Chapter 8 Air and Sound

8.1 Affected Environment

This section discusses the existing environmental health conditions within the Town Center planning area, primarily sound and air quality. This section also provides an overview of the agencies and regulations that govern sound and air-quality in the study area.

8.1.1 Sound

When sounds are unpleasant or disturbingly loud, they are usually considered "noise." Sound is any change in air pressure that the human ear can detect. Sound ranges from barely perceptible to levels that cause hearing damage. In general, the greater the change in air pressure, the louder the sound. Sound is measured in terms of loudness and frequency. The unit used to measure the loudness of sound is called a decibel (dB). A range from 0 to 120 dB is the typical range of human hearing. To account for the human ear's sensitivity to different sound frequencies, the dB measurement scale is adjusted to provide an accurate measure of what the human ear can actually hear. When the adjusted dB scale is used, these measures are referred to as the A-weighted decibel scale, or dBA.

Normal human conversation ranges between 44 to 65 dBA when people are about 3 to 6 feet apart. The smallest change in sound level that a human ear can perceive is about 3 dBA. For most people, each 10 dBA increase in sound seems twice as loud, while a 10 dBA decrease in sound levels is perceived to be half as loud. The point at which sound begins to harm hearing is 70 dB (USEPA, 1974).

Human response to sound varies from person to person. Some key factors that can influence an individual's response include the loudness, the frequency, the amount of background sound present, and the nature of the activity that is being affected by the sound. As stated previously sounds that are unpleasant, disturbingly loud, or disruptive are considered "noise."

Community sound (also called environmental noise, residential noise, or domestic noise) is defined as sound emitted from all sources except sound at the industrial workplace (World Health Organization, 1999). Primary sources of community sound include road, rail, and air traffic; industries; construction and public work; and the neighborhood. The main indoor sources of noise sound are ventilation systems, office machines, home appliances, and neighbors. In residential areas, noise is generated from mechanical devices (e.g., heat pumps, ventilation systems, and traffic), as well as voices, music, sounds generated by neighbors (e.g., lawn mowers, vacuum cleaners, and other household equipment, music, and noisy parties), and domestic animals such as barking dogs (World Health Organization, 1999). In general, residential land uses do not create an excessive amount of noise. Commercial and industrial activities can sometimes produce a significant amount of noise.

There are several noise-sensitive uses located in the City of Sammamish, including residences, schools, parks, and churches. Residential receptors are spread throughout the Town Center planning area.

8.1.1.1 Town Center Sound Sources

Within the Sammamish Town Center planning area, the primary sources of sound are associated with existing traffic on 228th Avenue SE and the surrounding street network. Background evening rush-hour sound levels are estimated to be between 58 and 65 dBA depending on distance from the roadway (75 to 250 feet) (City of Sammamish, 2003b). Activities related to the area schools (Skyline High School, East Catholic High School, Arbor Elementary, and Sammamish Children's School) including arrival and departure of students, sports events, and other school events are also sources of sound. Current land use in the Town Center planning area is primarily residential.

The City's comprehensive land use plan includes Public/Institutional land uses, which typically produce more environmental sound than residential. There are currently no industrial or manufacturing activities located or proposed within the Town Center planning area. These would represent an even greater noise source. Construction of the Sammamish Commons constitutes an existing noise source in the Town Center planning area.

8.1.1.2 Applicable Regulations

The Washington Administrative Code (WAC) noise regulations establish limits for sound levels that cross property lines, but the regulations also include exemptions for noise from construction activities between the hours of 7:00 a.m. and 10:00 p.m. As shown in Table 8-1, residential areas have the lowest permissible noise levels, and the allowable nighttime levels are 10 dBA lower than the daytime levels. For weekdays the WAC defines nighttime as 10:00 p.m. to 7:00 a.m.

Table 8-1. Maximum Permissible Environmental Noise Levels (dBA) Under Washington State Regulations

Type of Noise Source	Type of Receiving Property		
	Residential Day / Night	Commercial	Industrial
Residential	55 / 45	57	60
Commercial	57 / 47	60	65
Industrial	60 / 50	65	70

Source: WAC 173-60-040

The State law recognizes that the function of noise abatement and control are primarily the role of local government. However, local sound control measures may not differ with these without approval from the Washington State Department of Ecology (WAC 173-60-110).

The Sammamish Municipal Code (SMC) Chapter 8.15, Public Disturbance Noise, establishes a policy to minimize the exposure of its citizens to the harmful physiological effects of excessive sound. Section SMC 8.15.012 makes it unlawful for sound that is a public nuisance to originate

from any property. Construction noise in the City is exempt from noise regulations from 7:00 a.m. to 8:00 p.m. Monday through Friday and 9:00 a.m. to 6:00 p.m. Saturday and holidays. Construction noise is not allowed on Sundays (SMC 16.05.030).

