APPENDIX C

PUYALLUP TRIBE ALL HAZARD MITIGATION PLAN 2017-2022 EDITION MAPS, FIGURES AND TABLES

Geological Hazards	
Map, Figure or Table Title	Page Number
AVALANCHE	
Figure 4.1-1 Slab Avalanche	Pg 4.1-3
Map 4.1-1 Areas Vulnerable to Avalanche	Pg 4.1-5
Table 4.1-1 Pierce County Avalanches of Record	Pg 4.1-7
EARTHQUAKE	
Figure 4.1-1 Types of Earthquakes	Pg 4.2-2
Map 4.2-1 Major Faults in the Puget Sound Basin	Pg 4.2-4
Map 4.2-2 Seattle and Tacoma Fault Segments	Pg 4.2-5
Map4.2-3 Pierce County Seismic Hazard	Pg 4.2-6
Map4.2-4 Puyallup Tribe of Indians Seismic Hazard	Pg 4.2-7
Map 4.2-5 Puyallup Tribe Of Indians Downtown Liquefaction	Pg 4.2-8
Map 4.2-6 Puyallup Tribe Of Indians Fife/Puyallup Liquefaction	Pg 4.2-9
Map 4.2-7 Puyallup Tribe Of Indians Port Of Tacoma Liquefaction	Pg 4.2-10
Map 4.2-8 Puyallup Tribe Of Indians Orting/Wilkeson Liquefaction	Pg 4.2-11
Map 4.2-5 Major Pacific Northwest Earthquakes	Pg 4.2-12
Table 4.2-1 Notable Earthquakes Felt in Pierce County	Pg 4.2-13
Figure 4.2-2 Salmon Beach, Tacoma Washington – Following Feb. 2001 Earthquake	Pg 4.2-17
Figure 4.2-3 Liquefaction, Niigata Japan 1964	Pg 4.2-20
Figure 4.2-4 Lateral Spreading – March 2001	Pg 4.2-20
LANDSLIDE	
Figure 4.3-1 Northeast Tacoma – Landslide 01/2007	Pg 4.3-2
Table 4.3-1 Notable landslides in Pierce County	Pg 4.3-4
Map 4.3-1 Pierce County Landslide and Soil Erosion Hazard	Pg 4.3-5
Map 4.3-2 Pierce County Shoreline Slope Stability Areas	Pg 4.3-6
Map 4.3-3 Puyallup Tribe of Indians landslide and Soil Erosion Hazard	Pg 4.3-7

Geological Hazards	
Map, Figure or Table Title	Page Number
Figure 4.3-2 Ski Park Road – Landslide 01/31/03	Pg 4.3-9
Figure 4.3-3 SR-165 Bridge Along Carbon River – Landslide 2/1996	Pg 4.3-11
Figure 4.3-4 Aldercrest Drive – Landslide	Pg 4.3-11
TSUNAMI	
Figure 4.4-1 Hawaii 1957 – Residents Explore Ocean Floor Before Tsunami	Pg 4.4-2
Figure 4-4-2 Hawaii 1949 – Wave Overtakes a Seawall	Pg 4.4-3
Figure 4.4-3 Puget Sound Fault Zone Locations, Vertical Deformations, and Peak Ground Acceleration	Pg 4.4-6
Map 4.4-1 Seattle and Tacoma Faults	Pg 4.4-7
Figure 4.4-4 Tsunami Inundation and Current Based on Earthquake Scenario	Pg 4.4-8
Figure 4.4-5 Puget Sound Landslide Areas and Corresponding Tsunamis	Pg 4.4-10
Figure 4.4-6 Puget Sound River Deltas, Tsunami Evidence, and Peak Ground Acceleration	Pg 4.4-11
Figure 4.4-7 Salmon Beach, Pierce County, 1949 – Tsunamigenic Subaerial Landslide	Pg 4.4-13
Figure 4.4-8 Puyallup River Delta – Submarine Landslides	Pg 4.4-15
Figure 4.4-9 Puyallup River Delta – Submarine Landslides and Scarp	Pg 4.4-16
Figure 4.4-10 Damage in Tacoma from 1894 Tsunami	Pg 4.4-17
Map 4. 4-2 Washington State Tsunami Vulnerability	Pg 4.4-19
Map 4.4-3 Puyallup Tribe of Indians Seattle Fault Earthquake Scenario	Pg 4.4-20
Map 4.4-4 Puyallup Tribe of Indians Tacoma Fault Earthquake Scenario	Pg 4.4-21
Map 4.4-5 Puyallup Tribe of Indians Rosedale-dominant Tacoma Fault Earthquake Scenario	Pg 4.4-22
Map 4.4-6 Puyallup River Delta	Pg 4.4-25
VOLCANIC	
Figure 4.5-1 Volcanic Hazards	Pg 4.5-2
Figure 4.5-2 Debris flow at Tahoma Creek, July 26,1988	Pg 4.5-3
Figure 4.5-3 Douglas Fir Stump – Electron Lahar Deposit in Orting	Pg 4.5-3
Figure 4.5-4 Landslide from Little Tahoma Peak Covering Emmons Glacier	Pg 4.5-4
Table 4.5-1 Tephra Types and Sizes	Pg 4.5-5
Map 4.5-1 Lahars, Lava Flows, and Pyroclastic Hazards of Mt. Rainier	Pg 4.5-6
Table 4.5-2 Estimated Lahar Travel Times for Lahars 10(7) to 10(8) Cubic Meters in Volume	Pg 4.5-8
Map 4.5-2 Ashfall Probability From Mt. Rainier	Pg 4.5-9
Map 4.5-3 Annual Probability of 10 Centimeters or more of Tephra	Pg 4.5-9

