

PART 3

Affected Environment, Impacts, and Mitigation Measures

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Some pages in this document have been purposefully skipped so that this document will copy correctly when duplexed.

Geology and Soils

Affected Environment

The geology of the Puget Sound region includes a thick sequence of over consolidated glacial and unconsolidated nonglacial soils overlying bedrock. Glacial deposits were formed by ice sheets originating in the mountains of British Columbia and by alpine glaciers that descended from the Olympic and Cascade mountains.

The surficial geology in the Washington Park Arboretum consists predominantly of glacially derived sediments. Glacial till, an unstratified compact mixture of boulders, cobbles, pebbles, sand, silt, and clay, underlies most of the soil in the park. Glacial till, often called hardpan, is very dense and has low permeability. Recent alluvium deposits are present along Arboretum Creek, which runs parallel to Lake Washington Boulevard East. The alluvium deposits typically consist of silt and fine to medium sand (Liesch et al. 1963).

According to a geologic map developed for the Washington Park Arboretum (Gessel 1966), sanitary landfill material has been identified in the area underlying the Japanese garden and extending southeast to the parking area. Additional landfill material has been identified along the western shoreline of Duck Bay and extending to the west for about 350 feet.

The Seattle (1996) critical areas maps identify an abandoned landfill underlying the Washington Park playfield to the south of the park, although only a small portion of the identified landfill area extends onto park property. The mapped critical areas have been generalized and are likely not as precise as the Gessel (1966) geologic map.

Mapping of surface soils within the park was reviewed to correlate the locations of wetland and upland areas (Gessel 1966; Emery 1977). The King County soil survey map does not include the Washington Park Arboretum because the site lies within an urban area (Snyder et al. 1973). Upland areas consist of nonhydic soils that include Alderwood gravelly sandy loam, Indianola fine sandy loam, and Kitsap silt loam. These upland areas consist of ridges oriented north/south on either side of Lake Washington Boulevard East, as well as Honeysuckle Hill. Another upland soil described in the park is of anthropomorphic origin, consisting of fill material overlying the native soils. Wetland areas within the park contain hydric soils such as Bellingham silty clay, Issaquah silt loam, Norma fine sandy loam, and peat. These wetland areas are restricted to the Arboretum Creek valley, the two ponds in the rhododendron glen, the shoreline of Lake Washington, and Foster Island. Figure 6 illustrates soil series mapping of the Washington Park Arboretum by Gessel (1966).

The Washington Growth Management Act (RCW 36.70A) requires each city and county to identify critical areas within its jurisdiction and to formulate development regulations for their protection. Among the critical areas designated by the statute are geologically hazardous areas, defined as areas that because of their susceptibility to erosion, sliding, earthquake, or other geologic events are not suited for development consistent with public health and safety concerns.

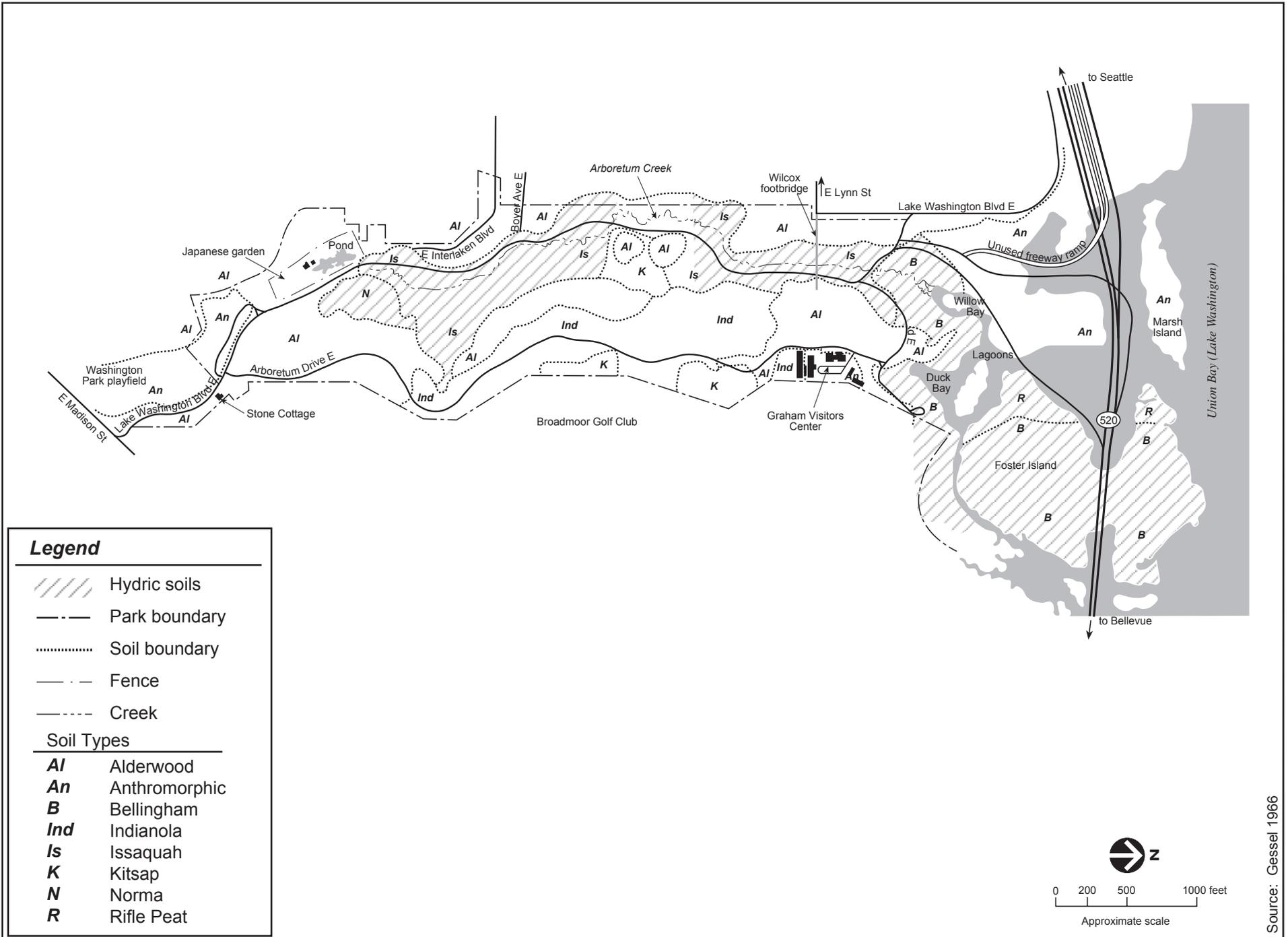


Figure 6. Soils map for Washington Park Arboretum.

The City of Seattle has developed regulations governing environmentally critical areas (Seattle Municipal Code 25.09). A series of maps or folios have been developed by the city to delineate geologically hazardous areas, including liquefaction-prone areas, known and potential slide areas, and steep slopes of 40 percent or greater (Seattle 1996).

Steep Slope and Landslide Hazard Areas

Steep slopes are generally defined as those that rise at an inclination of 40 percent or more with a vertical change of at least 10 feet. There are more than 25 such areas greater than 100 feet in length scattered throughout the park. Several large areas with steep slopes greater than 500 feet in length have also been identified in the southern portion of the park, particularly along the western boundary.

The Seattle critical areas maps do not designate any known or potential landslide areas within the Washington Park Arboretum (Seattle 1996). However, based on identified soil types, hydrologic conditions, and steep slope areas, potential slide areas may exist within the park.

Erosion

The shoreline around Duck Bay and other wetland banks, including areas along the creek, shows evidence of erosion, compacted soil, and dead vegetation resulting from overuse. The shoreline in this area changed when the Montlake cut was completed to connect Lake Union with Lake Washington. At that time the water level reportedly dropped about 11 feet, exposing areas consisting of silt and organic material that were extremely susceptible to erosion. Soil compaction and erosion around Duck Bay has been attributed to fishing, canoe and kayak usage, unstable fill soils in that area, wave action and water movement, runoff, pedestrian traffic along the banks, and waterfowl activity. Watercraft frequently land along the shoreline and are carried or dragged along the grass from the Duck Bay parking area into the bay (Wott 1999 personal communication).

Erosion from social trails (i.e., paths along the shoreline that have developed from overuse) has also contributed to the degradation of the shoreline. These paths have been covered with bark and mulch to control erosion and path width, but some of the mulch has washed into the bay. Estimates of shoreline erosion in the vicinity of Duck Bay range up to 8 feet within the last several decades (Wott 1999 personal communication).

Seismic Conditions

A major tectonic plate boundary between the Juan de Fuca plate and the North American plate lies just west of the Washington coast. This convergent boundary is the Cascadia subduction zone, and the shallow, dipping zone of contact between the two continental plates is the Cascadia fault zone (USGS 1996). Consequently, the Seattle area is susceptible to three types of earthquake: crustal, intraplate, and subduction earthquakes. Crustal earthquakes result from the

shifting of rock masses within the North American plate, whereas intraplate earthquakes involve shifting within the underlying Juan de Fuca plate. The 1949 Olympia earthquake and the 1965 Seattle earthquake (of magnitudes 7.1 and 6.5 on the Richter scale, respectively) are examples of intraplate events. While the recurrence interval for these intraplate events is uncertain, five events of magnitude 6.0 or greater have been recorded since 1870. Most of the earthquakes recorded historically in the Seattle area have occurred 25 to 35 miles deep within the Juan de Fuca plate (USGS 1996).

Subduction earthquakes typically occur along boundaries between converging tectonic plates. The Cascadia subduction zone, however, has not been historically seismic, and no record of thrust earthquakes has been identified over the 200-year period of record (McCrum et al. 1989). However, recent geological research indicates that western Washington is at risk from subduction earthquakes exceeding magnitude 8 on the Richter scale (Noson et al. 1988). Earthquakes of this type are estimated to have a 400- to 500-year return period.

Seismic Risk Zones

The uniform building code, which establishes building design standards used by architects and engineers, has assessed seismic risk in the Puget Sound region in order to provide earthquake design standards for regional construction. The Puget Sound region is currently classified in seismic zone 3 on the uniform building code seismic risk scale of zero (low risk) to 4 (high risk). However, following the recent determination that large earthquakes exceeding magnitude 8 have occurred in western Washington, reclassification of the Puget Sound region to zone 4 is under consideration.

Liquefaction

When shaken by an earthquake, certain soils are susceptible to liquefaction; i.e., they lose strength and temporarily behave like liquids. The seismically induced loss of strength can result in failure of the ground surface, most typically expressed as lateral spreads, surface cracks, settlement, or sand boils. A structure can sustain substantial damage during a large seismic event if it is supported in or on a soil susceptible to liquefaction. Seismically induced liquefaction typically occurs in loose, saturated, sandy material commonly associated with recent river, lake, and beach sedimentation. In addition, seismically induced liquefaction can be associated with areas of loose, saturated fill (Sound Transit 1999; USGS 1992).

The Seattle critical areas maps designate liquefaction-prone areas in the Washington Park Arboretum along the low-lying land masses around Duck Bay and along Arboretum Creek (Seattle 1996).

Environmental Impacts

As described above, some of the existing hydrogeologic and soil conditions found in the Washington Park Arboretum are susceptible to potential adverse impacts under the proposed plan or its alternative elements. These conditions are summarized in the list below, and the paragraphs that follow discuss the potential impacts that could result from each of the plan elements.

- The scattered, small areas of the park that have been identified as having steep slopes of greater than 40 percent could pose hazards to constructed features located on or adjacent to these slopes.
- Perched water may be encountered during construction activities because of the variability of the underlying glacial deposits.
- Exposed soils in areas of localized ground water could pose erosion or landslide hazards due to excess pore pressure within saturated soils.
- The Seattle area is susceptible to seismic activity, and the Puget Sound area including the Washington Park Arboretum is classified in seismic zone 3 according to the uniform building code (ICBO 1997). Liquefaction-prone areas have also been identified within the park. These areas are underlain by cohesionless soils of low density (usually in association with a shallow ground water table), which lose substantial strength during earthquakes.
- An abandoned landfill in the vicinity of the Washington Park playfield and sanitary landfill material in the northwest corner of the park have been identified.

Proposed Plan

Potential geological and seismic impacts of specific elements of the proposed plan are discussed below.

Roadways

The proposed roadway revision at the north entry to the park and the proposed Lake Washington Boulevard East improvements and pedestrian overpasses both lie within liquefaction-prone areas identified on city maps of environmentally critical areas (Seattle 1996). Sanitary landfill material underlies a portion of the area proposed for redesign of the intersection connecting Arboretum Drive East and the Japanese garden/Washington Park playfield parking lot with Lake Washington Boulevard East. This soil is also susceptible to liquefaction and might pose an environmental health risk to construction workers during site grading.

The realignment of Arboretum Drive East and consolidation of parking lots are proposed for locations adjacent to areas mapped as steep slopes. Where Arboretum Drive East would be relocated adjacent to the eastern property line of the park, cut slopes may require retention. Perched water may also be encountered during construction, which could cause erosion or landslide conditions.

Pedestrian and Bicycle Circulation

The proposed pedestrian trail along the west side of Lake Washington Boulevard East would pass through areas with steep slopes of 40 percent or more, as designated by the critical areas maps (Seattle 1996). Perched water encountered during construction could cause erosion or landslide conditions.

The proposed overpass on Lake Washington Boulevard East south of the Japanese garden and north of the Washington Park playfield both overlie liquefaction-prone areas.

Parking Facilities

The proposed consolidation, expansion, and addition of parking lots would be subject to the erosion and slope stability risks discussed above.

Buildings

The expansion of the operation and maintenance headquarters buildings is proposed adjacent to critical areas identified as steep slopes of 40 percent or more. Perched water could be encountered during construction, increasing the likelihood of erosion or landsliding.

Perched water, erosion, and steep-slope conditions could affect expansion of existing facilities and new construction proposed in the vicinity of the Graham Visitors Center.

Structural expansion and additions in the vicinity of the Japanese garden are proposed within liquefaction-prone areas and adjacent to an abandoned landfill.

Outdoor Shelters

One of the four proposed outdoor shelters (to be located on Foster Island) is proposed to be sited within a liquefaction-prone area. Construction of shelters, proposed at the rise with the alpine plant display and at Madrona Terrace, may encounter perched water, resulting in erosion.

Landscape Features

The proposed landscape features, including reorganization and addition of plant exhibits with habitat and boulevard improvements, would not result in any adverse impacts on geologic and soil conditions. Proposed landscape alterations would tend to have beneficial impacts, minimizing erosion risks and contributing to slope stability. Clearing required for new exhibits could pose temporary erosion risks.

Safety Features

No adverse geological impacts are expected to result from proposed lighting, telephone, and signage improvements. Elimination or reduction of existing parking areas may require the use of heavy equipment, and the exposure of soils could result in erosion during construction.

Alternatives to Proposed Plan Elements

Potential geological and seismic impacts of alternatives to the proposed plan elements are discussed below.

Four-Way Stop at North Entry to Washington Park Arboretum

Rerouting of the roadways in this area could result in soil erosion. This area is also a liquefaction-prone area.

Lake Washington Boulevard Improvements with At-Grade Crossings

No adverse geological impacts are expected to result from installation of at-grade crossings on the boulevard.

Arboretum Drive Parking Lot Consolidation with Restricted Access

Elimination or reduction of existing parking areas may require the use of heavy equipment, and the exposure of soils could result in erosion during construction.

Overpass at East Interlaken Boulevard

Construction of a pedestrian/bicycle overpass at the north end of the Japanese garden would occur within a liquefaction-prone area.

Separated Bicycle and Pedestrian Trails

The proposed pedestrian trail along the west side of Lake Washington Boulevard East would pass through areas with steep slopes of 40 percent or more, as designated by the Seattle (1996) critical areas maps. Perched water could be encountered during construction, increasing the likelihood of erosion or landsliding.

South-End Stop Light and Crosswalk

No adverse geological impacts are expected to result from an at-grade crossing.

Parking Lot Expansion at Dispersed Locations

The expansion of the Japanese garden/Washington Park playfield parking lot is proposed in a liquefaction-prone area and adjacent to an abandoned landfill.

Building Renovations without Expansion, and South-End Structure at Madrona Terrace

Perched water, erosion, and steep-slope conditions could affect new construction at the Madrona Terrace educational gateway site, depending upon the specific location of the facility.

Limited Educational Space Offerings

No adverse geological or seismic impacts are expected to result from building renovations required to accommodate two or three new indoor classrooms for education.

No Building Expansion, with Administration and Operations Moved Offsite

No adverse geological or seismic impacts are expected to result from building space reallocation at the Graham Visitors Center.

Limited Lighting and Telephone Improvements for Safety

No adverse geological impacts are expected to result from proposed lighting and telephone improvements.

No Action

Limited impacts may result from the no-action alternative. The consolidation, expansion, and addition of parking lots would be subject to the erosion and slope stability risks previously discussed. No adverse geological or seismic impacts are expected to result from the building renovations proposed under the 1978 master plan.

Mitigation Measures

All excavation and grading for roadways, trails, building foundations, and slope stabilization should be designed and executed in accordance with recommendations of a geotechnical engineer based on site-specific exploration of soil and ground water conditions.

Standard erosion control measures should be implemented during the earthwork portions of the project. These measures involve the use of water trucks to reduce dust, as well as the use of vegetative cover, temporary plastic sheeting, silt fences, siltation ponds, and other best management practices (BMPs) to temporarily control surface water drainage and reduce erosion of exposed soils.

Abandoned landfills are considered environmentally critical areas, and although it is unlikely that methane gas is produced by the abandoned landfill located at the south end of the park, development standards of the Seattle Municipal Code (chapter 25.09) must be followed during construction in this area. If contaminated soil is encountered during construction, proper handling and disposal of the contaminated materials are required in accordance with the Model Toxics Control Act cleanup regulation (Washington Administrative Code [WAC] 173-340).

During the proposed construction and renovation of buildings, roadway improvements, and trail modifications, no further mitigation measures would be required beyond compliance with Seattle Municipal Code chapter 25.09, regulations for environmentally critical areas, and seismic zone 3 design specifications. Site-specific engineering and geotechnical studies would be required to ensure the adequacy and stability of the local soils, particularly in liquefaction-prone areas.

