City of Damascus

Natural Hazards Mitigation Plan Addendum

Prepared for
City of Damascus
19920 SE Hwy 212
Damascus, OR 97089

In cooperation with

Clackamas County Emergency Management
2200 Kaen Road
Oregon City, OR 97045

Adopted by City Council on November 16, 2009

U.S. Department of Homeland Security
Region X
130 228th Street, SW
Bothell, WA 98021-9796

FEMA

December 4, 2009

Honorable Lynn Peterson,
Chair, Board of County Commissioners
2051 Kaen Road
Oregon City, Oregon 97045

Dear Chair Peterson:

On October 19, 2007, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) approved the *Clackamas County Natural Hazards Mitigation Plan Update 2007* as a multi-jurisdictional local plan as outlined in 44 CFR Part 201. With approval of this plan, the following entities are now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through October 19, 2012:

Clackamas County	**City of Canby**	**City of Damascus**
City of Estacada	**City of Milwaukie**	**City of Oregon City**
City of West Linn		

The list of approved jurisdictions has been updated to include the Cities of Damascus and Estacada, which have recently adopted the *Clackamas County Natural Hazards Mitigation Plan Update 2007*. To continue eligibility the plan must be reviewed, revised as appropriate, and resubmitted within five years of the original approval date.

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

Sincerely,

Mark Carey

Mark Carey, Director
Mitigation Division

cc: Dennis Sigrist, Oregon Emergency Management

KM:bb

CITY OF DAMASCUS
RESOLUTION NO. 09-236

RESOLUTION ADOPTING CITY OF DAMASCUS' ADDENDUM TO THE CLACKAMAS COUNTY MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN

WHEREAS, the City of Damascus is vulnerable to the human and economic costs of natural disasters, and

WHEREAS, the City Council of the City of Damascus recognizes the importance of reducing or eliminating those vulnerabilities for the overall good and welfare of the community, and

WHEREAS, the City of Damascus has participated in the development of Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan, which has established a comprehensive, coordinated planning process to eliminate or minimize these vulnerabilities, and

WHEREAS, the planning process identified natural hazards risks and a number of proposed actions and programs needed to mitigate the vulnerabilities of the City of Damascus to the impacts of future disasters, NOW THEREFORE

THE CITY COUNCIL OF THE CITY OF DAMASCUS RESOLVES AS FOLLOWS:

Section 1. The City Council of the City of Damascus hereby accepts and approves of its section of the Clackamas County Multi-Jurisdiction Hazard Mitigation Plan as a reasonable process to identify and plan for potential hazards in the City of Damascus and Clackamas County,

Section 2. City of Damascus staff are requested to pursue available funding opportunities for implementation of the actions describe therein,

Section 3. The City of Damascus will, upon funding or other necessary resources, will seek to implement the mitigation proposals identified in the plan, and

Section 4. The City of Damascus will continue to participate to update and expansion of this plan in the years ahead, and

Section 5. The City of Damascus will further seek to encourage businesses, and community groups operating within and/or for the benefit of the City of Damascus to participate in the updating and expansion of the City of Damascus Natural Hazards Mitigation Plan Addenda to the Clackamas County Multi-Jurisdictional Hazard Mitigation Plan in the years ahead.

INTRODUCED AND ADOPTED this 16th day of November, 2009.

Jim Wright, Mayor

ATTEST:

Millicent Morrison, Clerk

City of Damascus
Natural Hazards Mitigation Plan Addendum

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Overview

The City of Damascus developed this addendum to the Clackamas County Natural Hazards Mitigation Plan in an effort to increase the community's resilience to natural hazards. The addendum focuses on the natural hazards that could affect Damascus, Oregon, which include flood, landslide, wildfire, severe storms, earthquake and volcano. It is impossible to predict exactly when disasters may occur, or the extent to which they will affect the city. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to minimize the losses that can result from natural hazards.

The addendum provides a set of actions that aim to reduce the risks posed by natural hazards through education and outreach programs, the development of partnerships, and the implementation of preventative activities such as land use or watershed management programs. The actions described in the addendum are intended to be implemented through existing plans and programs within the city. The addendum is comprised of the following sections: 1) Planning Process; 2) Community Profile; 3) Risk Assessment; and 4) Action Items.

Section 1: Planning Process

1.1 How was the Addendum Developed?

In the fall of 2007, the Oregon Partnership for Disaster Resilience (OPDR / the Partnership) at the University of Oregon's Community Service Center partnered with Oregon Emergency Management, Resource Assistance for Rural Environments (RARE), Clackamas County, and cities within Clackamas County to develop a Hazard Mitigation Grant Program (HMGP) planning grant proposal. The City of Damascus joined the Partnership by signing a memorandum of understanding for this project. FEMA awarded the Partnership with a grant to support the development and update of city addenda in Clackamas County, and Damascus's local planning efforts began in January, 2009. RARE provided a staff person ('RARE Participant') to facilitate and document the city's addendum development process.

Participants in Planning Process

Representatives from the Sandy Emergency Operations Center Group (SEOC) served as steering committee members for the City of Damascus's natural hazards mitigation planning process. Committee members included:

- Chris Alfino, City of Damascus GIS Technician
- Seth Atkinson, City of Sandy Assistant City Manager
- Carnetta Boyd, Corbett Neighborhood Emergency Response Team
- Craig Brooks, Oregon Trail School District Assistant Maintenance Supervisor
- Rita Ezard, Sandy Action Center Director
- Captain Scott Howland, Sandy Fire District
- Alice Lasher, Sandy Fire Public Education and Information Officer
- Chief Gary McQueen, Sandy Fire
- Martin Montgomery, City of Sandy Public Works
- Erika Palmer, City of Damascus Associate Planner
- Laurel Reimer, Clackamas County Emergency Management
- Kathleen Reiter, Corbett Neighborhood Emergency Response Team HAM Radio
- Jim Seipel, Oregon Trail School District Director of Facilities
- Chief Harold Skelton, Sandy Police Department
- Dan Thompson, Oregon Trail School District Safety Coordinator
- Helen Turner, Estacada Fire/Citizen Corps

The Sandy Emergency Operations Center Group is a standing committee comprised of emergency first responders, CERT and NERT team members, city staff from Damascus and Sandy, and representatives from a number of citizen groups. Additionally, Damascus and Sandy share a number of common stakeholders due to their close proximity to one another. As such, natural hazards mitigation planning meetings for both Damascus and Sandy occurred in tandem via standing SOEC meetings.

Planning Process

The RARE Participant and Clackamas County Emergency Management developed and facilitated three plan development meetings with the Sandy Emergency Operations Center Group on January 16th, February 20th, and March 20th, 2009. Please see Appendix B for meeting agendas and minutes.

Introduction - January 16, 2009: the RARE Participant attended a regularly scheduled SEOC meeting to present a brief overview of the natural hazards mitigation planning process. The SEOC discussed a planning timeline, and additionally decided to serve as the steering committee for Damascus's and Sandy's planning processes.

Risk Assessment - February 20, 2009: Between January and February 2009, the RARE Participant developed the plan's Community Profile (see Section 2 below), and researched the causes and characteristics of natural hazards in Damascus, as well as past events. On February 20th, 2009 the RARE Participant facilitated the first of two plan development meetings with the SEOC. Group members identified and discussed past hazard events, vulnerable systems within the communities, and existing emergency management capabilities. Additionally, the group identified various public involvement activities to implement during the planning process, as well as continued public involvement strategies that could occur after the plan's completion. The SEOC also identified a future coordinating body for Damascus's Natural Hazards Mitigation Plan Addendum, as well as a plan convener.

March 20, 2009: Between February and March, 2009 the RARE Participant drafted the community's Risk Assessment (see Section 3 below), and developed a list of potential mitigation actions based on vulnerabilities identified at the February 20th plan development meeting. On March 20th, 2009 the RARE Participant facilitated the second of two plan development meetings with the SEOC. Group members discussed the RARE Participant's proposed mitigation actions, and developed a final list of actions. Additionally, the SEOC developed a future meeting schedule (see 1.3 Plan Implementation and Maintenance below).

Public Involvement

During the addendum development process the city posted meeting minutes on the city website to allow for public comment. Meeting minutes and drafts of the plan were sent out to members of the Natural Features Topic Specific Team (TST) who were unable to attend meetings. Once a final draft was created, the city requested that citizens provide input and/or comment on the plan's content. Clackamas County's project webpage located on the Partnership's website (www.oregonshowcase.org/plans/clackamas) hosted plan drafts during the plan development process, and the city's website provided a link to the Partnership's website. Upon completion of a final draft the city sent a press release to its email list serve and posted the press release on the city website (see press release language below). Additionally, an announcement was placed in the city newsletter, City News. The press release and newsletter announcement detailed the planning process and informed residents where they could find the final draft of the plan. Residents were asked

to review the plan and send comments to the Associate City Planner. Residents were given three weeks time to provide comments. No comments were received.

> ***City Seeks Public Comment on Natural Hazards Mitigation Plan***
>
> *A natural hazards mitigation plan provides a community with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities, and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects. To view the plan please visit the city website. Send comments to Erika Palmer via email (epalmer@ci.damascus.or.us), or by mail or phone by August 14.*

Adoption

The City of Damascus adopted the Clackamas County Natural Hazards Mitigation Plan via resolution on November 16, 2009.

1.2 Addendum Mission and Goals

The City of Damascus adopts the Clackamas County Natural Hazards Mitigation Plan's mission and goals.

Mission

The mission of the Clackamas County Natural Hazards Mitigation Plan is to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards. This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

Goals

<u>Protect Life and Property</u>

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to losses from natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

<u>Promote Public Awareness</u>

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.

- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

Enhance Natural Systems

- Balance watershed planning, natural resource management, and land use planning with natural hazard mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

Encourage Partnerships and Implementation

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

Augment Emergency Services

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, business, and industry.
- Coordinate and integrate natural hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

1.3 Plan Implementation and Maintenance

This section details the formal process that will ensure that the Damascus Addendum to the Clackamas County Natural Hazards Mitigation Plan remains an active and relevant document. The plan implementation and maintenance process includes a schedule for monitoring and evaluating the plan annually, as well as producing an updated plan every five years. Finally, this section describes how the city will integrate public participation throughout the plan maintenance and implementation process.

Implementing the Plan

After the plan is locally reviewed and deemed complete, the Damascus Associate City Planner will submit the plan to the State Hazard Mitigation Officer at Oregon Emergency Management. Oregon Emergency Management submits the plan to the Federal Emergency Management Agency (FEMA--Region X) for review. This review addresses the federal criteria outlined in the FEMA Interim Final Rule 44 CFR Part 201. Upon acceptance by FEMA, the Damascus City Council will adopt the plan via resolution. At that point the city will gain eligibility for the Pre-Disaster Mitigation Grant Program, the Hazard Mitigation Grant Program funds, and Flood Mitigation Assistance program funds.

Coordinating Body

The Damascus Natural Features Topic Specific Team (TST) is an existing body that will serve as the coordinating body for Damascus's Natural Hazards Mitigation Plan Addendum. The convener may choose, however, to initiate the development of a separate natural hazards mitigation planning committee, if needed. The TST is currently

a volunteer advisory committee that was appointed by the City Council to provide recommendations, comments, and suggestions regarding Goal 5 and Goal 7 inventory analyses. The following persons are TST members. All are Damascus residents.

- Bruce Adams
- Diana Bradshaw
- John Ferguson
- Greg Jordan
- James Lucas
- Keith Marshall

Due to scheduling conflicts, members of the TST could not attend plan development meetings. However, all meeting materials and minutes were sent to the TST for review and comment during the planning process. SEOC members will be invited to participate in future TST natural hazards meetings as well. The TST may additionally engage outside organizations and/or agencies as needed.

Roles and responsibilities of the coordinating body include:

- Serving as the local evaluation committee for funding programs such as the Pre-Disaster Mitigation Grant Program, the Hazard Mitigation Grant Program funds, and Flood Mitigation Assistance program funds;
- Prioritizing and recommending funding for natural hazard risk reduction projects;
- Encouraging stakeholders, and relevant hazard mitigation organizations and agencies to implement and/or report on implementation on the plan's identified action items;
- Evaluating and updating the Natural Hazards Mitigation Plan Addendum following a disaster;
- Evaluating and updating the Natural Hazards Mitigation Plan Addendum in accordance with the prescribed plan maintenance schedule; and
- Developing and coordinating ad hoc and/or standing subcommittees. The Natural Features TST will engage relevant organizations, agencies, and/or neighboring communities as technical advisers in hazard mitigation as needed.

Convener

The Damascus Community Development Department will serve as the plan's convener. The convener's roles and responsibilities include:

- Assigning additional stakeholders and representatives to the coordinating body as needed;
- Coordinating TST meeting dates, times, locations, agendas, and member notification;
- Documenting the outcomes of TST meetings;
- Serving as a communication conduit between the TST and the public and/or key plan stakeholders;
- Identifying emergency management-related funding sources for natural hazard mitigation projects;

- Facilitating the incorporation, maintenance, and update of the city's natural hazard risk GIS data elements;
- Utilizing the risk assessments as a tool for prioritizing proposed natural hazard risk reduction projects; and
- Facilitating and documenting the plan's five-year update.

Implementation through Existing Programs

The plan is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the city; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other city plans and programs including the Comprehensive Land Use Plan, Capital Improvements Plan, Building Codes, as well as the Clackamas County Natural Hazards Mitigation Plan, and the State of Oregon Natural Hazards Mitigation Plan. The mitigation actions described in Section 4 below are intended to be implemented through existing plans and programs within the city. Implementation opportunities are further defined in action items (see Section 4) when applicable.

Plan Maintenance

Plan maintenance is a critical component of the natural hazard mitigation plan addendum. Proper maintenance of the plan ensures that this plan will maximize the city's efforts to reduce the risks posed by natural hazards. This section includes a process to ensure that regular review and update of the plan occurs. The Natural Features Topic Specific Team and the Damascus Community Development Department will be responsible for maintaining the plan.

Semi-Annual Meetings

The Natural Features TST will meet on a semi-annual basis to complete the following tasks. During the first meeting, the committee will:

- Discuss funding opportunities for the implementation of mitigation strategies.
- Review existing action items to determine appropriateness for funding;
- Educate and train new members on the plan and mitigation in general; and
- Identify issues that may not have been identified when the plan was developed.

During the second meeting of the year, the committee will:

- Review existing and new risk assessment data, and incorporate this information into the plan;
- Document success in implementing mitigation actions and/or applying for funding;
- Discuss the addition and/or subtraction of mitigation actions from the plan;
- Discuss methods for continued public involvement;
- Document successes and lessons learned during the year; and
- Generate a list of members that should be included in future meetings.

The convener will be responsible for documenting the outcome of the semi-annual meetings. The process the TST will use to prioritize mitigation projects is detailed in

Section 4 below. The plan's format allows the city to review and update sections when new data becomes available. New data can be easily incorporated, resulting in a natural hazards mitigation plan that remains both current and relevant.

Five-Year Plan Update

Local mitigation plans must be updated and resubmitted to the Federal Emergency Management Agency (FEMA) for approval every five years in order to maintain eligibility for federal hazard mitigation assistance programs. Plan updates must demonstrate that progress has been made in the past five years for local mitigation plans to fulfill commitments outlined in the previously approved plan.

Damascus's Natural Hazards Mitigation Plan Addendum will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. Because this is an addendum to the Clackamas County Natural Hazards Mitigation Plan, the addendum must be updated in accordance with the county's five-year plan update schedule. As such, Damascus must update this addendum by September 2012 (and then again five years thereafter). Sufficient time should be allotted for plan update activities and FEMA review, meaning the city should begin the plan update process by September 2011. Additional time will be needed if the city intends to pursue application for mitigation planning grants, and/or contracting for technical or professional services.

During the five-year plan update, the city must review and revise its plan to reflect changes in development, progress in mitigation efforts, and changes in priorities. The following questions will be asked to determine what actions are necessary in updating the addendum:

- Have public involvement activities taken place since the plan was adopted?
- Are the plan goals still relevant?
- Is mitigation being implemented through existing planning mechanisms (such as comprehensive plans, or capital improvement plans)?
- Are there new hazards that should be addressed?
- Have there been hazard events in the community since the plan was adopted?
- Have new studies or previous events identified changes in any hazard's location or extent?
- Has vulnerability to any hazard changed?
- Have development patterns changed? Is there more development in hazard prone areas?
- Do future annexations include hazard prone areas?
- Did the plan identify the number and type of existing and future buildings, infrastructure, and critical facilities in hazards areas?
- Are there new high risk populations?
- Did the plan document and/or address National Flood Insurance Program repetitive loss properties?
- Is there an action dealing with continued compliance with the National Flood Insurance Program?
- Did the plan identify data limitations?
- Did the plan identify potential dollar losses for vulnerable structures?

- What is the status of each mitigation action?
- Are there completed mitigation actions that have decreased overall vulnerability?
- Are there new actions that should be added?
- Are changes to the action item prioritization, implementation, and/or administration processes needed?
- Do changes need to be made within the five year update schedule?

The convener will be responsible for organizing the Natural Features TST to address plan update needs. The TST will be responsible for updating any deficiencies found in the plan, and for ultimately meeting the Disaster Mitigation Act of 2000's plan update requirements. If needed, FEMA provides plan update guidance, tools, and training to assist communities in the plan development/update process.

Continued Public Involvement & Participation

The City of Damascus is dedicated to involving the public directly in the continual reshaping and updating of the Natural Hazards Mitigation Plan Addendum. Although members of the Natural Features TST represent the public to some extent, the extended public will additionally have the opportunity to provide feedback on future plan amendments and updates.

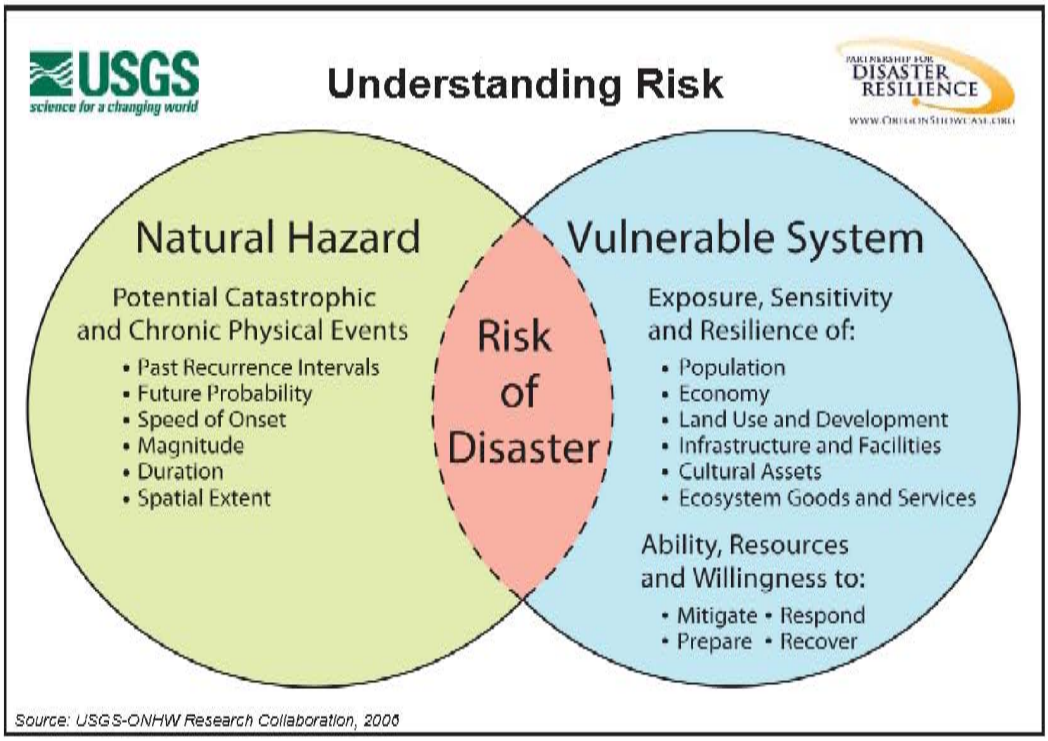
During the plan development process, public participation was incorporated into every stage of the plan development process. To ensure that these opportunities will continue, copies of the plan will be available online at the city's website, and hard copies will be available in offices around the city. A number of city service websites, such as the fire department website, will have a link to the addendum. The addendum will additionally be available for viewing during the city's open house events. Public meetings regarding plan content will be scheduled when deemed necessary, such as after a natural hazard event.

In addition to the involvement activities listed above, the city's Natural Hazards Mitigation Plan Addendum has been archived and posted on the University of Oregon Libraries' Scholar's Bank Digital Archive. Contact information is posted on all plan copies.

Section 2: Community Profile

The following section describes the City of Damascus from a number of perspectives in order to help define and understand the city's sensitivity and resilience to natural hazards. Sensitivity factors can be defined as those community assets and characteristics that may be impacted by natural hazards, (e.g., special populations, economic factors, and historic and cultural resources). Community resilience factors can be defined as the community's ability to manage risk and adapt to hazard event impacts (e.g., governmental structure, agency missions and directives, and plans, policies, and programs). The information in this section represents a snapshot in time of the current sensitivity and resilience factors in Damascus when the addendum was developed. The information documented here, along with the risk assessments located in Section 3 below, should be used as the local level rationale for the risk reduction actions identified at the end of this addendum. The identification of actions that reduce the city's sensitivity and increase its resilience assist in reducing overall risk, or the area of overlap in Figure 1 below.

Figure 1 Understanding Risk



Source: USGS - Partnership for Disaster Resilience Research Collaborative, 2006.

2.1 Community Overview

Damascus is a rural residential and agricultural community located approximately 19 miles southeast of downtown Portland. Damascus is located along Highway 212, between Highway 26 and Interstate 205.

Damascus existed as an unincorporated place within Clackamas County until the area was brought into the Portland Metro Urban Growth Boundary (UGB) in December 2002. Metro, the regional government for the Portland metropolitan area, identified 12,200 acres in the Damascus/Boring and east Happy Valley areas on the southeastern edge of the former urban growth boundary as an area for urban-level development. This area contained about 3,200 households and was partially served with fire and emergency services, and some public water. Public sewer and storm drainage lines were located in the Carver area only. The county sheriff provided police service and Clackamas County provided governance.

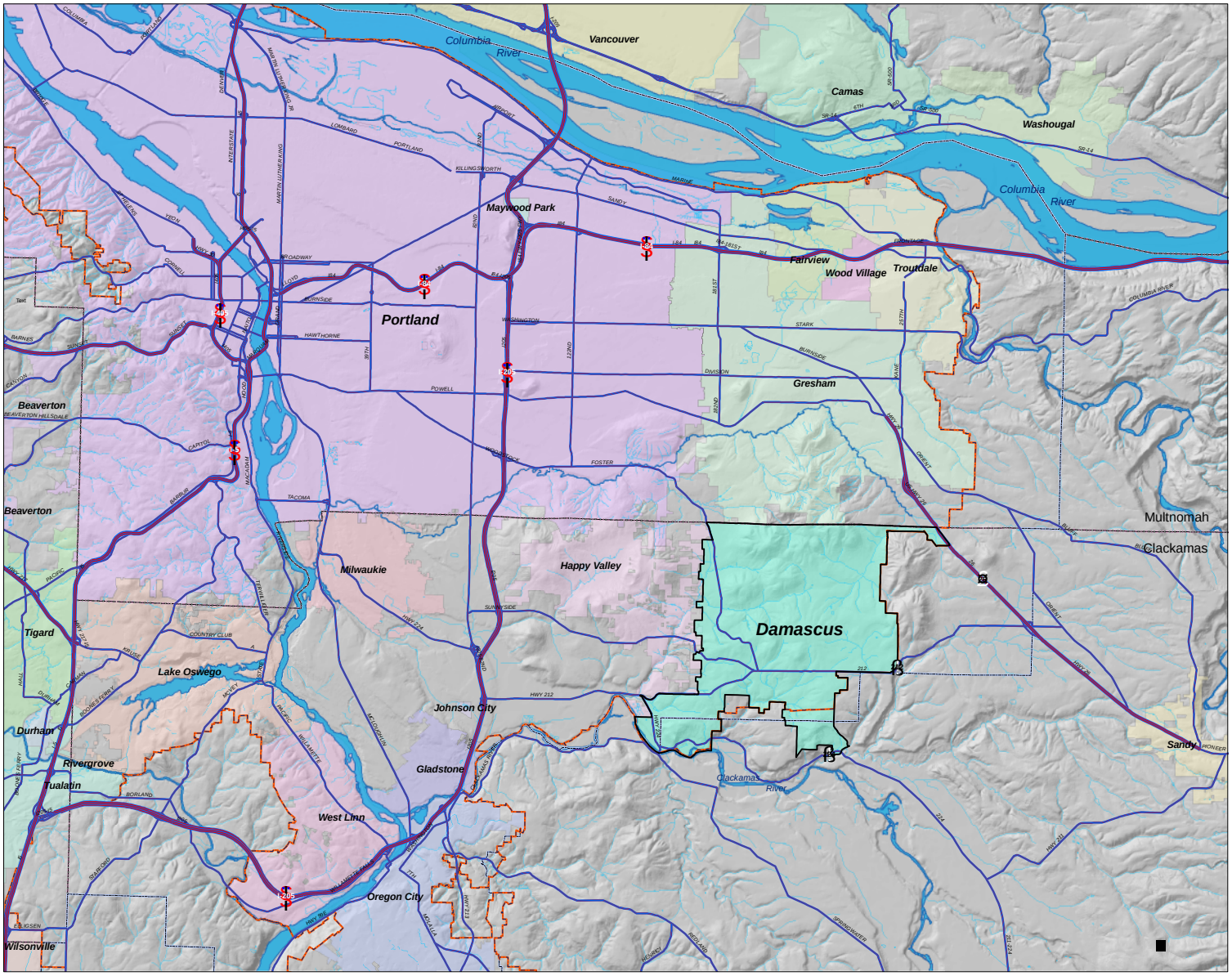
Concerns about potential annexation by adjacent cities as well as a desire to shape planning decisions in the area encouraged the people of Damascus to vote to incorporate in 2004 as the City of Damascus. The new city encompasses 10,333 acres of land (about 80% of the Damascus/ Boring and east Happy Valley area brought into the UGB).

