4.00 ENVIRONMENTAL RESOURCES QUALITY ELEMENT INDEX

4.10 PURPOSE

4.20 CHARACTERISTICS AND QUALITY OF THE AIR, WATER AND LAND RESOURCES

- Air Resource
  - Characteristics
  - Climate and Airshed
  - Atmospheric Conditions
  - Topography

- Air Quality
  - Total Suspended Particulates (TSP)
  - Photo Chemical Oxidants
  - Carbon Monoxide
  - Hydrocarbons
  - Nitrogen Dioxide

- Noise
  - Characteristics
  - Quality

- Water Resource
  - Characteristics and Quality
  - Surface Water Runoff
  - Groundwater

- Land Resource
  - Characteristics
  - Quality

4.30 FUTURE QUALITY OF AIR, WATER AND LAND RESOURCES

- Future Air Quality
- Future Noise Quality
- Future Water Quality
- Future Land Quality

4.40 CARRYING CAPACITY OF THE ENVIRONMENT

4.50 FINDINGS

4.10 PURPOSE

The purpose of this section is to evaluate the characteristics and quality of the air (including noise), water and land environmental resources of the UGB area, determine the future quality of the environmental resources, and define the concept of "carrying capacity" as it is related to the environmental resources.

4.20 CHARACTERISTICS AND QUALITY OF THE AIR, WATER AND LAND RESOURCES

Air Resource

Characteristics - There are three factors that affect the quality of the air in the UGB area; climate and airshed, atmospheric conditions and topography.

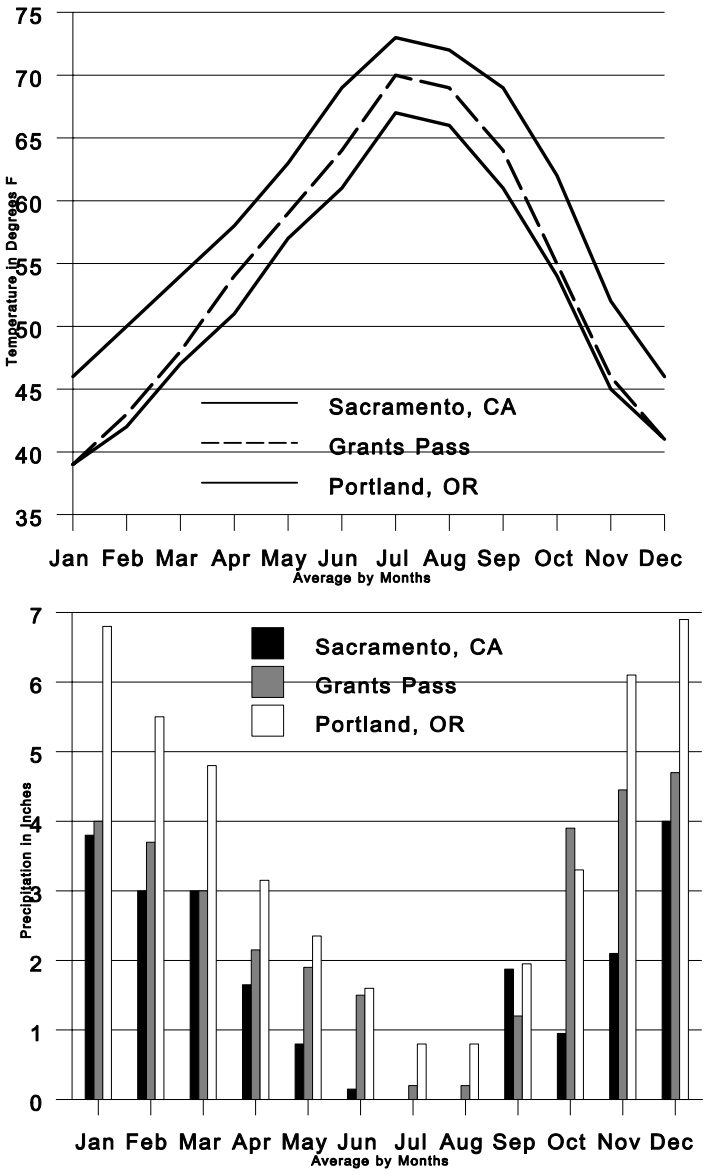
Climate and Airshed - The transitional climate of Grants Pass offers a pleasant blend of the Mediterranean climate of the south and the marine-mesothermal climate of the north. Figure 4.1 illustrates the average temperature and precipitation of the city and compares Grants Pass to Sacramento, a typical Mediterranean climate, and Portland, a typical marine-mesothermal climate.

The excellent year-round climate is marked by dramatic seasonal changes and average annual precipitation rates which equal approximately 30 inches. Freezing temperatures normally occur from mid October through mid May, with the lowest temperatures seldom dropping below 16 degrees. The maximum temperatures typically occur in July and often exceed 90 degrees. Temperatures greater than 100 degrees are not uncommon during July and August.

Precipitation, also illustrated in Figure 4.1, is concentrated during the winter months. Snowfall in the city is rare with an annual average of less than twelve inches, which generally melts rapidly.

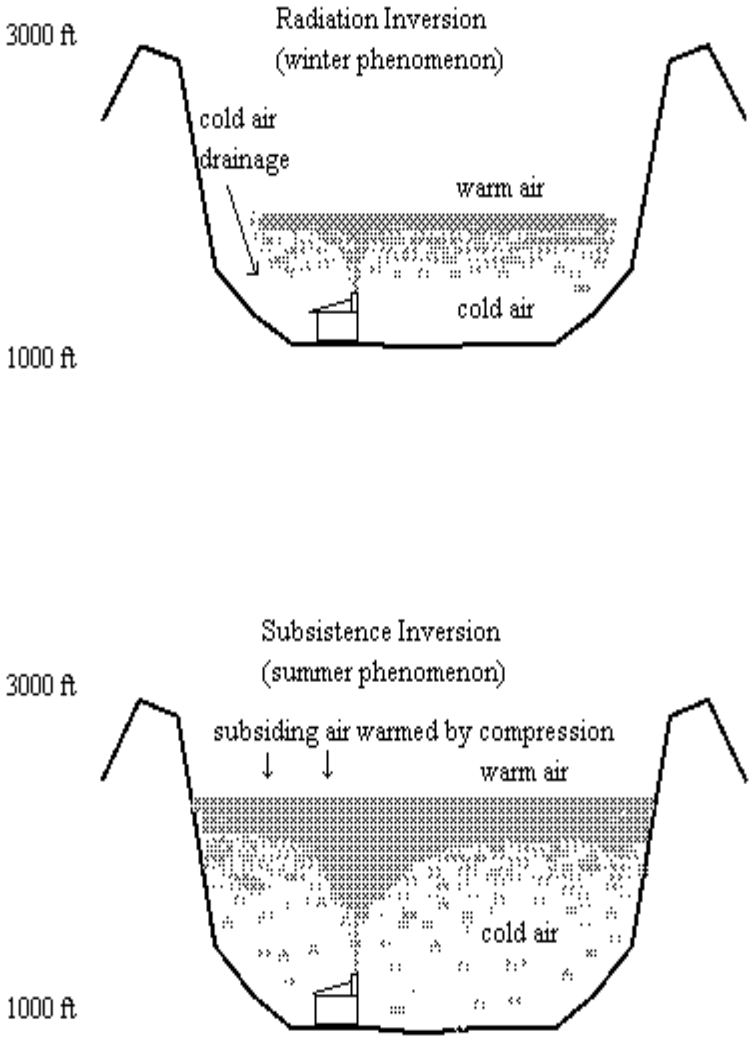
Winds in Grants Pass are normally light with an annual average windspeed of approximately 3.3 miles per hour. The mountains that surround the city generally shelter Grants Pass from wind and protect it from the strong sea breezes from the Oregon coast. During the summer months, winds are generally light and prevail from a westerly direction. In the winter months, winds generally prevail from the southeast.

FIGURE 4.1
Comparative Temperature and Precipitation



Atmospheric Conditions - Extremely stable atmospheric conditions are called inversions that act as barriers to pollutants, and in mountainous areas form a lid that traps the pollutants and prevents their dispersal. In the Grants Pass area, traditional cooling and subsidence are the two primary mechanisms that are responsible for the formation of inversions. Figure 4.2 illustrates the winter and summer phenomenon of radiation and subsidence inversions.

FIGURE 4.2
Inversion Formation



Source: Grants Pass Airshed Study, 1978

Radiational cooling is enhanced in the nearby hills as flows of cold air move downward along the canyons forming a pool of cold air in the valley with warmer air above. The radiation inversion may have a depth of several thousand feet and cooling within this layer is often sufficient to cause the formation of fog. Normally, winter radiation inversions dissipate after sunrise as the ground warms and fog burns off, although during stagnant air conditions, the inversion and fog may remain for several days.

