Appendix Two:

Metro Regional Framework Plan — Chapter Five: Natural Hazards

Natural Hazards

Chapter 5 Regional Natural Hazards

Overview

Natural hazards provide a "reality check" to growth in any region, a yardstick against which we can ask, "Has the region's future been built on solid ground?"

In the past few years, natural disasters have impacted many local communities. Two examples include the Scott Mills earthquake in 1993, and the 1996 floods. For the three-county area, the cost of flooding and landslides from the February, 1996 event has been estimated at almost $60 million – some 200 households were within the area of inundation. Figure 5.1 depicts the frequency of flooding in the region. Reminders of the power that natural hazards can unleash on communities include distant more powerful events, such as the Loma Prieta (1989) and Northridge (1994) earthquakes in California; and the widespread Midwest floods in 1993. We know that major disaster can strike this region.

Flood Date	Flood Inundation Level[18] Willamette at Portland	Flood Inundation Level Columbia at Vancouver
February 1996	30.2 ft.	28.8 ft.
December 1977	17.6 ft.	Not available
January 1974	25.7 ft.	25.0 ft.
December 1964	29.8 ft.	29.5 ft.
June 1956	26.4 ft.	26.8 ft.
May 1951	Not available	21.5 ft.
June 1950	Not available	25.1 ft.
June 1948	31.6 ft.	32.8 ft.
January 1943	21.8 ft.	Not available
June 1894	35.1 ft.	36.0 ft.

Figure 5.1 Columbia and Willamette River Flooding[19]

Hazard mitigation planning, part of a new comprehensive approach to emergency management, can be instrumental in reducing the region's vulnerability to disasters. Hazard mitigation requires a partnership between emergency managers who are experts in emergency response needs, and experts in other professions such as land use planning, engineering and economics.

Growth expected to occur as estimated in Metro population growth forecasts will require Metro, local governments and private partners to balance many policy considerations. Failure to address natural hazard

[18] River heights are measured by National Geodetic Vertical Datum.
[19] Table information from the City of Portland Hazard Mitigation Plan for the February 1996 flood.

management issues in the community planning and development stages can lead to amplification of future losses.

This chapter of the Regional Framework Plan outlines the background, analysis and policies concerning regional natural hazard mitigation planning. It addresses known regional natural hazards, and offers policy guidance for a comprehensive planning process that will help minimize the risks associated with such hazards to communities.

Policies (Goals and Objectives)

Policies concerning hazard mitigation, emergency preparedness, disaster response and recovery should be adopted and implemented. Policies addressing natural hazards mitigation and response are as follows:

5.1 Earthquake Hazard Mitigation Measures

The risk of loss or damage from an earthquake depends on: 1) the presence of seismically-hazardous land (land subject to failure or strong effects from an earthquake); and, 2) land use (structures by type and occupancy or use characteristics).

5.1.1 Metro will use the relative earthquake hazard maps for a variety of planning purposes, including:

- Urban Growth Boundary selection;
- public facility plans;
- transportation planning;
- solid waste management plans;
- natural hazard mitigation programs;
- parks and greenspaces planning.

5.1.2 Metro will encourage local governments to utilize the relative earthquake hazard maps in developed and undeveloped areas as they undertake planning actions, including:

- comprehensive land use plans updates;
- redevelopment plans updates;
- subdivision reviews;
- zoning;
- infrastructure plans updates;
- siting of new public facilities;
- siting of new public and private utility facilities;
- public and private facility emergency plan updates;
- developing retrofit and other mitigation programs;
- emergency response planning.

In planning for seismic hazards, land use classifications were identified as shown in Figure 5.2, grouping land uses according to a common tolerance for risk. Representatives of the public and private sectors participated through the Metro Advisory Committee for Mitigating Earthquake Damages (MACMED) in reviewing and approving the land use groups in this figure. Each land use classification is comprised of uses recommended as having roughly equivalent ability to withstand earthquake damage. Metro encourages local governments to consider these land use classifications for seismic hazard mitigation planning and actions. Many land uses could be placed into more than one category. The table begins with land uses that should be most protected from earthquake damage and ending with land uses that need minimal protection.