Significant Unavoidable Adverse Impacts

No significant unavoidable adverse geological or seismic impacts from the proposed plan or alternative plan elements are expected, provided that recommended design, engineering, and construction practices are followed.

Air Quality

Affected Environment

This section briefly discusses the local climate, sources of air pollution, air quality standards and regulations, and existing air quality in the vicinity of the Washington Park Arboretum. Sources of information used to prepare this section include existing regulatory and permitting agency requirements, air quality monitoring data maintained by the Puget Sound Clean Air Agency and discussions with agency representatives, previous environmental documents prepared for other projects in the vicinity, and site visits to the area.

Climate

Weather in Seattle is characterized by sunny, mild days during summer and cloudy, wet days during winter. Prevailing winds in Seattle are from the southwest and average 9 miles per hour throughout the year. Occasionally, severe winter storms produce strong southerly or northerly winds. Peak wind speeds in excess of 40 miles per hour tend to occur between November and March.

Seasonal meteorological conditions, topography, and land uses largely control air quality in the Puget Sound area by enhancing or preventing dispersion of air pollutants. Wind prevents pollutants from concentrating by dispersing pollutants to areas of lower concentration. Periods of low wind velocity, however, allow pollutants to concentrate and ambient temperatures to increase, causing chemical reactions between volatile organic compounds and nitrogen oxides, thereby producing smog, the primary component of which is ground-level ozone. These conditions occur primarily during winter months when temperature inversions persist for several days (i.e., when warmer air blankets cooler air, trapping pollutants), often resulting in exceedance of local, state, and national air quality standards (PSCAA 1999).

Air Pollution Sources

Air contaminants that may concentrate at significant levels in urban areas include carbon monoxide, ozone, sulfur dioxide, nitrogen dioxide, and particulate matter. Motor vehicles produce approximately 90 percent of the carbon monoxide measured in urban areas. Carbon monoxide levels are typically highest during the winter months, especially during periods of air stagnation. Ground-level ozone, or smog, is formed near the ground when volatile organic compounds and nitrogen oxides react chemically. Ozone can lower resistance to pneumonia and the common cold and can cause irritation to the nose, throat, and lungs. Emissions from motor vehicles, gasoline and paint vapors, aerosol products, and industrial operations all contribute to ozone formation. Vehicular traffic and other pollutant sources add to existing smog, increasing pollutant density near pollutant sources. Sulfur dioxide, which can cause a variety of respiratory

diseases, is a colorless gas produced by industrial facilities such as smelters, paper mills, power plants, and steel manufacturing plants. Nitrogen dioxide is a poisonous gas formed from high-temperature fuel combustion and subsequent atmospheric reactions. Nitrogen dioxide in ambient air has been associated with a range of respiratory diseases (U. S. EPA 1993; PSCAA 1999).

Two types of fugitive dust or particulate matter are monitored and regulated by federal, state, and local government: total suspended particulates, having a diameter of less than 10 micrometers (abbreviated as PM_{10}), and fine particulate matter, having a diameter of less than 2.5 micrometers (abbreviated as $PM_{2.5}$). Particulate matter consists of discrete solid or aerosol particles dispersed in the air. PM_{10} and $PM_{2.5}$ cannot be seen with the human eye but can become lodged deep in the lungs, potentially damaging lung tissue and leading to serious respiratory problems. Wood smoke, wind-blown dust, and industrial emissions are the major sources of PM_{10} and $PM_{2.5}$ (PSCAA 1999).

According to the Puget Sound Clean Air Agency and the Washington Department of Ecology, vehicle usage is growing two to three times faster than Washington's rate of population increase. As a result, motor vehicles are the largest air pollution source in the state. Industry is the second largest source, followed by wood-burning stoves and outdoor burning. According to the U. S. Environmental Protection Agency (U. S. EPA), the three most common pollutants from these sources are particulate pollutants, carbon monoxide, and smog. As these common air contaminants accumulate and disperse, they undergo chemical reactions from wind and sunlight exposure to form the most prevalent criteria air pollutant, ground-level ozone.

Regulations and Standards

Air Pollutants

The U. S. EPA lists six "criteria pollutants" to be monitored as indicators of air quality and has identified for each of them a maximum concentration above which adverse human health effects may occur. These threshold concentrations are established as the national ambient air quality standards (NAAQS).

Key elements of the 1990 Clean Air Act Amendments include defining nonattainment areas, controlling hazardous pollutants at the source, reducing acid rain, requiring air quality permits and annual reporting for industrial polluters, instituting automobile tailpipe emission standards and oxygenated fuels, and phasing out ozone-depleting chlorofluorocarbons. *Nonattainment* is the term applied to areas where concentrations of pollutants exceed public health and environmental safety standards.

In compliance with the 1990 Clean Air Act Amendments, Washington state adopted the Clean Air Washington Act in 1991, which includes ambient air quality standards for criteria air pollutants that are at least as stringent as the federal standards for protection of health and the environment. The Clean Air Washington Act is administered by the Washington Department of Ecology and, in Seattle, by the Puget Sound Clean Air Agency (formerly known as the Puget

Sound Air Pollution Control Agency, or PSAPCA), which has air quality permitting responsibilities within the Puget Sound region.

Federal, state, and Puget Sound ambient air quality standards are shown in Table 4. The U.S. EPA established new standards for particulate matter (PM_{2.5}) and ozone in July 1997. These new standards are included in Table 4.

Table 4. Federal, state, and Puget Sound ambient air quality standards.

| Criteria Pollutants | Federal (National Ambient Air Quality Standards) | | Washington State | Puget Sound Region |
|--|--|--------------------|--------------------|--------------------|
| | Primary | Secondary | | |
| Nitrogen oxides, annual average (ppm) | 0.053 ^a | 0.053 ^a | 0.053 ^a | 0.053 ^a |
| Sulfur dioxide (ppm) | | | | |
| Annual average | 0.03 ^a | – | 0.02 ^a | 0.02 ^a |
| 24-hour average | 0.14 ^b | – | 0.10 ^b | 0.10 ^b |
| 3-hour average | – | 0.50 ^b | – | – |
| 1-hr, 2 times/7 days | – | – | 0.25 ^c | 0.25 ^c |
| 1-hr, 1 time/8 hours | – | – | 0.40 ^b | 0.40 ^b |
| Carbon monoxide (ppm) | | | | |
| 8-hour average | 9 ^b | – | 9 ^b | 9 ^b |
| 1-hour average | 35 ^b | – | 35 ^b | 35 ^b |
| Ozone (ppm) | | | | |
| 8-hour average ^d | 0.08 ^b | 0.08 ^b | 0.08 ^b | 0.08 ^b |
| 1-hour average ^e | 0.12 ^b | 0.12 ^b | 0.12 ^b | 0.12 ^b |
| Lead, calendar quarter average (µg/m ³) | 1.5 ^a | 1.5 ^a | – | 1.5 ^a |
| Particulate Matter (µg/m ³) | | | | |
| Total suspended particulates | | | | |
| Annual geometric mean | – | – | 60 ^a | 60 ^a |
| 24-hour average | – | – | 150 ^b | 150 ^b |
| Particulate matter (PM ₁₀) | | | | |
| Annual arithmetic mean | 50 | 50 | 50 | 50 |
| 24-hour average | 150 ^b | 150 ^b | 150 ^b | 150 ^b |
| Particulate matter (PM _{2.5}) ^d | | | | |
| Annual arithmetic average | 15 | 15 | 15 | 15 |
| 24-hour average | 65 | 65 | 65 | 65 |

^a Never to be exceeded.

^b Not to be exceeded more than once per year.

^c Not to be exceeded more than twice in 7 days.

^d New federal regulation adopted July 1997.

^e Currently, the 1-hour ozone standard is revoked and replaced by the new 8-hour standard when an area is shown to meet the 1-hour standard for 3 consecutive years. However, U. S. EPA has proposed to reinstate the 1-hour standard in nearly 3,000 counties in which the standard has been revoked since 1998.

ppm = parts per million.

µg/m³ = micrograms per cubic meter.

Source: Puget Sound Clean Air Agency (PSCAA 1999).

Odor

The Puget Sound Clean Air Agency regulates odorous emissions (through section 9.11 of Regulation I), which prohibits emission of any air contaminant in sufficient quantity, character, or duration to be injurious to human health, property, or plant or animal life. Section 9.11 also requires that odors not interfere with enjoyment of life or property.

The Seattle land use code (Seattle Municipal Code, chapter 23) also contains odor standards. These standards require venting odors, fumes, vapors, smoke, cinders, dust, and gas at least 10 feet above finished sidewalk grade, and directing odors away from residential uses within 50 feet of the vent.

Local Air Quality

Maintenance of pollution control programs involving industrial emission reporting, vehicle inspection, and use of oxygenated fuel during winter months has resulted in good air quality in Seattle overall since 1995 (PSCAA 1997, 1999). In 1995, PSAPCA estimated the background levels of carbon monoxide in urban areas of Puget Sound at 3.5 parts per million for the 8-hour average and 5 parts per million for the 1-hour average (Pade 1994, 1995 personal communications). These averages are now expected to be even lower. The Puget Sound region is an attainment area for all criteria pollutants monitored by the Puget Sound Clean Air Agency, with the exception of particulate matter (PM₁₀). Part of the Duwamish area in Seattle is still technically in nonattainment for PM₁₀, even though the agency has collected several years of clean air monitoring data in the area (Sound Transit 1999.)

In 1997 (the most recent year with complete data), no violation of any ambient air quality standard was measured. Preliminary data for January through September 1999 show that air quality has been generally good during the year.

Air Quality in the Washington Park Arboretum Vicinity

Motor vehicles are the primary source of air pollutants in the vicinity of the Washington Park Arboretum. Vehicles traveling on SR 520 to the north, Lake Washington Boulevard East and 24th Avenue East to the west, and East Madison Street to the east carry the most vehicles in the vicinity of the arboretum and likely contribute the largest amount of area air pollutants, especially during peak traffic times or other periods of traffic congestion. Vehicles traveling on streets located in or partially within the park (i.e., Lake Washington Boulevard East, East Interlaken Boulevard, Arboretum Drive East, Foster Island Road East, and the SR 520 ramps to and from the Boulevard through the park) also contribute to air pollution in the arboretum. Vehicles using the 19 small parking lots located throughout the park also contribute air pollutants. The numerous trees and other vegetation in the arboretum likely absorb and cleanse air pollutants, thereby improving air quality at ground level for humans and wildlife.

There are few other significant sources of air pollution in the project area, because the areas surrounding the Washington Park Arboretum are predominantly residential (i.e., the Montlake, Capitol Hill, Washington Park, Broadmoor, and Madison Park neighborhoods) or recreational (i.e., the Broadmoor Golf Club). Except for the carbon monoxide monitoring station in the University District, no other air monitoring stations are located in the vicinity of the park, and no air quality studies have been undertaken to determine existing conditions in the immediate vicinity (Anderson 1999 personal communication; Kircher 1999 personal communication). During periods of temperature inversion in the Seattle area, however, pollutants from vehicle exhaust may be trapped in the low atmosphere, temporarily causing higher ambient levels of carbon monoxide, oxides, and other pollutants.

Environmental Impacts

Proposed Plan

Roadways

Many of the proposed roadway improvements would result in temporary, localized increases in pollutant emissions from construction activities and equipment. These improvements include roadway revisions at the north entry to the Washington Park Arboretum, realigning the SR 520 ramps/Lake Washington Boulevard connection, modifying the unused freeway ramp with a multi-use link to the Museum of History and Industry, and relocating the northern one-third of Arboretum Drive eastward. Primarily, dust from excavation and grading would contribute to ambient concentrations of suspended particulate matter. Construction contractors must comply with Puget Sound Clean Air Agency Regulation I, section 9.15, which requires contractors to take reasonable precautions to minimize dust emissions.

Some of the roadway improvements would require using heavy equipment such as trucks and bulldozers during construction, along with smaller equipment including generators, pumps, and compressors. The engines on such equipment would emit air pollutants that would slightly degrade local air quality. However, these emissions and resulting concentrations typically would be exceeded by emissions from normal traffic in the Washington Park Arboretum vicinity, particularly in the northern project area around SR 520 and along Lake Washington Boulevard East. Consequently, as long as construction equipment is properly maintained and operated to minimize emissions, no significant air quality impacts would be expected to result from construction activities.

Some phases of construction would cause odors that could be detectable to people located at a distance from the construction site, particularly during any required paving operations. Odors also could result from diesel-powered equipment. Because prevailing winds in the area are typically southwesterly, odors would be directed more often toward Broadmoor Golf Club and over SR 520, and possibly the Broadmoor neighborhood; the Montlake area to the west is less likely to be affected. Regardless of wind direction, such odors would be temporary, and construction contractors must comply with Puget Sound Clean Air Agency Regulation I, section

9.11 prohibiting emissions of air pollutants and odor-bearing air contaminants sufficient to interfere with the reasonable enjoyment of life or property.

Proposed roadway features designed to improve pedestrian crossings on Lake Washington Boulevard would likely have a slight impact on local air quality. Traffic would be required to stop, thereby increasing vehicle idling, exhaust, and pollutants. The expected increase in park visitors would also likely bring more vehicles into and through the arboretum, increasing the total amount of air pollutants generated in the park.

The proposed plan is not likely to significantly increase carbon monoxide levels to the extent of creating or exacerbating a violation of the standard. Similarly, project operation is not expected to significantly increase particulate matter or cause violations of the standard.

Pedestrian and Bicycle Circulation

No significant air quality impacts related to proposed pedestrian and bicycle circulation improvements would be expected during construction or operation. Minor, short-term increases in dust could occur during construction of these improvements, particularly adding earthen fill for the wheelchair-accessible overpass over Foster Island Road East, constructing new pedestrian and bicycle trails, constructing the Lake Washington Boulevard overpass, and installing sidewalks.

Parking Facilities

Demolishing some of the existing parking lots, constructing new parking lots, and reconfiguring some existing lots would cause temporary, localized air quality and odor impacts, especially from demolition and paving equipment and operations (see the roadways section above).

Consolidating the many existing small parking lots throughout the park and increasing parking capacity would concentrate and slightly increase air pollutants from vehicles in the north end of the park. Similarly, adding a 30-car lot at Madrona Terrace near the south end of the park would bring additional vehicles and pollutants into a part of the park that currently receives little vehicular traffic. These impacts are not likely to be significant but could result in some odor (i.e., exhaust) impacts not currently experienced at Madrona Terrace, where traffic volumes are very low at present.

Buildings and Outdoor Shelters

Construction and renovation of all proposed buildings could cause temporary air quality impacts (see the roadways section above), affecting park visitors, employees, Broadmoor Golf Club golfers and visitors, and possibly residents closest to the westernmost construction projects, such as residents along the bluff or near 28th Avenue East during the Japanese garden renovations. Impacts on neighborhoods, however, would not be significant, because most building construction would take place away from potentially affected neighborhoods.

Operation of the new and renovated buildings would not significantly affect air quality. Increased activity throughout the park, especially increased vehicular activity in areas that currently are relatively undeveloped, would slightly increase air pollutants in those areas. Adjacent neighborhoods are not likely to be affected.

No significant air quality impacts related to proposed outdoor shelters would be expected. Minor, short-term increases in dust could occur during construction of these structures.

Landscape Features

No significant air quality impacts related to proposed landscape features would be expected. Minor, short-term increases in dust could occur during construction of some landscaping features.

Safety Features

No significant air quality impacts related to proposed safety features would be expected.

Alternatives to Proposed Plan Elements

Roadways

General construction and operational impacts from the alternative roadway improvements would be similar to those described above for the proposed plan. Demolishing the unused SR 520 ramps could create more dust and particulate matter than other construction projects under the proposed plan. Closing Arboretum Drive East to vehicular traffic and removing the small parking lots would minimize air quality impacts within the central part of the park. Installation of a four-way stop controlled intersection at the junction of Lake Washington Boulevard East, Foster Island Drive East, and the SR 520 ramps would increase traffic congestion, tending to increase air contaminant concentrations at these locations.

Pedestrian and Bicycle Circulation

General construction and operational impacts from the alternative pedestrian and bicycle improvements would be similar to those described for the proposed plan. No significant impacts would be expected.

Parking

General construction and operational impacts from the alternative parking improvements would be similar to those described for the proposed plan. Greater expansion of the Japanese garden/Washington Park playfield parking lot and retention of the scattered small parking lots along Arboretum Drive East could result in slightly worse air quality in those areas than would occur under the proposed plan. Fewer parking spaces and less vehicular traffic in the Madrona

Terrace area would result in slightly less adverse air quality impact in this area than under the proposed plan. These differences, however, would not be significant.

Buildings and Outdoor Shelters

General construction and operational impacts resulting from the alternative building improvements would be similar to those described for the proposed plan, but impacts would vary in extent throughout different areas of the park. Alternatives that move operations offsite or otherwise minimize the amount of construction and activities within the park would result in fewer air quality impacts than either the proposed plan or the no-action alternative. However, air quality impacts could occur elsewhere at offsite locations, depending on construction requirements and the location of the offsite facilities. Use of offsite locations would likely entail a small number of additional vehicle trips by staff to and from the arboretum.

Reducing the size and functions of the Madrona Terrace educational gateway structure and parking facilities at the south end of the park would result in slightly less vehicular activity and resulting air impacts in that area. Locating this facility at the Japanese garden entry would further decrease air impacts in the Madrona Terrace area but would slightly increase impacts near the Japanese garden. The increased parking required west of Lake Washington Boulevard East under this alternative would also increase air quality impacts near the Japanese garden. However, none of the building alternatives under consideration would result in significant air quality impacts.

General construction and operational impacts from the alternative outdoor shelter improvements would be similar to those described for the proposed plan. Constructing and operating one additional shelter would not result in significant air quality impacts.

Safety Features

Retaining the existing parking distribution through the park would result in slightly higher air quality impacts through the middle of the park than the other alternatives that close these lots. However, no significant air quality impacts related to proposed safety features would be expected.

