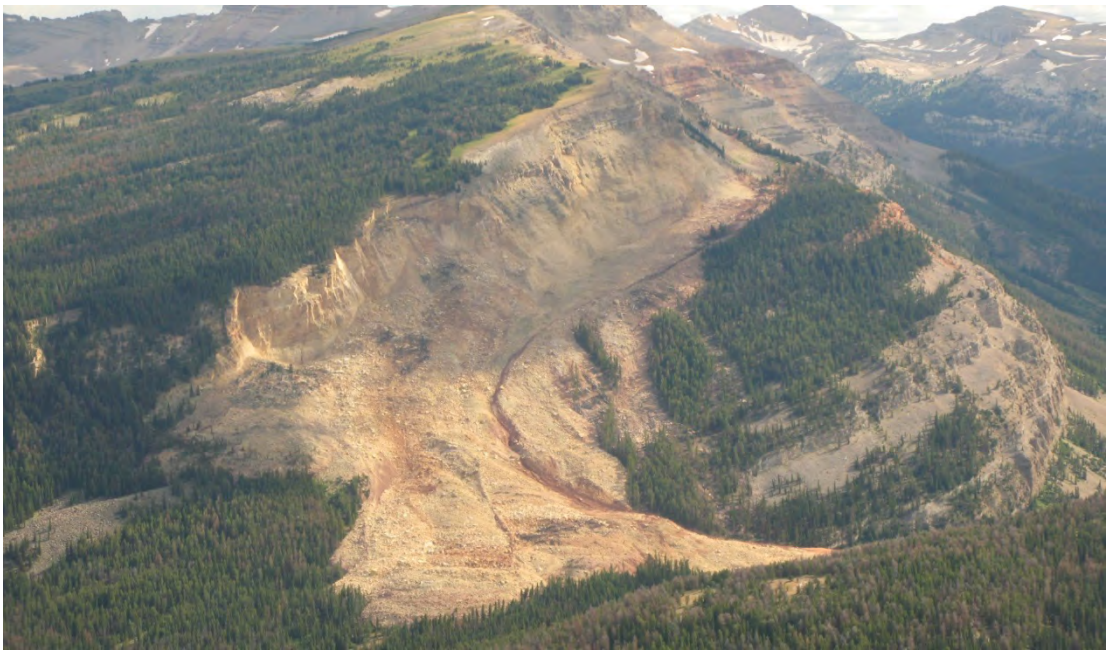
The types of projects under the three goals in the plan are diverse and include; education and awareness, emergency response, natural resource protection, prevention, property protection, and structural projects. Public and Local Emergency Planning Committee (LEPC) surveys indicated the strongest support for emergency response type projects. Together, the projects address all of the hazards either directly or through increasing the effectiveness of emergency response. Projects do not represent an unfunded mandate for local governments. Projects represent an identified need and will be undertaken if/when resources (personnel, funding, and technical expertise) is available.

TETON COUNTY

HAZARD MITIGATION PLAN MEETING

Monday, August 3, 6:00 p.m.

Library Meeting Room, Jackson



Crystal Peak Slide, August 2008

- Anyone with an interest is encouraged to attend!
- Agenda items include; explanation of the draft plan, a quiz about past disasters in the county and what natural disasters can cost, a discussion about what you need to be better prepared, and information about earthquakes and dam failures
- For more information, contact: Barb Beck, 406 446-3628, barbbeck@bresnan.net

We will be drawing for three 72-hour disaster kits.

You must be present to win!

Message sent via Nixle | Go to nixle.com | Unsubscribe

Friday July 24, 2015, 12:40 PM

Teton County Emergency Management

Share Tweet Forward

Community: We need your help with our Hazard Mitigation Plan! Public meeting 8/3/15 at 6p at TC Library. Win a disaster kit!

Flyer August public mtg.pdf

Hazard Quiz Multiple Choice.pdf

Public Mtg agenda August.pdf

Dear Charlotte Reynolds,

Teton County Emergency Management is hosting a public meeting at the Teton County Library Ordway Auditorium on Monday, August 3rd at 6pm. We are seeking comment on our Teton County/Town of Jackson Multi-Hazard Mitigation Plan update.

Come out to offer input, learn about hazards that can impact our community, and find out how you can be better prepared for disasters.

Attendees that complete a hazard quiz can enter a drawing to win one of three 72 hour disaster kits! You must be present to win.

Contact Barb Beck barbbeck@bresnan.net or Rich Ochs rochs@tetonwyo.org for more information. See attached event flyer, meeting agenda, and disaster quiz (answers will be given at the public meeting).

Contact Information:
Richard Ochs
rochs@tetonwyo.org

For full details, view this message on the web.

Sent by **Teton County Emergency Management**
3240 S Adams Canyon Dr , Jackson, WY 83001

To manage your email settings, click here. To update your account settings, login here.
If you prefer not to receive future emails, unsubscribe here.

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Note: The county posted photos and information about this meeting on its Facebook Page—both before and after the meeting.

Hazard mitigation plan needs some local history

By Michael Polhamus | Posted: Wednesday, July 29, 2015 4:30 am

County emergency management officials hope to enlist the aid of the public in crafting a plan to deal with natural disasters.

Called a hazard mitigation plan, the document could assist in reducing the harm of natural disasters and other hazards and is meant to prepare citizens and residents for those that do occur.

Public input is key to the plan because members of the community often have anecdotal knowledge of historic and local hazards that official reports don't cover. Those interested are encouraged to attend a Monday meeting on the plan.

"This is very much a whole-community kind of project," Teton County Emergency Management Coordinator Rich Ochs said. "We want to get feedback from as many members of the community as possible, because this is something that definitely impacts the larger community as a whole."

The feedback will educate emergency management officials about hazards, past problems and protective measures that they might not have considered.

"If you look at the breakdown of our community, there are quite a few people who have been here a long time, or have been here their whole lives," Ochs said. "But a lot of people have not, so sometimes you lose that local knowledge, and we want to gather as much of that as we can."

Monday's meeting will build on a meeting that took place May 20 at which officials and residents worked to identify all the natural disasters that could affect Jackson Hole, Ochs said.

Information gathered there formed "a good snapshot of what has happened and what could happen here," he said.

It's hoped that next week's meeting will give officials ideas on projects that could lessen the harm associated with those natural disasters.

"We're looking for a different set of eyes on the projects," Ochs said. "Are we missing something obvious?"

By writing a hazard mitigation plan Teton County becomes eligible for Federal Emergency Management Agency funds that could pay for some of those projects, Ochs said.

"For larger projects that could definitely be worth it," he said.

The previous hazard mitigation plan, written in 2010, expired in February, Ochs said.

Teton County Hazard Mitigation Plan Update
Public Meeting Agenda
August 3, 2015

Welcome (Barb)

What is the Hazard Mitigation Plan and why prepare and update the plan? (Barb)

What's in this update? (Barb)

- Hazard profiles
- Hazard quiz and discussion
- Goals and projects—how they were developed, what they are

Discussion (All, Rich)

- What have you done already?
- What would help you be better prepared for a natural disaster?

Earthquakes and Dam Failure (Barb and Rich)

- More in-depth information from the research
- Information on how to prepare

Questions?
Drawing for 72-hour kits

Teton County Hazard Mitigation Plan Update
Public Meeting Agenda
August 3, 2015

Handouts: Briefing Paper, Executive Summary, Hazard Quiz

Welcome (Barb)

What is the Hazard Mitigation Plan and why prepare and update the plan?

Contractor, Barb Beck, covered the information in the briefing paper and Executive Summary such as the purpose for the plan update.

What's in this update? (Barb)

- Hazard profiles—hazards being profiled were listed.
- Hazard quiz and discussion—the group took the quiz together. Teton County Emergency Management Coordinator, Rich Ochs, provided a great deal of local information as part of the discussion of the answers. The people in attendance had a high level of knowledge about natural disasters and got many of the answers to questions in the quiz correct. This discussion consumed most of an hour.
- Goals and projects—Barb gave an overview of the mitigation projects, how they were developed, what they cover, and the three jurisdictions that will adopt the plan. A couple of extra hard copies of the projects were handed out to those that were very interested in reviewing and commenting on the projects.

Earthquakes and Dam Failure (Barb and Rich)

- More in-depth information from the research was presented on dam failure and earthquakes. There were questions about the failure of Jackson Lake Dam and what that would mean for different places. Earthquake intensity was discussed. All but one of the members of the public present had experienced and earthquake personally. Many of them had been in multiple earthquakes and most of the experiences had been in Teton County.
- Information on how to prepare for earthquakes and flooding was displayed and made available for people to pick-up and take away with them.

Next Steps

Barb and Rich explained that the draft MHMP would be available for public comment by or before August 14. The plan will be available on the Teton County Emergency Management website and hard copies at the Town, County, Emergency Management Office, and the library.

Rich held a drawing for three 72-hour kits.

The formal meeting concluded and people were invited to stay afterwards and visit informally with Rich and Barb. Rich displayed floodplain maps in the wall and was able to show individuals where their property lies with respect to various flooding probabilities.

Multi-Hazard Mitigation Plan Quiz
Teton County, Wyoming

Circle the correct answer **NAME:** _____

1) This occurs when water becomes super cooled in shallow, turbulent creeks.
   A. Frazil Ice B. Whirlpools
   C. Tsunamis D. Vortex
2) In a worst case event of this disaster, Teton County could experience $681 million in capital stock and income losses. An estimated 379 buildings would be completely destroyed. What is this hazard?
   A. Tornado B. Earthquake
   C. Flood D. Drought
3) How many damaging hail storms have there been in Teton County since 1959?
   A. 3 B. 13
   C. 23 D. 33
4) Teton County has had 43 fatalities from this hazard in the past 50 years, averaging one deadly every 2.2 years. What is this hazard?
   A. Lightning B. Hazardous Materials Spill
   C. Avalanche D. Flash Flood
5) Ten million dollars is the estimated cost of stabilizing the area and repairing the damage from this disaster.
   A. 2012 Horsethief Fire B. 2014 Budge Landslide
   C. 2015 AmeriGas Fire D. 2011 Teton County Flood Season
6) What is far the most costly natural hazard to our society?
   A. Hurricane B. Wildfire
   C. Drought D. Blizzard
7) There has only been one documented damaging event of this hazard in the County. It produced damages equivalent to over $5 million in 2015 dollars. What is this hazard?
   A. Dam Failure B. Drought
   C. Blizzard D. Tornado
8) $4.9 billion and 4,911 structures are at risk from this hazard. What is this hazard?
   A. Wildfire B. Earthquake
   C. Flood D. Tornado
9) In a scenario where the Teton Fault generated a 7.2 magnitude earthquake, direct economic losses to buildings in the County were estimated to be _____ and damages to transportation infrastructure (primarily bridges and the airport) were estimated to be _____.
   A. $370 and $43 B. $370,000 and $43,000
   C. $370,000,000 and $43,000,000 D. $370,000,000,000 and $43,000,000,000

10) How many high hazard dams (meaning they have potential to significantly impact lives and property) are in Teton County?