Land Uses with Potentially Catastrophic Consequences if Damaged

- Large dams
- Nuclear facilities
- Facilities using/ storing large quantities of hazardous materials (defined by Oregon State law)

High-Occupancy Land Uses with Involuntary or Dependent Occupants

- Day care centers < 250 children
- Day care centers > 250 children
- Schools K-12 <300 students
- Schools K-12 > 300 students
- Convalescent homes < 50 persons
- Convalescent homes > 50 persons
- Jails and retention facilities

Land Uses Essential for Emergency Response

- Fire and police stations
- Garages for emergency vehicles
- Water tanks
- Structures housing fire suppressants
- Government communications centers
- Emergency response centers
- Hospitals
- Medical buildings with surgical services

Land Uses Critical to the Functioning of the Metro Region

- Large power plants
- Power intertie
- Sewage treatment plants
- Water storage/treatment facilities
- Regional highways, bridges & tunnels
- Regional rail lines
- Port facilities
- Major communications facilities
- Telephone exchanges
- Radio and TV stations

Land Uses with High-Occupancy

- Buildings > 10 stories
- Public & private colleges < 500 occupants
- Public & private colleges > 500 occupants
- Public assembly places w/ > 300 capacity
- Hotels & motels > 50 rooms >60,000 sq. ft. > 10 stories
- Major industries & employers
- Apartments > 25 units
- Buildings w/ > 150 employees

Land Uses with Important Local Impacts if Damaged

- Facilities using/storing small quantities of hazardous materials
- Small dams that could cause flooding
- Gas stations
- Highways, streets & bridges
- Utility lines, substations, & gas mains
- Water & sewer mains
- Industries & businesses important to economy
- Health care clinics
- Co-generation plants

Land Uses with Moderate-Occupancy

- Buildings w/4 to 10 stories
- Apartments 9 to 25 units
- Buildings w/ 50 to 150 employees
- Buildings w/ 50 to 150 employees >60,000 sq. ft. >10 stories
- Public assembly places: 50 to 300 capacity
- Hotels & motels <50 rooms <60,000 sq. ft. <10 stories

Land Uses with Low-Occupancy

- Apartments w/ 2 to 8 units
- Buildings w/ < 50 employees
- Buildings w/ 1 to 3 stories
- Public assembly places w/ < 50 capacity
- Single-family houses in a subdivision
- Single-family houses
- Mobile homes in a subdivision
- Mobile homes

Figure 5.2 Land Uses Grouped By Seismic Risk

Adoption or use of earthquake hazard maps and land use mitigation goals and policies will not, however, provide any "bright line" for determining risks, given the current level of scientific knowledge. MACMED suggested one method of determining which land uses should require site-specific studies and which land uses should not require such studies. The MACMED table is attached in the Appendices.

5.1.3 Metro will encourage local governments to use the table in the Appendices to set requirements for where site-specific seismic hazard evaluation is needed .

5.2 Flood Hazard Mitigation Measures

The surest and safest flood hazard mitigation measure is to build outside areas that can be flooded. However, the FEMA designated floodplains have been shown to be insufficient in protecting property from much less than catastrophic events. Many areas that were outside the FEMA 100 year floodplain flooded in 1996. Acquisition of vulnerable property and relocation of structures can convert a flood hazard area into a community asset. Title 3 of the Urban Growth Management Functional Plan (see Appendices) will restrict development in many of these flood hazard areas.

5.2.1 Metro will collaborate with federal agencies and local governments in using the February 1996 flood elevations and other relevant data to update the existing 100-year floodplain map.

5.2.2 Metro will encourage local governments to implement approaches for mitigating flood hazards such as the following:

- acquisition, relocation or flood proofing of vulnerable facilities;
- changing local development ordinances related to height requirement above base flood elevation;
- allowing cluster or planned unit development that keep buildings out of floodplains;
- overlay zoning that sets public health, safety or welfare requirements;
- subdivision development requirements for locating public utilities and facilities (such as sewer and water systems) to minimize flood damage;
- construction of levees and flood walls to mitigate flood hazards, particularly in densely developed urban areas, but should only be utilized when potential upstream and downstream damage is expected to be minimal;
- plans to leverage federal, state and local disaster assistance and hazard mitigation funds that may become available following a flood event;
- long-term capital improvement plans should be prepared and include provisions to elevate above the floodplain essential buildings for public health, safety and welfare services;
- flood threat recognition and/or warning systems should be investigated for cost-effectiveness.

5.2.3 Avoidance of floodplain development and other non-structure flood mitigation measures shall be favored over levee and dike construction and other structural flood mitigation techniques. The use of dikes and levees should only be used for protection of developed urban areas, and should not be used to reclaim vacant floodplain lands for development.