No Action

In general, air quality impacts under the no-action alternative would likely occur to a somewhat lesser degree than under the proposed plan and some of the alternative elements, because fewer construction and operational activities would occur. The proposed 20-car parking lot near the Boyer Avenue East/Lake Washington Boulevard East intersection could slightly increase vehicular activity and exhaust in that area, potentially affecting nearby residents. General visitation is expected to grow, which would likely result in worsening congestion in areas where congestion already occurs, thereby exacerbating local impacts on air quality. However, no significant air quality impacts would be expected under the no-action alternative.

Mitigation Measures

Emissions from construction equipment and trucks can be reduced by using relatively new, well-maintained equipment. Avoiding prolonged periods of vehicle idling also would reduce emissions.

Construction contractors must comply with Puget Sound Clean Air Agency Regulation I, sections 9.11 and 9.15 requiring reasonable precautions to minimize odor and dust impacts. Dust produced by construction activities could be reduced in several ways. Areas of exposed soils could be sprayed with water or other dust suppressants. Soil tracked out of the construction area by trucks could be reduced by washing off deposits of mud, dirt, and other debris from vehicle bodies, fenders, frames, undercarriages, and wheels. Covering dusty truck loads and providing adequate freeboard to prevent spillage can also minimize dispersal of fugitive dust from construction trucks. Finally, soil that does escape the construction area on exiting vehicles could be reduced with an effective street-cleaning effort.

Trucking of materials to and from the project site could be scheduled to minimize congestion by avoiding peak-hour travel times. This measure in turn would minimize secondary air quality impacts caused by traffic traveling at reduced speeds.

No operational mitigation measures would be required. Project-generated carbon monoxide concentrations near the areas with the highest potential for air quality problems would comply with established standards. Mitigation measures related to roadway modifications along Lake Washington Boulevard East, described in the transportation section, would also mitigate potential air quality impacts associated with increased traffic congestion.

Significant Unavoidable Adverse Impacts

With implementation of the proposed mitigation measures, no significant unavoidable adverse air quality impacts would be expected under any of the alternatives.

Water Resources

Affected Environment

This section discusses the existing characteristics of water resources in and near the Washington Park Arboretum. The water bodies in the park include the shoreline of Lake Washington, Arboretum Creek, and three tributary channels and small ponds that drain into Arboretum Creek (Figure 7). Several wetland areas are associated with these surface water features and include forested, scrub/shrub, emergent, and aquatic plant communities. The hydrology of these streams and wetlands is influenced by storm drainage systems in the park, ground water movement, lawn and garden irrigation, and drainage from the Broadmoor Golf Club grounds. The water quality of surface water bodies within the park is affected by runoff from paved surfaces, waterfowl, and the application of fertilizers and pesticides within the park and at the Broadmoor golf course. The following sections describe the water resources of the Washington Park Arboretum that may be affected by the alternatives under consideration.

The hydrology and water quality conditions within the Washington Park Arboretum were evaluated based on a literature review, field survey of surface water features, water quality samples, wetland reconnaissance, and interviews with arboretum and city staff. Much of the information was obtained during preparation of the 1997 master plan (Portico 1997). Information collected for this investigation included:

- Topographic maps from the U. S. Geological Survey (USGS) and other sources were reviewed to identify landscape features and major drainage patterns (USGS/NOAA 1983; Portico 1996)
- A nautical chart of the Lake Washington ship canal showing near-shore bathymetric contours in Union Bay and around Foster Island was reviewed (NOAA 1983)
- Aerial photographs were reviewed to evaluate land use characteristics in the park
- Support materials assembled by staff from the University of Washington and Washington Park Arboretum were reviewed for site-specific information on the arboretum (University of Washington 1996)
- Storm flow and base flow water quality samples were collected at the headwaters and mouth of Arboretum Creek
- A reconnaissance of the entire project vicinity was performed to identify and characterize water bodies.

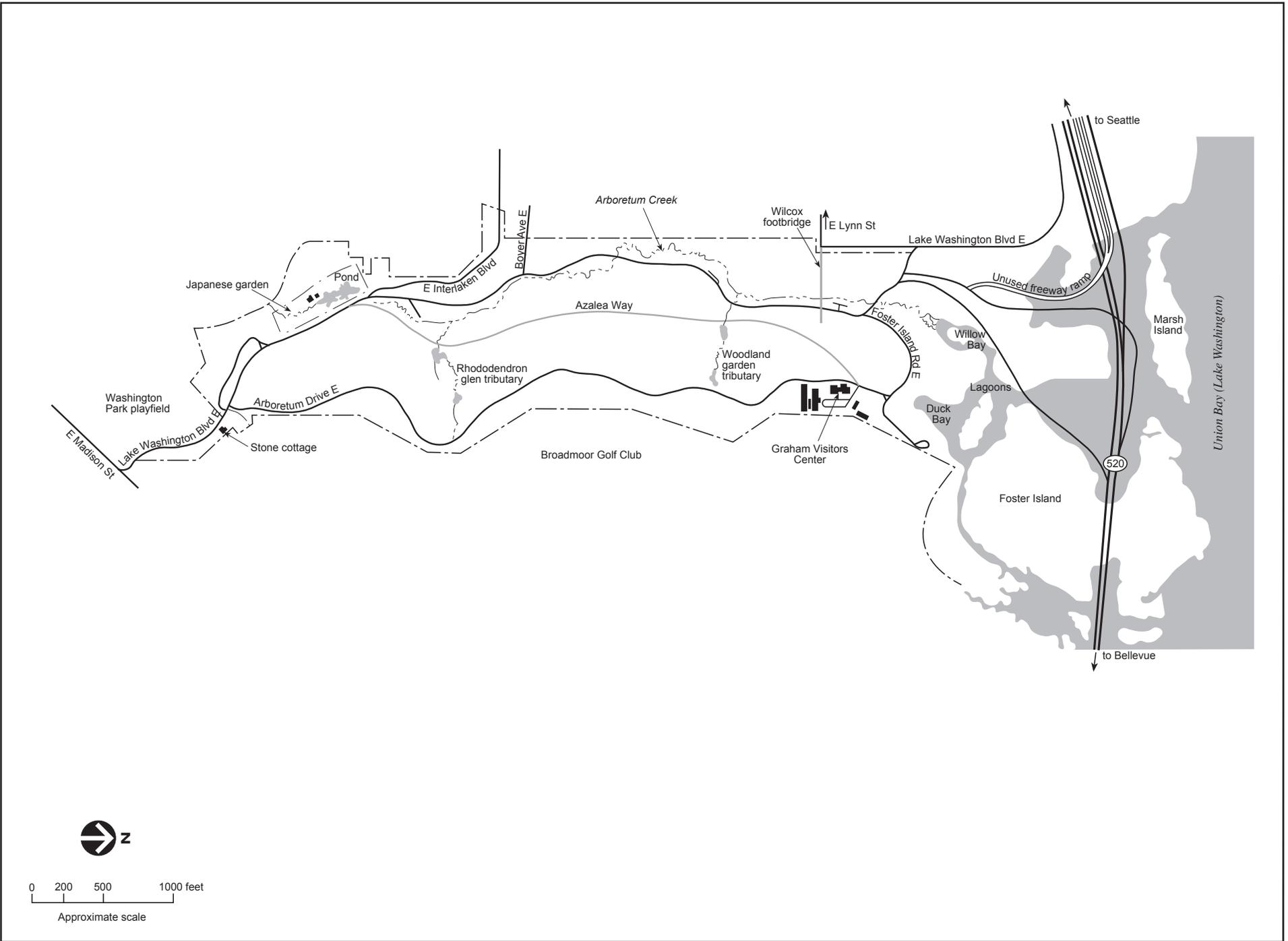


Figure 7. Water resources in the vicinity of the Washington Park Arboretum.

General Watershed Characteristics

The Washington Park Arboretum lies within the 1,020-acre watershed of Arboretum Creek, adjacent to and west of the Broadmoor golf course and the Harrison Valley to the south. Its topography is dominated by north/south oriented ridges and valleys that slope north toward Lake Washington (University of Washington 1996). The site consists of a mixture of steep ridge slopes, gently undulating upland areas, and grassy flats that vary in drainage patterns.

The predominant water bodies in the Washington Park Arboretum include the shoreline of Lake Washington, Arboretum Creek (flowing north through the park), one pond and an associated tributary channel in the Japanese garden, two ponds and an associated tributary channel in the woodland garden area, two ponds and an associated tributary channel in the rhododendron glen, and a small stream near the stone cottage (Figure 7).

Lake Washington Shoreline

Lake Washington forms the northern boundary of the Washington Park Arboretum and is the most significant water body in the park. In the vicinity of the park, the lake is a mixture of shallow inlets (Willow Bay, Duck Bay, and the lagoons) and islands (Foster Island, Marsh Island, and two unnamed islands). The islands provide considerable protection from shoreline erosion within the park boundaries; however, stormwater discharges (mostly via flow in Arboretum Creek) have caused localized shoreline erosion. Extensive wetland systems dominate the shoreline. These include palustrine emergent, scrub/shrub, and forested wetlands, and lacustrine littoral, aquatic bed, and open-water wetlands. The plants and animals section of this document provides detailed information on wetlands within the park.

Water quality in Lake Washington varies; the southern portion receives a substantial amount of flow from the relatively clean Cedar River (50 percent of total lake inflow). Pollutant inputs are more significant in the northern sections where runoff originates from more developed watersheds. In addition, significant amounts of fine sediment have been transported to the lake from Arboretum Creek. Overall, water quality in the lake is good, although increasing development in the Lake Washington basin can be expected to contribute to cumulative water quality impacts occurring in the lake.

Arboretum Creek

The 230-acre park is drained by Arboretum Creek. Arboretum Creek is a relatively small stream that flows from south to north through a well-defined, meandering channel along the length of the park, paralleling Lake Washington Boulevard East (Figure 7). The creek's natural watershed once consisted of a total of 1,020 acres, including a predominantly urban area south of East Madison Street. During the early part of the 20th century, the valley was bisected by the earthfill at East Madison Street, blocking the natural path of the creek. Stormwater from roughly 595 acres of the creek's watershed, upstream of the Madison Street blockage, was subsequently

routed to the combined stormwater/sanitary sewer system. Presently, flow that enters this sewer system is conveyed several miles to the West Point wastewater treatment plant on the shore of Puget Sound. Much of the surface runoff from the remaining 425 acres of the watershed north of East Madison Street still contributes flow to Arboretum Creek, although localized portions from residential areas have also been routed to the combined stormwater/ sanitary sewer system.

The headwaters of the creek begin near the pond in the Japanese garden. The pond is connected to the park's irrigation system (supplied by the city water system). A timer in the irrigation system supplements flow to the pond, maintaining the waterfall at the pond and flow in the headwaters when rainfall is limited. During the rainy season, surface runoff from a nearby hillslope contributes flow to the pond, thereby providing flow to the headwaters of the creek system. As Arboretum Creek flows from the Japanese garden pond toward Lake Washington, three main tributaries (discussed in detail in subsequent sections) contribute additional flow.

Beginning at the pond in the Japanese garden, Arboretum Creek flows through a culvert underneath Lake Washington Boulevard East and surfaces on the other side. The creek continues to parallel the east shoulder of Lake Washington Boulevard East for another 700 feet before meeting the tributary draining the rhododendron glen. The creek continues to parallel the east shoulder of the boulevard for an additional 1,450 feet before reaching a culvert that carries flow back under the roadway near Honeysuckle Hill. The channel then parallels the west shoulder of the boulevard for approximately 1,650 feet as it meanders through a 50-foot-wide floodplain. The soils in this area are generally wet and very muddy. An extensive network of french drains (perforated pipe laid in gravel) have been installed east of Lake Washington Boulevard to help improve drainage in the area. The woodland garden tributary also discharges into Arboretum Creek within this segment. Beyond the floodplain area, the stream flows in a culvert for 270 feet underneath Lake Washington Boulevard East and a parking lot before surfacing near the Wilcox footbridge at East Lynn Street. The stream continues on for approximately 400 feet through an open channel with incised banks to Willow Bay. The mouth of Arboretum Creek is located in Willow Bay along the Lake Washington shoreline near the eastbound on-ramp for SR 520.

Japanese Garden Tributary

As noted above, the pond in the Japanese garden is considered the headwaters of Arboretum Creek. Flow to the pond is provided by small seeps and surface runoff originating from the adjacent hillslope and offsite property. Flow in the pond is augmented by water from the city's piped distribution system to maintain the pond's waterfall during dry-weather periods.

Woodland Garden Tributary

The woodland garden tributary to Arboretum Creek (Figure 7) drains two ponds and associated emergent wetlands. Proceeding upstream from its confluence with Arboretum Creek, the tributary is culverted for 100 feet underneath Lake Washington Boulevard East. The tributary surfaces for 50 feet before turning into another culvert that passes underneath Azalea Way for 100 feet, emerging again at the lower pond. The remaining 200 feet of the tributary consists of a

narrow channel connecting the lower pond to the upper pond. The tributary receives flow from the subsurface drain system within the Broadmoor Golf Club grounds that is culverted into the upper pond. During the drier summer months, the segment originating from the golf course usually is dry. The tributary flow is augmented by ground water springs and subsurface drainage from within the park that essentially flow year-round in the woodland garden area.

Rhododendron Glen Tributary

Another tributary to Arboretum Creek originates in the rhododendron glen and receives flow from two ponds, emergent wetlands along the shorelines, and tributary channels (Figure 7). Proceeding upstream from its confluence with Arboretum Creek, this tributary consists of an open channel that meanders for 130 feet. The tributary is culverted underneath Azalea Way for 100 feet from the outlet of the reflecting pool. A small channel alternating between open and culverted sections leads uphill from the reflecting pool for 330 feet to the upper pond. A second smaller channel to the south connects flow from subsurface soil drains and seeps to the reflecting ponds. Above the upper pond, a steep intermittent channel occurs in a ravine for 320 feet between Arboretum Drive East and the upper pond. This tributary originates from a subsurface drain system in the Broadmoor golf course that is culverted into the ravine (dry during summer). This flow is augmented by year-round ground water seeps along the creek, adjacent to the trail through the rhododendron glen.

Stone Cottage Tributary

Another small creek channel exists in the southeast corner of the park, near the stone cottage. Flow in the channel originates from subsurface drainage in the Broadmoor golf course, which is supplemented during the wet season by ground water seeps along the creek. The creek flows for 200 feet along the south shoulder of Arboretum Drive East to the intersection with Lake Washington Boulevard East. The creek then empties into a storm drain catch basin that crosses underneath the Japanese garden and connects to another storm drainpipe near the Wilcox footbridge. Flow within the stone cottage tributary generally is low during the summer months but seems to persist year-round.

Irrigation Water

Surface water drainage in the park is influenced by the irrigation of grass lawns and scientific plant collections (University of Washington 1996). The original irrigation system installed in 1938 is still in use and is in varying states of decline within the pinetum, East Madison Street, lagoons, and Foster Island areas. Irrigation lines were installed in the lilac area in 1970 and an automatic system and upgrade of other lines were completed in 1980. Supplemental irrigation during periods of low precipitation has resulted in increased soil saturation, surface runoff, and ground water discharge in the park during normally drier conditions (University of Washington 1996).

Irrigation of the Broadmoor golf course also contributes significant flow to Arboretum Creek. Approximately 80 acres of the 126-acre course is irrigated (Hilprets 1999 personal communication), much of which drains to Arboretum Creek in surface drainage, underground flow collection systems, or ground water seeps. Water quality and quantity in the creek, therefore, are influenced by the golf course management practices.

Ground Water

Springs and seeps are common throughout the steeper slopes of the park and contribute to soil saturation in the valleys and at the bases of slopes. Of the numerous locations that experience seasonal wetness, four major areas are distinct in that seasonal wetness restricts use in these areas:

- The area of the lookout pond and slopes from the rhododendron glen to the south across from the Japanese garden
- The flats below Azalea Way to Lake Washington Boulevard East, from the parking lot at Boyer Avenue East to the Loderi crossing
- West of Azalea Way in the vicinity of the lower woodland pond
- The perimeter of Duck Bay.

Limited information is available on deeper ground water conditions in the project vicinity. Because none of the proposed alternatives is anticipated to affect deeper ground water in the area, deeper ground water is not addressed here.

Drainage Systems

An extensive drainage system exists within the park to collect ground water. Much of the original system, installed in 1938, is dysfunctional and in need of repair (University of Washington 1996). Clay tiles have broken or filled in with sediment in many places, thereby allowing ground water to saturate the soils and cause slumping in some areas, such as in the rhododendron glen. Many small drainage systems have been installed since the 1960s in specific display gardens. Drainage systems for Azalea Way were installed in 1988 and are in need of additional improvements.

Subdrainage Systems

The health of many plants is dependent on adequate drainage. For example, plants within the *Sorbus* collection have suffered because proper drainage has not been provided beneath the ground surface. Recent improvements have been implemented in an effort to revive the collection. In contrast, an appropriate subdrainage system (underground) was installed in the winter garden, and the collections there have since thrived.

Attempts have been made since the 1930s to drain the many remaining wet areas. These efforts have met with mixed success or have become less effective as they age. Many of the old subdrain systems have become clogged or broken by tree roots, while others have been rendered ineffective by soil movement along the slopes. In some areas collection systems direct water to broken conveyance lines, concentrating the water where it creates another problem.

Water Quality

The water quality of surface water bodies in the Washington Park Arboretum is affected by roadway runoff within and outside the park, fertilizer and pesticide applications in the park and on the Broadmoor golf course, and miscellaneous land uses within the park boundaries. Two water quality samples were collected for this study during a November 1999 storm event. The sampling data reflect conditions typical of urban streams in the Seattle area, with a general decrease in water quality between the upstream and downstream stations. The upstream sampling station is located on the hillslope southwest of the Japanese garden, where flow ultimately reaches the ponds through the french drains. The downstream sampling station is located at the mouth of Arboretum Creek, approximately 20 feet upstream of Willow Bay.