Geological Hazards	
Map, Figure or Table Title	Page Number
Accumulation in the Pacific NW	
Map 4.5-4 Puyallup Tribe of Indians Lahar Hazard Area	Pg 4.5-10
Figure 4.5-5 Cascade Eruptions	Pg 4.5-11
Table 4.5-3 Mt. Rainier Identified Tephra, last 10,000 years	Pg 4.5-12
Table 4.5-4 Pierce County River Valley Debris Flow History	Pg 4.5-12
Figure 4.5-6 Mt. Rainier	Pg 4.5-27

Meteorological Hazards	
Map, Figure or Table Title	Page Number
CLIMATE CHANGE	
Figure 4.6-1 Global Temperature Change: 1850 to 2006	Pg 4.6-2
Table 4.6-1 Recent and Projected Temperatures for the Pacific Northwest	Pg 4.6-5
Figure 4.6-2 Comparison of the South Cascade Glacier: 1928 to 2003	Pg 4.6-9
Figure 4.6-3 Lower Nisqually Glacier Retreat: 1912 to 2001	Pg 4.6-10
DROUGHT	
Figure 4.7-1 Sequence of Drought Impacts	Pg 4.7-3
Table 4.7-1 Palmer Drought Severity Index	Pg 4.7-4
Figure 4.7-2 % Area of Basin in Drought Conditions Since 1895	Pg 4.7-5
Map 4.7-1 Pierce County Watersheds	Pg 4.7-6
Map 4.7-2 % of Time in Severe to Extreme Drought: 1895-1995	Pg 4.7-7
Map 4.7-3 % of Time in Severe to Extreme Drought: 1985-1995	Pg 4.7-7
Table 4.7-2 Notable Droughts Affecting Pierce County	Pg 4.7-8
Figure 4.7-3 National Drought Mitigation Center Drought Impact Reporter	Pg 4.7-12
Map 4.7-4 Columbia River Basin	Pg 4.7-13
Map 4.7-5 USDA Climate Zones – Washington State	Pg 4.7-17
FLOOD	
Map 4.8-1 Pierce County Watersheds	Pg 4.8-4
Map 4.8-2 Puyallup Tribe of Indians Flood Hazard	Pg 4.8-5
Map 4.8-3 Pierce County Repetitive Loss Areas	Pg 4.8-6
Map 4.8-4 Puyallup Tribe of Indians Repetitive Loss Areas	Pg 4.8-9
Map 4.8-5 Clear Creek Basin	Pg 4.8-10
Map 4.8-6 Repetitive Flood Loss Aerial Photo	Pg 4.8-11
Table 4.8-1 Flood Hazard Declared Disasters	Pg 4.8-14
Figure 4.8-1 Feb 8, 1996 Flooding – Del Rio Mobile Homes Along Puyallup River	Pg 4.8-16
Figure 4.8-2 Nov. 2006 Flooding River Park Estates – Along Puyallup River	Pg 4.8-19
Map 4.8-7 Puyallup Tribe Of Indians Port Of Tacoma Flood Hazard Area	Pg 4.8-20
Map 4.8-8 Puyallup Tribe Of Indians Downtown Flood Hazard Area	Pg 4.8-21
Map 4.8-9 Puyallup Tribe Of Indians Fife/Puyallup Flood Hazard Area	Pg 4.8-22
Figure 4.8-3 Nov. 2006 Flooding State Route 410 – Along Puyallup River	Pg 4.8-24
Figure 4.8-4 Nov. 2006 Flooding Rainier Manor – Along Puyallup River	Pg 4.8-25
SEVERE WEATHER	