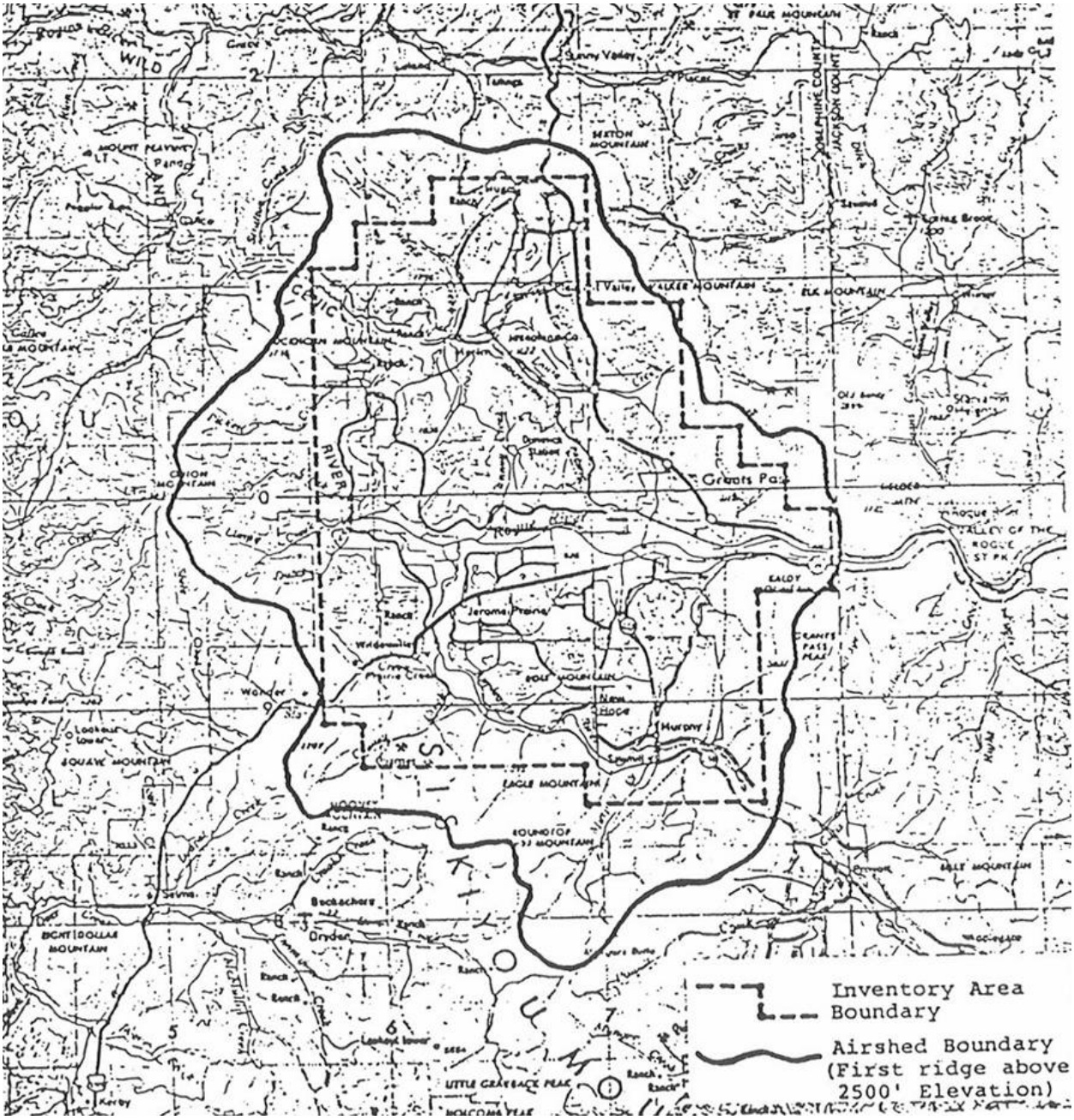
Unlike winter inversions, subsidence inversions occur several thousand feet above the ground. These inversions are formed by subsiding air which is warmed by compression and which may last for several days. This phenomenon is typically associated with periods of stagnant air movement.

Topography - Grants Pass is located in a relatively wide, circular valley nearly surrounded by mountains with a few high and narrow gaps that results in light winds which limits the horizontal dilution of air pollutants.

A nationwide study prepared by the U.S. Environmental Protection Agency in 1972 surveyed the air pollution potential of all areas within the contiguous United States and found that Southern Oregon in general and the Rogue River Valley in particular has one of the highest potentials for air pollution within the United States. It was found, in fact, that the pollution potential within the Rogue River Valley was approximately four times greater than Los Angeles. In other words, if a city the size of Los Angeles were built in the Rogue River Valley, air contaminant levels would have been four times greater than those currently existing in Los Angeles.

Under a grant from the Oregon Department of Land Conservation and Development, a study was made of the Grants Pass airshed. In summary, according to that 1978 Grants Pass Airshed Study, "the air pollution potential of the Grants Pass area is very high. Wind movement in the area is very low, and the combination of restricting terrain and frequent inversions that limit vertical dilution combine to frequently limit the ability of the atmosphere to transport or dilute pollutants". The boundary of the Grants Pass airshed and area inventoried by the 1978 study are illustrated by Figure 4.3.

FIGURE 4.3
Grants Pass Airshed and Inventoried Area



Source: Grants Pass Airshed Study, 1978

Air Quality

The Federal Clean Air Act of 1967 as amended established primary and secondary or welfare standards for several pollutants. Oregon uses the federal guidelines as its present levels for the State's standards. The standards, reported in Figure 4.4 below, relate to durations for specific contamination levels that are designed to avoid adverse affects with a reasonable margin of safety.

FIGURE 4.4
Federal and Oregon Air Quality Standards

Pollutant	Averaging Time	Federal Standard: Primary (Health)	Federal Standard: Secondary (Welfare)	Oregon Standards
Total Suspended Particulate (TSP)	Annual Geometric Mean 24 Hours (1) Monthly (2)	The Federal TSP standard was dropped in 1987. Oregon retained the state standard.		60 ug/m3 150 ug/m3 100 ug/m3
PM 10 (Fine Particulant)	Annual Arithmetic Mean 24 Hours	50 ug/m3 150 ug/m3	50 ug/m3 150 ug/m3	50 ug/m3 150 ug/m3
Ozone	1 hour	0.12 ppm	0.12 ppm	0.12 ppm
Carbon Monoxide	8 hours 1 hour	9 ppm 35 ppm	9 ppm 35 ppm	9 ppm 35 ppm
Sulfer Dioxide	Annual Arithmetic Mean 24 hours 3 hours	0.03 ppm 0.14 ppm	 0.5 ppm	Same as Federal
Nitrogen Dioxide	Annual Arithmetic Mean	0.053 ppm	0.053 ppm	Same as Federal
Hydrocarbons (Nonmethane)	3 hours (1) (6 - 9 a.m.)	160 ug/m3 "The EPA has repealed its standard for non-methane hydrocarbons and DEQ has taken similar action." (1988 Oregon Air Quality Annual Report)		160 ug/m3
Lead	Calendar Quarter	1.5 ug/m3	1.5 ug/m3	Same as Federal

Source: Table 4, p 17. OREGON AIR QUALITY 1988 ANNUAL REPORT
Notes: ug/m3 = micrograms of pollutant per cubic meter of air
ppm = parts per million

As illustrated in Figure 4.4, the State of Oregon and federal government are concerned with several pollutants, although adequate monitoring for all of them has not been done. None of the pollutants appear to present an immediate problem in the Grants Pass area. The following is simply a descriptive analysis of the composition and primary causes of the various pollutants and the quality of the Grants Pass airshed in relation to the pollutants.

Fine Particulate (PM10) - Total Suspended Particulate (TSP)

PM10 - "Particulate monitoring in Oregon changed from a measurement of Total Suspended Particulate (TSP) to respirable particulate below a diameter of microns (PM10) in 1987 with the advent of new federal regulations" (OAQ 1988 AR)*. "Fine particulate air pollution consists of solid particles or liquified droplets that are less than 10 microns in diameter (about 50 times smaller than the period at the end of this sentence).

Particles in this size range are of great concern because they can be inhaled deeply into the lungs where they can remain for years. The health effect of particulates vary with the size, concentration and chemical composition of the particles. In general, particulates cause three kinds of health problems:

1. The particles may be inherently toxic because of their chemistry.
2. The particles may mechanically damage the respiratory system.
3. The particles may be carriers for absorbed toxic substances.

Relationships have been shown between exposure to high concentrations of particulate matter and increased hospital admissions for respiratory infections, heart disease, bronchitis, asthma, emphysema and similar diseases. In addition, there may be several potential carcinogens present in particulates. Of particular concern are the condensed organic compounds released from low temperature combustion processes (woodstoves for example).

