5.00 AREAS SUBJECT TO NATURAL HAZARDS INDEX

AREAS SUBJECT TO NATURAL HAZARDS

5.10 PURPOSE

The purpose of the Natural Hazard Element is to identify and map areas within the Boundary subject to natural hazards, and to describe appropriate safeguards.

5.20 GEOLOGIC, SLOPE AND SOILS HAZARD

PURPOSE
The purpose of this section is to define the geologic, slope and soil characteristics of the UGB area, identify the geologic, slope and soil related hazards in the UGB area, and describe appropriate safeguards from hazardous areas.

CHARACTERISTICS

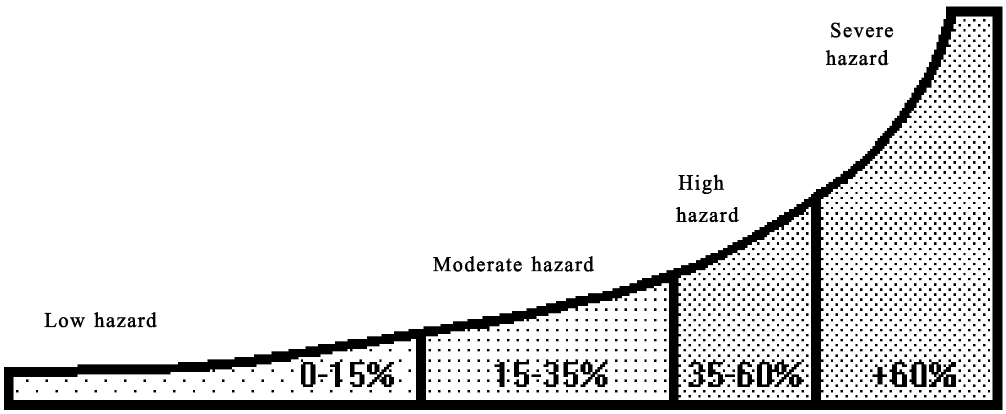
Geology - The geology and mineral resources of southwestern Oregon have been studied since the late 1800's. The most recent and up-to-date source of geologic information is contained within a 1979 publication by the Oregon Department of Geology and Mineral Industries, entitled Geology and Mineral Resources of Josephine County, Oregon. Although geologic information specific to the Grants Pass Urban Growth Boundary area is limited, it is known that two geologic formations characterized the Grants Pass area. The overlying formation is the recent Quaternary Sediment which is made up of stream deposited sand, silt and gravel. The underlying formation is the Grants Pass Pluton which is composed of Quartz Diorite and related rock. Several extensive north-to-northeast longitudinal faults with vertical dips occur in Josephine County. These faults lie parallel to the major axis of folding and fit the regional tectonic pattern for the Klamath Mountains. The pattern of displacement is not clear or uniform along these faults, although most appear to have some vertical displacement. There is only one major high-angle longitudinal fault within the UGB area. That fault occurs along the contact of the Applegate formation and the Grants Pass Pluton.

Slopes - Earthflow is a natural geologic and geomorphic process. This process can be, and often is, greatly accelerated by human activity. The natural forces that hold a hillside in place are altered through the construction of roads and buildings which increase the bearing load of the hillside and through excavations which remove support from below. The removal of natural vegetation from a site results in increased soil saturation and decreases slope stability. That can result in supersaturation of the soil and consequent earthflows. The extensive root system of natural vegetation found in steeply sloped areas reduces soil erosion by holding soil in place within the root network. The removal of vegetation without other immediate mitigation measures causes the soil to succumb to the forces of gravity which it cannot resist without the aid of viable roots.

Steepness of slope is the single greatest contributing factor to earthflow, whether it be slope erosion or mass movement. Slopes over thirty-five percent generally have high to extreme susceptibility to mass movement. Moderate susceptibility for mass movement exists between fifteen to thirty-five percent, although areas of unusually wet or unstable soil can increase the landslide potential.

Alteration of the load bearing capabilities through excavation and construction, or increasing water saturation through the removal of natural vegetation may upset the stability of slopes over thirty-five percent, resulting in slope erosion. There is also a potential for slope erosion on slopes ranging from fifteen to thirty-five percent when the soil, slope and vegetation balance is upset the actions of man. Relatively low potential for slope erosion exists for slopes less than fifteen percent. The potential for slope erosion, as used here, is relative to the percent of the slope. Obviously, erosion can occur on any slope and even on "flat" ground.

EXHIBIT 5.20.1
Slope Steepness



The percentage of slope is found by dividing the vertical rise by the horizontal run of a specific area of the slope.

Soils - Soils are made up of decomposed rock and organic material. The sources of the decomposed rock are the geologic formations found in the Rogue River drainage basin. Chemicals, wind, water, plant roots and gravity all act on the rocks to break them down into three general soil particle sizes: sand, silt and clay. The soil particles bind up with organic material derived from decomposed plant matter to form a cohesive veneer of porous material overlying the rock formations. Soils have pore spaces that are filled either with water or air depending on the season, level of the water table and depth of soil. These pore spaces are vital for the formation of the soil structure which affects soil stability, water-holding capacity and root penetration.

The combinations of soil particles, organic materials and soil structure can vary greatly from geographic area to geographic area due to the diversity of weathering forces, topography, climate and vegetation.