2.2 Geography & Climate

Weather patterns generally move west to east across the region, originating in the Pacific Ocean and crossing the Coast Range and the Willamette River Valley before reaching Damascus. The region's climate is greatly tempered by the winds from the Pacific Ocean. The closest Oregon Climate Service study area is the Troutdale Station, where average annual precipitation is 44.85 inches. Daily average highs range from 46°F in January to 82.5°F in August; while average lows range from 33.9°F in January to 68.9°F in August.[i]

The City of Damascus is comprised of three basic landforms: the steeper East Buttes/ Boring Lava Domes complex and their immediate slopes, the inter-butte valleys with low to moderate gradient drainages, and the Clackamas River Valley characterized by steep valley margins and stream canyons. The Clackamas River and Johnson Creek form the city's major hydrologic basins. Draining south to the Clackamas River are the sub-basins of Deep Creek, Noyer Creek, Richardson Creek and Rock Creek. Draining north to Johnson Creek are Badger Creek, Kelley Creek and Sunshine Creek.

In 2007 Damascus inventoried the natural resources within city limits. Twenty-three wetlands were determined to be Locally Significant Wetlands (LSWs), for a total area of 146 acres or 1.4% of total land. Twenty riparian sites were identified along streams and rivers for an area of significant riparian corridors of 1,674 acres or 15% of land. Twenty-one habitat sites were identified within the city, which includes significant wetlands and riparian corridors. The total area of significant wildlife habitat is 3,338 acres or 32% of land. Natural hazard areas comprise 2,168 acres or 21% of Damascus land. The combined area of both natural resources and natural hazards is 4,013 acres or 39% of the land in Damascus.[ii]



- Major Arterials selection
- Damascus Boundary
- Freeways
- Major Arterials
- Urban Growth Boundary
- Metro Boundary
- County Line
- Rivers

Damascus Vicinity Map
2007

GIS
Source - RLIS
DCM005 - Aug 2007

0 1 2 4 Miles

2.3 Population & Demographics

Because Damascus was incorporated in 2004 after the 2000 census, population characteristics are not readily available. However, the City of Damascus Existing Conditions Report/Atlas created a rough approximation of the city boundary by using Census 2000 tracks 232.01 and 232.02 block groups 1 and 2, which include all but the easternmost edge of the city.

Damascus had an estimated population of 9,975 in 2008, a 3.15% increase from the 2006 population estimate.[iii] In 2000 Damascus had a larger share of residents between the ages of 40 and 59 (39%), compared with Clackamas County (31%) and the Portland Region (28%). Damascus is less ethnically and racially diverse than Clackamas County or the Portland region. In 2000, 95% of Damascus' residents reported being white alone, compared with 91% of Clackamas County residents and 85% of residents of the Portland region. About 2% of Damascus' residents were Hispanic in 2000, compared with 5% of Clackamas County residents and 7% of residents of the Portland area.[iv]

Residents of Damascus had higher average incomes and educational achievement than residents of Clackamas County and the Portland Region. Damascus's 1999 median income ranged from $67,070 to $72,016, higher than Clackamas County ($52,080), the Portland Region ($47,077), and the nation ($41,994). In 2005, Clackamas County continued to have a larger share of high-income populations within the state. Twenty-one percent of Clackamas County residents had incomes over $100,000 in 2005, compared to 13% of Oregon residents. A larger share of Damascus residents also had attained higher levels of education in 2000; 67% had completed some college, or received an associate's, bachelor's, or graduate degree, compared with 65% of Clackamas County residents and 63% of Oregonians.[v]

2.4 Employment & Economics

The Damascus economy has a high concentration of agriculture, forestry, fishing and hunting, construction, education, and arts, entertainment, and recreation. This concentration of sectors is different from the Portland region, where manufacturing, government, retail, and health and social assistance dominate. Agriculture and construction have especially large concentrations compared to the Portland region, but this is primarily due to the lack of agricultural uses throughout much of the Portland region.

Table 2.1 show that employment sectors with the largest numbers of employees include agriculture, forestry, fishing and hunting, construction, retail trade, and administrative and support services.

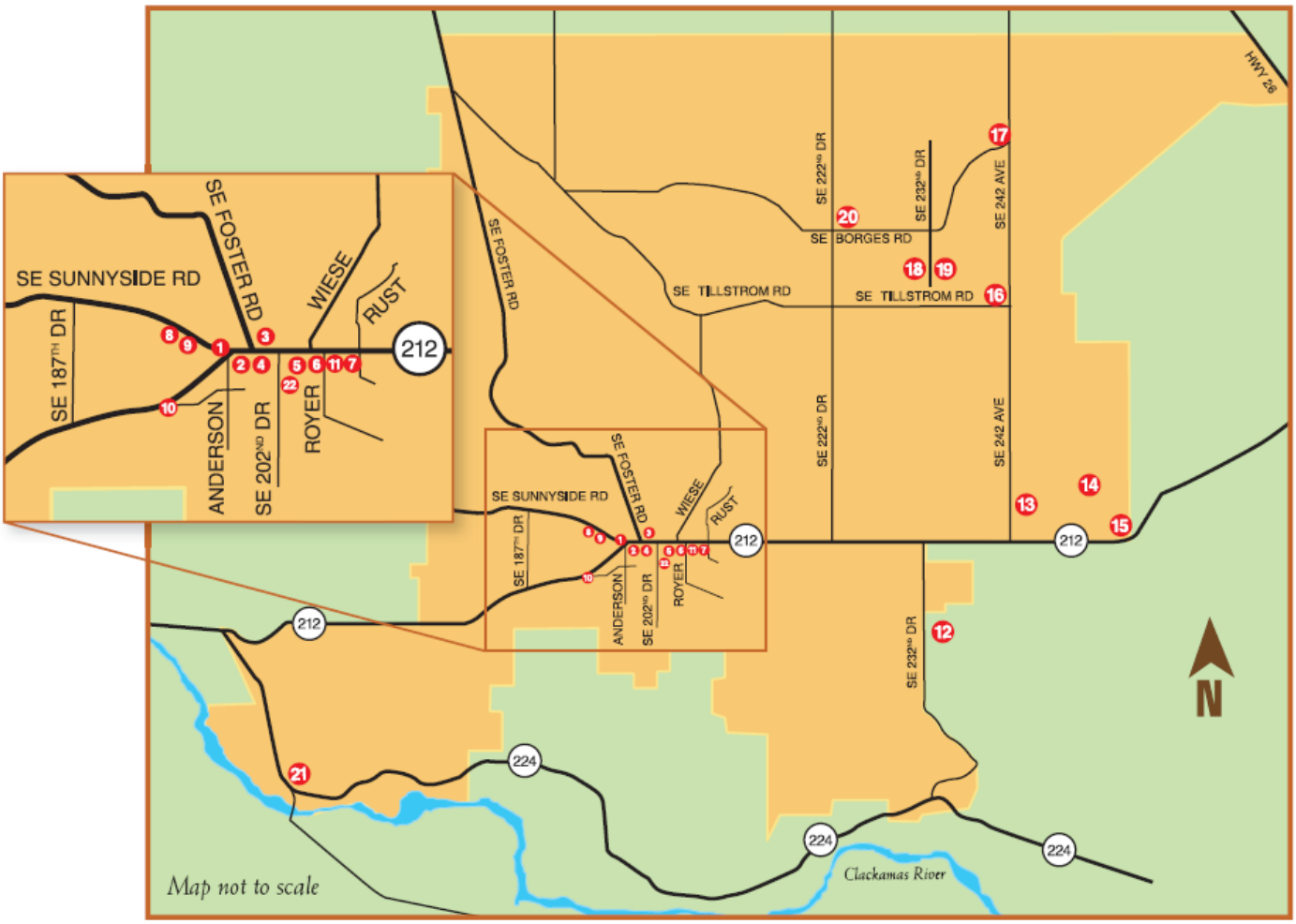
Table 2.1 Employment by Industry in 2005

Sector/Industry	Employment	Establishments
Agriculture, Forestry, Fishing, and Hunting	409	10
Construction	353	104
Retail Trade	142	14
Administrative & Support Srv. and Waste Mgt	101	23
Manufacturing	87	12
Accommodation and Food Services	82	11
Government/Professional & Scientific Srv.	81	24
Private Educational Services	81	4
Arts, Entertainments, and Recreation	50	4
Wholesale Trade	32	20
Real Estate	32	15
Health Care and Social Assistance	31	9
Finance and Insurance	24	9
Transportation and Warehousing	9	5
Other Services	74	29
Total	**1,588**	**293**

Source: City of Damascus Existing Conditions Report/Atlas

Employment in Damascus is concentrated in three major areas: the Highway 212 and Sunnyside Road intersection; near the residential subdivisions and the intersection of Highway 224; and Springwater Road in the southwest portion of the city. Much of the city's agriculture, forestry and fishing is located on Tillstrom Road between 222nd and 242nd Avenues. Almost all of the city's retail and wholesale trade, manufacturing, accommodation and food services, and administrative services jobs are located on Highway 212 near its intersection with Highway 224 and Foster Road. Most of the 34 retail and wholesale employers are located near the intersection of Highway 212 and Sunnyside Road. The following graphic identifies the locations of Damascus's largest businesses:

Damascus & Surrounding Area



Legend

1. **212/Foster/Sunnyside Corner**
   19900 Block SE Hwy 212
   a. Terra Casa
   b. Damascus Law
   c. Wescott's Auto Restyling
   d. McGill's Drive Thru Espresso & Dairy
2. **Damascus Square**
   19900 Block SE Hwy 212
   a. BI-MART
   b. Damascus City Hall
   c. Key Bank
3. **Safeway**
   19900 Block SE Hwy 212
4. **Damascus Fire District #59**
   20100 SE Hwy 212
5. **Damascus Market Square and Professional Building**
   20000 Block SE Hwy 212
6. **Damascus Medical**
   20000 SE Hwy 212
7. **Damascus Mini Storage**
   14613 SE Old Barn Lane
8. **U-Pull-It Auto Wrecking**
   19510 SE Sunnyside Road
9. **Damascus Veterinary Clinic**
   19530 SE Sunnyside Road
10. **Damascus Pioneer Cemetery**
    19428 SE Chitwood Road
11. **Burns and Olsen Real Estate**
    20000 Block SE Hwy 212
12. **Deep Creek Elementary School**
    15600 SE 232nd Drive
13. **Damascus Middle School**
    14151 SE 242nd Avenue
14. **Duncans Nursery**
    14232 SE Hollyview Terrace
15. **Misty Meadow Kennels**
    25550 SE Hoffmeister Road
16. **Thompson Farms**
    24727 SE Bohna Park Road
17. **Borges Corner**
    24180 SE Borges Road
18. **William Dillard Nursery Co.**
    23055 SE Tillstrom Road
19. **Leo Gentry Wholesale Nursery**
    11251 SE 232nd Avenue
20. **Olson Farms**
    22398 SE Borges Road
21. **Carver Business District**
    16000 Block SE Hwy 224
22. **Prudential NW Properties**
    20320 SE Hwy 212

Source: Clackamas County Business & Economic Development Damascus Profile
http://www.clackamas.us/docs/business/profile_damascus.pdf

2.5 Housing

Housing type and year-built dates are important factors in mitigation planning. Certain housing types tend to be less disaster resistant and warrant special attention: mobile homes, for example, are generally more prone to wind and water damage than standard wood frame construction. Generally the older the home is, the greater the risk of damage from natural disasters. This is because stricter building codes have been developed following improved scientific understanding of plate tectonics and earthquake risk. For example, structures built after the late 1960s in the Northwest use earthquake resistant designs and construction techniques. In addition, FEMA began assisting communities with floodplain mapping during the 1970s, and communities developed ordinances that required homes in the floodplain to be elevated to one foot above Base Flood Elevation.

Fortunately, much of the housing stock in Damascus was built after 1970 and the vast majority of housing is wood-frame construction. Sixty-eight percent of homes were built after 1970, compared with 66% of housing in Clackamas County and 58% of housing in the Portland Region. Single family homes comprise 96% of the housing stock in the city, which is much higher than Clackamas County's 67% and the Portland Region's 63%. Damascus has one manufactured home park, located in the Carver area, which amounts to 3% of the housing stock.[vi]

Damascus has a very low vacancy rate at 2%, compared with 6% vacancy of housing units in both Clackamas County and the Portland Region. Of the homes in Damascus, 94% are owner occupied and only 6% are renter occupied. These numbers are much lower than Clackamas County's 29% renter occupied and the Portland Region's 37% renter occupied. Table 2.2 below provides more information about housing in Damascus, Clackamas County, and the Portland Region.[vii]

Table 2.2 Type and Tenure of Housing Units in 2000[viii]

	Portland Region		Clackamas County		Damascus	
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Total Housing Units	**786,300**	**100%**	**136,954**	**100%**	**2,449**	**100%**
Single-Family	491,898	63%	92,210	67%	2,346	96%
Multifamily	251,949	32%	32,857	24%	16	1%
Manufactured/Mobil	40,301	5%	11,543	8%	80	3%
Occupied Housing Unit	**741,776**	**100%**	**128,201**	**100%**	**2.398**	**100%**
Owner Occupied	466,383	63%	91,142	71%	2.262	94%
Renter Occupied	275,393	37%	37,059	29%	136	6%

2.6 Land Use & Development

Damascus's land use is dominated by rural residential, forest, and agricultural uses. According to Metro, roughly 87% of the total land area within the city limits does not have improvements or structures. Damascus has about 9,770 net acres of land (10,467 gross acres) in 4,654 tax lots. About 61% of land within the city has rural plan designations: agriculture, forestry, and general rural. Single-family uses account for 30%

of the city's land. Commercial and industrial uses account for less than 1% of Damascus's land uses.[ix]

The majority of Damascus's land is currently zoned for residential or agricultural uses. Roughly 68% of the land relegated to tax lots within city limits (6,597 acres) is vacant. Two-thirds of the city's land is zoned for Rural Residential or Future Urban use. About 60% (3,877 net aces) is undeveloped. According to Metro, only one dwelling unit per acre is permitted on RRFU land, but these areas are designated for potential future development, meaning that parcel subdivisions or higher density designations may be allowed.[x]

Thirty-percent of Damascus's land (3,004 net acres) is zoned for agriculture or forestry. These lands have been zoned for commercial-scale agricultural production because they have high quality soil for agricultural production or other factors amenable to plant growth. The areas zoned for agriculture or forestry uses will not be available for development in the near future.[xi]

2.7 Community Assets

This section outlines the resources, facilities and infrastructure that if damaged could significantly impact public safety, economic conditions, and/or the environmental integrity of Damascus.

Critical Facilities: Those facilities and infrastructure necessary for emergency response efforts.

- Boring Fire Station in Damascus
- Clackamas County Emergency Operations Center (EOC)
- Clackamas Fire District #1 Station 162nd
- Damascus Emergency Operations Center (EOC) located at City Hall
- Damascus Police Office
- Hospitals: Kaiser Permanente (Sunnyside)

Critical Infrastructure: Infrastructure that provides services for the city

- Highway 212
- Highway 224
- Highway 205
- Highway 26
- Foster Road
- 222nd Avenue
- 232nd Avenue
- 242nd Avenue
- Tillstrom Road
- Sunnyside Road
- Royer Road
- Tong Road
- Carver Bridge
- Barton Bridge

- Private Bridges on Troge, Hueke, and Winston
- Gas lines
- Sewer lines
- Power lines
- Communication Towers (Radio Butte)
- Kingswood Heights Water Coop
- Carver Water Coop
- River View Manufactured Home Court (Water)
- Carver Mobile Home Ranch (Water)
- Fuel Stations (Safeway and 76)

Essential Facilities: Those facilities and infrastructure that supplement response efforts.

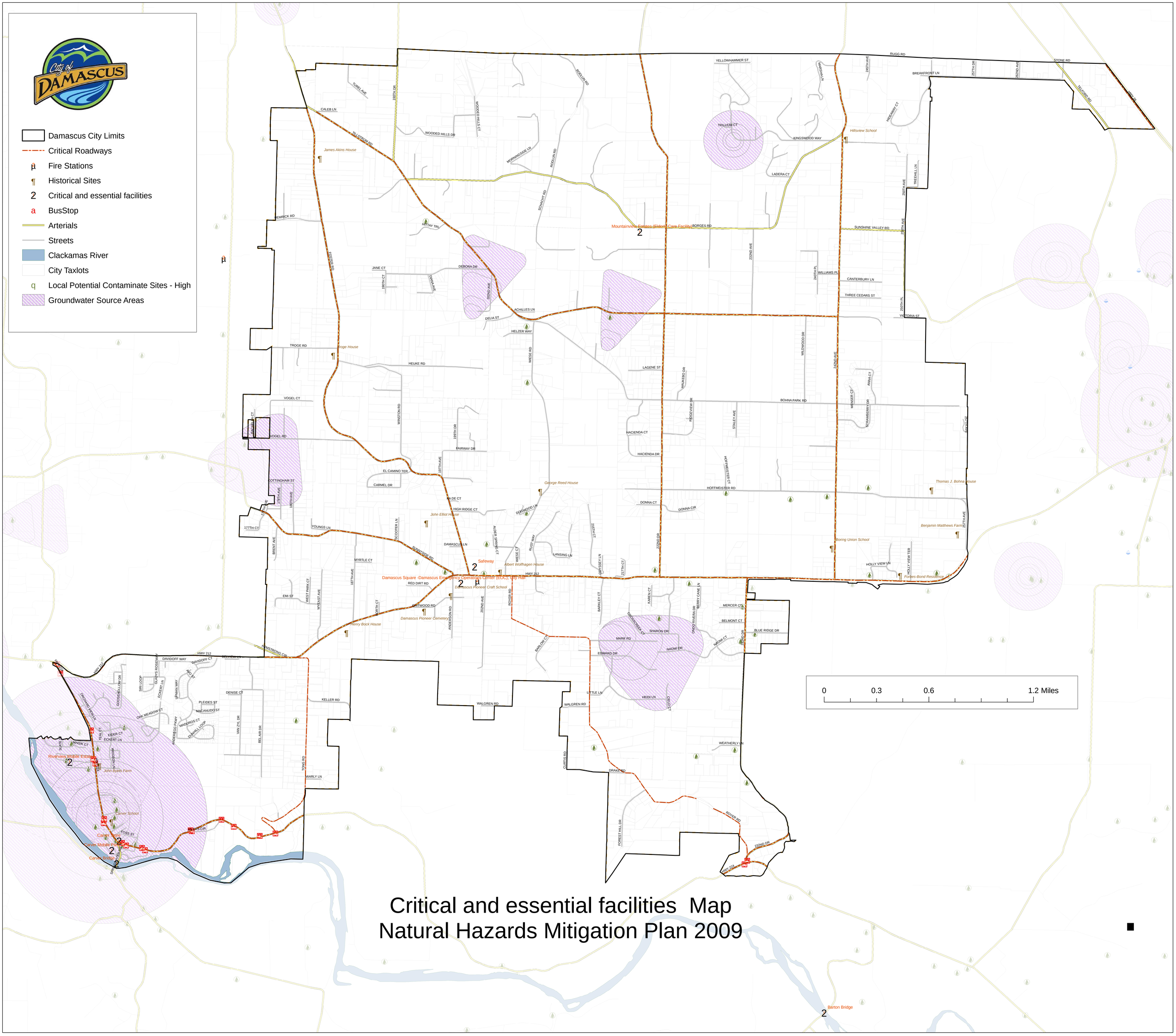
- City Hall
- Schools
    - Carver School
    - Damascus Christian School
    - Damascus Middle School
    - Deep Creek Elementary
- Churches (potential shelter sites)
    - Carver Community Church
    - Damascus Community
    - Hillsview Community Church
    - Hollyview Family Fellowship
    - Sunnyside Community

Vulnerable Populations: Locations serving populations that have special needs or require special consideration.

- Schools
    - Carver School
    - Damascus Christian School
    - Damascus Middle School
    - Deep Creek Elementary
- Carver Mobile Home Ranch
- Riverview Mobile Park
- Mountainview Estates (Elderly Care Facility)

Economic Assets/ Population Centers: Economic Centers are those businesses that employ large numbers of people, and provide an economic resource to the City of Damascus. If damaged, the loss of these economic centers could significantly affect economic stability and prosperity. Population Centers are usually aligned with economic centers, and will be of particular concern for evacuation/notification during a hazard event.

- Damascus Square
- Safeway
- The Carver Store



Critical and essential facilities Map
Natural Hazards Mitigation Plan 2009

- Arterials
- Streets
- Clackamas River
- City Taxlots
- Boring Water Pipe
- Boring Water Wells
- Boring Water Valves
- Boring Fire Hydrants
- Sunrise Water Pipe
- WES Sewer Lines
- WES Sanitary Man Holes
- PGE_Survey_line
- PGE_SecondaryCircuit
- PGE_Vaults
- PGE_Poles

0 0.3 0.6 1.2 Miles

Critical and essential infrastructure Map
Natural Hazards Mitigation Plan 2009

2.8 Historic & Cultural Resources

Historic and cultural resources such as historic structures and landmarks can help to define a community and may also be sources of tourism dollars. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important. The following, aside from Damascus Park, are historical resources within the City of Damascus:

- Albert Wolfhagen House
- Benjamin Matthews Farm
- Boring Union School
- Carver School
- Damascus Pioneer Cemetery
- Damascus Pioneer Craft School
- Forbes-Bond Residence
- George Reed House
- Henry Bock House
- Hillsview School
- James Akins House
- John Byers Farm
- John Elliot House
- Thomas J. Bohna House
- Troge House
- Damascus Park

2.9 Government Structure

The City Council is the policy making body for the City of Damascus. The City Council is comprised of a mayor and six councilors, all of which are elected from the city at large. The mayor and councilors appoint the city manager.

The city manager assists the mayor and City Council in the development of city policies, and carries out policies established by ordinances and resolutions. The city manager is responsible to the mayor and Council for the proper administration of all city business. The city manager appoints, supervises, and removes city employees.

The community development department coordinates and provides services to reflect the community's vision for the future. The department focuses on land use planning, transportation planning, parks and open space planning, wetland and riparian area protection, land use code enforcement, and economic development.

The public works department manages transportation, traffic, drinking water, wastewater, surface water, solid waste, and parks and grounds. The department develops public works infrastructure project standards and specifications in coordination with the community development department.

2.10 Existing Plans & Policies

Communities often have existing plans and policies that guide and influence land use, land development, and population growth. Such existing plans and policies can include comprehensive plans, zoning ordinances, and technical reports or studies. Plans and policies already in existence have support from local residents, businesses and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, and can easily adapt to changing conditions and needs.[xii]

Damascus's Addendum to the Clackamas County Natural Hazards Mitigation Plan includes a range of recommended action items that, when implemented, will reduce the city's vulnerability to natural hazards (see Section 4 below). Many of these recommendations are consistent with the goals and objectives of the city's existing plans and policies. To the extent possible, Damascus will work to incorporate the recommended mitigation action items into existing plans, programs and policies. Linking existing plans and policies to the mitigation plan helps identify existing city resources that can be used to implement the plan's action items. Likewise implementing the mitigation plan's action items through existing plans and policies increases their likelihood of being supported and getting updated, and maximizes the city's resources.

The following are Damascus's existing plans and policies (specifically, those that directly relate to natural hazards mitigation):

Plan: City of Damascus Municipal Code
Date of Last Revision: January 2009
Author/Owner: City of Damascus
Description: The purpose of the Municipal Code is to set rules and regulations on construction and activities within the city.
Relation to Natural Hazards Mitigation:

- Title 8 Health and Safety: 8.04.100 Snow and Ice removal, 8.04.110 Weeds and noxious growth, 8.04.140 Surface-waters and drainage
- Title 15 Building and Construction
- Title 16 Environment: 16.12 Seismic Conditions, 16.16.020 Soil report, 16.28 Erosion control
- Title 18 Flood Hazard Regulations

Plan: Natural Resources Report
Date of Last Revision: July 2007
Author/Owner: City of Damascus
Description: The report is an inventory of natural resources within the city limits. The report includes wetlands, riparian corridors, wildlife habitats, groundwater resources, and Oregon scenic waterways.
Relation to Natural Hazards Mitigation: A natural resources report can be used to implement mitigation activities related to emergency situations.

Plan: Natural Hazards Report
Date of Last Revision: July 2007

Author/Owner: City of Damascus
Description: The inventory addresses the geologic and seismic hazards, wildfire hazards, windthrow hazards, and flood hazards.
Relation to Natural Hazards Mitigation: The inventory provides an important base of information and strategy recommendations on natural hazards that will inform subsequent actions.

Ordinance: Ordinance No. 2008-25 An Ordinance relating to the flood hazard regulations and amending Chapter 18.04 of the Damascus Municipal Code
Date of Last Revision: March 3, 2008
Author/Owner: City of Damascus
Description: The ordinance aims to minimize the damages resulting from flood incidents and increase the safety of citizens.
Relation to Natural Hazards Mitigation: The ordinance provides methods of reducing flood losses, restrictions on development, and penalties for non-compliance.

Section 3:
Risk Assessment

The following hazards have been addressed in the Clackamas County Natural Hazards Mitigation Plan. The City of Damascus reviewed the county's plan on February 20, 2009 and assessed how Damascus's risks vary from the risks facing the entire planning area.

3.1 Flood

The Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes and characteristics, history, location, extent and impacts of the flooding hazard in the City of Damascus. Descriptions of the flood hazard can be found on pages 6-1 to 6-22 of the 2002 Clackamas County Natural Hazards Mitigation Plan and pages 25 to 29 of the 2007 update. The main flood sources in Damascus the Clackamas River, Rock Creek, Richardson Creek, Sunshine Creek, Nover Creek, and Deep Creek. A number of the city's small tributaries have their own local names or no names because they are so small. Additionally, numerous culverts in the city are undersized, causing back-ups and flooding to occur.

From January 1-2, 2009 a winter storm event led to flooding throughout many of the city's smaller tributaries. Some homeowners rerouted drainage ways near their homes to protect their property, but this resulted in more damage and flooding to neighbors downstream and to other parts of the city. Some Damascus residents depend on small bridges over culverts to access their homes. A few of these culverts were washed out, causing damage to the bridges and essentially cutting citizens off from their homes. One home in Damascus is built in a stream bed. The tributaries leading to this house had to be rerouted to divert water away from the home, but the home still experienced flooding. Other homes experienced basement flooding. The SEOC believes the January, 2009 flooding event was worse than the 1996 flooding events. (Please see Clackamas County's Natural Hazards Mitigation Plan for a full description of the 1996 flooding events).