Among the most obvious effects of fine particles are reductions in insolation and visibility due to absorption and scattering of light by suspended particles. Almost all smoke particles from residential woodstoves and fireplaces, industrial boilers, field burning and other combustion processes are in the PM10 size range. In contrast, a minor fraction of the particles from road dust, agricultural tilling and windblown dust are in the PM10 size range" (OAQ 1988 AR).

TSP - "Pollution made up of particulates less than about 100 micrometers in diameter is called TSP (100 micrometers is about the thickness of a human hair). Larger particles tend to settle out of the air quickly and do not cause pollution problems. The smaller particles in a TSP sample are the same as PM10 and so have the same adverse health effects because of their ability to reach the thoracic or lower regions of the respiratory tract.

Other effects of TSP include soiling and corrosion of building materials and textiles, damage to vegetation, and toxicity to animals which feed on vegetation covered by toxic particulate matter.

Natural sources include pollen, windblown dust and smoke from wildfires. Human-caused sources include a variety of combustion sources (motor vehicles, utility and industrial boilers and dryers, woodstoves, open burning, field burning, slash burning), and dust from roads, agriculture, construction and mining" (OAQ 1988 AR).

Photochemical Oxidants (OX) - Ozone (O3) - Photochemical oxidants consist of a variety of oxidizing substances that are formed in the atmosphere. Photochemical oxidants, commonly known as "smog", are the result of a number of chemical reactions between hydrocarbons and oxides of nitrogen in the presence of sunlight. Unlike other pollutants, photochemical oxidants are not emitted directly into the atmosphere from any sources. Major sources of oxides of nitrogen include combustion sources such as automobiles and factories, and the evaporation of fuels and solvents. The health effects include damage to lung tissues and eye irritation. Certain materials such as rubber are damaged and certain plant species react adversely to photochemical oxidants.

Oxidant concentrations are not regularly measured in Grants Pass. The nearest monitoring site is in Medford. In 1976, the Oregon Graduate Center conducted airborne measurements over Grants Pass of ozone, the primary photochemical oxidant. On one of these flights, concentrations equaling or exceeding the federal standard were found at an altitude of 500 feet above the city. Although three aircraft flights are insufficient to determine whether the oxidant level is regularly exceeded, the severity of the oxidant problem in Medford suggested that photochemical oxidant could be a problem in Grants Pass.

During the summer of 1980, an ozone monitoring station was operated by DEQ at Averill Drive, located East of the city limits. According to Josephine County Environmental Health Officials, there were no violations of DEQ standards for ozone levels during that period. Mark Hansen, DEQ monitoring technician, confirmed that ozone did not appear to be reaching problem levels in the Grants Pass area.

"Ozone is a pungent, toxic, highly reactive form of oxygen. It causes irritation of the nose, throat and lungs. Exposure to ozone can cause increased airway resistance and decreased efficiency of the respiratory system. In individuals involved in strenuous physical activity and in people with pre-existing respiratory disease, ozone can cause sore throat, chest pain, cough and headaches. Plants can also be affected. Reductions in growth and crop yield have been attributed to ozone.

Ozone can affect a variety of materials, resulting in fading of paint and fabric, and accelerated aging and cracking of synthetic rubbers and similar materials. It is also a major contributor to photochemical smog.

Ozone is not emitted directly into the air. It is formed through a series of photochemical (sunlight-requiring) reactions between other pollutants and oxygen (O2). Most important are nitrogen oxides and volatile organic compounds. To control ozone pollutants, it is necessary to control emissions of these other pollutants" (OAQ 1988 AR).

Carbon Monoxide (C0) - "Carbon monoxide is a colorless, odorless gas. In the body, CO binds tightly to hemoglobin (the red pigment in the blood that moves oxygen from the lungs to the rest of the body). Once hemoglobin is bound to CO, it can no longer carry oxygen. In this way, CO reduces the oxygen-carrying capacity of the blood and can have adverse health effects. High concentrations of CO strongly impair the functions of oxygen-dependent tissues, including brain, heart and muscle.

Prolonged exposure to low levels of CO aggravates existing conditions in people with heart disease or circulatory disorders. There is a correlation between CO exposure and increased hospitalization and death among such patients. Even in otherwise healthy adults, carbon monoxide has been linked to increased heart disease, decreased athletic performance and diminished mental capacity. Carbon monoxide also affects newborn and unborn children. High CO levels have been associated with low birthweights and increased infant mortality.

A major natural source of CO is spontaneous oxidation of naturally occurring methane (swamp gas). The major human-caused source is incomplete combustion of carbon-based fuels. This is primarily from gasoline-powered motor vehicles. Other important sources are woodstoves and slash burns.

How a motor vehicle is operated has an effect on the amount of CO emitted. In stop-and-go driving conditions, CO emissions are high. Emissions are also increased when the outside temperature is low. Oregon's most serious CO problems occur during the winter in urban areas, when CO emitted by slow-moving traffic is trapped near ground" (OAQ 1988 AR).

Sulfur Dioxide (SO2) - "Sulfur dioxide is a colorless, pungent gas. In the body it acts as a lung and eye irritant. When SO2 is inhaled, it causes bronchial constriction, which results in breathing difficulty and increased pulse and respiratory rate. People with respiratory diseases like asthma, bronchitis or emphysema are particularly susceptible to the effects of SO2.

When particulates capable of oxidizing sulfur dioxide to sulfuric acid are present, the irritant response of SO2 increases in magnitude by two to three times. When sulfuric acid is inhaled, mucous production increases. This reduces the respiratory system's ability to remove particulates, and can lead to more severe respiratory infections, such as pneumonia. Chronic exposure to SO2 can lead to coughs, shortness of breath, fatigue and bronchitis.

Sulfur dioxide can also damage plants and building materials. The leaves of some vegetables (spinach and lettuce, for example) are damaged by exposure to high levels of SO2. Sulfur oxides accelerate corrosion of metals and other building materials (limestone, marble, mortar) by forming sulfuric acid on the surface of the material or in the atmosphere, with subsequent deposition on the material.

In addition, sulfuric acid and sulfate particles formed in the atmosphere from SO2 can cause scattering of visible light, thus contributing to haze. These same processes can contribute to acid rain and lead to acidification of lakes and soils.

The major source of SO2 pollution nationwide is combustion of high-sulfur coal. In Oregon, burning of high sulfur coal is not allowed. Diesel fuel and heating oil are the major sources in Oregon" (OAQ 1988 AR).

Nitrogen (NO2) - "Nitrogen dioxide is a reddish-brown gas that is toxic in high concentrations. It is a lung irritant and may be related to chronic pulmonary fibrosis. It is also important in the photochemical reactions leading to the formation of ozone. It can cause indirect damage to materials when it combines with moisture in the air to form nitric acid. The nitric acid can then cause corrosion of metal surfaces and can also contribute to acid rain. In addition, NO2 absorbs visible light and causes reduced visibility. It has also been linked to suppressed growth rates in some plants.

The major human-caused source of NO2 is fuel combustion in motor vehicles, and utility and industrial boilers. Nitric oxide (N0) is the major nitrogen oxide produced during the combustion process, but once in the atmosphere, NO is rapidly oxidized to form NO2 in the presence of ozone" (OAR 1988 AR).

Hydrocarbons (HC) (Non-methane) - "Non-methane hydrocarbons are a large family of compounds made up of hydrogen and carbon. These compounds are instrumental in the complex series of reactions leading to the formation of ozone and photochemical smog.

The compounds come primarily from motor vehicles, fuel evaporation, the coatings industries, and combustion processes. The EPA has repealed its standard for non-methane hydrocarbons and DEQ has taken similar action" (OAR 1988 AR).

Lead (Pb) - "Lead is a toxic heavy metal, abundant in the earth's crust. Airborne lead particles are of sufficiently small size (less than 0.7 microns) that they can penetrate deep within the lungs and ultimately be absorbed into the blood. High concentrations of lead in the blood can cause severe and permanent brain damage, especially in children. Lower levels have vague, non-specific symptoms, including headaches, malaise, stomach pain, irritability and pallor. Damage can be caused to heart, kidney, liver, and nerve and blood tissues. The major source of lead in the air is the combustion of leaded gasoline in automobiles. This one source accounts for close to 90 percent of the total emissions in the country annually" (OAQ 1988 AR).

Noise

Characteristics - Noise travels mainly through the air as a wave of sound. Air consists of gas molecules that are distributed fairly evenly and that move around in a random fashion. The gas molecules give air its mass and elasticity. Therefore, when a sound wave moves away from its source the wave compresses the mass of gases surrounding it. That compression moves away from the source in alternating waves relative to the frequency of the original sound. The loudness of the sound is related to the pressure of the source. The pressure of the source determines the distance the wave will travel and the sound level as measured in decibels.

A decibel is a measure of how loud sound is. It is a measure of the magnitude of sound pressure with respect to a standard reference value such as microbars or watts. One decibel is the first level that a human can hear. Humans whisper at 30 decibels and converse at 60 decibels.