A. 1 B. 2
C. 3 D. 4

11) What natural hazard has caused four fatalities, 51 injuries, and over $2.6 million in property damage in Teton County since 1967?

A. Earthquake B. Lightning
C. Microburst D. Hail

12) There were 32 hazardous material incident responses in the County between 2004 and 2014. Which two materials were the cause of all of these incidents?

A. Chlorine and Phosgene B. Hydrochloric Acid and Butane
C. Benzene and Crude Oil D. Natural Gas and Propane

13) Since 1996, Teton County has averaged 4.5 of these events per year. What is this hazard?

A. Hazardous Materials Spill B. Lightning
C. Winter Storm D. Flood

14) Which Fire Station is projected to be at 47.2% functionality on Day 1 of a 7.2 magnitude earthquake of the Teton Fault? _____ . Which Fire Station is projected to be at 11% functionality on Day 1 of a 7.2 magnitude earthquake of the Teton Fault? _____

A. Station 3 Hoback and Moose Fire Station B. Station 1 Jackson and Colter Bay Fire Station
C. Station 6 Teton Pines and Teton Village FD D. Station 4 Moran and Station 2 Wilson

15) On December 31, 2014, the Town had 69 federal flood insurance policies in effect. How many federal flood insurance policies did the County have in effect on that date?

A. 103 B. 255
C. 314 D. 407

16) How many properties in Teton County are located in a landslide hazard area according to a WY State Geological Survey map? The dollar exposure of these properties is $121 million.

A. 2 B. 20
C. 200 D. 2,000

17) Damaging floods occur on average once every _____ years in Teton County.

A. 10 B. 15
C. 20 D. 25

18) A disaster from this hazard would probably cause loss of life and up to $2.5 billion in damages. What is this hazard?

A. Hail B. Drought
C. Dam Failure D. Frazil Ice

19) Teton County has the potential for up to _____ in flood losses from a 100-year flood.

A. $11 million B. $31 million
C. $71 million D. $91 million

20) The impact of this hazard in Teton County over the years 1999-2003 was over $14.7 million, not counting impacts to the tourism industry.

A. Blizzard
B. Drought
C. Flood
D. Landslide

Thank you for participating! This quiz is part of Teton County and the Town of Jackson's 2015 Multi-Hazard Mitigation Plan update. For more information, visit www.tetonwyo.org/em, email em@tetonwyo.org, or call 307-733-9572.

August 3, 2015 public meeting, Teton County Library

Multi-Hazard Mitigation Plan Quiz
Teton County, Wyoming

Circle the correct answer **NAME: Answer Key**

1) This occurs when water becomes super cooled in shallow, turbulent creeks.
   - A. Frazil Ice
   - B. Whirlpools
   - C. Tsunamis
   - D. Vortex
2) In a worst case event of this disaster, Teton County could experience $681 million in capital stock and income losses. An estimated 379 buildings would be completely destroyed. What is this hazard?
   - A. Tornado
   - B. Earthquake
   - C. Flood
   - D. Drought
3) How many damaging hail storms have there been in Teton County since 1959?
   - A. 3
   - B. 13
   - C. 23
   - D. 33
4) Teton County has had 43 fatalities from this hazard in the past 50 years, averaging one deadly every 2.2 years. What is this hazard?
   - A. Lightning
   - B. Hazardous Materials Spill
   - C. Avalanche
   - D. Flash Flood
5) Ten million dollars is the estimated cost of stabilizing the area and repairing the damage from this disaster.
   - A. 2012 Horsethief Fire
   - B. 2014 Budge Landslide
   - C. 2015 AmeriGas Fire
   - D. 2011 Teton County Flood Season
6) What is far the most costly natural hazard to our society?
   - A. Hurricane
   - B. Wildfire
   - C. Drought
   - D. Blizzard
7) There has only been one documented damaging event of this hazard in the County. It produced damages equivalent to over $5 million in 2015 dollars. What is this hazard?
   - A. Dam Failure
   - B. Drought
   - C. Blizzard
   - D. Tornado
8) $4.9 billion and 4,911 structures are at risk from this hazard. What is this hazard?
   - A. Wildfire
   - B. Earthquake
   - C. Flood
   - D. Tornado
9) In a scenario where the Teton Fault generated a 7.2 magnitude earthquake, direct economic losses to buildings in the County were estimated to be _____ and damages to transportation infrastructure (primarily bridges and the airport) were estimated to be _____.
   - A. $370 and $43
   - B. $370,000 and $43,000
   - C. $370,000,000 and $43,000,000
   - D. $370,000,000,000 and $43,000,000,000
10) How many high hazard dams (meaning they have potential to significantly impact lives and property) are in Teton County?
    - A. 1
    - B. 2
    - C. 3
    - D. 4
11) What natural hazard has caused four fatalities, 51 injuries, and over $2.6 million in property damage in Teton County since 1967?
    - A. Earthquake
    - B. Lightning
    - C. Microburst
    - D. Hail

Teton County Multi-Hazard Mitigation Plan
Public Meeting, Jackson, WY.
August 3, 2015

Name	Representing	E-mail
Rich Ochs	Teton EMA	rochs@tetonwyo.org
Bob Culver	Self	bobculver@local.com
Eric Huber	SCF	[illegible]
David Hennessey	CERT 420 S. Redmond	davidclees@hotmail.com
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Ann Keller	self	—
Barrie Frazier	self	bfrazier@bresnan.net
Frank Cheemond	Self	[illegible]
Rob Sand	Teton Conservation District	rob@tetonconservation.org
Bill Beck	BC	
Stacy Noland	Field Innovation Team	Stacy.noland@gmail.com

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8 Remaining

Hazard planners say get ready for anything

You name it, if it's bad it could happen here, and residents should be preparing to tough it out.

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POSTED: WEDNESDAY, AUGUST 5, 2015 4:30 AM
By Emma Dreyfuss | 0 comments

In the final public meeting before releasing a draft hazard mitigation plan, Teton County emergency management officials got a jump Monday on one of the plan's goals.

"It's not necessarily something you hear a lot about, but it's probably the plan which has the most applicability for businesses and households," Teton County Emergency Management Coordinator Rich Ochs said.

The plan, last updated in 2010, is due for another update this year.

Consultant Barb Beck, who helped with the last rewrite, will help Ochs' agency to release a draft plan later this month.

Eventually the town of Jackson, Teton County and, for the first time, the Teton Conservation District, will sign on to the plan. That will make them eligible for federal funding to address the hazards of living in the valley.

"Building on the earlier plan, this update contains the results of research on past disasters including location, severity and frequency, and uses models and the historical record to project potential damages from future natural disasters," the executive summary presented to attendees Monday says.

Several of the mitigation projects likely to go into the plan focus on public education and awareness.

The 10 attendees got a crash course in Teton County disasters and their frequency with a quiz the group filled out.

View this week's e-edition View today's e-edition

MOST POPULAR MOST COMMENTED

Stories

1. One dead, four injured in park dormitory blaze
2. Teenager charged with raping classmates at party
3. Colter Bay dorm fire kills one
4. Man charged with assault at county fair faces evaluations
5. Search still on for man lost in Yellowstone River

Go to complete list >

Photos

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JACKSON HOLE FORECAST

WEDNESDAY	THURSDAY	FRIDAY
Lo 50 / Hi 75 rain showers & some T-storms	Lo 48 / Hi 76 partly cloudy to mostly sunny	Lo 45 / Hi 76 partly cloudy day T-storms evening

Powered By:

Jackson Hole Calendar

Every Woman Inspired
7:00 pm | Intersections, Jackson

An Evening with Annie Barrows
7:00 pm | Teton County Library, Jackson

Jackson Hole News&Guide
PROOF OF PUBLICATION

COUNTY OF TETON
THE STATE OF WYOMING

Kevin Olson

Being duly sworn, deposes and says that he is the Publisher of the JACKSON HOLE NEWS&GUIDE, weekly newspaper published in Jackson in said county and state, and that the annexed Notice was published in 2 consecutive issues of said newspaper and not in a supplement, the first publication thereof being on August 19, 2015

Kevin Olson

Subscribed in my presence and sworn to before me this 31 Day of August 2015.

Kathleen M. Godines

KATHLEEN M. GODINES
COUNTY OF TETON
STATE OF WYOMING
MY COMMISSION EXPIRES
NOTARY PUBLIC

Fee for publication $ 18.20 Charge to the following:

Account No: 33102 Name: Beck Consulting

Address: PO Box 870 Red Lodge MT 59068

Teton County Multi-Hazard Mitigation Plan available for public review, 8/14-9/17 at www.tetoncounty.org/em.
Publish: 08/19, 8/26/15

APPENDIX B. 2009 Project Status Table

2009 GOAL ONE: Develop or enhance critical infrastructure in order to improve community resilience.

#	Description	Priority	Cost	Type	Responsible agency for implementation, coord.	Status of Project in 2015
1.a	Assess all state highway bridges for structural integrity	High	$25000+	P, PR, NRP, S	WYDOT Engineer	Not within Town or County authority. Delete.
1.b	Assess secondary road bridges for structural integrity	Med	$25000+	P, PR, NRP, S	WYDOT Engineer; TC Engineer	County Road and Levy has completed an inventory and some assessment as part of critical transportation system.
1.c	Assess Town bridges for structural integrity	Med	$5000-$25000	P, PR, NRP, S	TOJ Public Works Director	Not done for seismic.
1.d	Inventory and map all private bridges.	Med	$25000+	P, PR, NRP, S	WYDOT Engineer; TC Engineer; TC GIS Coordinator	Completed. Delete.
1.e	Perform structural retrofitting of vulnerable bridges.	High	$25000+	P, PR, NRP, S	FEMA Mitigation Specialist; WYDOT Engineer FHWA Engineer; TC Road and Levy Foreman; TOJ Public Works Director	Not accomplished. Select one or two specific key bridges and do this. Roll over project in 2015 plan.
1.f	Identify nearest resources for installation of temporary bridges	High	Less than $5000	P, PR, NRP, S	WYDOT Engineer; TCEM Coordinator; WOHS Coordination; WYNational Guard	Completed. There are no nearby bridge replacement resources.
1g	Assess critical infrastructure (water, sewer, roads, utilities) for structural integrity	High	$25000 +	P, PR, PP, S, NRP	FEMA Mitigation Specialist; WYGS Geologist; WOHS Coordinator; TCEM Coordinator; Utility Company Managers; TOJ Public Works Director, WYDOT, TV Water and Sewer District Supervisors	Not accomplished, too general. 2015 HIRA may touch on this.