A number of Damascus's roads have been flooded in the past as well. These roads include Telford Road, Rugg Road, Foster (Highway 26), and Troge Road. Carver Mobile Home Ranch is located along the Clackamas River and has flooded a number of times in the past.

The geographic location of the flooding hazard was determined using the designated FEMA NFIP 100-year floodplain data, as well as the inundation line for the 1996 flood. The Fire and Flood Hazards Map on page 38 below illustrates the flood hazard area for Damascus. The Fire and Flood Hazards Map shows the total floodplain acreage is 138 acres, or 1.3% of land area within Damascus. The flood hazard includes portions of Highway 224, SE Eilers Circle, S. Springwater Road, and most of the Carver Mobile Home Ranch. Some PGE transmission lines and Sunshine Water Authority pipelines are in the floodplain hazard. Tax lot data was used to estimate the potential economic impact of the flood hazard. The total value of tax lots intersecting the flood hazard is $10,751,547. This estimate does not include loss of revenue due to business closures.

The floodplain hazards are well documented by FEMA in the Clackamas River corridor, but floodplain hazards along Sunshine Creek, Noyer Creek, the upper reaches of Rock and Richardson Creeks, and the smaller tributary basins are not well defined. All of these streams except Sunshine Creek are moderate gradient streams with generally narrow floodplains. Lower Sunshine Creek and upper Noyer Creek have low to moderate gradients and may be at greater risk of flooding.[xiii] The extent of flooding hazards in Damascus primarily depends on climate and precipitation levels. Additionally, withdrawals for irrigation and drinking water, as well as stream and wetland modifications or vegetation removal can influence water flow.

The City of Damascus employs a number of mitigation strategies to reduce the city's risk to flood events. The city is a regular participant in the National Flood Insurance Program (NFIP) with 2 policies in force at a value of $175,000. Damascus's most current effective Flood Insurance Rape Map (FIRM) date is June 17, 2008 (initial FIRM 7/19/2000). At this time there are zero looses paid and zero repetitive loss properties. Additionally, the city has yet to have a Community Assistance Visit, and Damascus is not yet a participant in the Community Rating System (CRS). The city has a floodplain ordinance (see 2.10 Existing Plans and Policies above) and is in the process of preparing a public facilities plan that will incorporate low-impact design strategies, such as bio-swales, that will use natural systems for flood control and enhanced water quality. Culverts in Damascus are regularly cleaned out. The city is creating a stormwater management plan which will include a comprehensive drainage assessment. Boring Fire District is also developing a "disaster series" for the residents of east Clackamas County which will include a class focusing on flood mitigation practices.

The city's Natural Hazards Report (see 2.10 Existing Plans and Policies above, or Appendix C), recommends the following flood mitigation actions:[xiv]

- An inventory should be made of stream reaches that experienced significant erosion, mass wasting, or channel change events during the most recent (since 1990) extreme precipitation events. These areas should be considered for designation as flood erosion hazard areas pending area specific hydraulic analysis.
- Areas of steeper stream gradient and/or areas where previous large rain events (1996, 2004, 2006) have caused mass wasting, erosion, or channel changes should receive specific hydraulic/hydrologic analysis prior to large scale developments.
- Areas with significant ponding during recent large rainfall events should be mapped, including both depth and duration of ponding. These areas should be considered for designation as flood hazard areas.
- Areas identified as potential flood hazard areas should receive additional evaluation of development elevations, proposed in-filling, and the routing/disposal of storm water prior to expensive development.

The SEOC estimates that the probability of future flooding events in Damascus is 'high,' meaning one event is likely to occur within a 10 to 35 year period. The SEOC additionally estimates that the city's vulnerability to flooding events is 'moderate' meaning 1-10% of the city's population and/or assets could be affected in a major flood

event. Both ratings are in agreement with the county's probability and vulnerability estimates.

3.2 Landslide

The Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes and characteristics, history, location, extent and impacts of landslides in the region. Descriptions of the landslide hazard can be found on pages 7-1 to 7-13 of the 2002 Clackamas County Natural Hazards Mitigation Plan and pages 33 to 39 of the 2007 update.

The county plan does not identify specific landslide events that have occurred within Damascus, but the SEOC identified the following areas that have experienced landslides in the past: the area northwest of Rodlund Road, the area south of 190th Court and Debora Drive, Eckert Road, Borges Road, Kingswood Way, Highway 212, Highway 224, the area east of the Carver Bridge, and the area of Royer Road above Highway 224. Damages in these areas have been minimal. The Damascus Natural Features Inventory Natural Hazards Report, (see 2.10 Existing Plans and Policies above), also describes the causes and characteristics of steep slopes, soil creep, landslides, rapidly moving landslides, soils with high shrink-swell potential, fills, and high groundwater. For more information about the geologic characteristics of Damascus, please see the Natural Hazards Report in Appendix C.

As shown in the Slope/Landslide Map on page 39 below, the geographic area of the landslide hazard was delineated using 25% or greater slope,[1] historic landslide locations, and landslide topography surface indicators. Landslides could affect 2,882.37 acres, or 28% of the city's land area, and over 3.5 miles of roadway is exposed to the landslide hazard. A number of the city's utility lines are also exposed to the landslide hazard including half a mile of sewer pipelines, 500 miles of PGE poles and lines, over 30 miles of Sunshine Water Authority pipeline, and about 2.5 miles of Boring Water District pipeline. Additionally, the city's historical George Reed House is exposed to the landslide hazard.

The SEOC estimates that the probability of future landslide events is 'high,' meaning one event is likely to occur within a 10 to 35 year period. This estimate is in agreement with the county's 'high' probability estimate. The SOEC additionally estimates that Damascus has a 'moderate' vulnerability to landslide hazards. A 'moderate' ranking means that between 1-10% of the population and/or community assets could be affected by a landslide event. The city's vulnerability estimate is higher than the county's 'low' vulnerability rating due to potential impacts described below.

A landslide event could impact Damascus in a number of ways. A slide could pollute the city water supply if sediment enters streams and rivers. Damascus's citizens are very

[1] Slopes steeper than 25 % are potentially unstable and require independent evaluation prior to development to measure slope stability.

dependent on Foster Road, and Highways 212 and 224 for transporting to and from work, and Damascus' stores are similarly dependent on Highways 26, 212, and 224 for inventory. If a large slide impacted any of these arterials Damascus could be cut off from neighboring communities.

The steering committee believes the primary impact of a landslide would be economic. Tourism on Mt. Hood has a great impact on the Damascus economy. If the roads leading to Mt. Hood are altered by a landslide tourism would be severely impaired. In addition to skiing, Damascus is home to a large mountain biking and hiking community. A landslide could block access to these activities, or create an unsightly environment and reduce tourism in the area.

In order to estimate the potential economic impacts of landslides within the city, Damascus's geographic information systems (GIS) department intersected tax lot data with steep slope areas within the city. Tax lot data was used to estimate the potential economic impact of the landslide hazard. The total value of tax lots that intersect potential landslide areas is $257,860,361. This estimate does not include loss of revenue due to business closures.

Damascus is working to mitigate future landslide hazards by creating a steep slope development code. The development code will create steep slope overlay zones that will require evaluation prior to development.

The city's Natural Hazards Report (see 2.10 Existing Plans and Policies above, or Appendix C), recommends the following landslide mitigation actions[xv]:

- Slopes steeper than 25% should be evaluated in detail by a Certified Engineering Geologist (CEG) through a geologic assessment prior to development. The preliminary evaluation can be visual depending upon access, the proposed type of construction, and potential effects on adjacent properties, in order to confirm the stability or instability of the slopes. (pg. 18)
- Before a building permit or other land use approval is issued, the slope conditions should be verified by subsurface exploration. If the slopes are found to be unstable, analysis and mitigation measures should be made in conjunction with a Geotechnical Engineer (GE) using Oregon State Board of Geologist Examiners (OSBGE) guidelines and the Oregon State Board of Examiners for Engineering and Land Surveying (OSBEELS) standards of care for engineering practice. (pg. 18)
- All the areas mapped as landslides or as having landslide topography should be subject to these recommendations. (pg. 19)
- If development or construction is planned on or within 100 feet of mapped Landslide Topography, known or suspected landslides, or Debris Flow Hazard zones, the potential effects of the slide areas on the development should be made by a CEG through a geologic assessment. If the geologic assessment indicates that the land is developable and the potential hazards can be mitigated, the slide hazard area should be evaluated by subsurface exploration. (pg. 19)

- During any landslide investigation, the limits of the slide mass should be accurately measured and the stability of the slide mass and the mechanics of slide movement should be determined. This may (depending on opinion of a CEG) require installation of subsurface ground monitoring equipment (such as slope inclinometers) to determine whether deep-seated movements are occurring. (pg. 19)
- All studies pertaining to slope stability should include an explanation of the methodology used and should provide recommendations for suitable setbacks, keeping in mind the anticipated life of the structure or development. (pg. 19)
- If the known or suspected landslide area is to be built upon, or if the proposed development or structure is within the setback or buffer zone, an in-depth stabilization and construction plan should be developed by the CEG in conjunction with a GE using OSBGE standards for care for engineering practice. (pg. 19)
- Surface water flowing from an existing property or new development should be controlled such that it does not negatively impact adjacent public or private property by increasing flow, concentrating flow, or stimulating erosion that was not present beforehand. (pg. 20)
- New developments should submit a storm drainage plan at the time of application. The City of Damascus personnel should judge the adequacy of the plan based on the size and type of development and specific site conditions. The City may require an engineered Storm Drainage Plan if site conditions warrant. (pg. 20)
- All new developments should incorporate basement and foundation drainage to control groundwater and keep it from crawl space, underslab, and below-grade areas. (pg. 20)

3.3 Wildfire

The Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan's descriptions of the causes and characteristics, location, extent and impacts of the wildfire hazard apply to the City of Damascus. Descriptions of the wildfire hazard can be found on pages 8-1 to 8-16 of the 2002 Clackamas County plan. The Clackamas County Community Wildfire Protection Plan details a limited history of wildfire in the county. In 1951 approximately 2,000 acres burned in Clackamas and Multnomah Counties. In 2001 lightning strikes started eight fires in eastern Clackamas County on US Forestry Service lands, burning about 80 acres. In 2002 the Bowl Fire burned over 300 acres just east of Estacada. No history of wildfires is reported for Damascus.[xvi]

Clackamas County has two major physiographic regions: the Willamette River Valley in western Clackamas County and the Cascade Range Mountains in eastern and southern Clackamas County. The Willamette River Valley is the most heavily populated portion of the county and is characterized by flat or gently hilly topography. The Cascade Range, which includes Damascus, has a relatively small population and is characterized by heavily forested slopes. Eastern Clackamas County is at higher risk to wildfire than western portions of the county due to the lack of dense forested land. Human caused fires are responsible for the majority of fires in Clackamas County, and in eastern

Clackamas County the most common human induced wildfire source is debris burn escape. Homeless camps are another source of wildfires.

To create the fire portion of the Fire and Flood Hazards Map (see page 38 below), the city used data previously compiled for the Natural Features Inventory. A project team reviewed existing aerial photography and developed a GIS analysis of slope and aspect as risk factors for wildfire. The team's efforts were focused on those areas that potentially contained high fuel loads and/or significant risk to clusters of homes. The project team also held discussions with natural resource and wildland fire professionals and then conducted limited ground-truthing of the potential wildfire hazard areas. The steering committee used this data and generated a GIS map that identifies 49 properties at risk to wildfire for a total area of 417.42 acres, or 4.1% of the city's land area. Some PGE transmission lines are located in wildfire hazard zones. Arching wires are a potential fire ignition source so trees near these power lines are trimmed regularly by PGE.

The SEOC estimates the probability of future wildfire events to be 'moderate,' meaning one event is likely within a 35 to 75 year period. This is in agreement with the county's 'moderate' probability rating. The SEOC additionally ranked the city's vulnerability to wildfires as 'high,' meaning more than 10% of the population and community assets would be affected by a major wildfire event. This is higher than the county's 'moderate' rating.

While the history of wildfires in Clackamas County is minimal, it does not provide a proper indication of the level of risk. According to the Clackamas County Community Wildfire Protection Plan, the forests have accumulated an unnatural buildup of fuel as a result of decades of timber harvest and aggressive fire suppression. This buildup of fuels could result in a larger, more forceful fire in the future. Additionally, residential development near the wildland urban interface has increased the community's overall exposure to wildfire hazards. Damascus has limited transportation routes in and out of the city, and some areas do not have evacuation plans. The potential for loss of life is great because of this accessibility issue.

Damascus uses a number of mitigation tools to reduce the city's risk to wildfires. Nuisance ordinances prohibit the growing of tall grasses within city limits. Boring Fire District identifies homes with branch overhangs that create access issues for fire trucks and increase wildfire vulnerability to the structures. Homes with overhanging branches do not have defensible space, increasing their exposure to fuel sources. The fire district notifies residents of the burning season and strictly enforces burning regulations. The fire district stays current on issues by participating in the Clackamas County Fire Prevention Cooperative, a group consisting of the fire districts within the county. The district also contributed in creating the Clackamas County Community Wildfire Protection Plan.

Public outreach is a primary mitigation tool used by Boring Fire District. The Boring Fire District website includes ample information about fire safety and prevention. The District teaches fire safety in grade schools and hosts community safety fairs. Sandy Fire District #72 also works closely with Damascus on public outreach programs. Together the districts offer classes on defensible land space, create a media awareness campaign

during fireworks season, and post signs at nurseries to inform citizens of fire resistant plants and proper pruning techniques. The Sandy and Boring Fire Districts share a "fire safety house" trailer that serves as an education and outreach tool for fire-safe practices. The District brings the fire safety house to public events to educate children on safe evacuations. Children enter the safety house to watch a movie about fire safety and then practice climbing out windows and down ladders. This provides kids a safe and supervised environment to practice evacuation procedures.

Clackamas Fire District #1 services portions of Damascus. Clackamas Fire District #1 has a Fire Prevention Division dedicated to protecting and preserving life and property through education, engineering, and enforcement. The Fire Prevention Division offers numerous education opportunities including school programs, public presentations, media events, and safety fairs. They review pre-construction plans and develop fire codes. Additionally this division inspects buildings for fire code compliance, enforces open burning regulations, and offers juvenile fire setter counseling and follow-up.

The city's Natural Hazards Report (see 2.10 Existing Plans and Policies above, or Appendix C), recommends the following landslide mitigation actions[xvii]:

- Expand on and refine the work conducted for the Clackamas County CWPP, tailoring its findings to local conditions. As development in the Damascus area continues, an increase in human ignitions is likely.
- Encourage residents to follow the recommendations of local fire agencies experienced in protecting homes from wildfires. These pertain to creating a defensible space around buildings and to fire prevention measures.
- Consider an ordinance requiring lots with grass to be mowed by August 1. This would ensure that the grass is mature and not likely to become a hazard again during fire season. The August 1 deadline will allow spring ground nesting birds to successfully rear their young. The Oregon Department of Fish and Wildlife should be consulted on relevant bird species and timing.

3.4 Severe Storms: Wind and Winter

The Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes and characteristics, history, location, extent and impacts of the severe storm hazard in the City of Damascus, but a few incidents require more explanation:

- Southwest winds from December 14th to 15th, 2006 blew over a mature Douglas fir, which landed on a home in Damascus.
- December 26, 2008 to January 2, 2009: Oregon experienced its worst winter storm in 40 years. Snow accumulation caused hazardous driving conditions, several flat-roof structures collapsed, power outages occurred for up to 1,300 homes in the area, garbage and mail service was delayed, altered, or canceled, and telephone service was interrupted. From January 1st to 2nd, 2009 flooding resulted from the winter storm, causing 38 homes in the carver mobile home ranch to be

evacuated. A shelter was set up for twelve of the evacuated residents. Several roads were closed due to high water, slides, or fallen trees.

Additional severe storm information can be found on pages 9-1 to 10-7 of the 2002 Clackamas County Natural Hazards Mitigation Plan, and pages 46 to 50 in the 2007 plan update.

Mitigating severe storms can be difficult because storms affect all areas of the city, but Damascus has made progress to reduce the effects of storms. All new construction is required to have underground utilities. Boring Fire District has a Community Emergency Response Team (CERT) which could be utilized for response and public outreach efforts. Finally, Damascus has a database where citizens can register to volunteer and list resources they own and are willing to use in emergency events, such as snowmobiles.

The SEOC estimates that the probability of severe wind and winter storm events is 'high,' meaning one event is likely within a 10 to 35 year period. This estimate is the same as the county's 'high' winter storm probability estimate, but higher than the county's 'moderate' wind storm estimate. The history of wind storms in Damascus shows that they occur frequently enough to warrant the 'high' probability rating. The SEOC estimates a 'moderate' vulnerability to wind and winter storms, meaning 1-10% of the population and/or community assets could be affected by a severe storm event. This rating is in agreement with the county's 'moderate' winter storm vulnerability rating, but is higher than the county's 'low' vulnerability rating for wind storms. Damascus's wind storm vulnerability is greater than the county's rating because much of the city's utilities are still above ground and vulnerable to falling tree branches and debris.

3.5 Earthquake

The Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes and characteristics, history, location, extent and impacts of the earthquake hazard affecting Damascus. Descriptions of the earthquake hazard can be found on pages 11-1 to 11-20 in the 2002 Clackamas County Natural Hazards Mitigation Plan, and pages 53 to 58 in the 2007 plan update. The Damascus Natural Features Inventory Natural Hazards Report further details the causes and characteristics of seismic events (see Appendix C).

Within the Northern Willamette Valley/Portland Metro Region, three potential faults and/or zones are capable of generating high-magnitude earthquakes. These include the Portland Hills Fault Zone, Gales Creek-Newberg-Mt. Angel Structural Zone, and the Cascadia Subduction Zone.

- Portland Hills Fault Zone
  The Portland Hills Fault Zone is a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years ago) sediment.[xviii] The fault zone extends along the eastern margin of the Portland Hills for a distance of 25 miles, and lies about 2 miles northeast of Oregon City.

- Gales Creek-Newberg-Mount Angel Structural Zone
  The Gales Creek-Newberg-Mount Angel Structural Zone is a 50-mile-long zone of discontinuous, NW trending faults that lies about 17 miles southwest of Oregon City. These faults are recognized in the subsurface by vertical separation of the Columbia River Basalt and offset seismic reflectors in the overlying basin sediment.[xix]

- Cascadia Subduction Zone
  The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year.[xx] Paleoseismic studies along the Oregon coast indicate that the state has experienced seven Cascadia Subduction Zone (CSZ) events possibly as large as M9 in the last 3,500 years. These events are estimated to have an average recurrence interval between 500 and 600 years, although the time interval between individual events ranges from 150 to 1000 years. Scientists estimate that the chance in the next 50 years of a great subduction zone earthquake is between 10 and 20 percent assuming that the recurrence is on the order of 400±200 years.[xxi]

Earthquake fault lines can be seen on the Fire and Flood Hazards Map, located below on page 38. A high magnitude earthquake could have significant impacts in Damascus. The city has a number of older structures built before stricter seismic building codes were implemented. A water facility on Kingswood could be impacted in a major event. Additionally, Damascus has one grocery store in the city. The building is older and could be damaged, limiting residents' access to supplies in a major event. In 2007, the Department of Geology and Mineral Industries (DOGAMI) released the results of the Statewide Seismic Needs Assessment, which evaluated the collapse potential of education and emergency services buildings. The study found the Damascus Fire Station has a 'high' collapse potential.[xxii] Please see Clackamas County's Natural Hazards Mitigation Plan for additional information regarding potential earthquake-related impacts.

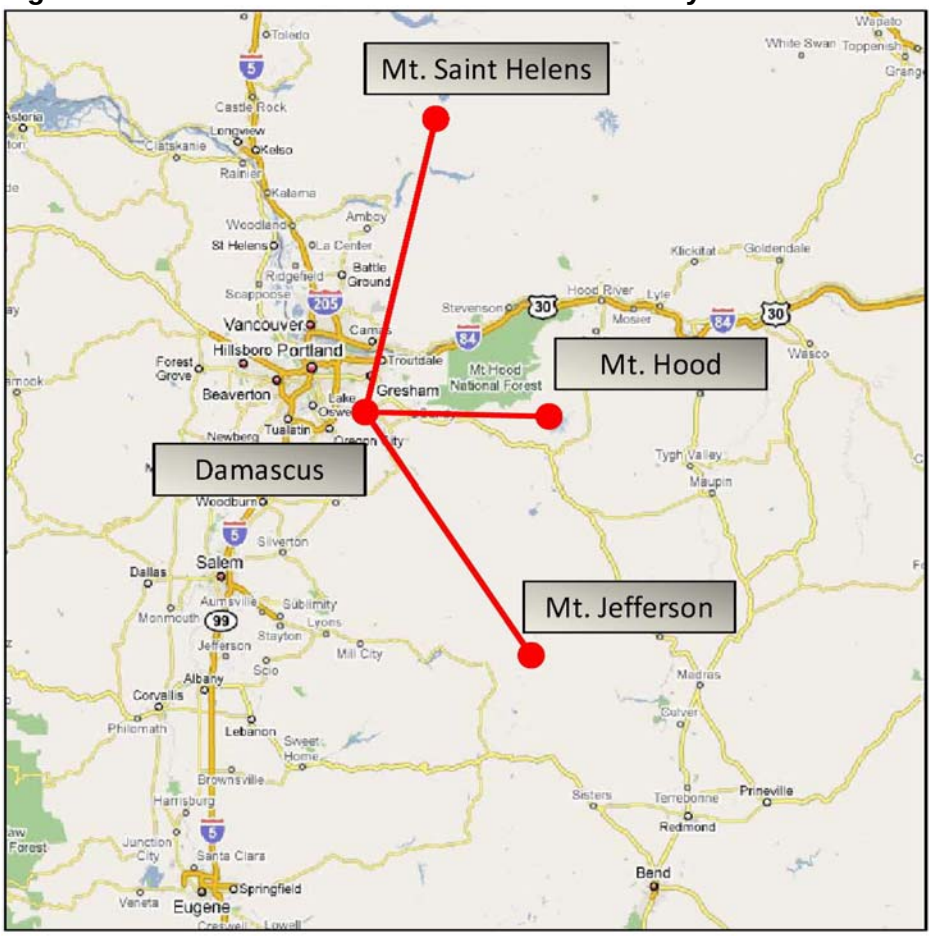
The SEOC ranks the probability of future earthquake events as 'high,' meaning one event is likely within a 10 to 35 year period. This estimate is the same as the county's 'high' probability estimate. The SEOC ranked the vulnerability to earthquakes as 'high,' meaning more than 10% of the population and assets would likely be affected in a major event. This is also in agreement with the county's 'high' vulnerability estimate.

3.6 Volcano

The Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan adequately describes the causes and characteristics, history, location, extent and impacts of volcanic eruptions affecting the City of Damascus. Descriptions of the volcano hazard can be found on pages 12-1 to 12-13 of the 2002 Clackamas County Natural Hazards Mitigation Plan and pages 61 to 64 of the 2007 plan update.

Immediate danger areas for volcanic eruptions lie within a 20-mile radius of the blast site, and ashfall is likely to affect communities downwind of the eruption. Several volcanoes are located near Damascus, the closest of which are shown in Figure 2 below. Additionally, Mount Adams is located north of Mount Hood; Mount Rainier is located north of Mount Saint Helens; and the Three Sisters lie to the south of Mount Jefferson.

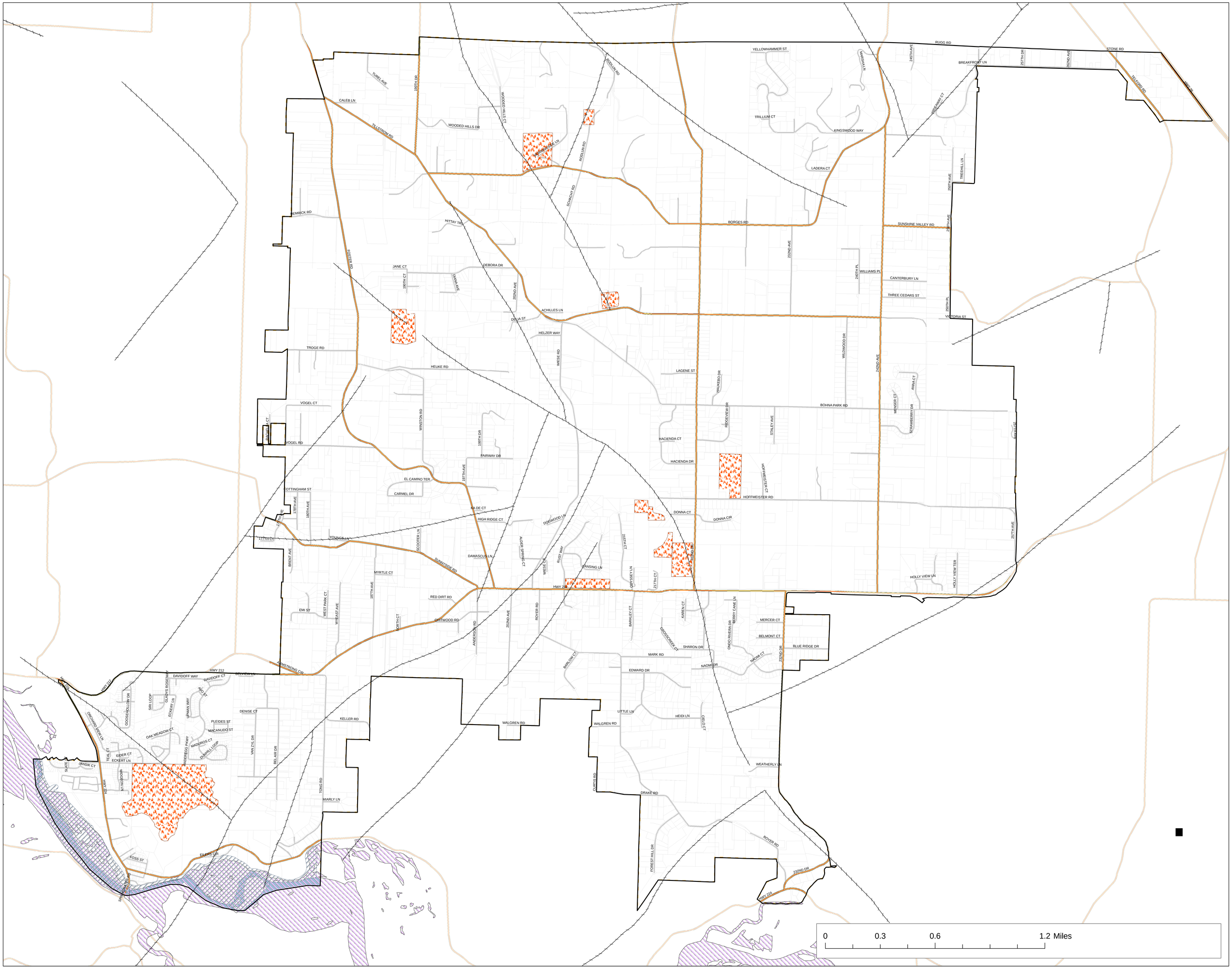
Figure 2. Volcano Locations in Relation to the City of Damascus



Due to Damascus's relative distance from volcanoes, the city is unlikely to experience the immediate effects that eruptions have on surrounding areas (i.e., mud and debris flows, or lahars). Depending on wind patterns and which volcano erupts, however, the city may experience ashfall. The eruption of Mount St. Helens in 1980, for example, coated the Willamette Valley with a fine layer of ash. If Mount Hood erupts, however, the city is likely to be fully coated in ash.