5.3 Landslide Hazard Mitigation Measures

Exposure to landslide hazard is a function of site geology , type of construction, surrounding development and events that trigger landslides. The effect of landslides on public safety, welfare and recovery cost can

be minimized by measures that focus on mitigation. Land use policies and regulations are often the most effective measures for mitigating or minimizing exposure of lives and property to landslides.

5.3.1 Metro will encourage local governments to adopt landslide mitigation measures including:

- Logging regulations on steep slopes
- Landscape requirements
- Drainage controls
- Pre-development geotechnical studies

5.3.2 Metro will encourage local governments to limit development in the areas of greatest landslide hazard, except where development contributes to mitigation of the hazard. Such development should include appropriate safeguards and facilitate disaster response in the event it becomes necessary.

5.3.3 Metro will encourage local governments to investigate and take part in Federal Emergency Management Agency "mudslide" and "mudflow" insurance programs through the National Flood Insurance Program.

5.4 Volcanic Hazard Mitigation Measures

Mitigation of volcanic eruptive events is particularly relevant to development of the Clackamas River valley and Sandy River valley. Those areas are subject to periodic mudflows and pyroclastic flows from Mount Hood. Mudflow and flooding events are secondary to volcanism and should be addressed under the mudflow/mudslide and flooding policies.

5.4.1 Metro will collaborate with federal, state and local agencies to evaluate the regional risks of pyroclastic events, and encourage local governments to adopt appropriate hazard mitigation measures.

5.5 Wildland-Urban Interface Fire Mitigation Measures

The wildland-urban interface is defined as the area where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuel. In certain weather conditions, small fires in the interface areas can grow quickly to create extremely dangerous firestorms that are virtually impossible to control.

5.5.1 Metro will collaborate with federal, state and local agencies to evaluate the regional risks of wildland-urban interface fires, and encourage state and local governments to adopt appropriate hazard mitigation measures which may include:

- Collecting data related to fuel load and mapping vulnerable areas;
- Identifying areas of steep slopes with limited year-around water availability;
- Regulation of highly flammable material on structures, for example wooden roof shingles;

- Adequate roadway requirements to assure response by fire protection agencies;
- Adequate placement of fire suppression water hydrants;
- Landscaping regulation to improve fire resistance.

5.6 Severe Weather Hazard Mitigation Measures

Severe weather events may include windstorm, winter weather (snow, ice, prolonged cold), thunderstorms, tornadoes, drought, prolonged extreme heat and other weather events that disrupt vital regional systems.

5.6.1 Metro will collaborate with federal, state and local agencies to evaluate the regional risks of severe weather events, and encourage local governments and private organizations to adopt appropriate hazard mitigation measures which may include:

- Encouraging replanting with wind-resistant trees near power lines and other sensitive facilities.
- Incentives to retain larger stands of trees in newly developed areas, rather than preserve widely separated trees which are more vulnerable to wind fall.
- Incentives for drought-resistant landscaping.
- Improving public understanding of severe weather warnings and improving implementation of protective actions by governments, businesses and individuals.
- Encouraging vegetation management programs by utilities and local jurisdictions to reduce potential damages from the effects of severe weather events.

5.7 Biological Hazard Mitigation Measures

As development occurs around wetlands, greenbelts and open spaces, and as natural areas are set aside for environmental protection in previously developed areas, contact between humans and wildlife and insect populations is likely to increase. Death or injury to humans and loss of habitat for species can result from this contact.

5.7.1 Metro will collaborate with federal, state and local agencies to evaluate the regional risks of biological hazards, and encourage local governments to adopt appropriate hazard mitigation measures which may include:

- Support for existing insect and vector control programs to reduce the population of mosquitoes, flies, rats, etc., for disease prevention.
- Regulatory structure to create or preserve habitat for appropriate urban wildlife, while discouraging inappropriate urban wildlife such as large predators.

5.8 Other Hazard Mitigation Measures

Metro will collaborate with federal, state and local agencies to evaluate the regional risks of other natural hazards, and encourage local governments to adopt appropriate hazard mitigation measures.

5.9 Natural Disaster Response Coordination

Natural disasters such as a major earthquake will cause significant loss of life, injury and property damage. While vulnerability to hazards cannot be eliminated, implementation of the hazard mitigation policies described in this chapter will reduce human misery and property loss following a natural disaster. Metro has played an important role in assisting local emergency management agencies with disaster planning related to regional functions, such as disaster debris management and emergency transportation route designation.