Table 5 summarizes the results of water quality analyses of these samples. The data indicate that both stations on Arboretum Creek had slightly degraded water quality compared to the average storm flow conditions reported for 23 similar streams in King County (Metro 1994). In addition, the storm samples collected in Arboretum Creek exceeded several of the applicable state Class AA water quality standards (WAC 173-201A; Ecology 1997). In particular, minor violations occurred for dissolved oxygen (upstream and downstream), turbidity (upstream), and fecal coliform bacteria (upstream and downstream). However, the water quality conditions measured in Arboretum Creek also were well below the maximum values reported for the King County streams (Metro 1994). Overall, although the data do not indicate severely degraded conditions in the creek, they show clear signs of human impacts on water quality between the upstream and downstream stations.

Table 5. Storm flow monitoring data from Arboretum Creek, November 1999.

| Water Quality Parameter | Upstream Location | Downstream Location | Class AA Standard |
|--|-------------------|---------------------|----------------------|
| Temperature (°C) | 10.2 | 10.4 | ≤16 |
| pH | 7.8 | 6.8 | 6.5 to 8.5 |
| Dissolved oxygen (mg/L) | 9.1 | 9.0 | >9.5 |
| Turbidity (NTU) | 40 | 56 | ≤5 over background |
| Soluble reactive phosphorus (mg/L) | 0.258 | 0.041 | – |
| NO ₃ + NO ₂ (mg/L) | 0.142 | 1.11 | – |
| Total suspended solids (mg/L) | 53 | 46 | – |
| Fecal coliform bacteria (#/100 mL) | 480 | 1,020 | ≤10% of samples >100 |
| Dissolved copper (mg/L) | <0.0010 | 0.0071 | 0.0089 ^a |
| Dissolved zinc (mg/L) | <0.003 | 0.011 | 0.0636 ^a |

^a Acute (1-hour average) toxicity criterion assuming hardness of 50 mg/L (average storm flow value for King County streams [Metro 1994]).
 mg/L milligrams per liter. NTU nephelometric turbidity units mL milliliters

Stormwater runoff from roads and parking lots in the Washington Park Arboretum and in nearby areas likely contains petroleum hydrocarbons, heavy metals, and suspended sediments. These types of pollutants are common in runoff from roadways throughout the region. The application of fertilizers, pesticides, herbicides, and fungicides in the Broadmoor golf course and the Washington Park Arboretum may contribute nutrients (nitrogen and phosphorus) and toxic chemicals that degrade water quality. Nutrient enrichment of the waters along the Lake Washington shoreline contributes to algal blooms, low dissolved oxygen levels in localized areas, and increased productivity. Fecal coliform bacteria from domestic animals (e.g., dogs and cats) and waterfowl also may be elevated in these water bodies and are indicative of the potential presence of other pathogenic microorganisms.

Environmental Impacts

In general, the activities and physical alterations associated with any of the proposed development plans are not expected to result in significant impacts on water resources, provided that applicable city, state, and federal environmental regulations are met. Precise calculations of impervious surface area and runoff volumes under the various alternatives cannot be made at this time, given the programmatic level of design detail available. New impervious surfaces areas would include roadway revisions, new or expanded parking areas, the dual-use trail, buildings, shelters, and circulation areas near buildings. Impervious surface areas would be removed in several existing parking areas, at the greenhouses (which would be replaced with approximately the same area of new greenhouses), and in locations where roads are realigned. Some trails that are currently turf or wood chips, along with some new trails, would be surfaced with crushed rock (to reduce erosion and improve accessibility for the disabled). Any of the proposed improvement plans would be required to meet or exceed the requirements of the Seattle stormwater, grading, and erosion control code, ordinance 117789, chapter 22.8.

The proximity of the project area to Lake Washington, a designated surface water with capacity to receive drainage discharges without adverse hydrologic effects (Seattle ordinance 117789), and the low likelihood of a substantial increase in pollutant loadings under any of the development alternatives, suggest that net impacts on water resources would be minimal. The following discussion focuses on surface water impacts, because it is expected that ground water beneath the Washington Park Arboretum area would be generally unaffected, and there are no known well users in the vicinity.

Proposed Plan

Roadways

Roadway improvements under the proposed plan, including the relocation of some existing roadways, are not expected to result in significant increases in impervious surface areas or corresponding increases in pollutant loads discharged to surface waters in the project area. Although many pollutants are typically present in road surface runoff (including oil and grease,

hydrocarbons, metals, suspended solids, and toxic organic compounds), runoff from new roadway and parking surfaces would be subject to the appropriate water quantity and quality controls, as outlined in ordinance 117789. The new roadway surfaces should not contribute significant pollutant loads to surface waters. Moreover, because existing roadway runoff currently receives no water quality treatment, the removal of some existing roadways could result in a net reduction of pollutant loading.

Specific treatment and peak flow control (detention) requirements would depend on final development plans, but could include water quality treatment and detention facilities. The proposed addition of pedestrian and bicycle trails along Lake Washington Boulevard East would also increase impervious surface coverage and hence runoff volumes. However, these trails would not increase motor vehicle traffic and therefore would not significantly contribute to the loadings of typical roadway pollutants.

Construction-phase impacts of the roadway modifications could result in significant impacts on water resources if appropriate erosion and sediment control measures are not implemented. Although City of Seattle regulations require temporary erosion and sediment control measures at construction sites, these measures can be ineffective if they are not planned, designed, and maintained appropriately. In particular, the areas of proposed roadway construction near the mouth of Arboretum Creek and the Lake Washington shoreline have a high potential for transport of eroded material directly to surface waters. In addition, the construction of a pedestrian overpass could result in a large amount of disturbed area that would require effective erosion control measures. The proper design and maintenance of temporary erosion and sediment control facilities is crucial to the prevention of water quality problems. Implementation of effective erosion and sediment control measures as required in chapter 22.8 of the Seattle Municipal Code (SMC) would greatly reduce the potential for erosion and sediment transport and would help prevent significant impacts on water resources during construction.

Long-term impacts on water resources are not expected to be significant. Water quality treatment facilities that would be required to comply with city regulations (e.g., wet vaults or bioswales) should minimize long-term operational impacts on water quality. Treatment facilities would not remove all of the pollutants generated in new roadway areas but would reduce a substantial proportion of them. If the treatment facilities provided for the new roadways are adequately maintained over time, runoff from the new roadways only would cause minor water quality impacts, if any.

In addition, it is possible that minor increases in peak flows could occur in Arboretum Creek because detention may not be required for discharges of runoff from new impervious areas. Current city regulations (ordinance 117789) allow an exemption from detention requirements if runoff would enter Lake Washington within a short distance downstream and if the conveyance system that carries the runoff to the lake would not be adversely affected. There are no concerns related to high-flow impacts in the lake or in the lower reaches of Arboretum Creek, and therefore an exception to the city's normal peak flow control requirements could be obtained. Because the proposed roadway improvements would constitute a small portion of the drainage area (less than 1 percent) for the creek, the effects of increased storm flows would be minimal.

City engineering staff should be consulted during the design stage of proposed improvements to verify the stormwater management requirements that apply to the project.

Pedestrian and Bicycle Circulation

Improvements to pedestrian and bicycle circulation under the proposed plan would result in an increase in impervious surface areas and a corresponding increase in stormwater runoff rates and volumes that reach surface waters in the project area. As with the new roadways that are proposed, these improvements would also be subject to the applicable water quantity and quality controls as outlined in Seattle ordinance 117789. Permanent water quality treatment facilities would not be necessary, because no significant pollutant loads would be generated from these types of impervious areas. Thus, no significant impacts on water quality are expected. However, the increase in impervious ground cover would result in an increase in runoff to surface waters and may require water quantity control facilities. As discussed previously, direct discharges of runoff without detention in various areas of the park may be acceptable under current city regulations (Seattle ordinance 117789), because that runoff would enter Lake Washington within a short distance downstream. Provided that the natural or constructed conveyance systems in the vicinity of the pedestrian and bicycle improvements can convey the increased flows without damage or surcharging, the increases in flow rates would not cause adverse impacts.

As with new roadways, construction activities related to the pedestrian and bicycle improvements could result in significant impacts on water resources if appropriate erosion and sediment control measures are not implemented. The proper design and maintenance of temporary erosion and sediment control facilities are crucial to the prevention of water quality problems. Implementation of effective erosion and sedimentation control measures, as required under the city code, would significantly reduce the potential for erosion and sediment transport and would help prevent significant surface water impacts during construction.

Parking Facilities

The proposed net increase in parking area would result in an increase in impervious surface areas and a corresponding increase in pollutant loads to surface waters in the project area. The construction and operation of parking facilities would have impacts similar to those discussed for roadway improvements. These portions of the proposed development would be subject to the appropriate water quantity and quality controls as outlined in Seattle ordinance 117789. Specific treatment and detention requirements would depend on final development plans but would likely include water quality treatment facilities at a minimum.

Construction activities associated with the parking lot modifications could result in significant impacts on water resources if appropriate erosion and sediment control measures are not implemented. In particular, the proposed modifications (parking expansions and removals) near the mouth of Arboretum Creek and the Lake Washington shoreline have a high potential for transport of eroded material directly to surface waters. The proper design and maintenance of temporary erosion and sediment control facilities is crucial to the prevention of water quality

problems. Implementation of effective erosion and sedimentation control measures, as required under the city code, would greatly reduce the potential for erosion and sediment transport and would serve to prevent significant impacts on surface waters during construction.

Long-term impacts on water resources associated with proposed parking modifications are not expected to be significant. Water quality treatment facilities that would be required by city regulations should minimize any associated long-term operational impacts on water quality. Treatment facilities would not remove all of the pollutants generated in new parking areas but would reduce a substantial proportion of them. If the treatment facilities provided for the new parking areas are adequately maintained over time, runoff from these areas would be expected to cause only minor water quality impacts, if any.

As discussed for new roadway areas and bicycle and pedestrian facilities, it is possible that minor increases in peak flows could occur in small drainage systems and in Arboretum Creek, because detention may not be required for discharges of runoff from new impervious areas. The increases in peak flow rates that could result from improvements to parking areas would likely not cause adverse hydrologic impacts as existing conveyance systems should be able to handle increased flows. City engineering staff should be consulted during the design stage of proposed parking improvements to verify the stormwater management requirements that apply to the project.

Buildings

The net increase in impervious surfaces associated with the proposed building expansions would result in an increase in impervious surfaces and a corresponding increase in stormwater runoff rates and volumes that reach surface waters in the project area. As with other improvements proposed for the Washington Park Arboretum, any development of buildings on site also would be subject to the appropriate stormwater controls outlined in Seattle ordinance 117789.

Permanent water quality treatment facilities likely would not be necessary, as significant pollutant loads would not be expected from the new rooftop areas. If the selected roofing materials do not include galvanized (zinc) flashing and/or copper strips for moss control or for ornamental purposes, no long-term impacts on water quality are expected. The increase in impervious surface coverage may require water quantity control, although as discussed for other proposed improvements it is possible that an exception to city detention requirements could be obtained. Provided that the natural or constructed conveyance systems in the vicinity of proposed buildings can handle the increased flows, the increases in flow rates would not cause adverse impacts.

Construction-phase impacts of new buildings and building renovations would result in areas of disturbed soils, and therefore could result in significant impacts on surface waters if appropriate erosion and sediment control measures are not implemented. The proper design and maintenance of temporary erosion and sediment control facilities is crucial to the prevention of water quality problems. Implementation of effective erosion and sedimentation control measures, as required under the city code, would greatly reduce the potential for erosion and

sediment transport and would help prevent significant impacts on surface waters during construction.

Outdoor Shelters

Construction and operation of additional outdoor shelters would have nearly the same impacts as those associated with the construction of new buildings. The net increase of impervious area would place a greater burden on the receiving systems (due to increased runoff rates) but is not expected to result in significant adverse impacts. Likewise, construction of the shelters has the potential to result in the transport of eroded sediment to surface waters. The net impact of construction activities for outdoor shelters depends on the effectiveness of erosion and sediment control measures that would be applied in accordance with city requirements, but is not expected to be significant.

Landscape Features

In general, the proposed changes to landscape features are not expected to result in any significant adverse impacts on water resources. Small-scale construction activities, additional plantings, and exhibit restorations would have no impact on water resources, provided that heavy construction equipment is not required. If heavy equipment is required in the landscaping modifications, erosion control measures may be necessary to reduce or prevent erosion and sediment transport from disturbed soils.

Retaining the current location of the compost area would not result in any adverse impacts on water resources. Runoff from the area infiltrates the surrounding soils and does not reach surface waters directly. In the event that the compost pile is relocated to the north end of the park, significant adverse impacts on surface waters could result if the facility is not covered and runoff is allowed to reach surface waters directly. The addition of excess nutrients and humic acids that are likely present in runoff from the compost area could cause adverse impacts on Arboretum Creek, if runoff is routed directly to the creek. Likewise, if runoff is routed directly from the compost pile to a pond, the pond could experience increased algal productivity that in turn would degrade water quality.

Presuming that any proposed increases to surface water flow in Arboretum Creek would take into account the capacity of the creek, as well as increases in flow that could occur with increases in impervious areas related to other improvements, modifications to landscape features should not result in any adverse impacts on the creek. Likewise, any improvements to the ecological function of the creek would certainly result in beneficial impacts on surface waters. Significant short-term adverse impacts on surface waters could result during the construction of instream improvements, as disturbed sediment could be transported downstream to Lake Washington. However, the long-term benefits of the improvements would offset any short-term impacts.

Safety Features

The proposed improvements to safety features in the park are not expected to result in any significant adverse impacts on water resources.

Alternatives to Proposed Plan Elements

Four-Way Stop at North Entry to Washington Park Arboretum

Compared to the proposed intersection configuration, the development of a four-way traffic stop would result in essentially the same extent of impacts on water resources, and those impacts would not be significant. Demolishing the unused freeway ramp would result in less impervious roadway surface area, and therefore slightly reduced long-term impacts on surface waters. On the other hand, the construction phase of the ramp demolition would have a high likelihood of contributing pollutants directly to Lake Washington.

Lake Washington Boulevard Improvements with At-Grade Crossings

If a pedestrian overpass is not constructed, there would be fewer construction-related impact on water resources and slightly less stormwater runoff volume generated over the long term because of less impervious surface area. The net reduction in impacts would be minimal in the context of all of the proposed plan elements, but this alternative would have less potential for short-term water quality impacts.

Arboretum Drive Parking Lot Consolidation with Restricted Access

Closing Arboretum Drive East to vehicular through-traffic would result in a decrease in pollutant deposition on the roadways, and therefore a decrease in pollutants reaching surface waters. The net reduction is not expected to be significant, given the relatively light traffic on the roadway under existing conditions.

Removal of all small parking areas would reduce the sources of automobile-related pollutants (oil, grease, metals, and chemical depositions) that currently affect surface waters. However, if the parking areas are simply relocated (without new treatment facilities), there would be no net reduction in pollutant loading. If the new parking areas include stormwater treatment facilities, there would be a significant net reduction in pollutant loading to surface waters.

Pedestrian Overpass at East Interlaken Boulevard

The net impacts on water resources would be the same as under the proposed plan.

Separated Bicycle and Pedestrian Trails

Assuming that separated trails would require a slightly larger surface area than the proposed dual-use trail, a separated trail system would result in minor increases in impervious surface areas (less than 1 acre total) and associated surface water runoff rates, and the impacts on water resources would therefore be only slightly greater than under the proposed plan. Conversely, if

the separated trails required equal or less impervious surface area than the proposed plan, there would be similar or slightly less hydrologic impact by comparison. As discussed for the proposed plan, it is expected that bicycle and pedestrian trails would not cause adverse impacts on surface water quality, stormwater conveyance capacity, or stream channel characteristics.

Dual-Use Trail System with South-End Stop Light and Crosswalk

A stop light and crosswalk in place of an overpass would result in fewer construction-related impacts on water resources and slightly less stormwater runoff volume generated over the long term compared to the proposed master plan, because of less impervious surface area. The net reduction in impacts would be minimal in the context of all of the proposal plan elements, but this alternative would have less potential for short-term water quality impacts.

Parking Lot Expansion at Dispersed Locations

Expanding the Japanese garden parking lot and retaining the small parking lots along Arboretum Drive East would result in an increase in impervious surface areas and a corresponding increase in pollutant loading to surface waters compared to the proposed plan. Although expanded parking areas may have to drain to water quality treatment facilities in accordance with city requirements, runoff from the existing small lots currently receives no water quality treatment. Therefore, the associated impacts on surface water quality would be greater than under the proposed plan (under which the untreated lots would be removed). However, the overall net increase in impacts on water resources relative to the proposed master plan would not be significant, given the relatively light use of the small existing parking areas.

Building Renovations without Expansion, and South-End Structure at Madrona Terrace

The net reduction in impervious surfaces compared to the proposed plan would result in a reduction in impacts on water resources. Specifically, the decrease in impervious areas would reduce surface runoff flow rates and volumes (relative to the proposed plan) and reduce pollutant loadings associated with parking spaces. Regardless, the water quality and hydrology impacts would not be significant under the proposed plan, and would be of even less concern with these potential modifications.

Limited Educational Space Offerings

The net reduction in impervious surface area compared to the proposed plan would result in a reduction in impacts on water resources. Specifically, the decrease in impervious areas would reduce surface runoff flow rates and volumes relative to the proposed plan. Thus, the net impacts on water resources would be reduced compared to the proposed plan. Regardless, as stated previously the hydrology impacts would not be significant under the proposed plan, and these impacts would be of even less concern with these potential modifications.

No Building Expansion, with Operations Moved Offsite

The net reduction in impervious surfaces compared to the proposed plan would result in a reduction in impacts on surface water hydrology. Specifically, the decrease in impervious areas would significantly reduce surface runoff flow rates and volumes relative to the proposed plan. Regardless, as stated previously the hydrology impacts would not be significant under the proposed plan, and these impacts would be of even less concern with these potential modifications.

Addition of Outdoor Shelters

The construction of additional shelters would result in a slight increase in disturbed ground and an associated increase in the potential for eroded soil and sediment transport during construction. Likewise, the shelters would increase the amount of impervious cover on the site, thereby increasing runoff to surface waters. The net increase in impacts would be minimal in comparison with other changes in impervious areas under any of the proposed plan elements.

