Appendix O

EARTHQUAKE PREPAREDNESS EVALUATION

City of Tumwater
2017 Comprehensive Water System Plan

Technical Memorandum 4
EARTHQUAKE PREPAREDNESS EVALUATION

FINAL | June 2021

carollo

City of Tumwater
2017 Comprehensive Water System Plan

Technical Memorandum 4

EARTHQUAKE PREPAREDNESS EVALUATION

FINAL | June 2021

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June 30, 2021

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Contents

Technical Memorandum 4 - Earthquake Preparedness Evaluation 4-1

4.1 Background 4-1

4.2 Critical Customers 4-1

4.3 Seismic Backbone System 4-2

4.3.1 General Considerations and Standards for Seismic Resiliency 4-3

4.3.2 Cost Estimates 4-4

4.4 Next Steps 4-6

Appendix

Appendix A Tumwater Hazard Mitigation Plan

Figure

Figure 4.1 Seismic Backbone System Map 4-5

Abbreviations

ADD	average day demand
ASCE	American Society of Civil Engineers
Carollo	Carollo Engineers, Inc.
CIP	Capital Improvement Plan
City	City of Tumwater
CSZ	Cascadia Subduction Zone
ER DIP	Earthquake-Resistant Ductile Iron Pipe
gpm	gallons per minute
LOS	level of service
M9.0	Magnitude 9.0
ORP	Oregon Resilience Plan
THMP	Tumwater Hazard Mitigation Plan

Technical Memorandum 4

EARTHQUAKE PREPAREDNESS EVALUATION

4.1 Background

The City of Tumwater (City) completed a Hazard Mitigation Plan (THMP) in 2017, which identified potential major natural hazards their water system could encounter. These potential hazards include earthquakes, storms, floods, landslides, wildland fires, and volcanic events. The earthquake hazard is a high risk to the system and was considered the highest priority when preparing the system for a major natural hazard. The THMP showed areas of liquefaction within the City's water service area, specifically around the Palermo Wellfield and west of Barnes Lake.

Communities in the Pacific Northwest are becoming increasingly aware of the major threat that a catastrophic seismic event will have on our communities. Recent seismological research conducted by Oregon State University geologists and published by the U.S. Geological Survey provide compelling evidence that Cascadia Subduction Zone (CSZ) earthquakes represent the most eminent seismic hazard in our region. The CSZ earthquake with a magnitude of 8.0 to 9.0 or 9.2 — similar to recent events in Japan, Chile, and Indonesia — has an estimated probability of occurrence off the Oregon Coast on the order of 10 to 40 percent over the next 50 years (Goldfinger and others, 2012).

The CSZ earthquake will result in significant damage to our urban infrastructure, disrupting daily life and our local economy. As part of this Plan, the City tasked Carollo Engineers, Inc. (Carollo) to help create a high-level earthquake preparedness evaluation with the following goals:

- Define the critical customers that are highest priority to be served in the aftermath of an earthquake.
- Identify the backbone system, which will be confirmed when a complete resiliency study is performed, that should be seismically resilient to serve critical customers in the aftermath of an earthquake.
- Identify the next steps for developing a seismic resiliency plan.

4.2 Critical Customers

Critical customers are defined as customers with the highest priority to be served after a catastrophic event. Typically these customers require water within 24 hours due to health and safety concerns, emergency services, or for sheltering purposes. The City went through an initial assessment and determined the following critical customers would be part of the seismic backbone system:

1. **Hospitals**
    a. Urgent Care South
    b. Tumwater Veterinary Hospital
    c. DaVita Tumwater Dialysis

d. Olympics West Retirement Inn
e. Hampton's Alzheimer's Special Care Center

2. **Emergency Services**
   a. North End Fire Station
   b. Tumwater Fire and Police Department Headquarters
   c. Tumwater City Hall
   d. City of Tumwater O&M facility (This facility is not built yet but is in the works)
3. **Schools/Shelters**
   a. Peter G Schmidt Elementary School
   b. Tumwater Public School Special
   c. Michael T. Simmons Elementary School and District 33 Building
   d. Tumwater High School
   e. George Washington Bush Middle School
   f. Black Lake Elementary
   g. Washington Connections Academy
   h. US Armory Reserve Center
   i. Tumwater Readiness Center (This facility is not built yet but is in the works)
   j. Olympic Flight Museum
   k. Mountain View Church
   l. Northstar Church
   m. Camp Solomon Schechter

These critical customers are identified on Figure 4.1 Seismic Backbone System Map, which is defined in the next section.

4.3 Seismic Backbone System

A water system backbone is the infrastructure required to maintain adequate water service to critical customers following an earthquake. The Oregon Resilience Plan (ORP), which is the region's preferred resiliency guide, presents target states of recovery following a seismic event. The backbone system is defined in the ORP as follows:

> The backbone water system should be capable of serving key community facilities including hospitals, fire departments and emergency response centers while damage to the broader, non-backbone system, is being addressed.

The City has made a critical first step in identifying their own seismic backbone map with critical customers and facilities. The critical pipes and facilities of the backbone system are highlighted in orange in Figure 4.1. They include 14 miles of piping, two interties with the City of Olympia, the 350 Reservoir, the Airport Wells, and the Bush Middle School Wells. The City's critical customers are also shown in Figure 4.1. The areas of liquefaction found in the THMP were included in the map to provide a picture of which critical facilities have a higher risk of failure given the geotechnical hazard. For example, the Palermo Wellfield was not included as part of the backbone system due to its location in a high liquefaction area. The City also considered the following topics during development of the seismic backbone:

- Customers or facilities that are located in the 454 and 549 pressure zones are not part of seismic backbone.

- The City will decide if both interties to the Olympia Water System will be included in the backbone system:
  - The Crosby Blvd (direct valve) intertie is in a higher pressure zone.
  - The Capital Blvd (pump only) intertie is in the 350 pressure zone and also close to high liquefaction areas.
- The Bush Middle School Wells (Wells #12 and #14) have enough supply capacity (2,940 gallons per minute [gpm]) to handle the City's projected average day demand (ADD) until 2027 (2,848 gpm).

These considerations will help the City when they conduct a full seismic resiliency plan.

4.3.1 General Considerations and Standards for Seismic Resiliency

In general, there are some typical practices that can be performed on certain components to make them seismically resilient. At this time, the American Society of Civil Engineers (ASCE) is developing standards for seismic resiliency, and it is anticipated to be completed in 2020 or 2021. The following sections present a high-level description of recommendations.

4.3.1.1 Piping

There are several different types of earthquake-resilient piping that can be used depending on the specific geotechnical hazards that need to be addressed. The following piping could be considered:

- Kubota Earthquake-Resistant Ductile Iron Pipe (ER DIP)
- U.S. Pipe ER DIP
- American Pipe ER fittings on joints – spacing depended on geohazards present
- Restrained joints – flexibility and elongation would have to be considered.
  - Heat fusion welded HDPE
  - Bell and spigot welded steel pipe

4.3.1.2 Pump Stations

Pump stations can generally have both structural and nonstructural deficiencies. For the pump station housing structure, some recommendations would be to anchor the roof and confirm that the structure is stable from lateral forces. Components inside the structure, including any cabinetry, piping, and electrical or HVAC equipment, should be anchored down to avoid any falls.

Wet wells in pump stations could have enough lateral movement during a seismic event to cause precast risers to shift. Installing stainless steel bent plates across the wet well joints could possibly avoid potential damage. Flexible coupling is also typically recommended to be installed at any piping connection that would be rigid.

Pump stations are recommended to have an emergency generator that is properly anchored onto a concrete housekeeping pad in order to have back up power available after a seismic event.

4.3.1.3 Reservoirs

For reservoirs, there are both structural and nonstructural deficiencies that can occur during a seismic event. Some considerations would be similar to the pump station recommendations: providing anchoring to any nonstructural components, securing any floor grating to supports with grating clips, installing flexible fittings at otherwise rigid areas, and upgrading the reservoirs to handle seismic water sloshing. In some cases, water utilities choose to operate their tanks at a lower level to improve the tank's ability to withstand sloshing.

4.3.1.4 Wells

Standalone wells are fairly resilient to damage during earthquakes because they move with the ground motion. Any transitions between underground components and above-ground components are susceptible to damage during an earthquake. Anchoring and flexible coupling are recommended.

4.3.2 Cost Estimates

Developing high-level cost estimates for structural and nonstructural seismic retrofits can be challenging without knowing the details of the condition of components. However, there are general considerations that can help the City budget for future projects that include hardening their backbone system.

4.3.2.1 Pipelines

In general, seismically resilient piping costs approximately 30 percent more than normal piping. This would not include any contingencies, engineering, legal/administration, or planning, which can increase the project upwards of an additional 80 percent.

To develop a high-level cost estimate for replacing the pipes in the backbone system with seismically resilient pipe, we have assumed an average diameter of 12 inches at a unit cost of $390/LF. Including an additional 15 percent contingency and 25 percent for engineering, legal, and administration costs, the total unit cost comes to approximately $560/LF. With a backbone pipe network of 14 miles, the cost to replace the entire backbone is estimated at $42 million.

4.3.2.2 Reservoirs

Typical reservoir costs for seismic retrofitting would include bracing and anchorage, which can range from $1,000 to $10,000 depending on the size and components. Structural stabilization can also vary greatly, depending on the soil conditions and the current condition of the reservoir. A unit cost of $10 to $25 per square foot is a generally accepted estimate for bracing in critical facilities.

City of Olympia
Crosby Blvd Intertie with Olympia Water System
Northwest School of Innovative Learning
Capitol Blvd Intertie with Olympia Water System
Irving St. PRV
Somerset Hill Dr. PRV
Tumwater Hill Elementary School
350 Reservoir
Sunrise Beach School
Somerset Reservoir & Mottman B Tanks
C Street and Zone 4 Booster Pump Stations
Bush Mountain BPS
Crosby Blvd. PRV
Michael T Simmons Elementary School & District 33 Buidling
North End Fire Station
The Hampton's Alzheimer's Special Care Center
Serendipity Children's Center
Palermo Wellfield
Olympics West Retirement Inn
Multicare Indigo Urgent Care
DaVita Tumwater Dialysis
Capital Region ESD 113
Peter G Schmidt Elementary School
Lakeland Manor Water System
Tumwater Middle School
Cadence Academy Preschool, Tumwater
Tumwater Public School Special
Black Lake Elementary
Urgent Care South
Nazarene Christian School
Northstar Church
Tumwater Veterinary Hospital
Tumwater High School
Washington Connections Academy
Secondary Options
Mountain View Church
Airport Wells
Camp Solomon Schechter
A G West Black Hills High School
New Market Skills Center
Tumwater Fire & Police Department Headquarters
Airport Reservoir (Inactive)
Tumwater City Hall
George Washington Bush Middle School
Olympic Flight Museum
Tumwater Readiness Center
City of Tumwater O&M facility
Bush Middle School Wells
Lathrop Water System
Black Lake
Ward

Inset Map
Somerset Reservoir
Mottman A Tank
Mottman B Tank
350 Reservoir
Zone 4 Booster Station
C Street Booster Station

Legend

- Government - Local or National
- Hospital
- School or Day Camp
- Church
- Museum
- Fire Stations
- City Hall
- Police Stations
- PRV
- Intertie
- Well
- Seismic Well
- Pump Station
- Reservoir
- Retail Water Service Area

Water Mains
- <= 4 inches
- 6-8 inches
- >= 10 inches
- Unknown Diameter
- Seismic Backbone
- Major Highways
- Streets
- Water Body
- Rivers
- High Liquefaction Hazard
- City-owned Satellite Water System
- Parcel

Pressure Zone
- 350 Zone (Zone 1)
- 454 Zone (Zone 2)
- 549 Zone (Zone 4)

Miles
0 0.5 1

Data Sources: City of Tumwater, WSDOT, Washington NHD, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Figure 4.1 Seismic Backbone System Map

4.4 Next Steps

A Seismic Resiliency Plan is recommended as part of the City's Capital Improvement Plan (CIP). The Seismic Resiliency Plan will provide a clear plan on which critical structures will be required to serve the critical customers during the recovery periods after a seismic event. The plan will also help identify any interdependencies the City has with other systems and utilities. In general, the following items should be included in the Seismic Resiliency Plan:

- Identify the water system performance objectives and Level of Service (LOS) goals.
- Identification of geotechnical hazards from a magnitude 9.0 (M9.0) CSZ earthquake.
- Detailed evaluations of the selected critical facilities.
- Recommended resilience design standards.
- Recommended list of improvement projects and timing to build resilience into the water system.

Appendix A

TUMWATER HAZARD MITIGATION PLAN

The City of Tumwater Annex to the Hazards Mitigation Plan for the Thurston Region

July 17, 2017

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Table of Contents

Table of Contents

Table of Contents 1
Adopting Resolution 5
Community Profile 6
City of Tumwater Plan Development Process 7
Hazard Mitigation Plan Workgroup 7
Hazard Mitigation Plan Development 7
Opportunities for Public Participation 10
Ongoing Public Participation 11
Integration in Plans, Policies, and Planning Mechanisms 11
Updates 12
Mitigation Initiative Prioritization Process 12
Changes in Development 13
City of Tumwater Risk Assessment 14
Introduction 14
Hazard Analysis Definitions 15
Risk Rating 15
Probability of Occurrence 15
Vulnerability 16
Summary Risk Assessment 16
Local Risk Assessment 17
Earthquake 18
Severity 18
Impacts 18
Probability of Occurrence 18
Historical Occurrences and Impacts Specific to this Jurisdiction 18

Summary Assessment 23
Storm 25
Severity 25
Impacts 25
Probability of Occurrence 25
Historical Occurrences and Impacts Specific to this Jurisdiction 25
Summary Assessment 29
Flood 31
Severity 31
Impacts 31
Probability of Occurrence 31
Historical Occurrences and Impacts Specific to this Jurisdiction 31
Summary Assessment 37
Landslide 38
Severity 38
Impacts 38
Probability of Occurrence 38
Historical Occurrences and Impacts Specific to this Jurisdiction 38
Summary Assessment 40
Wildland Fire 42
Severity 42
Impacts 42
Probability of Occurrence 42
Historical Occurrences and Impacts Specific to this Jurisdiction 42
Summary Assessment 43
Volcanic Hazards 44
Severity 44
Impacts 44
Probability of Occurrence 44
Historical Occurrences and Impacts Specific to this Jurisdiction 44

Summary Assessment 44
Maps 45
City of Tumwater Mitigation Initiatives 50
Current Adopted Mitigation Initiatives 50
Completed or Removed Mitigation Initiatives 52
City of Tumwater Mitigation Initiatives 54
City of Tumwater Implementation of the National Flood Insurance Program (NFIP) 78
Introduction 78
Future Land Use Plans, Zoning, and Development Regulations 78
Additional Activities 80

RESOLUTION NO. R2017-013

A RESOLUTION of the City Council of the City of Tumwater, Washington adopting the 2017 update to the Hazards Mitigation Plan for the Thurston Region.

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

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

WHEREAS, the City of Tumwater has been an active participant in the Natural Hazards Mitigation Planning Workgroup and Task Force, which have established a comprehensive, coordinated planning process to eliminate or decrease these vulnerabilities; and

WHEREAS, the City of Tumwater has identified, justified and prioritized a number of proposed projects and programs needed to mitigate the vulnerabilities of Tumwater to the impacts of future disasters; and

WHEREAS, these proposed projects and programs have been incorporated into the 2017 update edition of the *"Hazards Mitigation Plan for the Thurston Region"* that has been prepared and issued for consideration and implementation by the communities of Thurston County;

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF TUMWATER AS FOLLOWS:

Section 1. The Tumwater City Council hereby accepts and approves of its designated portion of the 2017 update to the *"Hazards Mitigation Plan for the Thurston Region"* attached as exhibit A.

Section 2. The agency personnel of the City of Tumwater are requested and instructed to pursue available funding opportunities for implementation of the proposals designated therein.

Section 3. The City of Tumwater will, upon receipt of such funding or other necessary resources, seek to implement the proposals contained in its section of the strategy.

Section 4. The City of Tumwater will continue to participate in the updating and expansion of the *"Hazards Mitigation Plan for the Thurston Region"* in the years ahead.

Section 5. The City of Tumwater will further seek to encourage the businesses, industries and community groups operating within and/or for the benefit of the City of Tumwater to also participate in the updating and expansion of the *"Hazards Mitigation Plan for the Thurston Region"* in the years ahead.

Section 6. Ratification. Any act consistent with the authority and prior to the effective date of this Resolution is hereby ratified and affirmed.

Section 7. Severability. The provisions of this Resolution are declared separate and severable. The invalidity of any clause, sentence, paragraph, subdivision, section, or portion of this Resolution or the invalidity of the application thereof to any person or circumstance, shall not affect the validity of the remainder of the Resolution, or the validity of its application to other persons or circumstances.

Section 8. Effective Date. This Resolution shall become effective immediately upon adoption and signature as provided by law.

RESOLVED this 1st day of August, 2017.

CITY OF TUMWATER

Pete Kmet

Pete Kmet, Mayor

ATTEST:

Melody Valiant

Melody Valiant, City Clerk

APPROVED AS TO FORM:

Karen Kirkpatrick

Karen Kirkpatrick, City Attorney

Community Profile

Community Profile: City of Tumwater

City info: (360) 754-5855
www.ci.tumwater.wa.us

Demographics

Population, 2000		12,698
Population, 2010		17,371
Population, 2016		23,040
Avg. Ann. Pop. Growth, 2000-2010		3.2%
Avg. Ann. Pop. Growth, 2010-2016		5.8%
Households, 2010		7,566
Average Household Size, 2010		2.30
Age Structure, 2010:		
17 and under	3,767	22%
18 - 64	11,354	65%
65 and over	2,250	13%
Median Age	37	--
Race and Ethnicity, 2010:		
White	14,769	85%
Black/African American	301	2%
American Indian & Alaska Native	201	1%
Asian	841	5%
Native Hawaiian & Other Pacific Islander	90	1%
Other Race	272	2%
Two or More Races	897	5%
Hispanic or Latino (Of Any Race), 2010:		
Hispanic[2]	1,069	6%

Tumwater, originally called "New Market," was the first permanent American settlement on Puget Sound. In 1845, a party of 30 men and women, led by Michael T. Simmons and George Bush, established a settlement when the area was still a British territory. Initially, the community developed around the falls of the Deschutes River, called *SpEkwa'L*, "cascade," by the Coastal Salish. The town was later known as "Tumwater," Chinook jargon for "waterfall." Tumwater was incorporated November 25, 1869 and reincorporated on November 12, 1875.