Land areas nearest the source of the sound are impacted more seriously by the sound level than those land areas which are further away or are protected by a sound barrier. Figure 4.8 depicts the sound levels of certain noise sources, measured in decibels, and the sound levels measured at certain locations. There is no direct relationship between the sources and locations listed in the table. Instead, the sources and locations should be compared in order to achieve an appreciation of sound levels.

FIGURE 4.8
Sound Levels by Noise Source and Location

Noise Source (Exposure Level)	Sound Level in decibels	Location* (average 24 hour period)
Air Raid Siren	130	Rocket Launching Pad
Jet Take-off	120	Airport
Chainsaw	110	Lumber Mill
Motorcycle	100	Railroad Yard
Lawn Mower	90	Apartment next to Interstate
Heavy Traffic	80	Apartment near Downtown Area
Vacuum Cleaner	70	Row Housing on Major Street
Conversation	60	Older City Neighborhood
Rainfall	50	Woodlot Residence
Library Activity	40	Rural Residence
Soft Whisper	30	Wilderness
Very Soft Whisper	30	
Breathing	10	
Inaudible	0	

* Sound level for 24 hour period that characterizes average sound levels.
Sources: (1) Protective Noise Levels EPA 550/9-79-100.
(2) Noise and the Environment EPA Journal, Vol 5, #9, Oct. 1979.

There have been no measurements of noise levels within the UGB area. It is assumed that sources of noise generate similar noise levels regardless of geographic location. Therefore, Figure 4.8 may be representative of noise levels in the UGB area wherever similar noise sources and/or locations exist. Street noise in the downtown area is loud because of the high volume of traffic, especially truck traffic. Chainsaws and lawnmowers can occasionally be heard throughout the City and urbanizing area. The railroad passes through the center of the City. All these sources of noise contribute to the overall background noise level of the urban area, also termed the ambient noise level.

Quality - Noise can be harmful to peoples' health; there is no question that exposure to certain levels of noise can damage hearing. Figure 4.9 contains at-ear noise exposure levels that produce no more than 5 decibel noise-induced hearing damage for both 8-hour and 24-hour exposure on a yearly and working day basis over a 40-year period. Since an individual often experiences intense noise exposure outside of working hours, protection on a 24-hour basis requires exposure of an intermittent variety which is less than the work day exposure.

FIGURE 4.9
At-Ear Noise Exposure Marginal Safety Levels (In Decibels)

Exposure Time	Continuous Noise	Intermittent Noise	Margin of Safety
8 hours	71.4	76.4	75
24 hours	66.4	71.4	70

Source: Protective Noise Levels, EPA 550/9-79-100

Figure 4.9 depicts the average sound levels of locations during a 24-hour period. Locations with an average daily sound level that is greater than 70 decibels are described as "harmful to hearing". It is important to note that three residential locations are considered "harmful to hearing." Those residential locations are 1) an apartment next to an Interstate Highway - 90 decibels, 2) an apartment near a downtown area - 80 decibels, 3) row housing on a major street - 70 decibels. (See Figure 4.8.)

In addition to sound levels that cause hearing loss, there are levels of sound and durations of sound that can cause other health problems and even learning problems. The Oregon Department of Environmental Quality (DEQ) has defined noise for two different situations. During the day, 7 a.m. to 10 p.m., harmful noise is generally any sound that disturbs normal speech. Tests have shown that sound to be above 60 decibels. Ambient sound levels that are higher than 60 decibels can interfere with normal communications in the home and work place. The Environmental Protection Agency (EPA) has identified special effects of noise on children in learning environments:

> "Levels of noise which do not interfere with the perception of speech by adults may interfere significantly with the perception of speech by children as well as with the acquisition of speech, language and language-related skills." (National Academy of Sciences Report," Noise: A Health Problem EPA, August 1978.)

The learning problem extends to locations beyond the school. Children who live in noisy neighborhoods and homes, and who play in noisy areas, may suffer listening disabilities that may hinder the development of language skills.

The second noise hazard situation defined by DEQ is the disruption of sleep and sleep patterns by noise levels above 45 decibels. The DEQ has made three significant findings:

1. Noise affects the quantity and quality of sleep.
2. The elderly and sick are more sensitive to disruptive noise.
3. When sleep is disturbed by noise, work efficiency and health may suffer.

According to DEQ, humans respond to noise before and during sleep. The elderly and sick are especially sensitive to noise. The elderly are more easily awakened by noise, and once awake, find great difficulty returning to sleep. In order to maintain their health and vigor, the elderly need to develop consistent sleep patterns. Disruption of sleep can result in insomnia and instability. (EPA, August, 1978, IBID)

Other health problems related to excessive noise levels, but not conclusively demonstrated by research, are heart disease, nervous stress, fetal stress and low birth weights, emotional and behavioral aberrations, headaches and fatigue.

In 1971 the Oregon State Legislature found that noise was reaching excessive levels. Noise had become a threat to the human environment as was air or water pollution. The legislature authorized the Environmental Quality Commission (EQC) to design and enforce noise control standards for the State of Oregon. The DEQ, the administrative agency for EQC, was given the task of setting standards. DEQ undertook an extensive citizen involvement process in order to receive the views and complaints of citizens concerning noise pollution.

Based on the input of the citizens, standards in 3 areas were set:

1. For new motor vehicles sold in the state
2. For motor vehicles presently in use
3. For industry and commerce

The standards are found in Chapter 340, Oregon Administrative Rules. In addition to these standards, EPA has set noise standards on interstate transport trucking. The Federal Occupational Safety and Health Act has set standards for the workplace.

However, many noise hazards are not covered by state and federal standards. Noise created by heat pumps, motorcycles, amplifiers, lawnmowers and chainsaws cause a great deal of noise pollution in the urban area. The location of residential uses in noisy areas also sets up potential conflicts between humans and noise.

Future Noise Quality - Noise pollution will no doubt increase as population increases. According to the DEQ, the level of noise is rising 10% per year in many urban areas. "Noise consciousness" is still low. Many new products currently being manufactured will be noisy, and combined with the

existing inventory of noisy products, will actually increase the level of noise in the future. If more people are using noisy products, then the levels of noise within the UGB will probably increase.

The effects of noise on human health is proportionate to the level and duration of the noise. If the level of noise increases in the future then the adverse effects on human health from noise will also increase. There are two practical methods for a jurisdiction to affect local noise levels and the effects of noise on human health: enact noise ordinance and locate noise sensitive developments away from the major noise sources. A local noise ordinance can be used to prevent excessive sound which may jeopardize the health and welfare or safety of the citizens. The DEQ has developed a "Model Noise Ordinance for Oregon Communities," which establishes a noise control officer and a noise control review board. The model ordinance prohibits certain acts that create noise disturbances such as the operation of noise products at odd hours or within a specified distance from noise sensitive area. The location of noise-sensitive developments, such as housing, away from major noise sources, is a preventive measure that can reduce the future hazards from excessive level of noise. If noise sensitive developments cannot be located away from noise sources then noise attenuation measures should be required of those developments. There are various architectural and site development techniques for attenuating noise levels.

Architectural methods of attenuating noise levels include the orientation of the building away from the noise source, the use of noise attenuating building materials and the use of design measures that block-out the noise and/or locate the living and sleeping rooms away from the noise source. The following Figures show examples of some of these techniques.