INVENTORY

Geologic Hazard Areas

A large number of high-angle cross faults tending northwest to west have been mapped since 1940. Many such faults occur north and west of Grants Pass and are either approximately located or concealed. Only two faults are known to be located within the Grants Pass UGB area. One fault is concealed, running north/south and adjacent to McLearn Drive. The other fault is located in the upper Grants Pass area, east of Interstate 5 in the vicinity of Terrace Drive. Both faults are high-angle faults and no recent movement has been detected along these or other faults in Josephine County. No earthquake epicenters or seismic activity have been recorded.

Slope Hazard Areas

The slope hazard map depicts the land areas of the Grants Pass Urban Growth Boundary Area with the slopes greater than 15%. (Map 5.20.2) Generally these slopes are located along the edges of the UGB in the Northwest, Northeast and Harbeck-Fruitdale subareas. Few steeply sloped areas within the UGB are developed because the potential hazards of steep slopes cause building designs to be more complex and expensive, and the cost of extending services such as streets, sewer and water is correspondingly high.

The Salem Homebuilders Association estimated the additional expense for building a home "in the hills." Their findings are presented in Table 5.20.3

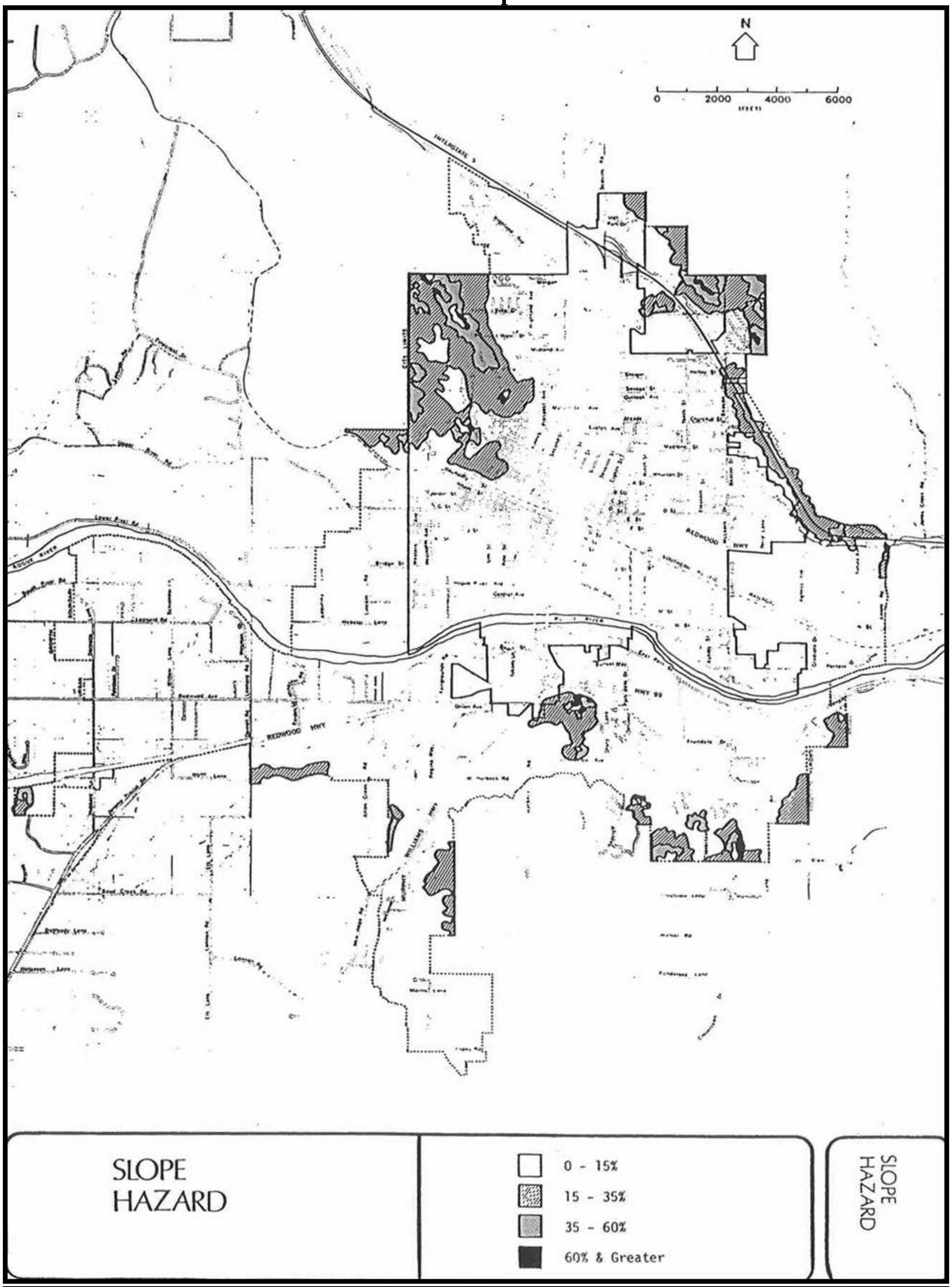
TABLE 5.20.3
Effect of Slope on Housing Cost

Slope	Added Cost
0 - 5%	0
6 - 8%	10 - 12%
8 - 12%	50%
12 - 15%	50 - 75%
18+ %	100%

Source: Salem Home Builders Association, 1976

Although these figures represent a general guideline, it would appear that only certain housing types and development styles are adaptable to steep topographic conditions. Generally, allowing the transfer of density to or the clustering of allowable units on a bench, or on a more gently sloping portion of the lot, can increase the cost effectiveness of a development project.