Clackamas County's Natural Hazards Mitigation Plan adequately documents historic volcanic events for Mount Hood, Mount Saint Helens, Mount Rainier, Mount Adams, and Mount Saint Helens. Please refer to Section 12 of the Clackamas County Natural Hazards Mitigation Plan for more information regarding previous volcanic events.

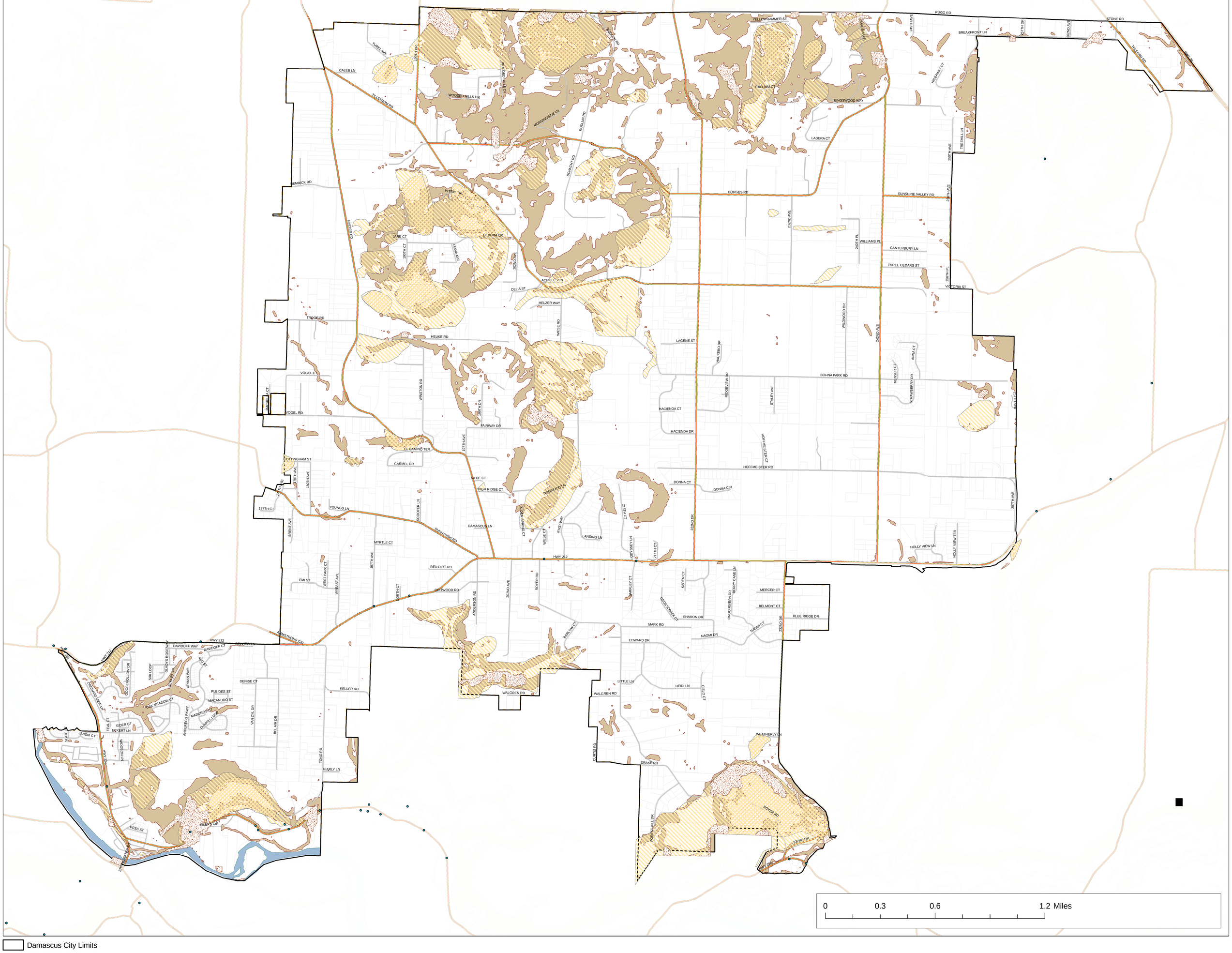
Clackamas County estimates a low probability that volcanic eruptions will occur in the future, and a high vulnerability to volcanic events. Both ratings are true for the city of Damascus as well. Hazards related to volcanic eruptions (i.e., potential community impacts) are adequately described in the Clackamas County Natural Hazards Mitigation Plan. Although the city of Damascus is unlikely to experience lahars or lava flows, tephra (sand-sized or finer particles of volcanic rock that is ejected rapidly into the air from volcanic vents) drifts downwind from the explosions and can form a blanket-like deposit of ash. Tephra is a public health threat, and can damage agriculture and transportation systems (i.e., aircraft and on-the-ground vehicles). Tephra can also clog drainage systems and create major debris management problems. Within Damascus, public health would be a primary concern, and keeping transportation routes open/accessible would be important as well.



- Damascus City Limits
- Earthquake Faults
- Floodplain (FEMA) in Damascus
- 1996 Flood
- Fire Hazards
- Arterials
- Streets
- Clackamas River

Fire and Flood Hazards Map
Natural Hazards Mitigation Plan 2009

April 2009



0 0.3 0.6 1.2 Miles

- Damascus City Limits
- Arterials
- Streets
- Over 25% Slope (RLIS Lidar data)
- Clackamas River
- Landslide Locations (DOGAMI)
- Historic Landslides (DOGAMI)
- Landslide Topography Surface indicators (Ash Creek)
- Potentially Rapidly Moving Landslides (DOGAMI)

Slope/Landslide Map
Natural Hazards Mitigation Plan 2009

Draft 2009

City of DAMASCUS

Section 4: Action Items

4.1 Action Items

Short and long-term action items identified through the planning process are an important part of the mitigation plan. Action items are detailed recommendations for activities that local departments, citizens and others could engage in to reduce risk. Each action item has a corresponding action item worksheet describing the activity, the project's rationale, potential ideas for implementation, and coordinating / partner organizations. The action item worksheets can assist the community in pre-packaging potential projects for grant funding. Full action item worksheets are located in Appendix A of this addendum.

- MH #1: Maintain public education programs to inform the public about methods for mitigating the impacts of natural hazards.
- MH #2: Integrate the goals and action items from Damascus's Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.
- MH #3: Identify and pursue funding opportunities to develop and implement hazard mitigation activities.
- MH #4: Continue to update and improve hazard assessments in the Natural Hazards Mitigation Plan as new information becomes available.
- MH #5: Implement the recommendations identified in the Natural Hazards Report.
- MH #6: Improve vegetation management throughout the city.
- MH #7: Encourage structural mitigation practices in developments at risk to hazards.
- FL #1: Continue to implement and enhance the flood public education program designed to inform local residents about:
    - The causes of local drainage problems, flooding and landslides;
    - Why channels, ditches and swales should be created and maintained;
    - What owners can do to protect their properties;
    - The penalties for dumping in or altering watercourses;
    - Information regarding health and safety issues resulting from the flooding hazard (such as sewerage leakages);
    - The types of flooding and benefits of flooding as a natural process; and
    - The benefits of vegetation in floodplains.
- FL #2: Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.

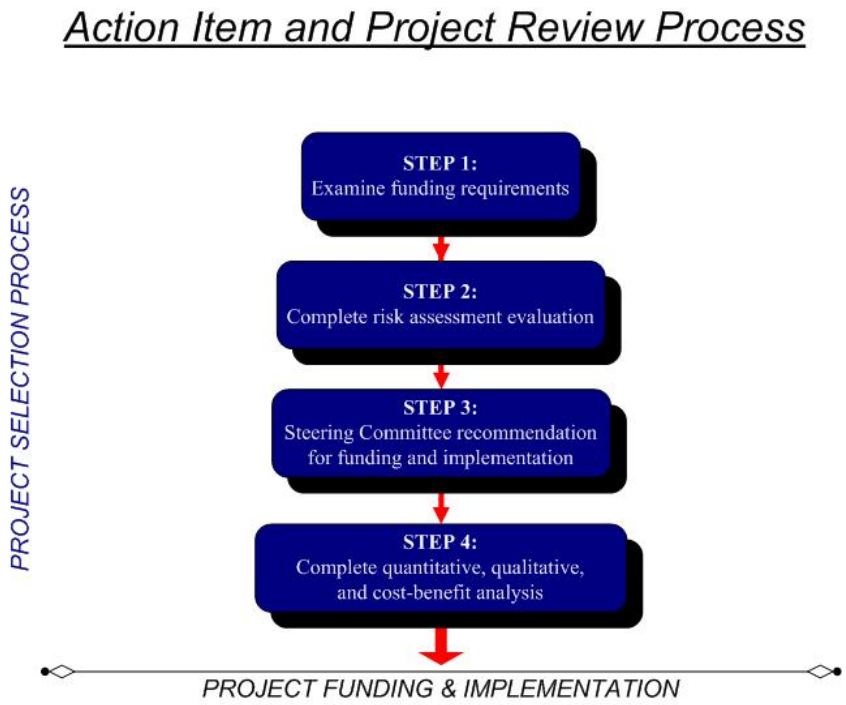
- FL #3: Explore participation in the NFIP's Community Rating System.
- FL #4: Develop a stormwater management plan.
- FL #5: Promote and protect the use of naturally flood prone open space or wetlands as flood storage areas.
- FL #6: Identify specific properties within Carver Mobile Home Ranch and identify feasible mitigation options.
- LS #1: Maintain and update an inventory of streets and properties threatened by landslides.
- LS #2: Reduce the vulnerability of property owners in landslide-prone areas.
- WF #1: Promote fire-resistant strategies for existing and new developments.
- WF #2: Mitigate life loss due to wildfires.
- SS #1: Reduce negative effects from severe windstorm and severe winter storm events.
- EQ #1: Reduce negative impacts of earthquakes by performing seismic evaluations and retrofits.

Note: the City of Damascus does not believe that implementing volcano-related mitigation activities will be cost-effective at this time. As such, the city has not identified volcanic-eruption mitigation action items. Damascus will partner with Clackamas County, however, on the implementation of mitigation strategies that benefit both jurisdictions.

4.2 Project Prioritization Process

The Disaster Mitigation Act of 2000 (via the Pre-Disaster Mitigation Program) requires that jurisdictions identify a process for prioritizing potential actions. Potential mitigation activities often come from a variety of sources; therefore the project prioritization process needs to be flexible. Projects may be identified by committee members, local government staff, other planning documents, or the risk assessment. Figure 3 illustrates the project prioritization process.

Figure 3: Project Prioritization Process



Source: Community Service Center's Partnership for Disaster Resilience at the University of Oregon, 2008.

Step 1: Examine funding requirements

The first step in prioritizing the plan's action items is to determine which funding sources are open for application. Several funding sources may be appropriate for the city's proposed mitigation projects. Examples of mitigation funding sources include but are not limited to: FEMA's Pre-Disaster Mitigation competitive grant program (PDM), Flood Mitigation Assistance (FMA) program, Hazard Mitigation Grant Program (HMGP), National Fire Plan (NFP), Community Development Block Grants (CDBG), local general funds, and private foundations, among others.

Because grant programs open and close on differing schedules, the Natural Features TST will examine upcoming funding streams' requirements to determine which mitigation activities would be eligible. The TST may consult with the funding entity, Oregon Emergency Management, or other appropriate state or regional organizations about project eligibility requirements. This examination of funding sources and requirements will happen during the TST's semi-annual plan maintenance meetings.

Step 2: Complete risk assessment evaluation

The second step in prioritizing the plan's action items is to examine which hazards the selected actions are associated with and where these hazards rank in terms of community risk. The TST will determine whether or not the plan's risk assessment supports the implementation of eligible mitigation activities. This determination will be based on the location of the potential activities, their proximity to known hazard areas, and whether community assets are at risk. The TST will additionally consider whether the selected actions mitigate hazards that are likely to occur in the future, or are likely to result in severe / catastrophic damages.

Step 3: Committee Recommendation

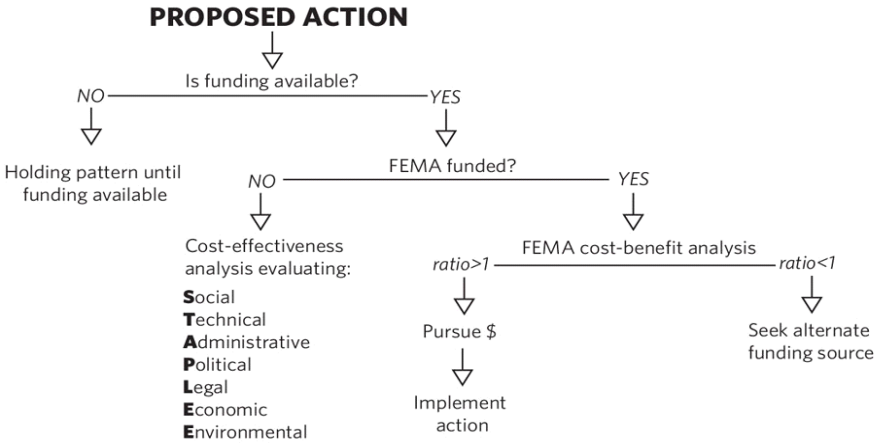
Based on the steps above, the TST will recommend which mitigation activities should be moved forward. If the TST decides to move forward with an action, the coordinating organization designated on the action item form will be responsible for taking further action and, if applicable, documenting success upon project completion. The TST will convene a meeting to review the issues surrounding grant applications and to share knowledge and/or resources. This process will afford greater coordination and less competition for limited funds.

The TST and the community's leadership have the option to implement any of the action items at any time, (regardless of the prioritized order). This allows the TST to consider mitigation strategies as new opportunities arise, such as funding for action items that may not be of the highest priority. This methodology is used by the TST to prioritize the addendum's action items during the annual review and update process.

Step 4: Complete quantitative and qualitative assessment, and economic analysis

The fourth step is to identify the costs and benefits associated with the selected natural hazard mitigation strategies, measures or projects. Two categories of analysis that are used in this step are: (1) benefit/cost analysis, and (2) cost-effectiveness analysis. Conducting benefit/cost analysis for a mitigation activity assists in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later. Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating natural hazards provides decision makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects. Figure 4 shows decision criteria for selecting the appropriate method of analysis.

Figure 4: Benefit Cost Decision Criteria



Source: Community Service Center's Partnership for Disaster Resilience at the University of Oregon, 2006.

If the activity requires federal funding for a structural project, the committee will use a Federal Emergency Management Agency-approved cost-benefit analysis tool to evaluate the appropriateness of the activity. A project must have a benefit/cost ratio of greater than one in order to be eligible for FEMA grant funding.

For non-federally funded or nonstructural projects, a qualitative assessment will be completed to determine the project's cost effectiveness. The committee will use a multivariable assessment technique called STAPLE/E to prioritize these actions. STAPLE/E stands for Social, Technical, Administrative, Political, Legal, Economic, and Environmental. Assessing projects based upon these seven variables can help define a project's qualitative cost effectiveness.

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[i] Oregon Climate Service. 2009. www.ocs.oregonstate.edu/index.html

[ii] City of Damascus Existing Conditions Report/Atlas. August 2007.

[iii] Population Research Center, Portland State University. March 2009. http://www.pdx.edu/sites/www.pdx.edu.prc/files/media_assets/PopRpt08c2.pdf

[iv] Census 2000

[v] City of Damascus Existing Conditions Report/Atlas. August 2007.

[vi] Ibid.

[vii] Ibid.

[viii] Ibid.

[ix] Ibid.

[x] Ibid.

[xi] Ibid.

[xii] Burby, Raymond J., ed. 1998. *Cooperating with Nature: Confronting Natural Hazards with Land-Use Planning for Sustainable Communities.*

[xiii] City of Damascus Natural Hazards Report. July 2007.

[xiv] Ibid, pg. 32.

[xv] Ibid, pgs. 18-20.

[xvi] Clackamas County Community Wildfire Protection Plan, 2005. Page 16-18.

[xvii] City of Damascus Natural Hazards Report. July 2007. Page 26.

[xviii] Madin, Ian, 1990. *Earthquake-hazard geology maps of the Portland metropolitan area, Oregon; text and map explanation: Portland, OR.* Oregon Department of Geology and Mineral Industries.

[xix] Yeats, R.S., Graven, E.P., Werner, K.S., Goldfinger, C., and Popowski, T., 1996. *Tectonics of the Willamette Valley, Oregon.* U.S. Geological Survey Professional Paper 1560

[xx] Goldfinger, C., L. D. Kulm, R. S. Yeats, C. Hummon, G. J. Huftile, A. R. Niem, C. G. Fox, and L. C. McNeill, 1996. *Oblique strike-slip faulting of the Cascadia submarine forearc: the Daisy Bank fault zone off central Oregon*, in Subduction Top to Bottom, G. E. Bebout, D. Scholl, S. Kirby and J. P. Platt (Editors), American Geophysical Monograph 96, 65–74.

[xxi] NOAA, 1993. Tsunamis affecting the West Coast of the United States: 1806-1992.

[xxii] Department of Geology and Mineral Studies, 2007. *Statewide Seismic Needs Assessment: Implementation of Oregon 2005 Senate Bill 2 relating to public safety, earthquakes, and seismic rehabilitation of public buildings.* http://www.oregongeology.org/sub/projects/rvs/OFR-O-07-02-SNAA-onscreen.pdf.

Appendix A: Action Item Worksheets

Multi Hazard #1

Proposed Action Item:	**Alignment with Plan Goals:**
Maintain public education programs to inform the public about methods of mitigating the impacts of natural hazards.	***Protect Life and Property, Promote Public Awareness, Encourage Partnerships and Implementation***

Rationale for Proposed Action Item:

- Conducting public outreach campaigns raises awareness about natural hazards and helps illustrate what residents and businesses can do to reduce the impact of a natural disaster on their properties, thereby significantly reducing the impact of natural hazards on Damascus.
- The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(ii)]. Developing public education programs for hazard risk mitigation would be a way to keep the public informed of, and involved in, the county's actions to mitigate hazards.

Ideas for Implementation:

- Maintain hazard related information and public information materials provided by Boring Fire District and Clackamas Fire District #1. Disseminate through existing resources such as the city website, City News, Planning news Quarterly, brochures, and other mailings;
- Partner with Clackamas County and other jurisdictions to develop education outreach for all hazards;
- Conduct public education as hazard seasons approach. Provide information for earthquake awareness month in April, wildfire prevention in summer, and flood and severe storm information in winter;
- Include hazard information on the Boring Fire Department website;
- Identify property owners in flood, landslide, and wildfire hazard zones, and conduct a target mailing to disseminate information on all hazards;
- Prepare and distribute an informational brochure on unstable slopes, historical landslide areas, and mitigation strategies.
- Encourage individual homeowners to implement mitigation practices;
- Include insurance information in public outreach and education materials;
- Promote purchase of appropriate insurance coverage;
- Educate the public about the resources available for hazard mitigation, response, and preparedness;
- Use faith based, civic and humanitarian, and business groups to affiliate volunteers; and
- Create an unmet needs committee and long-term recovery committee to create a pool of volunteers that can take in needs requests during a small event.

Coordinating Organization:	Damascus Public Involvement Coordinator

Internal Partners:	**External Partners:**
Boring Fire District; Damascus Public Works Department; Clackamas Fire District #1	Clackamas County, Oregon Partnership for Disaster Resilience, Community Organizations Active in Disaster (COAD)

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
Ongoing		

Form Submitted by:	SEOC
Status	New Action, 2009

Multi Hazard #2

Proposed Action Item:	**Alignment with Plan Goals:**
Integrate the goals and action items from the Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.	***Protect Life and Property, Promote Public Awareness, Enhance Natural Systems, Encourage Partnerships and Implementation, Augment Emergency Services***

Rationale for Proposed Action Item:

- The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Incorporating natural hazards plans into comprehensive plans, local ordinances, and land-use regulations will ensure that communities implement the proper mitigation measures for their community.

Ideas for Implementation:

- Use the mitigation plan to help the City's Comprehensive Land Use Plan meet State Land Use Planning Goal 7, designed to protect life and property from natural disasters and hazards through planning strategies that restrict development in areas of known hazards;
- Use zoning codes to regulate development in hazard-prone areas;
- Integrate the city's mitigation actions into the current emergency operations plan and capital improvement plans (where appropriate);
- Partner with other organizations and agencies with similar goals to promote building codes that are more disaster resistant at the state level;
- Use citizen input for the creation of appropriate ordinances; and
- Use the natural hazard mitigation planning resources provided by the Oregon Partnership for Disaster Resilience to learn how to better integrate the NHMP into existing documents and programs.

Coordinating Organization:	Damascus Planning Department

Internal Partners:	**External Partners:**
Damascus Public Works Department	OPDR

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
Ongoing		

Form Submitted by:	SEOC
Status	New Action, 2009

Multi Hazard #3

Proposed Action Item:	**Alignment with Plan Goals:**
Identify and pursue funding opportunities to develop and implement hazard mitigation activities.	***Protect Life and Property, Promote Public Awareness, Enhance Natural Systems, Encourage Partnerships and Implementation, Augment Emergency Services***

Rationale for Proposed Action Item:

- Implementation cannot occur without proper funding. The switch from planning to implementation is the step that begins the reduction of risk.
- The Pre-Disaster Mitigation Grant Program provides funds for hazard mitigation planning and project implementation prior to a disaster event. PDM grants are nationally competitive.
- The Hazard Mitigation Grant Program provides funds to implement long-term hazard mitigation measures and projects after a major disaster declaration. HMGP funds are available to communities within states that have recently received Presidential Disaster Declarations. HMGP funds are prioritized for communities that are directly affected by a disaster, but communities outside of the disaster declaration are typically eligible as well.
- Flood Mitigation Assistance helps communities implement measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the National Flood Insurance Program.

Ideas for Implementation:

- Meetings will be held semi-annually to discuss, update, and implement actions in the NHMP. Funding opportunities should also be discussed at the semi-annual meetings.
- Develop incentives for special service districts, citizens, and businesses to pursue hazard mitigation projects;
- Review mitigation projects during each city budget review cycle;
- Allocate city resources and assistance to mitigation projects when possible; and
- Partner with other organizations and agencies to identify grant programs and foundations that may support mitigation activities.

Coordinating Organization:	Damascus Planning Department, Public Works Department, GIS Department, Public Involvement Coordinator, Boring/Clackamas Fire District #1 Fire Prevention Division, Damascus EOC

Internal Partners:	**External Partners:**
SEOC, Finance Department	Oregon Emergency Management, FEMA Region X

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
Ongoing		

Form Submitted by:	SEOC
Status	New action, 2009

Multi Hazard #4

Proposed Action Item:	**Alignment with Plan Goals:**
Continue to update and improve hazard assessments in the Natural Hazards Mitigation Plan as new information becomes available.	***Promote Public Awareness, Augment Emergency Services***

Rationale for Proposed Action Item:

- The city was unable to conduct a quantitative risk analysis for most hazards.
- Oregon updates the state risk assessment once every three years. Communities are informed of new risk information if it affects areas in their jurisdiction.
- New demographic data will become available after the 2010 census. Damascus incorporated in 2004, meaning the 2010 census will be the first time the city of Damascus will be represented. The new census information could alter the GIS maps.

Ideas for Implementation:

- Actively use data to update vulnerability assessment;
- Update hazards maps;
- Use new data to guide public outreach programs and update educational outreach pieces as new data becomes available;
- Update codes and city policies when new data and information becomes available as required by state planning goal 7; and
- Cooperate with participating agencies to secure funding needed to obtain data to perform a risk analysis.

Coordinating Organization:	Damascus GIS Department & Planning Department

Internal Partners:	**External Partners:**
NFTST or designated committee, Damascus Planning Department	Clackamas County, DOGAMI

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
Ongoing		

Form Submitted by:	SEOC
Status	New Action, 2009

Multi Hazard #5

Proposed Action Item:	**Alignment with Plan Goals:**
Implement the recommendations identified in the Natural Hazards Report.	***Protect Life and Property, Promote Public Awareness, Enhance Natural Systems, Encourage Partnerships and Implementation, Augment Emergency Services***

Rationale for Proposed Action Item:

- The Natural Hazards Report details the geologic and seismic hazards, wildfire hazards, windthrow hazards and flood hazards. The inventory provides an important base of information and strategy recommendations on natural hazards.

Ideas for Implementation:

- Review all recommendations and determine priority for implementation; and
- Identify funding sources to implement recommendations.

Coordinating Organization:	NFTST or designated committee

Internal Partners:	**External Partners:**
Damascus Planning Department	Clackamas County, OEM

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	Ongoing	

Form Submitted by:	SEOC
Status	New Action, 2009

Multi Hazard #6

Proposed Action Item:	**Alignment with Plan Goals:**
Improve vegetation management throughout the city.	***Protect Life and Property, Promote Public Awareness, Enhance Natural Systems, Encourage Partnerships and Implementation***

Rationale for Proposed Action Item:

- Landscaping and vegetation make a difference in mitigating the impacts of natural hazards. Trees break the force of the wind and stabilize the soil. Wetlands absorb much of the overflow from stream channels. Fire-resistant vegetation can retard the spread of wildfires toward vulnerable buildings. Limiting or regulating the amount of vegetation cleared off a hillside lot reduces the risk of increasing the number of landslide-prone areas in a community. Planting vegetation or maintaining slope terraces can also reduce slope-runoff. Planners can use landscaping requirements to preserve or enhance the protection such natural features afford. These requirements may be part of site plan reviews or a separate set of zoning regulations and environmental performance standards.