#	Description	Priority	Cost	Type	Responsible agency for implementation, coord.	Status of Project in 2015
1.h	Perform necessary structural and non-structural retrofitting of vulnerable infrastructure.	High	$25000+	P, PR, NRP, S	FEMA Mitigation Specialist; WYGS Geologist; WOHS Coordinator; TCEM Coordinator; Utility Company Managers; TOJ Public Works Director; WYDOT; TV Water and Sewer District Supervisors	Not accomplished. Too general. First need to identify specific infrastructure.
1.i	Assess critical facilities (hospital, shelters, fire stations, police stations, governmental administration buildings) for structural integrity	High	$25000+	P, PR, PP, S, NRP	FEMA Mitigation Specialist; WOHS Coordinator; TC Planning and Building Inspector; TOJ Planning Director and Building; Facility Owners	Not accomplished. Too general. First need to identify specific facilities.
1.j	Perform necessary structural and non-structural retrofitting of vulnerable facilities.	High	$25000+	P, PR, NRP, S	FEMA Mitigation Specialists; WOHS Coordinator; TCEM Coordinator; Facility Owners	Delete.
1.k	Identify and pursue fund sources for hazard mitigation projects	High	Less than $5000	C	TC Grants Specialist; TCEM Coordinator; WOHS Coord; FEMA Mitigation Specialist	Completed as needed.
1.l	Encourage purchase of earthquake insurance for homes and businesses	High	Less than $5000	P, PR, PP, EA, S	TCEM Coordinator	Completed but need to continue to emphasize education and awareness. Roll over into 2015 plan.
1.m	Assess vulnerability of schools	High	$25000+	PR, PP, S	TCEM Coordinator, Superintendent of Schools	Not accomplished. Not a high priority for schools. State has a new initiative. Delete.

2009 GOAL TWO: Incorporate mitigation strategies into community plans.

#	Description	Priority	Cost	Type	Responsible agency for implementation coordination	Status of Project in 2015
2.a	Initiate participation in the Community Rating System.	High	Less than $5000	P, PP	TC Engineer; TCEM Coordinator; WOHS Coordinator	Not accomplished. Roll over into 2015 plan.
2.b	Assess local regulations to determine their effect on reducing the risks from natural hazards	High	Less than $5000	P, PP	TC Planner and Building Department; TOJ Planner and Building Inspector; Jackson Hole Fire/EMS Chief	Not accomplished. Roll over into 2015 plan.
2.c	Consider natural hazards when creating/updating community development plans	High	None	PR, C	TC Planner; TOJ Planner; Teton County BCC; TOJ Town Council	Comprehensive plan completed. Natural hazards were considered.
2.d	Complete Fire/EMS Capital Project #21, new fire station at Jackson Hole Golf and Tennis	High	$25000+	P, PR, PP, NRP, S	Town of Jackson Administrator; Teton County Administrator; Jackson Hole Fire/EMS Chief	Not accomplished. Replace this with current highest priority item (as per LEPC on 5/21/2015.)
2.e	Produce a county-wide hazard map	High	$25000+	PR, PP, NRP, C	TOJ Planner; TC Planner; TC Engineer; TCEM Coordinator; WOHS Coordinator, WYGS Geologist; TC GIS Coord.	Lots of information available but not integrated into GIS system. Roll over into 2015 plan.

2009 GOAL THREE: Reduce vulnerability to natural hazards.

#	Description	Priority	Cost	Type	Responsible agency for implementation coordination	Status of Project in 2015
3.a	Offer two CERT courses/year	High	$5000 - $25000	P, EA	TCEM Coordinator; Jackson Hole Fire/EMS Chief	Not accomplished. Change to offer one course/year and roll over into 2015 plan.
3.b	Offer 2-4 weather spotter courses/year	High	Less than $5000	P, EA	TCEM Coordinator; NOAA Meteorologist	Accomplished. Change to offer 1-2 courses/year and roll over into 2015 plan.
3.c	Offer hazard awareness education to the public	High	Less than $5000	P, EA	TCEM Coordinator; Town of Jackson Administrator	Accomplished. Reword to emphasize joint communication outreach with law, fire, EM, etc.
3.d	Develop and run avalanche public service announcements	Med	$5000 - $25000	P	TCEM Coordinator; Avalanche Center Manager; SAR Coordinator	Accomplished. Broaden to general preparedness and Nixle sign-up.
3.e	Community participation and compliance with the HSEEP	High	$25000+	PR,C	Town of Jackson Planner; TCEM Coordinator	Accomplished and ongoing. Delete.
3.f	Monitor known slide areas.	High	Less than $5000	PR, NRP	WYDOT Engineer; TC Road and Levee Foreman; TOJ Public Works Director; TC Sheriff; JPD Chief	Accomplished and ongoing. Roll over into 2015 plan specifying Budge Slide and N. entrance to South Park Loop Road.
3.g	Complete DFIRM mapping of Teton County	High	Less than $500	P, PP, S	FEMA NFIP Coordinator; WOHS Coordinator; TC Engineer; TOJ Public Works Director	Completed.
3.h	Implement measures to prevent frazile ice build-up	Med	$5000 - $25000	PP, NRP	WOHS Coordinator; FEMA NFIP Coordinator; TOJ Engineer; TC Engineer	Accomplished and ongoing. Change to supporting work of Flat Creek Water Improvement District and roll into 2015 plan.
3.i	Rehabilitate the Flat Creek drainage.	Med	$25000+	P, PR, NRP, S	FEMA NFIP Coordinator; WOHS Coordinator; TOJ Engineer; TC Engineer	Karns Meadow storm water mitigation project (habitat and sediment work) accomplished.
3.j	Complete North Cache storm water upgrade.	High	$25000+	PR, S	FEMA NFIP Coordinator; WOHS Coordinator; TOJ Engineer	Completed. Delete.

#	Description	Priority	Cost	Type	Responsible agency for implementation, coord.	Status of Project in 2015
3.k	Extend Taylor #3 levee 600' downstream	Med	$25000+	P, PP, NRP	FEMA NFIP Coordinator; USACE Engineer; BLM Engineer; WOHS Coordinator; TC Road and Levee Foreman	Completed.
3.l	Complete the Town of Jackson's hazard tree reduction program	Med	$5000 - $25000	P, PP, S	TC Parks and Rec Director; TOJ Public Works Director	Accomplished and ongoing through Parks and Recreation Department.
3.m	Conduct fire hazard mitigation education	Med	Less than $5000	P, PR, PP, EA	Jackson Hole Fire/EMS Chief	Accomplished and ongoing. Town/County fire has put on workshops.
3.n	Fire fuel reduction; removal of high-risk (diseased and infested) trees	High	$25000+	P, PP	Interagency Wildfire Working Group Fire Management Officers; Jackson Hole Fire/EMS Chief	Accomplished and ongoing. Teton County CD active in this. Roll over into 2015 plan.
3.o	Develop a Community Rating Plan	Med	$5000 - $25000	P, PP, S, NRP	TCEM Coordinator, TOJ Floodplain Administrator, FEMA NFIP Coordinator	Not accomplished. Duplicate project. Delete.
3.p	Quantify assets located in high hazard wildlife urban interface	Med	$5000-$25000	P, PP, NRP	Jackson Fire/EMS Chief, Forest Service and National Park FMOs	Addressed in 2014 CWPP and 2015 HIRA will address.
3.q	Taylor Creek Flood Mitigation	High	$25000+	P, PP, NRP, S	County Road and Levee, BLM	Delete.

2009 GOAL FOUR: Reduce vulnerability to technological disasters.

#	Description	Priority	Cost	Type	Responsible agency for implementation coordination	Status of Project in 2015
4.a	Conduct a commodity flow study to determine the amount and type of hazardous materials moving through the county	Med	$5000 - $25000	PR	TCEM Coordinator; Jackson Hole Fire/EMS Chief; TC LEPC members	Not accomplished. State Emergency Response Commission has undertaken this for the state. May not get to Teton County for some time. Roll over into 2015 plan with Low Priority.
4.b	Review and upgrade security access to critical facilities	Med	$25000+	PR, S	JPD Chief; TC Sheriff	Completed.
4.d	Review and upgrade security at critical infrastructure	Med	$25000+	PR, S	JPD Chief; TC Sheriff; WOHS Coordinator	Not accomplished. Too general. Identify specific critical infrastructure and initiate this. Roll over into 2015 plan.
4.e	Provide technological hazard awareness education	High	$5000 - $25000	P, EA	TCEM Coordinator	Not accomplished. Delete.
4.e	Identify mental health resources available locally	Med	Less than $5000	PR, C	TC Public Health Administrator, ARC Director, Jackson Hole Community Counseling Center Director	Completed.

APPENDIX C: Resolutions of Adoption

County [illegible]

JOINT RESOLUTION OF THE COUNTY OF TETON, WYOMING; CITY OF JACKSON, WYOMING; AND THE TETON CONSERVATION DISTRICT ADOPTING THE TETON COUNTY MULTI HAZARD MITIGATION PLAN

Whereas, Teton County, Wyoming, a duly organized county of the State of Wyoming; the City of Jackson , Wyoming, a Wyoming Municipality; and the Teton Conservation District, a Wyoming Conservation District; are seeking FEMA approval of the Teton County Multi-Hazard Mitigation Plan which recognizes the threat that natural hazards pose to people and property within our county; and

Whereas, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

Whereas, the U.S. Congress passed the Disaster Mitigation Act of 2000 ("Disaster Mitigation Act") emphasizing the need for pre-disaster mitigation of potential hazards;

Whereas, the Disaster Mitigation Act made available hazard mitigation grants to state and local governments;

Whereas, an adopted Multi-Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

Whereas, Teton County, Wyoming; the City of Jackson, Wyoming; and the Teton Conservation District have all fully participated in the FEMA-prescribed mitigation planning process to prepare this Multi-Hazard Mitigation Plan; and

Whereas, the Wyoming Office of Homeland Security and the Federal Emergency Management Agency Region VIII officials have reviewed the Teton County Multi-Hazard Mitigation Plan, and approved it contingent upon this official adoption of the participating governing bodies;

Whereas, Teton County, Wyoming; the City of Jackson, Wyoming; and the Teton Conservation District desire to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Teton County Multi-Hazard Mitigation Plan.

Whereas, adoption by the governing bodies of Teton County, Wyoming; the City of Jackson; and the Teton Conservation District demonstrates all three jurisdictions' commitment to fulfilling the mitigation goals and objectives outlined in this Multi-Hazard Mitigation Plan.

Whereas, this adoption legitimacies the plan and authorizes responsible agencies to carry out their responsibilities under the plan.

Now, therefore, be it resolved, that the **Teton County Board of County Commissioners, Jackson City Council, and Teton Conservation District Board** adopts the Teton County Multi-Hazard Mitigation Plan.

IN WITNESS WHEREOF, the parties hereto have executed this resolution of adoption as of the last written date below.