8.1.2 Air

Air quality is measured by the concentration of chemical compounds and particulate matter in outdoor air. Air that contains certain compounds and particulates can degrade the health of humans, animals, and plants.

Human health risks from poor air quality range from headaches and dizziness to cancer, respiratory disease, and other serious illnesses that can lead to premature death. Potential ecological impacts include damage to trees and other types of vegetation. Quality of life concerns from air pollution include reduced visibility and deposition of soot and other particulate matter on homes and property.

8.1.2.1 Town Center air pollution sources

The City of Sammamish is located in eastern King County. King County is compliant with all of EPA's emissions-based standards and thus is not considered a non-attainment area. The primary sources of air pollution in the Sammamish Town Center planning area are automobile traffic and wood burning. These are characteristic of residential suburban areas.

Wood smoke from fireplaces and wood stoves contains fine particles (PM2.5), toxic air pollutants (TAPs), volatile organic compounds (VOC), nitrogen oxides (NOx), carbon dioxide (CO2), carbon monoxide (CO), and other combustion constituents that are a health threat. High levels of particulates occur in the Puget Sound area during temperature inversions. Recent studies link high levels of fine particle pollutants to an increase in asthma attacks, emergency-room visits, hospital admissions, and premature deaths. Children, older people, and people with lung and heart diseases are more at risk. As with cigarette smoke, fine particles are linked to lung cancer and heart disease. Fine particles accelerate hardening of the arteries and affect heart function (PSCAA, 2005).

Ecology and the Puget Sound Clean Air Agency (PSCAA) maintain air quality monitoring stations throughout the Puget Sound region. Stations are located in areas where there may be air quality problems such as urban areas or in proximity to air pollution sources. Stations are also located in remote areas, which provide indicators of regional air quality. There are no air quality monitoring stations in the City of Sammamish. The nearest monitoring station is located in Lake Sammamish State Park for ozone. Three stations in downtown Bellevue monitor particulates and carbon monoxide.

8.1.2.2 Applicable Agencies & Regulations

The United States Environmental Protection Agency (EPA), Ecology, and PSCAA establish regulations that govern both the concentrations of pollutants in the outdoor air and contaminant emissions from air pollution sources. PSCAA has jurisdiction to regulate air quality for King, Kitsap, Pierce, and Snohomish Counties.

In addition to monitoring pollutants, the PSCAA manages two programs focused on identifying health risks, providing information to the public, and regulating individual actions. The first of these programs is the Burn Ban program and is a mandatory set of requirements. Burning of any material in residential fireplaces and uncertified wood stoves are prohibited when PM2.5 (particulate matter with a diameter of 2.5 mm) levels reach 35 micrograms per cubic meter per 24-hour period (µg/m3/24 hrs) unless the fireplace or stove is the only source of adequate heat. A ban at this stage is known as a first stage ban. A second stage ban is enforced if PM2.5 levels exceed 60 µg/m3/24 hours. This ban prohibits the use of all wood-burning devices. The federal PM2.5 standard is 65 µg/m3/24 hours.

The second program, called Smog Watch, is a voluntary program designed to advise residents of potential smog problems and to recommend short-term actions they can take to help reduce maximum ozone levels (PSCAA, 2005). A smog watch is issued if temperatures in the upper 80s (°F) or higher with little or no wind are forecast for at least a 48-hour period.

The PSCAA regularly monitors six pollutants of concern or criteria air pollutants (CAPs) to reduce public health risks. Each CAP has been shown to cause significant human health effects, especially in the respiratory system. Table 8-2 lists some of the sources and health effects of CAPs.

Table 8-2. Criteria Air Pollutants, Sources, and Health Effects

Pollutant	Major Sources	Potential Health Effects
Particulate Matter (PM_{10} and $PM_{2.5}$)[a]	Motor vehicles Wood stoves Slash burning	Mortality Respiratory distress Asthma
Carbon Monoxide (CO)	Motor vehicles Aluminum production	Aggravated angina Headaches and dizziness from short-term exposure to high concentrations
Sulfur Dioxide (SO_2)	Fossil fuel burning Industrial sites (smelters, paper mills, power plants and steel manufacturing plants)	Increased respiratory infections Asthma
Nitrogen Dioxide (NO_x)	Fuel combustion (industrial furnaces and boilers) Motor vehicles	Respiratory diseases
Ozone (O_3)	Motor vehicles Gasoline delivery, storage	Asthma, chronic bronchitis Headache from short-term exposures
Lead (Pb)	Lead smelting Motor vehicles Lead-based paint	Learning deficits in children Hyperactivity

Source: PSCAA, 2005.