FIGURE 4.10
Orientation of Buildings on Sites

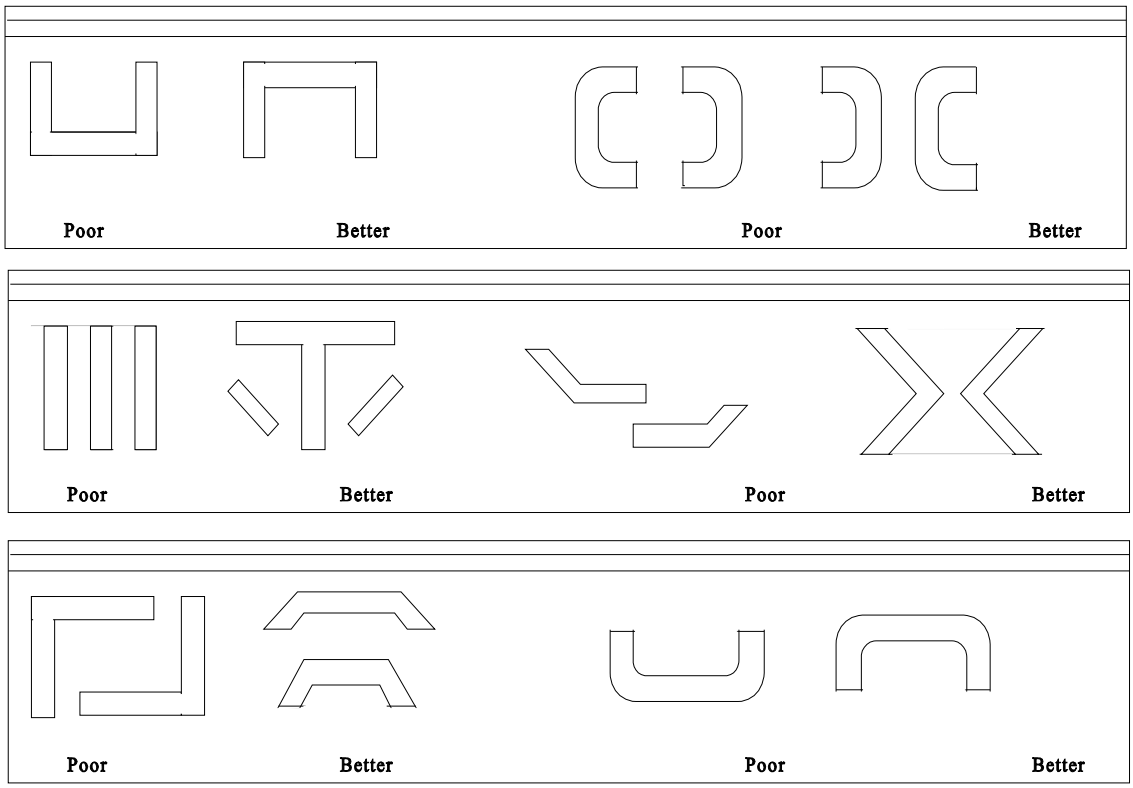


FIGURE 4.11
Use of Courtyard House to Obtain Quiet Outdoor Environment

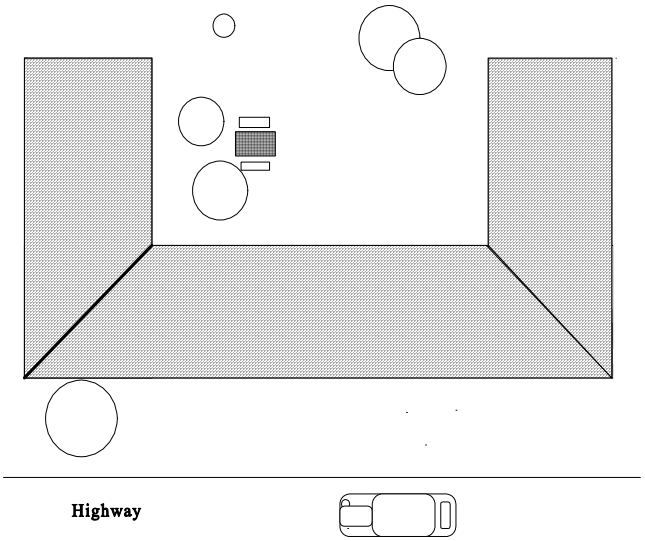
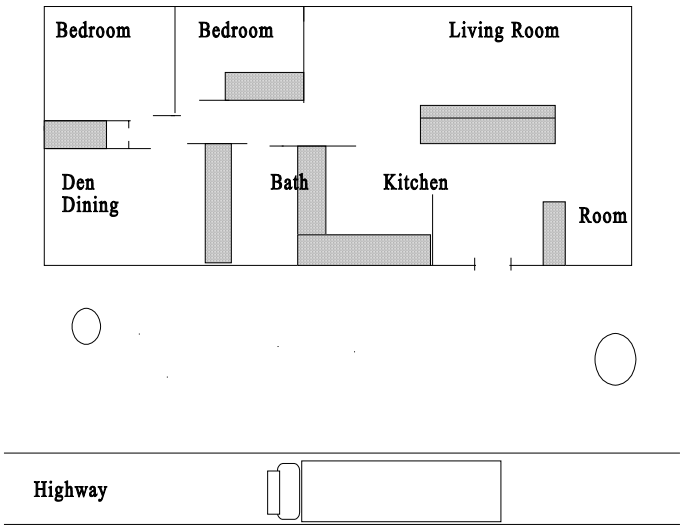


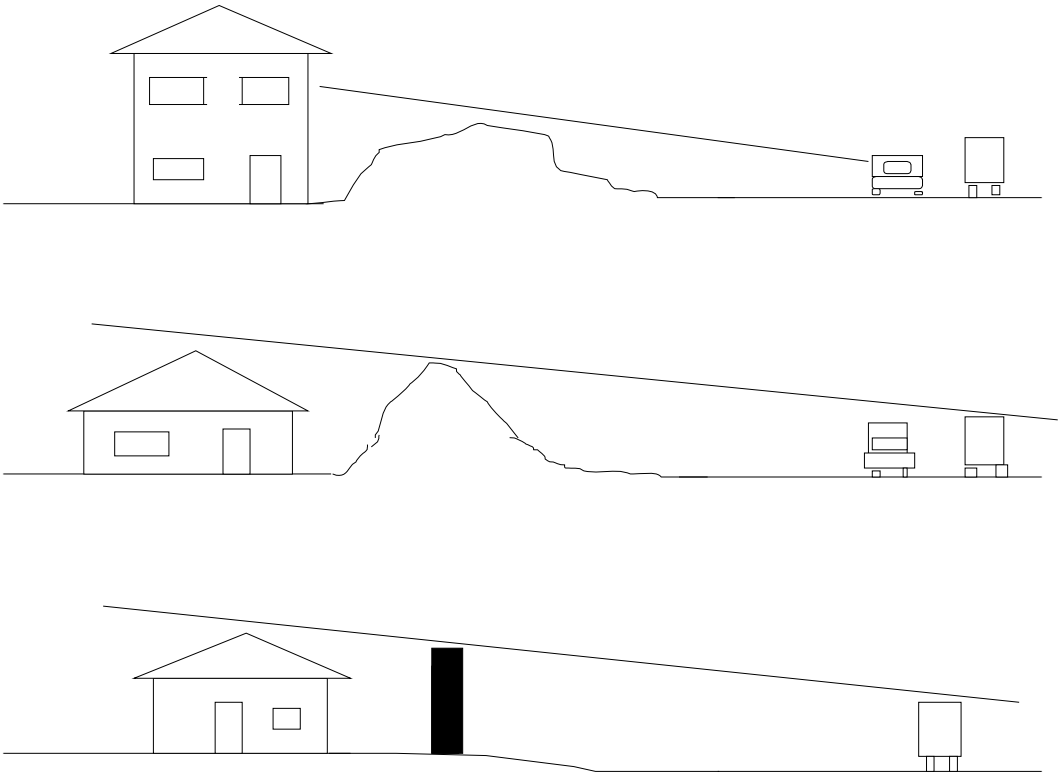
FIGURE 4.12
Use of Accoustical Architectural Design to Reduce Noise Impacts on More Noise Sensitive Living Spaces



Site development techniques can include simple concepts like increased setbacks or open space, locating the building behind a natural or constructed berm, and establishing a vegetative and masonry barrier between the building and the noise source. The following figures are examples of some of these techniques.

FIGURE 4.13
Using Cluster Development Open Space to Reduce Noise Levels

FIGURE 4.14
Using Berms and Reduced Building Height to Reduce Noise Levels



Noise impacts can be reduced by the use of a single story house. To be effective, a barrier must block the line of sight between the highest point of a noise source and the highest point of a receiver.

Source: Highway Noise, US Department of Transportation

Water Resources

Characteristics and Quality - There are three sources of water in the UGB area: 1) surface water runoff of snow melt and recent precipitation, 2) groundwater flow of precipitation that has percolated down into the soil and subsoil and 3) the Grants Pass Irrigation District system.

Surface water runoff in the UGB area is in the form of overland flow on the surfaces of the urban area and stream flow in the water channels of the area.

Overland flow comprises water which, failing to infiltrate the surface, travels over the ground surface toward a stream channel. In the urban area the infiltration capacity is greatly reduced by rooftops and paved surfaces. Precipitation is caught by these surfaces and carried to the stormwater drainage system which is designed to dispose of the water into nearby streams as rapidly as possible. The overland water flow is often polluted with urban litter like paper and plastic items, and with street waste like oil, grease and other insoluble chemicals that are disposed of onto driveways and street.

Stream flow water runoff occurs mainly in five tributary streams and one major stream within the UGB area. All streams have summer flow due to the Grants Pass Irrigation District system. The five tributary streams, Skunk, Gilbert, Fruitdale, Allen and Sand Creeks, all discharge into the area's major stream, the Rogue River.

The quality of the water in the tributary streams can be affected by the activities within the urban area. The flow of the tributaries and any other direct discharge can affect the quality of Rogue River water which also flows through upstream urban areas. The City of Grants Pass uses the Rogue River as the source of its municipal water. The water is treated and disinfected at the water treatment plant before it is distributed by the water treatment plant. Eventually, the water is discharged into the river by the City's sewage treatment plan as treated wastewater. The City has been in violation of DEQ wastewater discharge permit regulations. Most of these violations were a result of excessive inflow resulting from rainy periods and are in the winter only. At times, untreated raw sewage is discharged directly into the Rogue River. (See Public Facilities Element, Sewer Services Section 10.3.2). Otherwise, wastewater is treated according to DEQ standards. Microorganisms that are present in the wastewater are disinfected prior to the discharge of the wastewater into the Rogue River.