Ideas for Implementation:

- Partner with Clackamas County, Oregon Department of Forestry, US Forestry Service, ODOT, and citizens to control vegetation along transportation corridors;
- Identify appropriate practices for eliminating invasive species;
- Maintain healthy urban canopy;
- Maintain vegetation coverage for slope stability;
- Identify hazardous trees for remediation or removal;
- Coordinate with watershed councils and others;
- Review and update existing ordinances to incorporate and improve vegetation management on private property;
- Develop mechanism to review vegetation on a case by case basis;
- Provide education to the public about justifications for, and benefits of vegetation mitigation practices; and
- Encourage fuels reduction on private property by providing education for pruning and remove trees and using native vegetation

Coordinating Organization:	Public Works Department

Internal Partners:	**External Partners:**
SEOC, Damascus Planning Department, Code Enforcement	Clackamas Soil and Water Conservation District, Fire Co-op, Oregon Department of Forestry, US Forestry Service, Clackamas County, Clackamas River Basin Council

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	Ongoing	

Form Submitted by:	SEOC
Status	New Action, 2009

Multi Hazard #7

Proposed Action Item:	**Alignment with Plan Goals:**
Encourage structural mitigation practices in developments at risk to hazards.	***Protect Life and Property, Promote Public Awareness, Enhance Natural Systems, Encourage Partnerships and Implementation***

Rationale for Proposed Action Item:

- Strengthening facilities will improve recovery capacity and reduce risk and loss of life.
- A hazard event may negatively impact a local economy, especially if a community's businesses are located in the floodplain, near steep slopes, in the wildland-urban interface, or in unreinforced masonry buildings.
- Promoting structural mitigation can assist property owners in identifying their vulnerability to hazards and identifying mitigation activities. Encouraging property owners with this may increase the likelihood that property owners would share responsibility for mitigation on their properties and implement mitigation activities.
- Incentive programs include a variety of benefits to building owners or developers that help to offset the cost of mitigation. Examples of possible incentive programs include: density bonuses, tax credits, property tax incentives or deferrals, real estate disclosures, property acquisition or purchase of development rights, increased funding of public infrastructure programs, and phasing retrofitting programs over a longer period of time.

Ideas for Implementation:

- Flood – construct retention ponds, swales, and dikes/ditches/culverts; elevated buildings
- Landslide – construct retention ponds and retaining walls; enforce proper drainage; contract for geological studies
- Wildfire – create defensible space; reduce fuels; construct streets wide enough to allow for easy emergency vehicle maneuverability
- Earthquake – retrofit buildings to meet seismic standards
- Severe Storms – encourage construction of sloped roofs; improve chimney bracing; store deicing agents
- Volcano – encourage construction of sloped roofs
- Boring Fire District is currently developing a disaster series to educate citizens about ways to prevent and prepare for disasters.

Coordinating Organization:	Damascus Planning Department

Internal Partners:	**External Partners:**
Damascus GIS Department, Boring Fire District, Clackamas Fire District #1	Sandy Fire District #72, Clackamas County

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	Ongoing	

Form Submitted by:	SEOC
Status	New Action, 2009

Flood #1

Proposed Action Item:	**Alignment with Plan Goals:**
Continue to implement and enhance the flood public education program designed to inform local residents about: • The causes of local drainage problems, flooding and landslides; • Why channels, ditches and swales should be created and maintained; • What owners can do to protect their properties; • The penalties for dumping in or altering watercourses; • Information regarding health and safety issues resulting from the flooding hazard (such as sewerage leakages); • Educating about types of flooding and benefits of flooding as a natural process; and • Educate about the benefits of vegetation in floodplains	***Protect Life and Property, Promote Public Awareness, Enhance Natural Systems, Encourage Partnerships and Implementation,***

Rationale for Proposed Action Item:

- Conducting public outreach campaigns raises awareness about natural hazards and helps illustrate what residents and businesses can do to reduce the impact of a natural disaster on their properties, thereby significantly reducing the impact of natural hazards on the City of Damascus.
- The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(ii)]. Developing public education programs for hazard risk mitigation would be a way to keep the public informed of, and involved in, the county's actions to mitigate hazards.

Ideas for Implementation:

- Community-wide dissemination of information through newsletters and websites;
- Promote purchase of appropriate floodplain insurance coverage;
- Use GIS database to identify property owners in flood prone areas, and target these people for a group mailing; and
- Distribute flood preparedness information.

Coordinating Organization:	Damascus Public Involvement Coordinator

Internal Partners:	**External Partners:**
GIS Coordinator; Planning Department	Clackamas County

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
Ongoing		

Form Submitted by:	SEOC
Status	New Action, 2009

Flood #2

Proposed Action Item:	**Alignment with Plan Goals:**
Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.	***Protect Life and Property, Promote Public Awareness, Enhance Natural Systems, Encourage Partnerships and Implementation, Augment Emergency Services***

Rationale for Proposed Action Item:

- The National Flood Insurance Program provides communities with federally backed flood insurance to homeowners, renters, and business owners, provided that communities develop and enforce adequate floodplain management ordinances. The benefits of adopting NFIP standards for communities are a reduced level of flood damage in the community and stronger buildings that can withstand floods. According to the NFIP, buildings constructed in compliance with NFIP building standards suffer approximately 80 percent less damage annually than those not built in compliance.
- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Continued participation in the NFIP will help reduce the level of flood damage to new and existing buildings in communities while providing homeowners, renters and business owners additional flood insurance protection.

Ideas for Implementation:

- Community Assistance Visits (CAV) are scheduled visits to communities participating in the NFIP for the purpose of: 1) conducting a comprehensive assessment of the community's floodplain management program; 2) assisting the community and its staff in understanding the NFIP and its requirements; and 3) assisting the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered. Actively participate with DLCD and FEMA during Community Assistance Visits.
- Conduct an assessment of the floodplain ordinances to ensure they reflect current flood hazards and situations, and meet NFIP requirements.
- Coordinate with the county to ensure that floodplain ordinances and NFIP regulations are maintained and enforced.
- Mitigate areas that are prone to flooding and/or have the potential to flood. These areas include portions of Highway 224, SE Eilers Circle, S. Springwater Road, and most of the Carver Mobile Home Ranch.

Coordinating Organization:	Damascus Planning Department

Internal Partners:	**External Partners:**
EOC	FEMA, DLCD, Clackamas County Planning Department

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
Ongoing		

Form Submitted by:	SEOC
Status	New Action, 2009

Flood #3

Proposed Action Item:	**Alignment with Plan Goals:**
Explore participation in the NFIP's Community Rating System (CRS).	***Protect Life and Property, Promote Public Awareness, Enhance Natural Systems, Encourage Partnerships and Implementation, Augment Emergency Services***

Rationale for Proposed Action Item:

- The Community Rating System (CRS) is operated under the National Flood Insurance Program (NFIP). The NFIP provides flood insurance to homes and businesses located in floodplains at a reasonable cost, and encourages the movement of development away from the floodplain. The program is based upon mapping areas of flood risk, and requiring local implementation to reduce that risk, primarily through restrictions on new development in floodplains. CRS recognizes community efforts that go beyond the minimum standards of the NFIP. This recognition is in the form of reduced flood insurance premiums for communities that adopt such standards. CRS encourages community activities that reduce flood losses, facilitate accurate insurance rating, and promote flood insurance awareness.

Ideas for Implementation:

- Identify staff or community members to lead participation efforts; and
- Review CRS participation requirements and take steps towards reaching the first ranking.

Coordinating Organization:	Damascus Planning Department

Internal Partners:	**External Partners:**
Damascus Community Department	FEMA, DLCD, OEM, Clackamas County Planning Department

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
Ongoing		

Form Submitted by:	SEOC
Status	New Action, 2009

Flood #4

Proposed Action Item:	**Alignment with Plan Goals:**
Develop a stormwater management plan.	***Protect Life and Property, Enhance Natural Systems***

Rationale for Proposed Action Item:

- Damascus does not currently have a comprehensive Stormwater Management Plan.
- Stormwater management is a key element in maintaining and enhancing a community's livability. There is a direct link between stormwater and a community's surface and ground waters. As a community develops, the impervious surfaces that are created increase the amount of runoff during rainfall events, disrupting the natural hydrologic cycle. Without control, these conditions erode stream channels and prevent groundwater recharge. Parking lots, roadways, and rooftops increase the pollution levels and temperature of stormwater runoff that is transported to streams, rivers, and groundwater resources. Protecting these waters is vital for a great number of uses, including fish and wildlife habitat, recreation, and drinking water.

Ideas for Implementation:

- Identify appropriate staff members to work on developing a stormwater management plan;
- Research consulting firms that specialize in stormwater management plans;
- Identify funding to create the plan; and
- Identify mitigation action items that reduce the city's vulnerability to flood and landslide related hazards

Coordinating Organization:	Damascus Planning Department, Public Works Department

Internal Partners:	**External Partners:**
Damascus Planning and Public Works Departments	Clackamas County Water Environment Services, Oregon Department of Environmental Quality

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
Ongoing		

Form Submitted by:	SEOC
Status	New Action, 2009

Flood #5

Proposed Action Item:	Alignment with Plan Goals:
Promote and protect the use of naturally flood prone open space or wetlands as flood storage areas.	***Protect Life and Property, Promote Public Awareness, Enhance Natural Systems, Encourage Partnerships and Implementation***

Rationale for Proposed Action Item:

- One of the goals of the National Flood Insurance Program is to protect the natural and beneficial functions of floodplains. Natural and beneficial floodplain functions include both the natural infiltration capacities of floodplains, as well as minimizing the pollutants that can enter waters from floodplain development activities. A number of options local governments can choose from are: 1) Prohibit all activities in the floodplain that may be hazardous to public health or water quality (e.g. septic systems, storage of hazardous materials) 2) Require new floodplain developments to avoid or minimize disruption to stream channels and stream banks 3) Adopt regulations pursuant to a Habitat Conservation Plan approved by the US Fish and Wildlife Service or the National Marine Fisheries Service.

Ideas for Implementation:

- Develop and implement flood protection alternatives for properties within and adjacent to the 100-year floodplain by taking into account city codes related to the floodplain.
- Gain support for protecting naturally flood prone open space by educating the public of its importance

Coordinating Organization:	Damascus Planning Department

Internal Partners:	External Partners:
Damascus Planning, GIS, and Public Works Departments	Clackamas Soil and Water Conservation District, Division of State Lands, Johnson Creek Watershed Council, Clackamas River Basin Council

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	Ongoing	

Form Submitted by:	SEOC
Status	New Action, 2009

Flood #6

Proposed Action Item:	**Alignment with Plan Goals:**
Identify specific properties within Carver Mobile Home Ranch and identify feasible mitigation options.	***Protect Life and Property, Promote Public Awareness, Enhance Natural Systems, Encourage Partnerships and Implementation, Augment Emergency Services***

Rationale for Proposed Action Item:

- The Carver Mobile Home Ranch is located on the Clackamas River and is subject to frequent flooding. Much of the property is located within the floodplain.

Ideas for Implementation:

- Identify specific properties at risk to the flood hazard;
- Use federal grant funds to acquire or elevate individual properties within the floodplain; and
- Partner with agencies interested in pursuing land acquisition.

Coordinating Organization:	Damascus Planning Department

Internal Partners:	**External Partners:**
EOC	METRO, FEMA, DLCD, Clackamas County Planning Department

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
Ongoing		

Form Submitted by:	SEOC
Status	New Action, 2009

Landslide #1

Proposed Action Item:	**Alignment with Plan Goals:**
Maintain and update an inventory of streets and properties threatened by landslides.	***Encourage Partnerships and Implementation, Augment Emergency Services***

Rationale for Proposed Action Item:

- The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Developing an inventory of landslide areas can help a community identify which streets might be more vulnerable to damage. Such information can help a community in better identifying and prioritizing projects that can assist a community in mitigating its overall risk to landslides.
- Areas that have experienced landslides in the past include: the area northwest of Rodlund Road, the area south of 190th Court and Debora Drive, Foster Road, Eckert Road, Borges Road, Barton Park, Kingswood Way, Highway 212, Highway 224, the area east of the Carver Bridge, and the area of Royer Road above Highway 224.

Ideas for Implementation:

- Utilize technology, geologic resources, and other available data to identify areas of slope risk;
- Identify areas where strategic planting could assist in soil stabilization; and
- Coordinate with DOGAMI to receive LiDAR data for Damascus.

Coordinating Organization:	Damascus GIS Department

Internal Partners:	**External Partners:**
Damascus Planning, GIS, and Public Works Departments	DOGAMI, Clackamas County GIS, Oregon Department of Transportation

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
Ongoing		

Form Submitted by:	SEOC
Status	New Action, 2009

Landslide #2

Proposed Action Item:	**Alignment with Plan Goals:**
Reduce the vulnerability of property owners in landslide-prone areas.	***Protect Life and Property, Promote Public Awareness, Enhance Natural Systems***

Rationale for Proposed Action Item:

- The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for landslides to cause damage can assist a community in mitigating its overall risk to landslide events.
- Areas that have experienced landslides in the past include: the area northwest of Rodlund Road, the area south of 190th Court and Debora Drive, Eckert Road, Borges Road, Kingswood Way, Highway 212, Highway 224, the area east of the Carver Bridge, and the area of Royer Road above Highway 224.

Ideas for Implementation:

- Conduct a study to identify appropriate mitigation strategies for problem areas including buildings and infrastructure in the problem areas;
- Develop public information to emphasize economic risk when building on potential or historical landslide areas;
- Update the landslide hazard map when LIDAR data becomes available; and
- Review the planning and building codes and make updates or changes, if necessary.

Coordinating Organization:	Damascus Planning Department

Internal Partners:		**External Partners:**
Damascus Planning and GIS Departments		DOGAMI, Clackamas County
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
Ongoing		

Form Submitted by:	SEOC
Status	New Action, 2009

Wildfire #1

Proposed Action Item:	**Alignment with Plan Goals:**
Promote fire-resistant strategies for existing and new developments.	***Protect Life and Property, Promote Public Awareness, Enhance Natural Systems, Encourage Partnerships and Implementation, Augment Emergency Services***

Rationale for Proposed Action Item:

- The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on existing and new buildings and infrastructure [201.6(c)(3)(ii)]. Developing and implementing programs to improve fire-resiliency will reduce the potential for wildfires to cause damage and can assist a community in mitigating its overall risk to wildfire events.

Ideas for Implementation:

- Require fuel breaks in site plans, describe the procedures for ongoing maintenance, and place information on the city website for public view;
- Review roofing standards and develop recommendations for promoting non-combustible roofing;
- Encourage installation of double pane windows;
- Promote use of sprinkler systems in residential construction;
- Maintain awareness of potential city growth into the wild land urban interface; and
- Encourage defensible space creation and use of fire resistant landscaping.

Coordinating Organization:	Boring Fire Prevention Division

Internal Partners:	**External Partners:**
Damascus Planning Department	Boring Fire District, Clackamas Fire District #1, Clackamas County Fire Prevention Co-op, Firewise

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
Ongoing		

Form Submitted by:	SEOC
Status	New Action, 2009

Wildfire #2

Proposed Action Item:	**Alignment with Plan Goals:**
Mitigate life loss due to wildfires.	***Protect Life and Property, Promote Public Awareness, Encourage Partnerships and Implementation, Augment Emergency Services***

Rationale for Proposed Action Item:

- The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Developing and implementing programs to mitigate life-loss will reduce the potential for wildfires to harm citizens and can assist a community in mitigating its overall risk to wildfire events.
- The forests surrounding Damascus have accumulated an unnatural buildup of fuel as a result of decades of timber harvest and aggressive fire suppression. Additionally, residential development near the wildland urban interface has increased exposure to wildfire hazards.

Ideas for Implementation:

- Develop evacuation plans;
- Ensure structural mitigation measures are met;
- Equip and train first responders;
- Ensure evacuation routes are well marked; and
- Require street design that facilitates the movement of fire fighting equipment

Coordinating Organization:	Boring Fire Prevention Division

Internal Partners:	**External Partners:**
EOC	Clackamas Fire District #1, Clackamas County Fire Prevention Co-op

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
Ongoing		

Form Submitted by:	SEOC
Status	New Action, 2009

Severe Storm #1

Proposed Action Item:	**Alignment with Plan Goals:**
Reduce negative effects from severe windstorm and severe winter storm events.	***Protect Life and Property, Promote Public Awareness, Encourage Partnerships and Implementation, Augment Emergency Services***

Rationale for Proposed Action Item:

- The Disaster Mitigation Act of 2000 requires communities to identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure[201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for wind and winter storms to cause power outages can assist a community in mitigating its overall risk to wind and winter storms.

Ideas for Implementation:

- Reduce power outages by partnering with PGE to obtain funding to bury power lines subject to frequent failures;
- Encourage burial of power lines for existing development;
- Ensure that there are back up underground lines to major businesses & employers;
- Develop partnerships to implement programs to keep trees from threatening lives, property, and public infrastructure;
- Continue regular tree trimming practices;
- Partner with PGE to continue hazardous tree inventory and mitigation programs;
- Create sheltering programs; and
- Promote safe installation and use of generators.

Coordinating Organization:	Damascus EOC

Internal Partners:	**External Partners:**
Planning and Public Works Departments	PGE

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	Ongoing	

Form Submitted by:	SEOC
Status	New Action, 2009

Earthquake #1

Proposed Action Item:	**Alignment with Plan Goals:**
Reduce negative impacts of earthquakes by performing seismic evaluations and retrofits.	***Protect Life and Property, Encourage Partnerships and Implementation, Augment Emergency Services***

Rationale for Proposed Action Item:

- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for earthquakes to cause damage can assist a community in mitigating its overall risk to earthquakes.
- Pre-disaster mitigation strategies will reduce post-disaster response needs by lessening life loss, injury, damage, and disruption.
- Refer to risk assessment, and DOGAMI's rapid visual assessment scores

Ideas for Implementation:

- Obtain funding to perform seismic evaluations;
- Conduct seismic evaluations on identified community assets (including shelters) for implementing appropriate structural and non-structural mitigation strategies;
- Prioritize seismic upgrades based on criticality of need and population served;
- Seismically retrofit critical government facilities to guarantee continuous operation during and after a natural disaster;
- Partner with appropriate organizations to implement seismic upgrades;
- Update COOP plans; and
- Create damage assessment procedures.

Coordinating Organization:	Damascus EOC

Internal Partners:	**External Partners:**
Planning Department	DOGAMI, Clackamas County

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	Ongoing	

Form Submitted by:	SEOC
Status	New Action, 2009

Appendix B: Planning and Public Process

The following appendix documents Damascus's natural hazards mitigation planning and public involvement processes.

Work Sessions

Meeting: Damascus/Sandy Natural Hazard Mitigation Plan Meeting 1
Date: February 20, 2009
Time: 9:00am to 1:00pm
Location: Sandy Main Fire Station

MINUTES

1. Meeting Attendees
    a. Chris Alfino, City of Damascus
    b. Seth Atkinson, City of Sandy
    c. Carnetta Boyd, Corbett NERT
    d. Craig Brooks, Oregon Trail School District
    e. Megan Findley, Oregon Partnership for Disaster Resilience
    f. Alice Lasher, Sandy Fire
    g. Gary McQueen, Sandy Fire
    h. Martin Mongomery, City of Sandy
    i. Erika Palmer, City of Damascus
    j. Laurel Reimer, Clackamas County Emergency Management
    k. Kathleen Reiter, Corbett NERT HAM
    l. Jim Seipel, Oregon Trail School District
    m. Harold Skelton, Sandy Police Department
    n. Helen Turner, Estacada Fire

2. Planning Process Discussion
    a. Laurel provided a brief overview of the disaster cycle and emphasized that the Natural Hazard Mitigation Plan (NHMP) focuses on mitigation, not response, recovery, or preparedness.
    b. Next Laurel provided an overview of the planning process and briefly explained each agenda item and an overview of the next meeting on action items.
    c. Laurel asked the group to review the county's mission and goals. The committee adopted the county mission and goals
    d. Laurel asked the group to identify a person to serve as convener
        i. Alice Lasher will serve as Sandy's convener
        ii. Erika Palmer will serve as Damascus' convener
    e. Then Laurel asked each city who will serve as the NHMP coordinating body
        i. The Sandy Emergency Operations Center Group (SEOCG) will serve as Sandy's coordinating body
        ii. The Damascus Natural Features Topic Specific Team (TST) will serve as Damascus' coordinating body
    f. Finally Laurel asked each city to identify ways the public will stay informed about the NHMP. Sandy and Damascus will do the following to inform and involve the public:
        i. Meeting minutes will be sent out to the community organizations invited to attend the meetings so they can make comments. Many

of these community organizations were unable to attend the first meeting but their input would be valuable.

ii. Once the plan has been finished, each city will present the plan to the public so they can comment on it before the City Council adopts it.
iii. A press release will be sent to the local papers to inform the city the NHMP will be presented to the City Council
iv. The NHMP will be available online at each city's website and hard copies in offices around the city
v. The plan will be available during any city open house events
vi. A link to the NHMP will be posted on numerous city websites, such as the fire department website
vii. Each city's NHMP will be available online at the Oregon Partnership for Disaster Resilience site, and on the University of Oregon Scholars Bank site
viii. Public meetings will be scheduled when deemed necessary, such as after a natural hazard event.

3. Critical/Essential Facilities & Infrastructure
    a. Laurel provided each city with a list of example critical and essential facilities and asked each city to come up with a list of assets in their own communities.
    b. Gary McQueen provided Laurel with a detailed list of Sandy's community assets from the Sandy Fire District #72 2008 Risk Assessment study. The list includes schools, special populations, mobile homes and hotels, churches, fuel/oil stations, hazardous materials locations, infrastructure and utilities, transportation networks, food/supply stores, and public facilities.
    c. The City of Damascus has similar lists of community assets but did not bring it to the meeting. Erika Palmer will update the Damascus list.
    d. Alice Lasher and Erika Palmer will sit down together and review each city's list to ensure all assets are listed. Once this list is created they will post it to each city's website to allow time for the public to comment on the list.
    e. Once the lists have been finalized they will be sent to Laurel for inclusion in each city's plan.

4. Hazard Identification
    a. Laurel created a handout detailing each of the following hazards: flood, landslide, wildfire, earthquake, severe storms, and volcano. The group went over each hazard and added information on causes and characteristics, history, location and extent, impacts, and mitigation efforts completed thus far. Finally the group compared each city's probability of future occurrence and vulnerability ratings to the county's ratings.

b. Both cities noted that they have a fair amount of pre-existing, non-conforming developments in city limits.
c. Both cities also noted they have large numbers of mobile homes. Manufactured homes are at a higher risk to damage than stick and mortar buildings.

d. Flood
    i. HISTORY:
        1. The flooding history in the county's NHMP accurately details the historical flooding events in Damascus and Sandy.
        2. The January 1-2, 2009 winter storm event led to flooding throughout Sandy and Damascus. Both cities agreed this flood event was worse than the 1996 floods. Interestingly the floodplains were not as impacted as areas outside of the traditional floodplain. This flood event mostly impacted each city's culverts and smaller tributaries. Many homeowners rerouted these smaller tributaries and caused more damage and flooding to their neighbors and other parts of the city.
    ii. LOCATION AND EXTENT:
        1. The smaller tributaries in Sandy include Tickle Creek, Cedar Creek, Badger Creek, and numerous culverts alongside roads. The Sandy River is Sandy's main tributary.
        2. The smaller tributaries in Damascus include: Rock Creek, Richardson Creek, Sunshine Creek, Nover Creek and Deep Creek. Many of the city's creeks have their own local names or no names because they are so small. The Clackamas River is Damascus' main tributary.
    iii. IMPACTS:
        1. Many citizens in Sandy and Damascus depend on culvert bridges to get to their homes and some of these culverts were washed out, cutting off citizens from their homes.
        2. The culvert along Hwy 212 (Damascus) eroded to the side of the pavement in some places.
        3. In Damascus one home is built in the natural stream bed so water rushed into their home during the Jan 2009 event. The tributaries leading to this house had to be rerouted to divert water away from the home.
        4. Other Damascus homes had basement flooding.
        5. Sandy lost two trailers and many homes experienced crawlspace flooding.
        6. Carver Mobile Home Ranch in Damascus is located in the floodplain and has flooded in the past.