[a] Particulate matter with a diameter of less than or equal to 10 micrometers (µm) is referred to as PM_{10} and particulate matter with a diameter of less than or equal to 2.5 µm is referred to as $PM_{2.5}$. Particles as small as 2.5 micrometers or smaller may pose a more serious health danger because these particles have the ability to penetrate deeper into lung tissue. The EPA established new federal standards for $PM_{2.5}$ in 1997 (PSCAA, 2005).

These compounds represent a high priority for compliance with the federal Clean Air Act and contribute directly to the Air Quality Index (AQI), an EPA measure that monitors air quality. CAPs are monitored for each county throughout the year.

8.2 Impacts

Impacts related to sound and air environmental conditions were analyzed qualitatively in terms of potential effects resulting from implementation of the three Town Center action alternatives and the No Action alternative. Differences between the alternatives involve the amount and location of new and expanded roads, associated vehicular use increases, intensity and type of land use, and area remaining undeveloped.

8.2.1 Sound

8.2.1.1 Temporary Construction Impacts Common to All Action Alternatives

All three of the action alternatives would create construction related noise impacts, which could extend over the 25-year planning horizon. Construction of individual components of any adopted alternative would vary temporally and geographically, with noise impacts to any one portion of the Town Center planning area or adjacent areas occurring over a portion (or portions) of the 25-year planning period.

In general, it is expected that the greatest amount of noise would be produced during earth-moving and excavation stages of any construction activity, when heavy equipment (dozers, backhoes, etc.) and heavy trucks would be used. Diesel-powered construction equipment typically makes more noise compared to gasoline-powered vehicles. The low frequency noise of diesel engines travels farther and can impact older homes with less insulation and single-pane windows. Additionally, chains, metal truck beds, and vehicles rattling may temporarily create metal-to-metal noise.

As discussed above, temporary construction noise is exempt from city and state noise limitations. In the City of Sammamish, construction noise is exempt from noise regulations from 7:00 a.m. to 8:00 p.m. Monday through Friday and 9:00 a.m. to 6:00 p.m. Saturday and holidays. Construction noise is not allowed on Sundays (SMC 16.05.030).

8.2.1.2 Alternative 1 – Commercial Focus

Under Alternative 1, the Commercial Focus alternative, the highest densities of both residential and retail development would occur within the Town Center planning area. Approximately 46 percent of projected residential development would occur within the northwest quadrant of the planning area, largely due to the residential towers and mixed-use development included in this area under. Additional increases in densities would be spread throughout the remaining quadrants of the planning area.

Under this alternative, vehicular traffic is expected to increase more than for the other proposed alternatives, as discussed further in Chapter 7, Transportation. Likewise, noise produced from vehicular traffic under this alternative is expected to have a greater impact than under Alternatives 2, 3, and 4**.**

Generally, noise impacts will likely be most pronounced during typical a.m. and p.m. commutes, during which noise from vehicular traffic would be expected along all existing and proposed

roadways, and especially at the major intersections of: SE 4th Street and 228th Avenue SE; E Main Street and 228th Avenue SE; and at other proposed intersection locations.

Noise impacts from vehicular traffic and pedestrian traffic would be expected to occur throughout the day (during typical retail hours) at the commercial core proposed for the vicinity of the existing intersection of SE 4th Street and 224th Place SE. Residential noise, including lawn mowers and other landscaping equipment, generators, music, and other sources, would be expected to increase with higher residential densities. Certain outdoor noise sources would be reduced in high-density (multi-family and residential tower) residential areas, as outdoor noise making opportunities would no longer be available. Higher recreational use, and increased noise impacts, would be expected in the planning area's public parks.

8.2.1.3 Alternative 2 – Low Intensity

Noise impacts under Alternative 2, the Low Intensity Alternative would be from similar sources as those discussed under the Commercial Focus Alternative. The sources of noise would be largely the same, but a large reduction in vehicular traffic (as identified in Chapter 3-7, Transportation) is anticipated. This alternative would result in a large reduction in the frequency of noise production compared to the frequency anticipated under Alternatives 1 and 3. As in the other alternatives, the highest frequencies of vehicular noise would occur at existing and proposed major intersections.

Approximately 22 percent of residential density increase anticipated under Alternative 2 would occur as single-family development. Noise impacts from higher density single-family development differ from the predominantly multi-family development noise impacts associated with Alternatives 1 and 3. Outdoor residential noise sources, such as lawn mowers and other landscaping equipment, generators, music, and human voices, would increase above existing conditions and above Alternative 1 and 3 conditions.