TETON COUNTY, WYOMING

Date: 2-16-2016

Barbara Allen, Chair
Teton County Board of County Commissioners

Attest by:

Sherry L. Daigle, Teton County Clerk

JACKSON, WYOMING

Date: 2/16/16

Sara Hilmer, Mayor

Attest by:

Olivia Goodale, Jackson Town Clerk

TETON CONSERVATION DISTRICT
Jackson, Wyoming

Date: 2-17-16

Dave Adams, Chair

Attest by:

Board Secretary

Appendix D. Catalog of Seismic Activity

1900s Earthquakes:

The first earthquake that was reported in Teton County occurred on October 6, 1906, approximately 2.5 miles northwest of Jackson (U.S.G.S. National Earthquake Information Center). No damage was reported from this intensity IV event.

1920s Earthquakes:

On March 24, 1923, an intensity V earthquake occurred approximately 13 miles northeast of Jackson. This earthquake was felt as far south as the Green River Basin. The Jackson Hole Courier (March 29, 1923) reported that several shocks were felt, with the largest rocking buildings all over the county. The paper reported that "Rocks weighing tons were shaken loose along the Tetons and in the hills about Grovont, and rolled into the valley. Many of the snow slides which run about this time of year or a little later were started on their way by the Quake". A local resident reported that it felt like his home had been lifted up and shaken violently, and set down with a thump. No significant damage was reported.

On June 23, 1925, the lower Gros Ventre landslide north of Jackson activated, damming the Gros Ventre River. Nearby seismic activity on June 21 was reported by the Jackson Hole Courier (June 25, 1925) as being "quite severe." Voight (1978) described a report of local seismic activity on June 22, 1925, the night before the Gros Ventre River was dammed by the landslide. An intensity IV earthquake was also reported near Jackson on September 3, 1925. Most town residents felt the earthquake, which was centered approximately 3 miles northwest of Jackson. Objects were rattled, but no damage occurred (Blackwelder, 1926).

On March 31, 1928, an intensity IV earthquake occurred approximately 18 miles north of Jackson. Reports indicated that many residents in the area felt a trembling sensation. This was the strongest earthquake to date along the Gros Ventre River above Kelly. The earthquake was not felt at Moran (Heck and Bodle, 1930).

1930s Earthquakes:

Several earthquakes were recorded in Teton County in the 1930s. An intensity VI earthquake occurred on March 26, 1932, approximately 4 miles northeast of Jackson. The earthquake cracked plaster walls and foundations in several Jackson homes and businesses. The main shock was preceded by a few events along the Upper Gros Ventre River, and was followed by a number of intensity III and IV aftershocks. Because the event occurred at night, several residents ran from their homes without grabbing any clothing, and a few were thrown from their beds. The earthquakes were felt in Jackson, Kelly, Grovont, Wilson, Teton Pass, and the Snake River Canyon, but were not felt at Moran (Jackson Hole Courier, January 28, 1932).

On January 14, 1936, and intensity VI, magnitude 5.0 (estimated) earthquake occurred approximately 19 miles southwest of the south entrance to Yellowstone National Park. The earthquake, which was not felt in Jackson, cracked two brick chimneys and moved small objects. Residents of Moran reported beds rocking (Neumann, 1938).

In 1939, two earthquakes occurred approximately 3 miles northwest of Jackson. The first, an intensity III event, took place on October 22, 1939. The second, an intensity IV event, occurred on November 2, 1939. Neither caused damage.

1940s Earthquakes:

Four earthquakes occurred in the county in the 1940s. Two intensity III earthquakes were detected on October 22, 1940 and on November 2, 1940 (U.S.G.S. National Earthquake Information Center). Both were located approximately 3 miles northwest of Jackson, but neither caused damage.

The next earthquake in the county occurred on January 8, 1947. This intensity IV earthquake was located approximately 3.5 miles southeast of the south entrance to Yellowstone National Park. No damage was associated.

On February 23, 1948, an intensity VI, magnitude 5.0 (estimated) earthquake was recorded approximately 13 miles west of Jackson. Some residents in the area reported that their houses rocked and swayed in an east-to-west direction. People also reported that dishes and windows rattled and pictures fell from walls. Some buildings in Jackson sustained cracked and twisted logs (Jackson Hole Courier, February 26, 1948).

1950s Earthquakes:

Only one earthquake was reported in Teton County in the 1950s. An intensity IV earthquake occurred on March 15, 1953, approximately 2 miles northeast of Alta. Many area residents reported that buildings creaked and loose objects rattled. In addition, thunderous sounds were heard before and during the earthquake (Murphy and Cloud, 1955).

1960s Earthquakes:

Teton County experienced several earthquakes in the 1960s. On October 6, 1962, an intensity IV earthquake occurred approximately 11 miles north of Jackson. The event lasted a few seconds and rattled dishes and windows (Casper Tribune-Herald and Star, October 7, 1962).

On October 12, 1963, a magnitude 3.9-4.0 earthquake occurred near the south border of the county, approximately 9 miles west-southwest of Hoback Junction. No damage was reported from this event. Two earthquakes were detected in December of 1963. The first magnitude 4.0 event occurred on December 8, 1963, approximately 26 miles southeast of Moran Junction. A few days later, on December 14, 1963, a magnitude 4.1 earthquake was reported approximately 19 miles southeast of Moran Junction. Neither of the December 1963 earthquakes caused damage or was felt.

A magnitude 3.8 earthquake occurred in Teton County on February 27, 1964. This event was centered approximately 23 miles southeast of Moran Junction. Again, this earthquake caused no damage and no one felt it. On May 1, 1964, a magnitude 4.0 earthquake was recorded approximately 17.5 miles south-southeast of Moran Junction. This event was followed by another earthquake on May 7, 1964. No specific magnitude or intensity has been associated with the May 7 earthquake, which was centered approximately 16.5 miles east-southeast of Hoback Junction. On June 24, 1964, another earthquake of no specific magnitude or intensity occurred approximately 4 miles southwest of Hoback Junction. None of the May or June 1964 earthquakes caused damage or were felt.

No other earthquakes were recorded in Teton County until December 20, 1967, when an earthquake of no specific magnitude or intensity occurred approximately 6 miles southeast of Moran Junction. It was not felt and did not cause damage.

The last earthquake to occur in Teton County in the 1960s took place on November 15, 1968. This magnitude 3.9 earthquake was recorded approximately 19 miles southeast of Moran Junction. No one reported feeling the earthquake.

1970s Earthquakes:

Twenty-one earthquakes were recorded in Teton County in the 1970s. Most of the earthquakes that occurred during this decade were not felt and did not cause any damage. On November 12, 1970, a magnitude 3.9 earthquake was detected in the northern portion of the county. This event was centered approximately 14 miles southeast of the south entrance to Yellowstone National Park. No one felt this earthquake.

An earthquake of no specific magnitude or intensity occurred in the same area on June 23, 1971. Again, no one reported feeling this event.

Three more earthquakes of no specific magnitude or intensity were recorded on March 24, 25, and 29, 1973. These March 1973 events were centered approximately 17, 20, and 23 miles northeast of Moran Junction, respectively. None of these earthquakes were felt.

On September 23, 1974, an earthquake was detected by the U.S.G.S. in western Teton County. No one reported feeling this magnitude 3.0 event, although it was centered approximately 0.5 mile northeast of Alta. On October 18, 1974, a magnitude 3.6, intensity IV earthquake was recorded approximately 4 miles southeast of the south entrance to Yellowstone National Park. No damage was associated with this event. Another non-damaging earthquake occurred on December 22, 1974. This magnitude 3.3 event was located approximately 10.5 miles southeast of the south entrance to Yellowstone National Park.

Four earthquakes occurred in Teton County in 1975. The first was recorded on January 23, 1975, approximately 12.5 miles east of the Yellowstone National Park south entrance. This magnitude 2.5 event was not felt and did not cause any damage. Magnitude 3.3 earthquakes occurred in the county on June 17, 1975, and on July 17, 1975. The June 17 event was located approximately 12 miles southwest of Jackson, while the July 17 event was centered approximately 9 miles east-southeast of Moran Junction. Neither of these earthquakes was felt. The last earthquake to occur in the county in 1975 took place on August 14, 1975. The epicenter of this non-damaging, magnitude 3.0 earthquake was approximately 11.5 miles east-southeast of Moran Junction.

In March of 1976, a series of earthquakes occurred in southern Teton County. The University of Utah Seismograph Stations detected a magnitude 2.0 earthquake on March 11, 1976. No one reported feeling this earthquake that was centered approximately 12.5 miles west-northwest of Hoback Junction. On March 14, 1976, a magnitude 3.7 earthquake was recorded approximately 5 miles south-southeast of Hoback Junction. This event was followed by a magnitude 3.9 earthquake on March 17, 1976. This earthquake was centered approximately 6 miles south-southeast of Hoback Junction. On March 21, 1976, a magnitude 2.9 earthquake and a magnitude 2.8 earthquake occurred approximately 5 miles southeast of Hoback Junction. These events were followed by a magnitude 2.7 earthquake on March 27, 1976. This earthquake was centered approximately 10 miles east-southeast of the south entrance to Yellowstone National Park. No one reported feeling any of the March 1976 earthquakes, and no damage was associated with them. A magnitude 3.1 earthquake was detected in Teton County on May 8, 1976, approximately 17.5 miles east of Kelly. Again, no one reported feeling this earthquake.

On July 22, 1977, a magnitude 3.0 earthquake occurred approximately 16 miles east-northeast of Jackson. No one reported feeling this earthquake.

Teton County did not experience another earthquake until March 10, 1978. On this date, a magnitude 3.2 earthquake occurred approximately 17 miles east-southeast of Moran Junction. No one reported feeling this event.

On July 3, 1979, a magnitude 3.2, intensity IV earthquake occurred approximately 5 miles southeast of Jackson. Jackson residents reported that dishes rattled and that pictures on walls moved. Horses at the Teton County Fairgrounds were also noticeably disturbed (Casper Star-Tribune, July 4, 1979).

1980s Earthquakes:

A number of earthquakes occurred in Teton County in the 1980s, but few caused any significant damage. The first earthquake in this decade was recorded on January 5, 1980. This non-damaging, magnitude 2.8 event was centered in the east-central portion of the county, approximately 22 miles east of Moran Junction. On May 31, 1980, a magnitude 2.5 earthquake occurred approximately 10.5 miles southeast of the south entrance to Yellowstone National Park. No one reported feeling this event.

The first earthquake that was felt in the 1980s occurred on May 6, 1981. The epicenter of the magnitude 3.7, intensity IV earthquake was located approximately 7 miles southeast of Jackson. A local disc jockey reported that “window frames changed position briefly, and the turntable and the seat of my pants came up and down at the same time”. A local secretary said her desk moved during the event (Casper Star-Tribune, May 7, 1981). A magnitude 3.0 earthquake occurred a few days later on May 12, 1981, centered approximately 10 miles southeast of Moran Junction, but no one reported feeling it.