7. Sandy's sewage treatment plant could be isolated in a bad flood because the road leading to the plant is in the floodplain and could be washed out.
8. In Damascus many roads have been cut off in past flooding events including Telford Road, Johnson Creek Road, Foster (Hwy 26), and Troge Road. Erika Palmer will provide Laurel with a list of these roads.

iv. MITIGATION EFFORTS:
1. Sandy has a stormwater management plan and Damascus is working on one. The Damascus stormwater management plan will include a comprehensive drainage assessment.
2. Damascus has hired people to clean out culverts.
3. Both cities are working on a "disaster series" for the residents in east Clackamas County. They would like to host classes on flood mitigation practices, including information on proper culvert maintenance.
4. Sandy would like to do more landslide assessments with relevant agencies and public involvement. This could be an action item for next meeting.
5. Both cities are participants in the National Flood Insurance Program
6. Damascus has a floodplain ordinance.
7. Damascus is in the process of implementing bio-soils.
8. Sandy has stormwater detention basins build into all systems which release water into streams slowly.

v. PROBABILITY OF FUTURE OCCURRENCE
1. Sandy and Damascus say the probability is high, which is in agreement with the county's rating.

vi. VULNERABILITY ASSESSMENT
1. Sandy and Damascus rate their vulnerability as medium, which is higher than the county's low rating. This is because Damascus and Sandy are largely bedroom communities so they depend on traveling out of the city for work. In large flooding events their transportation routes could be cut off.

e. Landslide

i. HISTORY:
1. The county plan lists landslides on the following streets in Damascus: Ridge Road, Gronlund Road, Lusted Road, Borges Road, Barton Park, Fabion Loop(might be in the Welches area), Hwy 26, Hwy 224. Erika will send Laurel the list of historic landslides in Damascus.
2. The county plan lists landslides on the following streets in Sandy: Gronlund Road (not in the sandy area), Lusted

Road, Fabion Loop (not in the sandy area), Ten Eyck Road, Hwy 26, Bluff Road, Barlow Trail, Laughing Water Road, Salmon River Road

3. Damascus has a map of all historical slides
4. Sandy - 1980 Ten Eyck Road slide left hwy 26 closed for 3 to 4 months
5. January 1-2, 2009 – the severe winter storm led to flooding and landslides. A landslide took out the 911 service in Sandy for some time due to a fiber optic cable being damaged.

ii. LOCATION AND EXTENT:

1. Hwy 26 and 224 have had historic slide events
2. Coalman Road in Sandy has steep slopes on the east end and saw minor activities in the January 2009 event
3. Laughing Water Road in Sandy has had some sliding activity
4. Bluff Road in Sandy is a potential slide area. Good vegetation is established along the road but it's a very steep slope and in some areas there isn't too much slope along the road.
5. Park Street in Sandy is built entirely on fill. Areas built on fill are subject to liquefaction in a earthquake event.
6. Kingswood Drive in Damascus has their own private water utility on top of a hill.

iii. IMPACTS:

1. If Bluff Road in Sandy slid it could take out the water line. There are not too many customers on Bluff Road so the impact would not be very great.
2. Park Street has houses built on it so a landslide event would greatly impact them.
3. Significant economic impacts are possible with local and/or regional landslides that impact transportation routes, especially when you take out the road to Mt. Hood (skiing).
4. Social impacts too (visually unappealing, etc).
5. Water quality and wildlife habitat could be impacted by a large slide. Sandy has an agreement with Portland to get water assistance. They will have two separate water sources when the agreement is done (Bull Run water).
6. Sandy and Damascus have a big mountain biking/hiking community so these could be impacted in addition to the ecosystem issues.
7. There is a water diversion dam on alder creek accessible by helicopter and going through the creek. They doubt a slide would plug the dam but if a lot of trees came down into the creek it could plug the diversion intake. It would be

unlikely they would be able to move equipment into this area within any reasonable amount of time.

iv. MITIGATION EFFORTS:
    1. Damascus is in the works of putting together a steep slope development code to create steep slope overlays.

v. PROBABILITY OF FUTURE OCCURRENCE
    1. Damascus and Sandy both agree with the county's high probability rating

vi. VULNERABILITY ASSESSMENT
    1. Damascus and Sandy both say they have a moderate vulnerability to landslides. This is higher than the county's low rating because these cities rely on highways 26 and 224 so much. There have been many historical slides along these routes and cutting off the highways has a huge impact on the cities, and on tourism.

f. Wildfire

i. HISTORY:
    1. While the history of wildfires is minimal, it doesn't provide a proper indication of the level of risk the cities are at. There is an unnatural buildup of fuels in the forests, creating a very high level of risk.
    2. Debris burn escape is the biggest source of fire in eastern Clackamas County.

ii. LOCATION AND EXTENT:

iii. IMPACTS:
    1. None of the benefits listed in the county's NHMP will actually be "benefits" because the forest is no longer in a natural state. The fires will completely destroy the soil due to the high amount of fuel buildup on the forest floor.
    2. West of the cascades there is a much higher risk of catastrophic wildfire because the climate prevents frequent occurrence of wildfires.

iv. MITIGATION EFFORTS:
    1. Sandy has a community wildfire protection plan but the risk assessment will need to be updated slightly.
    2. Boring Fire District has a wildfire protection plan.
    3. Both cities participated in the creation of the Clackamas County Community Wildfire Protection Plan.
    4. Sandy Fire District #72 offers classes on defensible land space.
    5. Sandy Fire posts signs at nurseries informing people of fire resistant plants, pruning classes.
    6. Biomass utilization efforts going on in the county
    7. The cities participate in the Fire Prevention Co-op.

8. Sandy has an “Ask Alice” column in their local newspaper which provides the citizens to ask Alice Lasher fire and emergency questions.
9. Sandy has a media awareness campaign during fireworks season.
10. Both cities have forms that identify access issues to houses with too many branch overhangs.
11. Both cities have nuisance ordinances that prohibit tall grasses within city limits.
12. Sandy Fire purchased Trimble units – handheld GPS units that can be used for a fire risk assessment. At this time they do not have the capability to do this.

v. PROBABILITY OF FUTURE OCCURRENCE
   1. Sandy and Damascus both agree their vulnerability is ‘moderate’, which is in agreement with the county’s plan.

vi. VULNERABILITY ASSESSMENT
   1. Sandy and Damascus both agree their vulnerability is ‘high’, higher than the county’s ‘moderate’ rating. This is because many areas in these cities do not have evacuation plans and they only have one way in and one way out. Loss of life is a huge potential because of this.

g. Severe Storm: Wind and Winter
   i. Sandy isn’t always influenced by the cold air from the gorge.
   ii. HISTORY:
      1. January 1980 – people were without power for about a week and a half
      2. December 2003 to January 2004 - 3 inches of ice covered the cities. A fire started in Sandy after a power line was pulled down. Many injuries occurred from people falling on the ice or getting their legs caught and twisted in the ice.
      3. November/December 2006 – trees fell onto Hwy 26 and it had to be closed
      4. January 1-2, 2009 – the snow levels were so high the fire hydrants were covered and difficult to find. Sandy lost 911 service for some time because of a landslide. Snowmobiles were needed to access some citizens on private access roads. Some people needed help getting out of their homes for medical appointments, food shopping, and prescription refills.
   iii. LOCATION AND EXTENT: City-wide
   iv. IMPACTS:
      1. Every year Sandy loses power to the water plant but they have a generator now. The power is often cut by falling trees.

2. A shelter was activated in Damascus for the winter storm of January 1-2, 2009

v. MITIGATION EFFORTS:
   1. The utility company trims the trees around the power lines
   2. Sandy Fire Department bought two 4-wheel drive fire engines so they could maneuver easier in the ice/snow
   3. Sandy Transit Department bough a 4 wheel drive vehicle which was used to transport citizens to get supplies, etc
   4. Sandy has a CERT Team
   5. Volunteer Now is a database for citizens to register what resources they have

vi. PROBABILITY OF FUTURE OCCURRENCE
   1. Sandy and Damascus say the probability of wind events is 'high', which is higher than the county's 'moderate' rating. The cities seem to have a wind event each year.
   2. Sandy and Damascus agree with the county's 'high' rating for winter storm events

vii. VULNERABILITY ASSESSMENT
   1. Sandy and Damascus agree with the county's 'moderate' vulnerability rating for winter storms.
   2. Damascus and Sandy say the vulnerability to wind storms is 'moderate' because they get them every year and most of their utilities are above ground, making them more vulnerable to falling tree branches and wind debris.

h. Earthquake

i. HISTORY:
   1. The county plan accurately details the earthquake events for Damascus and Sandy.
   2. March 25, 1993 – Molalla high school had to tear down buildings because it was severely damaged

ii. LOCATION AND EXTENT: city-wide

iii. IMPACTS:
   1. Sandy Main Fire Station, Damascus fire station, and Roslyn Lake fire stations are not seismically sound
   2. Damascus has one older grocery store and the city sees this as a vulnerability.
   3. Homes on Bluff Road could be impacted
   4. Park Street in Sandy is built entirely on fill. Areas built on fill are subject to liquefaction in a earthquake event.
   5. Both cities have a number of older structures build before the stricter building codes were implemented
   6. Sandy's water treatment building is a cinder block building
   7. In Damascus the Kingswood water facility could be impacted

iv. MITIGATION EFFORTS:

1. There are a number of educational outreach efforts for Damascus and Sandy about earthquake safety and ways of reducing losses to life and property.

v. PROBABILITY OF FUTURE OCCURRENCE
   1. Both cities agree with the county's 'high' rating

vi. VULNERABILITY ASSESSMENT
   1. Both cities agree with the county's 'high' rating

i. Volcano
   i. HISTORY:
      1. The county plan accurately describes the historical volcanic events for Damascus and Sandy
   ii. LOCATION AND EXTENT:
      1. Mt. Hood will shoot out lahar and potentially wipe out Troutdale.
      2. Both cities will be entirely coated in ash.
   iii. IMPACTS:
      1. The dams would be affected. Bull run water will be impacted
      2. Dust and ash will cause breathing problems and create issues for engines.
      3. Roofs could collapse because of the heavy ash coating.
      4. Protecting livestock from the ask will be an issue
   iv. MITIGATION EFFORTS:
   v. PROBABILITY OF FUTURE OCCURRENCE
      1. Both cities agree with the county's 'low' rating
   vi. VULNERABILITY ASSESSMENT
      1. Both cities agree with the county's 'high' rating

5. Next Time
   a. Laurel handed out the action item worksheet and asked the group to be thinking about action items to correspond with the identified vulnerabilities. At the next meeting we will discuss action items and the formal review process.
   b. The next meeting is scheduled for Friday, March 20th from 9am to 1:00pm at Sandy Main Fire Station.

Natural Hazard Mitigation Plan Update Meeting #1

Cities of Damascus and Sandy
February 20, 2009
9:00am to 1:00pm

food #30

First	Last	Agency	Job Title	Email	Roundtrip Mileage
Jeff	Atkinson	City of Sandy	Finance Director	satkinson@ci.sandy.or.us.	
MARTIN	MONTGOMERY	City of Sandy	Public Works	mmontgomery@ci.sandy.or.us	
Carnetta	Boyd	Corbett NERT	Trainer, Logistics Section Chief	Koalaty7@Gmail.com	
Kathleen	Reiter	Corbett NERT HAm	?Mult. Co. CERT Liaison	nlert@pdxw.blackberry.com Brewkatrit@aol.com	
Alice Lasher		Sandy Fire	?	sfd72fmo@hotmail.com	
Gary McQueen	McQueen	Sandy FD	chief	g.mcqueen@sandyfire.org	0
CRAIG	BROOKS	OTSD #46	ASSISTANT FACILITIES SUPERVISOR	brocksc1@ORTRAIL.K12.OR.US	0
JIM	SEIPEL	OTSD 46	DIRECTOR OF FACILITIES & NUTRITION	seipelj@ortrail.k12.or.us	
ERIN	Palmer	City of Damascus	Associate Planner	epalmer@ci.damascus.or.us	
CHRIS	ALFINO	City of DAMASCUS	GIS TECH	CALFINO@CI.DAMASCUS.OR.US	
HELEN	TURNER	ESTACADA FIRE	?	W7OKF@hotmail.com	
Harold	Skelton	Sandy PD	Police Chief	hskelton@ci.sandy.or.us	
Megan	Findley	Oregon Partnership for Disaster Resilience	PDH Program Manager	mfindley@uoregon.edu	NA

Meeting: Damascus & Sandy Natural Hazards Mitigation Plan Meeting 2
Date: March 20, 2009
Time: 9:00am to 1:00pm
Location: Sandy Main Fire Station

AGENDA

1. Meeting Attendees
    a. Chris Alfino, City of Damascus
    b. Seth Atkinson, City of Sandy
    c. Carnetta Boyd, Corbett NERT
    d. Alice Lasher, Sandy Fire Department
    e. Gary McQueen, Sandy Fire Department
    f. Erika Palmer, City of Damascus
    g. Dennis Simons, Sandy Fire Department and Police Department
    h. Harold Skelton, Sandy Police Department
    i. Dan Thompson, Oregon Trail School District

2. Formal Review Process and Plan Maintenance
    a. Laurel provided the committee with a handout of questions to answer for maintaining the plan.
    b. The Sandy EOC Group decided they will assign representatives to the committee, not the City Council.
    c. The Damascus City Council will assign representatives to the committee.
    d. The Sandy EOC Group meets on the third Friday of every month, so they will continue to meet monthly and discuss the NHMP at each meeting.
    e. The Damascus committee will meet twice a year, once in the spring and again in the fall
    f. At each meeting the committee will identify funding for the implementation of mitigation strategies, evaluate the effectiveness of the plan, develop new mitigation strategies to reduce losses from natural hazards, and detail any new hazard events.
    g. The NHMP will be formally evaluated every 5 years in conjunction with the county's update schedule. This puts the plan update at September, 2012.
    h. The convener will be responsible for initiating the update process.
    i. The convener or designee will be responsible for updating the NHMP.
    j. All City of Sandy plans are reviewed in January so the Sandy NHMP will begin review in January 2012.
    k. The Damascus plan will have a one-year timeline for update. The update process will begin one year before the update is due, meaning the plan will next be updated beginning in September 2011.

l. Laurel included a list of questions the committee should ask for future meetings. This list will be included in addendum.
m. The convener will submit the updated addendum to OEM.

3. Review Anatomy of an Action Item
    a. Laurel provided the committee with a handout that detailed the parts of an action item and explained ideas for implementation, coordinating organization, timeline, and internal/external partners.

4. Brainstorm Action Items
    a. Laurel provided the committee with a list of potential action items
    b. The committee reviewed each action item and modified it to their liking.
    c. The list of action items can be viewed in a separate attachment

5. Next Steps
    a. Finally, Laurel told the group how the rest of the update process will go. Laurel will create a draft and send it to the committee for review. Once the committee has reviewed it, the document will be sent to the Oregon Partnership for Disaster Resilience for review, and then returned for a second committee review if changes need to be made. Finally the document will be FEMA for pre-approval.
    b. Once FEMA has pre-approved the addendum, it will come back to the city for adoption by the City Council. Once the plan is adopted it will be sent to FEMA for formal approval.

6. Shameless Plug: “Open for Business” Business Continuity Planning
    a. Finally, Laurel informed the group about “Open for Business” a free web-based program that allows businesses to create customized property protection and recovery plans
    b. For more information contact:

        Adam Crawford
        Oregon Partnership for Disaster Resilience
        Acrawfo1@uoregon.edu
        541-346-7331

March 20, 2009

Sandy/Damascus NHMP Update Meeting #2

Name	Representing	Email	Miles traveled
Carnetta Boyd	Corbett NERT	Koalaty7@gmail.com	20
Alice Lasher	SFD	sfd72fmo@hotmail.com	8
Dennis Simons	Sandy Fire/Robie	Kdsimons@earthlink.net	
Harold Skelton	Sandy PD	hskelton@ci.sandy.or.us	0
DAN THOMPSON	OREGON TRAIL School DIST	THOMPSOD@ORTRAIL.K12.OR.US	
Gary McGowan	Sandy FD	g.mcgowan@Sandyfire.org	
Erika palmer	Damascus	Epalmer@ci.damascus.or.us	
Chris Altino	Damascus	caltino@ci.damascus.or.us	
Seth Atkinson	Sandy	Satkinson@ci.sandy.or.us	

DAMASCUS NATURAL FEATURES INVENTORY

NATURAL HAZARDS REPORT

Prepared for:

CITY OF DAMASCUS
19920 SE Highway 212
Damascus, Oregon 97089

Prepared by:

WINTERBROOK PLANNING

In association with:

ASH CREEK ASSOCIATES
Landslide and Seismic Hazard Assessment

TROUT MOUNTAIN FORESTRY WITH MIKE ANDREWS
Wildfire and Winthrow Hazard Assessment

July, 2007

Damascus Natural Features Inventory
Natural Hazards Report

Table of Contents

Introduction

The City of Damascus retained a consultant team led by Winterbrook Planning to conduct an inventory of natural hazards within the city limits. The inventory addresses the geologic and seismic hazards, wildfire hazards, windthrow hazards and flood hazards. Natural hazards are addressed by Statewide Planning Goal 7. The inventory provides an important base of information and strategy recommendations on natural hazards that will inform subsequent steps in the Comprehensive Planning process.

This report is a companion to the Damascus Goal 5 Natural Resources Inventory Report, submitted under separated cover. The report begins with a brief review of study area characteristics and public involvement efforts. Each hazard is then addressed individually, beginning with a brief overview and review of inventory methods, a summary of inventory results, and a review of recommendations on how to mitigate the risks posed by natural hazards. The Natural Hazard Map (Figure 1) illustrates the combination of natural hazards in Damascus that can be readily mapped. The report concludes with a list of references for each subject area.

Public involvement and outreach for the Damascus Natural Feature Inventory project began in the fall, 2006 and continued through June, 2007. The process included extensive landowner notices (to more than 1,400 landowners), two series of public meetings, published notices and articles in the *The Observer*, on the City's web site, and at City Hall. A Natural Features Topic Specific Team was established to review the inventory work and make recommendations to the City Council. The committee was composed of a representative group of citizens from the Damascus community. A more detailed review of the public involvement efforts is provided in the Goal 5 Natural Resources Report, the companion piece to this report.

The Goal 7 inventory and associated map provide the basis for subsequent steps in the Comprehensive Planning process. As part of that process, the consequences of alternative conservation and development strategies will be weighed, through a public process, and an appropriate Goal 7 hazard program will be developed.

Summary of Findings

The following is a brief synopsis of key findings and recommendations of the Damascus Natural Hazard Inventory. Methods for collecting information for these reports included analyzing existing maps and other data from Clackamas County, Metro, Department of Geology and Mineral Industries, Federal Emergency Management Agency, and other public agencies as well as onsite fieldwork where local property owners granted access. The inventory was completed to address State Land Use Goal 7 (Natural Hazards).

Slopes

Based on the field inventory, slopes steeper than 25 percent are assumed to be unstable or potentially unstable. Total steep slope area is 1,030 acres or roughly 10 percent of land within Damascus.

Recommendation:

- Prior to development, slopes steeper than 25 percent should be evaluated by a Certified Engineering Geologist (C.E.G). If the slope is found to be unstable, analysis and mitigation measures should be taken.

Landslides

Hillsides show evidence of previous landsliding. Total landslide topography area is 1,489 acres or roughly 14 percent of land within Damascus. Area of rapidly moving landslide is 156 acres or 1.5 percent of land within Damascus.

Recommendation:

- Prior to development within 100 ft of mapped landslide topography or on landslide areas, a geologic assessment should be prepared by a C.E.G. that investigates the limits and stability of the slide mass, and the mechanics of slide movement locally.

Drainage

Based on available data and field observation, high groundwater is expected to be present throughout the wet season.

Recommendations:

- Surface water should be controlled such that it does not impact adjacent property by increasing flow, concentrating flow, or stimulating erosion.
- Prior to new development, a storm drainage plan should be submitted and approved by the City.
- Developments should incorporate basement and foundation drainage to control groundwater.

Fills

Significant fills and those obscured by age and previous development are present throughout Damascus.

Recommendation:

- Geologic and geotechnical investigations should address the presence or absence of man-made fills as part of the reporting process.

Wildfire

Wildfire is influenced by four major factors: fuels, weather, topography and ignition. Total area of wildfire hazard is 175 acres or 1.6 percent of land area within Damascus.

Recommendations:

- Adapt the Clackamas County Community Wildfire Protection Plant to local conditions and encourage residents to follow the recommendations of local fire agencies experienced in protecting homes from wildfires.
- Consider an ordinance requiring lots with grass to be mowed by August 1.

Windthrow

Windthrow occurs when trees are snapped or uprooted by high winds. The primary factors contributing to windthrow likelihood are root and stem diseases, saturated soils for prolonged periods, land clearing, and landscape position.

Recommendations:

- Consider development of a tree ordinance that will reduce the risk of windthrow.
- Develop a program to encourage or even require "clumped" rather than "dispersed" retention of trees during subdivision and housing development to reduce the risk of windthrow.

Floodplains

Floodplain hazards in the study are documents by FEMA. Total floodplain acreage is 140 acres or 1.3 percent of land area within Damascus.

Recommendations:

- Consider designation of areas such as parts of Sunshine Creek as flood erosion hazard areas pending specific project-related hydraulic analysis.
- Prior to large scale developments areas of steeper stream gradient should receive reach specific hydraulic/ hydrologic analysis

Study Area Overview and Geology

The City of Damascus is located in northern Clackamas County, south of Gresham and the Pleasant Valley area, and east of Happy Valley. The City includes the communities

of Carver (on the Clackamas River) and Damascus. The City borders the Clackamas River to the south and Multnomah County to the north (see Figure 1). The study area is generally defined as the city limits, with a total size of 10,333 acres. The City/study area extends outside the Urban Growth Boundary to the southeast, near the junction of Oregon 224 and 232nd Avenue.

In general, the Damascus area is characterized by a series of conical buttes in the western and northwestern portion of the City (East Buttes/Boring Lava Domes), separated by erosional stream valleys. The eastern part of the City is more characterized by rolling hills and shallower stream and ancient floodplain valleys. The southern part of the City borders the Clackamas River valley and is characterized by steep erosional valley margins, stream canyons, and portions of the Clackamas River floodplain

The buttes were formed by a series of volcanic eruptive centers during the Late Pliocene to Pleistocene. Prior to the eruptions, the area was characterized by relatively flat, rolling hills and plains topography formed by the deposition of the Sandy River Mudstone and Troutdale Formations. The eruptions spread lava flows, ash fall, and mud flows over the region, filling stream valleys and altering the landscape to a semblance of what it is today. The present ground surface surrounding the buttes and in the Sunshine Valley region in the eastern part of the City are covered by a formation referred to as Pliocene-Pleistocene Gravels which are the erosional remnants of erupted mudflow deposits, both within the Damascus area, and from the east. and southeast toward the Cascade Range.

Since that time, the area has been more subject to erosion than depositional (accumulation of sediments) or tectonic (large scale crust movement) activity. The exception would be the Aeolian Silt deposits of the Portland Hills Silt that still cover the surface of the buttes in the northwest corner of the City.

The ground surface along the Clackamas River floodplain is characterized by steep, actively eroding slopes within the Troutdale and Sandy River Mudstone Formations. Many areas along the Clackamas River have exposed sandstone beds, such as those near the Carver Bridge, which represent remnants of erosion-resistant portions of the Troutdale Formation.

In general, Schlicker and Finlayson (1979) and Trimble (1963) describe the geology of the area and list seven major geologic units within the Damascus city limits. A brief description of the units follows:

- **Alluvium.** Unconsolidated sand, gravel, and cobbles within stream channels and on adjacent flood plains; sandy silt up to 10 feet thick overlies gravel on flood plains.

- **Pleistocene Terrace Deposits.** Unconsolidated cobble and boulder gravel and silty mudflow deposits up to 200 feet thick along the Clackamas River, Richardson Creek, and Pleasant Valley in this area.
- **Aeolian Silt.** This formation is a wind-blown (loessal) silt deposit that caps some of the buttes in the northwestern portion of the City. The silt in this area is thought to be a maximum of 55 feet thick and to occur generally above elevation 250. Within the City of Damascus the silt appears to be present above about elevation 400 feet Mean Sea Level (MSL).
- **Pliocene-Pleistocene Gravels.** This formation is composed of gravel and mudflows with weak cementation, poor sorting, and rounded cobble and boulder-sized material. Many of the deposits were derived from pyroclastic (mixture of rock and ash explosively ejected from a volcanic vent) mudflows and are weathered and decomposed to a reddish-brown clayey soil. The deposits are as much as 400 feet thick and are poorly drained. They are nearly impermeable in places, and because of the poor quality of the rock and large number of fines, they are generally not suitable for aggregate production (Gray, 1978). In the eastern portion of the City the gravels were derived from similar volcanic events eastward toward the foothills of the Cascade Range.
- **Troutdale Formation.** This formation consists of Pliocene sandstones and conglomerate in a partially cemented state. The identifying marker is quartzite which makes up about 30 percent of the grains. The matrix can be composed of a volcanic glass that when deeply weathered can form a high shrink-swell clay.
- **Sandy River Mudstone.** This formation, in keeping with its name, is composed primarily of a fresh water mudstone with some siltstone and sandstone. The unit has a maximum thickness of about 725 feet. The clayey materials are very low strength and are prone to earth flows and slump failures of overlying, more intact rock formations.
- **Boring Lavas.** This is a Pliocene-Pleistocene, light gray olivine basalt with flow structures and some pyroclastic (explosive) materials near vents. Where underlain by weak soil and rock materials these materials are prone to deep bedrock sliding. The Boring Lavas appear to cover about half of the ground surface in the Damascus area.

Geologic and Seismic Hazards

Hazard Mapping

The mapping program consisted of a library research of existing maps and publications available for review, and identifying areas that needed field observation to verify or refute anticipated conditions. The next task involved a field overview of the mapping area to identify features on existing hazard maps and additional ones that show up on the Light Detection and Ranging (LIDAR) survey. The project team then prepared

preliminary hazard maps and identifying areas that needed closer inspection. The last phase of field mapping was spent visiting areas that the project team felt deserved closer scrutiny in order to refine the preliminary maps. Based upon the literature search and field mapping, the team prepared the geologic hazard maps and this report for inclusion in the overall Goal 5 and Goal 7 Resource Inventory.

Review of Existing Data and Hazard Maps

Prior to starting the field reconnaissance program, the project team reviewed existing geologic and geotechnical publications in the area, many of which are listed at the end of this report in the References section. The project team reviewed USGS Maps of the area, aerial photography, LIDAR survey information and maps, and visited with Clackamas County Building and Planning personnel to research past geotechnical and geologic reports in the Damascus area. However, very little geotechnical and geologic information was available. The project team also talked to the City of Damascus but due to the very short duration since the formation of the City, no records were yet available.