In 1896, Leopold Schmidt established a brewery at the falls, which became a focus of the city. In 1956, the construction of the freeway through the city razed most of the original downtown.

Now noted for its parks and museums, Tumwater has adopted the classic lines of the Old Brewhouse building for its civic structures along Israel Road.

Housing

Housing Units, 2016 Estimate:		
Single-Family	5,900	59%
Multifamily	3,400	34%
Manufactured Homes	760	8%
Average House Sale Price, 2014:		$252,235

Employment and Income

Median Household Income[1]:		
1999 (Census 2000)		$43,329
2010-2014 (ACS Estimate)		$62,258
Households by Income Category, 2010-2014[1]:		
Less than $24,999	1,369	18%
$25,000 to $49,999	1,384	18%
$50,000 to $74,999	1,958	25%
$75,000 to $99,999	1,422	18%
$100,000 or more	1,640	21%

Taxable Retail Sales, 2015:	$542,875,644
Total Jobs, 2014 Estimate[2]:	**20,610**
Manufacturing	800
Construction and Utilities	1,770
Transportation and Warehousing	3,190
Retail	575
Services	4,230
Finance, Insurance, Real Estate	1,035
Government	9,005

Development Activity

Residential Building Permits	
Avg. Ann. New Unit Permits 2000-'10	141
Avg. Ann. New Unit Permits 2011-'14	167
Total New Unit Permits 2015	88

Subdivision Activity, 2015:	**# Appl.**	**# Lots**
Short Plat	0	0
Long Plat	0	0

Explanation: [1]Estimates based on survey data and may have a large margin of error.
[2]Numbers may not add due to rounding.
Source: TRPC, Profile 2016 (www.trpc.org).

City of Tumwater Plan Development Process

Hazard Mitigation Plan Workgroup

The following individuals served as the City of Tumwater's hazards mitigation planning development workgroup:

Department/Title	Representative(s)
Long Range Senior Planner	David Ginther
Long Range Planning Manager	Brad Medrud
Community Development Director	Mike Matlock
General Government Committee	Councilmembers Joan Cathey, Debbie Sullivan, Eileen Swarthout
Public Health and Safety Committee	Councilmembers Tom Oliva, Ed Hildreth, Eileen Swarthout

Hazard Mitigation Plan Development

The following activities supported the development of the City of Tumwater's local hazard mitigation planning process:

Activity and Name(s)	Date
• **Emergency Preparedness Expo Held in Tumwater at Peter G. Schmidt Elementary School.**	September 24, 2014
• **Mitigation initiatives sent to City departments for review.**	December 30, 2014
• **Requested updated information on critical facilities from Finance and Executive Departments.**	March 23, 2015
• **Requested updated data on the critical facilities within Tumwater from the Administrative Services Department.**	March 24, 2015
• **Contacted Fire Dept to request review of the HMP and mitigation initiatives.**	March 25, 2015
• **Coordinated with Administrative Services Department, Police Department, and Thurston Regional Planning Council (TRPC) on gathering additional information necessary for the update to the plan and submitting it to TRPC.**	March 26, 2015
• **Received comments on plan from Fire Department.**	March 27, 2015
• **Compiled responses by department directors on mitigation initiatives and continued work on update to plan.**	April 8, 2015

Activity and Name(s)	Date
• **Conducted research into the amount of FEMA money the City received for the 2012 winter storm cleanup ($237,796.56)**	
• **Started updating Mitigation Initiatives based on feedback from Fire Chief, Public Works Director, and Parks Director.** • **Contacted Facilities Manager and Community Development Director regarding City-owned generators as well as those that are utilized by critical facilities.**	April 14, 2015
• **Continued updating Mitigation Initiatives based on feedback from Fire Chief, Public Works Director, and Parks Director.**	May 19-22, 2015
• **Continued updating Mitigation Initiatives based on feedback from Fire Chief, Public Works Director, and Parks Director.**	June 16, 2015
• **Continued updating Mitigation Initiatives.** • **Attended and participated in a Hazard Mitigation planning workgroup meeting at the Thurston County Emergency Management headquarters facility.**	June 18, 2015
• **Briefed a Council subcommittee (General Government Committee) on the Hazard Mitigation Plan and the update effort at a public meeting.** • **Worked on incorporating General Government Committee (GGC) meeting comments into plan update by adding back into the plan three mitigation initiatives dealing with elevating, acquiring, and informing properties on 58th Avenue which were annexed to the City. These homes are in the floodplain and parts of their properties are in the floodway.**	July 7, 2015
• **Worked on incorporating suggestions from the General Government Committee public meeting into the plan by modifying the mitigation initiative dealing with investigation of a floodwall around the golf course clubhouse to include investigation of floodproofing the structure as well.**	July 9, 2015
• **Continued updating Mitigation Initiatives based on feedback from department directors and General Government Committee.**	July 13-23, 2015
• **Reviewed the Comprehensive Drainage Plan for the Salmon Creek Basin to assess whether goals of that plan should be integrated into the Tumwater annex of the HMP.**	August 13-14, 2015
• **Completed review of the Comprehensive Drainage Plan for the Salmon Creek Basin to assess whether goals of that plan should be integrated into the Tumwater annex of the HMP. Created a summary sheet of the goals and the responsible party as listed by the Salmon Creek Plan.** • **Worked on draft version of Tumwater annex.**	August 17, 2015
• **Worked with Mayor to add an additional mitigation initiative related to elevating roads in areas prone to high groundwater flooding.**	August 18, 2015
• **Met with City Administrator and Department Directors to discuss draft plan.**	August 24, 2015
• **Reviewed wildland fire section in plan at request of Fire Chief.** • **Revised the last mitigation initiative involving elevating streets in the salmon creek basin. Expanded to include all infrastructure, utilities and appurtenances, and structures. Also included other options such as flood proofing and the use of berms or floodwalls.**	August 25, 2015
• **Interviewed Tumwater Building Official on high groundwater flooding, responses and responsibilities in regards to frequently flooded properties on 58th Avenue as well as other issues related to the building code and flooding.**	August 26, 2015

Activity and Name(s)	Date
Also discussed responses to various types of natural hazards.	
• **Researched Tumwater settler history and worked on updating community profile page and description.** • **Continued work on updating plan and mitigation initiatives.**	September 23-29, 2015
• **Further work on plan update and mitigation initiatives.**	October 15, 2015
• **Worksheet proofing for workgroup leader regarding mitigation initiative templates**	November 12, 2015
• **Workgroup meeting at Thurston EOC**	November 16, 2015
• **Photographed flood levels on the Deschutes at several locations to document flood levels following a significant storm event (Nov 17). Deschutes crested at 12.09ft on Nov 17 late in the evening. Flood stage is 11ft.**	November 18, 2015
• **Discussed mitigation initiatives with Police Commander of Tumwater PD.** • **Continued updating HMP draft and integrating police department photos and comments.**	November 19, 2015
• **City Council Work Session presentation. Issues and comments centered on flooding and its impacts on the Golf Course Clubhouse and the homes on 58th Avenue.**	December 8, 2015
• **Photographed flood levels on the Deschutes which crested at 12.75ft on Dec 9 in late morning. Flood stage is 11ft.** • **Continued updating draft of HMP.**	December 9, 2015
• **Researched flood levels, amount of fill put into valley by brewery for construction of bottling warehouses, and finished landslide and flood sections.**	December 13, 2015
• **Restarted work on HMP update.**	July 25, 2016
• **Conference call with TRPC regarding the requirements of the HMP update.**	July 28, 2016
• **Integrated mitigation initiatives into the main annex for Tumwater.**	August 1, 2016
• **Further review and updating of the draft HMP and annex.**	August 10-11, 2016
• **Provided draft to Planning Commission for review.**	August 17, 2016
• **Presentation to Planning Commission.**	August 23, 2016
• **Planning Commission Discussion and Comments.**	September 13, 2016
• **Revised draft after Planning Commission review.**	September 15, 2016
• **Workgroup meeting at Thurston EOC.**	December 1, 2016
• **Open House meeting on draft regional plan held at Thurston County Emergency Coordination Center.**	December 14, 2016
• **Reviewed draft regional plan and supplied comments to TRPC.**	March 15, 2017
• **Forwarded Mayors comments on the draft regional plan to TRPC.** • **Began revisions to Tumwater's annex after receiving it back from TRPC.** • **Updated City's web page in regards to the public comment period for the draft Hazard Mitigation Plan and provided a link to the plan on the TRPC website.**	March 24, 2017
• **Continued updating draft annex based on Mayors comments.**	April 3, 2017
• **Continued updating draft annex based on comments from State EMD and TRPC.**	April 20-26, 2017
• **Sent out press release & constant contact e-mail for June 14 Open House**	June 5, 2017

Activity and Name(s)	Date
• **Based on public comments, "wet microburst" storms were added to the Storm description section.**	June 12-13, 2017
• **Joint public open house on draft Annexes for Tumwater, Olympia, and Lacey held at Thurston Regional Planning Council.**	June 14, 2017
• **Planning Commission briefing held.**	June 27, 2017
• **Public Hearing before the Tumwater Planning Commission.**	July 11, 2017
• **Public meeting before the Public Health & Safety Committee, a subcommittee of the Tumwater City Council**	July 11, 2017

Opportunities for Public Participation

The first opportunity for public participation in Tumwater was the December 2014 Emergency Preparedness Expo held in Tumwater at the Peter G. Schmidt Elementary School. This expo was used as a way to engage community members and to solicit feedback on the mitigation plan during its development. Approximately 300 citizens attended the expo. Their comments were used to help shape the plan while it was being drafted.

On July 7, 2015, the Tumwater General Government Committee, a subcommittee of the Tumwater City Council, was briefed on the plan update. The packet items were posted on the City website and the meeting was open to the public. Based on feedback received during the meeting, staff updated and amended the mitigation initiatives dealing with flood prone properties on 58th Avenue SE.

On December 8, 2015, the City Council was briefed on the plan update during a work session. The packet items were posted on the City website and the meeting was open to the public. The meeting resulted in several further refinements of the mitigation initiatives and the draft plan.

The Tumwater Planning Commission was provided the draft annex and it was posted on the City website on August 17, 2016. A public meeting before the Planning Commission was held on August 23, 2016. The meeting was open to the public and meeting notices were distributed. This meeting was the first presentation of the draft annex to the Tumwater Planning Commission. A second Planning Commission meeting was held on September 13, 2016, to further discuss the draft annex. The meeting packet was posted on the City website and notices were distributed. Based on feedback from the meeting the draft annex was further refined and updated.

A multi-jurisdictional open house on the main plan and the annexes of Tumwater, Lacey, and Olympia was held on June 14, 2017. The Tumwater annex was posted on the City website and

was available for public comment and suggestions for two weeks before the event. A link to the comment form on SurveyMonkey was provided on the webpage. Additional notification of the open house occurred through a press release, an e-mail to the Constant Contact e-mail list maintained by the City, and an announcement appeared in the City newsletter "Tumwater on Tap". Based on public comment received, a portion of the storm section was modified to mention the wet microburst that occurred in the Tumwater/Olympia/Lacey area on May 4, 2017.

Additional public meetings before the Planning Commission and the City Council are scheduled for summer 2017.

Ongoing Public Participation

The City will continue promoting public participation in the plan by participating in a multi-jurisdictional open house in early summer of 2017. This will be the first of several opportunities for ongoing public participation. The planning commission will be briefed on the plan at a public meeting and hold a public hearing. The plan will also be presented at a public meeting of the General Government Committee, a subcommittee of the City Council. The City Council will hold a public work session and a public meeting on the plan as well. Events like this will be used in the future to allow for ongoing public participation.

Integration in Plans, Policies, and Planning Mechanisms

The Tumwater Capital Facilities Plan and the Biennial Budget for the City of Tumwater are both used to implement mitigation initiatives specified by this annex. After adoption of the Natural Hazards Mitigation Plan (NHMP), the first step is to seek funding for a project or action (mitigation initiative) in the Biennial Budget. The drafting and adoption of the Biennial Budget is an open public process available to the public. Community members are encouraged to participate in the shaping of the municipal budget. Also, getting an action or project into the Capital Facilities Plan is a way to get it in line for funding and a way to plan for when it will be implemented. The Capital Facilities Plan is updated every year in an open process which encourages public participation.

Both the Tumwater Land Use Plan and the Joint Plan were updated in 2016-2017. Both updates included integration of the NHMP in policies and action items. For example, Policy LU-6.5 of the Tumwater Land Use Plan strongly encourages implementation of the NHMP to reduce or eliminate the human and economic costs of natural disasters for the overall good and welfare of the community. Goal 4.6.1 of the Joint Plan includes a reference to the NHMP and

recommends that natural hazards should be considered when locating manufactured home parks and/or zoning areas for manufactured home parks. This helps to address the vulnerabilities discussed in the Earthquake Assessment section of Tumwater's annex.

Updates

The Long Range Planning division of the Tumwater Community Development Department will be responsible for updating the plan. The Long Range Planning Division has a Planning Manager and a Senior Planner. The City Council, or appropriate subcommittee, will be briefed annually on the status of the plan. Annual briefings will keep the plan more in the forefront and place the decision makers in a more ready position to update the plan if needed. The agendas and notices for these meetings are posted on the City website. These meetings are open to the public so there are additional chances for the public to participate in suggesting ideas for ongoing maintenance and updates to the plan.

The City also plans to work with Thurston County and Thurston Regional Planning Council in four years to meet the required five year update to the plan. Tumwater has participated in updates in this manner on a regular basis since the plan was first adopted in the early 2000s.

Mitigation Initiative Prioritization Process

The prioritization and review process for mitigation initiatives had three main steps. The first step was the internal staff review, the second part consisted of a Council subcommittee review, and the third consisted of full council review.

The internal review by staff involved Tumwater Fire Chief Scott LaVielle, Public Works Director Jay Eaton, Tumwater Parks Director Chuck Denney, and Community Development Director Mike Matlock. These department directors were e-mailed the plan and the list of mitigation initiatives in late 2014 and again in early 2015. The members provided comments on mitigation initiatives. The prioritization (ranking) of the mitigation initiatives was also assessed at this time and the original order of the remaining mitigation initiatives was retained. Recent countywide Federal disaster declarations (ex. 2012 storm) reinforced the impression that the order of the remaining mitigation initiatives was appropriate.

Following the internal staff review, a subcommittee of the Tumwater City Council met on July 7, 2015 to review the plan and initiatives. This subcommittee, called the General Government

Committee (GGC) decided to enhance some initiatives and add back into the plan some that had been removed during the 2008 update. The GGC amended the initiative regarding investigation of a floodwall around the golf course clubhouse by adding that floodproofing of the structure should also be investigated. The GGC was concerned about protecting the several million dollars in investment the City recently made in a remodel of the building. The building was not elevated or floodproofed during the remodel.

The committee also added back into the plan three other mitigation initiatives that were removed in 2008 related to elevating and acquiring flood prone structures and informing property owners and residents about flood hazards and their options for insurance. The reason for this reversal from the previous edition of the plan was that the 2016 Eastside UGA Annexation brought into the City several properties with residential structures that flood on a regular basis. This annexation was started in 2014 and was completed on January 1, 2016. These structures are located on 58th Avenue off Henderson Boulevard in the Deschutes River valley. After the GGC review, a City Council meeting was held on December 8, 2015 to review the mitigation plan and the initiatives.

On July 11, 2017 the Public Health and Safety Committee reviewed the plan and suggested that the mitigation initiatives should be further prioritized according to a methodology. The Planning Commission, which held a public hearing later that evening, re-prioritized the mitigation initiatives in accordance with the ranking of the hazards on p.17 of the plan.

Changes in Development

As infill and development occur in Tumwater the level of risk associated with hazards changes as well. For example, over the past several years hundreds of homes were built on Tumwater Hill. As these developments encroach on what were previously forested hillsides, the risks of impacts from wildfire increases too. As a result of this increase in risk a new mitigation initiative was created dealing with fire breaks for residential areas (see mitigation initiative TUM-WH 1 on p.50 of this annex).

In 2016, Tumwater annexed the entire eastern Urban Growth Area which expanded the City population by approximately 3,000 residents. This annexation included several homes along 58th Avenue SE that are within the 1% Floodplain. Portions of these properties are within the floodway as well. Three of the mitigation initiatives were brought into the plan to specifically address these flood prone properties. These include mitigation initiatives 10-12 (see p.51) which deal with informing properties about their flood risks and drafting lists of properties/structures that would be bought out or elevated if funding became available.

City of Tumwater Risk Assessment

Introduction

The risk assessment provides information about the hazards that threaten the City of Tumwater. This information provides the factual basis to identify and support a strategy that can effectively mitigate the effects of the hazards that threaten this jurisdiction's safety and challenge its ability to perform essential functions.

The content and structure of this plan's risk assessment was developed using the Federal Emergency Management Agency (FEMA) 2008 "Local Multi-Hazard Mitigation Planning Guidance." Table 1 shows the Disaster Mitigation Act (DMA) Risk Assessment Planning Requirements that must be met for this plan to receive a "satisfactory" score. Each of these planning requirements is met through the information contained in both the regional risk assessment and in this local annex.

Table 1: Disaster Mitigation Act Risk Assessment Planning Requirements

DMA Section	Requirement
§201.6(c)(2)(i):	[The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction …
§201.6(c)(2)(i):	[The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
§201.6(c)(2)(ii):	[The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.
§201.6(c)(2)(ii):	[The risk assessment in all] plans approved after October 1, 2008 must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged by floods.
§201.6(c)(2)(ii)(A):	The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas …
§201.6(c)(2)(ii)(B):	[The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(::)(A) of this section and a description of the methodology used to prepare the estimate …
§201.6(c)(2)(ii)(C):	[The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.
§201.6(c)(2)(iii):	For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

In general, the Federal DMA planning requirements with the words "shall" and "must" indicate that the item is mandatory and must be included in the plan, otherwise it will not be approved

by FEMA. Regulations with the word "should" indicate that the item is strongly recommended to be included in the plan, but its absence will not cause FEMA to disapprove the plan.