5.9.1 Metro will provide leadership and support to the Regional Emergency Management Group (REMG) and encourage local governments to participate in the existing intergovernmental agreement and to provide the resources required to develop a regional disaster response plan.

5.9.2 Metro will collaborate with federal, state and local agencies, businesses and individuals to utilize the resources of Metro's Regional Land Information System and Natural Hazards Program data in developing a region-wide emergency management information system to improve disaster response coordination.

Relationship to Future Vision

In response to Section 5(1) of the Metro Charter, a Future Vision statement was created and adopted by the Metro Council in 1995. This document states the importance of safety and that:

> "…personal safety within communities and throughout the region is commonly expected as well as a shared responsibility involving citizens and all government agencies. Our definition of personal safety extends from the elimination of prejudice to the physical protection of life and property from criminal harm, *to mitigation and preparation for and response to natural disasters*." (Emphasis added.)

Metro's Growth Management Services department has played a pivotal role in initiating coordination of regional growth management and natural disaster planning responsibilities among local emergency management agencies in the region. This Chapter continues the department's efforts in mitigation and preparation for response to natural disasters by development of the Regional Hazard Mitigation Plan and policies 5.1 to 5.9 above.

Background

In the past decade, local, state and federal agencies have launched initiatives to improve our knowledge of natural hazards. Understanding natural hazards and the risks they create is the starting point for the long and costly process of improving the safety of communities in relation to natural disasters. Only recently has the concept of hazard mitigation become the cornerstone for developing strategies to reduce the billions of dollars spent on response and recovery operations following natural disasters. The general natural hazard information outlined in this plan will be described in greater detail in the Metro Regional Natural Hazards Mitigation Plan currently being developed in coordination with local governments in the region, the State of Oregon and private sector organizations. That plan will describe hazard-specific risk reduction

strategies. It is not intended to include functional plan requirements for changes in city and county comprehensive plans.

National Mitigation Planning

The Federal Emergency Management Agency (FEMA) coordinates all federal resources in support of state and local government activities in all phases of the emergency management process: emergency preparedness, mitigation, response and recovery. Congress stated its intention in the Robert T. Stafford Disaster Relief and Emergency Assistance Act to "...provide an orderly and continuing means of assistance...to local governments in carrying out their responsibilities by...encouraging hazard mitigation measures to reduce losses from disasters, including development of land use and construction regulations."

FEMA has recently adopted a national strategy to carry out the intent of Congress to reduce the cost of natural hazards through hazard mitigation programs. FEMA administers a post-disaster hazard mitigation grant program that is currently the only source of funds for encouraging state and local adoption of hazard mitigation measures. Pending federal legislation is intended to provide FEMA additional funding to encourage states to create pre-disaster mitigation programs.

State Mitigation Planning

Several state agencies are responsible for a variety of natural hazard management programs which address mitigation planning and response and recovery strategies. For example, the Oregon Department of Geology and Mineral Industries is responsible for assessing and characterizing geologic hazard and identifying earthquake mitigation measures in the state. The Office of Emergency Management, a division of the Oregon State Police, is responsible for the state's emergency management program, including the all-hazard mitigation planning process. Other state agencies also share hazard mitigation responsibility for various functions including, but not limited to, the state Department of Environmental Quality, the Oregon Department of Transportation, the state Fire Marshal, the state Health Division of the Human Resources Department and the state Department of Water Resources.

State land use planning goals were adopted in 1969 by the Oregon Legislature requiring counties and cities to prepare comprehensive land use plans. In 1973, Senate Bill 100 established the Land Conservation and Development Commission to monitor compliance of local plans with state goals which, through passage of the bill, were rewritten to link concerns about urban sprawl with environmental protection measures. Goal 7, Areas Subject to Natural Disaster and Hazards, establishes the goal that developments shall not be planned or located in areas of natural disasters and hazards without appropriate safeguards. Goal 7 defines "Areas of Natural Disaster and Hazards" as "areas that are subject to natural events that are known to result in death or endanger the works of man..."

This Regional Framework Plan, as well as local plans, must comply with applicable state land use planning goals. This chapter and Title 3 of the Urban Growth Management Functional Plan (See Appendices) address aspects of statewide Goal 7.