MAP 5.20.2
Grants Pass Slope Hazards



Soil Hazard Areas
Within the Grants Pass urbanizing area there are approximately forty-one different soil types or soil mapping units. The suitability of different soils for urban uses is determined by the combination of several factors including steepness of slope, underlying geologic formation, hydrologic characteristics, and particle size. Table 5.2.4 depicts the constraints and limitations of each of the soil mapping units found within the Grants Pass UGB area.

A slight soil limitation is the rating given to soils that have the properties favorable for the rated use. This degree of limitation is easily overcome and good performance and low maintenance can be expected.

A moderate soil limitation can be overcome or modified by special planning, design or maintenance. During some part of the year, the performance of the structure or other planned use is somewhat less desirable than for soils rated slight. Moderate soil limitations have soil properties only moderately favorable for the rated use.

A severe soil limitation has one or more soil properties that are unfavorable for the rated use. This degree of limitation generally requires major soil reclamation, special design or intensive maintenance.

The soil erosion factor is a measure of the susceptibility of soil particles to detachment and transport by rainfall and runoff. There are several soil properties that affect soil erosion including soil texture, percent of sand, organic matter content, soil structure, permeability, clay mineralogy and rock fragments.

Soil properties that most affect the design and construction of roads are the land bearing capacity and stability of the subgrade. The shrink-swell potential is an indication of the traffic supporting capacity, and wetness or flooding affect the stability of the material. Slope, depth to hard rock or cemented layers, content and size of stone or rocks, and wetness affect the ease of excavation. As the rock content of a soil increases, then the amount of cut needed to make a fill for an excavation project decreases.

Buildings With and Without Basements. As reported in Table 5.20.4, this category applies to structures less than three stories high that are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil relate the capacity of a soil to support a load and resist settlement under a load, and those that relate to the ease of excavation.

Soil properties that relate to load bearing capacity are wetness, density, plasticity, texture and shrink-swell potential. Soil properties that affect excavations are wetness, slope, depth to bedrock and content of rock and stones. These factors alone or in combination may cause moderate to severe soil limitations that require special planning, design, construction techniques or maintenance to overcome.

TABLE 5.2.4
Soil Types - Constraints and Limitations

Soil Name	Shrink-Swell Potential	Erosion Factor	Road Con-struction	Buildings Without Basements		Buildings With Basements		Corrosivity	
				Rating	Limitation	Rating	Limitation	Steel	Concrete
Newberg Fine Sandy Loam	low	mod	severe	severe	floods	severe	floods	low	mod
Wapato Silt Loam	low	mod	severe	severe	floods wetness	severe	floods wetness	high	mod
Evans Loam	low	mod	severe		floods	severe	floods	low	high
Central Point Sandy Loam	low	low	slight	slight	-	mod	wetness	low	mod
Takilma Cobbly Loam	low	low	mod	mod	large stones	mod	large stones	mod	low
Takilma Variant Extremely Cobbly Loam	low	low	severe	severe	large stones	severe	large stones	mod	low
Selmac Loam 2 - 7% Slopes	low	mod	severe	severe	shrink-swell	severe	wetness shrink-swell	high	mod
Camas Gravelly Sandy Loam	low	low	severe	severe	floods	severe	floods	mod	mod
Abegg Gravelly Loam 2 - 7% Slopes	low	low	slight	slight	-	slight	-	mod	mod
Abegg Gravelly Loam 12 - 20% Slopes	low	low	severe	severe	slope	severe	slope	mod	mod
Kerby Loam	low	mod	slight	slight	-	slight	-	low	mod
Copsey Clay 3-7% Slopes	high	low	severe	severe	floods, wetness shrink-swell	severe	floods, wetness shrink-swell	high	low

Soil Name	Shrink-Swell Potential	Erosion Factor	Road Construction	Buildings Without Basements		Buildings With Basements		Corrosivity	
				Rating	Limitation	Rating	Limitation	Steel	Concrete
Holland Sandy Loam, Cool 2 - 7% Slopes	mod	high	mod	mod	shrink-swell	slight	-	mod	mod
Holland Sandy Loam, Cool 7 - 12% Slopes	mod	high	mod	mod	shrink-swell, slope	mod	slope	mod	mod
Holland Sandy Loam, Cool, 12 -20% Slopes	mod	high	severe	severe	slope	severe	slope	mod	mod
Holland Sandy Loam, Cool, 20 - 35% Slopes	mod	high	severe	severe	slope	severe	slope	mod	mod
Clawson Sandy Loam 2 - 7% Slopes	low	mod	mod	severe	wetness	severe	wetness	mod	mod
Barren Coarse Sandy Loam 2 - 7 % Slopes	low	mod	slight	slight	-	slight	-	low	mod
Jerome Sandy Loam	low	mod	severe	severe	wetness	severe	wetness, shrink-swell	high	mod
Brockman Cobbly Clay Loam 2 - 7 % Slopes	mod	mod	severe	severe	shrink-swell	severe	wetness, shrink-swell	high	low
Brockman Cobbly Clay Loam 7 - 20% Slopes	mod	mod	severe	severe	shrink-swell	severe	wetness, shrink-swell	high	low
Brockman Cobbly Loam 7 - 12% Slopes	mod	mod	severe	severe	shrink-swell	severe	wetness, shrink-swell	high	low
Cove Silty Clay Loam	mod	mod	severe	severe	floods, wetness, shrink-swell	severe	floods, wetness, shrink-swell	high	mod