Limited Lighting and Telephone Improvements for Safety

Retaining the existing parking areas would result in slightly greater impacts on water resources compared to the proposed plan. The existing small lots currently receive no water quality treatment, whereas the parking areas under the proposed plan would likely incorporate some degree of new water quality treatment facilities. Likewise, the small lots represent impervious surfaces that generate greater amounts of stormwater runoff to surface waters than would occur with the proposed plan. The net impacts would be slightly greater than those identified under the proposed plan but would not be significant.

No Action

In general, the no-action alternative would have fewer impacts on water resources than the proposed plan or its alternatives, because no action would result in less additional impervious area and less construction-related disturbance. New roadways that could increase surface runoff and pollution are not anticipated under the no-action alternative. Likewise, pedestrian and bicycle circulation facilities would remain similar to existing conditions, so existing stormwater runoff patterns in these areas would not change. The parking facilities would be modified slightly under the no-action alternative, but significant increases in impervious surface areas would not occur. No large buildings or shelters would be developed that could increase stormwater runoff flows and result in construction-related impacts.

Thus, most of the impacts associated with the proposed plan would not occur under the no-action alternative. However, because the net impacts on water resources associated with the proposed plan would not be significant, the relative reduction in impacts associated with the no-action alternative also would not be significant.

Mitigation Measures

Proposed Plan

Overall, the proposed additions and modifications to vehicular and pedestrian roadways, buildings, shelters, and parking areas would each result in an increase of greater than 9,000 square feet of developed area. Therefore, these portions of the proposed development would be subject to the appropriate water quantity and quality controls as outlined in Seattle ordinance 117789. Specific treatment and detention requirements would depend on final development plans, but might include the following:

- Peak flow control for runoff from the new impervious surface area, and possibly for some existing impervious surfaces nearby
- Best management practices (BMPs) to limit erosion and sediment transport during construction (e.g., limiting the extent of site disturbance at any point in time; providing mulch cover on disturbed surfaces; and using sediment basins, silt fences, and check dams to reduce flow velocities and trap sediments onsite)
- Permanent BMPs to provide water quality treatment for roadway and parking lot runoff (e.g., wet ponds, bioswales, filtration systems, and wet vaults)
- Permanent BMPs to prevent stream bank erosion and scouring at stormwater outfalls (e.g., riprap energy dissipaters).

Given that the proposed improvements are localized and scattered over a large area, water quality treatment facilities may have to be designed to treat existing roadways and parking areas to account for any areas of new roadways and parking that cannot feasibly receive water quality treatment. Final stormwater management requirements would depend on the design details of the proposed development and would require extensive consultation with city engineers. Likewise, the net impacts of the total increase in impervious areas may have to be considered when determining the detention requirements for the proposed plan. If direct discharges to Lake Washington via Arboretum Creek are not permitted by the city, detention facilities would be required to prevent any impacts associated with increased flows. These facilities might have to be designed to manage flow from some of the larger existing impervious surfaces (roads, parking lots, and rooftops) to account for the many small increases in impervious areas (smaller buildings, trails, and shelters).

In addition, the net impact of the increase in impervious surfaces on the Washington Park Arboretum overall should be considered when determining detention requirements. Although no significant impacts are expected for water resources (i.e., Lake Washington and Arboretum Creek), the increase in surface runoff may affect smaller drainage systems on the site. The impacts associated with the proposed development are not expected to be significant, but they would contribute to the cumulative surface runoff rates that result in small-scale flooding and

soil saturation onsite. Reuse of stormwater runoff for irrigation could be considered as part of the final design of new and expanded buildings.

Finally, even though the amount of construction at any one time would be limited because of the long period of master plan implementation, the proper design and maintenance of temporary erosion and sediment control facilities are crucial to the prevention of water quality problems. A diligent erosion control and water quality monitoring plan should be implemented as soon as construction work begins to ensure that water quality impacts are avoided. Specifically, extra attention should be given to keeping soil disturbance, clearing, and grading of the site to a minimum, thereby limiting the erosion and transport of sediment during construction. If possible, construction activities should be scheduled for the dry season. Implementation of effective erosion and sedimentation control measures can significantly reduce the potential for this type of contaminant transport.

Alternatives to Proposed Plan Elements

Mitigation measures beyond those outlined for the proposed plan would not be necessary.

Significant Unavoidable Adverse Impacts

Proposed Plan

With the implementation of the mitigation measures described above for construction activities and long-term operations, it is expected that development of the Washington Park Arboretum under the proposed plan would result in few unavoidable water quality impacts, all of which would be reduced to a level of nonsignificance. Specifically, a small amount of sediment erosion and transport during construction would be unavoidable, yet the net impacts would not be significant. Likewise, a portion of the pollutants present in runoff from new roadway and parking areas would not be removed by the required treatment facilities and would reach surface waters. Again, these impacts would not be significant.

Alternatives to Proposed Plan Elements

Unavoidable adverse impacts would be nearly identical to those that would occur with the proposed plan, and with required mitigation measures, these impacts would be reduced to a level of nonsignificance.

Plants and Animals

This section focuses on existing conditions, impacts, and mitigation measures related to biological resources and habitats. For this reason, the plant exhibits, scientific collections, and native vegetation all are treated from the perspective of their value as habitat.

Affected Environment

This section describes existing conditions of plant communities and wildlife habitat within the Washington Park Arboretum and regulatory concerns pertinent to these resources. The description of plant communities is divided into upland areas such as grass lawn, forest, and the scientific collections; while the wetland areas include the Lake Washington shoreline, Arboretum Creek, and ground water seeps. The description of wildlife species and habitat includes mammals, birds, reptiles, amphibians, and fish that use these plant communities as habitat. This section also discusses the threatened and endangered wildlife and fish species reported to occur in the park.

Regulations

Federal, state, and local resource regulations govern activities associated with implementing the Washington Park Arboretum master plan. At the federal level, the Endangered Species Act is implemented by the National Marine Fisheries Service (NMFS) and the U. S. Fish and Wildlife Service (USFWS). The USFWS also oversees bird species covered by the Federal Migratory Bird Treaty Act. All waters of the United States, including wetlands, are regulated by the Clean Water Act, which the U. S. Army Corps of Engineers enforces.

In Washington state, the Department of Ecology and local governments regulate shorelines as mandated by the Shoreline Management Act. The Washington Department of Fish and Wildlife implements the hydraulic project approval regulations, which govern activities within those state waters below the ordinary high water mark. The Washington Department of Natural Resources, under the direction of the commissioner of public lands, regulates activities within forested areas.

Local sensitive areas ordinances and other municipal regulations and policies, including Seattle's Urban Wildlife and Habitat Management Plan, govern lands that are especially subject to natural hazards or that support unique, fragile, or valuable natural features. The Seattle *Environmentally Critical Areas Folio* identifies the wetlands associated with Foster Island and Lake Washington, while the remaining non-wetland portion of the Washington Park Arboretum is mapped as critical fish and wildlife habitat (Seattle 1992). The Seattle Shoreline Master Program regulates the development along shorelines in the city and superimposes the underlying land use zones in the shoreline district. Environmentally critical areas, such as geologic hazard areas, flood-prone areas, riparian corridors, wetlands, and fish and wildlife habitat conservation areas, are afforded special protection from development impacts. In many cases, these ordinances and policies supplement federal and state regulations.

Plant Communities

Plant community types identified within the Washington Park Arboretum were mapped using the *King County Wildlife Habitat Profile* system (King County 1987). This system consists of 31 wildlife habitats that are grouped into four major categories: saltwater, freshwater, riparian, and upland. Wildlife species occurring within a particular vegetation type can vary considerably depending on several factors, such as size of the area, presence of or proximity to other valuable habitat, level of human disturbance, diversity of plant species, presence of multiple canopy layers (i.e., tree, shrub, forb, and emergent layers), and the presence of threatened, endangered, or sensitive species.

The upland and wetland plant communities in the park contain a mixture of native, invasive, and landscape species that provide valuable wildlife and fish habitat, especially for migratory waterfowl, passerine birds, amphibians, reptiles, and fish (Audubon Society 1996; Plummer 1991; Shapiro and Associates 1990). The park contains 14 of the 31 wildlife habitat types, which are described in Table B-1 in Appendix B. Figure 8 illustrates the different plant communities that provide wildlife habitat within the park.

Upland Plant Communities

Within the Washington Park Arboretum there are unforested and forested upland plant communities that provide differing values of wildlife habitat. Unforested habitats lack the presence of a tree canopy higher than 20 feet due to design, maintenance, or disturbance. Two types of unforested upland habitat occur in the park: lowland grass/forb-stable, mowed, and lowland shrub-persistent. Four types of forested upland communities exist in the park: coniferous second-growth lowland forest, deciduous second-growth lowland forest, mixed coniferous and deciduous second-growth lowland forest, and urban and suburban landscape gardens. The park has been logged and cleared several times in the past, most recently in the 1930s (Robertson 1991); therefore only nonvirgin forest exists. These various habitat types are discussed in the subsections below.

The Washington Park Arboretum contains 10,000 accessional plants, of which 1,180 were collected in the wild. A total of 179 taxa listed by the International Union for the Conservation of Nature (IUCN) are present (Hitchin 1999 personal communication). These are plant species considered threatened and endangered throughout the world.

The scientific collections are organized into three themes: taxonomic, geographic/ecological, and landscape function. There are 20 major collections and 30 minor collections. Within the taxonomic collections, certain genera have more representative taxa from throughout the world than other genera. These genera include *Acer* (124 taxa), *Camellia* (243 taxa), *Ilex* (211 taxa), *Magnolia* (98 taxa), *Pinus* (91 taxa), *Prunus* (83 taxa), *Rhododendron* (757 taxa), *Sorbus* (81 taxa), and *Viburnum* (95 taxa). The geographic/ecological collections are displayed in thematic settings that correspond to place or community of origin, including a Mediterranean section (65 taxa), Sino-Himalayan hillside (84 taxa), and New Zealand high country (85 taxa). Functional landscape collections include the J. A. Witt winter garden (160 taxa of plants with distinctive

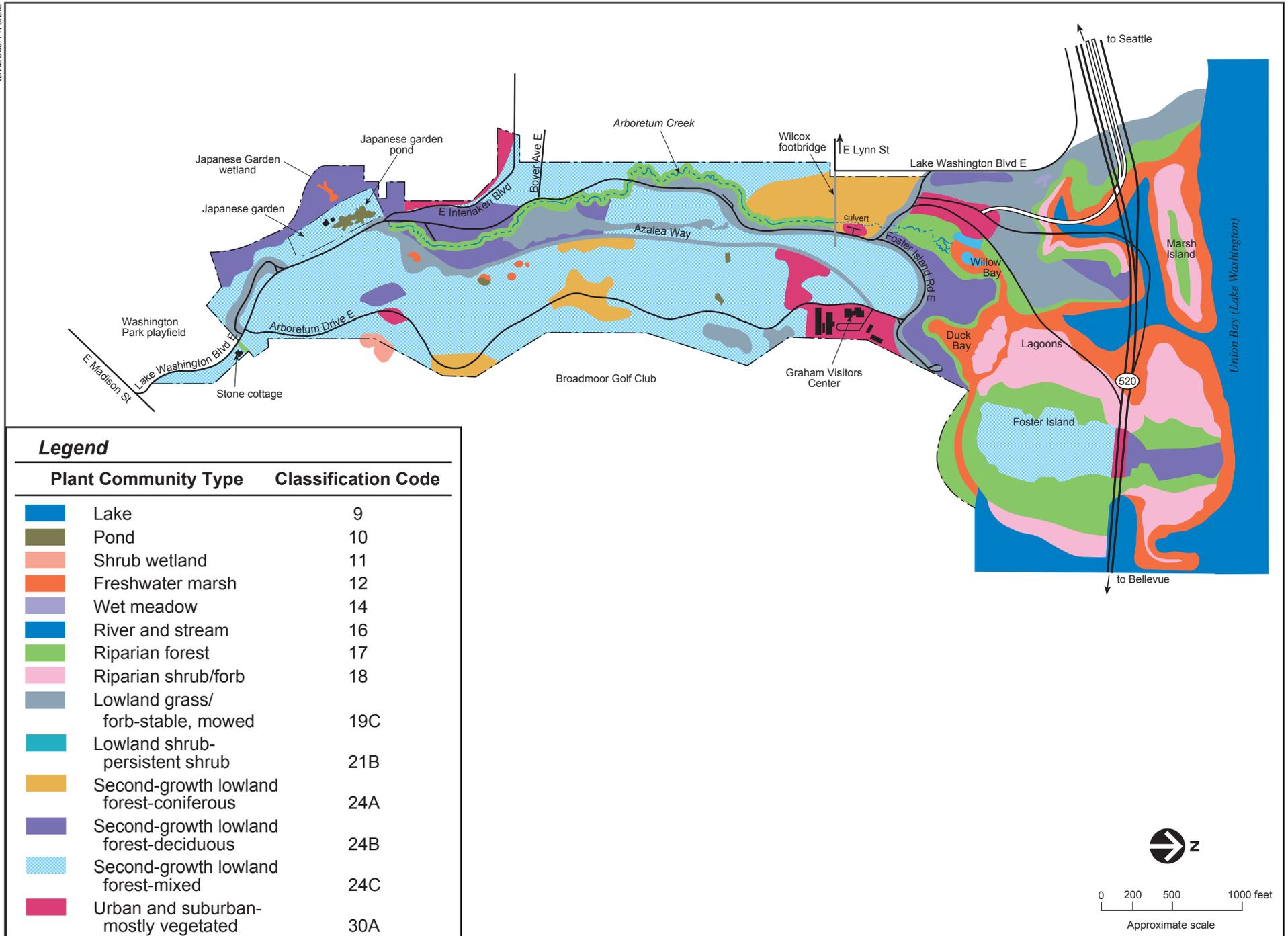


Figure 8. Plant community types in the Washington Park Arboretum.

winter interest), the woodland garden (75 taxa of *Acer palmatum*), and the Japanese garden. Wildlife species using this habitat include medium-sized mammals and birds that prefer forested habitats (e.g., hawks, woodpeckers, owls, and passerine birds).

Lowland Grass/Forb–Stable, Mowed

Open grass lawns are located in the flat area along Arboretum Creek, on the east side of Arboretum Drive East near the winter garden, along Azalea Way, and at the Graham Visitors Center. Grass lawns are maintained by mowing, fertilization in selected areas, and seeding of nonnative grasses. The lawns consist of herbaceous species such as bentgrass (*Agrostis* sp.), common velvetgrass (*Holcus lanatus*), English plantain (*Plantago lanceolata*), bluegrass (*Poa* sp.), colts-foot (*Petasites frigidus*), and red clover (*Trifolium pratense*). Wildlife species expected to use these areas in the park include birds (waterfowl such as Canada geese, gulls, crows, starlings, robins, and sparrows) and small mammals (rodents).

Lowland Shrub–Persistent Shrub

One area of the Washington Park Arboretum falls into this category, the shoreline of Lake Washington around Willow Bay. Invasive species are the dominant vegetation in these areas, including nonnative Himalayan blackberry, Scots broom, and English ivy. This habitat is used by small and medium-sized mammals, passerine birds, salamanders, newts, frogs, and snakes.

Second-Growth Lowland Forested–Coniferous

Coniferous second-growth lowland forest has conifers representing over 70 percent of the crown cover. The areas in the Washington Park Arboretum meeting this criterion are the pinetum, the conifer meadow, and portions of Foster Island, most of which contain introduced collections. In native forests of this type, conifers and alders are the dominant vegetation. In the arboretum the mix of species is quite broad, because it comprises both the collection and native species. This habitat type is interspersed with the other forested habitat types. Wildlife species favoring coniferous second-growth forest include small, medium-sized, and large mammals, birds (hawks, owls, woodpeckers, flycatchers, nuthatches, chickadees, and crows), salamanders, newts, frogs, and snakes.

Second-Growth Lowland Forested–Deciduous

Deciduous second-growth lowland forest has deciduous species comprising over 70 percent of the crown cover. The oak grove and the slope west of the Japanese garden are the only two areas in the Washington Park Arboretum that fall into this category. The dominant deciduous vegetation includes nonnative oak and native big-leaf maple, red alder, madrone, and vinemaple. Wildlife species similar to those using the second-growth lowland forest–coniferous habitat are expected here.

Second-Growth Lowland Forested–Mixed

Coniferous and deciduous species each exceed 30 percent of crown cover, but neither exceeds 70 percent in the second-growth lowland forested–mixed habitat type. The majority of the forested areas in the Washington Park Arboretum are included in this habitat type: the forested strip near the stone cottage, the slope surrounding Washington Park playfield, the south woods, the rhododendron glen, the middle woods, Yew Hill and Honeysuckle Hill, and Loderi Valley. Big-leaf maple, red alder, Douglas fir, western hemlock, western red cedar, snowberry, and huckleberry natives dominate this wildlife habitat type. Wildlife species found in the above two forested habitat types are expected here as well.

Urban and Suburban–Mostly Vegetated

Specific areas within the Washington Park Arboretum consist of landscape gardens that surround parking lots and buildings and provide wildlife habitat for species habituated to humans. These upland plant assemblages mainly consist of nonnative species belonging to shrub and herbaceous strata. This type of habitat occurs around the Graham Visitors Center, East Interlaken Boulevard, and the on-ramps to SR 520.

Wetland Plant Communities

Regulated aquatic resources and waters of the United States (as defined by the Code of Federal Regulations [CFR] 328.3a) include wetlands, lakes, rivers, and streams. Using existing information and site reconnaissance, wetlands and other aquatic resources were mapped and characterized within the Washington Park Arboretum. In 1996, wetlands in the park were delineated by Herrera Environmental Consultants for the master plan using criteria established by the *Army Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987). A topographic survey of these wetland boundaries within the park is presented in Figure 9. These wetland plant communities were classified using the King County wildlife habitat system and the U. S. Fish and Wildlife Service (USFWS) system (Cowardin et al. 1979).