In 1979, the Department of Geology and Mineral Industries (DOGAMI) prepared a series of Geology and Geologic Hazard maps of the northwestern portion of Clackamas County, including the current City of Damascus boundaries. The hazards mapped by DOGAMI included slope steepness, mass movement (landslides, landslide topography, debris flows), soil hazards (organic, high shrink-swell, high water table), flooding, and stream bank erosion. Since that time, many of the Goal 7 elements incorporated into the 1979 study have been updated by government agencies and include:

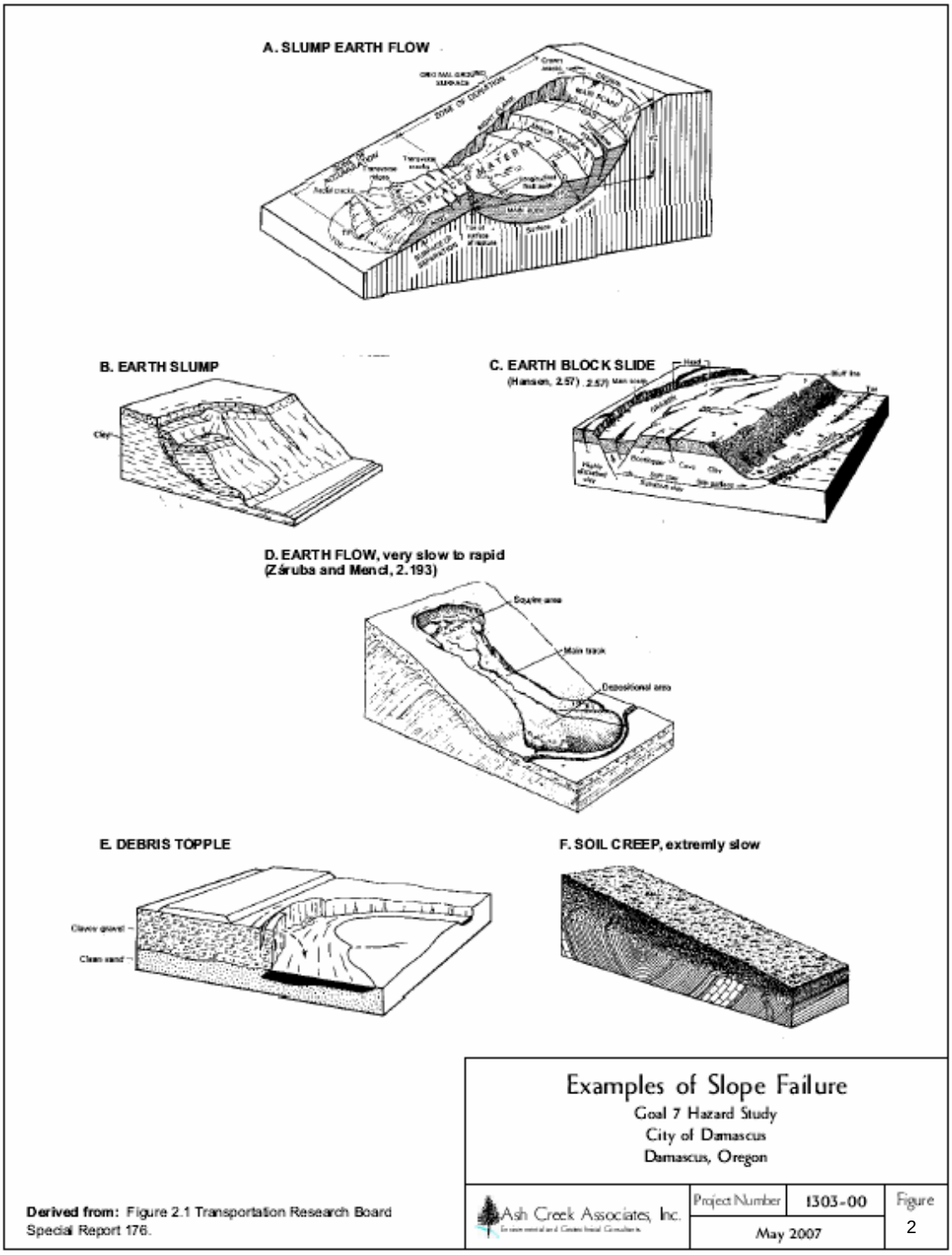
- Clackamas County Soil Survey (NRCS 1985 and current data available on-line only) that covers hydric soils, high groundwater, and shrink-swell potential of soils,
- Earthquake hazards (DOGAMI 1996, 1997, 2003), and
- Flood Insurance Rate Mapping (FIRM) studies (FEMA 1987, 2000, and 2006).

The Goal 7 Geologic Hazard study by Ash Creek Associates, Inc. has focused primarily on slope and landslide hazards.

Field Methodology

The field-mapping program consisted of initially visiting areas noted on previous Hazard Maps as Landslide Topography or Local Slump and earthflow, and apparent anomalies detected during this study using the LIDAR survey data, to verify the existence or absence of geologic hazards. Subsequent field mapping was used to refine the observations and more closely delineate the hazard areas. Figure 2 (derived from

Figure 2. Examples of Slope Failure.



Schuster and Krizek,1978; and Turner and Schuster, 1996) provides examples of slope movements that might be found in the study area. In subsequent discussions, the project team may refer to particular features by Figure 2A, 2B, etc. While in the field the project team's observations included, but were not limited to:

- "Pistol-butted" evergreen (fir, cedar, etc.) trees, indicative of ground movement and subsequent attempts by the trees to correct themselves to a normal vertical growth. Only one or two deformed trees in a grove or forest would not be indicative of ground movement; their growth patterns could have been altered by ice loading, wind, or animal activity during early stages of development.

  Deciduous trees are not normally good indicators of movement and generally should not be solely relied upon to evaluate ground movement.

- Clumps of evergreen trees all leaning upslope (possibly indicating a rotational slump), leaning downslope (possibly indicating shallow movements pushing trees over while the roots attempt to hold them in place), or leaning and tilting in all directions (possibly indicative of translational movement disrupting the ground in all directions).

Older trees undergoing recent movement

- "Hummocky" topography consists of a rolling or lumpy appearing ground surface on relatively gentle slopes that generally results from debris flow or massive landsliding "run-out". Hummocky ground in and of itself is a clue, but not necessarily a result of landsliding. Surface topography can be controlled by geologic conditions beneath the surface in the form of undulatory lava flows, flood scouring, or man-made cut and fill areas.

- Sharp breaks in slope can be uppermost scarps of over steepened ground formed when a block of soil breaks loose and slumps downward (Figure 2A, 2B, 2C, 2D). The scarps are generally parallel to the contours, are usually arc-shaped, and are higher near the center of the arc and feathering out toward the sides.

- Cracks and bulges running downslope (perpendicular to the contours) can be shear zones at the slide margins (Figure 2A, 2B, 2C). Often surface water encounters "sag ponds" or flattened slope areas, and flows parallel to the scarp, turning downslope and following the shear zone (Figures 2A, 2B).

- "Teardrop" or "spoon" shaped hollows that narrow to a stream channel downslope and may or may not have a fan of material below the channel (Figure

2D). These features are commonly referred to as "blowouts", earth flows, or debris flows.

- Closed depressions or grabens are hillside features that have interrupted normal drainage patterns (Figures 2A, 2C) and may or may not have visible outlets. If they contain water they may be referred to as sag ponds. These features can form when the scarp area of a rotational slide or slump tilts back into the hillside and cuts off flow.
- In areas of aggressive stream erosion the banks may be undercut causing the soil or rock to fail in blocks, or topple into the stream leaving a vertical or near-vertical slope behind (Figure 2E). The most visible examples of this condition occurs along the Clackamas River, primarily along the outside bend of active channels where the soil or rock does not have the opportunity to reach a relatively stable angle of repose before being undercut again. This particular form of erosion occurs along the north bank of the Clackamas River floodplain near the Baker Bridge in Carver. Toppling failures may occur on small streams or tributaries at a scale too small to map or observe.
- Pavement and curb cracks, fence misalignment, and other surface feature indicators can reflect ground movement from soil creep (Figure 2F). In forested areas, very slow and minor movements can be totally obliterated by topsoil, sod, brush, etc., whereas rigid structures such as curbs, pavement, retaining walls, etc., or those in visual alignment, can reflect very small movements (such as the undulating roadbed pictured here).

Soil creep: undulating pavement and curbs

- Springs and seeps. If springs and seeps are noted issuing from the face, or base, of a slope they can be indicative of a landslide mass covering a channel or a debris flow resting at the base of a slope. The slide mass remains saturated from infiltration into the top of the slide, or from the slide mass cutting below the groundwater surface. Rather than concentrated flow from a defined channel the occurrence of water may be widespread as a spring line or seepage zone with no defined source.

LIDAR Survey

LIDAR mapping has been around since the 1960s, but has only been in use for terrain modeling for about 10 years. Clackamas County had a LIDAR survey performed as part

of an overall Portland Metropolitan mapping project. The City of Damascus was included in the survey and that data was the primary non-field mapping tool used in this study. Previous hazard mapping used United States Geologic Survey (USGS) maps with 10 foot contour intervals based upon aerial photography. The LIDAR survey allowed us to refine many of the boundaries of previous hazard maps and to identify additional hazard areas.

LIDAR is an active sensor, similar to radar that transmits laser pulses to a target and records the time it takes for the pulse to return to the sensor receiver. This technology is currently being used for high-resolution topographic mapping by mounting a LIDAR sensor, integrated with Global Positioning System (GPS) and inertial measurement unit (IMU) technology, to the bottom of aircraft and measuring the pulse return rate to determine surface elevations.

Recent studies indicate that LIDAR can increase the number of identified landslides by 2,000 percent over conventional USGS 10-meter elevation models, while decreasing the minimum size of detected slides from almost 35,000 m^2 to less than 30 m^2. In the fall of 2006, DOGAMI published its bulletin *Cascadia* (Vol. 4, No. 2), which serves as an excellent guide to how LIDAR is used, the limitations of low-resolution contour information, and the status of ongoing LIDAR projects in Oregon.

Map Presentation

On the final Hazard Maps, the project team combined historical (Schlicker and Finlayson) DOGAMI maps of Clackamas County Landslides and Landslide Topography with those identified in the current study. For ease of presentation, the team's final maps combine past and present mapping into one consistent product with the text of this Hazard Report and map key explaining that the Landslide Topography on the City of Damascus maps is a combination of the two studies. The Clackamas County DOGAMI study (Schlicker and Finlayson), the on line NRCS Soil studies, and FEMA (FIRM) flood maps are available as independent documents.

Hazards

Slope hazards and landslide topography have been the primary targets mapped as part of the Goal 7 resource study for the City of Damascus. Although not necessarily associated with slopes the project team has also included discussions on moisture-sensitive soils (high shrink-swell potential), high groundwater, and man-made fills. The following sections provide a brief description of the hazards associated with this study.

Steep Slopes

The slope hazard areas used for this study generally place slopes in two categories of steepness: 0 to 25 percent and greater than 25 percent slopes. In the project team's opinion, these categories are appropriate for the geologic conditions within the Damascus area. The Schlicker and Finlayson Hazard Maps (Bulletin 99) show five slope categories but their study covered a very large area with greater varieties of geologic conditions. Slopes greater than 25 percent are shown on the Natural Hazard Map (Figure 1). The total area encompassed by steep slopes in Damascus is 1,030 acres.

Most of the existing steep slopes in the Damascus area have geologic conditions consistent with widespread landslide topography, and since no site-specific subsurface information is available to contradict the assumptions, the project team has assumed that slopes steeper than 25 percent are potentially unstable and will require independent evaluation prior to development. Certainly, there are isolated areas of steep slopes that are not potential landslide hazards, such as the basaltic cliff face between SE Winston and SE Heuke Road.

Soil Creep

Soil creep occurs primarily on natural slopes steeper than approximately 25 percent; on slopes over-steepened by cutting or filling, adjacent to drainages, and near areas of active erosion. Soil creep occurs when soil particles undergo short scale movements from cyclic wetting and drying, or freezing and thawing. On a near-microscopic scale, if a soil particle is exposed to swelling (from moisture adsorption) or freezing it will move upward perpendicular to the slope face. When the particle is dried or thaws, it will move vertically downward resulting in a net movement down slope.

Movements may be on the order of a few millimeters or centimeters per year, and may not be detectible on an annual basis. Soil creep can cause shallow-rooted evergreen trees to tilt downslope, and as they right themselves they may develop pistol-butted trunks similar to areas of slow moving landslides. However, over a period of 10 or 50 years an object resting on the ground surface may move as much as 12 to 60 inches Soil creep is typically confined to the upper two to three feet of soil and can be

Trees as indicators of slope movement

controlled by maintaining a vegetative cover of deep rooting material, flattening slopes, constructing retaining walls, or embedding foundations. The Hazard Maps do not specifically identify soil creep, but they assume that it occurs on slopes steeper than 25 percent such as those along the north side of Borges Road east of Tillstrom and along the stream margins adjacent to the buttes.

Landslides - General

The landslide topography depicted in this report includes those areas shown on the existing Clackamas County hazard maps (Schlicker and Finlayson DOGAMI Bulletin 99) and those derived from this investigation. Approximately 1,489 acres of land in Damascus is mapped as landslide topography on the Natural Hazard Map (Figure 1). As noted above, all slopes steeper than 25 percent should be considered as potentially unstable and landslide-prone. In the case of many ancient landslides, the movement has resulted in slopes flatter than 25 percent (such as in the Kingswood area and north of Rock Creek east of Foster) surrounded by scarp areas steeper than 25 percent.

As discussed in a previous section, the underlying bedrock in this area is several millions of years old and has undergone deep chemical and mechanical weathering. The topography in the Damascus area and the present day slope configurations has been formed by hundreds of thousands (and in isolated cases, millions) of years of soil and rock movement generated by earthquakes, volcanoes, floods, stream erosion, and landslides (Schlicker and Finlayson, 1979; Trimble, 1963; Wells and Snavely, 1983). This being the case, the soil and rock on the existing slopes are assumed to be in a state of near-equilibrium under historic conditions. Depending upon the type of the rock and soil, the slopes may be subject to renewed movement if disturbed by earthquakes, undercutting, re-routing of stream or drainage courses, raising groundwater levels, removing vegetation, etc.

In addition, non-engineered fills placed on slopes can create a soil or rock overload triggering landslides, and fills placed over eroding streams or shallow, sloping bedrock can move down slope. A current example of this can be seen on Eckert Road as it crosses the stream valley south of Highway 212.

Rapidly Moving Landslides

Mudflows or debris flows are another type of landslide, commonly termed Rapidly Moving Landslides (RML), which can occur naturally or can be man-caused. The total area of potential RML hazards in Damascus is 156 acres. The Oregon Department of Land Conservation and Development (DLCD), Oregon Forestry Department (OFD), Earth Systems Institute, and DOGAMI collaborated on a paper (DOGAMI Interpretive Map Series IMS-22) to map RML throughout the state of Oregon. Although the information has not necessarily been field verified, the hazard maps include zones within

the Damascus city limits that were mapped as having the potential for RML. Where the project team was able to verify landslide topography conditions, and the RMLs were within the landslide topography zones, the team incorporated them into the zones. Two notable areas where this occurred are the large slide area east of the Carver Bridge and the area of Royer Road above Highway 224.

Soils with High Shrink-Swell Potential

These soils can generally be derived from two sources within the Damascus area:

- Residual soils formed from in-place weathering of the Sandy River Mudstone, or
- Flood plain sediments derived from the Sandy River Mudstone or eroded ash deposits derived from weathering of Boring Lava materials.

The mapped exposures of these soils (Schlicker and Finlayson) are generally concentrated in drainages immediately east of the Damascus city center (Boring Lava derived), and in known landslide areas along the Clackamas River (Sandy River Mudstone derived).

Fills

Man-made fills are an integral part of any developed area, and if properly constructed they can simulate strength properties of the native soils. The modern-day building codes regulate the placement of fill soils with controls on soil types, moisture content, and compaction effort.

The fills most likely to cause problems are those that were placed prior to building code implementation or enforcement (which generally began in 1974). Many of the landslide areas mapped during the 1996 floods occurred within filled areas on public roadways, mostly on Oregon Highway 212 and 224, and are indicated on the Goal 7 Hazard Map as "Landslide Locations – DOGAMI." Fills that have failed more recently can be observed on SE Eckert Lane, Immediately south of Highway 212 and on Borges Road along the drainage west of SE 222nd Drive. Fills that have settled and caused bumpy, wavy, or cracked pavements (but are not considered landslides) can be observed on virtually any secondary road that traverses a steep hillside or crosses a drainage. Because historically non-engineered fills are widespread and are generally obscured by recent vegetation, it is not possible to map them all nor is it possible to discern whether they meet modern engineering requirements. For these reasons it should be up to the permit applicant and their consultants to determine whether any pre-existing fills would have a detrimental effect on their development.

High Groundwater

High groundwater can result in softening of near-surface soils, flooding, landsliding, and spring activity. High groundwater areas were mapped by DOGAMI on Bulletin 99 using NRCS and existing geologic mapping information. In general the high groundwater conditions are defined as water levels being within at least 1.5 feet of the ground surface during the wet season. The conditions are a result of poorly drained or clayey soils, porous soils resting on a clay layer that retards infiltration, or relatively thin soils developed on gently sloping bedrock. The high groundwater areas generally include the entire City of Damascus, but some of the exceptions are:

- A few isolated slopes along the Clackamas River and other incised drainages where the slopes are extremely steep and the soils very thin;
- A few acres of bluff top areas where Boring Lava is near the ground surface, both above the Clackamas River and the top of the butte along Debora Street; and
- Some of the gravelly terraces along the Clackamas River.

High groundwater can cause excavation and caving problems in utility trenches and construction cuts; cause basement walls and floors to crack and leak; cause underground storage tanks and swimming pools to rise; and prevent infiltration of septic effluent.

The project team's general recommendation is to assume that high groundwater will be present throughout Damascus during the wet season, and provisions should be made for controlling surface and subsurface water in all new construction.

Regional Seismicity

The Portland Metropolitan area, including the City of Damascus, is widely acknowledged to be in an area of impending seismic hazards. The most likely hazards are liquefaction, ground subsidence, ground shaking, and earthquake-induced landslides. DOGAMI has produced earthquake hazard maps (Interpretive Map Series IMS-1 Relative Earthquake Hazard Map of the Portland Metro Region) that include Clackamas County and the City of Damascus. A comprehensive seismic hazard study is beyond the scope of the current project. However, some elements of earthquake hazards are related to the current study, so the project team will briefly relate the known conditions to potential seismic hazards.

Seismic Hazards

The December 2004 subduction zone earthquake and tsunami inundation in southeast Asia is evidence of the destructive nature and dangers associated with subduction zone earthquakes. The states of Oregon and Washington have a similar geologic setting offshore within the Cascadia Subduction Zone (CSZ). In addition to tsunami damage, the shaking action from large earthquakes can cause terrestrial landslides, submarine

landslides, and seiches (Seiche is the back and forth sloshing of waves in bays or closed basins, and on occasion can be as destructive as a tsunami). The City of Damascus would only be concerned with potential damage from ground shaking, landsliding, and liquefaction

Liquefaction is the settlement or lateral spreading of unconsolidated, cohesionless sediments by ground shaking in an area of saturation. This model generally fits relatively flat-lying areas of cohesionless soils and granular fills under saturated conditions such as those noted previously in the Rock Creek watershed..

Ground subsidence is another hazard related to CSZ earthquakes, but is mostly an issue along the Oregon coastline. Ground subsidence can also occur as a result of liquefaction of soils on moderate slopes or adjacent to stream banks.

Ground shaking can cause building collapse and liquefaction of granular soils as described above. The primary danger is usually from falling debris.

Landslides can be generated by earthquake induced ground shaking, especially on steep slopes combined with saturated soils. Non-engineered fills on steep slopes are highly vulnerable to earthquake-induced landslides.

Regionwide Events

Very large earthquakes can cause damage many miles away from the epicenter, and although Damascus is not seismically active, it is susceptible to damage from distant earthquakes. The seismicity in the Portland Metropolitan area, and hence the potential for ground shaking, is controlled by three separate fault mechanisms. These include the CSZ, the mid-depth intraplate zone, and the relatively shallow crustal zone. Descriptions of these potential earthquake sources are presented below.

The CSZ is located offshore and extends from Northern California to British Columbia. Within this zone, the oceanic Juan De Fuca Plate is being subducted beneath the continental North American Plate to the east. The interface between these two plates is located at a depth of approximately 15 to 20 kilometers (km). The seismicity of the CSZ is subject to several uncertainties, including the maximum earthquake moment magnitude (Mw) and the recurrence intervals associated with various Mw earthquakes. (Moment magnitude is used by seismologists to measure larger earthquakes and is based on fault displacement and area of fault rupture, while for smaller earthquakes, the moment magnitude is approximately equal to the familiar Richter Scale Magnitude.) Anecdotal evidence of previous CSZ earthquakes has been observed within coastal marshes along the Oregon coast, establishing the existence of these events. Sequences of interlayered peat and sands have been interpreted to be the result of large subduction zone earthquakes occurring at intervals on the order of 300 to 500 years, with the most recent event taking

place approximately 300 years ago. A definitive study of Oregon seismic hazards completed by Geomatrix (1995) suggests that the maximum earthquake associated with the CSZ is Mw 8 to 9. This is based on an empirical expression relating Mw to the area of fault rupture derived from earthquakes that have occurred within subduction zones in other parts of the world. A Mw 9 earthquake would involve a rupture of the entire CSZ. As discussed by Geomatrix (1995), this has not occurred in other subduction zones that have exhibited much higher levels of historical seismicity than the CSZ and is considered unlikely. For the purpose of this study, an earthquake of Mw 8.5 was assumed to occur within the CSZ.

The intraplate zone encompasses the portion of the subducting Juan De Fuca Plate located at a depth of approximately 30 to 50 kilometers below western Oregon. Very low levels of seismicity have been observed within the intraplate zone in Oregon. However, much higher levels of seismicity within this zone have been recorded in Washington and California. Several reasons for this seismic difference were suggested in the Geomatrix (1995) study and include changes in the direction of subduction between Oregon and British Columbia as well as the effects of volcanic activity along the Cascade Range. Historical activity associated with the intraplate zone includes the 1949 Olympia Mw 7.1 and the 1965 Puget Sound Mw 6.5 earthquakes. Based on the data presented within the Geomatrix (1995) report, an earthquake of Mw 7.25 has been chosen to represent the seismic potential of the intraplate zone. Shaking in the Damascus area can be felt from these earthquakes but damage is expected to be slight.

The third source of seismicity that can result in ground shaking is near-surface crustal earthquakes (less than 30 kilometers in depth) occurring within the North American Plate. The historical seismicity of crustal earthquakes in western Oregon is higher than the seismicity associated with the CSZ and the intraplate zone. The 1962 Portland earthquake and the 1993 Scotts Mills (Mw 5.6) and Klamath Falls (Mw 6.0) earthquakes were crustal earthquakes. Only light damage was reported in the Portland area from these quakes, mostly from the 1962 event.

Earthquake Hazards

Compared to the Portland and western Washington County areas, according to Mabey (1996 and 1997), the Damascus area ranks relatively low in the earthquake hazard ratings, with no discernable movement on any of the nearby faults within the past 20,000 years. Ground response to earthquakes outside the city limits are discussed in a subsequent section of this report. In general the earthquake hazards are directly related to the underlying geology. If ground conditions are soft, loose or saturated, liquefaction or ground amplification can occur. If slopes are steep due to the relative consistency of the underlying bedrock, if the bedrock is soft and unstable, or if landsliding has occurred previously, landslides can be induced by ground shaking. The hazards rated by Mabey *et al.* (1997) include Liquefaction, Relative Amplification of Peak Ground Acceleration,

and Relative Slope Instability. The categories were then combined and an overall rating map was produced. A generalized discussion of the categories of earthquake hazards is discussed below:

- Very few of the soils underlying Damascus would be classified as subject to liquefaction hazards. The exceptions would be the Rock Creek Watershed. With this being the case, the project team does not recommend a liquefaction study be required on all new construction. The DOGAMI IMS-1 publication (see Mabey *et al.* 1997) should be used as a guide in determining the relative potential for liquefaction in private developments. During the course of subsurface analysis, the liquefaction potential of the soils should be assessed by groundwater levels and soil grain size distribution. By doing so, the owners can judge whether their developments could be impacted by settlement-induced liquefaction. Critical facilities (hospitals, fire stations, etc.) are required by prevailing law to be evaluated for liquefaction, tsunami run-up, seiche, etc., so they are already covered.
- Soil and soft sedimentary rock at the ground surface can modify, or amplify, bedrock ground shaking caused by an earthquake. This modification can increase (or decrease) the strength, duration, or frequency of the shaking. The areas of Damascus susceptible to ground amplification are very closely related to those susceptible to liquefaction.

Earthquake-induced landslides occur on steep slopes or in areas of previous landsliding that are reactivated by the shaking. IMS-1 ranks these hazards in four categories with the lowest being in very flat or unusual locations and the highest being in areas of 45% or steeper slopes (24.2^{o}), or in areas of previous landsliding. The City of Damascus Slope Hazard rating of 25 percent or steeper being considered unstable generally coincides with the IMS-1 earthquake hazard rating between 1 and 2 or slopes on the order of 15^{o} or steeper.

Discussion and Recommendations

Throughout the Pacific Northwest and California a large number of state, county, and local level agencies have developed Natural Hazard Mitigation Plans to cope with natural disasters. The plans are designed to reduce risk from natural hazards through education, outreach programs that foster partnerships with regional, state and federal agencies; and implementation of preventive activities such as land use programs that restrict and control development in areas subject to damage from natural hazards. Within the immediate area, the State of Oregon Office of Emergency Management (OEM), the City of Salem, Oregon, and Washington County OEM have all developed Mitigation Plans that are generally available on the internet. As an example, we have listed the Uniform Resource Locator (URL) for Washington County Landslides in the References section of this report.

As noted previously, this study has been conducted to provide the City of Damascus with tools to aid in future planning and development. As the new development occurs, the materials contained in this report and on the accompanying maps are intended to trigger different levels of site evaluation, from visual geologic assessment to in-depth subsurface geotechnical explorations. Geologic assessments should be conducted by a State of Oregon Certified Engineering Geologist (C.E.G.) utilizing the *Guidelines for Preparing Engineering Geologic Reports in Oregon*, adopted by The Oregon State Board of Geologist Examiners (OSBGE). Geotechnical assessments should be conducted by a State of Oregon registered Professional Engineer (P.E.), with a specialty registration as a qualified Geotechnical Engineer (G.E.), and in cases where both engineering geology and geotechnical engineering are required, reports should contain the signatures and stamps of both.

Specific recommendations for each geologic hazard type are indicated with bullets.

Slopes

Slopes steeper than 25 percent are assumed to be unstable, or potentially unstable. Slope steepness alone should not preclude development but should be one of the items used to trigger closer planning and building scrutiny. Many of the slopes in this range of steepness are underlain by shallow bedrock and only the surface few feet of soil may actually be unstable. Based upon our reconnaissance-level mapping this could be the case in the area of SE 190th Ave and SE Tillstrom Road and other areas with the combination of steep slopes and basaltic bedrock,, but without landslide topography.

- Slopes steeper than 25 percent should be evaluated in detail by a C.E.G. through a geologic assessment prior to development. The preliminary evaluation can be visual depending upon access, the proposed type of construction, and potential effects on adjacent properties, in order to confirm the stability or instability of the slopes.
- Before a building permit or other land use approval is issued, the slope conditions should be verified by subsurface exploration. If the slopes are found to be unstable, analysis and mitigation measures should be made in conjunction with a G.E. using OSBGE guidelines and the Oregon State Board of Examiners for Engineering and Land Surveying (OSBEELS) standards of care for engineering practice.