Hazard Analysis Definitions

The *Hazards Mitigation Plan for the Thurston Region* uses a subjective risk measurement process based on Thurston County's Hazard Inventory and Vulnerability Assessment or HIVA. This methodology rates elements of each hazard's risk characteristics using the descriptors high, moderate, and low. These descriptors are applied to the hazards' probability of occurrence, vulnerability, and overall risk. The following is an overview of this risk measurement model:

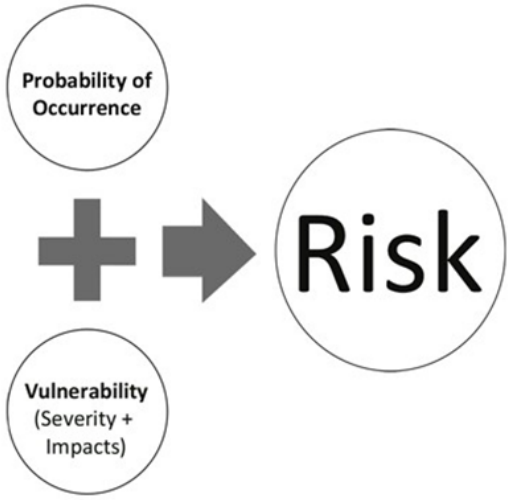


Figure 1: Risk is a subjective estimate of the combination of a hazard s probability of occurrence and a community s vulnerability.

Risk Rating

A description (high, moderate, or low) of the subjective estimate of the combination of any given hazard's probability of occurrence and the region's vulnerability to the hazard.

- **High** – There is strong potential for a disaster of major proportions.
- **Moderate** – There is medium potential for a disaster of less than major proportions.
- **Low** – There is little potential for a disaster.

Probability of Occurrence

A description (high, moderate, or low) of the probability of a hazard impacting Thurston County within the next 25 years.

- **High** – There is great likelihood that a hazardous event will occur within the next 25 years.
- **Moderate** – There is medium likelihood that a hazardous event will occur within the next 25 years.
- **Low** – There is little likelihood that a hazardous event will occur within the next 25 years.

Vulnerability

A description (high, moderate, or low) of the potential impact a hazard could have on Thurston County. Vulnerability can be expressed as a combination of the severity of a hazard's effect and its consequential impacts to the community. It considers the population, property, commerce, infrastructure, and services at risk relative to the entire county.

- **High** – The total population, property, commerce, infrastructure, and services of the county are uniformly exposed to the effects of a hazard of potentially great magnitude. In a worst-case scenario, there could be a disaster of major to catastrophic proportions.

- **Moderate** – The total population, property, commerce, infrastructure, and services of the county are exposed to the effects of a hazard of moderate influence; or the total population, property, commerce, infrastructure, and services of the county are exposed to the effects of a hazard of moderate influence, but not all to the same degree; or an important segment of population, property, commerce, infrastructure and services of the county are exposed to the effects of a hazard. In a worst-case scenario, a disaster could be moderate to major, but not catastrophic, proportions.

- **Low** – A limited area or segment of population, property, commerce, infrastructure, or service is exposed to the effects of a hazard. In a worst-case scenario, there could be a disaster of minor to moderate proportions.

Summary Risk Assessment

Based on the regional risk assessment and the local risk assessment in the subsequent section, the following hazards pose the greatest threat to the City of Tumwater.

Hazard	Probability of Occurrence	Vulnerability	Risk
Earthquake	High	High	High
Storm	High	High	High
Flood	High	Moderate	High
Landslide	High	Low	Low
Wildland Fire	High	Low	Low
Volcanic Event	Low	Moderate	Low

Local Risk Assessment

A comprehensive risk assessment of the major natural hazards that threaten the City of Tumwater was developed for this plan through the regional risk assessment process described in Chapter 4.0. The regional risk assessment and its hazard profiles serve as the foundation for this jurisdiction's risk assessment. A list of all of the potential natural hazards that could impact this jurisdiction is located in Chapter 4. Chapter 4 includes six natural hazard profiles for earthquake, storm, flood, landslide, wildland fire, and volcanic events. Each profile defines the hazard and describes its effects, severity, impacts, probability of occurrence, and historical occurrences. The regional profiles describe this jurisdiction's local vulnerabilities in terms of the portion of the jurisdictions land base or service area, population, employment, dwelling units, jurisdiction-owned assets, and critical facilities that are within each hazard zone.

This section of the plan provides additional details or explains differences where this jurisdiction's risks for each hazard vary from the risks facing the entire planning area. Maps of the hazards that affect the City of Tumwater are scaled to local boundaries and are included in this section.

Earthquake

Severity

Same as described in Regional Risk Assessment.

Impacts

Generally, the same as described in Regional Risk Assessment. As shown in the tables in the regional risk assessment found in Chapter 4 of this plan, 75% of the land area and 80% of the population of Tumwater and the Tumwater Urban Growth Area (UGA) are in earthquake hazard areas.

In addition, according to the Water Resource Division of the Tumwater Public Works Department, more than one third of Tumwater's drinking water comes from the Palermo well field in the Deschutes River Valley, which is identified as an area of high liquefaction susceptibility by data provided by the Washington State Department of Natural Resources. Damage to the Palermo wells and/or related infrastructure could cause a significant disruption in the supply of potable water for Tumwater residents and emergency responses such as firefighting.

Probability of Occurrence

Same as described in Regional Risk Assessment.

Historical Occurrences and Impacts Specific to this Jurisdiction

Four of the seven large manufactured/mobile home parks within Tumwater are in areas of high liquefaction hazards and/or on peat.[1] These include Eagles Landing, Tumwater Mobile Estates, and Western Plaza, which are all located on Trosper Road, and Thunderbird Villa on Dennis Street. The latter three sustained damage during the 2001 Nisqually earthquake.[2]

Tumwater Mobile Estates experienced substantial liquefaction during the earthquake. Part of a private street within the mobile home park collapsed into a pond, taking two unoccupied cars into the water. The sidewalk also ended up in the pond. Private water lines and a natural gas

[1] Map-Tumwater Mobile & Manufactured Home Parks Liquefaction Soil Hazards
[2] Former Tumwater Fire Chief John Carpenter-phone conversation 6-3/9/10-2009

line were ruptured prompting the evacuation of 50 residences in the mobile home park.[3] Evidence of liquefaction in the form of sand boils appeared in several areas of the park.[4]

The Western Plaza mobile home park experienced settling due to liquefaction, although it was to a lesser degree than that seen at Tumwater Mobile Estates.[5] Thunderbird Villa on Dennis Street had damage as well. The Tumwater Fire Department observed at least one home in Thunderbird Villa that had the backyard settle several feet abruptly off the back of the home.[6]

Photo by Tumwater staff

The Olympics West assisted living facility, located on the south side of Trosper Road across from the Tumwater Mobile Estates mobile home park, also experienced settling and minor damage even though it is located within an area designated as low to moderate risk.[7] John Carpenter, the former Tumwater Fire Chief, was inside the building at the time and witnessed the formation of a 10" step in the middle of a formerly flat hallway.[8] It is of particular concern that these types of facilities and mobile/manufactured home parks, which tend to be populated by

[3] Former Tumwater Fire Chief John Carpenter-phone conversation 6-3/9/10-2009
[4] USGS report on 2001 Nisqually Earthquake: http://pubs.usgs.gov/of/2003/ofr-03-211/NisquallyFinal.html#sunset
Geo-Earthquake Engineering Reconnaissance report on 2001 Nisqually Earthquake: http://research.eerc.berkeley.edu/projects/GEER/GEER_Post%20EQ%20Reports/Nisqually_2001/liquefaction/lateralspread/index.html#sunset
[5] Former Tumwater Fire Chief John Carpenter-phone conversation 6-3/9/10-2009
[6] Former Tumwater Fire Chief John Carpenter-phone conversation 6-3/9/10-2009
Picture by Tumwater Fire Department of earthquake damage at Thunderbird Villa mobile home park
[7] Map-Tumwater Mobile & Manufactured Home Parks Liquefaction Soil Hazards
Former Tumwater Fire Chief John Carpenter-phone conversation 6-3/9/10-2009
[8] Former Tumwater Fire Chief John Carpenter-phone conversation 6-3/9/10-2009

some of the more vulnerable citizens, including the elderly and disabled as well as low income, are located in areas that are highly susceptible to liquefaction.

Even buildings within areas of low to moderate liquefaction susceptibility sustained damage. The main Tumwater fire station on Israel Road, which houses the Emergency Operations Center, was structurally damaged during the quake. The apparatus bay shifted away from the main building of the fire station even though the two were structurally joined together.[9]

Most City buildings had at least some minor damage. Both the main fire station and station #2 on Linwood Avenue, Tumwater City Hall, the Tumwater Timberland Library, Old Town Center, the historic Crosby house, the Henderson House Museum, and portions of the Tumwater Valley Municipal golf course all were damaged in the earthquake.[10] There were approximately 173 reports of damage to private property in Tumwater.[11]

Figure 1: The Best Western hotel located on the bluff above the Palermo well field had a portion of the rear parking lot settle and start to slide down the hill. (Former Tumwater Fire Chief John Carpenter-phone conversation 6-3/9/10-2009)

[9] Former Tumwater Fire Chief John Carpenter-phone conversation 6-3/9/10-2009
[10] Former Tumwater Fire Chief John Carpenter-phone conversation 6-3/9/10-2009
Jeff Vrabel-Tumwater Facilities Manager-phone conversation 6-10-2009
City of Tumwater Preliminary Damage Assessment Worksheet 3-5-01
[11] City-wide damage spreadsheet (Excel) sourced from Tumwater Fire Department

Figure 2: The Extended Stay America facility near the Highway 101/Crosby Boulevard interchange had a large retaining wall give way, which broke a water line. (Former Tumwater Fire Chief John Carpenter-phone conversation 6-3/9/10-2009)

Figure 8-10. Hillside slid away from beneath this four-hundred-foot section of a Union Pacific Railway branch line at Tumwater, near Olympia, Washington, during the Puget Sound Earthquake of 1965. A large landslide during the heavy-rainfall winter of 1996-97 also damaged the rail line. Photo by G.W. Thorsen, Washington Division of Geology and Earth Resources.

Figure 3: During the 1965 Puget Sound Earthquake, a large portion of the railroad lines north of the old brewhouse were significantly damaged in an earthquake induced landslide.

After the 2001 Nisqually earthquake, the Department of Natural Resources (DNR) mapped liquefaction hazard areas in Tumwater. The entire river valley southeast of Capitol Boulevard

has been identified as an area of high liquefaction hazard. Aerial photos from the 1930s and the early 1950s[12] show that the area where the brewery warehouses are now located was once part of the Deschutes River channel. The river was relocated, 7.5 acres were filled with 130,000 cubic yards of material from the adjacent hillside along Cleveland Avenue, and the warehouses were built on top of the fill.[13]

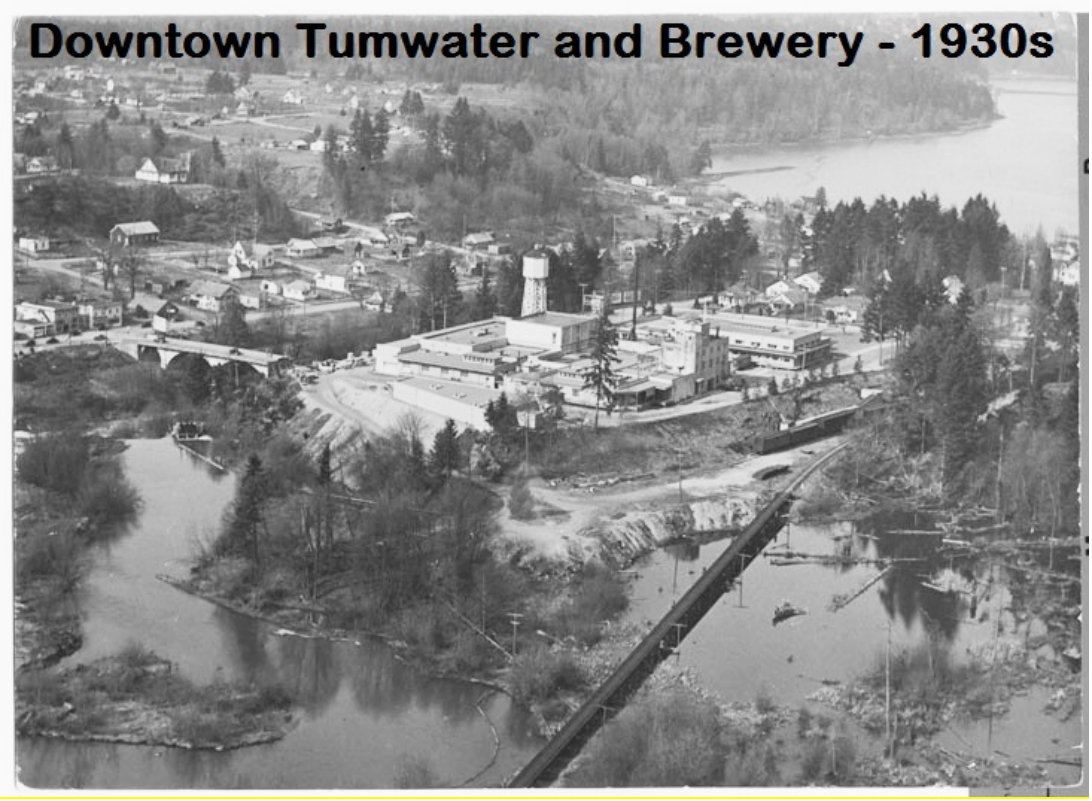


Figure 4: HHM080 – Henderson House Museum Collection

[12] Henderson House Museum Collection No. 78 and No. 80
[13] "It's the Water" Brewery newsletter. A Hill Becomes A Fill. June-July 1953

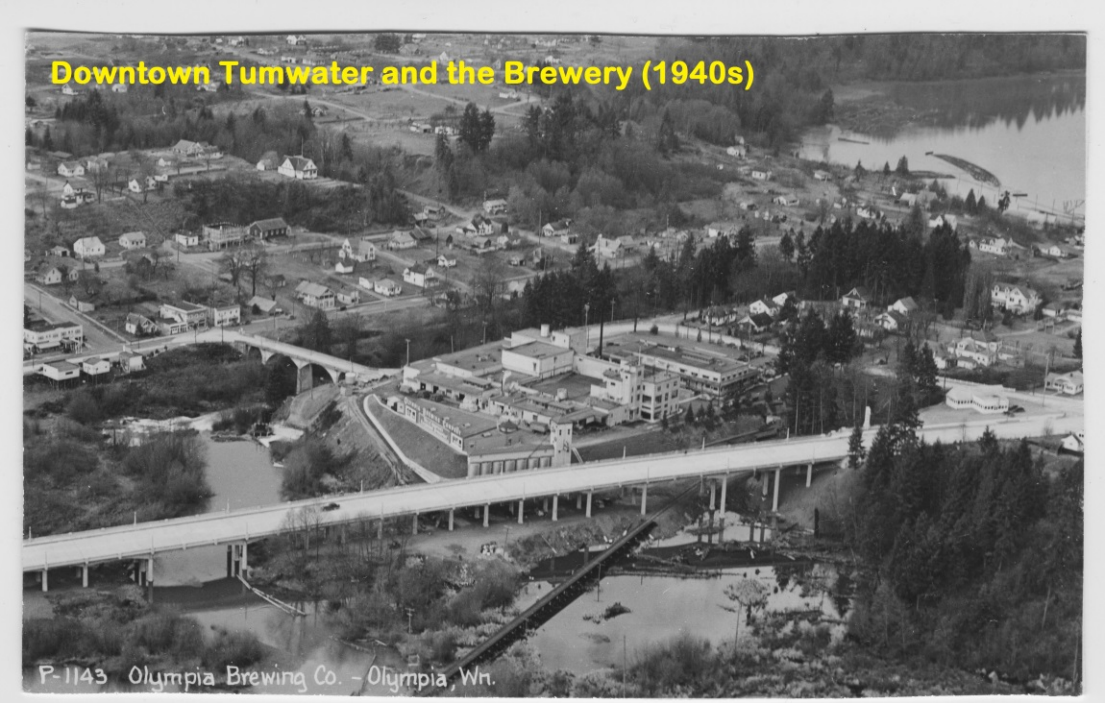


Figure 5: HHM078 – Henderson House Museum Collection

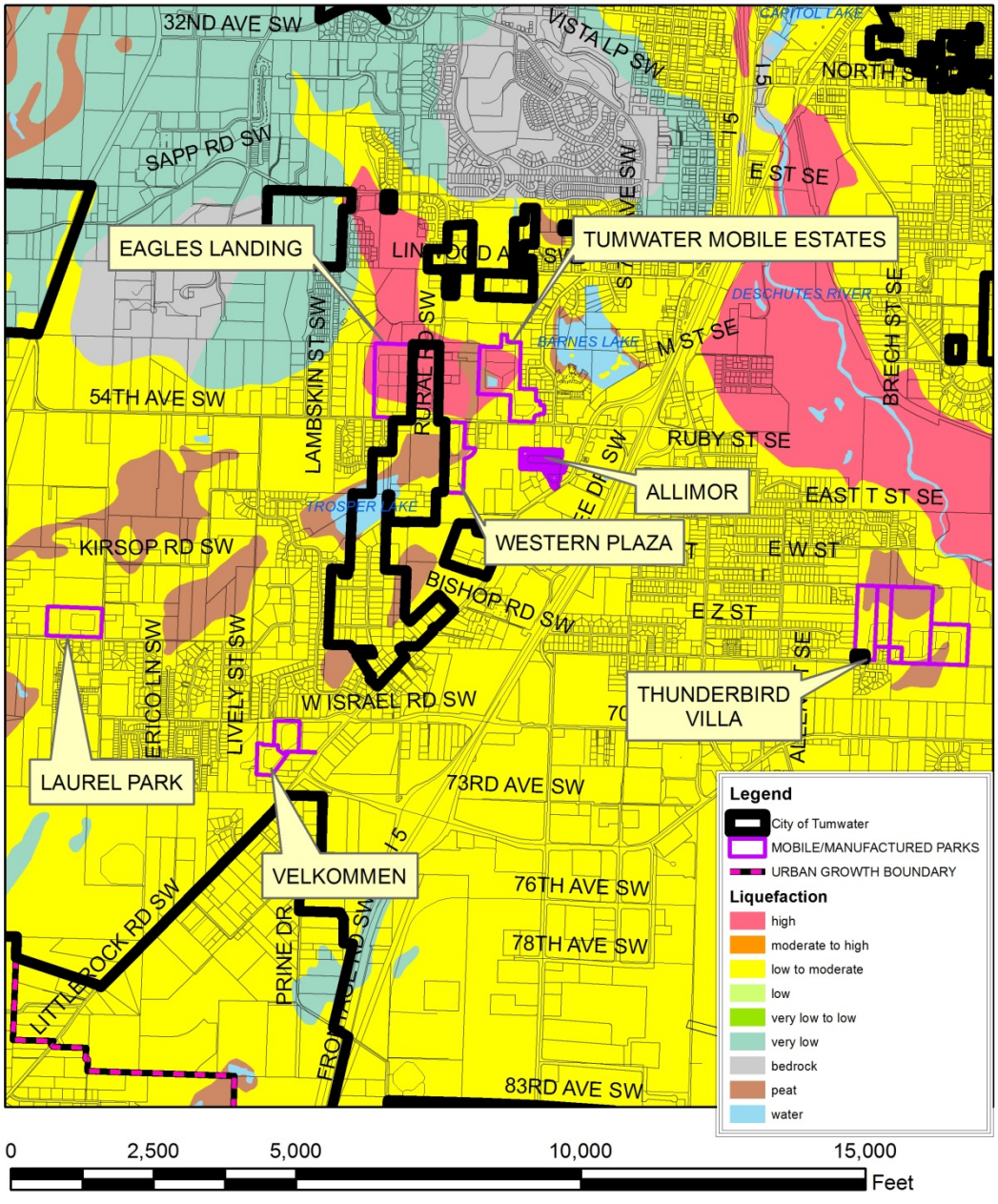
Summary Assessment

Same as described in Regional Risk Assessment. The probability, vulnerability, and risk for earthquakes in Tumwater are all high. This is due to the amount of land in Tumwater and its UGA located within earthquake hazard areas, the large number of people in those areas, particularly the large number of elderly or disabled living in mobile/manufactured home parks on soils highly susceptible to liquefaction, and a major City drinking water source is located within an area that is highly susceptible to liquefaction.