Soil Name	Shrink-Swell Potential	Erosion Factor	Road Construction	Buildings Without Basements		Buildings With Basements		Corrosivity	
				Rating	Limitation	Rating	Limitation	Steel	Concrete
Ruch Gravelly Silt Loam 2 - 7% Slopes	low	mod	mod	mod	shrink-swell	mod	shrink-swell	mod	mod
Banning Loam	low	mod	severe	severe	wetness	severe	wetness	high	low
Siskiyou Gravelly Sandy Loam 20 -35% Slopes	low	low	severe	severe	slope	severe	slope	mod	mod
Siskiyou Gravelly Sandy Loam 35-60% South Slopes	low	low	severe	severe	slope	severe	slope	mod	mod
Siskiyou Gravelly Sandy Loam 35 - 70% North Slopes	low	low	severe	severe	slope	severe	slope	mod	mod
Debenger Loam 7-12% Slopes	low	mod	mod	mod	slope	mod	slope, depth to rock	mod	mod
Debenger Loam 12 - 25% Slopes	low	mod	severe	severe	slope	severe	slope	mod	mod
Camas - Newberg Complex	low	mod	severe	severe	floods	severe	slope	mod	mod
Vannoy Silt Loam 20 - 35% Slopes	low	mod	severe	severe	slope	severe	slope	mod	mod
Vannoy Silt Loam 35 - 55% North Slopes	low	mod	severe	severe	slope	severe	slope	mod	mod
Vannoy-Voorhies Complex 25 - 35% South Slopes	low	low-mod	severe	severe	slope	severe	slope	mod	low-mod
Witzel Rock Outcrop Complex 30 - 75% Slopes	low	low	severe	severe	slope depth to rocks, large stones	severe	slope depth to rocks, large stones	mod	mod
Manita Loam 2 - 7% Slopes	low	mod	severe	severe	shrink-swell	severe	shrink-swell	high	mod

Soil Name	Shrink-Swell Potential	Erosion Factor	Road Construction	Buildings Without Basements		Buildings With Basements		Corrosivity	
				Rating	Limitation	Rating	Limitation	Steel	Concrete
Manita Loam 7-12% Slopes	low	mod	severe	severe	shrink-swell	severe	shrink-swell	high	mod
Manita Loam 20 - 35% Slopes	low	mod	severe	severe	shrink-swell, slope	severe	shrink-swell, slope	high	mod
Manita Loam 35 - 50% Slopes	low	mod	severe	severe	shrink-swell, slope	severe	shrink-swell, slope	high	mod
Manita Loam 5 - 50% South Slopes	low	mod	severe	severe	shrink-swell, slope	severe	shrink-swell, slope, depth to rocks	high	mod
Bestman-Colestine Comlpex 50 - 80% North Slopes	low	low	severe	severe	slope	severe	slope	low	low

Shrink-Swell Potential - The shrink-swell potential of a soil may be defined as the relative change in volume with changes in moisture content. In other words, the extent to which a soil shrinks as it dries out or swells when it gets wet. The extent of shrink-swell is influenced by the quantity of clay in the soil. This potential often increases with depth, such that the shrink-swell potential may be low on the surface and at a depth of twelve inches, but high at a depth of sixty inches. This accounts for the low ratings for shrink-swell on the surface and severe limitations for building foundations.

MAP 5.2.5
Shrink-Swell Hazard Areas

SAFEGUARDS FROM HAZARD AREAS

Geologic Hazard Areas

Since there is no recent record of any geologic activity in the region, it is reasonable to assume that development may proceed without implementing safeguards such as earthquake design or avoidance of location on fault lines.

Slope Hazard Areas

The most effective method for the city and county to minimize the hazards of development on steep slopes is to review the development process. Slopes in the excess of 35% should be considered hazardous areas. Development that is proposed on slopes greater than 35% should be required to have development plans approved by a licensed engineering geologist in order to ensure that soil erosion and earth movement hazards will be minimized. A review of hillside developments on slopes 15% to 35% should be made by an engineer and a soil scientist in order to minimize the hazards to the structure and to reduce the potential for erosion. Supplemental engineering and site design may be required to lessen the degree of risk.

Soil Hazard Areas

In the preceding subsection, the various soils within the UGB area are inventoried according to a set to characteristics that relate the properties of each soil to specific hazards.

Safeguards for each hazard are primarily related to regulations that protect the stability of the soil and the major hazard for most soils. Once significant soil erosion begins in an area, drastic and costly "stop-gap" measures must be implemented to arrest the rate of erosion. Preventive measures for soil stability on erodible soils is often the best approach. Such preventive measures are:

- traps to keep top soil on the site
- leaving natural vegetation in place
- reducing surface water run-off with vegetative planting and keeping natural water retention areas.

Shrink-swell and road building hazards can be safe-guarded with adequate design and site preparation. An important task is to ensure that builders and developers are made aware of the soil properties of the site or area before planning and construction begin. The soil mapping and inventory of this section should serve as adequate generalized information regarding the hazards of soils within the UGB area. Site specific analysis of the soils should be encouraged in sensitive areas where soils are exposed to weathering and/or where slopes are steeper than 35% percent.

The relationship between steep topography, soils and natural vegetation becomes increasingly delicate as the percentage of slope increases. This delicate balance is strongly affected by human actions in developing or preparing sites for development. Extensive excavations for cut and fills, premature removal of natural vegetation and the additional load placed on a hillside by development can lead to earth movement in the form of slope erosion or mass movement.

5.30 FLOOD HAZARD

PURPOSE

The purpose of this section is to describe the history of flooding in the urban growth boundary area, identify the flood-prone areas, evaluate the degree of hazard, and describe the appropriate safeguards from flooding.