On November 2, 1983, a magnitude 3.5, intensity IV earthquake was recorded approximately 10 miles west-southwest of Jackson. Although the event was felt, no damage occurred. Another non-damaging earthquake occurred a week later on November 9, 1983. This magnitude 3.6, intensity III earthquake was centered approximately 17.5 miles east-southeast of Moran Junction. The U.S.G.S. National Earthquake Information Center reported that this event was felt. The next earthquake to occur in Teton County took place on December 20, 1983, approximately 10 miles south of Jackson. This magnitude 4.5, intensity IV earthquake was felt from Jackson to the Palisades Reservoir in Idaho. In Jackson, there were reports of Christmas trees falling over and dishes breaking (Laramie Daily Boomerang, December 21, 1983). A number of aftershocks followed the December 20, 1983 event. The largest aftershock was a magnitude 3.4 earthquake that occurred on December 22, 1983.

On January 5, 1984, a magnitude 3.0 aftershock occurred in the same area. A magnitude 2.6 earthquake was detected on January 17, 1984, approximately 11 miles east of the south entrance to Yellowstone National Park. No one reported feeling this event. A magnitude 2.8 earthquake was detected on March 23, 1984, approximately 3 miles northwest of Hoback Junction. Area residents reported feeling it as an intensity II event. An earthquake was detected on November 2, 1984, approximately 6 miles northwest of Jackson. People did report feeling the earthquake, which was a magnitude 3.1, intensity III event.

On May 25, 1985, a magnitude 2.6-2.8 earthquake was recorded approximately 4 miles northwest of Moran Junction. This event was not felt.

Beginning in June of 1986, the U.S. Bureau of Reclamation began operation of the Jackson Hole Seismic Network. Hundreds to thousands of earthquakes have been detected since 1986. Only

the earthquakes that were jointly detected by the U.S. Geological Survey and the University of Utah Seismograph Stations are described in detail in this report. A yearly summary of the number of earthquakes detected by the U.S. Bureau of Reclamation will be noted.

In 1986, no earthquakes of magnitude 3.0 or greater were recorded in Teton County. The U.S. Bureau of Reclamation did detect approximately 14 additional earthquakes ranging in magnitude between 2.0 and 2.8 in or in the near vicinity of Teton County.

On February 20, 1987, two earthquakes occurred in Teton County, approximately 11 miles southeast of Moran Junction. No damage was reported from these magnitude 3.1 and 3.2 events (U.S. Bureau of Reclamation). Another magnitude 3.1 earthquake was recorded by the U.S. Bureau of Reclamation on June 4, 1987. It was centered approximately 9 miles southwest of the south entrance to Yellowstone National Park. No one reported any damage from this earthquake. The U.S. Bureau of Reclamation detected approximately 396 additional earthquakes ranging in magnitude from 0.2 to 2.8 in or in the near vicinity of Teton County in 1987.

Teton County did not experience another earthquake until August 24, 1988, when two earthquakes occurred approximately 3.5 miles northeast of Jackson. Area residents reported feeling the first earthquake, which was a magnitude 2.8 event, but no one reported feeling the second, magnitude 2.4 earthquake. The U.S.G.S. National Earthquake Information Center detected two earthquakes in southern Teton County on October 21, 1988. The first, a magnitude 3.6 earthquake, was centered approximately 16.5 miles east-southeast of Hoback Junction. The second earthquake was a magnitude 3.5 event, located approximately 19 miles east-northeast of Hoback Junction. Neither earthquake was felt. A magnitude 3.6 earthquake on December 4, 1988, was centered approximately 22 miles east of Jackson. No one felt this earthquake. In 1988, the U.S. Bureau of Reclamation detected approximately 41 additional earthquakes ranging in magnitude between 2.0 and 2.9 in or in the near vicinity of Teton County.

On May 12, 1989, a magnitude 2.6 earthquake occurred approximately 1.5 miles east-northeast of Jackson. No one reported feeling this earthquake. It was followed closely by a magnitude 3.1 earthquake approximately 5 miles southeast of Jackson. The U.S.G.S. National Earthquake Information Center reported that the earthquake was felt as an intensity III event in Jackson, but no damage occurred. On June 24, 1989, two earthquakes were felt strongly at Jackson. They both were centered approximately 2 miles north of Jackson. The first earthquake, which occurred at 3:25 a.m., had a magnitude of 3.8. The second earthquake, which occurred one hour later, had a magnitude of 3.7. People reported windows rattling, but no damage was associated with these earthquakes (Casper Star-Tribune, June 25, 1989). Two more earthquakes were detected by the U.S.G.S. National Earthquake Information Center later that same day. Both were magnitude 3.0, but neither was felt. On July 26, 1989, the U.S. Bureau of Reclamation recorded a magnitude 3.1 earthquake approximately 22 miles southeast of Kelly. No damage was reported from this event. In 1989, the U.S. Bureau of Reclamation detected approximately 49 additional earthquakes ranging in magnitude between 2.0 and 2.9 in or in the near vicinity of Teton County.

1990s Earthquakes:

The first earthquake to be detected in Teton County in the 1990s occurred on March 4, 1990. This magnitude 4.1 earthquake was centered approximately 6 miles south of Jackson. Jackson area residents felt the earthquake as an intensity IV event, but no damage was reported (Casper Star-Tribune, March 6, 1990). On March 14, 1990, a magnitude 3.4 earthquake was detected by the U.S. Bureau of Reclamation near the Teton County-Sublette County border. No damage was

reported from this event that was centered approximately 10 miles southeast of Hoback Junction. Two earthquakes occurred in the county in October of 1990. The first took place on October 2, 1990, when a magnitude 3.6 earthquake was recorded approximately 16 miles east-northeast of Jackson. The second event was a magnitude 3.0 earthquake that occurred on October 26, 1990. Its epicenter was located approximately 17 miles east-southeast of Moran Junction. No one reported feeling either of these October 1990 earthquakes. In 1990, the U.S. Bureau of Reclamation detected approximately 17 additional earthquakes ranging in magnitude between 2.0 and 2.5 in or in the near vicinity of Teton County.

On August 14, 1991, a magnitude 3.0 earthquake was recorded approximately 4.5 miles northeast of Hoback Junction. This earthquake was not felt. A magnitude 3.2 earthquake that occurred on September 29, 1991, approximately 26 miles east of Jackson, was also not felt. The U.S. Bureau of Reclamation recorded a magnitude 3.1 earthquake in Teton County on December 19, 1991. No damage was reported from this event, which was located approximately 9 miles southeast of Kelly. In 1991, the U.S. Bureau of Reclamation detected approximately 41 additional earthquakes ranging in magnitude between 2.0 and 2.7 in or in the near vicinity of Teton County.

The area near Mount Leidy experienced a magnitude 3.7 earthquake on September 24, 1992. No one felt this earthquake that was located approximately 25 miles northeast of Jackson. In 1992, the U.S. Bureau of Reclamation detected approximately 35 additional earthquakes ranging in magnitude between 2.0 and 2.9 in or in the near vicinity of Teton County.

The first earthquake to occur in Teton County in 1993 took place on February 27, 1993. The epicenter of this magnitude 3.0 earthquake was located approximately 5 miles northeast of Hoback Junction (U.S. Bureau of Reclamation). No damage was associated with this earthquake. On April 1, 1993, a magnitude 3.1 event was centered approximately 21.5 miles southeast of Moran Junction. No one felt this earthquake. The U.S. Bureau of Reclamation recorded a magnitude 3.0 earthquake on May 15, 1993, in western Teton County, approximately 4 miles south-southeast of Alta. No damage occurred from this event. On November 26, 1993, a magnitude 3.8 earthquake occurred approximately 29 miles east-northeast of Jackson. Again, this event was not felt. A magnitude 4.7 earthquake, intensity V earthquake occurred on December 28, 1993, approximately 34 miles east of Jackson. The earthquake was felt in Jackson, Dubois, Hudson, Lander, and Rock Springs. Most reports indicated that the earthquake felt like a heavy truck passing by. A ranch near the epicenter reported swinging lights, but no damage. In 1993, the U.S. Bureau of Reclamation detected approximately 44 additional earthquakes ranging in magnitude between 2.0 and 2.8 in or in the near vicinity of Teton County.

On February 3, 1994, a magnitude 2.7 and magnitude 2.6 earthquakes were detected in southwestern Teton County, approximately 15 miles southwest of Jackson. No one reported feeling these earthquakes. The U.S.G.S. National Earthquake Information Center detected a magnitude 2.9 earthquake on July 31, 1994, approximately 6 miles south of the south entrance to Yellowstone National Park. According to the U.S.G.S., people did report feeling the earthquake as an intensity III event. Four other earthquakes occurred in the county in 1994, but none were felt and no damage was reported. These include a magnitude 3.0 earthquake on May 19, 1994, that was located approximately 10 miles southeast of Moran Junction, a magnitude 3.0 earthquake on September 7, 1994, that was centered approximately 20 miles southeast of Moran Junction and magnitude 2.2 and 3.1 earthquakes on December 4, 1994, approximately 5 miles southwest of the south entrance to Yellowstone National Park. In 1994, the U.S. Bureau of Reclamation detected approximately 82 additional earthquakes ranging in magnitude between 2.0 and 2.9 in or in the near vicinity of Teton County.

On January 27, 1995, an earthquake was recorded approximately 20 miles east-northeast of Jackson. No one reported feeling this magnitude 3.5 event. On August 27, 1995, three earthquakes occurred in the vicinity of Joy Park and Enos Lake in northeastern Teton County. The first event had a magnitude of 4.5, and was felt at Flagg Ranch, south of Yellowstone National Park, as well as at Fishing Bridge and Grant Village within the Park. At Flagg Ranch, there were reports of buildings vibrating and dishes rattling. At Grant Village, the event was felt for 10-15 seconds, and a few items fell off the shelves at the Hamilton Store. The magnitude 4.5 earthquake was quickly followed by a magnitude 2.6 earthquake that caused no damage. Within two hours, another non-damaging, magnitude 3.8 earthquake also occurred. In 1995, the U.S. Bureau of Reclamation detected approximately 64 additional earthquakes ranging in magnitude between 2.0 and 2.9 in or in the near vicinity of Teton County.

On January 29, 1996, a magnitude 3.2-3.7 earthquake occurred in the vicinity of Lower Slide Lake, approximately 16 miles northeast of Jackson. No damage was associated with the earthquake. As mentioned previously, there were reports of seismic activity in the same area in 1925. On May 10, 1996, a magnitude 3.1 earthquake occurred approximately 3 miles southeast of Jackson (U.S. Bureau of Reclamation). No damage was associated with this earthquake. A magnitude 3.7 earthquake was recorded on June 22, 1996, approximately 29 miles southeast of Moran Junction. No one felt this event. On July 5, 1996, a magnitude 3.1 earthquake occurred approximately 23 miles east-northeast of Jackson. A magnitude 3.2 earthquake was also detected 12 miles east-northeast of Jackson on July 5, 1996. Again, no one felt these earthquakes. The U.S. Bureau of Reclamation recorded a magnitude 3.0 earthquake on September 23, 1996. No damage was reported from this event, which was centered approximately 25 miles southeast of Kelly. In 1996, the U.S. Bureau of Reclamation detected approximately 65 additional earthquakes ranging in magnitude between 2.0 and 2.8 in or in the near vicinity of Teton County.