Summary Risk Assessment for Earthquake in Tumwater

Probability of Occurrence	Vulnerability	Risk
High	High	High

TUMWATER MOBILE&MANUFACTURED HOME PARKS
LIQUEFACTION SOIL HAZARDS



CITY OF TUMWATER COMMUNITY DEVELOPMENT DEPARTMENT
June 28, 2017 Mobile&Manufactured Home Parks Tum&UGA.MXD
Liquifaction data obtained from the Washington State Department of Natural Resources.

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DISCLAIMER: The City of Tumwater does not warrant, guarantee, or accept any liability for the accuracy, precision, or completeness of any information shown hereon or for any inferences made therefrom.

Storm

Severity

Same as described in Regional Risk Assessment.

Impacts

Same as described in Regional Risk Assessment.

Probability of Occurrence

Same as described in Regional Risk Assessment.

Historical Occurrences and Impacts Specific to this Jurisdiction

Lightning has caused damage to the infrastructure in Tumwater several times over the last couple of decades. The Tumwater Public Works Department uses a SCADA system (Supervisory Control and Data Acquisition) as part of the management of the water and sewer systems. SCADA automatically monitors reservoir levels, pumps, and other components of the potable water system as well as the lift stations in the sewer system in Tumwater. This system utilizes radio communication in order to function properly. When components of this system, such as radio antennas, are hit by lightning, the system does not work. As of the mid 2000s, a new system was being developed and implemented that utilizes fiber optic lines with radio communication as a backup. When fully implemented, this will make the system more reliable. It is being phased in and is already in use at a couple of sites. Future expansions of fiber optic lines to other parts of the system are planned.[14]

In the summer of 2015, a tree next to the Main Tumwater Fire Station was hit by lightning and had much of its bark blown off (pictured).

[14] Phone conversations with Public Works Operations Manager Steve Craig in 2008, 2015, and 2017.

In 1991, a deep freeze resulted in several frozen and broken water mains. Most of the water mains that froze were on overpasses. A couple of these frozen water mains were part of construction projects so the water was not moving inside the pipes, just sitting still. Usually a minor amount of water movement will prevent water from freezing inside a pipe. Steps have since been taken to prevent water mains from freezing again.[15]

During the December 2008 snowstorm, several apartment complexes in Tumwater had carports collapse. These included the Breckenridge Heights apartments, Indian Creek condominiums (pictured), and Capitol Heights apartments.[16] The Olympics West Retirement facility on Trosper Road was evacuated due to the threat of roof collapse from heavy snow.[17] Other relatively minor damage occurred to the main Tumwater Fire Station when the weight of the snow tore the gutters off of the building. No injuries were reported due to the collapses.

Due to the amount of trees in Tumwater, power outages are expected during storms. The most recent severe and long lasting power outages were during the December 2006, 2008, and 2012 winter storms. The 2006 windstorm resulted in City facilities without power for several days. A half million-dollar generator was installed at City Hall in 2009 to provide uninterrupted power for both City Hall and the Police Station. In addition, there are generators for most of the City facilities including, but not limited to, the Emergency Operations Center, which is inside the Main Fire Station, the North End Fire Station, the public works operations building, and several critical components of the water and sewer systems. Most City facilities are now able to function due to the generators.

Besides power outages, the other significant issue from storms is the damage to structures, utilities, and the transportation system from falling trees, as well as the cost of cleanup afterwards. The 2012 storm was a combination of heavy snow and ice, which severely damaged many trees throughout Tumwater. The damage and cleanup costs for removal of tree debris from City streets and properties were approximately $317,796.56.[18] Some of the

[15] Phone conversations with Public Works Operations Manager Steve Craig in 2008 and 2015.
[16] Picture from Tumwater Fire Department of collapsed carport at Indian Creek Condos 220 Israel Road in Tumwater on December 25, 2008 and conversation with Fire Department front counter staff.
[17] The Olympian newspaper article 12-28-2008 (online). "Riding arenas roof collapses." by Rolf Boone.
[18] Project reimbursement worksheet for submittal to FEMA prepared by Tumwater Fire Department staff 2012.

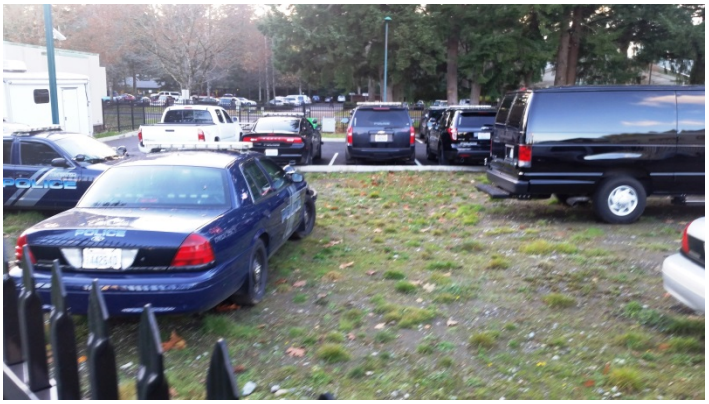
structure and infrastructure damage included a partially collapsed Fire Station wash rack roof (~$42,000) and part of the computer system for the SCADA sewer and water management system had to be replaced (~$16,000).[19]

During the police department expansion at City Hall in 2014, the row of ten large fir trees on the west side of the building had their root zones significantly disturbed during construction. These trees are within falling distance of the newly expanded police station (a critical facility) as well as the half million-dollar generator, which supplies power to the police station and City Hall. This generator also includes a special device to remove power fluctuations. For this reason, all power for City Hall, the Police Department, and the Public Works shop are routed from the Puget Sound Energy lines and through this device first before being distributed on-site. If a tree fell on the generator, it would also damage this special controller and completely interrupt power service on-site.

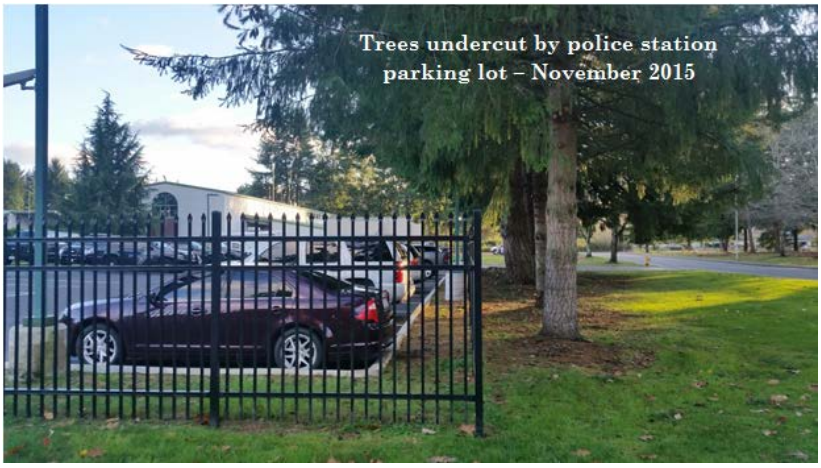
On May 4, 2017, a wet microburst touched down in parts of Tumwater, Olympia, and Lacey causing substantial damage in a relatively small area. Many trees and utility poles were broken or blown down in the short but severe storm. Localized urban flooding occurred as well due to the large amount of precipitation that occurred within a short time period. Microbursts happen when air cools quickly inside a thunderstorm, moves to the surface, hits the ground and then spreads horizontally on the ground. Microbursts tend to affect small areas, usually no larger than a few square miles. This weather phenomenon produces damage in a starburst pattern. The damaging winds radiate away from the point of impact in straight lines.

[19] Project reimbursement worksheet for submittal to FEMA prepared by Tumwater Fire Department staff 2012.

Other issues associated with these fir trees in this location is the clogging of the porous asphalt parking lot, fir needles and debris falling into and on cars, and tree sap dripping on to cars. Both of the latter issues can cause visibility issues with windshields on emergency vehicles. Police officers have taken to avoiding utilizing half of the parking lot for this reason and are parking on the grass at the back of the facility at times.



Special care should be taken to have a tree professional inspect these trees on a regular basis. An alternative and more proactive approach would be to remove them before a strong storm occurs and they topple onto a critical facility, the generator that powers the critical facility, or police vehicles/personnel. A first step may be to trim the lower branches to lighten the wind load on the trees.



In a somewhat similar situation, very tall fir trees also surround the Tumwater Fire Station (T1), which contains the Emergency Operations Center. These trees have not been disturbed since the construction of the main fire station in 2000 and have weathered several significant storms in the last decade and a half. However, one tree was hit by lightning in the summer of 2015 and much of its bark was blown off. The groves of trees on both sides of this critical facility should be assessed every few years as to their health and their ability to weather a severe storm. Monitoring the health of trees within falling distance of critical facilities should be done on a regular basis.

Summary Assessment

Generally the same as described in Regional Risk Assessment. Lightning has proven occasionally to be a problem for Tumwater's water and sewer telemetry system. However, changes have already been made to part of the system to make the lightning susceptible radio communications a backup feature of the system and instead, to utilize fiber optic as the backbone for communication in the system. Future expansions to the rest of the water and sewer systems are planned. In the past, there have also been some issues with freezing water mains. These issues have since been resolved for those lines that were most susceptible, such as where they are located on overpasses. The power outage issue is unlikely to be completely resolved but it is being mitigated and the City is prepared to deal with it when it occurs.

Tumwater matches the regional risk assessment for storms in regards to probability of occurrence, vulnerability, and risk in that all are "high." However, in regards to lightning the

City of Tumwater has slightly different assessments than the County as a whole. Even though the probability of occurrence is the same (moderate), the vulnerability and risk levels are higher. For Tumwater the latter two assessments will be placed at "moderate," instead of "low" like in section 4.2 of the countywide assessment. This difference in assessment is due to the amount of lightning strikes on the Tumwater water and sewer telemetry system in the past 15 years and the damage it causes when it does strike.

Summary Risk Assessment for Storm in Tumwater

Probability of Occurrence	Vulnerability	Risk
High	High	High

Flood

Severity

Same as described in Regional Risk Assessment.

Impacts

Same as described in Regional Risk Assessment.

Probability of Occurrence

Same as described in Regional Risk Assessment.

Historical Occurrences and Impacts Specific to this Jurisdiction

The vast majority of flooding events within the City occur within the Deschutes River valley. According to the National Weather Service records for the Rainier Flood gauge on the Deschutes, between 1949 and 2014 there were 43 events above Flood Stage.

The expansion and development of the former Olympia brewery properties within the valley led to a significant transformation of the area. Starting in 1953, several acres of riparian floodplain were filled with 133,000 cubic yards of material on which the bottling warehouses were built.[20] The river was partially re-channeled then as well. In 1963 an additional 114,000 cubic yards of material was moved from the adjacent hillside to fill a portion of the valley for a bottling warehouse expansion.[21] Later, in 1968 a much larger project began which moved two million cubic yards of fill material from the hillside on Cleveland Avenue into the valley. This project raised the level of the valley an average of five feet to make development of the golf course and valley athletic club possible.[22] A significant watercourse change to the river was also done at this time.

[20] It's the Water" Brewery newsletter. A Hill Becomes A Fill. June-July 1953
[21] "It's the Water" Brewery newsletter. Aesthetic Excavation Planned. July 1963
[22] 75th Anniversary Brewery "It's the water" newsletter. p.25, circa 1971.

Acres Of Green

In the spring of 1968, our Company launched a $2,000,000 public recreational complex in the Deschutes River Valley directly south of our plant facilities. The new recreational complex, located on 260 acres of brewery-owned property, includes an 18-hole, tournament golf course; pro shop; restaurant; two enclosed, heated swimming pools and four tennis courts. The recreational complex is handled by our Company-owned subsidiary, the Tumwater Valley Development Company.

Construction of this golf course involved moving two million cubic yards of sand into the low marshy valley of the Deschutes River, raising the face of the course an average of 5 feet above its original height. All of the course contours were made and gently shaped by man.

25

Source: 75th Anniversary Brewery "It's the water" newsletter. p.25 Circa 1971.

1996 Tim Walsh, WA DNR

The most obvious and visually dramatic examples of flooding in Tumwater generally occur within the Deschutes River valley. City owned properties and facilities such as Pioneer Park, Historical Park, the Tumwater Valley Golf Course, the Palermo well field and water treatment facility, the "M" Street sewer lift station, and other water and sewer infrastructure are located within this flood prone area. Private properties within this area include the bottling plant for the former Olympia brewery, a few homes in the Palermo neighborhood off of "M" Street, The Valley athletic club, Tumwater Falls park, which is a private park open to the public, the fish hatchery and associated fish ladder at Tumwater Falls, and the old brewhouse across from Historical Park.

Several residential structures on 58th Avenue across from Pioneer Park were annexed to the City in January of 2016. Since 1999, staff has observed and photographed these homes and properties being flooded on a regular basis.

Pioneer Park is one of several areas that are frequently inundated by floodwaters. Water typically flows through the entire parking lot area and some of the sports fields.[23] Fortunately, the building, which houses the restrooms, has yet to be flooded.[24] This building is also used as a storage shed for mowers, tractors, and other equipment used for park maintenance.[25] A sewer lift station is located here as well.[26] Access to the building and the sewer lift station has not been possible during floods due to the floodwaters surrounding the site and flowing over the access road.[27]

The generator for this sewer lift station is on a concrete pad behind the restrooms. If the power supply is interrupted this generator is to take over so the sewer lines do not backup and overflow. This generator is not elevated except for

[23] Picture of flooding in parking lot and access road at Pioneer Park-January 8, 2009.
[24] Picture of flooding near restrooms at Pioneer Park-December 4, 2007
[25] Phone conversation with Jeff Vrabel-Tumwater Facilities Manager-June 10, 2009.
[26] Phone conversation with Steve Craig-Tumwater Public Works Operations Manager-June 15, 2009.
[27] Phone conversation with Steve Craig-Tumwater Public Works Operations Manager-June 15, 2009.