Landslides and Landslide Topography

As the Damascus area continues to grow, because of the views and aesthetics the available land for development is often hillsides showing evidence of previous landsliding, or having surface characteristics of landslide topography. There are many

areas mapped as having landslide topography or previous ground movement that are currently developed and have not had ground movement problems. One such area is along Kingswood Way in the northeastern part of the City. The hillsides were previously mapped by Schlicker and Finlayson (DOGAMI Bulletin 99), and currently by Ash Creek Associates, as having landslide topography and surface indicators of ground movement. This appears to be an area where ancient landslides have stabilized and not moved for decades. In areas such as this, development may be allowed, provided it is consistent with other policies adopted by the City. It should be kept in mind that potential effects of property adjacent to landslides can span the life of the structure or development, usually on the order of 50 years.

If movements are observed or measured in even small increments the long-term effects on development should be considered. For instance, in a heavily vegetated area movements of one or two centimeters per year can go undetected. However, if rigid structures such as pavements or retaining walls are constructed in the same area, over the period of 25 to 50 years displacements of 10 to 20 inches could occur.

Areas that are susceptible to severe erosion and ground movement should be considered very marginal for development. This includes the south-facing slopes above the Clackamas River east of Carver and in the area of Royer and Highway 224. Both of these areas have landslide topography, visible ground movement, and have been mapped as having RML susceptibility.

- All the areas mapped as landslides or as having landslide topography should be subject to the recommendations in this section.
- If development or construction is planned on or within 100 feet of mapped Landslide Topography, known or suspected landslides, or Debris Flow Hazard zones, the potential effects of the slide areas on the development should be made by a CEG through a geologic assessment. If the geologic assessment indicates that the land is developable and the potential hazards can be mitigated, the slide hazard area should be evaluated by subsurface exploration
- During any landslide investigation, the limits of the slide mass should be accurately measured and the stability of the slide mass and the mechanics of slide movement should be determined. This may (depending on opinion of a CEG) require installation of subsurface ground monitoring equipment (such as slope inclinometers) to determine whether deep-seated movements are occurring.
- All studies pertaining to slope stability should include an explanation of the methodology used and should provide recommendations for suitable setbacks, keeping in mind the anticipated life of the structure or development.
- If the known or suspected landslide area is to be built upon, or if the proposed development or structure is within the setback or buffer zone, an in-depth stabilization and construction plan should be developed by the CEG in conjunction with a GE using OSBGE standards for care for engineering practice.

Drainage

As noted previously, we have assumed that high groundwater will be present throughout Damascus during the wet season, and provisions should be made for controlling surface and subsurface water in all new construction. Anticipating that seasonal or permanent groundwater will be present in most of the Damascus area, all new construction incorporate basement and foundation drainage to control water and keep it from crawl space, under-slab, and below-grade areas. Ground water control can range from perforated PVC pipe for foundation drains to engineered retaining wall drainage systems. The following recommendations are appropriate:

- Surface water flowing from an existing property or new development should be controlled such that it does not negatively impact adjacent public or private property by increasing flow, concentrating flow, or stimulating erosion that was not present beforehand.
- New developments should submit a storm drainage plan at the time of application. The City of Damascus personnel should judge the adequacy of the plan based on the size and type of development and specific site conditions. The City may require an engineered Storm Drainage Plan if site conditions warrant..
- All new developments should incorporate basement and foundation drainage to control groundwater and keep it from crawl space, underslab, and below-grade areas.

Fills

Significant fills and those totally obscured by age and previous development are present throughout Damascus. A number of landslides were mapped within the Damascus city limits by DOGAMI and Portland State University (Burns, et al) after the 1996 flood and landslide events. Virtually all of the slides occurred in road fill areas with poor drainage (referred to on the Natural Hazards Inventory map as "Landslide Locations – DOGAMI").

- All geologic and geotechnical investigations should address the presence or absence of man-made fills as part of the reporting process.
- New development in filled areas should evaluate, using subsurface exploration, whether any deleterious materials (contaminated with wastes, structurally unsound, etc.) are present that may affect building foundations, utilities, or pavements in future developments.
- Initial evaluations of the suspected filled areas can be conducted by a CEG or GE. If conditions require recommendations for foundation construction outside those provided in the International Building Code (IBC), those recommendations should be made by a GE.

Wildfire Hazards

Methods

The project team reviewed existing aerial photography and GIS data and developed a GIS analysis of slope and aspect as risk factors for wildfire. Based on this analysis, the team's efforts were focused on those areas that potentially contained high fuel loads and/or significant risk to clusters of homes.

The project team then conducted limited ground-truthing of potential wildfire hazard areas within the City of Damascus and developed a map of potential wildfire hazards for digitizing. The field survey was aided by examination of aerial photographs, discussion with natural resource professionals, and the personal knowledge of co-author Mike Andrews, who is a long-time Damascus resident and wildland fire professional.

Findings

Wildfire is influenced by four major factors: fuels, weather, topography, and ignition. These components affect the likelihood that a fire will get established, the speed and direction in which a wildfire will burn, and the ability to control it.

- Fuels: Forest fuels consist mainly of living and dead vegetation. The amount, size, moisture content and continuity influence how fast and how far a fire will burn. In the wildland-urban interface, residential housing can also supply fuels that contribute to the spread of a wildlfire.

- Weather: Dry, hot and windy weather increases the likelihood of a major wildfire. These conditions make ignition easier, allow fuels to burn faster and increase fire intensity.

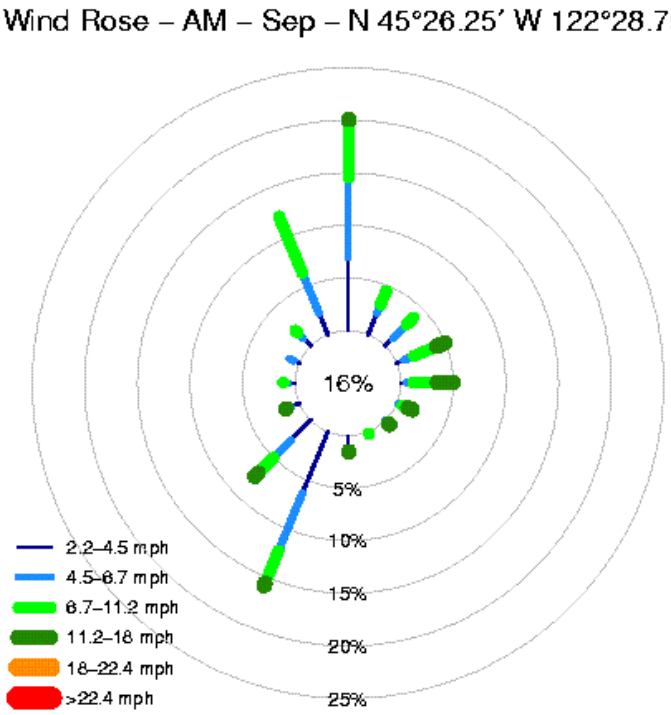
- Topography: Steepness and aspect of slope are the critical features of topography that affect fire behavior. As the steepness of slope increases, fire spreads more rapidly. Similarly, south and southwest aspects are driest and facilitate rapid fire spread.

- Ignition: Sources may include lightning strikes as well as anthropogenic sources.

Forest fuel types vary widely in the Damascus project area and reflect a long history of human activity. The term "fire hazard" refers to how flammable a given material is. Fire hazard is greatest where flammable fuels are continuous and heavy enough to carry fire through the landscape if not suppressed.

Dry, hot, windy weather conditions that are common in the project area in the late summer and early fall compound the existing fire hazard. During this time period, the hottest, driest winds come from the east. Other prevailing winds come from the north and southwest; however, these winds come from coastal areas and tend to have higher moisture content and therefore do not typically escalate fire conditions in the same way. These famous east winds come from high pressure cells in eastern Oregon that push hot dry air through the Gorge and into the greater Portland metropolitan area, including Damascus (Figure 3).

Figure 3. September Wind Rose for the Damascus area
Shows average wind speeds and directions during September. Prevailing winds are mainly from the N an SW, but E winds are a factor (Source: Ventilation Climate Information System, Joint Fire Science Program).



The Damascus area does include a number of volcanic buttes. Generally these topographic features do not present significant additional risk for wildfire because they do not tend to funnel winds in the way that steep canyons do. Further, the steep, south facing slopes that occur on these buttes are protected from the hot, dry East winds, thus mitigating the possible influence of these topographic features on wildfire risk.

General fuel types in the project area are: tall grass, brush, conifer forest, hardwood forest, mixed forest, and logging slash. Based on an analysis of aerial photography and limited field reconnaissance, the project team has identified a number of areas in Damascus that contain fuel types that could allow wildfire during certain climatic conditions. These areas are identified as wildfire hazards on the Natural Hazard Map (Figure 1) and together they cover approximately 175 acres of the City.

- Tall grass areas are fields that have not been mowed or grazed for one or more years. The resulting accumulated dead grass may remain a fire hazard for up to three years. Because the fuels are very fine and dry out quicker than larger fuel types, fires can occur in a wider time frame in grasses. Although late summer and early fall are typically the season when most fires occur, dry grasses can carry fire during extended dry periods in spring, early summer, and late fall.

- Brushy areas generally are clearings that historically were managed for various agricultural activities but have been abandoned and unmanaged for anywhere from five to twenty years. Fuels are characterized by accumulations of dead material (mostly leaves and limbs) from blackberries, hawthorn, scot's broom, sword fern, cascara, and grasses. Examples of these areas are abandoned pastures, tree nurseries, Christmas tree farms, and cane-berry fields. Because the brush is relatively short, there is high exposure to solar radiation all the way down to the ground and results in fuels that stay dry and flammable longer and that don't decompose as rapidly as shaded areas under a forest canopy. All of the areas identified on the fire hazard map have brush and/or brush-logging debris as the main component.

- Conifer forests are dominated by relatively even-aged second growth Douglas-fir with scattered western red cedar, western hemlock, and only minor amounts of hardwoods. Conifers have flammable oils in their needles which make them more of a fire hazard than hardwoods, both as live vegetation and as dead needles on the forest floor. Conifer forest canopies in the project area are usually dense, which results in sparse undergrowth. Canopy density also determines the amount of flammable dead limbs accumulating on the ground. Dense canopies result in light-starved lower limbs dying and dropping. Sparser canopies allow more sun to reach underneath and limit lower limb mortality. Because of the dense canopies in the project area there is a general absence of continuous ladder fuels. Ladder fuels are flammable materials that reach from the ground to the canopy. Continuous ladder fuels are necessary for large, catastrophic forest fires. Ladder fuels may exist around the outer edges of conifer forests where brush meets forest but usually not within the forest.

- Deciduous forests in the project area are characterized by a mix of even- and uneven-aged mostly non-flammable alder, maple, ash, cottonwood, and cherry.

These tree species generally maintain higher moisture contents in their leaves for longer periods as compared to evergreen species, and they generally lack the flammable compounds that are found in evergreens. Undergrowth is mostly non-flammable salmonberry, elderberry, and oceanspray, but may also contain pockets of Oregon grape and salal. Dead ground fuels are sparse and usually don't constitute a serious fire hazard. Flammable ladder fuels are generally not present.

- Most of the forests in the project area include a mix of conifer and deciduous species. There is a variety of ages and sizes of trees with understory species similar to pure deciduous forests. As a result, ladder fuels are generally not present except where conifer limbs reach close to the ground.

- Logging slash is debris from logging operations and it constitutes the most serious fire hazard in the project area especially in areas that have been clearcut. Clearcutting removes all the trees from a site and therefore adds heavy amounts of fuel to the ground. Within a few years of harvesting, the same flammable brush conditions that exist in other unmanaged areas also take over the clearcut adding even more fuel. The resulting extreme fuel accumulations make wildfires in these areas very difficult to control. Left untreated, logging slash can remain a fire hazard for 10-15 years.

The overall fire hazard in the Damascus project area is therefore relatively low based on the discontinuity of fuels and the general lack of extensive coniferous forests and associated high fuels concentrations. The areas with the highest hazard levels are mainly recently cleared areas where brush and slash pose short and medium term risks.

While fire hazard relates to the amount of flammable material, fire risk is the chance that a fire will actually occur. Fire risk in the project area is fairly high due to the large number of residents in a mostly rural setting. This presents a large number and variety of potential anthropogenic ignition sources. Wildfires in the project area are usually caused by activities common to rural settings: Debris burning, smoking, gas powered equipment (lawn mowers, chainsaws, heavy equipment, ATVs), fireworks, and children playing with fire.

County-wide, recent ten year averages show that lightning has caused about one to two fires per year on private land (Clackamas County 2005). In some years, lightning has ignited up to a dozen fires from one storm event in Clackamas County. These fires can create resource allocation problems as fire-fighting units are deployed to fight them.

The majority of fires in Clackamas County are caused by humans. The North Cascade District of Oregon Department of Forestry (ODF) lists debris burning as the number one cause of fires on forest lands in Clackamas County, causing more than 166 fires in the past ten years. The second leading cause of fires in the North Cascade District is

recreation, which is less of a concern in the Damascus area as compared to the Mt. Hood National Forest. Miscellaneous causes include ignitions from electric fences, burning buildings and vehicles, spontaneous combustions and sparks from mufflers and converters (Clackamas County 2005).

Discussion and Recommendations

Because the forest fuels of concern are primarily on private land, the primary means of reducing the risk of wildfire are landowner educational programs and regulatory measures designed to provide incentives for fuels reduction projects. Recently, there has been a nationwide movement in federal and state agencies encouraging the development of Community Wildfire Protection Plans (CWPPs). Spurred by passage of the Healthy Forest Restoration Act (HFRA) in 2003, CWPPs are intended to provide a framework for identifying and prioritizing fuels reduction projects on both federal and non-federal land.

CWPPs typically are organized at the county level, are led by the local communities and receive support from federal agencies such as the USDA Forest Service; in Oregon, Josephine and Jackson Counties were the first to develop CWPPs. Located near the devastating Biscuit Fire of 2003, these communities had very tangible and immediate reasons for developing a comprehensive strategy to fuels reduction in the wildland urban interface. With growing concern about wildfire in northwestern Oregon, Clackamas County in 2005 developed and approved the Clackamas County Community Wildfire Protection Plan (Clackamas County 2005).

The Clackamas County Community Wildfire Protection Plan identifies 15 “communities at risk” within the county, one of which is the Boring Fire District. Within this district, Damascus has been identified as a strategic planning area, meaning it was identified as high hazard in community meetings and/or by fire district personnel.

Maps developed for the Clackamas County Community Wildfire Protection Plan indicate that the Damascus area rates moderate to high on fire hazard, based on fuels, topography, and climate; low on protection risk, based on proximity to fire-fighting resources and access; moderate on historic fire occurrence and ignition risk. The overall rating for the Damascus area generally ranges from low to moderate, which is consistent with the project team’s assessment.

The Oregon Forestland-Urban Fire Protection Act of 1997, better known as Senate Bill 360, was intended to reduce risk of wildfire in the wildland urban interface zones in the state, mainly by establishing standards for property owners so they can work to minimize fire hazards and risks. The Oregon Department of Forestry has only implemented this legislation in Jackson and Deschutes Counties. The law means that landowners that fail to adequately reduce fire hazards and risks on their properties may be liable for costs associated with fighting wildfire if it does occur. Although Clackamas County has not yet

been selected for SB 360 implementation, the CWPP process is "laying the groundwork for implementation by coordinating agencies that have a vested interest in reducing wildfire hazards, implementing a wildfire prevention public outreach campaign, improving understanding of fire safe construction and practices in regulatory agencies, and promoting a more wildfire-based approach to managing the forests in Clackamas County." (Clackamas County 2005). This type of regulatory approach would create a strong incentive for landowners to implement recommended fuels reduction practices on their properties in the Damascus area and throughout the County.

Recommendation #1: Expand on and refine the work conducted for the Clackamas County CWPP, tailoring its findings to local conditions. As development in the Damascus area continues, an increase in human ignitions is likely.

Recommendation #2: Encourage residents to follow the recommendations of local fire agencies experienced in protecting homes from wildfires. These pertain to creating a defensible space around buildings and to fire prevention measures.

Recommendation #3: Consider an ordinance requiring lots with grass to be mowed by August 1. This would ensure that the grass is mature and not likely to become a hazard again during fire season. The August 1 deadline will allow spring ground-nesting birds to successfully rear their young. The Oregon Department of Fish and Wildlife should be consulted on relevant bird species and timing.

Windthrow Hazards

Methods

Using an approach similar to the wildfire hazard assessment, the project team reviewed existing aerial photography and GIS data related to risk factors for windthrow. Limited ground-truthing of existing and potential windthrow hazard areas within the City of Damascus was then completed. Although topographic features do play a role in exacerbating windthrow risk, this phenomenon is much harder to predict or prevent than wildfire, and the project team determined that spatially explicit windthrow hazard ratings could not readily be developed for the project area.

Findings

Windthrow occurs when trees are snapped or uprooted by high winds. The primary factors contributing to windthrow likelihood are:

- Root and stem diseases, which structurally weaken trees
- Saturated soils during prolonged periods of rain

- Land clearing, which exposes trees previously sheltered from the wind to direct gusts
- Landscape position: ridge tops and slopes facing the prevailing winds, particularly during the wettest times of year, typically winter

Trees that have grown primarily in an opening generally have a well developed root system, which helps anchor them during high wind events. Trees that develop in dense stands, or groups, of other trees typically have small crowns and relatively small root systems. These trees are sheltered from high winds by surrounding trees and stem or root breakage is normally minimized. Forest fragmentation, which has occurred and will continue to occur in the Damascus area in the form of clearcutting, road and powerline clearing, and residential development, exposes interior-grown trees to direct wind and removes trees that formerly acted as supports and wind breaks. Windthrow can be expected in such situations, although predicting exact locations and timing of windthrow is difficult. Generally, root strength is proportional to size of crown. In areas of dense conifers, various root rotting pathogens can weaken and kills roots, removing most structural resistance to high winds.

Damage to Damascus home from windthrown timber. This occurred during the December 2006 windstorms.

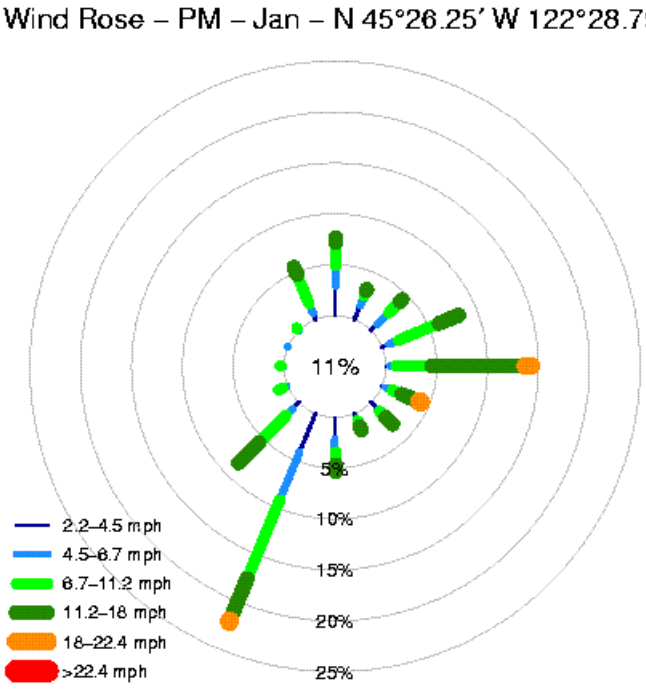
SW winds from December 2006 storm blew over a mature Douglas-fir on a ridgetop, which landed on this home in Damascus.

In the Damascus area, prevailing winds during winter include winds out of the southwest and east (Figure 4). Generally, exposed ridges are more susceptible to such winds, but there are so many variables that influence whether wind damage will actually occur, including tree health, tree density, soil conditions, and micro-wind patterns that it is very difficult to predict windthrow occurrence.

Windthrow is less likely in forest stands that have been thinned and managed over time to favor the healthiest, most wind-firm trees. Stands that are thinned or high-graded to remove the largest trees are typically very susceptible to windthrow.

In summary, within the project area there are no specific areas that can be singled out as having higher windthrow risk. New residential developments that attempt to retain mature trees should be encouraged because of the many benefits provided by mature shade trees; however, efforts should be made to encourage retention of the healthiest trees with the largest crowns to minimize the likelihood of windthrow.

Figure 4. January Wind Rose for the Damascus area
Shows average wind speeds and directions during January. Prevailing winds are mainly from the SW and E (Source: Ventilation Climate Information System, Joint Fire Science Program).



Discussion and Recommendations

Windthrow risk is increased when trees in a dense stand lose the support of some or all of their cohorts due to logging or other tree removal. Traditionally, large-scale housing developments that take place in forested areas have usually resulted in complete removal of the forest. Recently, the trend in development has included substantial efforts to preserve individual trees or groups of trees from the original forest to enhance the aesthetics and lived-in look of the development. This trend, while laudable for its attention to the values that mature trees can bring, has often resulted in trees blowing down.

One approach to this conundrum is to attempt "clumped" rather than "dispersed" retention (Maguire et al 2006). Dispersed retention involves retaining individual trees scattered throughout the project area, while clumped retention involves retaining one or more groups of trees. These clumps, if designed and executed properly, can offer a reduced risk of windthrow, as well as other benefits including increased aesthetic and habitat values.

Recommendation #1: Develop a tree ordinance to ensure that any tree cutting in residential areas does not result in an increased risk of windthrow. The ordinance could require that prior to cutting any mature trees, a city-endorsed arborist must verify that the cutting will not exacerbate windthrow hazards.

Recommendation #2: Develop a program to encourage or even require "clumped" rather than "dispersed" retention of trees during subdivision and housing development to reduce the risk of windthrow.

Flood Hazards

Methods

The evaluation of flood hazards for the Clackamas River floodplain was based on Federal Emergency Management Agency (FEMA) maps and data. Evaluation of flood hazards for the other landforms in the study area is based on general topography, soil/slope relationships, mapping of wetlands and hydric soils, and on the synoptic hydraulic/ hydrology evaluation for the area (Clackamas County Service District No. 1 Surface Water Management Plan). Reach specific hydraulic and flood forecasting analyses are not available in the study area.

Flooding of the Clackamas River has shifted the river's course. This bank has lost up to 100 feet in recent years.

Flood Hazard Assessment

Floodplain hazards in the study are well documented and delimited by FEMA for those lands in the Clackamas River corridor and for the lower Rock and Richardson Creek corridors. The lower (FEMA mapped) portions of Rock and Richardson Creeks are not within the Damascus city limits. FEMA 100-year floodplains within the city are shown on the Natural Hazard Map (Figure 1). The total mapped floodplain area is 140 acres.

Floodplain hazards along upper reaches of Rock and Richardson Creeks, along Sunshine and Noyer Creeks, and along smaller tributary basins on the northern project area periphery are not well defined, however, the *CCSD No.1 Surface Water Master Plan Hydrologic-Hydraulic Analysis* sheds considerable light on the general hydraulic and hydrologic problems for these drainages. In general, the hydraulic analysis documents that models are available that can adequately predict runoff and flow conditions during large storm events under different development scenarios. All of these streams except Sunshine Creek are moderate gradient streams with generally narrow floodplains.

However, each stream has reaches of lower gradient where local flood hazards may be more severe. Areas of specific development concern may require detailed modeling to identify specific flood heights and velocities during design storms.

In the absence of specific hydraulic modeling, existing natural features (such as embankment height, riparian vegetation, fluvial soil deposits, etc) may provide for preliminary estimation of potential flood threat areas. Lower Sunshine Creek and upper Noyer Creek have low to moderate gradients and may be at greater flooding risk. Detailed analyses of these basins are not available. Flooding hazards in the Sunshine Creek basin (Sunshine Valley) are expected to be primarily due to inundation of lower lying areas.

Some previous studies document that the East Butte/Boring Lava complex is likely not a significant recharge area both because of limited permeability of the boring lavas as well as the low permeability of the resultant weathered soil (Brody-Hein 2005); however, other studies (Ecotrust 2000) indicate that portions of this butte complex may provide critical recharge to aquifers feeding local streams. Soils in this landform are generally thin and slopes are steep to moderate. Stream flows in these areas are typically very flashy and respond rapidly to rainfall. Flood hazards in this landform group are limited in extent to the narrow drainage channels and can be readily observed by noting past scars from erosional events such as slumps and bank cuts. Flood hazards are primarily associated with the force of moving water to erode soils or damage or undercut structures that are close to the stream channels. The particular problem in this area is that additional development in areas of unstable soils or concentration of runoff from impervious areas routing may cause much higher peak flows with related stream erosion events.

The inter-butte landform area is characterized generally by low permeability soils on gently to moderately sloping terrain. Ecotrust (2000) mapped significant areas of hydric soils in this landform, indicating areas of periodic inundation. Shallow groundwater is reportedly in generally poor connectivity with the deeper Troutdale gravel aquifer and as a result, soils generally become saturated early in the rainfall season. Flood hazards in this area are largely associated with ponding and damage from inundation. There is some potential for damage from stream channel course changes during high water. Current flood hazard areas can generally be estimated by noting wetland (and former wetland) areas and areas that are within several feet (depending on the stream size) of the uppermost wetland area. Because flood hazards will depend on local gradients, channel conditions, soils, and development factors, hydraulic modeling is an appropriate tool for quantifying potential flood hazards in areas of concern.

The lower Clackamas River floodplain areas have defined flood hazards as noted on FEMA recurrence interval mappings of floodways and floodplain. Potential damage in this zone can come both from inundation and high velocity water damage.

Recommendations

- An inventory should be made of stream reaches that experienced significant erosion, mass wasting, or channel change events during the most recent (since 1990) extreme precipitation events. These areas should be considered for designation as flood erosion hazard areas pending area specific hydraulic analysis.
- Areas of steeper stream gradient and/or areas where previous large rain events (1996, 2004, 2006) have caused mass wasting, erosion, or channel changes should receive reach specific hydraulic/ hydrologic analysis prior to large scale developments.
- Areas with significant ponding during recent large rainfall events should be mapped, including both depth and duration of ponding. These areas should be considered for designation as flood hazard areas.
- Areas identified as potential flood hazard areas should receive additional evaluation of development elevations, proposed in-filling, and the routing/disposal of storm water prior to extensive development.

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