Regional Mitigation Planning

The 1992 Metro Charter was adopted by a popular vote of the citizens of the region. It authorizes Metro to focus on guiding the region in how and where it will grow. The Charter, Section 6(3), also authorizes Metro to exercise authority related to the "Metropolitan aspects of natural disaster planning and response coordination" function. The Charter did not include natural disaster planning as one of the required components of the Regional Framework Plan. However, the Metro Council directed in Resolution No. 96-2378 that natural disaster planning should become a part of the plan as recommended by the Metro Policy Advisory Committee.

The Metro Data Resource Center (DRC) has collected and maintained demographic and geographic information, including databases for emergency 9-1-1 purposes and flood hazard data that can assist in the mitigation process. The information is an essential component of the urban growth process. Through its centralized database server, the Regional Land Information System (RLIS) can spatially depict land use records, zoning, urban development patterns and natural resource information. RLIS has become a tool for planning programs, including natural hazards mitigation.

Since 1992, the Oregon Department of Geology and Mineral Industries (DOGAMI) and Metro have produced earthquake hazard maps showing areas of the region where geologic conditions are more likely to contribute to damage in an earthquake. As part of the project, the City of Portland, Portland State University and Metro have evaluated buildings for seismic risk, and identified vital systems and key facilities. With hazards and risks identified, Metro's geographic information system can be used to assess the region's vulnerability to earthquake hazards. As the seismic hazard maps produced by DOGAMI and Metro became available, a gathering of emergency management professionals from throughout the region began informal review sessions. More recently, the membership of the once "informal" gathering (including Metro), signed an intergovernmental agreement to form the Regional Emergency Management Group to develop a work plan for emergency management planning activities related to regional disaster issues.

As Metro worked to develop plans for how the region will grow, it became obvious that the region's ability to mitigate and respond to natural hazards needed to be considered. In response to this need, Metro's natural hazards mitigation program was created. The program provides regional coordination, outreach, data management services and technical assistance in developing regional strategies for mitigating natural hazards and preparing communities and residents for disasters.

Metro's Natural Hazards Program has collaborated with Metro's Regional Environmental Management Department and local and state emergency management agencies to develop a Regional Disaster Debris Management Plan. Metro's Natural Hazards Program has also collaborated with local and state transportation and emergency management agencies to produce a Regional Emergency Transportation Route Report.

Currently, a Regional Natural Hazards Mitigation Plan is being developed. The Natural Hazards Technical Advisory Committee created by the Metro Council will play an oversight role in the development of the plan.

Local Mitigation Planning

Local governments are required, in city and county comprehensive plans, to respond to state land use planning goals and, specifically, to develop and inventory known hazards.

Metro also conducted a survey of local governments in an attempt to identify policies, ordinances and administrative rules or codes for mitigating natural hazards. The results of the survey shed light on the status of the region's mitigation efforts. In addition, the Metro Council approved the formation of a Natural Hazards Technical Advisory Committee to consider measures that local governments, businesses and residents can take to reduce damage from natural disasters.

As a result of the February 1996 flood many local governments in the region have initiated or completed flood and landslide hazard mitigation plans. State and local government agencies and private organizations have also undertaken a range of hazard mitigation planning initiatives related to improving the seismic performance of infrastructure and buildings.

The 1996 flood demonstrated that natural disasters do not respect jurisdictional boundaries. The regional impact of a major disaster argues for the coordination of hazard mitigation, disaster response and recovery planning with Clark County, Washington, as well as the Portland metropolitan counties in Oregon. Regional planning issues in relation to Clark County are addressed in chapter six of this plan.

Analysis

Natural hazard issues create implications for the regional planning process and the regional urban form in the 2040 Growth Concept and the form of the regional and town centers. Over time, implementing natural hazards planning measures can reduce the disaster vulnerability of the people of the region and the structures they build.

There are generally two categories of natural hazard mitigation measures related to land use planning: (1) hazard mitigation measures that may be applied to *undeveloped* areas; and (2) hazard mitigation measures that may be applied to *developed areas*.

Local governments, businesses and individuals must also plan to respond appropriately to the damage created by natural hazard events because no hazard mitigation program can totally eliminate societal vulnerability to natural disaster.

Following are categories of metropolitan features that could be affected by natural disasters.