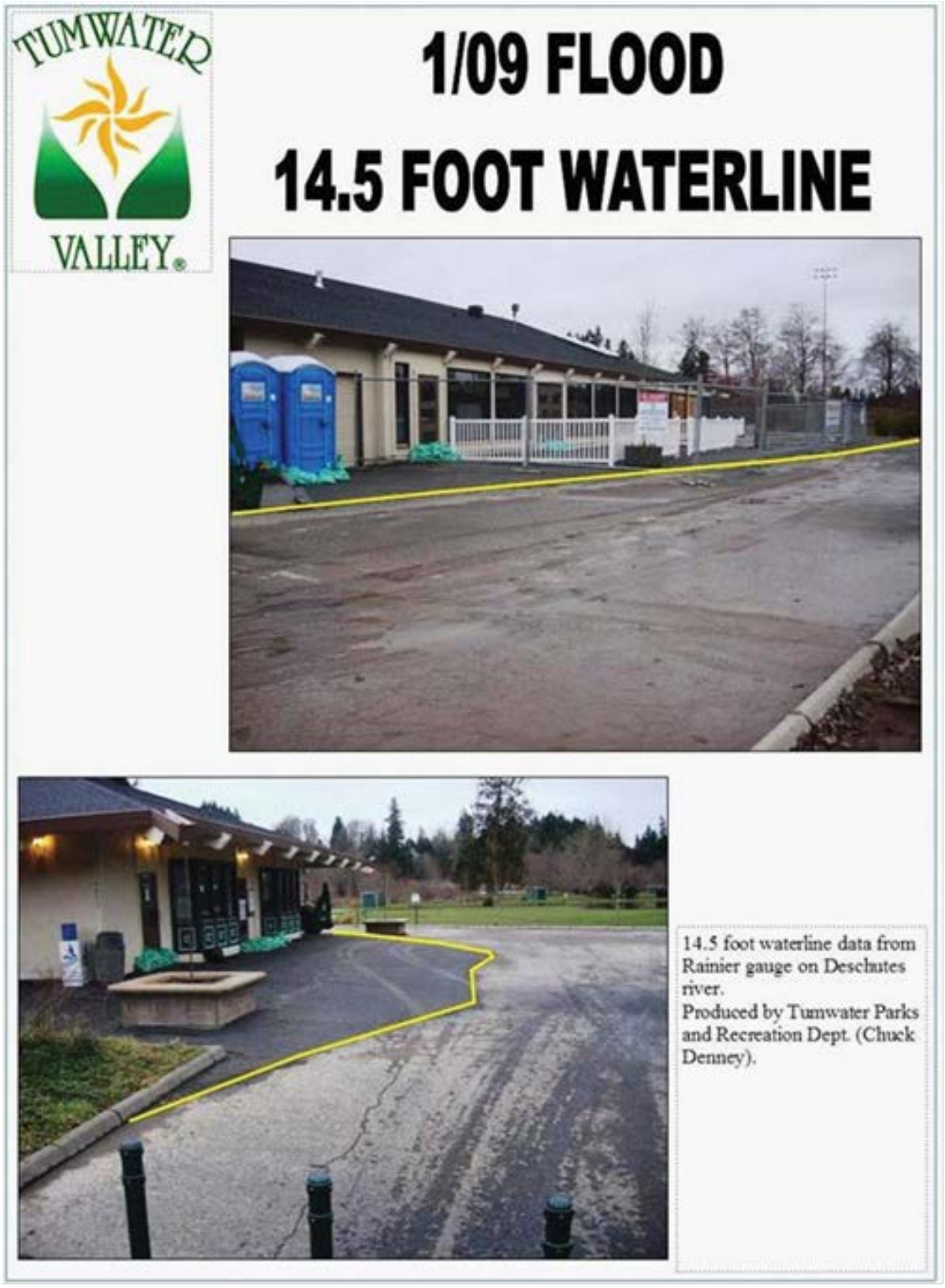
the mounting brackets and the concrete pad upon which it sits. Consideration should be given to elevating portions of the infrastructure such as this generator when they are located within floodplains.

The Palermo neighborhood off "M" Street has several homes within the 1% (100-year) floodplain. The area also contains the Palermo wellfield and water treatment facility and the "M" Street sewer lift station. Floodwaters have not yet flooded the drinking water treatment and wellhead facility, but have come close in the past several years.

The sewer lift station at the end of "M" Street is often surrounded by floodwaters but has not been affected by the floodwaters yet. The hatch to the wetwell has already been replaced to limit the inflow of floodwaters into the wetwell. In addition, plans to replace manway access to the drywell and increase its height are in process. This would help to avoid the flow of floodwaters into the sewer lift station.[28]

The Tumwater Valley golf course is within the 1% (100-year) floodplain and is flooded almost yearly. Floodwaters routinely cover the golf course and get to within a couple of feet of the door of the clubhouse/restaurant, which is only inches below the level needed to flood the interior. Chuck Denney, the Tumwater Parks and Recreation Director, produced a one-page demonstration of the water level at the Tumwater golf course clubhouse in the January 2009 flood. Two photos with yellow lines drawn on them indicate the extent of the water levels near the clubhouse and a citation of the water level at the flood gauge at Rainier on the Deschutes River (14.5 feet).

[28]Phone conversation with Steve Craig-Tumwater Public Works Operations Manager-June 15, 2009
Picture of sewer lift station on "M" Street (Palermo area) during January 8, 2009, floods.



With most storms that involve precipitation there are localized areas of flooding on streets. The Tumwater Public Works operations crew keeps a list of these areas so they can quickly identify and address this issue when it occurs. In most cases, it is tree leaves and other debris

blocking storm drains, which causes the water to back up into the streets. In the December 2008 and 2012 snow storms it became apparent that the snow and ice on Capitol Boulevard was blocking the storm drains and causing localized flooding for most of the length of Capitol Boulevard.[29]

In various areas along both Trosper and Kirsop Roads, localized flooding is a regular occurrence with large storms. The area has little in the way of frontage improvements. There are a series of deep ditches, many disconnected from upstream and downstream conveyance due to impacted or undersized culverts. In a few instances, beaver dams have obstructed a conveyance, which is now managed by the City under a permit from the Department of Fish & Wildlife. In addition, Tumwater Public Works completed a drainage study for the Trosper and Kirsop area in 2011, identifying a number of projects for retrofit to improve both conveyance and water quality. These projects have been added to the City's Capital Facilities Plan, with one project underway in 2015 for Kirsop Road, and others scheduled for 2016.[30]

High groundwater flooding is an issue in several areas but mostly concentrated in the southwest portion of Tumwater and the UGA. In order to deal with future groundwater flooding impacts the City of Tumwater and Thurston County adopted the Salmon Creek Drainage Basin Plan and implementing regulations in 2005. The regulations control development within areas impacted by high groundwater flooding.

Currently, twenty properties in Tumwater that have flood insurance and only nine claims have been paid since 1978 for a total of approximately $31,194.26. None of the Tumwater owned

[29] Phone conversation with Steve Craig-Tumwater Public Works Operations Manager-June 15, 2009. Photos of Capitol Boulevard taken by Senior Planner David Ginther during 2012 snowstorm.

[30] Conversation with Tumwater Public Works Water Resource Division Manager in 2009, December of 2015, and review of the June 15, 2009, Request for Statement of Qualifications for drainage studies in the City of Tumwater.

facilities or buildings, including the recently remodeled golf course clubhouse, which are located in the floodplain, have FEMA flood insurance. However, some work is planned to help minimize risks of flood damage. For example, a mitigation initiative discussing investigating the possibility of a floodwall around the golf course clubhouse and restaurant was modified to look into floodproofing or other techniques as well. The facility was not floodproofed or elevated during the remodel.

Summary Assessment

Although flooding occurs quite frequently within Tumwater, a large portion of the area that is prone to flooding is located within the Deschutes River valley. Floods in the last decade have not been large enough to cause significant damage. However, if the flooding elevations increase a minor amount there will be significant damages to sewer and water infrastructure located within the 1% (100-year) floodplain and buildings such as the golf course clubhouse. Recognizing that more work should be done to deal with the recently annexed flood prone properties on 58th, there have been mitigation initiatives added back into the plan that were removed in the 2008 update.

Summary Risk Assessment for Flood in Tumwater

Probability of Occurrence	Vulnerability	Risk
High	Moderate	High

Landslide

Severity

Same as described in Regional Risk Assessment.

Impacts

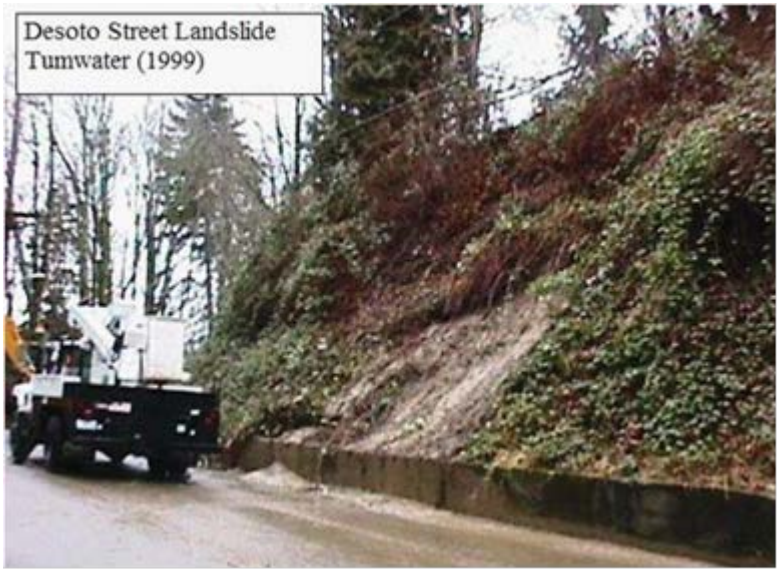
Same as described in Regional Risk Assessment.

Probability of Occurrence

Same as described in Regional Risk Assessment.

Historical Occurrences and Impacts Specific to this Jurisdiction

The areas within Tumwater that are most susceptible to landslides are shown on the City of Tumwater Steep Slopes map. Most of the steep slopes are in the northern portion of the City and include the bluffs along the Deschutes River valley, portions of Tumwater Hill, areas on Bush Mountain, and some areas west of Black Lake Boulevard including Jones Quarry.



A landslide occurred on Desoto Street near the base of Tumwater Hill in 1999.[31] The street lies along a short steep canyon called Desoto Canyon. The landslide occurred during the prolonged and heavy rainfall episode that happened in 1999.

However, the majority of landslides have occurred at the southeast end of Capitol Lake near the old brewhouse. This area is across the water from Tumwater Historical Park and behind the row of historic homes on Capitol Boulevard.

[31] Desoto Street landslide (1999)-Picture sourced from Tumwater Public Works Water Resource Division

The following is an excerpt from the Brewery Neighborhood Chapter of the Tumwater Land Use Plan:

> *There have been a number of landslides within this neighborhood. A slide in 1902 demolished several of the brewery buildings that were located east of the Old Brewhouse.*[32] *Slides in this same area have also occurred in 1965, 1996, 2001, and 2008 and have caused significant damage, mainly to infrastructure such as sewer lines.*[33] *The slides in 1965 and 1996 both ruptured main sewer lines resulting in untreated wastewater flowing directly into the Deschutes River and Capitol Lake.*

Figure 8-10. Hillside slid away from beneath this four-hundred-foot section of a Union Pacific Railway branch line at Tumwater, near Olympia, Washington, during the Puget Sound Earthquake of 1965. A large landslide during the heavy-rainfall winter of 1996-97 also damaged the rail line. Photo by G.W. Thorsen, Washington Division of Geology and Earth Resources.

The 1965 earthquake triggered a landslide in this area that took out the railroad tracks and the sewer line that transported wastewater from Tumwater to the LOTT treatment facility in Olympia.[34]

Another landslide in 1996 in the same area again took out the railroad tracks and the two main sewer lines.[35] The 1996 landslide was not triggered by an earthquake but occurred during a

[32] Source: 75th Anniversary Olympia Brewing Company Booklet~1971
[33] *Source: Natural Hazards Mitigation Plan for the Thurston Region-2009*
[34] 1965 landslide: WA EMD Washington State Hazard Mitigation Plan p.7 of the landslides section. http://www.emd.wa.gov/plans/documents/Tab_7.1.5_Landslide_final.pdf
[35] 1996 landslide: "Sewer line plan upended by quake." Tuesday, March 20, 2001. John Dodge. *The Olympian*.

prolonged and intense period of precipitation. The wastewater has since been redirected to a new pipe that is located on the other side of the valley along Deschutes Parkway.[36]

Another landslide in this general vicinity was observed to have occurred during the 2001 Nisqually earthquake.[37] This landslide was located slightly further to the north than the two previous landslides, but still south of Interstate 5. No damage to facilities or infrastructure resulted from this landslide.

The most recent landslide occurred in December 2008, at a location closer to the old brewery building. This slide was in close proximity to a minor sewer lift station and contributed partially to its temporary failure. This minor lift station only serves about 20 residences on and near Capitol Boulevard.[38]

Summary Assessment

Although Tumwater has several areas of steep slopes, most of the landslides have been concentrated in one area across the Deschutes River from Historical Park. The vulnerability level is low, as compared to moderate for the region, due to the fact that the main critical infrastructure (sewer mains) that were damaged by the landslides in 1965 and 1996 have been moved to Deschutes Parkway and stabilized to withstand future earthquakes. The railroad remains in the same location as the previous landslides but is not a significant transportation connection for Tumwater.

1996 landslide: WA EMD Washington State Hazard Mitigation Plan. November 2007. Hazard Profile-Landslide. p.9 http://www.emd.wa.gov/plans/documents/LandslideNov2007Tab5.6.pdf

[36] 1996 landslide: "Sewer line plan upended by quake." Tuesday, March 20, 2001. John Dodge. The Olympian.

[37] 2001 landslide: Landslide was noted in the 2002 Capitol Lake Adaptive Management Plan, "Also the February 2001 Nisqually earthquake caused a large landslide along the eastern shore of the South Basin across from Tumwater Historical Park,." http://academic.evergreen.edu/curricular/sustainabledesign/CLAMPPlan2003-2013.pdf

[38] Phone conversation with Steve Craig-Tumwater Public Works Operations Manager-June 15, 2009.

Summary Risk Assessment for Landslide in Tumwater

Probability of Occurrence	Vulnerability	Risk
High	Low	Low

Wildland Fire

Severity

Same as described in Regional Risk Assessment.

Impacts

Same as described in Regional Risk Assessment.

Probability of Occurrence

Same as described in Regional Risk Assessment.

Historical Occurrences and Impacts Specific to this Jurisdiction

Tumwater has had very few wildfires compared to most other fire protection areas in Thurston County. According to Table 4.5.1, Tumwater has had 41 fires in 35 years, which is an average of 1.2 wildland fires per year.

As shown on the City of Tumwater Wildfire Hazard Areas map there are no wildfire hazard areas within the City limits of Tumwater. There are a couple of relatively small wildfire hazard areas on the fringes of the Tumwater UGA. One area is near the intersection of Littlerock Road and 93rd Avenue. The other small area is in the northwest corner of the UGA near the rock quarry on Black Lake Boulevard.

If a fire occurred within the wildland fire hazard areas in the UGA, the primary responders would be Littlerock Fire District 11 and McLane Fire District 9 (Black Lake FD5). There are no fire hydrants near these areas. These districts have tenders (pumper trucks) and they are trained to fight fires such as these. The Tumwater fire department does have several hundred gallons of water on the fire engines but generally relies on the mutual aid agreements for situations where a tender is required.

Although not classified as wildfire hazard areas, there are several heavily wooded areas on slopes in Tumwater that, if they caught fire, could cause localized damage. One area in particular are the wooded slopes on Tumwater hill around the elementary school, several of which the City now owns. Establishing fire breaks next to the new houses in this area and then periodically cutting the remainder brush to maintain these fire breaks would be a preventative measure.

Summary Assessment

Vulnerability and risk to Tumwater are low for wildland fires due to the low number of wildland fires in Tumwater and the UGA and the small amount of land designated as wildland fire hazard areas.

Summary Risk Assessment for Wildland Fire in Tumwater

Probability of Occurrence	Vulnerability	Risk
High	Low	Low

Volcanic Hazards

Severity

Same as described in Regional Risk Assessment.

Impacts

Same as described in Regional Risk Assessment.

Probability of Occurrence

Same as described in Regional Risk Assessment.

Historical Occurrences and Impacts Specific to this Jurisdiction

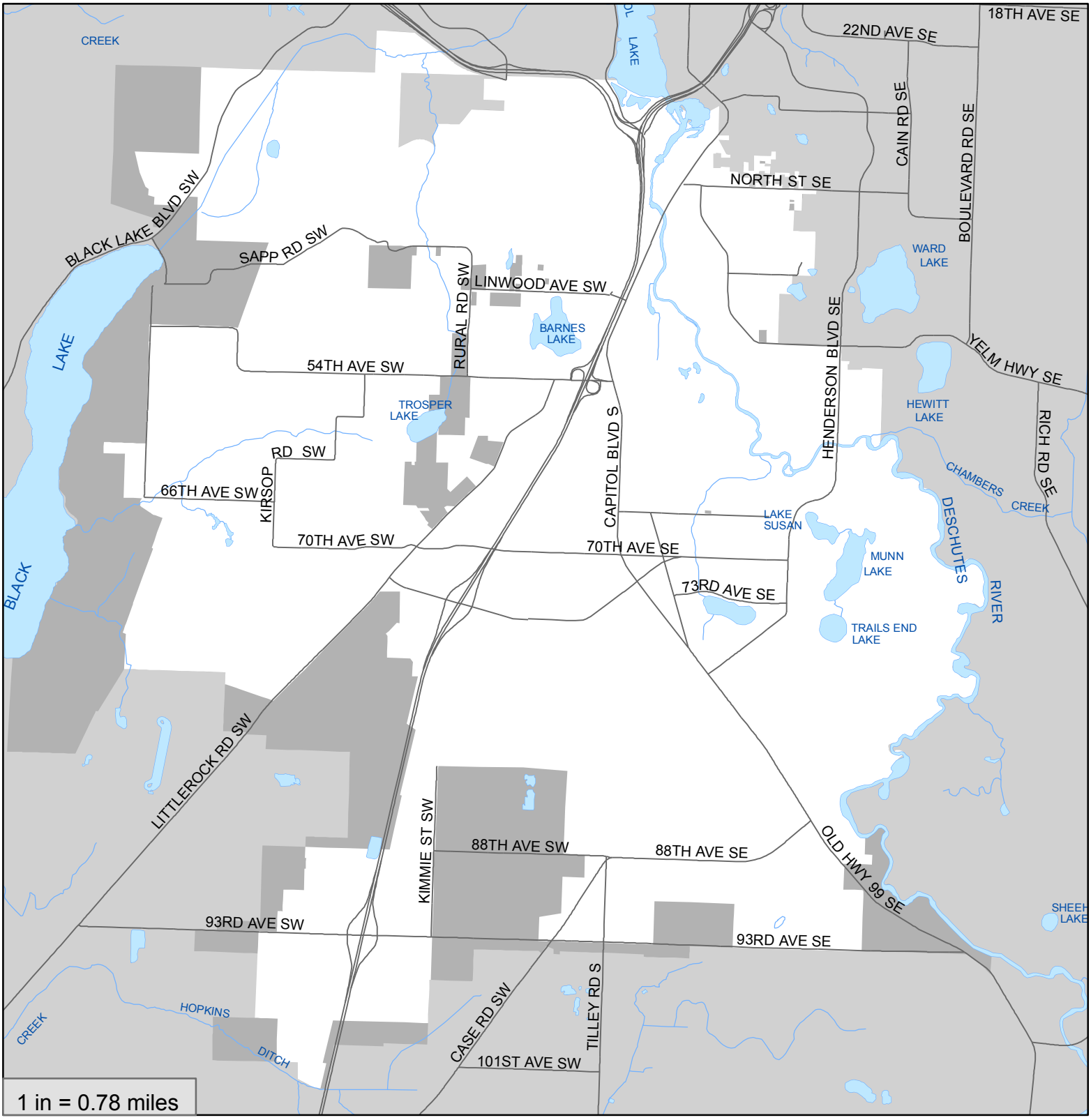
Same as described in Regional Risk Assessment.