8.2.1.4 Alternative 3 – Civic Focus

Noise impacts under Alternative 3, the Public Facility Focus Alternative would be similar to those occurring under Alternative 1. The sources of noise would be largely the same, but a small reduction in vehicular traffic (as identified in Chapter 3-7, Transportation) is anticipated. This alternative would result in a reduction in frequency of noise production. Specifically, residential development is projected to occur at 85% of the full build-out potential of Alternative 1. Additionally, the large residential/retail mixed-use development areas under Alternative 1 would occur as mixed-use residential/office development under Alternative 3. Although vehicular traffic would be reduced from Alternative 1 levels under this alternative, significant increases in noise impacts – above existing and Alternative 2 levels – associated with vehicular traffic should be anticipated, especially at the intersection of SE 4th Street and 228th Avenue SE.

The 4 acres of civic center land-use proposed under Alternative 3 would be a source of noise impacts from vehicular and pedestrian traffic during normal daytime hours. Additionally, certain civic locations would likely be the site of meetings and events both during daytime, evening, and occasional weekend hours; noise impacts associated with civic events would be anticipated.

8.2.1.5 Alternative 4 – No-Action

Under the No Action Alternative, limited expansion of existing residential densities would be expected within the Town Center planning area. Impacts would not be expected to increase or decrease from the existing levels described previously in Section 8.1, Affected Environment. No temporary or permanent noise impacts would result from this alternative.

8.2.2 Air

8.2.2.1 Temporary Impacts Common to All Action Alternatives

All three action alternatives would create construction related air impacts, which could extend periodically throughout the 25-year planning horizon. Construction of individual components of any adopted alternative would vary temporally and geographically, with air impacts to any one portion of the Town Center planning area or adjacent areas occurring over a portion (or portions) of the 25-year period.

In general, it is expected that the greatest amount of air impact would be produced during earth-moving and excavation stages of any construction activity, when heavy equipment (dozers, backhoes, etc.) and heavy trucks would be used. Diesel-powered construction equipment emits particulate pollutants to the air, affecting both a project site and project vicinity. Other project vehicles can release carbon monoxide, a green house gas, into the atmosphere. Additionally, earth moving, clearing, and grading activities can result in dust being released to the air, affecting both a project site and the project vicinity.

8.2.2.2 Alternative 1 – Commercial Focus

Under the Commercial Focus Alternative, the planning area under maximum potential build out would have higher residential densities than under any other action alternative. Levels of vehicular traffic, and vehicular carbon monoxide emissions would be higher under Alternatives 1 than any other alternative. High-density multi-family and townhome residential development would be expected to reduce emissions of fine particles and other pollutants (discussed in Section 8.1.2.2) from wood burning stoves and fireplaces and controlled outdoor fires.

8.2.2.3 Alternative 2 – Low Intensity

Under the Low Intensity Alternative, the planning area under maximum potential build out would have the lowest residential densities of the three action alternatives under consideration. Levels of vehicular traffic, and vehicular carbon monoxide emissions would be higher under Alternative 2 than with existing land use, however would be lower than under Alternatives 1 and 3. More residential development is planned as single-family homes under this alternative than other action alternatives; as such, higher levels of air pollution would be expected from wood burning fires.

8.2.2.4 Alternative 3 –Civic Focus

Under Alternative 3, the planning area under maximum potential build out would have residential densities similar to but lower than those under the Commercial Development

Alternative. Levels of vehicular traffic, and vehicular carbon monoxide emissions would be expected to be similar to those produced under Alternative 1. As discussed in the transportation impacts analysis in Chapter 3-7, however, vehicular emissions would be expected to be somewhat lower under Alternative 3 than Alternative 2. High density multifamily and townhome residential development would be expected to reduce emissions of fine particles and other pollutants (discussed in Section 8.1.2.2) from wood burning stoves and fireplaces and controlled outdoor fires.

8.2.2.5 Alternative 4 – No-Action

Under the No Action Alternative, no expansion of existing residential densities would be expected within the Town Center planning area. Air pollution sources and impacts would not be expected to increase or decrease from the existing levels described in previously in Section 8.1, Affected Environment. No temporary or permanent air impacts would result from this alternative.

8.3 Mitigation Measures

8.3.1 Sound

Mitigation measures to control noise impacts would be considered and developed on a project-by-project basis within the Town Center planning area. All infrastructure, civic, and private development activities would be required to comply with local and state noise regulations.

8.3.2 Air

Mitigation measures to control air impacts would be considered and developed on a project-by-project basis within the Town Center planning area. All infrastructure, civic, and private development activities would be required to comply with local, state, and national air regulations.

8.4 Significant Unavoidable Adverse Impacts

8.4.1 Sound

No significant unavoidable adverse noise impacts are expected to result from any of the proposed alternatives. Any adopted Town Center Sub-Area Plan would require associated development to comply with all local and state noise regulations.

8.4.2 Air

No significant unavoidable adverse air impacts are expected to result from any of the proposed alternatives. Any adopted Town Center Sub-Area Plan would require associated development to comply with all local and state air protection regulations.