Meteorological Hazards	
Map, Figure or Table Title	Page Number
Table 4.9-1 Fujita Tornado Damage Scale	Pg 4.9-3
Figure 4.9-1 Windstorm Tracks Pg 4.9-4	Pg 4.9-4
Map 4.9-1 Pierce County Severe Weather Wind Hazard – South Wind Event	Pg 4.9-6
Map 4.9-2 Pierce County Severe Weather Wind Hazard – East Wind Event	Pg 4.9-7
Map 4.9-3 Puyallup Tribe of Indians Severe Weather Wind Hazard – South Wind Event	Pg 4.9-8
Map 4.9-4 Puyallup Tribe of Indians Severe Weather Wind Hazard – East Wind Event	Pg 4.9-9
Table 4.9-2 Notable Severe Weather in Pierce County	Pg 4.9-10
Figure 4.9-2 Snowstorm 01/2004 Downtown Tacoma	Pg 4.9-13
Figure 4.9-3 Satellite Image – Hanukkah Eve Windstorm	Pg 4.9-15
Figure 4.9-4 Before/After Tornado Damage Greensburg, KS 05/04/07	Pg 4.9-16
Figure 4.9-5 Public Works Responds 2005 Snowstorm	Pg 4.9-17
Figure 4.9-6 Downed Power Pole 02/2006 Windstorm	Pg 4.9-20
Figure 4.9-7 County Road December 2006 Windstorm	Pg 4.9-22
Figure 4.9-8 Tacoma Narrows Bridge – November 7, 1940 Windstorm	Pg 4.9-25
WILDLAND URBAN INTERFACE FIRE	
Map 4.10-1 Washington State Fire Hazard Map	Pg 4.10-3
Map 4.10-2 Pierce County Forest Canopy	Pg4.10-4
Map 4.10-3 Industrial Fire Precaution Level Shutdown Zones	Pg 4.10-5
Figure 4.10-1 Carbon Copy Fire August 2006	Pg 4.10-6
Map 4.10-4 Washington State DNR Wildland Fire Statistics: 1973-2007	Pg 4.10-7
Table 4.10-1 DNR Wildland Response South Puget Sound Region: 2002-2007	Pg 4.10-7
Table 4.10-2 Pierce County DNR Fires	Pg 4.10-8
Map 4.10-5 Puyallup Tribe of Indians Wildland/Urban Interface Vulnerability	Pg 4.10-10