The wetland plant communities present within the Washington Park Arboretum are associated with water bodies such as the shoreline of Lake Washington and Foster Island, wetlands associated with Arboretum Creek and its tributaries, several wetlands created by ground water seeps, and wetlands in isolated depressions. A description of these water bodies, the stormwater collection and conveyance system, and their hydrologic connections is presented in the water section of this EIS. Other hydrologic influences within the park include lawn irrigation, subsurface drainage systems, and storm drains. The geology and soils section describes the topography and the hydric soil types that occur in the park.

Wetlands Associated with Lake Washington

The shoreline of Lake Washington and several islands within the Washington Park Arboretum (Foster Island, Marsh Island, and Duck Island) consist of concentric bands of wetlands distinguished by water depth or soil saturation. Progressing from deep-water habitat in Union Bay to upland habitat in the arboretum, these wetland plant communities are classified by the King County system as freshwater lake, freshwater marsh, riparian shrub/forb, and riparian forest. Each of these wetland habitat types is described below.

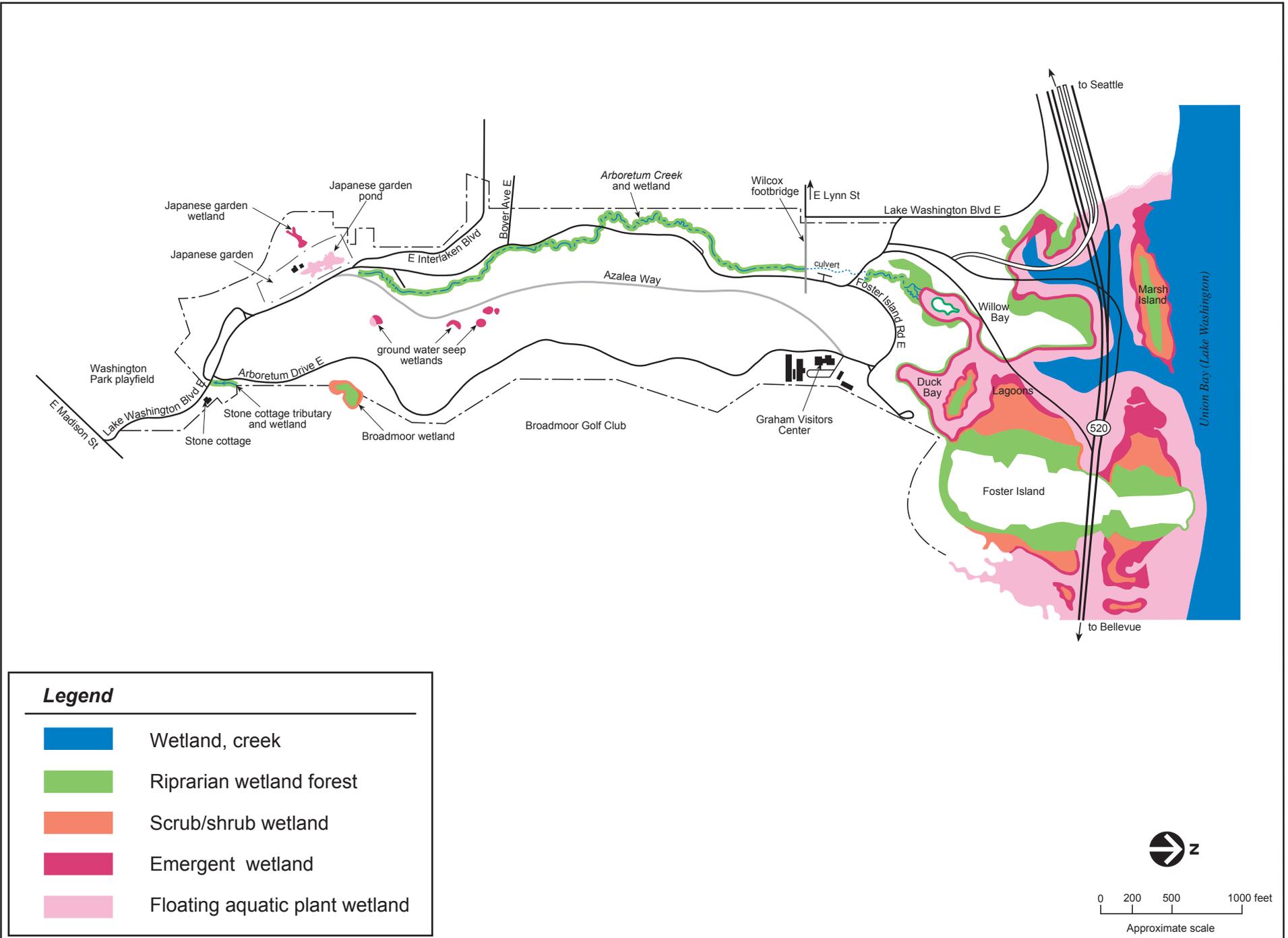


Figure 9. Wetland locations within the Washington Park Arboretum.

Freshwater Lake Habitat—This wetland type includes open water within Lake Washington (Union Bay) that is less than 2 meters deep, but where the bottom is not covered with emergent vegetation (NOAA 1983). Within the Washington Park Arboretum, these areas include open water around Foster Island, Marsh Island, Duck Island, and the peninsula facing Union Bay beneath the SR 520 on-ramps; as well as portions of Duck Bay, Willow Bay, and the lagoons. The dominant plant in these areas is yellow pond lily (*Nuphar luteum*). This area provides habitat for anadromous and resident fish, and birds (loons, grebes, cormorants, waterfowl, and gulls and terns). According to the USFWS system, this area is classified as a lacustrine, limnetic, open-water and aquatic bed wetland.

Freshwater Marsh Habitat—This wetland type occurs in shallow water along the shoreline where emergent vegetation covers the bottom. Within the Washington Park Arboretum, these areas include the shoreline of Foster Island, Marsh Island, Duck Island, and the peninsula facing Union Bay beneath the SR 520 on-ramps; as well as the shoreline of Duck Bay and the lagoons. The dominant plants in this area include common cattail (*Typha latifolia*), rushes (*Juncus* sp.), sedges (*Carex* sp.), and purple loosestrife (*Lythrum salicaria*). This area provides habitat for resident fish and birds (waterfowl). According to the USFWS system, this area is classified as a lacustrine, littoral, emergent wetland.

Riparian Shrub/Forb Habitat—This wetland type consists of dense thickets of shrubs and saplings in areas with seasonal inundation or soil saturation. Within the Washington Park Arboretum this includes the shoreline of Foster Island and Marsh Island, and the majority of Duck Island. The dominant plants in this area include Sitka willow (*Salix sitchensis*), red-osier dogwood (*Cornus stolonifera*), hardhack (*Spiraea douglasii*), bittersweet nightshade (*Solanum dulcamara*), red alder saplings (*Alnus rubra*), and creeping buttercup (*Ranunculus repens*). This habitat is used by mammals (rodents and carnivores), passerine birds, snakes, frogs, and newts. According to the USFWS system, this area is classified as palustrine scrub/shrub wetland.

Riparian Forest Habitat—This wetland type occurs in areas with saturated soils where a tree canopy of hydrophytic species covers more than 30 percent of the ground. Within the Washington Park Arboretum this includes portions of Foster Island and Marsh Island, the shoreline of Duck Bay, the lagoons, the peninsula facing Union Bay beneath the SR 520 on-ramps, the riparian zone of Arboretum Creek, and part of the Broadmoor marsh. The dominant plants in this wetland type include a tree layer of red alder, black cottonwood (*Populus trichocarpa*), western red cedar (*Thuja plicata*), and paper birch (*Betula papyrifera*); a shrub layer of hardhack, salmonberry (*Rubus spectabilis*), and Sitka willow; and herbaceous species such as skunk cabbage (*Lysichiton americanum*), slough sedge (*Carex obnupta*), and creeping buttercup. This habitat is used by mammals (rodents and carnivores), raptors, passerine birds, snakes, frogs, salamanders, and newts. According to the USFWS system, this area is classified as palustrine, forested wetland.

Wetlands Associated with Arboretum Creek

Wetlands that derive their hydrology from surface water drainage to Arboretum Creek and its tributaries in the woodland garden, the rhododendron glen, the Japanese garden, and near the

stone cottage are a mixture of habitat types. Based on the King County system, Arboretum Creek and its tributary channels provide freshwater river/stream and pond habitat that is lined by riparian forested and wet meadow habitat.

River and Stream Habitat—This habitat type consists of flowing water below the ordinary high water line in Arboretum Creek and its tributaries. This habitat type is characterized by an incised channel with unconsolidated bottom substrate (mud, sand, and gravel) and the lack of rooted vegetation. The only plants that persist in this habitat are water starwort (*Callitriche heterophylla*) and creeping buttercup. This habitat is used by mammals (rodents and carnivores), frogs, salamanders and newts, and resident fish. According to the USFWS system, this area is classified as riverine, lower perennial wetland.

Riparian Forest Habitat—Portions of Arboretum Creek and the tributary near the stone cottage are lined by riparian forest habitat. The riparian forest lining Arboretum Creek averages 25 feet wide on both banks as the channel meanders through a flat floodplain. The riparian forest lining the tributary near the stone cottage averages 10 feet wide as the channel cascades from the Broadmoor Golf Club grounds to a catch basin. Vegetation found in this habitat type includes trees such as red alder, black cottonwood, Pacific willow, Sitka willow, and western red cedar. Other wetland plants include salmonberry, sedge, horsetail (*Equisetum* sp.), yellow iris (*Iris pseudacorus*), skunk cabbage, small-fruited bulrush (*Scirpus microcarpus*), and creeping buttercup. This habitat is used by mammals (rodents and carnivores), raptors, passerine birds, snakes, frogs, salamanders, and newts. According to the USFWS system, this area is classified as palustrine, forested wetland.

Wet Meadow Habitat—Riparian wetlands lining portions of Arboretum Creek and its tributaries in the woodland garden and the rhododendron glen consist of a narrow band of emergent vegetation on both banks. This wet meadow habitat is located along Arboretum Creek upstream of the Wilcox footbridge and in the flats area; near the two ponds and tributary channel in the woodland garden; and near the reflecting pool, tributary channel, and upper pond within the rhododendron glen. Emergent vegetation in this area is dominated by small-fruited bulrush, velvetgrass (*Holcus lanatus*), creeping buttercup, and horsetail. This habitat is used by passerine birds, snakes, frogs, salamanders, and newts. According to the USFWS system, this area is classified as palustrine, emergent wetland.

Freshwater Pond Habitat—Several constructed ponds are located along the Arboretum Creek tributaries, including two ponds in the woodland garden, two ponds in the rhododendron glen, and one pond in the Japanese garden. These ponds consist of permanently flooded depressions that are less than 2 meters deep with little or no flow. These ponds have open water with emergent vegetation lining the shoreline that provides habitat for resident fish, waterfowl, frogs, and reptiles. Vegetation observed in these ponds during fieldwork for preparation of the master plan includes yellow pond lily, horsetail, yellow iris, and creeping buttercup. The University of Washington staff has recently removed some of this vegetation from several of the ponds. According to the USFWS system, this area is classified as palustrine, aquatic bed and emergent wetland.

Ground Water Seep Wetlands

There are six areas within the Washington Park Arboretum where ground water discharges from a steep slope and saturates the soil at the base of the slope long enough to create wet meadow habitat before the surface water is conveyed into stormwater catch basins. These include four small areas near the reflecting pond in the rhododendron glen, a swale northeast of Yew Hill, and the slope southwest of the Japanese garden. An extensive drainage system exists within the park to collect ground water, but this system, installed in 1938, is dysfunctional and in need of repair (University of Washington 1996). Clay tiles in the drainage system have broken or filled in with sediment in many places, thereby allowing ground water to saturate the soils and cause slumping in many areas.

Ground water seeps occur along the toe of the slope in the rhododendron glen, creating four areas with wet meadow habitat. These saturated soil conditions end along Azalea Way where drain pipes collect the seepage. A wet meadow also occurs in a broad depression between Yew Hill and the lower pond of the woodland garden, which drains to a catch basin that discharges to Arboretum Creek. A small ravine and alluvial fan deposit occurring at the toe of the slope is located on a forested hillside near the Japanese garden, which drains to a catch basin. Emergent vegetation in these areas is dominated by small-fruited bulrush, velvetgrass (*Holcus lanatus*), creeping buttercup, and horsetail. This habitat is used by passerine birds, snakes, frogs, salamanders, and newts. According to the USFWS system, this area is classified as palustrine, emergent wetland.

Isolated Wetlands

The Broadmoor marsh along the southeast fence line between the Washington Park Arboretum and the Broadmoor golf course is classified as freshwater shrub and forest wetland habitat. The majority of this wetland lies offsite on the Broadmoor Golf Club property, but a 15-foot-wide swath occurs in the arboretum. This isolated depression has standing water that supports black cottonwood trees and hardhack. This habitat is used by mammals (rodents and carnivores), raptors, passerine birds, snakes, frogs, salamanders, and newts. Based on the USFWS system, this is a palustrine scrub/shrub and forested wetland.

All wetlands are subject to Seattle's environmentally critical areas regulations, which require a 50-foot buffer around the wetland.

Wildlife Species and Habitat

The native forest matrix, scientific collections, and wetlands within the Washington Park Arboretum provide a diverse variety of habitats for mammals, birds, reptiles, amphibians, and fish. The wetlands lining the Union Bay shoreline are considered valuable habitat that supports over 145 wildlife species. The complete list of wildlife species known to occur throughout the park is included in Table B-2 in Appendix B.

Mammals

Although field surveys conducted for this project resulted in few observations of mammals, it is likely that a variety of mammals inhabit the Washington Park Arboretum. Beaver, muskrat, mink, long-tailed weasel, and river otter have been recorded in the wetlands along Lake Washington. Beaver, muskrat, and river otter use the open-water habitats. Evidence of muskrat and beaver activity includes downed trees and numerous cut willow saplings, cattails, and other forbs. Beavers usually feed on red alder, willow, quaking aspen (*Populus tremuloides*), salmonberry, swordfern, and sedges. Their activity has influenced wetland ecosystems throughout North America. Muskrat activity is expected to occur around the marsh-scrub/shrub shorelines. Muskrats are omnivorous; they will forage on skunk cabbage, cattails, rushes, and sedges and prey upon pond turtles and snails. Muskrats build houses in open water or burrow in banks surrounding open water. River otters are usually associated with streams, rivers, and lakes, but they will frequent bays and estuaries. River otters travel several miles from their dens and may cover over 150 miles of a particular river and its tributaries in a year. As carnivores, river otters eat a variety of aquatic species, including crayfish, frogs, turtles, fish, and invertebrates. Their diet also includes birds and mammals they can catch, such as muskrats (Maser 1998).

Minks, raccoons, striped skunks, and weasels feed on other small mammals, birds, amphibians, reptiles, and invertebrates. They occasionally eat insects, fruit, acorns, and carrion. These carnivores inhabit the forested and scrub areas, especially those areas close to the creek and wetlands. Minks and weasels are aggressive animals that take over the burrows and dens of their prey. Raccoons and striped skunks are adapted to urban environments; it is expected that they would wander into areas surrounding the park. However, minks and weasels are more sensitive to human disturbance and would likely be found in the northern portion of the park, around Foster Island. In addition, domestic cats feed on small mammals and birds in the park.

In the upland portions of the park, deciduous or mixed forests contain leaf litter and organic matter on the forest floor. This provides good foraging habitat for small omnivorous and insectivorous mammals. These areas would support shrews, moles, deer mouse, and Pacific jumping mouse. Mice, voles, and shrews also could inhabit the drier portions of the wetland north of the Broadmoor Golf Club grounds. These mammals are preyed upon by great horned owls, raptors, and domestic dogs and cats.

Douglas squirrels and eastern gray squirrels dwell in the deciduous and mixed-deciduous park forests and surrounding areas. They feed on seeds, acorns, fruits, berries, and new spring growth of trees. Douglas squirrels are active throughout the day, whereas eastern gray squirrels are most active in early morning and late afternoon. Like raccoons and striped skunks, opossums are adapted to human environments. They are scavenging omnivores that venture out at night. The little brown bat is also known to use habitat in the park (McCauley 1999 personal communication).

Birds

Over 80 bird species have been observed to rest, feed, and breed within the wetland complex bordering the Broadmoor Golf Club grounds and the adjacent areas of Foster Island Hathaway et al. 1987. The wetland area along the Lake Washington shoreline and Foster Island provides valuable bird habitat, as evidenced by the number of species observed (Audubon Society 1996). The wetland supports a large diversity of birds due to the structural complexity of the vegetation. Approximately 50 additional bird species have been observed in other portions of the Washington Park Arboretum, for a total close to 130 species (Plummer 1991; Shapiro & Associates 1990). The native coniferous forest matrix within the southeastern section of the arboretum and portions of the Broadmoor grounds bordering the arboretum provide refuge and habitat for native bird species (Ross 1999 personal communication). Barred owls and great blue herons have been observed nesting in the park; an eagle's nest was started but abandoned.

Common waterfowl using and breeding within the wetland areas include Canada goose, mallard, pied-billed grebe, gadwall, and American coot. Great blue heron, hooded merganser, cinnamon teal, and bufflehead are also frequently seen. Less common waterfowl species include wood duck and green-backed heron. Open water with dense vegetated borders provides important habitat along the migration corridor for waterfowl. Numbers and diversity of waterfowl are greatest in the winter months.

Adult bald eagles have been seen perching in the tall cottonwoods located in the wetland areas and on Foster Island. During a site visit in December 1999, a bald eagle nest was seen in a black cottonwood tree on Foster Island, near the Broadmoor golf course. Other raptors observed include sharp-shinned hawk, northern harrier, osprey, and merlin. Great horned owls and western screech owls have been seen within the forested areas of the Washington Park Arboretum.

A large variety of passerine and non-passerine birds inhabit the wetland areas. The highest diversity probably occurs in late spring when both migratory and summer residents are present. Red-winged blackbird, house finch, black-capped chickadee, American robin, and swallow are common breeding species. Uncommon species occurring in the wetland areas include warbling vireo and western wood-pewee. In upland areas of the park, common year-round birds observed include crows, jays, chickadees, sparrows, nuthatches, bushtits, woodpeckers, wrens, hawks, and owls. Rufous hummingbirds are summer residents, and a small population of Anna's hummingbirds have been reported to reside in the park year-round because of its diverse collection of flowering plants (Shapiro & Associates 1990).