Sludge, which is separated from the wastewater during sewage treatment, must be regularly removed from the sewage digesters and disposed of using land application. The City sewage plant currently lacks dependable sludge disposal land sites.

Industrial wastewater is of concern to the City and DEQ (see Public Facilities Element). DEQ feels that industrial wastewater may be the source of excessive dissolved solids metals in the influent flow to the treatment plant. In 1969, Brown and Caldwell Consulting Engineers designed an industrial waste monitoring program to characterize waste discharges for their possible effects on sewage treatment (Sewage Treatment and Disposal Study, Brown and Caldwell, 1969.) In order to

determine the composition and strength of industrial waste, samples were taken from two plywood plants and a meat packing plant. The survey revealed relatively high phenol content in the glue waste from the plywood plants. The biologic oxygen demand (BOD) of the waste for all three industries that were tested was of no special significance.

The City is currently involved in an industrial waste pretreatment program under the conditions of the National Pollutant Discharge Elimination System Permit issued to the City on March 10, 1981. The City is making an inventory of industrial users and identifying sources of toxic pollutants. The results of the program survey of industrial users and the contents of industrial waste will determine the need for a pretreatment program, as part of our current facility planning process.

Groundwater, unlike surface water runoff which travels great distances in short periods of time and is readily replenished, flows slowly and is not readily recharged. Thus, the adverse impacts on ground water quality can have severe and long-lasting effects. The primary potential source of groundwater pollution in the UGB area is the subsurface septic disposal system. Also, according to the County Watermaster, improperly abandoned wells are another potential source. Groundwater pollution caused by failing septic systems was a significant problem in the Redwood and Harbeck-Fruitdale subareas of the UGB during the 1960's and early 1970's. Consequently, the Redwood Sewer Service District and the Harbeck-Fruitdale Sewer Service District were formed. Sewage collection and treatment systems installed and the pollution problem was arrested.

According to the watermaster, there are many improperly abandoned wells in the UGB area. These wells have been drilled and then abandoned without being properly capped or sealed to prevent pollution of the groundwater.

A saltwater intrusion problem has been recorded in the southern part of the Harbeck-Fruitdale subarea. The County Watermaster thinks that the problem will be a minor one during this planning period. However, some wells are excessively salty and the extension of municipal water may be the only cure for the problem.

Future development utilizing groundwater will cause further mining of the aquifers in the area. The potential loss of the Grants Pass Irrigation District system may also have an impact on this area.

Future Water Quality - Surface water quality within the UGB area can be greatly affected by future development. Increasing levels of development will create more impervious surfaces and urban runoff which may contain increasing quantities of water insoluble chemicals and litter. Erosion and stream siltation may increase as future development encroaches into the foothills and along the streambanks.

Sewage wastewater flows will improve greatly as the present plant is expanded and modified.

Groundwater quality will be affected directly by the potential hazards of uncapped or improperly abandoned water wells. Septic systems should not be a problem because the entire UGB area is or will be provided with sewers.

There are several methods for protecting the quality of the surface water in the UGB area. In order to reduce the pollutants from stormwater runoff, the stormwater can be treated at a stormwater treatment plant. A more practical preventive method would be to maintain a vigorous street sweeping and cleaning program and encourage residential and commercial land uses to maintain their impervious surfaces in clean, litter free conditions.

Groundwater quality can be protected by a diligent effort to identify all uncapped water wells and require that those wells be properly capped or sealed. All new wells that become dry should be required to be capped, sealed or properly abandoned immediately.

Saltwater intrusion into private wells of the Harbeck-Fruitdale area may eventually cause a health problem requiring municipal water service as an emergency corrective measure. Currently the problem appears to be minor.

Wastewater pollution of the Rogue River can be corrected by making capital improvements to the hydraulic capacity of the treatment plant. The City is currently making a study of the problem and solutions. (See Public Facilities Element, Sewer Section)

Land Resources

Characteristics - According to the Josephine County Comprehensive Plan, the soils in Josephine County are formed extensively from eroded igneous and metamorphic parent rocks. Those rocks contain a high percentage of quartz material that is the principal source of sand in soil formations. Sand is a relatively large soil particle that has a smaller surface area to volume ratio than the other soil particles such as silt and clay. Also, because a sand particle originated from the glass-like quartz material, its shape is spherical with an angular surface. In the soil formation, the sand particles "fit" loosely together because of the shape and surface of the particles. Consequently, there is a large volume of pore space in a soil formation that has a high percentage of sand particles. The pore space can be filled either with water or air depending on the season and the level of groundwater.

Due to the small surface area of the sand particles relative to the volume of space it displaces in the soil, and to the angularity of the sand particle, the amount of water retained on the surface of the particle is relatively smaller than silt and clay particles. The forces of surface tension are weak, thus water stored in a sandy soil formation is very susceptible to the forces of gravity and soil suction by plants.

Therefore, sandy soils are porous and are generally well-drained of water, especially in the dry season. The county plan describes most soils in the county as "well-drained" and/or "excessively-drained" soils. The water that drains from the soil percolates rapidly through the soil into the groundwater or surface water channels. The retention time of infiltrated water in the soils within the UGB area is probably quite short. Therefore, pollutants such as sludge, leachate and septic wastewater can affect the quality of the area's water resources if the land application process is improper or incorrect.

Quality - There are five potential sources of soil pollution within the UGB: sludge disposal, chemical fertilizers, products used in commercial and industrial operations, leachate from solid waste disposal, and septic wastewater from subsurface septic disposal.

1. Sludge is a thick liquid waste residue from the sewage digesters at the sewage treatment plants. The sludge must be removed from the digesters on a regular basis. Sludge has the potential to be a contaminant if contaminants are not eliminated at the source. An enforced pre-treatment ordinance should prevent the presence of pollution elements such as heavy metals. Based on a combination of pretreatment, composting and/or other additional treatment, the sludge may be used for land application without a detrimental effect to the environment. Currently, the sludge is transferred from the treatment plant to local farm lands outside the UGB where it is spread onto the soil.

2. Chemical fertilizers include the categories of herbicides and pesticides. Proper application of these chemicals will lessen their potential to contaminate the soil.

3. Products used in commercial and industrial operations within the UGB fall into several categories. They include underground storage tanks used by both commercial, industrial and private property owners, products used at gas stations and automobile repair shops (oil, solvents, antifreeze, lead) and products and residues from mill and wood product manufacturing. A pretreatment ordinance and the site plan review process impose conditions toward prevention of future contamination.

4. Leachate is a wastewater that emerges from solid wastes which contains objectionable impurities such as metals, minerals, micro-organisms and dissolved gases. Leachate occurs when precipitation and/or groundwater mix with the solid wastes in the landfill.

5. Septic wastewater is derived from subsurface septic waste disposal systems. The wastewater emerges from the subsurface leach lines and percolates into the soil. These systems are generally associated only with residential development.

The Department if Environmental Quality (DEQ) regulates sludge and solid waste disposal. Sludge disposal onto local farmland is regulated by rules that set forth the soil type, slope, depth to ground water and weather conditions that must be met before land application can proceed.

Solid waste disposal is also regulated by rules that specify the methods by which solid waste shall be disposed of. Leachate is an ongoing condition at the Merlin solid waste site. Please see the Public Facilities Element: Solid Waste Section for further details.

Future Land Quality - Land quality will be impacted in the future by increasing volumes of sludge and solid waste. The land application of sludge is regulated by DEQ and will continue to be so regulated in the future.

As the volume of solid waste increases concurrent with the population growth and with increased development, the City will continue to monitor activities within the community through the development and building permit process. On-site storage of materials having the potential to contaminate the local soils is permitted only after design plans have been approved demonstrating chemical product containment in the event of any intentional or accidental spill or discharge.

As the landfill is currently constructed, the increasing volumes of solid waste would create more leachate. However, the City will cover ninety-percent of the landfill with an interim plastic cover that will significantly reduce the amount of leachate generated. In addition the City will install a leachate collection system and implement other activities to contain the leachate, treat what may be in the groundwater and protect the environment. These studies and activities are occuring according to the DEQ and EPA regulations.

The Merlin landfill operates on leased Bureau of Land Management (BLM) property. The lease expires in the year 2000. The City is currently negotiating with the BLM on when and how landfill closure will occur, but it is expected that the landfill will remain operating for several more years. However, in anticipation of eventual closure the City is working with the private sector to locate a transfer station, possibly within the UGB. The City expects to aggressively recycle and ultimately transfer its solid waste to the regional landfill, Dry Creek, located in Jackson County.