Technological Hazards		
Map, Figure or Table Title	Page Number	
ABANDONED MINES		
Figure 4.11-1 Warning sign Posted at Mine	Pg 4.11-2	
Table 4.11-1 Some Pierce County Named Coal Mines	Pg 4.11-3	
Figure 4.11-2 Lady Wellington Mine Tipple	Pg 4.11-4	
Map 4.11-1 Puyallup Tribe of Indians Mine Hazard Areas	Pg 4.11-5	
Figure 4.11-3 Pacific Coast Coal Mine Tipple, Carbonado	Pg 4.11-7	
CIVIL DISTURBANCE		
Map 4.12-1 Puyallup Tribe of Indian Civil Disturbance Hazard Area	Pg 4.12-4	
DAM FAILURE		
Figure 4.13-1 Reasons for Dam Failures Nationally	Pg 4.13-2	
Table 4.13-1 Pierce County Dams that Pose a High or Significant Risk to the Public	Pg 4.13-3	
Map 4.13-1 Pierce County High and Significant Risk Dams	Pg 4.13-4	
Table 4.13-2 Select Dam Failures in Washington State	Pg 4.13-5	
Map 4.13-2 Puyallup Tribe of Indians Dam Failure Flood Inundation from Lake Tapps	Pg. 4.13-7	
Map 4.13-3 Puyallup Tribe of Indians Dam Failure Flood Inundation from Mud Mountain Dam	Pg. 4.13-8	
Figure 4.13-2 Mud Mountain Dam Intake	Pg 4.13-9	
ENERGY EMERGENCY		
Map 4.14-1 Puyallup Tribe of Indians Energy Emergency	Pg 4.14-4	
Figure 4.14-1 The Carrier Lexington Providing Electricity to the City of Tacoma	Pg 4.14-6	
Figure 4.14-2 Solar Panels, the New Face of Power Generation	Pg 4.14-10	
EPIDEMIC/PANDEMIC		
Map 4.15-1 Puyallup Tribe of Indians Epidemic/Pandemic Hazard Area	Pg 4.15-3	
Figure 4.15-1 Individuals Hoping to Avoid Contacting Disease	Pg 4.15-6	
HAZARDOUS MATERIAL		
Table 4.16-1 List Of Constituents Or Ingredients found In Bakken Crude Oil	Pg 4.16-2	
Table 4.16-2 EPA's Toxic Release Inventory For Pierce County 2013	Pg 4.16-3	
Table 4.16-3 EPA's Identified Top Five Facilities	Pg 4.16-3	
Figure 4.16-1 Exxon Valdez Oil Spill, 1989	Pg 4.16-4	
Map 4.16-1 Puyallup Tribe of Indians Hazardous Material Area	Pg 4.16-5	
Map 4.16-2 Puyallup Tribe Of Indians Hazardous Material – Port Of Tacoma Area Major Roads	Pg 4.16-7	

Map 4.16-3 Puyallup Tribe Of Indians Hazardous Material – Port Of Tacoma	Pg 4.16-8	
Area Railroads		
Map 4.16-4 Puyallup Tribe Of Indians Hazardous Material – Downtown Area	Pg 4.16-9	
Major Roads		
Map 4.16-5 Puyallup Tribe Of Indians Hazardous Material - Downtown Area	Pg 4.16-10	
Railroads		
Map 4.16-6 Puyallup Tribe Of Indians Hazardous Material – Fife/Puyallup	Pg 4.16-11	
Area Major Roads		
Map 4.16-7 Puyallup Tribe Of Indians Hazardous Material – Fife/Puyallup	Pg 4.16-12	
Area Railroads		
Figure 4.16-2 Dalco Passage Oil Spill Clean Up	Pg 4.16-13	
PIPE HAZARD		
Table 4.17-1 Cities and Towns with Interstate Pipeline within, or within 1	Pg 4.17-3	
Mile of City Limits		
Figure 4.17-1 Olympic Pipeline Rupture 1999	Pg 4.17-3	
Map 4.17-1 Puyallup Tribe of Indians Pipeline Hazardous Area	Pg 4.17-5	
Figure 4.17-2 Whatcom Falls Park, 2003	Pg 4.17-8	
TERRORISM		
Figure 4.18-1 World Trade Center, 9/11/2001	Pg 4.18-2	
Table 4.18-1 Select U.S. Terrorist Incidents	Pg 4.18-4	
Figure 4.18-3 Responders search the pile at the WTC	Pg 4.18-7	
Map 4.18-1 Puyallup Tribe of Indians Terrorism Hazard Area	Pg 4.18-8	
TRANSPORTATION EMERGENCY		
Table 4.19-1 Airports in Pierce County	Pg 4.19-2	
Table 4.19-2 Ferry Service in Pierce County	Pg 4.19-4	
Figure 4.19-1 Train Wreck on Mounts/Old Nisqually Road	Pg 4.19-5	
Map 4.19-1 Puyallup Tribe of Indians Transportation Hazards	Pg 4.19-9	

(This page left blank intentionally)
APPENDIX C-8