Reptiles

Three reptiles have been observed in the Washington Park Arboretum: painted turtle (*Chrysemys picta*), western pond turtle (*Clemmys marmorata*), and common garter snake. The two turtles, both aquatic, are the only turtles known to occur in the northwest.

Painted turtles prefer marshy ponds or small lakes but are also found in slow-moving streams. They prefer muddy bottoms with considerable aquatic vegetation and require long periods of basking time during the day. When nesting, painted turtles lay eggs up to 150 meters from water in a variety of places (e.g., beaches, floodplains, shrubby fields, roadsides, gravel or dirt roads, and pastures), but the nest site must receive direct sunlight for the majority of the day. They are omnivores and feed on most kinds of plants and small animals in their waters.

The western pond turtle is considered a federal candidate species and an endangered species in Washington state. Western pond turtles inhabit marshes, sloughs, moderately deep ponds, and slow-moving portions of creeks and rivers. They nest up to 100 meters from water in sandy banks or sunny fields. Western pond turtles are also omnivorous; their diet consists of water lilies, fish, worms, and other invertebrates.

The common garter snake is usually found in wet meadows and along watercourses, but it can be found far from water in open valleys and coniferous forests. Adults eat primarily frogs, toads, and salamanders (Nussbaum et al. 1983).

Amphibians

Amphibians have complex life cycles involving many developmental stages (i.e., eggs, larvae, adult larvae, and metamorphosed adults), and they often occupy different habitats depending on the stage of development. Most amphibians are dependent on wetlands for breeding. However, outside the breeding season, adults live in wooded areas or meadows. The seven amphibians known to occur in the Washington Park Arboretum include the Pacific tree frog (*Pseudacris regilla*), red-legged frog (*Rana aurora*), bullfrog (*Rana catesbeiana*), northwestern salamander (*Ambystoma gracile*), long-toed salamander (*Ambystoma macrodactylum*), ensatina (*Ensatina eschscholtzi*), and rough-skinned newt (*Taricha granulosa*).

The Pacific tree frog is the most common frog in the Pacific Northwest. It lives in a variety of habitats, including wetlands, and is tolerant of urban areas. It breeds in shallow, vegetated wetlands. The red-legged frog is mainly terrestrial, and adults prefer woodlands adjacent to slow-moving streams. When breeding, the red-legged frog is found in marshes, bogs, swamps, ponds, lakes, and slow-moving streams. The bullfrog is an introduced species that is highly aquatic and eats anything it can swallow. Its entire life cycle is spent in or immediately adjacent to the water.

The northwestern salamander is common in the Pacific Northwest and is able to coexist with bullfrog and introduced fish species. It prefers wetlands adjacent to sluggish streams and medium to large lowland lakes for laying eggs. Adults live in underground burrows such as rotting logs or rodent burrows. The long-toed salamander, which is the most widespread salamander, lives in a variety of habitats. Distributed from southeast Alaska to California, it feeds on Pacific tree frog larvae. Adults predominantly lay their eggs in temporary pools. Ensatina is also widespread, ranging from British Columbia to Baja California. It prefers woody debris as habitat, especially the base of snags and stumps in the forest. Ensatina is a toxic species of salamander. Eggs are commonly laid in nests beneath or inside conifer logs or in

rodent burrows. The rough-skinned newt is extremely toxic to almost any predator except the common garter snake (*Thamnophis sirtalis*). One adult newt contains enough poison to kill 25,000 mice. Adults court and breed along the vegetated fringes of permanent water bodies (e.g., lakes, beaver ponds, and slow-moving streams) (Leonard et al. 1993; Nussbaum et al. 1983).

Fish

The fish species expected to occur within the Washington Park Arboretum are listed in Table B-3 of Appendix B according to common and scientific names for the major classes of fish (Wydoski and Whitney 1979). The major classes of fish listed in this table include anadromous species (salmon, trout, and lamprey) that migrate between saltwater and freshwater, and resident species (trout, lamprey, minnow, sucker, catfish, sunfish, perch, stickleback, sculpin, and smelt) that only inhabit freshwater. Table B-3 also lists the type of habitat for each fish, its seasons of use, and habitat requirements.

Spawning survey records provided by the Washington Department of Fish and Wildlife listing the locations where fish were observed, run timing, and population estimates (WDFW 1998) indicate that the Washington Park Arboretum area is not used as spawning habitat by anadromous salmon and trout (i.e., chinook, coho, sockeye, chum, pink, and steelhead).

Chinook salmon migrate through the Lake Washington ship canal and spawn from late September to late –October, with the peak occurring during early-October. Over the last 5 years, there has been an average of 4,400 chinook returning to the Lake Washington drainage basin.

Coho salmon migrate through the Lake Washington ship canal and spawn between early October and early December, with the peak occurring during late October. Over the last 5 years, there has been an average of 2,700 coho returning to the Lake Washington drainage basin.

Sockeye salmon migrate through the Lake Washington ship canal and spawn between late August and late –December, with the peak occurring from October to mid-November. Over the last 5 years, there has been an average of 148,800 sockeye returning to the Lake Washington drainage basin.

Low numbers of chum salmon (less than 135), pink salmon (less than five), and steelhead trout (less than 25) also migrate through the Lake Washington ship canal to spawn between late September and mid-December in the Cedar River subbasin.

Juvenile salmon and trout that rear in freshwater for one year or more typically out-migrate between April and June, passing the Washington Park Arboretum on their way to Puget Sound. Data on releases of juvenile salmon and trout at multiple locations within the Lake Washington drainage basin over the last 5 years (WDFW 1998) indicate that WDFW has released an average of 2,483,000 chinook, 1,932,000 coho, 11,244,000 sockeye, and 27,000 steelhead within the Lake Washington drainage basin. The other anadromous species (such as lamprey) spawn

between April and July. Resident fish spawn in the Lake Washington ship canal within the project corridor mainly during the spring and summer when water temperatures increase.

Fish Habitat Requirements

Habitat requirements that these anadromous and resident fish species need for spawning and rearing is highly variable. Water bodies that provide fish habitat within the Washington Park Arboretum include the Lake Washington shoreline, Arboretum Creek and its tributaries, and several constructed ponds.

Fish habitat within that portion of the Lake Washington shoreline potentially affected by the Washington Park Arboretum master plan includes portions of Union Bay, Duck Bay, Willow Bay, and the lagoons. This area consists of freshwater lake habitat with a relatively undeveloped shoreline that is dominated by rooted aquatic plants and emergent vegetation. Fish habitat in Arboretum Creek consists of the main stem channel and three tributary channels draining the woodland garden, the rhododendron glen, and the area east of the stone cottage. These stream channels provide spawning and rearing habitat for resident fish species adapted to flowing water. Several ponds in the park (located in the woodland garden, the reflecting pool, and the Japanese garden) provide fish habitat for species adapted to shallow depressions with slow flow rates.

Anadromous salmon and trout usage of the Lake Washington ship canal as a migration corridor mainly consists of adults returning to spawn and juveniles out-migrating. The anadromous fish species (salmon, trout, and lamprey) migrating through this area do not spawn within the park, although the juveniles may feed along the shoreline during their out-migration. The resident fish species found in Lake Washington require freshwater lake habitat with minimal current and seasonal thermal stratification. Resident fish that typically use this habitat include bass, crappie, pumpkinseed, yellow perch, three-spine stickleback, catfish, and sculpin. These fish feed along lake shorelines that have rooted aquatic vegetation and substrates ranging from mud to gravel. A notable exception is longfin smelt, which feeds in water 40 to 120 feet deep within Lake Washington.

Fish habitat in Arboretum Creek and its tributaries is used by mainly resident fish, because migration barriers limit anadromous fish passage. This stream, which receives stormwater runoff that causes high peak flows and low base flows, has been fragmented by development and is culverted under roads and parking lots. Resident fishes expected to inhabit this stream habitat include cutthroat and rainbow trout, western brook lamprey, peamouth, sucker, three-spine stickleback, and sculpin. Fish habitat in the ponds is used mainly by carp (goldfish), catfish, and sculpin.

Usual and Accustomed Fishing Areas

The usual and accustomed fishing area of the Suquamish and Muckleshoot Indian tribes is located in Union Bay, which borders the northern edge of Foster Island in the Washington Park Arboretum (Warner 1999 personal communication; Zischeke 1999 personal communication). However, the Suquamish do not assert their rights to this area and historically have used the

marine waters immediately downstream of the Ballard locks. The Muckleshoots have used the open-water area north of Foster Island for a gill net fishery targeting anadromous salmon and trout. Historically they have targeted sockeye, fall chinook, coho, and winter steelhead, but due to the inability to meet escapement goals (i.e., goals for the number of adult fish that avoid being caught by fishing gear and succeed in migrating upstream to their spawning grounds), the Muckleshoots have not fished here for several years.

Threatened and Endangered Species

A database search was requested of the U. S. Fish and Wildlife Service to identify listed threatened and endangered species that could be affected by the project, while a National Marine Fisheries Service database search was also conducted. The Washington Department of Fish and Wildlife and Department of Natural Resources were consulted for information on rare plants and ecosystems that may occur in the project area. The Department of Fish and Wildlife priority habitats and species database identifies three nearby bald eagle territories, as well as the Washington Park Arboretum, Foster Island, and University of Washington wetlands, and designates the arboretum as urban natural open space (WDFW 1999). The Seattle *Environmentally Critical Areas Folio* identifies the wetlands associated with Foster Island and Lake Washington, while the remaining non-wetland portion of the Washington Park Arboretum is mapped as critical fish and wildlife habitat (Seattle 1992).

Wildlife

Three pairs of nesting bald eagles (*Haliaeetus leucocephalus*), a federally listed threatened species, occur within a 1.5-mile radius of the Washington Park Arboretum (USFWS 1999). The Broadmoor golf course bald eagle territory has a nest on the 17th fairway. During the December 3, 1999 site visit, a bald eagle was seen at a nest on Foster Island; this may be a new nest for the eagles within the Broadmoor bald eagle territory. Within one mile south of the Washington Park Arboretum is the Seward Park bald eagle territory. The third bald eagle territory is located on private property near Laurelhurst, north of the arboretum.

A northwestern pond turtle (*Clemmys marmorata marmorata*), a federal species of concern, was observed in 1992 in Union Bay under the SR 520 ramps. Other federal species of concern potentially found within the Washington Park Arboretum project area include olive-sided flycatcher (*Contopus borealis*), Oregon spotted frog (*Rana pretiosa*), Pacific Townsend's big-eared bat (*Corynorhinus townsendii townsendii*), long-legged myotis (*Myotis volans*), and long-eared myotis (*Myotis evotis*). Washington state lists the northwestern pond turtle and Oregon spotted frog as endangered species. Although suitable habitat exists for each of these species to migrate through the park, breeding habitat does not exist.

Fish

The National Marine Fisheries Service identifies two anadromous fish species in the project area that are protected under the Endangered Species Act (NMFS 1999). These include the Puget Sound evolutionarily significant unit (ESU) of chinook salmon (*Oncorhynchus tshawytscha*) as a

threatened species, and the Puget Sound/Strait of Georgia evolutionarily significant unit of coho salmon (*O. kisutch*) as a candidate for listing as threatened. The U. S. Fish and Wildlife Service identifies three fish species that may occur in the vicinity of the project area (USFWS 1999). These include the coastal/Puget Sound distinct population segment (DPS) of bull trout (*Salvelinus confluentus*) as a threatened species, and Pacific lamprey (*Lampetra tridentata*) and river lamprey (*L. ayresi*) as species of concern. Although there is no spawning habitat, the Lake Washington shoreline within the Washington Park Arboretum may provide rearing habitat for juveniles of these listed species. In addition, two species of koi inhabit the pond at the Japanese garden.

Environmental Impacts

Proposed Plan

The proposed master plan would result in a variety of impacts on plants and animals in the Washington Park Arboretum. These impacts involve short-term construction effects and long-term operational effects, as well as cumulative effects from implementing all the elements of the master plan. Construction impacts involve clearing of vegetation and conversion of vegetated areas to impervious surfaces. Impacts from clearing vegetation also are evaluated in terms of the relative values of different plant communities as wildlife habitat, such as grass lawn versus forested areas. The long-term operational impacts of these changes are also evaluated based on the permanent conversion of vegetated areas to impervious surfaces and increased human disturbance to wildlife. All projects would be designed to comply with Seattle's environmentally critical areas regulations, which include buffers for wetlands and riparian corridors, as well as policies that encourage protection of fish and wildlife habitat areas.

Roadways

Impacts on plants and animals from changes to the roadway system would occur during relocation of the northern portion of Arboretum Drive eastward and construction of an 18-car parking lot northeast of the woodland meadow. Although this construction is planned for a more sparsely vegetated area of the park that consists of mixed coniferous/deciduous forest and grass lawn, it covers approximately one acre. The remaining roadway changes would have minimal to no impact on plants and animals because of the small area involved or low wildlife value of the habitat affected. These changes include minor clearing of vegetation and loss of wildlife habitat for reconfiguration of the north entry to the park, reconfiguration of the intersection between Arboretum Drive East and Lake Washington Boulevard East, and modification of the alignment of the SR 520 on-ramp. Although traffic in this area precludes heavy wildlife use of the trees, these changes would require removal of trees and lawn cover.

Pedestrian and Bicycle Circulation

The main impacts associated with alterations to pedestrian and bicycle circulation in the park involve construction of a dual-use pedestrian/bicycle trail along the eastern side of Lake Washington Boulevard East, and reorienting pedestrian trails for improved public access to plant

collections. These changes would affect deciduous forest, mixed coniferous/deciduous forest, scientific collections, and lawn vegetation types. Trail alignment is intended to follow existing trails and to avoid removal of mature vegetation wherever possible. If local trail realignment or widening is required, then small wetland areas may be filled, and riparian vegetation may be removed along Arboretum Creek for the trails. Long-term operation of the dual-use pedestrian/bicycle trail in the Arboretum Creek riparian corridor may disturb wildlife.

The proposed trail connection to the Museum of History and Industry at the northwest end of the park would require construction in or near wetlands. This could involve excavating under the unused SR 520 ramp, or constructing an access up onto that ramp. The footings of the unused freeway ramp are located within wetlands and wetland buffer areas.

The remaining changes proposed for the pedestrian trail system would have minor impacts on plants and animals. These alterations include adding or expanding a pedestrian trail along the western side of Lake Washington Boulevard, adding an overpass over Lake Washington Boulevard East south of the Japanese garden, installing sidewalks along Lake Washington Boulevard East from East Madison Street to Arboretum Drive East, and modifying the unused freeway ramp at the north end of the park for a pedestrian/bicycle link to the Museum of History and Industry. These changes would affect coniferous forest, deciduous forest, and lawn vegetation types. Providing better trails could reduce the amount of vegetation trampled by visitors wandering off structured paths.

Parking Facilities

Construction of a 30-car parking lot at Madrona Terrace and reconfiguration of the lot near Interlaken Boulevard would be required to provide 50-foot buffers from nearby wetlands. These and other parking facilities proposed would affect deciduous forest, scientific collections, and lawn areas. Parking would be added and removed in roughly the same quantities so that the net long-term effect on habitat throughout the park would be relatively small. Vegetation would be removed in areas where new parking would be provided, reducing cover, nesting, and food resources for some animals. Areas where parking would be removed would be temporarily impacted during construction, which could potentially harm wetland and riparian areas. However, measures to prevent soil erosion and protect water quality would be employed, and these impacts are expected to be avoided.

Buildings and Outdoor Shelters

Minor impacts on plants and animals would result from construction of the four small interpretive shelters at various locations in the park. Deciduous forest, scientific collections, and lawn would be affected. Higher levels of human activity would be generated in these areas. A small amount of wildlife habitat would be removed, and noise would affect the wildlife remaining.

The other proposed building projects would have less impact on plants and animals. These projects include the Japanese garden pavilion and entrance facility, the south-end education and

visitor services facility, the operation and maintenance headquarters buildings, the greenhouse buildings, and new facilities at the Graham Visitors Center. These changes would have little impact on vegetation and wildlife, because these sites are currently covered with impervious surfaces or are located in areas of relatively high human activity. The outdoor shelters would be located in areas with less human activity and thus could have slightly greater localized impacts. Constructing the outdoor shelter on Foster Island may affect a nesting pair of bald eagles near the proposed shelter location.

Landscape Features

Plants and animals would be affected during restoration of Arboretum Creek, renovation of 30 existing plant exhibits, and creation of 21 new exhibits. Excavation to restore Arboretum Creek to a surface channel and revegetation of the stream banks may cause sedimentation and erosion problems during construction. Renovation of plant exhibits by incorporating species that are threatened with extinction worldwide is a preservation measure that benefits worldwide plant communities. However, replacing native plant species with exotic species may be detrimental to native wildlife that cannot use the exotic plant species for foraging or nesting habitat.

The remaining changes proposed for landscape features would have minor impacts on plants and animals. These projects include construction of a viewing platform along the shoreline south of Marsh Island and stabilization of the Duck Bay shoreline in environmentally sensitive areas. Clearing of wetland vegetation, erosion of the shorelines, and wildlife disturbances may occur during construction; and the viewing platform would permanently shade littoral wetland.

Safety Features

All of the proposed safety features would have minimal impact on plants and animals due to the small area involved. Disturbances would be minimal for installation of lights, emergency telephones, and trail signage. Spreading programmatic activities more evenly throughout the park may have a long-term impact on wildlife due to additional human activity in lower-use areas of the park.

Alternatives to Proposed Plan Elements

Roadways

Installation of a four-way stop at the north entry to the Washington Park Arboretum, and demolition of the unused freeway ramp would result in impacts on plants and animals. This construction would occur in a sparsely vegetated area of the park that generally consists of exotic species and grass lawn. Noise generated during construction would be expected to disturb small animals in the vicinity of these projects. The remaining roadway alternatives would have minimal to no effect on plants and animals, because of the small area involved or low wildlife value of the habitat affected.