Summary Assessment

Same as described in Regional Risk Assessment.

Summary Risk Assessment for Volcanic Hazards in Tumwater

Probability of Occurrence	Vulnerability	Risk
Low	Moderate	Low



City of Tumwater

Jurisdiction Boundary

Urban Growth Area

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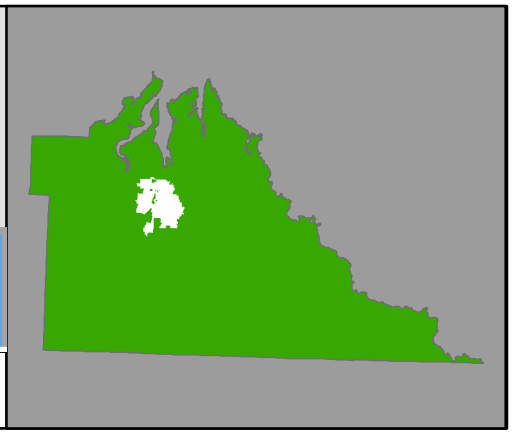

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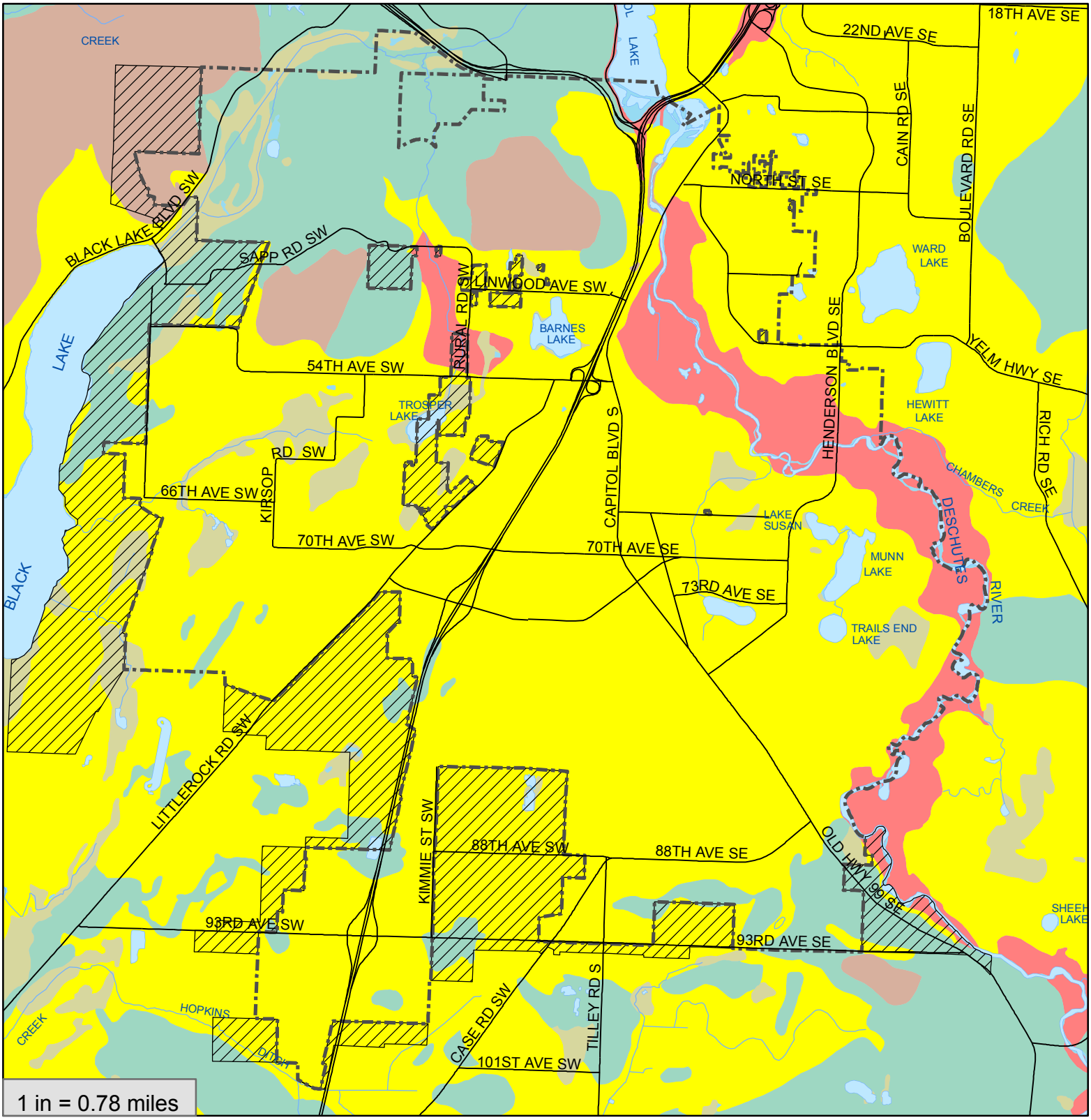

City of Tumwater Liquefaction Hazards

- high
- moderate to high
- low to moderate
- low
- very low to low
- very low
- bedrock
- peat
- water
- Jurisdiction Boundary
- Urban Growth Area

N W E S

Liquefaction Data Source: Washington State Dept. of Natural Resources

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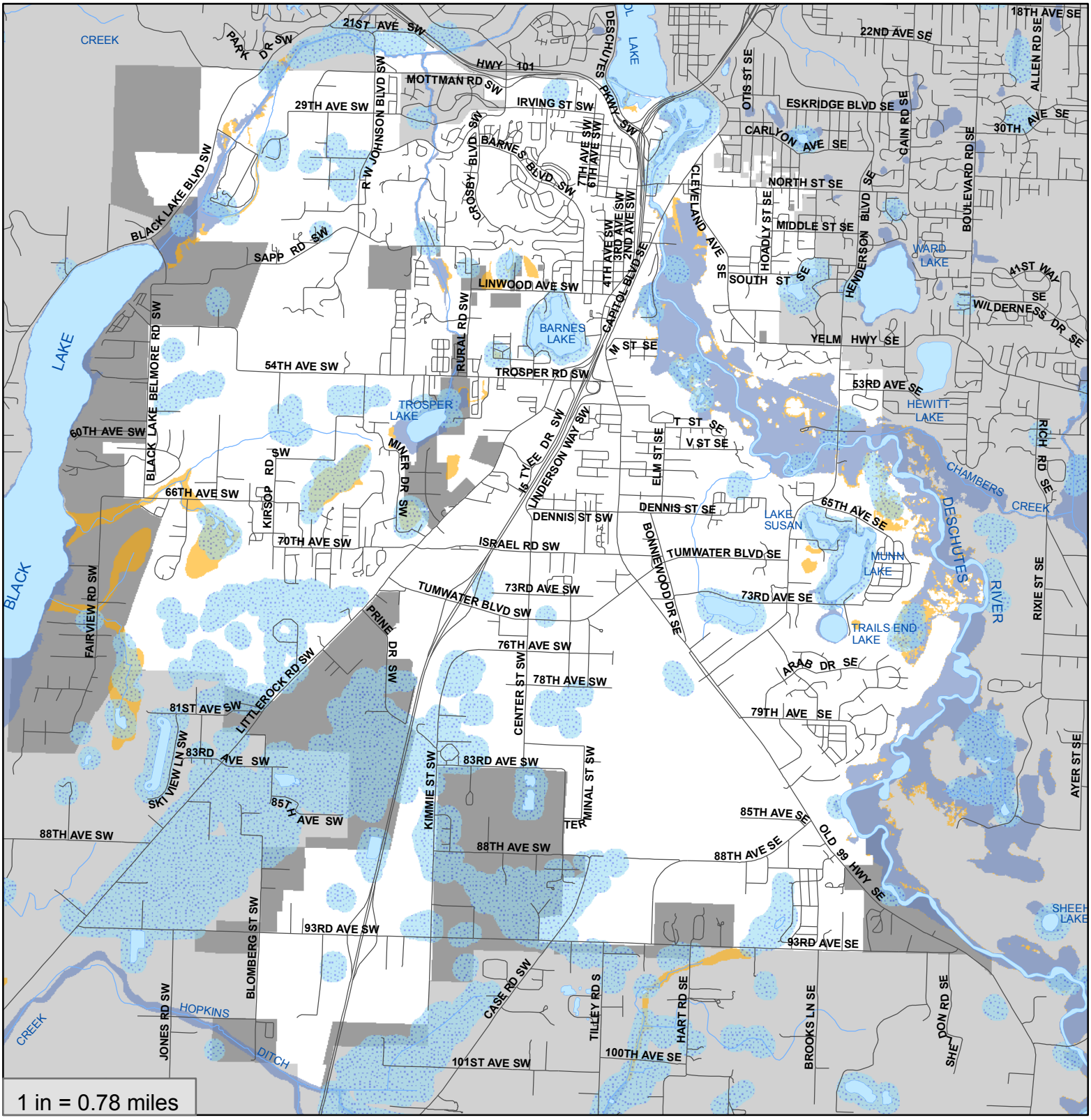
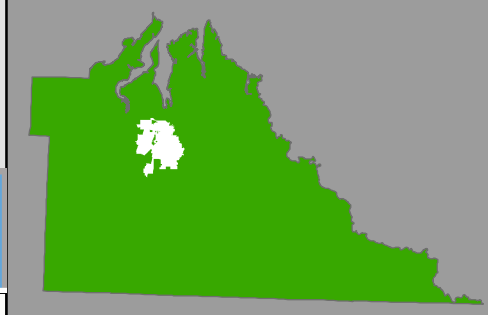


City of Tumwater Flood Hazards

- 1% Chance of Flood (100 Year Floodplain*)
- .2% Chance of Flood (500 Year Floodplain*)
- High Ground Water Flooding **
- Jurisdiction Boundary
- Urban Growth Area

N W E S

* Source: FEMA DFIRM (Digital Flood Insurance Rate Map)
** High Ground Water Flooding Area Includes a 300 Foot Buffer. Source: Thurston GeoData Center



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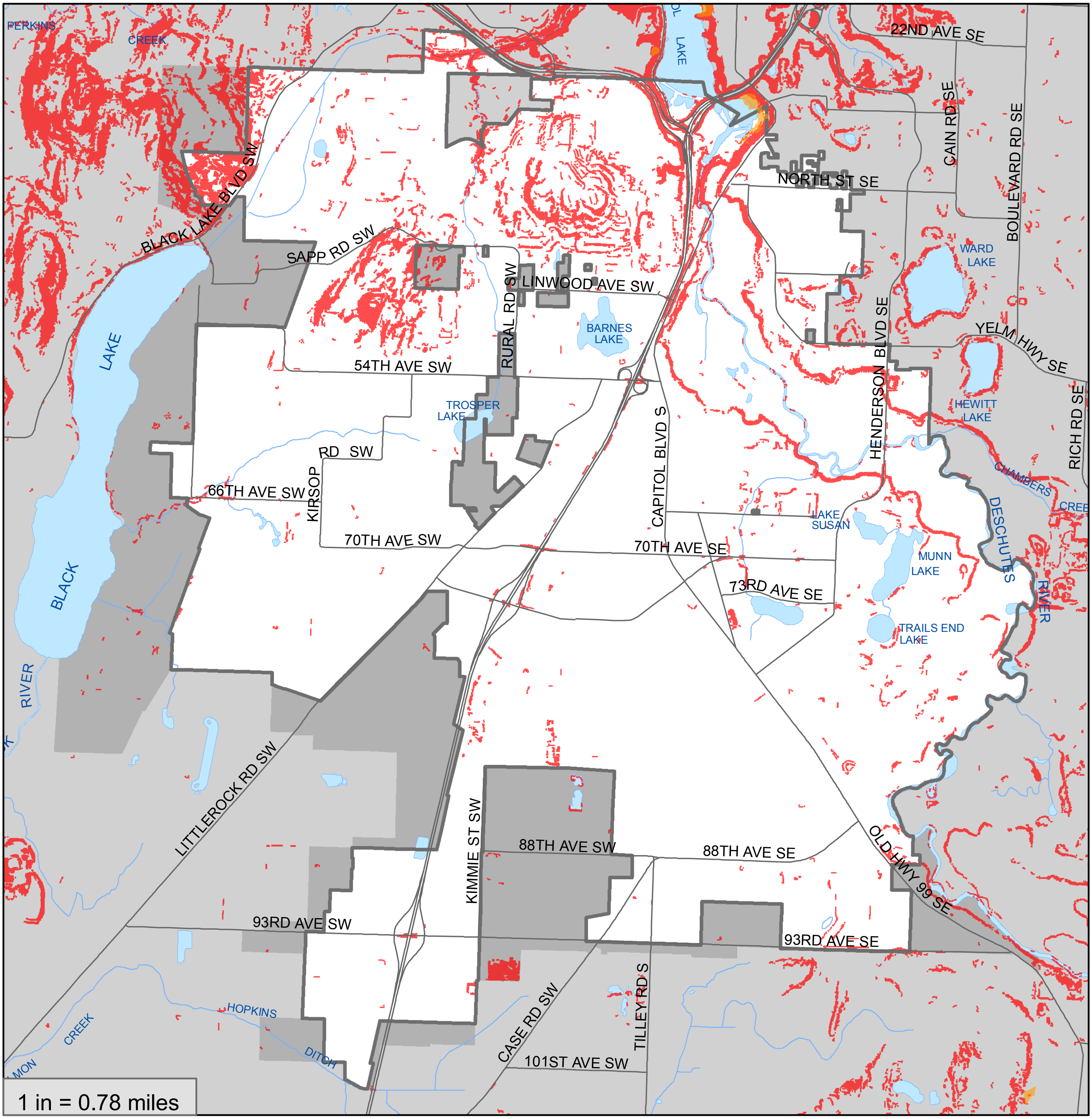
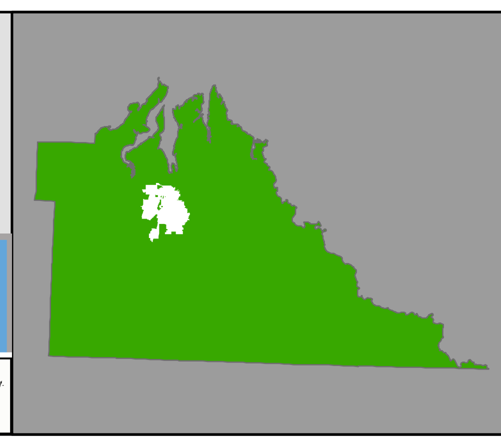


City of Tumwater Steep Slopes

- WADNR Mapped Landslides
- Slopes of 40% or Greater
- Jurisdiction Boundary
- Urban Growth Area

N W E S



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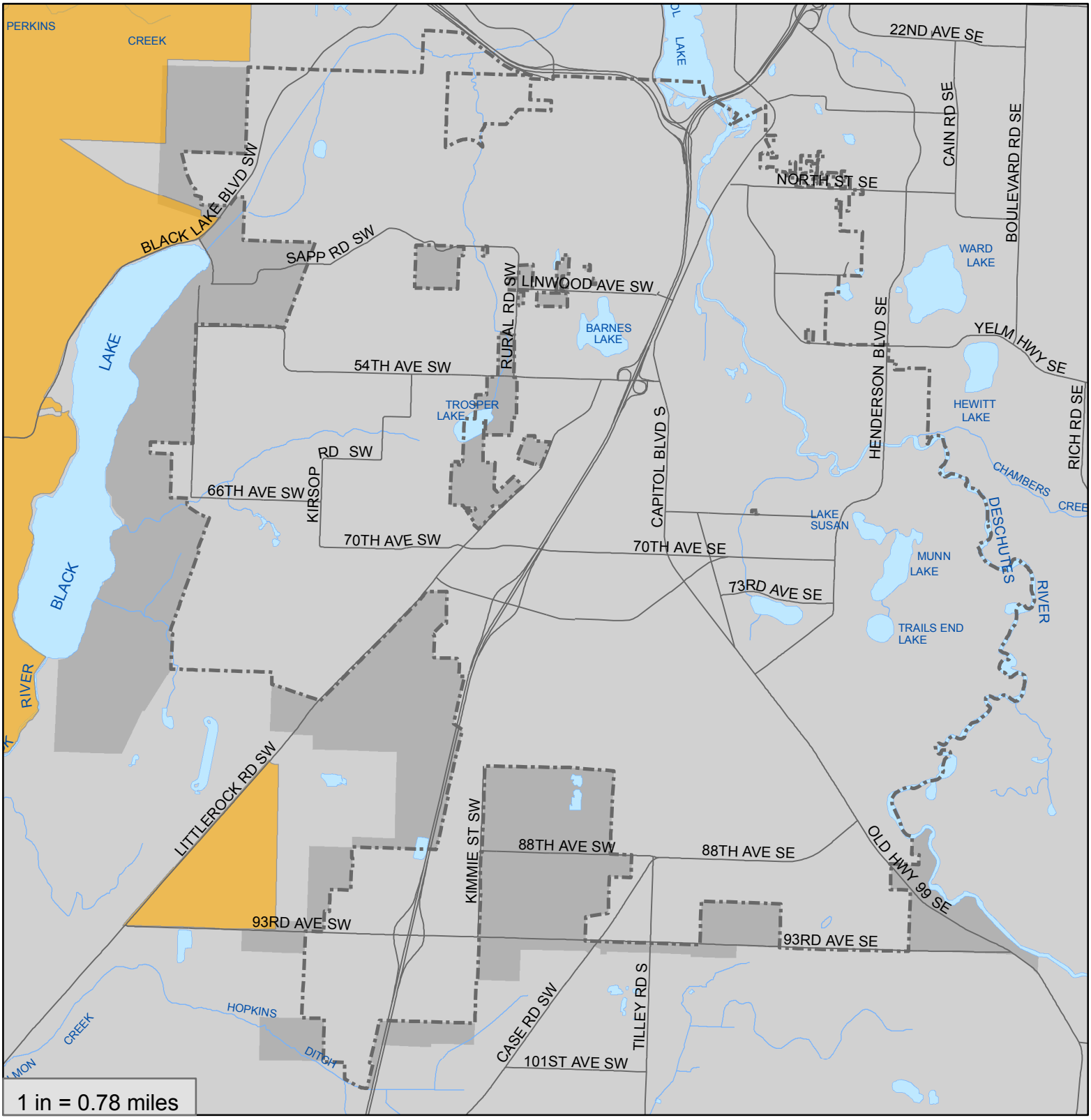


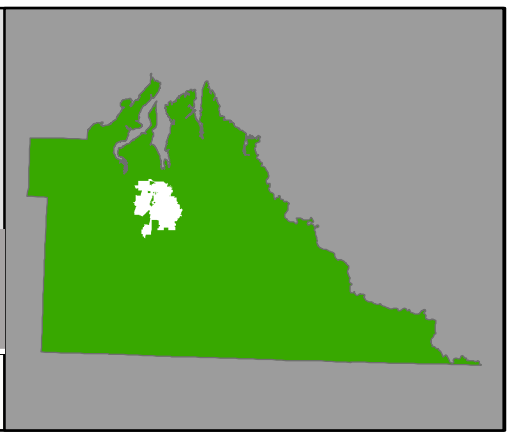
City of Tumwater

High Risk Wildland Urban Interface Areas

Wildfire Hazard Areas*

Jurisdiction Boundary

Urban Growth Area



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* Source: DNR, USFS, and National Fire Protection Association determined these high risk areas through a process of evaluation that considered behavior potential, fire protection capability, and risk to social, cultural and community resources

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City of Tumwater Mitigation Initiatives

Current Adopted Mitigation Initiatives

Current Mitigation Initiatives consist of actions that have not yet begun or require additional work. They consist of new initiatives identified by the City of Tumwater during the plan update process. They also consist of existing initiatives that were carried over in their original form from the first edition of this plan or other plans, or modified from their original form to reflect present needs.