The largest earthquake to occur in Teton County in 1997 took place on September 13, 1997. This magnitude 2.8 event was centered approximately 5 miles east-southeast of Jackson, but no one reported feeling it. In 1997, the U.S. Bureau of Reclamation detected approximately 46 additional earthquakes ranging in magnitude between 2.0 and 2.5 in or in the near vicinity of Teton County.

A series of earthquakes occurred in the county during the spring of 1998. On June 14, 1998, a swarm of earthquakes with magnitudes greater than 2.0 began to occur approximately 3.5 miles southeast of Hoback Junction near Camp Davis. Approximately 14 earthquakes with magnitudes ranging from 2.0 to 3.3 preceded a magnitude 4.7 earthquake that occurred in this area on June 20, 1998. No damage was reported from the magnitude 4.7 event, but it was distinctly felt at Hoback Junction and was felt by many residents of Jackson. Through June 22, 1998, approximately 14 aftershocks with magnitudes greater than 2.0 occurred in the area. On July 11, 1998, a magnitude 3.0 earthquake was detected approximately 6.5 miles east of Jenny Lake. Again, this event was not felt. Two earthquakes occurred on August 23, 1998, approximately 5 miles north-northeast of Alta. No one felt the first earthquake, which was a magnitude 3.2 event. People in this area did, however, feel the magnitude 4.2 earthquake that quickly followed. This same area experienced several more earthquakes in 1998, including magnitude 3.8 earthquakes on August 26, 1998 and September 17, 1998; a magnitude 3.3 earthquake on September 26, 1998; and magnitude 3.2 events on October 18, 1998 and November 1, 1998. None of these earthquakes were felt and no damage was associated with any of them. In 1998, the U.S. Bureau of Reclamation detected approximately 123 additional earthquakes ranging in magnitude between 2.0 and 2.9 in or in the near vicinity of Teton County.

On January 15, 1999, a magnitude 3.4 earthquake was recorded approximately 3 miles northeast of Alta. A few days later, on January 20, 1999, a magnitude 3.2 earthquake occurred in the same area. No one reported feeling either of these earthquakes. Another earthquake occurred in the Alta area on April 10, 1999. Area residents did report feeling this magnitude 3.8 event. Three more earthquakes were recorded in Teton County in 1999, but none of them were felt and no damage was reported from any of them. On April 19, 1999, a magnitude 2.8 earthquake occurred approximately 3 miles southeast of Hoback Junction. A magnitude 3.6 event was detected on June 29, 1999, approximately 4 miles northeast of Alta. The last earthquake to occur in the county in 1999 took place on November 16, 1999. This magnitude 3.1 event was centered approximately 19 miles east-northeast of Hoback Junction. In 1999, the U.S. Bureau of Reclamation detected approximately 75 additional earthquakes ranging in magnitude between 2.0 and 2.9 in or in the near vicinity of Teton County.

2000s Earthquakes:

Five earthquakes occurred in Teton County in 2000. On February 3, 2000, a magnitude 3.0 earthquake was detected approximately 18 miles east-northeast of Moran Junction. No one reported feeling this event. Another magnitude 3.0 earthquake occurred on April 9, 2000. Area residents did report feeling this earthquake, which was centered approximately 6 miles west-southwest of Jackson. On April 20, 2000, a magnitude 2.7 earthquake and a magnitude 2.3 earthquake were detected in far southern Teton County. No one reported feeling these earthquakes, which were centered approximately 6 miles south-southeast of Hoback Junction. A magnitude 3.9 earthquake occurred on October 3, 2000, approximately 18 miles southeast of Moran Junction. No one felt this event. In 2000, the U.S. Bureau of Reclamation detected approximately 30 additional earthquakes ranging in magnitude between 2.0 and 2.6 in or in the near vicinity of Teton County.

Several earthquakes occurred in Teton County in 2001. On February 3, 2001, a magnitude 2.5 earthquake was detected approximately 8 miles southeast of the south entrance to Yellowstone National Park. No one felt the earthquake. The U.S. Bureau of Reclamation recorded a magnitude 3.1 earthquake on February 19, 2001, in the southeastern portion of the county. No damage resulted from this event, which was centered approximately 30 miles southeast of Kelly. A magnitude 3.3 earthquake occurred approximately 5 miles southwest of Hoback Junction on June 14, 2001. No damage was reported. The U.S. Bureau of Reclamation detected another earthquake on August 22, 2001, approximately 20.5 miles east of Jackson. No damage was associated with this magnitude 3.1 event. On September 27, 2001, an earthquake was recorded near the Fremont County-Teton County-Sublette County borders, approximately 36 miles east of Jackson. Area residents reported feeling this magnitude 4.3 event. On November 15, 2001, a magnitude 2.9 earthquake and a magnitude 2.8 earthquake were recorded approximately 11 miles south of Moran Junction. Neither event was felt. In 2001, the U.S. Bureau of Reclamation detected approximately 69 additional earthquakes ranging in magnitude between 2.0 and 2.9 in or in the near vicinity of Teton County.

Several earthquakes were also recorded in Teton County in 2002. An increase in seismic activity was noted in the Kelly, Wyoming area in 2002. From January 1, 2002 to April 15, 2002, 31 small earthquakes occurred approximately 1.5-3 miles south of Kelly. These events can be classified as a small swarm. Earthquake swarms are common in northwestern and western Wyoming. Most have not been precursors to larger events. On January 2, 2002, a magnitude 3.1 earthquake occurred approximately 26 miles east of Jackson. No one reported feeling this event. On January 29, 2002, an earthquake was detected approximately 11 miles northeast of Jackson. According to the U.S.G.S. National Earthquake Information Center, residents in this area did report feeling this magnitude 3.7 earthquake. A magnitude 2.9 earthquake occurred 11 miles northeast of

Jackson on March 5, 2002. This event was not felt. A magnitude 2.8 earthquake occurred in eastern Teton County on April 24, 2002. No one reported feeling this earthquake, which was centered approximately 14.5 miles east-northeast of Moran Junction. The U.S. Bureau of Reclamation recorded a magnitude 3.1 earthquake in Teton County on May 12, 2002. No damage resulted from this earthquake, which was centered approximately 4 miles southeast of Kelly. On June 30, 2002, the U.S. Bureau of Reclamation recorded a magnitude 3.0 earthquake approximately 13.5 miles east-northeast of Jackson. No damage was reported. Another magnitude 3.1 earthquake was detected by the U.S. Bureau of Reclamation on July 25, 2002. No damage was associated with this event, which was centered approximately 3 miles southeast of Kelly. On November 8 and 9, 2002, two earthquakes occurred approximately 17.5 miles southeast of Kelly. No damage resulted from these magnitude 3.1 earthquakes. A magnitude 3.2 earthquake was recorded in northern Teton County on November 20, 2002. This non-damaging event was centered approximately 7 miles southeast of the south entrance to Yellowstone National Park. This same area experienced two more earthquakes in November 2002. The U.S. Bureau of Reclamation recorded a magnitude 3.1 earthquake on November 22, 2002, and most recently, a magnitude 3.2 earthquake on November 24, 2002. No damage was associated with any of the November 2002 earthquakes. In 2002, the U.S. Bureau of Reclamation detected approximately 156 earthquakes ranging in magnitude between 1.5 and 2.9 in or in the near vicinity of Teton County.

The mid-March 2007, minor earthquakes shook at both ends of Jackson Hole—one in the Teton Wilderness and one east of Alpine. The quakes were 2.3 and 2.9 respectively. No damages were reported in Teton County from these quakes. A swarm of 16 small earthquakes measuring up to 2.7 shook Yellowstone Park in May 2007. There were no reports of damage in Teton County from this event.

In late December 2008 and early January 2009, a swarm of small quakes occurred under Yellowstone Lake. According to the University of Utah, it was the most intense swarm (800+ earthquakes) since a 1985 swarm. The strongest quake in the recent swarm was a 3.9. No damages were reported.

2010s Earthquakes:

Roughly 40 small earthquakes shook Jackson Hole in early August 2010. At least four of the earthquakes had a magnitude greater than 3.0, including one event of at least magnitude 5.0. The 5.0 magnitude earthquake caused minor damage in the Gros Ventre area; buildings shook, objects fell off shelves and walls, and boulders rolled off mountainsides. No major damage or injuries occurred as a result of the quake. (Jackson Hole News & Guide, August 6, 2010)

Regional Historic Seismicity

Teton County is in close proximity to Yellowstone National Park, one of the most volcanically and seismically active regions in the United States. Many known active faults are exposed in the Yellowstone area and thousands of earthquakes have been recorded inside the Park boundaries since the late 1800s. The largest earthquake recorded in this region occurred on August 17, 1959. This magnitude 7.5, intensity X event occurred just outside of Yellowstone National Park, near Hebgen Lake in Montana. The event triggered a landslide that dammed the Madison River and created Earthquake Lake. Twenty-eight people lost their lives; most of them were buried in

the campground located directly beneath the landslide. Numerous aftershocks, some as large as magnitude 6.5, occurred within or near Yellowstone National Park. This earthquake is a model for what can occur along the Teton fault in Teton County. The largest earthquake that occurred inside Yellowstone National Park boundaries was on June 30, 1975. This magnitude 6.4, intensity VII event caused landslides and large cracks in the ground.

Several earthquakes have also occurred in the counties near Teton County, beginning in the 1960s. On June 25, 1963, a magnitude 4.2 earthquake occurred in western Park County, approximately 27.5 miles northeast of Moran Junction. No one felt this earthquake. A magnitude 4.3 earthquake was recorded in eastern Idaho on October 11, 1963. No one reported feeling this event, which was located approximately 18 miles southwest of Jackson. A magnitude 4.4 earthquake occurred on October 8, 1966, in northern Lincoln County. This non-damaging earthquake was centered approximately 16 miles southwest of Hoback Junction. This same area experienced a magnitude 3.7 earthquake on October 27, 1966. No one reported feeling the October 1966 earthquakes. The last earthquake to occur in the region in the 1960s took place on February 25, 1969. This non-damaging, magnitude 3.6 event was centered in eastern Idaho, approximately 6 miles north-northwest of Alta.

Four earthquakes were recorded near Teton County in the 1970s. The first occurred on September 21, 1970, in northern Lincoln County near the Elbow Campground, approximately 9 miles south-southwest of Hoback Junction. The Jackson Hole Guide (September 24, 1970) reported that residents from Jackson through the Hoback Canyon to Bondurant felt this magnitude 4.4 earthquake. Some residents from Jackson thought that the event was a sonic boom. At Camp Davis, a resident reported a figurine knocked off a television set and a “vibrating” staircase. Eleven miles south of Jackson, a resident reported rattling windows and a shaking bed. Near Bondurant, in Sublette County, a resident reported that windows rattled and her whole house shook. A magnitude 3.6 earthquake was recorded in southern Yellowstone National Park on April 24, 1974, approximately 9 miles east-northeast of the south entrance to the Park. No one reported feeling this earthquake and no damage was reported. On December 27, 1975, a magnitude 3.1 earthquake occurred in northern Lincoln County. Its epicenter was located approximately 12 miles south-southwest of Hoback Junction. No damage was reported from this earthquake.

