

## 7 Conclusions

### 7.1 Ground Shaking

The 9.0-magnitude earthquake along the Cascadia fault line off the coast of northern California, Oregon, and Washington, along with a resulting tsunami, causes significant damage and loss of life along coastal regions of California, Oregon, and Washington. Further structural damage is experienced along the I-5 corridor from Seattle to Portland. The earthquake's effects are felt throughout the region, but the greatest damage is in the coastal areas and west of the coastal mountains of Washington and Oregon. Approximately 1,100 fatalities are forecast to result from ground shaking, primarily due to structure collapse.

#### 7.1.1 Tsunami

Many communities along the northern California, Oregon, and Washington coast have as little as 15 minutes warning of the resulting tsunami. Almost two thousand lives could be lost due to tsunami inundation along the Pacific coast. The communities of Crescent City and Grays Harbor are particularly hard hit, although there are no significant tsunami impacts further into the Puget Sound or inner reaches of the Columbia River.

### 7.2 Transportation

#### 7.2.1 Roads

Significant damage to roads can be expected, particularly those along the coast and connecting the coast to the I-5 corridor. Some coastal communities along U.S. 101 can expect to be isolated due to complete inaccessibility for the short term. U.S. 101 is expected to have substantial damage due to both shaking and tsunami and is expected to have limited capacity for several months. Road and bridge damage will likely impact accessibility of emergency services as well as essential repair crews for other sectors.

#### 7.2.2 Rail

The complete loss of key rail bridges in the Olympia and Seattle areas, as well as the loss of a bridge in downtown Portland, and extensive damage to the critical bridge spanning the Columbia River immediately north of Portland will cause long-term disruption to rail traffic along the I-5 corridor for a year or more. Eastbound lines for both Seattle and Portland should suffer fewer impacts and offer alternate routes for those population centers.

#### 7.2.3 Airports

Smaller airports along the coast are expected to suffer substantial runway damage, limiting fixed-wing access for emergency services. Seattle and Portland international airports should quickly regain functionality to near full capacity. There may be some near-term fuel supply issues.

#### 7.2.4 Ports

Intermodal facilities are very hard hit as a result of being close to the coast and because they are located in areas susceptible to liquefaction. These facilities could take months to restore.

Tsunami damage at the mouth of the Columbia River will impact navigation and the ability to export agricultural commodities.

### **7.3 Banking and Finance**

Loss of the Alaska telecommunications link would significantly impact the ability of Alaskan banks to process payments/ settlements. Satellite uplinks might not be an available option due to scarcity of bandwidth and contractual agreements.

Loss of major transpacific undersea cable capacity would affect transoceanic commerce, settlement, and transpacific financial market exchanges. With the loss of approximately half the undersea cable capacity, communications systems could face abnormally high congestion.

### **7.4 Water and Wastewater**

Disruptions to potable water supply are expected with restoration times of three weeks to seven months with the greatest damage and longest restoration times near the coastline. There is some risk of release of untreated wastewater and sewer-line backups, which would cause a shutdown of the system until repairs can be completed. Availability of water supply and wastewater systems can delay economic recovery, particularly along the coastline. The region may experience an increase in waterborne diseases due to contamination of drinking water.

### **7.5 Health Care**

The Cascadia earthquake and tsunami constitute a catastrophic event with 15,000 to 30,000 casualties. There is an expected loss due to damage of 15-27 hospitals comprising 524-1708 regular beds and 60-228 critical bed facilities particularly near the coast. The number of mass casualties is sufficient to saturate the excess capacity of other hospitals within a 250-mile range of the site of injuries. Restoration to pre-earthquake levels will occur over one to two years.

### **7.6 Electric Power**

Extensive electric power outages are experienced throughout the region with medium-term outages forecast for the coastal areas. Seattle and Tacoma, Washington; Portland, Oregon; Vancouver Island, British Columbia; and all other Oregon and Washington cities within 100 miles of the Pacific coastline will experience at least partial blackout, with a few additional blackout areas in northwest California. Restoration of power proceeds on a prioritized basis with most areas having power restored within one to eight days.

### **7.7 Natural Gas**

Segments of the backbone natural gas transmission pipeline serving western Washington and Oregon, as well as the compressor stations along that pipeline, are at risk of being damaged. Both the transmission pipeline and the networks of distribution pipelines are likely to suffer enough damage that the majority of customers in western Washington and western Oregon will not receive natural gas service until pipelines can be repaired. Combined with electrical outages, many homes may lose all sources of heating. Only 12 percent of electric power generation capacity is fueled by natural gas in the region, so disruption of natural gas is not expected to have a major impact in overall EP capacity, unless the transmission lines delivering hydroelectric power from the east fail.

## **7.8 Hospitals and Emergency Services**

Widespread damage to hospitals, fire stations, police stations, and emergency services along with widespread bridge and road outages along the immediate coastal communities are expected to substantially limit the abilities of first-responders to assist in rescue and medical aid for victims.

### **7.8.1 Emergency Services**

Widespread damage to police stations, fire stations, and hospitals is expected along the coast. Bridge and road outages will inhibit accessibility and emergency response capabilities. Communications disruptions will be a widespread problem for emergency response operations along the entire coast. Transportation fuels to key emergency operations centers may become an issue until road access is restored.

## **7.9 Telecommunications**

Telecommunications and Internet services are likely to be severely disrupted across the regions experiencing liquefaction due to damage to the facilities and the loss of communication cables connecting those facilities. Repair of the facilities and restoration of the cables is likely to take weeks to months.

The earthquake will likely sever undersea cables that primarily provide communications services to Alaska and major transpacific routes. This will cause severe communications disruptions between Alaska and the contiguous United States. The loss of the major transpacific communication routes will cause disruption and severe delays in communication to and from East Asian countries, which could have impacts on other infrastructures that rely on real-time or near real-time operation and timely large data transfers over transpacific networks. Restoration of these cable systems is likely to take two to three months depending on the number of breaks and the availability of cable ships to conduct the repairs.

## **7.10 Transportation Fuels**

Petroleum refining capacity in the region will not be significantly impacted. However, many of the pump stations critical to moving refined product along the Olympic and Oregon Line pipeline system will be completely damaged. Thus, based on pump station operability alone, it is reasonable to assume a disruption in pipeline functionality measured in months.

A majority of refined product terminals are expected to be completely destroyed; as a consequence, the ability to distribute refined products fuels along the Pacific Northwest corridor will be significantly reduced. As a result, the Portland, Eugene, and Kennewick-Richland demand regions will experience a major reduction in transportation fuels supplies.

## **7.11 National, Regional, and Local Impact Summary**

National infrastructure impacts resulting from the earthquake and tsunami are not expected to be severe; however, there will be longer term regional impacts to the telecommunication sector and increasing shortages of gasoline and refined petroleum products south of Seattle to Portland, Eugene, and beyond. Coastal areas taking the brunt of the earthquake and tsunami will experience a long recovery time; this is due to both limited access to begin restoration activities and the extent of structural damage of coastal communities.