HISTORY OF FLOODING

The earliest recorded flood in Josephine County occurred in 1861. Since no subsequent flood has surpassed the magnitude of that flood, it has been chosen to represent the "100 year flood." (Army Corps of Engineers) Flood magnitudes are rated by their chance of annual occurrence. A "100 year flood" is assumed to have a 1% chance of occurring each year. A "1 year flood" is assumed to have a 100% chance of occurring each year. These are mathematical relationships that ignore the natural variables which affect the weather. Table 5.30.1 depicts the major floods of the Rogue River at Grants Pass during the last 120 years.

TABLE 5.3.1
Major Floods of the Rogue River at Grants Pass

Flood Year	Water Discharge in Cubic Feet Per Second (cfs)
Nov. - Dec., 1861	175,000 cfs (“100 year”)
Feb., 1890	160,000 cfs
Feb., 1907	60,500 cfs
Nov., 1909	70,000 cfs
Feb., 1927	138,000 cfs
Dec., 1942	54,400 cfs
Dec., 1945	70,000 cfs
Jan., 1948	59,900 cfs
Oct., 1950	65,400 cfs
Jan., 1953	77,000 cfs
Dec., 1955	135,000 cfs
Dec., 1964	152,000 cfs (“50 year”)
Dec., 1972	82,500 cfs
Dec., 1974	96,400 cfs

The table reveals that there is little mathematical order to the occurrence of floods. Floods of similar magnitude can occur within a few years of each other, such as the February 1907 and November 1909 floods and the October 1950 and January 1953 floods. Floods of relatively great magnitude can occur within a decade of each other, such as the December 1955 and December 1964 floods. The long range forecasting of flood occurrences would seem able to predict only that floods will occur at random intervals and at varying magnitudes.

FLOODPRONE AREAS

The Rogue River flows through the approximate center of the Urban Growth Boundary area. There are five confluent creeks that discharge into the Rogue River within the UGB. Map 5.30.3 shows the UGB and the floodprone areas (shaded). The actual areas of special flood hazard are identified by the Federal Emergency Management Agency in a scientific and engineering report titled “Flood Insurance Study” with the accompanying Flood Insurance Rate Maps for Josephine County and Incorporated areas effective date December 3, 2009, and any revision. These areas were subject to flooding during the 1964 flood. Note that flood levels protruded into the channels of Gilbert and Allen Creeks. This phenomenon occurs because the flood level of the river is at a high elevation and the flood waters of the creeks are effectively "dammed" by river water. Water always seeks mean sea level and, therefore, is always flowing to the ocean. When the creeks are dammed by the river, then they overflow their banks upstream and water flows in sheets over the surface of the land in its relentless search for sea level. Therefore, the confluent creeks of the UGB area are also prone to a flood hazard relative to the magnitude of the river flooding.

DEGREE OF FLOOD HAZARD

The degree of flood hazard is measured in terms of loss of life and property. No deaths from flooding in the Grants Pass area are noted in the literature. Flood warnings usually occur in time to prevent loss of life, as people are able to move out of the floodprone areas. However, real property and improvements such as buildings are subject to the forces of flooding water. A quote from the Postflood Report, December 1964 Flood (Army Corps of Engineers) can dramatically relate the damages to property by flooding.

"One of the major factors causing excessive damages during this flood was the enormous quantity of debris brought into the channel from every source. This debris collected behind bridges resulting in the complete destruction of several, and major damage to nearly ever other bridge across the main stream. It also contributed to residential damage all along the river, knocking buildings from their foundations or smashing into walls."

Within the UGB area, residential areas on both sides of the river were flooded up to 8 feet. (Postflood Report, 1964. Army Corps of Engineers). The city sewage treatment plant sustained damages estimated at about $65,000. The Postflood Report did not summarize the value of residential damage but did state the values of the home flooded to be between $30,000 and $50,000 per home and estimated the average residential damage to be $900 per residence. Exhibit 5.30.2 shows an aerial view of the flooding of 1964.

EXHIBIT 5.30.2
Aerial View of 1964 Flood

SAFEGUARDS FROM FLOODING

Safeguards from flooding that can be implemented at the local level are warning systems, land use regulations and the Federal Flood Insurance Program.

Warning Systems

The Army Corps of Engineers operates a computer simulation model for the hydrological characteristics of all the significant water drainage basins in Oregon. That simulation model can predict fairly accurately when a flooding river system will "crest", or reach its highest flooding elevation, and what the elevation will be at the "crest." That information is provided to all radio stations and local emergency units like the police and national guard. If elevations of floodprone areas are known by recognized landmarks, then people and mobile property can be removed from the anticipated flooding area. An emergency evacuation program that employs local police, fire department and other civic groups can help facilitate the relocation of persons and property from a floodprone area.

Land Use Regulations

The City and/or County can regulate the use of land within known floodprone areas. The regulations can range from allowing no development in floodprone areas to allowing any type of development in conjunction with federal floodplain laws. The regulations can also selectively designate floodprone areas as public open space for parks, wildlife areas and floodways. Public open spaces would allow active public use of the land and enhance the attractiveness and livability of the Urban Growth Boundary Area, while reducing future potential losses of life and property from flooding.

Land use regulations can also be used to set aside land areas for the detention of storm water. Those lands, such as wetlands, grassed waterways, and woodlands, may reduce flood elevations of the frequent small floods, and prevent future increases in flood heights of these frequent floods.