4.50 AIR, WATER & LAND RESOURCES QUALITY FINDINGS

Air Characteristics and Quality

1. The combination of climate, atmospheric conditions and topography have created a unique airshed for the Southern Oregon and Grants Pass UGB area.

2. Air inversions are common in the Grants Pass UGB area. Inversions act as barriers to pollutants by forming a "lid" of stable air over the Rogue River Valley that traps the pollutants and prevents their dispersal.

3. There are six major potential air pollutants to be found in the Rogue River Valley: 1) total suspended particulates (TSP) which are now categorized as PM10, 2) ozone, 3) carbon monoxide, 4) lead, 5) sulfur dioxide and 6) nitrogen dioxide.

4. **TSP-PM10.** "Particulate monitoring in Oregon changed from a measurement of Total Suspended Particulate (TSP) to respirable particulate below a diameter of 10 microns (PM 10) in 1987 with the advent of new federal regulations" (Oregon Air Quality 1988 Annual Report). Grants Pass was designated as a PM10 Group I area in 1987 which meant that the city violated the required standards. (*Grants Pass was not designated a non-attainment area by the state in 1987 for not meeting federal ambient air standards*.) "The majority of the areas that experience difficulty meeting the PM10 standard do so principally because of impacts of wood space heating. The southern Oregon communities generally experience more of a problem than those in northern Oregon from this source for a variety of reasons.

   First, surveys indicated that wood is a more common fuel for home heating in southern Oregon. Also, the majority of southern Oregon is higher in elevation than is northern Oregon and wood stoves burn less efficiently at higher elevations, producing more particle emissions per unit of heat output.

   Finally, there is a tendency toward sustained thermal inversions in the interior of southern Oregon, so emissions from wood stoves have a greater impact on air quality levels than in the better ventilated areas of the north.

   Control strategies are being developed for all Group I areas by the Department of Environmental Quality. "Because it has no authority to regulate home space heating, the Department is assisting city and county officials and advisory committees with development of workable and acceptable local plans to abate the problem."

   The Oregon Air Quality 1988 Annual Report showed Grants Pass as having 3 days in 1987 and 0 days in 1988 exceeding standards for Fine Particulate (PM10). During the years 1984 and 1986 there were no days in violation. (OAQ 1988 AR).

5. **Ozone.** "The summer of 1988 was one of the hottest on record for many locations in Oregon and around the nation. Sustained high temperatures coupled with low wind speeds produced elevated ozone potential in most areas. The Medford area monitor recorded the highest level in over ten years but still managed to stay within the standard. Eugene experienced a single day above the standard which was also due to high temperatures and stagnant conditions.

   Because ambient ozone concentrations are related to the release of VOCs from motor vehicles and other commercial and industrial sources, control strategies have centered mainly on these two source categories.

   Major reductions in VOCs (volatile organic compounds) have been achieved through the federal new car program, the state vehicle inspection and maintenance program, and local transportation control strategies. Industrial emissions from gasoline handling have also been substantially reduced by improved controls on gasoline storage and transport facilities" (Oregon Air Quality 1988 Annual Report).

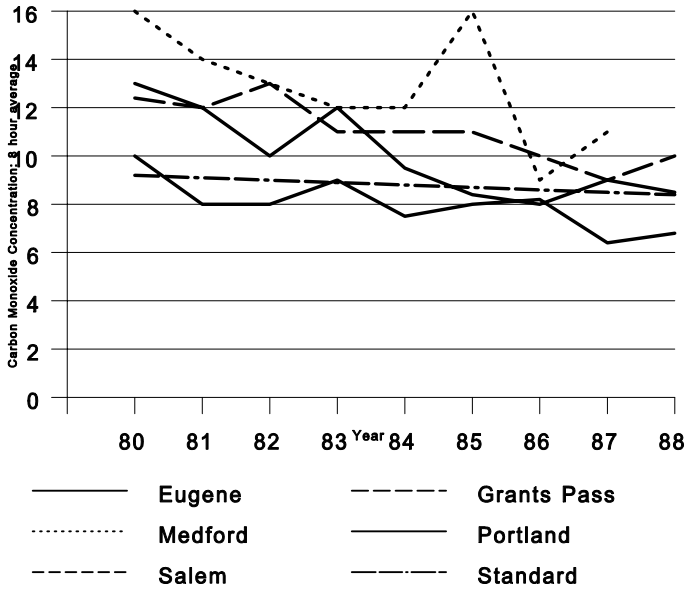
6. **Carbon monoxide**. "Carbon monoxide levels generally continued to improve around the state in 1988. The CO standard is violated when more than one exceedance of the 9 ppm 8 hour average occurs in 8 calendar quarters. (See Figure 4.5 (a).) These measurements are in keeping with the planned attainment and maintenance strategy developed for the Portland area." The Oregon Air Quality 1988 Annual Report gave the following records on Carbon Monoxide levels for Grants Pass:

   Number of Days Exceeding Standards

1984 = 9	1987 = 4
1985 = 10	1988 = 2
1986 = 2	

   "Because carbon monoxide pollution is strongly influenced by motor vehicle emissions, control strategies have focused mainly on the federal Motor Vehicle Emission Control Program. Manufacturers responded to this program by equipping most vehicles built after 1974 with catalytic converters and other emission control features. In addition, EPA has developed a list of Reasonable Available Control Measures for transportation sources that can be employed in CO nonattainment areas. These additional measures are weighted for cost-effectiveness and feasibility of implementation before they are recommended for a specific area. These measures include: motor vehicle inspection and maintenance, public transportation improvement, park-and-ride lots, parking management and traffic flow improvements...In Grants Pass a new bridge is expected to relieve carbon monoxide problems by diverting traffic from the downtown area" (Oregon Air Quality 1988 Annual Report). Completion date is scheduled for December, 1991.

FIGURE 4.5 (a)
Ambient Carbon Monoxide Trends in Selected Oregon Cities
(Second Highest Day)



7. **Lead**. "No site in Oregon exceeded the lead standard in 1988. The last exceedance of the standard was reported in Portland during the second quarter of 1984" (Oregon Air Quality 1988 Annual Report).

8. **Sulfur Dioxide**. "No exceedance of sulfur dioxide standard has been recorded in Oregon. This is primarily due to the lack of use of heavy sulfur-laden fuels in the state.

9. **Nitrogen Dioxide**. No exceedance of the nitrogen dioxide standard has been recorded in Oregon" (Oregon Air Quality 1988 Annual Report).

Exceeding the Standards
Table 4.5 (b) from the Oregon Air Quality Annual Report indicates the number of days in each of the past five years that selected Oregon communities experienced pollution levels above the National Ambient Air Quality Standards. Many of the communities have multiple monitoring sites operating in them, and a day is considered to exceed the standard if as few as one site is found to exceed.

In 1988, the weather patterns appeared fairly normal except that the summer temperatures were relatively high, which lead to an increased tendency to produce elevated ozone levels.

The table indicates that most areas of the state are continuing to experience levels below the standards. Instances of increased number of days above the standard may be the result of more intensive monitoring in an attempt to characterize highest levels and obtain better data for strategy development..." (OAQ 1988 AR).

TABLE 4.5 (b)
Number of Days Exceeding Standards for Selected Cities
1984 through 1988

CITY	1984	1985	1986	1987	1988
FINE PARTICULATE (PM 10)					
Bend	0	1	0	1	0
Eugene / Springfield	-	12	1	2	0
Grants Pass	-	-	-	3	0
Klamath Falls	-	-	-	22	28
La Grande	-	-	0	1	5
Medford*	5	13	2	5	7
Pendleton	-	-	0	0	0
Portland*	0	0	1	0	0
White City	-	16	2	2	1
CARBON MONOXIDE					
Eugene / Springfield	0	1	0	0	0
Grants Pass	9	10	2	4	2
Medford*	18	35	16	4	2
Portland*	2	1	1	1	1
Salem	0	4	0	0	0
OZONE					
Eugene / Springfield	0	0	0	0	1
Medford*	0	0	0	0	0
Portland*	2	2	3	1	2
Salem	0	0	0	-	-

* Combined data from multiple sites in area.

Air Pollution Index Values

"The Air Pollution Index (API) provides the public with an objective means of assessing ambient (outdoor) air quality. The lower the API value, the better the air quality." (See Figure 4.5 (c) which is from Table 1, Oregon Air Quality 1988 Annual Report. These levels are measured for Eugene, Medford and Portland.)

FIGURE 4.5 (c)
Air Pollution Index Value and Air Quality Category

0 to 50	Good
51 to 99	Moderate
101 to 199	Unhealthful
200 to 299	Very Unhealthful
300 and up	Hazardous

"During 'good' days the amount of air pollution is very low, below roughly half of the standard for any of the pollutants measured. On 'moderate' days there may be some soiling, visibility impairment and damage to materials and crops but no human health or welfare effects. During 'unhealthful' days, high-risk individuals--those with asthma, or heart or lung disease--might suffer adverse effects. Healthy individuals may even experience some discomfort after prolonged exposure to levels at the 'unhealthful' range."