Housing

Regional objectives for housing related to specific goals for low-income and median-income housing can be thwarted by a disaster if the desired housing is located on less expensive land that may include hazardous ground, or if the housing is not sufficiently engineered to survive an event. Natural hazard considerations can encourage the location of different housing types on different hazard zones.

For example, concentrations of lower income housing at greater risk from natural hazards can create significant housing shortages after a natural disaster. A regional policy of more evenly distributing low and median-income housing throughout the region may improve the performance of the housing stock in a natural hazard event by distributing the population across a variety of soil and slope conditions.

Public Services and Facilities

Natural hazards considerations will play a key role in the development and redevelopment of public services and facilities. Public safety structures, schools and other key facilities must be built to standards that provide some assurance that they will survive a natural hazard event and be available to provide service when most needed. Natural hazard events can cause expensive and prolonged disruption of a community's vital systems (e.g., water, sewer, telecommunications and other utility services). Identification of system segments that cross hazardous ground can offer opportunities to engineer system components to respond better in an event, or relocate an especially fragile component to safer ground.

Transportation

Transportation infrastructure can be severely disrupted by natural events, hampering response and delaying recovery. Priority routes for response and recovery resource movement can be identified. Intermodal transfer points can be especially important after a natural hazards event. Engineering strategies to improve transportation infrastructure performance can be developed. Alternative routes can be designated to improve resource movement in the event of failure to a priority route. Natural hazards considerations can be incorporated in the public involvement process to establish transportation funding priorities.

Economic Opportunity

Natural hazard events can severely disrupt the local, regional and state economy. For example, hard hit areas may lose many stores, requiring neighborhood residents to travel to distant stores, thereby placing additional burdens on transportation systems in the disaster recovery phase.

To the extent that long-term economic development plans describe the types of industrial and commercial development appropriate to designated areas, consideration of the relationship of development to the location of natural hazards should be incorporated.

Urban/Rural Transition

Natural hazards can play a role in defining the most effective Urban Growth Boundary (UGB) to provide a clear transition between urban and rural land. Located along natural and built features (e.g., roads, rivers, floodplains or other major topographic features), the UGB may help define the types of natural hazards to be mitigated in the land use and emergency planning process.

Developed Urban Land

One key objective of growth management is to encourage the development and redevelopment of existing urban land. Development in areas known or newly discovered to be susceptible to natural hazards is especially appropriate for carefully planned redevelopment which reduces the vulnerability of the people who live in the area. In coordination with land use, economic development, redevelopment and financing agencies, a combination of regulations and incentives may be employed to encourage people to continue to live, work and shop in already developed areas that are susceptible to natural hazards.

For example, unreinforced masonry buildings (URMs) can pose significant earthquake risks to inhabitants and passersby. Neighborhoods that contain many URMs may become candidates for targeted regulation and assistance, perhaps requiring life safety retrofit of URMs by a specified date, and developing the bonding authority to provide low-interest loans to building owners for that work.

Urban Design

Natural hazard considerations can assist in the design of settlement patterns, structures and landscapes to improve the feeling of personal safety in an urban setting.

Other Implications

The natural hazards management planning process also has close ties to watershed management and water quality and supply measures. Natural hazards considerations may also create multi-objective watershed management opportunities and encourage reliance on natural processes to address flood control, storm water management and abnormally high winter and low summer stream flows.

Hazard factors can influence which natural areas may be identified for preservation. For example, land susceptible to flooding may be appropriate for fish and wildlife habitat, development into parks for periodically intensive or moderate human use, parking areas, or appropriate constructed environments. However, land that is susceptible to flooding which is also susceptible to strong seismic damage may be more appropriate for fish and wildlife habitat and human use open space, including parking areas, and less appropriate for constructed environments. Such multiple hazard factors should be taken into account when determining open space designations or any other designation based upon an evaluation of economic, social and environmental factors.

Although the potential for water quality degradation resulting from flood has been addressed in the Watershed Management and Regional Water Quality chapter of this plan, other growth management planning measures remain to be discussed in relation to:

Life protection;

Personal and public property loss reduction;

Business recovery policies.

Consideration of natural hazards as a major factor or constraint in all aspects of the regional planning process will produce realistic information that can be used in developing procedures and standards for achieving Metro's 2040 Growth Concept. This has direct implications on the development of comprehensive land-use plans by cities and counties, and in the development of comprehensive emergency management plans to address issues related to hazard mitigation, emergency preparedness, disaster response and recovery.