Flood heights have the potential for increase in proportion to the increases in urban level development in the Boundary area. Urban development increases the amount of storm water runoff by increasing the area of impervious surfaces such as streets, driveways, parking lots, and rooftops. If the natural storm water detention areas of the UGB area are converted to impervious surfaces by urban development, then the storm water runoff will flow more rapidly over the surface, into stormdrains and on to the creeks and the river, thereby increasing the elevation of the flood and/or decreasing the elapsed time between the beginning of the flood and the flood "crest".

Land use regulations can provide equitable transfers of land use intensities for each land use type from the floodprone areas and storm water detention areas to other less sensitive areas.

For example, a proposed residential development in an area with potential for storm water detention may be encouraged to preserve the detention area through incentives encouraging the transfer of density. The potential number of dwelling units that can be built on the detention area may be transferred to the remaining buildable area of the land that has less potential for detention. In this way, the developer retains the revenue potential of the development, and may even reduce the costs of development by clustering. The community retains an open space and a storm water detention area, reducing the hazard of flood, and reducing the size and cost of storm drain lines.

Federal Flood Insurance Program

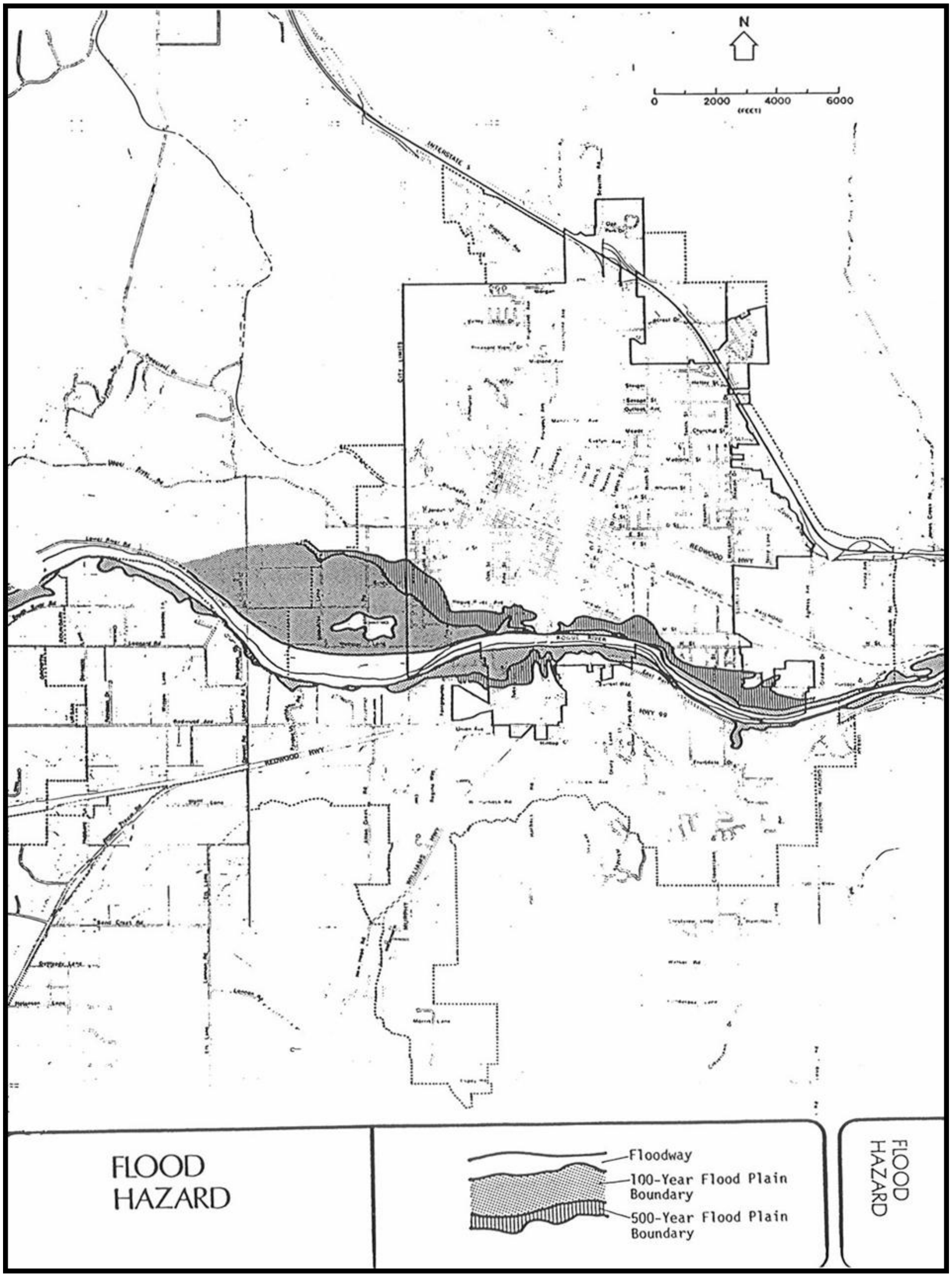
The catastrophic nature of flooding and the relatively localized effect of intermittent floods caused the insurance industry to find it financially unfeasible to provide flood insurance at reasonable rates. Increasingly, the federal government was requested to act to protect and safeguard private property. Legislation was passed in 1956, but money was never appropriated to implement the program. Further studies resulted in Title XIII, National Flood Insurance, part of the Housing and Urban Development Act of 1968 (Public Law 90-448) and the Flood Disaster Protection Act of 1973. Together these acts created an enormous federal subsidy in an effort to provide reasonable flood insurance at affordable rates. In effect, the federal government underwrites private insurance companies and subsidizes insurance premiums by paying the difference between the "affordable" premium which is charged to the policyholder, and the actuarial or "true cost" premium. The actuarial premium would be the rate charged to the policy holder if the insurance policy were written based on the statistical likelihood of flooding combined with the potential losses resulting from flood damage. In exchange for the reduced rate, property owners, through state and local governments, agree to adopt appropriate land use control measures to bring the risk of public and private losses to acceptable levels.