Priority	I.D. Number	Category	Action	Status
1 of 14	TUM-EH 1	Critical Facilities Replacement/Retrofit	Conduct a voluntary non-structural earthquake readiness inspection for all critical facilities on an annual basis	Modified
2 of 14	TUM-EH 2	Hazard Damage Reduction	Have a professional engineer or otherwise qualified person assess infrastructure for earthquake vulnerability. Key infrastructure such as bridges, especially those over the Deschutes river, key water system components, sewage lift stations and water and sewer mains should be included in this periodic inspection.	
3 of 14	TUM-EH 3	Hazard Preparedness	Encourage the public to be prepared to be self-sufficient for the first 72 hours after a disaster.	New
4 of 14	TUM-SH 1	Critical Facilities Replacement/Retrofit	Periodically Inspect all trees within falling distance of the four City-owned critical facilities (both fire stations, the public works shop, and the Police Department/City Hall building), related equipment such as generators, and utilities such as power and communication lines within the immediate vicinity to determine if they pose a hazard to the facility or operation of the facility during a storm.	Modified
5 of 14	TUM-FH 15	Hazard Damage Reduction	Consider and investigate methods and options of construction of a short floodwall around the Tumwater Valley golf course clubhouse or floodproofing	Modified

			the structure to FEMA standards to stop the infiltration of floodwaters during a flood event.	
6 of 14	TUM-FH 14	Data Collection and Mapping	Install or upgrade flood elevation gauges on the Deschutes River	Modified
7 of 14	TUM-FH 6	Hazard Damage Reduction	Work with landowners to reforest corridors along river and stream shorelines.	Modified
8 of 14	TUM-FH 12	Plan Coordination and Implementation	Continue to be actively involved in inter-jurisdictional flood hazard reduction efforts where Tumwater and other jurisdictions are located within the same basin	Existing
9 of 14	TUM-FH 10	Hazard Damage Reduction	Draft a prioritized list of residences Tumwater would elevate above the base flood elevation, if state or federal monies are available	New[39]
10 of 14	TUM-FH 09	Hazard Damage Reduction	Draft a prioritized list of residences Tumwater would acquire (buyout) if state or federal monies are available	New[39]
11 of 14	TUM-FH 02	Public Information	Mail flood insurance information to owners of properties located within a floodplain and to residents who live in a floodplain	New[39]
12 of 14	TUM-FH 14	Hazard Preparedness	Investigate funding sources for projects that will reduce or eliminate damage from flooding for streets, structures, utilities and appurtenances, and other infrastructure within areas prone to flooding; more specifically funding for projects that will elevate or floodproof in some manner, including but not limited to, FEMA approved floodproofing construction techniques as well as the use of berms and floodwalls.	New
13 of 14	TUM-VH 1	Hazard Preparedness	Keep a supply of air filters on hand for critical equipment, generators, and vehicles in case of ash fall from a volcanic eruption.	Modified
14 of 14	TUM-WH 1	Hazard Damage Reduction	Establish fire breaks next to residences on heavily wooded hills in Tumwater,	

[39] Mitigation initiative removed in the 2008 update but reinserted with minor modifications in 2016

		particularly those on Tumwater Hill adjacent to City property, and then periodically cut the remainder brush to maintain these fire breaks.	

Hazard Category Codes are as follows: EH=Earthquake Hazard; FH=Flood Hazard; LH=Landslide Hazard; MH=Multi Hazard; SH=Storm Hazard; WH=Wildland Fire Hazard; and VH=Volcanic Hazard.

Completed or Removed Mitigation Initiatives

Initiatives that have been completed are included in this plan to provide evidence of progress made. Included with these are other initiatives that have been removed because they are no longer relevant or they were combined with other initiatives, among other reasons. These mitigation initiatives are no longer part of the City of Tumwater's adopted mitigation strategy. These initiatives are not ranked, as they are no longer relevant. It should be noted that three initiatives that were removed in 2008 were added back into the plan this year. These include FH-2, FH-9, and FH-10, which deal with informing residents and property owners about their options for flood insurance, evaluating flood prone structures for elevating, and evaluating flood prone properties for buy-outs by the City.

I.D. Number	Category	Action	Status
TUM-FH 4	Development Regulations	Adopt development regulations for high groundwater areas	Completed
TUM-FH 5	Data Collection and Mapping	Determine the width and conditions of buffers along river and stream shorelines	Completed
TUM-FH 1	Plan Coordination and Implementation	Apply to FEMA to be included into the Community Rating System (CRS) Program as a part of the National Flood Insurance Program	Removed
TUM-FH7	Hazard Damage Reduction	Encourage research into bioengineering and other techniques which provide stream bank protection and support local demonstration projects which could provide such research	Locations for stream bank protection were identified in the Deschutes River Phase I TMDL
TUM-FH 8	Hazard Damage Reduction	Plant trees and other native vegetation and install large woody debris to prevent erosion and stream scour which occurs as a result of excessive runoff	Ongoing
TUM-FH 11	Hazard Damage	Construct stormwater detention and treatment facilities for Tumwater's	On going

	Reduction	municipal stormwater that is not currently contained or treated.	
TUM-FH 13	Plan Coordination and Implementation	Secure funding for the stormwater related projects within Tumwater's 6-year Capital Facilities Plan.	On going
TUM-LH 1	Hazard Damage Reduction	Replant native vegetation along the rivers to stabilize banks and to prevent landslides	On going
TUM-LH 2	Development Regulations	Re-evaluate development regulations in regards to steep slopes	Reviewed. No changes anticipated at this time.
TUM-FH 3	Development Regulations	Reevaluate land uses and zoning based upon new floodplain maps	Completed

City of Tumwater Mitigation Initiatives

Priority: 1 of 14 **Status**: Modified

Hazard Addressed: Earthquake Hazard
Category: Critical Facilities Replacement/Retrofit

TUM-EH 1: Title: Conduct a voluntary non-structural earthquake readiness inspection for all critical facilities on an annual basis.

Rationale: It is in the best interest of Tumwater to ensure that all critical facilities are prepared for the possibility of an earthquake. An annual inspection should be done. As new staff, new equipment, and workstation/office changes occur it is possible that the earthquake damage preventative measures (such as retaining straps for books shelves, computers, or other equipment, etc) can be lost or left unused. An annual inspection would help to keep these preventative measures in place.

Relates to Plan Goal(s) and Objectives: NHMP Goals 1, 2, 3. NHMP Objective 1A, 2C, 3B.

Implementer: Tumwater Community Development Department and the Tumwater Fire Department.

Estimated Cost: $1,000 for in-house staff time (and supplies if necessary).

Time Period: 2017

Funding Source: City of Tumwater.

Source and Date: 2003 Natural Hazards Mitigation Plan

Adopted Plan Number: TUM-EH1.

Reference Page: V229

Initiative and Implementation Status: Ranked 1 of 18 in the 2003 initial plan and 1 of 8 in the 2008 plan update. This initiative has never been implemented yet. In 2008 it was changed to

specify that an annual inspection should be done. Minor change in 2017 to mention supplies could be part of the estimated cost.

Priority: 2 of 14 **Status**: New

Hazard Addressed: Earthquake Hazard
Category: Hazard Damage Reduction

TUM-EH 2: Title: Have a professional engineer or otherwise qualified person assess infrastructure for earthquake vulnerability. Key infrastructure such as bridges, especially those over the deschutes river, key water system components, sewage lift stations and water and sewer mains should be included in this periodic inspection.

Rationale: Inspections and assessments of key infrastructure, such as bridges, water towers and pump stations, sewer lift stations, and water/sewer main lines, in regards to their ability to withstand earthquakes will help to prioritize projects and upgrades. The information gained will help to prevent and mitigate the impacts from earthquakes on critical infrastructure.

Relates to Plan Goal(s) and Objectives: NHMP Goal 2. NHMP Objective 2A,2B.

Implementer: Tumwater Public Works Department.

Estimated Cost: $10,000

Time Period: 2017-2022

Funding Source: City of Tumwater

Source and Date: New in 2017

Adopted Plan Number: TUM-EH2.

Reference Page:

Initiative and Implementation Status: New in 2017

Priority: 3 of 14 **Status**: New

Hazard Addressed: Earthquake Hazard
Category: Hazard Preparedness

TUM-EH 3: Title: Encourage the public to be prepared to be self sufficient for the first 72 hours after a disaster.

Rationale: The first 72 hours after a disaster are critical. Electricity, gas, water and telephones may not be working. In addition, public safety services such as police and fire departments may not be able to reach you immediately during a serious crisis. Each person should be prepared to be self-sufficient - able to live without running water, electricity and/or gas, and telephones - for at least three days following a disaster. 72 hour disaster kits should be assembled by citizens and include, but are not limited to, items such as food, water, first aid kit, fire extinguisher, flashlights with extra batteries, and weather radios.
Implementation of this mitigation initiative could take the form of inviting Thurston Emergency Management to give a personal emergency preparedness presentation at a televised City Council meeting.

Relates to Plan Goal(s) and Objectives: NHMP PS-2.10 p.3.1-21

Implementer: Tumwater Fire Department and Executive Department.

Estimated Cost: N/A

Time Period: 2017-2022

Funding Source: unknown

Source and Date: New in 2017

Adopted Plan Number: TUM-EH3.

Reference Page:

Initiative and Implementation Status: New in 2017

Priority: 3 of 13 **Status**: Modified

Hazard Addressed: Storm Hazard
Category: Critical Facilities Replacement/Retrofit

TUM-SH 1: Title: Periodically inspect all trees within falling distance of the four City-owned critical facilities (both fire stations, the public works shop, and the Police Department/City Hall building), related equipment such as generators, and utilities such as power and communication lines within the immediate vicinity to determine if they pose a hazard to the facility or operation of the facility during a storm.

Rationale: The removal of hazard trees that could damage, destroy, or even hinder the operation of critical facilities will help to keep critical facilities functioning properly when they are needed the most.

Relates to Plan Goal(s) and Objectives: NHMP Goal 1,2,3. NHMP Objective 1A, 2C, 2D, 3A, 3B.

Implementer: Tumwater Parks Department.

Estimated Cost: $5,000 for an inspection by a professional arborist (tree removal is not included because this initiative only deals with inspection)

Time Period: 2017-2018

Funding Source: City of Tumwater.

Source and Date: 2003 and 2008 Natural Hazards Mitigation Plans

Adopted Plan Number: TUM-SH1.

Reference Page: V263

Initiative and Implementation Status: Ranked 2 of 18 in 2003 and 2 of 8 in 2008. This initiative has never been implemented. Modified in 2008 to add related equipment such as generators and nearby infrastructure such as communication and electrical lines. In 2007, Tumwater installed a $500,000 generator to supply constant power to the Police station and City Hall in

the event of a power outage. This generator is within falling distance of several large fir trees. Furthermore, the root zones of these fir trees were impacted by excavation and heavy equipment during the construction of the police station expansion in 2014. The future impact of this root zone damage is currently unknown and as such, a professional arborist should be hired to assess the situation. There are numerous other generators at City facilities including, but not limited to those located at the Public Works shop, the North End Fire Station (T2) and the Fire Department Main Station (T1) which includes the Emergency Operations Center; these should be included in the hazard tree evaluation. The initiative has not been funded as of yet and responsibility was moved from Planning and Facilities to the Parks Department in 2010 due to a re-organization within the City. The cost estimate was doubled to $5,000 in 2015 based on input from the Parks Director. The Parks Director has also stated he will seek funding in future budgets and through the Capital Facilities Plan.

Priority: 4 of 13 **Status**: Modified

Hazard Addressed: Flood Hazard
Category: Hazard Damage Reduction

TUM-FH 15: Title: Consider and investigate methods and options of construction of a short floodwall around the Tumwater Valley golf course clubhouse or floodproofing the structure to FEMA standards to stop the infiltration of floodwaters during a flood event.

Rationale: The Tumwater Valley golf course clubhouse is located within the 1% (100-year) floodplain according to the most recent Flood Insurance Study and Flood Insurance Rate Map. The building has not yet been flooded but the floodwaters came within a few inches of the door in the January 2009 flood event when the Deschutes River crested at 14.5 feet at the Rainier gauge. A several million-dollar remodel of the building was completed in early 2009. Due to the significant dollar investment in the building, a floodwall surrounding the building that could prevent flood damage or upgrading the structure to include floodproofing should be seriously considered. Evaluation of these options should include costs, benefits, impacts to nearby properties including the Tumwater Valley Athletic club, as well as impacts to the floodplain as a whole.

Relates to Plan Goal(s) and Objectives: NHMP Goal 2,3. NHMP Objective 2C,3B

Implementer: Tumwater Parks and Recreation Department.

Estimated Cost: Unknown.

Time Period: 2017-2022

Funding Source: City of Tumwater.

Source and Date: 2008 Natural Hazards Mitigation Plan

Adopted Plan Number: N/A

Reference Page: N/A

Initiative and Implementation Status: This was a new mitigation initiative in 2008. It was modified in 2015 to include the option of investigating floodproofing of the structure. The modification was the result of direction from a City Council subcommittee.

Priority: 5 of 13 **Status**: Modified

Hazard Addressed: Flood Hazard
Category: Data Collection and Mapping

TUM-FH 14: Title: Install or upgrade flood elevation gauges on the Deschutes River.

Rationale: Previously the flood gauge at the "E" Street bridge was an older type which had to be read manually. It has since been updated to provide data every 15 minutes. However,flood state information based on this gauge is not readily provided by USGS or NOAA, unlike the gauge at Rainier. This initiative was created because readings at the Rainier gauge do not always accurately reflect what is occurring 20 miles downstream in the Tumwater portion of the Deschutes River. For example, the January 2009, flood was one foot lower than the December 2007 flood at the Rainier gauge, however, photographs at Henderson Boulevard in Tumwater showed the water levels were higher in the 2009 flood than in the 2007 flood.
A gauge at the "E" Street bridge that linked data immediately to a public website such as USFS or NOAA would help in obtaining accurate records of flood levels in Tumwater which would be important for making decisions regarding future land use and zoning, infrastructure locations and designs, future critical facilities, etc.

Relates to Plan Goal(s) and Objectives: NHMP Goal 7. NHMP Objective 7A.

Implementer: Tumwater Public Works Department.

Estimated Cost: $20,000 per gauge and $4,000 per year for operating costs.

Time Period: 2017-2022

Funding Source: Department of General Administration, City of Olympia, City of Tumwater.
In regards to the funding for an upgraded electronically monitored gauge at the "E" Street bridge, reportedly the USGS would be interested in installing an upgraded gauge provided the local governments pay for the installation and operation of the gauge. It appears there is some interest by the Washington State Department of General Administration, and the City of Olympia to possibly partner with Tumwater for a new gauge. General Administration would be interested due to their need to control the water level in Capitol Lake with the dam. A gauge would be able to be integrated into a telemetry system to automatically open and close the

dam as necessary. Also, the City of Olympia has a vested interest in making sure that Capitol Lake doesn't flood a portion of downtown Olympia.

Source and Date: 2003 and 2008 Natural Hazards Mitigation Plan

Adopted Plan Number: TUM-FH14.

Reference Page: V-257 (NHMP)

Initiative and Implementation Status: Ranked 5 of 18 in 2003 and 4 of 8 in 2008. This initiative has not been implemented. The gauge at the E Street Bridge was slightly upgraded so the data does not have to be read manually, however, the data is still not available to for several months. The possibility of a gauge at Rich Road was removed in 2015 due to the lack of possible funding and the recent upgrades (and possible future upgrades) to the E Street gauge.

Priority: 6 of 13 **Status**: Modified

Hazard Addressed: Flood Hazard
Category: Hazard Damage Reduction

TUM-FH 6: Title: Work with landowners to reforest corridors along river and stream shorelines.

Rationale: To re-establish a forested edge along river and stream shorelines is one way to help reduce the impacts of flooding. The placement of large woody debris in rivers helps to dissipate the hydraulic energy along the river banks. Planting of trees and other vegetation also helps to reduce erosion and contributes to long term bank stabilization.