On January 28, 1980, a magnitude 2.8 earthquake occurred in western Fremont County. No one felt this event, which was centered approximately 25 miles east of Moran Junction. Local residents did feel the earthquake that occurred on February 8, 1983. This magnitude 4.4, intensity V earthquake was located in eastern Idaho, approximately 24 miles southwest of Jackson. No damage was reported. On November 2, 1983, a magnitude 3.5 earthquake was recorded in northern Sublette County, approximately 41 miles east-northeast of Hoback Junction. This event was not felt. In August and September of 1985, four earthquakes occurred in northern Lincoln County, three of which were felt in Jackson. The first, a magnitude 4.8, intensity V event on August 21, 1985, was lightly felt in Jackson. A local business reported that “it felt like something hit the side of the building” (Casper Star-Tribune, August 22, 1985). The second earthquake, a magnitude 4.3, intensity IV event, occurred on August 22, 1985, but was not felt in Jackson. The third, a magnitude 4.3, intensity V event on August 30, 1985, was felt in Jackson, but caused no damage (Laramie Daily Boomerang, August 31, 1985). The last earthquake occurred on September 6, 1985. This magnitude 4.6, intensity V event was felt as an intensity IV earthquake in Wilson. An earthquake-induced landslide temporarily closed a portion of U.S. Highway 89 in the Snake River Canyon (Casper Star-Tribune, September 8, 1985). Two earthquakes occurred in Lincoln County on November 17, 1986, approximately 12 miles south-southwest of Hoback Junction. The first was a magnitude 3.9 event, which was felt by residents in the area. The second, a magnitude 3.7 earthquake, was not felt.

Several earthquakes occurred near Teton County in the 1990s. A magnitude 3.5 event was detected in northern Lincoln County on April 9, 1990. The earthquake, which was located approximately 13 miles south-southeast of Hoback Junction, did not cause any damage. On April 19, 1990, a magnitude 3.3 earthquake was recorded in eastern Idaho, approximately 22 miles west-southwest of Hoback Junction. Residents in the area reported feeling this earthquake as an intensity IV event. The next earthquake that caused any concern occurred on April 3, 1992. The magnitude 4.0, intensity IV earthquake was located in eastern Idaho, approximately 4 miles north-northwest of Alta. Although it was felt as an intensity III event at Moose and Wilson, it did not cause any damage (Casper Star-Tribune, April 4, 1992). On August 22, 1993, approximately 34 miles southeast of Moran Junction, a magnitude 3.1 earthquake occurred in eastern Fremont County. No one reported feeling this event. Another 3.1 earthquake was detected in northern Lincoln County on October 10, 1993. No one felt this earthquake, which was centered approximately 12 miles west-southwest of Hoback Junction. On November 7, 1996, a magnitude 3.8 earthquake was detected in eastern Lincoln County, approximately 4 miles southwest of Alta. Residents in the area reported feeling this earthquake. A magnitude 2.8 earthquake was detected in eastern Idaho on June 28, 1999. No one reported feeling this event, centered approximately 7.5 miles north-northwest of Alta.

On April 21, 2001, a magnitude 5.4 earthquake occurred in eastern Idaho, approximately 42 miles southwest of Hoback Junction. It was felt as far away as Logan, Ogden, and Salt Lake City, Utah. In Wyoming, it was felt as an intensity V earthquake at Etna, an intensity IV earthquake at Thayne, and an intensity III earthquake at Afton, Jackson, and Wilson. On October 21, 2002, a magnitude 3.2 earthquake was detected approximately 3 miles northeast of Alpine or 16.5 miles southwest of Hoback Junction (U.S. Bureau of Reclamation). This event was followed closely by a magnitude 4.4 earthquake and a magnitude 4.2 earthquake (U.S. Bureau of Reclamation) centered in approximately the same area. Residents in the area reported feeling both of these earthquakes. No damage was reported from either event. On October 23, 2002, a magnitude 3.4 earthquake was reported approximately 4.5 miles north-northeast of Alpine. No one reported feeling this most recent earthquake.

Deterministic Analysis of Regional Active Faults with a Surficial Expression

Several active fault systems are present in Teton County. The Teton fault system is a series of northeast-southwest-trending normal faults located on the eastern edge of the Teton Range near Jackson, Wyoming. While Quaternary/Holocene-aged fault scarps have been identified along the entire length of the fault (Smith et al., 1990a, Wong et al., 2000), much is still unresolved about the Teton fault system. Previous investigations have divided it into northern, central, and southern segments (Smith et al., 1990a; Susong et al., 1987). Other researchers prefer an unsegmented model of the Teton fault (Ostenaa et al., 1988, Byrd et al., 1994). In addition, questions still exist as to whether or not the Beula-Hering Lakes faults in Yellowstone National Park are a northern extension of the Teton fault (Wong et al., 2000). Based upon unsegmented surface rupture lengths (48 miles/77 km including Beula-Hering Lakes faults; 40miles/64km not including Beula-Hering Lakes faults), Wong and others (2000) estimate the Teton fault is capable of generating a magnitude 6.9 to 7.5 earthquake. This agrees with other analyses, in which a maximum credible earthquake of magnitude 7.5 and a recurrence interval of 800-3600 years were suggested for the Teton fault (Doser and Smith, 1983; Gilbert et al., 1983). A trench on the Teton fault indicated

that the fault most recently activated between 4800-7000 years ago (Smith et al., 1993). As a result, Case (1997a) suggests that the Teton fault may be overdue for a magnitude 7.5 earthquake. If a magnitude 7.5 earthquake did occur on the Teton fault, it could potentially generate peak horizontal accelerations of approximately 20%g -21%g at Alta, approximately 20%g at Hoback Junction, approximately 39%g at Jackson, approximately 80%g at Jackson Lake Dam and Jenny Lake, approximately 36%g at Kelly, approximately 62%g at Moose, approximately 23%g at Moran Junction, and greater than 80%g at Wilson (Campbell, 1987). These accelerations are roughly equivalent to intensity IX earthquakes at Jackson Lake Dam, Jenny Lake and Wilson, intensity VIII earthquakes at Jackson, Kelly, and Moose, intensity VII earthquakes at Alta, Hoback Junction, and Moran Junction. Jackson Lake Dam, Jenny Lake and Wilson could sustain heavy damage. Heavy to moderate damage could occur at Jackson, Kelly, and Moose, and moderate to heavy damage could occur at Alta, Hoback Junction, and Moran Junction.

The Baldy Mountain fault system is a series of short faults located approximately 21 miles (33 km) east of the Teton fault. Investigators at the U.S.G.S. identified areas where the faults offset Quaternary-aged glacial moraines. No maximum magnitude earthquake has been specifically postulated for the Baldy Mountain fault system. It is generally accepted that a magnitude 6.5 earthquake is required to produce ground surface rupture. While evidence of ground surface rupturing has been identified on the Baldy Mountain fault system, the ground surface rupture length is not consistent with a magnitude 6.5 event. In the interest of public safety, however, this report will model the Baldy Mountain fault system as being capable of generating a magnitude 6.5 earthquake with a recurrence interval of approximately 13,000-25,000 years (Machette et al., 2001; Pierce and Morgan, 1992). A magnitude 6.5 earthquake on this fault system could, in turn, generate peak horizontal accelerations of approximately 3.6%g at Alta, approximately 3.3%g at Hoback Junction, approximately 4.5%g at Jackson, approximately 13%g at Jackson Lake Dam, approximately 8.2%g at Jenny Lake, approximately 7.4%g at Kelly, approximately 7.0%g at Moose, approximately 20%g at Moran Junction, and approximately 3.8 %g at Wilson (Campbell, 1987). These accelerations are roughly equivalent to an intensity VII earthquake at Moran Junction, an intensity VI earthquake at Jackson Lake Dam, intensity V earthquakes at Jackson, Jenny Lake, Kelly, and Moose, and intensity IV earthquakes at Alta, Hoback Junction, and Wilson. Moderate damage could occur at Moran Junction, light damage could occur at Jackson Lake Dam, and very light damage could occur at Jackson, Jenny Lake, Kelly, and Moose. No damage should occur at Alta, Hoback Junction, or Wilson.

The last active fault system in Teton County is the Togwotee Lodge fault system. This series of faults lie in the eastern part of the county, approximately 9 miles (15 km) west of Togwotee Pass. The U.S.G.S. found evidence that Quaternary-aged glacial deposits have been offset along the fault traces, with a recurrence interval of approximately 16,000-23,000 years (Marchette et al, 2001). As with the Baldy Mountain fault system, the Togwotee Lodge faults have a shorter ground surface rupture length than would be produced by a magnitude 6.5 earthquake. The presence of any ruptured ground surface along these faults, however, suggests that they may be capable of producing at least a magnitude 6.5 earthquake. A magnitude 6.5 earthquake on the Togwotee Lodge fault system could generate peak horizontal accelerations of approximately 2.8%g at Alta and Hoback Junction, approximately 3.5%g at Jackson, approximately 8.4%g at Jackson Lake Dam, approximately 5.4%g at Jenny Lake, approximately 6.2%g at Kelly, approximately 5.2%g at Moose, approximately 10.1%g at Moran Junction, and approximately 3.1%g at Wilson (Campbell, 1987). These accelerations are roughly equivalent to an intensity VI earthquake at Moran Junction, intensity V earthquakes at Jackson Lake Dam, Jenny Lake, Kelly, and Moose, and intensity IV earthquakes at Alta, Hoback Junction, Jackson, and Wilson. Light damage could

occur at Moran Junction, and very light damage could occur at Jackson Lake Dam, Jenny Lake, Kelly, and Moose. No damage should occur at Alta, Hoback Junction, Jackson, or Wilson.