In 1979, work was completed on the Flood Insurance Study for the City of Grants Pass. A similar study was completed for Josephine County in 1980. Initial use of this information will be to convert Grants Pass and Josephine County to the regular flood insurance program of the Federal Insurance Administration. Streams in the area requiring detailed study were identified at informal meetings held in January 1978, between the U.S. Geological survey, the Federal Insurance Administration and the City of Grants Pass. The Rogue River and Gilbert Creek were studied by detailed methods. Although the Gilbert Creek flood plain is quite small, the density and intensity of streamside development justified establishing the flood zones by detailed methods. Most recently, the Federal Emergency Management Agency completed a new Flood Insurance Study for Josephine County and Incorporated Areas dated December 3, 2009.

A primary purpose of the National Flood Insurance Program is to encourage state and local governments to adopt and enforce land use practices within flood prone areas to the degree necessary to reduce the risk to acceptable levels as set forth in the program. Each Flood Insurance Study therefore includes a map which delineates the extent and location of areas subject to periodic inundation and differentiates between the floodway and 100-year and the 500-year flood boundaries. In order to provide a national standard without regional discrepancies, the 100-year flood has been adopted by the Federal Insurance Administration as the base flood for flood management and insurance purposes. The 500-year flood is indicated simply to make communities aware of additional areas in the community with perceivable levels of flood risk. Map 5.30.3 illustrates the approximate location of the floodway, the 100-year and 500-year flood boundaries. The actual areas of special flood hazard are identified by the Federal Emergency Management Agency in a scientific and engineering report titled “Flood Insurance Study” with the accompanying Flood Insurance Rate Maps for Josephine County and Incorporated areas effective date December 3, 2009, and any revision.

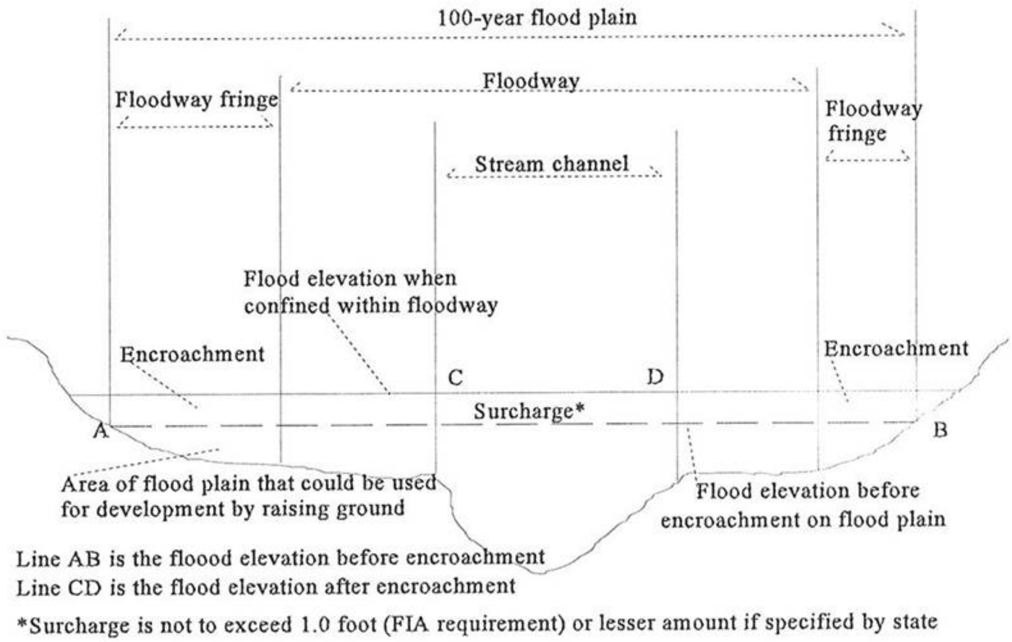
The principal result of the Flood Insurance Study is the Flood Insurance Rate Map. This map contains the official delineation of flood elevation lines. The level of flood risk and therefore insurance premiums are determined from this map.

MAP 5.30.3
Floodway and 100-Year Flood Plain for
Grants Pass Urban Growth Boundary



The National Flood Insurance Program divides the area of the 100-year flood into a floodway and floodway fringe. The floodway is the actual channel of a stream or river plus any adjacent flood plain areas that must be free of encroachment to allow the 100-year flood to flow freely without substantial increases in flood heights. Maximum federal standards establish a limit for flood height increases of one foot, provided that hazardous velocities are not produced. The area between the floodway and the boundary of the 100-year flood are termed the floodway fringe. Exhibit 5.30.4 depicts the relationship among the stream channel, floodway, floodway fringe and 100-year floodplain.

EXHIBIT 5.30.4
Floodway-Flood Plain Schematic



Insurance rates are based on the degree of flood risk. In order to establish actuarial insurance rates, the Federal Insurance Administration has developed a process to transform the data depicted in the floodway schematic drawing, into flood insurance criteria. That process includes the determination of flood hazard factors and flood insurance zone designations for each flooding river or creek.