Relates to Plan Goal(s) and Objectives: NHMP Goal 4, 6. NHMP Objective 4A, 4B, 6B

Implementer: Tumwater Public Works Department

Estimated Cost: Unknown. Stream restoration projects are part of an ongoing program with the Tumwater Stream Team (a division of the Tumwater Public Works-Water Resource Division). This initiative is not a single specific project but rather an ongoing effort to re-establish a forested edge along rivers and streams in Tumwater.

Time Period: 2017-2022

Funding Source: City of Tumwater

Source and Date: 2003 and 2008 Natural Hazards Mitigation Plan

Adopted Plan Number: TUM-FH6

Reference Page: V-241

Initiative and Implementation Status: Ranked 9 of 18 in 2003 and 6 of 8 in 2008. This initiative has been partially completed. Work continues on portions of the Deschutes River and Percival Creek where the natural riparian habitat has been disturbed or removed. The Tumwater Stream Team (in the Water Resources Division of the Tumwater Public Works Department) plans, organizes, and manages riparian restoration projects in Tumwater. Work has been done on

several portions of the Deschutes River along the Tumwater Valley Golf Course and Pioneer Park as well as along Percival Creek. However, more work remains to be done.
This intiative was partially modified in 2008 under the Rationale section by integrating the some of the rationale from mitigation initiative FH8 regarding large woody debris and its calming effects on hydraulic energy along river banks.

Priority: 7 of 13 **Status**: Existing

Hazard Addressed: Flood Hazard
Category: Plan Coordination and Implementation

TUM-FH 12: Title: Continue to be actively involved in inter-jurisdictional flood hazard reduction efforts where Tumwater and other jurisdictions are located within the same basin.

Rationale: Tumwater, being located at the mouth of the Deschutes River, is directly affected by activities occurring upstream and "downstream". Tumwater should work closely with upstream jurisdictions as well as Olympia which is "downstream" to ensure that any activities in these other jurisdictions do not adversely affect Tumwater. Olympia is referred to as "downstream" because it controls the lake at the mouth of the deschutes river with a dam. The lake has been filling in with silt and debris over the past several decades and now has very little storage capacity. Tumwater Historical Park and the historic Old Brewhouse are located at the base of the falls, effectively the mouth of the Deschutes River, which would be significantly impacted by lake level rise during a flooding event.

Relates to Plan Goal(s) and Objectives: NHMP Goal 6. NHMP Objective 6A.

Implementer: Tumwater Community Development Department, Tumwater Public Works Department, Tumwater Parks Department.

Estimated Cost: Unknown. This is not a specific project. It involves continued participation in intergovernmental work and planning that are related to flood hazards.

Time Period: 2017-2022

Funding Source: City of Tumwater.

Source and Date: 2003 and 2008 Natural Hazards Mitigation Plan.

Adopted Plan Number: TUM-FH12.

Reference Page: V-253 (NHMP)

Initiative and Implementation Status: Ranked 18 of 18 in 2003 and 8 of 8 in 2008. Tumwater continues to be involved with other jurisdictions in regards to the Deschutes River. The Tumwater Public Works Water Resource Division and the Tumwater Parks and Recreation Department both represent Tumwater on the Deschutes River, Capitol Lake, and Budd Inlet TMDL Technical Advisory Group. The scientific research on the river has been completed and the advisory group is working on an action plan to deal with the activities and land uses currently impacting the river. Currently logging and agricultural practices, as well as riparian habitat issues, are impacting the river. Although the focus of the research, the committee, and the eventual action plan is on water quality, it will also result in better quality riparian habitat, more naturally regulated flows in the river, and some positive impacts on the effects of downstream flooding episodes. In addition, the Tumwater Stream Team often works in conjunction with the Thurston Conservation District for riparian habitat restoration projects that involve agricultural uses and lands.

Priority: 8 of 13 **Status**: New

Hazard Addressed: Flood Hazard
Category: Hazard Damage Reduction

TUM-FH 10: Title: Draft a prioritized list of residences Tumwater would elevate above the base flood elevation, if state or federal monies are available.

Rationale: Repetitive loss properties negatively impact the property owner as well as the surrounding community. Frequently flooded properties and structures can also become a health and life safety issue for both residents, emergency responders, and the community in general. The City of Tumwater should work with regional, state and federal agencies in determining which residences should be elevated and how the funding for such actions will be acquired.

Relates to Plan Goal(s) and Objectives: Goal 3. Objective 3A.

Implementer: Tumwater Community Development Department, Tumwater Public Works Department, and Tumwater Executive Department.

Estimated Cost: Unknown. This is not a specific project. It involves continued participation in intergovernmental work and planning that are related to flood hazards.

Time Period: 2017-2022

Funding Source: City of Tumwater.

Source and Date: 2003 Natural Hazards Mitigation Plan.

Adopted Plan Number: TUM-FH10.

Reference Page: V-249 (NHMP)

Initiative and Implementation Status: Ranked 14 of 18 in 2003 and removed in 2008. Removal was because Tumwater had no repetitive loss or severe loss properties (Source: FEMA NFIP Insurance Report, Washington, May 4, 2009). In addition, since 1978 Tumwater had only two claims paid for a total of $12,515 (same source as above). This information was not readily available during the initial drafting of the plan in 2003. However, City has annexed an area on

58th Avenue off Henderson Boulevard (in the Deschutes River valley) with several homes that are frequently flooded. A subcommittee of the Tumwater City Council decided it would be appropriate to put this mitigation initiative back into the plan due to the aforementioned change of circumstances.

Priority: 9 of 13 **Status**: New

Hazard Addressed: Flood Hazard
Category: Hazard Damage Reduction

TUM-FH 09: Title: Draft a prioritized list of residences Tumwater would acquire (buyout) if state or federal monies are available.

Rationale: Repetitive loss properties negatively impact the property owner as well as the surrounding community. Frequently flooded properties and structures can also become a health and life safety issue for both residents, emergency responders, and the community in general. The City of Tumwater should work with regional, state and federal agencies in determining which residences should be purchased and how the funding for such actions will be acquired.

Relates to Plan Goal(s) and Objectives: Goal 3. Objective 3A.

Implementer: Tumwater Community Development Department, Tumwater Public Works Department, and Tumwater Executive Department.

Estimated Cost: Unknown. This is not a specific project. It involves continued participation in intergovernmental work and planning that are related to flood hazards.

Time Period: 2017-2022

Funding Source: City of Tumwater.

Source and Date: 2003 Natural Hazards Mitigation Plan.

Adopted Plan Number: TUM-FH09.

Reference Page: V-249 (NHMP)

Initiative and Implementation Status: Ranked 13 of 18 in 2003 and removed in 2008. Removal was because Tumwater had no repetitive loss or severe loss properties (Source: FEMA NFIP Insurance Report, Washington, May 4, 2009). In addition, since 1978 Tumwater had only two claims paid for a total of $12,515 (same source as above). This information was not readily available during the initial drafting of the plan in 2003. However, City has annexed an area on

58th Avenue off Henderson Boulevard (in the Deschutes River valley) with several homes that are frequently flooded. A subcommittee of the Tumwater City Council decided it would be appropriate to put this mitigation initiative back into the plan due to the aforementioned change of circumstances.

Priority: 10 of 13 **Status**: New

Hazard Addressed: Flood Hazard
Category: Public Information

TUM-FH 02: Mail flood insurance information to owners of properties located within a floodplain and to residents who live in a floodplain.

Rationale: Knowledge of flood insurance opportunities and other related information will be helpful for residents and property owners who may not be aware of the options.

Relates to Plan Goal(s) and Objectives: Goal 9. Objective 9A

Implementer: Tumwater Community Development Department.

Estimated Cost: $500

Time Period: 2017-2022

Funding Source: City of Tumwater.

Source and Date: 2003 Natural Hazards Mitigation Plan.

Adopted Plan Number: TUM-FH02.

Reference Page: V-249 (NHMP)

Initiative and Implementation Status: Ranked 12 of 18 in 2003 and removed in 2008. Removal was because Tumwater had no repetitive loss or severe loss properties (Source: FEMA NFIP Insurance Report, Washington, May 4, 2009). In addition, since 1978 Tumwater had only two claims paid for a total of $12,515 (same source as above). This information was not readily available during the initial drafting of the plan in 2003. However, the City annexed an area on 58th Avenue off Henderson Boulevard (in the Deschutes River valley) with several homes that are frequently flooded. A subcommittee of the Tumwater City Council decided it would be appropriate to put this mitigation initiative back into the plan due to the aforementioned change of circumstances.

Priority: 11 of 13 **Status**: New

Hazard Addressed: Flood Hazard
Category: Hazard Preparedness

TUM-FH 14: Investigate funding sources for projects that will reduce or eliminate damage from flooding for streets, structures, utilities and appurtenances, and other infrastructure within areas prone to flooding; more specifically funding for projects that will elevate or floodproof in some manner, including but not limited to, FEMA approved floodproofing construction techniques as well as the use of berms and floodwalls.

Rationale: Elevating and other means of floodproofing will reduce damages, reduce or eliminate provision of services (utilities), and allow travel of emergency vehicles as well as daily traffic during periods of flooding.

Relates to Plan Goal(s) and Objectives: Goal 2. Objectives 2A, 2D

Implementer: Tumwater Public Works Department, Tumwater Parks Department.

Estimated Cost: unknown

Time Period: 2017-2022

Funding Source: Federal and State Grants

Source and Date: New in 2015

Adopted Plan Number: TUM-FH14.

Reference Page: (NHMP)

Initiative and Implementation Status: New in 2015. Goal 7.2.3 of the Comprehensive Drainage Plan for the Salmon Creek Basin (2004) was for Thurston County to work with the State to elevate primary roadways (including the State Highway) that were located within areas prone to high groundwater flooding. The roadway has not been elevated as of yet. Due to several annexations since that time, some of the highway is now within Tumwater so having Tumwater

act as a partner with the aforementioned entities is a logical step, as is inclusion of this goal in this hazard plan.

Further expanding the aforementioned goal is to include all areas of flooding and to attempt to find funding for elevation or retrofit of streets, structures, infrastructure, and utilities and appurtenances.

Priority: 12 of 13 **Status**: Modified

Hazard Addressed: Volcanic Hazard
Category: Hazard Preparedness

TUM-VH 1: Title: Keep a supply of air filters on hand for critical equipment, generators and vehicles in case of ashfall from a volcanic eruption.

Rationale: In order to keep critical facilities operating during a volcanic ash fall situation, emergency operations equipment such as police vehicles, fire trucks, medic one units, the HVAC system for the Emergency Operations Center, and generators supporting critical facilities, etc., should have extra air filters on hand. Even though volcanic eruptions usually give indications several months in advance, the addition of this mitigation initiative will help to reduce the likelihood of forgetfulness in regards to stocking up on air filters beforehand. Continued operation of emergency response equipment and critical facilities during a disaster is very important to the health, safety, and welfare of the citizens of Tumwater.
This initiative was created to avoid situations where emergency response vehicles are put out of commission due to ash fall. This occurred in numerous communities during the 1980 eruption of Mt. St. Helens. The ash from Mt. St. Helens traveled around the world; it is located only 61 miles from Tumwater. An eruption of Mt Rainier, only 54 miles away, would likely have a significant impact on the community. Concern has been growing in the region over the past few decades regarding the possibility of an eruption of Mt Rainier. Preparation beforehand would help to minimize impacts to emergency response.

Relates to Plan Goal(s) and Objectives: NHMP Goal 1. NHMP Objective 1D.

Implementer: Tumwater Public Works Department, Tumwater Parks Department, Tumwater Fire Department.

Estimated Cost: $1,000

Time Period: 2017-2022

Funding Source: City of Tumwater.

Source and Date: 2008 Natural Hazard Mitigation Plan

Adopted Plan Number: N/A

Reference Page: N/A

Initiative and Implementation Status: This mitigation initiative has not been implemented. It was changed to reflect the fact that the Parks Department is now in charge of maintaining the generators at City facilities.

Priority: 13 of 13 **Status**: New

Hazard Addressed: Wildfire Hazard
Category: Hazard Damage Reduction

TUM-WH 1: Title: Establish fire breaks next to residences on heavily wooded hills in Tumwater, particularly those on Tumwater Hill adjacent to City property, and then periodically cut the remainder brush to maintain these fire breaks.

Rationale: While Tumwater may not have any recognized large wildfire hazard areas in its core, there are several areas with substantial trees that, if they caught fire, could cause localized damage. The one area in particular are the wooded slopes on Tumwater hill around the elementary school, several of which the City now owns. Establishing fire breaks next to the new houses in this area and then periodically cutting the remainder brush would help to minimize damages in the event of a localized wildfire.

Relates to Plan Goal(s) and Objectives: NHMP Goal 3. NHMP Objective 3A.

Implementer: Tumwater Parks Department.

Estimated Cost: $5,000 initial then $1,000 per year for maintenance

Time Period: 2017-2022

Funding Source: City of Tumwater

Source and Date: New in 2017

Adopted Plan Number: TUM-WH 1.

Reference Page:

Initiative and Implementation Status: New in 2017

City of Tumwater Implementation of the National Flood Insurance Program (NFIP)

Introduction

All local mitigation plans approved by FEMA must describe each jurisdiction's participation in the NFIP and must identify, analyze, and prioritize actions related to continued compliance with the NFIP. Basic compliance NFIP actions could include, but are not limited to the following:

- Adoption and enforcement of floodplain management requirements, including regulating all and substantially improved construction in Special Flood Hazard Areas;
- Floodplain identification and mapping, including any local requests for map updates, if needed; or
- Description of community assistance and monitoring activities.

Requirement §201.6(c)(3)(ii):	**[The mitigation strategy] must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.**

Summary of Tumwater National Flood Insurance Program Premiums, Policies, and Claims

Date of Entry Initial FIRM Effective Date	Policies In-Force	Insurance In-Force	Written Premium In-Force	Claims Since 1978	Total Payments	CRS Class
8/1/1980	22	$6,708,000	$10,355	2	$12,514	n/a

Tumwater has participated in the NFIP since August of 1980 and since that time, there have been only two claims paid for a total of approximately $12,514. Presently, only twenty-two properties in Tumwater have flood insurance policies. There are no repetitive loss properties and no severe loss properties within Tumwater.

Future Land Use Plans, Zoning, and Development Regulations

The Conservation Plan, an element of the Tumwater Comprehensive Plan, contains a chapter devoted to frequently flooded areas (Chapter 6). The goals listed in the chapter and the techniques to implement the goals are to protect life and property in frequently flooded areas.

The plan lists the adoption of a floodplain overlay zone and floodproofing regulations as two of the techniques to limit or prohibit, as appropriate, encroachment in floodplains that could endanger life and property during periods of flooding. Implementation of a floodplain overlay zone and floodproofing regulations are mentioned as techniques that will help to preserve the natural functions of floodplains to store, carry, and control floodwaters.

The Land Use Plan, which is also an element of the Tumwater Comprehensive Plan, acknowledges the problems of development in floodplains. The following is an excerpt from p.116 of the Land Use Plan:

> *"Nearly all of the Tumwater valley is a floodplain for the Deschutes River, and consequently is very unsuitable for any but the lowest intensity of development. It is subject to frequent flooding and seasonal high water tables. Its rich, alluvial soils, although excellent for agricultural purposes, present severe limitations for roads, buildings, and septic tanks. Moreover, the underlying geology contributes to severe settling problems."*

Goal #6 of the Land Use Plan is to reduce impacts from flooding. Consistent with this goal, future land use designations, including "Parks/Open Space," have been applied to areas within the floodplain. These land use designations help to preclude and minimize development within the special flood hazard areas and to reduce the impacts of flooding.

To reach the goals listed in both the Conservation Plan and the Land Use Plan a floodplain overlay zone (Tumwater Municipal Code (TMC) Chapter 18.38-Floodplain Overlay) was adopted in 1984 and is used to limit or prohibit, as appropriate, encroachment in floodplains that could endanger life and property during periods of flooding. In addition, Tumwater adopted a new floodplain ordinance based on the ESA model in 2016. This overlay zone district also helps to preserve the natural functions of floodplains to store, carry, and control floodwaters. A chapter establishing federal floodproofing requirements was adopted in 1981. TMC Chapters 15.28-Floodproofing Regulations Adopted and TMC 18.38-Floodplain Overlay are in place and serve to designate frequently flooded areas and to specify federal floodproofing regulations. If allowed at all, any structures permitted in the designated flood areas are subject to strict development regulations. The existing regulations were put in place after careful study and evaluation to ensure consistency with all state and federal requirements regarding floodplain regulations.

Additional Activities

The following activities carried out by Tumwater help to reduce the effects of flooding further:

1. Elevation Certificates: Tumwater maintains elevation certificates for new and substantially improved buildings within the floodway and one hundred-year floodplain. Copies of elevation certificates are made available upon request and may be viewed at Tumwater City Hall.

2. Open Space Preservation: Most of the special flood hazard areas on Tumwater are designated as open space or greenbelt.

3. Higher Regulatory Standards: Tumwater's floodplain regulations meet and in several instances exceed the minimum state and federal requirements. Tumwater also has regulations for development within the five hundred year floodplain. In 2016 Tumwater adopted the Endangered Species Act model floodplain ordinance.

4. Flood Data Maintenance: Tumwater maintains digital copies of D.F.I.R.M. maps and Flood Insurance Study Reports at Tumwater City Hall and they are available to the public. The D.F.I.R.M map coverage has also been integrated into the official zoning map for Tumwater which is available online and at Tumwater City Hall.

5. Stormwater Management: In 2017, the City of Tumwater adopted an updated stormwater manual, consistent with Thurston County.

6. Public Drainage System Maintenance: Tumwater's public drainage system is inspected regularly throughout the year and maintenance is performed as needed by the Tumwater Public Works Department. Records are maintained for both inspections and required maintenance. The Tumwater Capital Facilities, Plan, an element of the Tumwater Comprehensive Plan, is a financial planning and budgeting tool that includes capital drainage improvement projects.

7. Private Drainage Systems: Tumwater's Water Resource Division staff is in the process of mapping and inspecting private stormwater systems within Tumwater. The outreach is to make sure the systems are functioning properly and to continue the public education about the importance of such facilities and their role in controlling runoff, treating stormwater, and helping to reduce flooding impacts.