Active fault systems present in the southern portion of Yellowstone National Park may also affect Teton County. Love and Christiansen (1985) describe the Buffalo Fork fault as beginning on the western side of the South Arm of Yellowstone Lake and continuing south to Gravel Mountain in Teton National Forest. This normal fault that reactivated a reverse fault surface offsets the Quaternary Lava Creek Tuff near Channel Mountain (U.S.G.S., 1972). Based upon a maximum surface rupture length of 32 miles (51 km), a maximum credible earthquake of magnitude 7.1 has been postulated for this fault (Wong et al., 2000). No definite recurrence interval has been determined for the Buffalo Fork fault. The U.S.G.S. suggests a long recurrence interval of approximately 10,000 to 100,000 years (Marchette et al., 2001), since at least one event has occurred on the fault since the glaciers receded from the area. A magnitude 7.1 earthquake on the Buffalo Fork fault could potentially generate peak horizontal accelerations of approximately 4.7%g at Alta, approximately 3.6%g at Hoback Junction, approximately 4.8%g at Jackson, approximately 13.5%g at Jackson Lake Dam, approximately 8.4%g at Jenny Lake, approximately 7.8%g at Kelly, approximately 7.2%g at Moose, approximately 17%g at Moran Junction, and approximately 4.3%g at Wilson (Campbell, 1987). These accelerations are roughly equivalent to intensity VI earthquakes at Jackson Lake Dam and Moran Junction, intensity V earthquakes at Alta, Jackson, Jenny Lake, Kelly, Moose, and Wilson, and intensity IV earthquakes at Hoback Junction. Light damage could occur at Jackson Lake Dam and Moran Junction, and Alta, Jackson, Jenny Lake, Kelly, Moose, and Wilson could sustain very light damage. No damage should occur at Hoback Junction.

The Beula-Hering Lakes faults are present east of Hering Lake and extend south into Teton County. They may even be an extension of the Teton fault system (Case, 1997a; Love, 1961; Love et al., 1992; Wong et al., 2000). For this analysis, however, they will be considered as a separate fault system. (See the first paragraph of this section for information related to including the Beula-Hering Lakes faults as part of the Teton fault.) The Quaternary-aged Huckleberry Ridge Tuff and Lewis Canyon Rhyolite are displaced by the Beula-Hering Lakes faults. Based upon a maximum surface rupture length of 8 miles (13 km), Wong and others (2000) estimated that a maximum magnitude 6.7 earthquake could result from this fault system. A long recurrence interval is probable, as the most recent event is dated to less than 630,000 years before present (offset of the Lava Creek Tuff), but the 70,000 year old Pitchstone Plateau rhyolite flow is not disturbed by these faults (U.S.G.S., 1972; Marchette et al., 2001). A magnitude 6.7 earthquake on the Beula-Hering Lakes faults could generate peak horizontal accelerations of approximately 6%g at Alta, approximately 2.3%g at Hoback Junction, approximately 3.2%g at Jackson, approximately 11%g at Jackson Lake Dam, approximately 7.5%g at Jenny Lake, approximately 4.8%g at Kelly, approximately 5.2%g at Moose, approximately 9%g at Moran Junction, and approximately 3.3%g at Wilson (Campbell, 1987). These accelerations are roughly equivalent to an intensity VI earthquake at Jackson Lake Dam, intensity V earthquakes at Alta, Jenny Lake, Kelly, Moose, and Moran Junction, and intensity IV earthquakes at Hoback Junction, Jackson, and Wilson. Light damage could occur at Jackson Lake Dam. Alta, Jenny Lake, Kelly, Moose, and Moran Junction could sustain very light damage, but no damage should occur at Hoback Junction, Jackson, and Wilson.

The Mount Sheridan-Heart River fault system extends from the Heart Lake Geyser Basin southwest of Yellowstone Lake to near Bobcat Ridge in the Bridger-Teton National Forest. Quaternary-aged movement has been identified along these north-south-trending faults, as they offset the Huckleberry Ridge Tuff in several locations. Based upon a maximum surface rupture length of nearly 26 miles (41 km), a maximum magnitude 7.0 earthquake has been suggested for

this fault system (Wong et al., 2000). The U.S.G.S. estimated that because this fault system has a high slip rate (1-5mm/yr), the recurrence interval for the Mount Sheridan-Heart River fault is less than 5,000 years. The age of the most recent events are not known, as no dating has been done on this fault system. A magnitude 7.0 earthquake on the Mount Sheridan-Heart River fault could generate peak horizontal accelerations of approximately 6%g at Alta, approximately 3.2%g at Hoback Junction, approximately 4.4%g at Jackson, approximately 19%g at Jackson Lake Dam, approximately 10%g at Jenny Lake, approximately 7.2%g at Kelly, approximately 7.4%g at Moose, approximately 16.5%g at Moran Junction, and approximately 4.3%g at Wilson (Campbell, 1987). These accelerations are roughly equivalent to an intensity VII earthquake at Jackson Lake Dam, intensity VI earthquakes at Jenny Lake and Moran Junction, intensity V earthquakes at Alta, Jackson, Kelly, Moose, and Wilson, and an intensity IV earthquake at Hoback Junction. Jackson Lake Dam could sustain moderate damage, while Jenny Lake and Moran Junction could sustain light damage. Very light damage could occur at Alta, Jackson, Kelly, Moose, and Wilson. No damage should occur at Hoback Junction.

The Yellowstone River Valley in the southeastern portion of Yellowstone National Park is bounded by several active normal faults. These faults displace Quaternary/Holocene deposits and alluvium along their trace. Based upon a maximum surface rupture length of 14 miles (22 km), these faults could generate a maximum magnitude 6.6 earthquake (Wong et al., 2000). No specific recurrence interval has been determined for these faults. A magnitude 6.6 earthquake on these faults could in turn generate peak horizontal accelerations of approximately 2.1%g at Alta, approximately 1.9%g at Jackson, approximately 4.7%g at Jackson Lake Dam, approximately 3.1%g at Jenny Lake, approximately 2.8%g at Kelly, approximately 2.7%g at Moose, approximately 5.2%g at Moran Junction, and approximately 1.9%g at Wilson (Campbell, 1987). These accelerations are roughly equivalent to intensity V earthquakes at Jackson Lake Dam and Moran Junction, and intensity IV earthquakes at Alta, Jackson, Jenny Lake, Kelly, Moose, and Wilson. Very light damage could occur at Jackson Lake Dam and Moran Junction. Alta, Jackson, Jenny Lake, Kelly, Moose, and Wilson should sustain no damage. Hoback Junction would be subjected to ground accelerations of less than 1.5%g, which should not cause any damage.

The Yellowstone Lake fault extends from Dot Island in Yellowstone Lake south to Overlook Mountain. The U.S.G.S. (1972) found evidence that this fault has disturbed Quaternary Lava Creek Tuff and Mount Jackson Rhyolite deposits, as well as lacustrine deposits from Yellowstone Lake. Based upon a maximum surface rupture length of 17.5 miles (28 km), Wong and others (2000) estimated that a maximum magnitude 6.8 earthquake could be generated by this fault. Preliminary investigations of the Yellowstone Lake fault suggest a recurrence interval of approximately 7,000 years for the middle section of the fault (Marchette et al., 2001; Locke et al., 1992). A magnitude 6.8 earthquake could produce peak horizontal accelerations of approximately 3%g at Alta, approximately 2.2%g at Jackson, approximately 6%g at Jackson Lake Dam, approximately 3.9%g at Jenny Lake, approximately 3.2%g at Kelly, approximately 3.3%g at Moose, approximately 5.9%g at Moran, and approximately 2.2%g at Wilson (Campbell, 1987). These accelerations are roughly equivalent to intensity V earthquakes at Jackson Lake Dam, Jenny Lake and Moran Junction, and intensity IV earthquakes at Alta, Jackson, Kelly, Moose, and Wilson. Jackson Lake Dam, Jenny Lake, and Moran Junction could sustain very light damage, but no damage should occur at Alta, Jackson, Kelly, Moose, and Wilson. Hoback Junction would be subjected to ground accelerations of less than 1.5%g, which should not cause any damage.

Two active fault systems are also present near Teton County in northern Lincoln County. The Grey's River fault system is located in northern Lincoln County on the western side of the Wyoming Range. Evidence of late-Holocene movement has been identified on this north-south-trending normal fault (Jones and McCalpin, 1992; McCalpin, 1993). Based upon an estimated

surface rupture length of 54 km, the Grey's River fault system could potentially generate a magnitude 7.1 earthquake with a recurrence interval of approximately 2970 – 3400 years (Jones, 1995; Jones and McCalpin, 1992). However, because no movement occurred on the Grey's River fault system between approximately 5000 and 15,000 years before present, this recurrence interval may be variable (Jones and McCalpin, 1992). A magnitude 7.1 earthquake could generate peak horizontal accelerations of approximately 2.8%g at Alta, approximately 9.2%g at Hoback Junction, approximately 5.8%g at Jackson, approximately 2.5%g at Jackson Lake Dam, approximately 3.2%g at Jenny Lake, approximately 4.0%g at Kelly, approximately 3.8%g at Moose, approximately 2.6%g at Moran Junction, and approximately 5.4%g at Wilson (Campbell, 1987). These accelerations are roughly equivalent to an intensity V-VI earthquake at Hoback Junction, intensity V earthquakes at Jackson, Kelly, and Wilson, and intensity IV earthquakes at Alta, Jackson Lake Dam, Jenny Lake, Moose, and Moran Junction. Hoback Junction could sustain some light damage, while very light damage could occur at Jackson, Kelly, and Wilson. No damage should occur at Alta, Jackson Lake Dam, Jenny Lake, Moose, or Moran Junction.

The Star Valley fault system is the other active fault system in northern Lincoln County. This fault system, which has been subdivided into north and south segments, bounds the eastern edge of the Star Valley. Investigations of the Star Valley fault system determined that Holocene and late-Pleistocene offsets exist along the south fault segment (Piety et al., 1990; McCalpin et al., 1990; McCalpin, 1990). Several maximum magnitude earthquakes have been suggested for the Star Valley fault system. Piety and others (1986) proposed that the Star Valley fault system is capable of generating a maximum credible earthquake of magnitude 7.5 with a recurrence interval of 5,000 to 7,000 years. Based upon a surface rupture length of 27 miles, McCalpin and others (1990) determined that the Star Valley fault system could produce a maximum magnitude 7.2 earthquake. When McCalpin (1990) trenched a portion of the Star Valley fault near Afton, he determined that a magnitude 7.3 earthquake with a recurrence interval of 2550-6000 years is possible on this system. Because of the extensive seismic activity associated with the area surrounding the Star Valley fault, and because of the close proximity of towns to this fault system, a maximum magnitude of 7.5 will be used for this analysis. It should also be noted that it has been approximately 5500 years since the last confirmed event on the Star Valley fault at Afton. This fault system is therefore nearing its recurrence interval limit. A magnitude 7.5 earthquake could generate peak horizontal accelerations of approximately 7.5%g at Alta, approximately 17%g at Hoback Junction, approximately 14%g at Jackson, approximately 4.8%g at Jackson Lake Dam, approximately 6.7%g at Jenny Lake, approximately 7.8%g at Kelly, approximately 8.2%g at Moose, approximately 4.7%g at Moran Junction, and approximately 15%g at Wilson (Campbell, 1987). These accelerations are roughly equivalent to intensity VI earthquakes at Hoback Junction, Jackson, and Wilson, and intensity V earthquakes at Alta, Jackson Lake Dam, Jenny Lake, Kelly, Moose, and Moran Junction. Hoback Junction, Jackson, and Wilson could sustain light damage, but only very light damage should occur at Alta, Jackson Lake Dam, Jenny Lake, Kelly, Moose, and Moran Junction.