Figure 4.5 (d) from the Oregon Air Quality 1988 Annual Report "shows how API relates to possible air pollution activities initiated by the DEQ. An API of 100 means the air quality is right at the National Ambient Air Quality Standard. The long-term goal of DEQ is to design strategies to keep levels from going above those standards. A value of 200 or more may result in the declaration of an Air Pollution Alert if it is determined that the condition causing the levels is likely to persist. During an Alert, more intensive monitoring may be initiated and the public is advised of the situation. If the API exceeds 300 and conditions causing the elevated levels are forecast to continue, an Air Pollution Warning may be declared. At the Warning level, specific sources may be requested to curtail non-essential operations and additional cautions are issued to the public. At a level of 400, an Air Pollution Emergency may be deemed to exist and emergency measures may be enacted to prevent serious health impacts to the entire population. At the Emergency level, many air pollution sources would be required to terminate or severely curtail operations in an attempt to decrease pollution levels" (Oregon Air Quality 1988 Annual Report).

The latest Air Pollution Index is available from the phone numbers listed in Figure 4.5 (d) for the most recent reporting measurement period during normal work days. This information is also made available to the news media through the National Weather Service and is reported daily by some newspapers and broadcast media.

FIGURE 4.5 (d)
API Values and Air Pollution Episodes

Pollutant	Standard	Alert	Warning	Emergency	Significant Harm
API Value	100	200	300	400	500
PM10	150	350	420	500	600
TSP (24 hr) ug/m3	260	375	625	875	1,000
CO (8 hr) ppm	9	15	30	40	50
Ozone (1hr) ppm	0.12	0.20	0.40	0.50	0.60
SO2 (24 hr) ppm	0.14	0.30	0.60	0.80	1.00
NO2 (24 hr) ppm	n/a	0.16	0.31	0.41	0.52

Noise Characteristics and Quality

10. Noise travels through the air as sound wave. The loudness of a sound is related to the pressure of the source and is measured in decibels: one decibel is the first sound level that a human ear can hear. The farther a person is from the source of the sound the lower the decibel level. Figure 4.8 depicts the decibel levels as measured in some locations. There is no direct relationship between the sources and locations having similar decibel levels. However, the sources and locations should be compared in order to appreciate noise levels.

FIGURE 4.8
Sound Levels by Noise Source and Location

Noise Source (Exposure Level)	Sound Level in decibels	Location* (average 24 hour period)
Air Raid Siren	130	Rocket Launching Pad
Jet Take-off	120	Airport
Chainsaw	110	Lumber Mill
Motorcycle	100	Railroad Yard
Lawn Mower	90	Apartment next to Interstate
Heavy Traffic	80	Apartment near Downtown Area
Vacuum Cleaner	70	Row Housing on Major Street

Conversation	60	Older City Neighborhood
Rainfall	50	Woodlot Residence
Library Activity	40	Rural Residence
Soft Whisper	30	Wilderness
Very Soft Whisper	30	
Breathing	10	
Inaudible	0	

* Sound level for 24 hour period that characterizes average sound levels.
Sources: (1) Protective Noise Levels EPA 550/9-79-100.
(2) Noise and the Environment EPA Journal, Vol 5, #9, Oct. 1979.

11. It is assumed that the sources of noise listed in the above table generate similar noise levels regardless of location. Therefore, such noise sources with the exception of two, exist within the Grants Pass UGB.

12. The decibel levels of certain locations listed in Figure 4.8 are also assumed to prevail in most Oregon cities and therefore, within the UGB, (with the exceptions of the airport and launching pad).

13. Noise can be harmful to people's health. Certain levels of noise can damage hearing, especially if the 8-hour continuous noise level exceeds 75 decibels or if the 24-hour intermittent noise levels exceed 70 decibels. There are also sound levels and durations of sound, yet to be precisely determined, that can cause other health problems such as heart disease, low birth rates and emotional disturbance.

14. In figure 4.8 there are three residential locations which have 24-hour intermittent noise levels in excess of 70 decibels. All three are located along or nearby busy highways and major streets.

15. Normal speech can be disturbed by sound levels above 60 decibels. Learning disabilities in children are related to noise levels which interfere with the perception of speech. The learning problem can exist in a noisy school classroom situation and/or a noisy neighborhood and home environment.

16. The disruption of sleep and sleep patterns can be created by noise levels above 45 decibels. The DEQ has made three findings.
    - Noise affects the quantity and quality of sleep.
    - The elderly and sick are more sensitive to disruptive noise.
    - When sleep is disturbed by noise, then work efficiency and health may suffer.

17. Again, as shown in Figure 4.8, three residential location types have 24-hour intermittent noise levels that exceeds both the sleep interference level of 45 decibels and the speech interference level of 60 decibels.

18. The DEQ has set standards for noise levels in three areas:
    - For new motor vehicles sold in the state.
    - For motor vehicles presently in use.
    - For industry and commerce.

    The standards are found in Chapter 340, Oregon Administrative Rules.

19. There are proposed state standards and local standards for the noise sources that contribute to the intermittent background noise levels. These sources in Grants Pass are regulated under the City's Municipal Code, Chapter 5, Section 5.12.110: Unnecessary Noise.

Water Characteristics and Quality

20. There are three sources of water in the UGB area, 1) surface water runoff, 2) groundwater and the Grants Pass Irrigation District system. Surface water runoff in the UGB is in the form of overland flow on the surfaces of the UGB area and stream flow in Allen, Sand, Fruitdale, Skunk and Gilbert Creeks and the Rogue River. Groundwater is found in the Redwood aquifer which underlies the Central UGB area while the outlying areas are supplied by the granite aquifer.

21. Overland flow comprises water which, failing to infiltrate the surface, travels over the ground service toward a stream channel. The infiltration capacity of the land is greatly reduced by rooftops and paved surfaces. The overland water flow is often polluted with urban litter like paper and plastic items and with street waste like oil, grease and other insoluble chemicals that are disposed of onto driveways and streets. The overland flow in the urban area is directed into storm drains which eventually discharge into streams and river.

22. Most of the water distributed by the City's water treatment plant and private water sources is eventually discharged into the Rogue River by the two sewage treatment plants in the UGB. The City's sewage treatment has been in violation of DEQ wastewater discharge regulations. At times, untreated sewage is discharged directly into the river.

23. Wastewater is properly processed through the sewage treatment plant before being discharged into the Rogue River. However, some industrial wastewater may be of such quality and/or quantity as to require pretreatment. The City is currently involved in an industrial waste pretreatment program under the conditions of the National Pollutant Discharge Elimination System, Permit 3311-J.

24. Groundwater pollution by failing septic systems in the urbanizing area was arrested by the construction of the Redwood and Harbeck-Fruitdale sewage systems. However, according to

the County Watermaster, the quality of the groundwater in the UGB is still threatened by many improperly abandoned groundwater wells.

Land Characteristics and Quality

25. The soils of the UGB area are predominantly sandy soils that are well drained to the groundwater and surface water channels.

26. There are five potential sources of soil pollution within the UGB: sludge disposal, chemical fertilizers, products used in commercial and industrial operations, leachate from solid waste disposal and septic wastewater from subsurface septic disposal. Sludge is a thick, liquified waste transferred from the sewage treatment plants to local farms where it is spread onto the soil. Leachate is liquid waste that emerges from solid waste and contains many offensive chemicals. Chemical fertilizers and products used in commercial and industrial operations include such chemicals as herbicides, pesticides, fuels, oils and solvents that are petroleum based, lumber processing residues and wood product manufacturing glues. Septic waste leaches from surface leach lines of a subsurface wastewater septic system.

27. Sludge disposal is currently regulated by DEQ as to soil type, slope and depth-to-ground water of the soil. No problems have been recorded to date.

28. Leachate is one of many items regulated by DEQ at the Merlin Landfill site. The Merlin Landfill is currently being studied under the federal Resource Conservation Recovery Act (RCRA) / Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) / and Superfund Amendment and Reauthorization Act (SARA) regulations to determine how to treat the leachate and ground water, to plan for the eventual closure, and to prepare for the post-closure activities. The city is working closely with the DEQ to resolve the issues and to continue to protect the environment. The City will install and interim plastic cover over ninety-percent of landfill to reduce leachate generation. Quarterly samples taken from on-sight monitoring wells indicate some contamination. In addition, the City is sampling several off-site domestic wells. A couple of wells have low levels of three constituents but are well within the water quality standards established by the DEQ and the EPA. The City continues to monitor wells and is aggressively addressing the issue.

29. The entire UGB area is now served or able to be served by public sewerage systems. As development in the urbanizing area becomes increasingly more urban the use of septic systems will decrease accordingly.