The city has adopted a floodplain development ordinance that is in compliance with the National Flood Insurance Program. The city ordinance identifies buildable land within the 100-year floodplain as the floodway fringe. The floodway is not considered buildable. Development on the buildable land (floodway fringe) must be constructed so that the first floor level of the building is a minimum of one foot above the 100-year flood elevation. This regulation anticipates that once the floodway fringe is fully encroached upon by development, the actual flood elevation will be raised one foot above the 100-year flood level. Development in the floodway must demonstrate that encroachment will not raise the flood elevation beyond the one foot maximum above the 100-year flood elevation. The federal regulations require that a qualified surveyor determine the degree of displacement. The displacement of floodway water by the proposed floodway development may adversely affect other development on the adjacent floodway fringe, which usually precludes floodway development in an urban area.

5.25 GEOLOGIC, SLOPE AND SOILS HAZARD FINDINGS

1. There are three potential land hazards in the Grants Pass Urban Growth Boundary area; geologic, slopes and soils related.
2. There are two geologic formations in the Grants Pass UGB area. The overlying formation is composed of recent stream deposits of sand, silt and gravel. The underlying formation is a large mass of igneous material that is composed of quartz diorite. There are several major faults in Josephine County but only one within the UGB area: a north-south fault that is parallel to McLean Drive, and a north-south fault east of Interstate 5 in the vicinity of Terrace Drive. No recent movement of any faults has been detected in Josephine County. There are no earthquake epicenters. The region is geologically dormant.
3. The slopes in the UGB area range from 0% to greater than 60%.
4. There is a low potential for earthflows for slopes less than 15%. Moderate potential for earthflows exist between 15% to 35%, although areas of unusually wet or unstable soil can increase that potential. Slopes over 35% generally have a high to extreme potential for earthflows, especially when the integrity of the slope is disturbed by removal of vegetation, excavation and construction.
5. The slopes greater than 15% are identified on the Slope Hazards map. Generally, these slopes are located at the edge of the UGB in the Northwest, Northeast and Harbeck-Fruitdale subareas.
6. The most effective method for the city and county to minimize the hazards of development on steep slopes is to review the development process in these areas. Developments that are proposed on slopes between 15% and 35% should be reviewed by a soil scientist and an engineer in order to reduce the hazard potential. Developments that are proposed on slopes in excess of 35% should be required to have the development plans reviewed by a licensed engineering geologist in order to ensure that soil erosion and earth movement hazards are minimized.
7. Soils are composed of decomposed rock and organic material and are basically defined by the content of rock particles and organic matter, and structure. Soil types vary according to geographic area due to the diversity of weathering forces, topography, climate and vegetation. There are forty-one different soil types in the UGB area each with distinct characteristics which make them either more or less suitable for urban developments. Table 5.20.4 identifies the soils and their general characteristics related to urban development. These characteristics are erosion factor, road construction, buildings with or without basements, shrink-swell potential and corrosivity. The information in Table 5.20.4 is derived from the soil data of the U.S. Soils Conservation Service. The ratings for each soil should be considered general guidelines. Where necessary clarification is required, then a site specific soil analysis should be performed by a soil scientist.
8. The single most important potential soil hazard is erosion. Preventive measures for soil stability on erodible soils is often the best safeguard. Such preventive measures are:
   - traps to keep top soil on the site
   - leave natural vegetation in place

- reducing surface water run-off with vegetative planting and keeping natural water retention areas

9. Other important soils-related hazards such as shrink-swell and road construction can be mitigated by forewarning builders and developers early in the development process. Site specific analysis of soils should be encouraged in all developments with slopes in excess of 35%.

5.36 FLOOD HAZARD FINDINGS

1. The occurrence and magnitude of flooding the Grants Pass Urban Growth Boundary area is unpredictable. However, history reveals that flooding does occur at seemingly random times with varying degrees of magnitude. One can assume that flooding will occur in the future, and that the magnitude of the floods may be as great as any historical flood to date.
2. The floodprone areas within the UGB area are located along the Rogue River and the confluent creeks, especially Gilbert Creek. The flooding of the confluent creeks is relative to the magnitude of the river flooding.
3. The degree of flood hazard is measured in terms of loss of life and property. Apparently, no lives have been lost by flooding in the area, although property damages have been substantial. The 1964 flood caused $65,000 worth of damages to the city sewage treatment plant. After the 1974 flood, the Army Corps of Engineers estimated the average residential damage to be $900.00 per residence.
4. Safeguards from flooding that can be implemented at the local level are warning systems, land use regulations and a flood insurance program.
5. The warning system safeguard entails the use of the Army Corps of Engineers' flood simulation model for predicting peak flood elevations. Elevation landmarks should be established and made known so that the potential danger areas of the oncoming flood can be broadcast and evacuated.
6. Land use regulations can minimize the loss of life and property due to the flooding. Floodprone land that is designated as open space for parks, wildlife areas and floodways can enhance the livability of the community while reducing future potential losses of life and property from flooding. Land use regulations can also be used to set aside land areas for the detention of storm water. Storm water detention areas such as wetlands, grassed waterways and woodlands may reduce existing and future flooding conditions. Density transfer is a method to encourage the preservation of storm water detention areas without affecting the revenue potential of developments in such areas.
7. The National Flood Insurance Program is intended to encourage local government to adopt and enforce land use practices within floodprone areas to the degree necessary to reduce the risk to acceptable levels as set forth in the program. The City of Grants Pass has adopted a floodplain ordinance that adopts by reference the federal engineering report entitled "The Flood Insurance Study for the City of Grants Pass." That ordinance specifies that development in the floodplain may not raise the elevation of the 100-year flood by more than one foot, and, therefore, all new development must construct the level of the first livable floor at least one foot above the 100-year flood elevation.