Pedestrian and Bicycle Circulation

Construction and operation of a bicycle trail on the eastern side of Lake Washington Boulevard East and a pedestrian trail on the western side may affect plants and animals. This trail alternative would affect deciduous forest, mixed coniferous/deciduous forest, scientific collections, and lawn vegetation types. If local trail realignment or widening is required, then small wetland areas may be filled, and riparian vegetation may be removed along Arboretum Creek for the trail.

Parking Facilities

No significant impacts on plants and animals would result from the alternatives considered for parking facilities. The alternatives could have impacts on areas of lawn and some trees and shrubs that would be similar to impacts expected from the proposal.

Buildings and Outdoor Shelters

Impacts on plants and animals would result from construction of the Madrona Terrace educational gateway facility at the southern end of the park, affecting deciduous forest, scientific collections, and lawn for clearance around a 2,500-square-foot building and 30-car parking lot.

Landscape and Safety Features

No significant impacts on plants and animals would result from the alternatives for landscape or safety features.

No Action

Roadways

No impact on plants and animals would result from changes to the roadway under the no-action alternative.

Pedestrian and Bicycle Circulation

No impact on plants and animals would result from changes to pedestrian and bicycle circulation under the no-action alternative.

Parking Facilities

Minor impacts on plants and animals would result from constructing a 20-car parking lot near the Boyer Avenue East intersection with Lake Washington Boulevard East and a 25-car lot at north side of Foster Island Drive. These impacts would be similar to impacts expected generally from parking areas. Particularly during construction, wildlife would be disturbed and vegetation would be removed. These locations are not unique or significant habitat areas.

Buildings and Outdoor Shelters

No impact on plants and animals would result from building structures under the no-action alternative.

Landscape and Safety Features

Impacts on plants and animals would result from work to thin out mature collections and establish new taxonomic groupings during renovation of existing plant exhibits and creation of new exhibits. Although less extensive than the renovation and new exhibit development in the proposed master plan, this work would have similar but proportionately smaller impacts on vegetation and wildlife.

Mitigation Measures

Proposed Plan

Some of the elements of the proposed master plan would be beneficial to plants and animals within the Washington Park Arboretum, such as restoring the creek to a surface channel, revegetating shorelines and wetland buffers, and creating new wetland areas and ponds.

For adverse impacts on plants and animals, mitigation involves a hierarchy of avoidance, minimization, and compensation for these impacts. Efforts to avoid and minimize adverse impacts have been incorporated into the proposed master plan. Compliance with regulations for wetlands and for fish and wildlife habitat, such as maintaining and restoring buffers, and timing construction to avoid disruption of breeding or migration, would ensure that implementation of most projects under the plan would adequately protect wildlife. Because of the master plan's extended period of implementation, impacts occurring at any one time would be limited, with changes occurring at a gradual pace, allowing animals greater opportunity to adapt.

Relocating the northern one-third of Arboretum Drive East from the park interior to the outer edge of the park could give wildlife a greater area of connectivity, depending on the design and use of the areas where the road would be removed. Removal of the abandoned Arboretum Drive pavement and revegetation of this swath could provide a long-term benefit to wildlife. Beneficial impacts on wildlife would also result from reducing traffic use on Arboretum Drive. Eliminating trucks and other inappropriate vehicles would reduce the amount of noise that may disturb wildlife, and use of low-speed electric or pedal-powered tour vehicles would even further reduce the amount of noise.

Beneficial impacts could occur where parking lots are removed and additional vegetation is planted, thus creating new wildlife habitat.

Improvements to wildlife habitat may result from removing invasive species along the Duck Bay shoreline, planting trees along Lake Washington Boulevard East and Foster Island Drive East, expanding the rhododendron pool, and enhancing Arboretum Creek. The value of the wildlife

habitat provided by the native forest could be improved by installing bird and bat boxes, and restricting human activity in certain areas where wildlife species are more sensitive to disturbance.

The impacts of increased human activity could also be mitigated by educational and interpretive materials that inform users about the habitat in the park and how to limit disturbance.

Alternatives to Proposed Plan Elements

Beneficial impacts on wildlife could result from eliminating existing vehicular traffic and using electric tour vehicles on Arboretum Drive East. Eliminating small parking lots and consolidating parking at the north and south ends of the park would provide the opportunity to revegetate areas and create additional habitat for wildlife.

Significant Unavoidable Adverse Impacts

Proposed Plan

None of the elements of the proposed plan or alternatives would have significant unavoidable adverse impacts on plants or animals.

Energy and Natural Resources

Affected Environment

The Washington Park Arboretum presently uses electricity and natural gas to meet its energy demands. Seattle City Light supplies electricity, and Puget Sound Energy supplies natural gas. Electricity is used for the buildings in the park, the irrigation system, and outside lighting around the buildings. Natural gas is used as the heating fuel source for the buildings including the greenhouses and for the hot water heaters.

Electrical usage for the Washington Park Arboretum is divided into three areas: the Graham Visitors Center, the greenhouses, and the operation and maintenance buildings. Electrical consumption by the Graham Visitors Center (with a floor area of 6,700 square feet) from November 1998 to November 1999 was 64,577 kilowatt hours. Electrical consumption for the greenhouses (5,730 square feet) during the same period was 35,716 kilowatt hours. The operation and maintenance buildings, including the open structure (total of 5,405 square feet), used 30,560 kilowatt hours from November 1998 to November 1999 (Seattle City Light 1999).

Natural gas is also provided to the same three areas. The Graham Visitors Center used 281,000 cubic feet of natural gas from December 1998 to December 1999. The greenhouses used 257,000 cubic feet of natural gas from December 1998 to December 1999, and the operation and maintenance buildings used 193,800 cubic feet during the same time period (Puget Sound Energy 1999).

Environmental Impacts

Proposed Plan

Construction Usage

According to information provided in *The Arboretum Plan, a Greenprint for the Future* (Portico 1997), construction costs for that plan were estimated at \$46 million. To provide estimates of energy usage, this dollar amount can be used to convert construction costs to British thermal units (Btu). The energy in fuels is expressed as the heating value and is measured in British thermal units per pound of fuel. One British thermal unit is the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit.

An energy conversion factor was determined for construction of a maintenance facility in a study conducted by the California Department of Transportation (California 1983). The study (which offers the best available information for comparison) determined that for every construction dollar spent (1973 dollars), 50,100 Btu of energy would be used.

Based on a construction cost of \$46 million as estimated for *The Arboretum Plan, A Greenprint for the Future* (Portico 1997), and a consumer price index of 168.3 for December 1999 to convert from 1973 dollars to 1999 dollars (U. S. Department of Labor), a high estimate of 427 billion Btu would be used for construction of the components of the proposed master plan for the Washington Park Arboretum.

For comparison purposes, one gallon of gasoline represents 125,000 Btu. Therefore, construction of the components of the proposed plan would use energy equivalent to burning 3.4 million gallons of gasoline. According to annual records of gasoline usage reported to Puget Sound Clean Air Agency (PSCAA) by the Washington State Department of Revenue in 1996, King County service stations sold 720 million gallons of gasoline that year (PSCAA 2000), amounting to an average usage of 2 million gallons a day in King County. Considering the energy requirements for the thousands of ongoing construction projects within King County, and the fact that implementation of the proposed Washington Park Arboretum master plan would be phased over a period of 20 to 30 years, the energy usage required to implement the proposed plan would have an insignificant impact on the overall energy requirements for King County.

Operational Usage

Based on additional floor area of approximately 11,500 square feet from renovation and new construction of components of the proposed plan, estimated operational usage of natural gas and electricity would increase over current usage by a factor of 1.8, resulting in estimated additional usage of 110,000 kilowatt hours of electricity and 500,000 cubic feet of natural gas annually. The additional energy usage is comparable to the energy demands of 6 houses of approximately 2,000 square feet.

Alternatives to Proposed Plan Elements

Cost estimates for constructing alternatives to the proposed plan elements are not available. However, costs and hence energy requirements would be equal to or slightly less than those estimated for construction and operation of the proposed plan elements.

No Action

There would be some additional construction cost involved under the no-action alternative, with associated energy requirements. However, because no new roadways, major buildings, shelters, or trails would be constructed under the no-action alternative, additional energy usage for construction would be low.

Operational usage of energy in the park under the no-action alternative would continue as described above in the affected environment section.

Mitigation Measures

Construction activities would comply with the City of Seattle's energy and water conservation policy. During construction, energy could be conserved by recycling and reuse of materials, by reduction of demand through greater efficiency of operations, and by direct conservation through elimination of waste and reduction in activities that require energy. During building renovation, reusable materials such as fixtures, windows, wood, and masonry should be salvaged. Recyclable materials also should be sorted and recycled.

Energy impacts resulting from operation could be minimized through design and operational considerations. Building renovation and new construction would be designed to comply with the Seattle energy code (section 22.700 of the Seattle Municipal Code), which includes provisions to reduce overall energy consumption.

Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts are expected to result from the proposed plan or alternatives.

Noise

Affected Environment

This section describes general noise characteristics, noise standards and regulations, and existing sources of noise and sounds in the Washington Park Arboretum and surrounding area. Sources of information used to prepare this section include existing regulations, previous environmental documents prepared for other projects in the vicinity, and site visits to the area.

Characteristics of Sound

Sound travels away from a noise generator or source as waves of air pressure variation caused by vibration. The velocity of sound waves depends solely on the properties of the air surrounding the waves. In the absence of obstructions, sound waves form an expanding spherical surface with diminishing energy (loudness) as distance from the source increases. Sound attenuation (decrease), however, is often affected by factors other than distance from the source. These additional factors include topographic features and structural barriers that absorb, reflect, or scatter sound waves, increasing or decreasing noise levels. Sound echoing from topographic features or buildings can result in higher sound levels (lower sound attenuation rates) than normally expected. In addition, atmospheric conditions such as wind speed and direction, humidity level, and temperature also affect the degree of sound attenuation over distance. Temperature inversions and changes in wind conditions can refract and focus sound waves toward locations at a considerable distance from the noise source.

Noise Descriptors

Noise is distinguished as sound that is unwanted by the listener because it is unpleasant or bothersome and interferes with the perception of wanted sound (Kryter 1970).

People normally perceive sound levels between about 30 and 90 decibels, depending on their activity. For example, a loud nearby vehicle, radio, or power tool may produce 80 to 90 decibels, normal conversation creates about 50 to 60 decibels, and a bedroom or quiet office functions at about 30 to 40 decibels. Each 10-decibel increase in sound level corresponds to a tenfold increase of sound energy but is judged by a listener as only a doubling of loudness. The smallest changes in sound level considered clearly noticeable are about 3 to 5 decibels.

The human ear does not respond equally to all sound frequencies. Noise measurements, therefore, are adjusted to the frequency response of the human ear. The frequency weighting primarily used to evaluate environmental noise is A-weighting. A-weighting reduces measured sound pressure levels for low-frequency sounds and slightly increases measured pressure levels

for some high-frequency sounds. Measurements using this system are reported in A-weighted decibels, or dBA.

Sound levels from two or more sources are combined using logarithms, not by adding the decibel levels. When two levels are combined, the louder level predominates, and the combined decibel level is the louder level plus zero to 3 decibels. For example, two sources each producing 50 decibels together result in 53 decibels; two sources producing 50 and 40 decibels together result in 50 decibels.

Noise Criteria

Washington state and its local jurisdictions are governed by environmental noise standards set forth in the Washington Administrative Code (WAC), chapter 173-60. The City of Seattle implements the state noise standards through the Seattle/King County Department of Public Health noise ordinance (chapter 12.86–12.99) and Seattle Municipal Code (chapter 25.08). The state and city noise standards establish maximum permissible sound levels for residential, commercial, and industrial districts as sound sources and receiving properties. Maximum permissible sound levels in Seattle are listed in Table 6. These limits are reduced by 10 decibels during the nighttime hours of 10 p.m. to 7 a.m. on weekdays and 10 p.m. to 9 a.m. on weekends where the receiving property lies within a residential district.

Table 6. City of Seattle maximum permissible sound levels (dBA).

| Zoning of Noise Source | Zoning of Receiving Property | | |
|------------------------|------------------------------|------------|------------|
| | Residential (day/night) | Commercial | Industrial |
| Residential | 55/45 | 57 | 60 |
| Commercial | 57/47 | 60 | 65 |
| Industrial | 60/50 | 65 | 70 |

Source: Seattle Municipal Code chapter 25.08.

These levels are maximum levels that can be exceeded only for limited periods of time. The Seattle noise control ordinance allows the following increases over these maximum levels: 5 dBA for no more than 15 minutes in any hour, 10 dBA for no more than 5 minutes in any hour, or 15 dBA for no more than 1.5 minutes in any hour. Thus, the ordinance limits noise originating from a residentially zoned property (e.g., the Washington Park Arboretum) affecting another residential property to 55 dBA during the day and 45 dBA at night. With the allowed short-term increases, however, the daytime limits are 60 dBA for up to 15 minutes per hour, 65 dBA for up to 5 minutes per hour, and 70 dBA for up to 1.5 minutes per hour. Nighttime limits (10 p.m. to 7 a.m.) for residential receivers are more stringent by 10 dBA.

The Seattle noise control ordinance also regulates noise generated during construction (Seattle Municipal Code 25.08.425). The ordinance allows construction noise to exceed the sound levels listed in Table 6 during the hours of 7 a.m. to 10 p.m. on weekdays and 9 a.m. to 10 p.m. on

weekends. During these time intervals, construction noise is regulated 50 feet from the noise source or at the nearest receiver, whichever distance is greater. Regulations include allowable exceedances of sound levels listed in Table 6 by the following increments:

- 25 decibels (dBA) for equipment on construction sites, such as crawlers, tractors, bulldozers, rotary drills and augers, loaders, power shovels, cranes, derricks, graders, off-highway trucks, ditchers, trenchers, compactors, compressors, and pneumatic-powered equipment
- 20 dBA for portable power equipment used in temporary locations in support of construction activities
- 15 dBA for power equipment used in temporary or periodic maintenance or repair of the grounds and appurtenances of residential property.

Sound from impact equipment including pavement breakers, pile drivers, and jackhammers is allowed to exceed the maximum sound levels listed in Table 6 for one-hour periods between the hours of 8 a.m. and 5 p.m. However, the allowable increase may not exceed the following equivalent sound level values without a variance (*equivalent sound level* is a descriptor for measurement of fluctuating sound):

- 90 dBA continuously
- 93 dBA for 30 minutes
- 96 dBA for 15 minutes
- 99 dBA for 7.5 minutes.

Sound created by motor vehicles is regulated by the City of Seattle according to weight and vehicle speed. Trucks over 10,000 pounds gross vehicle weight may not exceed 86 dBA when traveling at or under 35 miles per hour (mph) and may not exceed 90 dBA over 35 mph. Motorcycles are limited to 80 dBA at or under 35 mph and to 84 dBA over 35 mph. All other motor vehicles may not exceed 76 dBA at 35 mph or less and may not exceed 80 dBA over 35 mph. Seattle Municipal Code chapter 25.08.480 exempts motor vehicle noise from the standards shown in Table 6, except for motor vehicles operated off public highways where receiving areas are located in residential districts.

Existing Noise Sources and Sound Levels

The Washington Park Arboretum is generally a quiet area. Existing noise in the area is generated primarily from motor vehicles traveling on roadways through and around the park. While noise from vehicles traveling on public arterials is generally exempt from noise regulations, traffic noise detracts from the quiet and serenity of the arboretum.

SR 520 immediately to the north and its on/off-ramps, Lake Washington Boulevard East within the west and south portions of the park, and East Madison Street on the south and east carry the

most vehicles in the park vicinity and subsequently generate the majority of the area's noise. In particular, noise from SR 520 can be substantial on Foster and Marsh islands and in other northern areas of the park. Vehicles on SR 520 and Lake Washington Boulevard East can also be heard from higher elevations of the park, including sections of the upper trail in the southern area of the park. This vehicular noise often makes it difficult for visitors to hear arboretum guides during tours and other events. Cars traveling and parking along Arboretum Drive East generate noise through the middle of the park. Foster Island Road East, East Interlaken Boulevard, Boyer Avenue East, and other smaller streets abutting or near the park also contribute some vehicle noise.

Apart from traffic noise, there are few other significant noise sources within the Washington Park Arboretum. Active recreational activities (e.g., football, Frisbee throwing, bicycling) are restricted or prohibited throughout much of the park, minimizing potential noise from within the park. Other sources of sound in the park include groups and individuals using the Graham Visitors Center, onsite maintenance activities, occasional arboretum-sponsored events, birds and mammals, and wind through trees and vegetation.

Noise from external sources is more noticeable, especially from aircraft overhead. The Washington Park Arboretum is located beneath or near a Seattle–Tacoma International Airport flight path, and jets and other aircraft flying overhead can be distracting. Construction and demolition projects, commercial activities along East Madison Street, events at the nearby Washington Park playfield, horns from trains in downtown Seattle, street maintenance activities, and other human activity contribute to existing or background noise levels. Much of the park, however, is buffered by residential neighborhoods and the generally quiet Broadmoor Golf Club, which helps to minimize noise impacts on the park.

No existing noise studies or measurements in or around the Washington Park Arboretum have been identified.

Environmental Impacts

Proposed Plan

Roadways

Heavy equipment and the hauling of materials during construction would cause temporary increases in sound levels near active construction areas and along roadways used for construction vehicles, including Lake Washington Boulevard East, Foster Island Road East, Arboretum Drive East, and other main access roads such as East Madison Street. The increases in noise levels would depend on the type of construction equipment being used and the duration of use. Sound levels near many types of construction equipment typically exceed the levels recommended for residential land uses, decreasing at a rate of about 6 dBA for each doubling of distance from the source. At a distance of 100 feet, typical construction equipment sound levels range from approximately 74 dBA for backhoes to 83 dBA for pavers, jackhammers, scrapers, and trucks

(FTA 1995). Some areas of surrounding neighborhoods, particularly those immediately west of the park, could be susceptible to construction noise during certain activities.

All master plan alternatives for the Washington Park Arboretum must comply with the construction noise requirements in the Seattle noise control ordinance (see affected environment section). The noise control ordinance allows noise from construction equipment to exceed the noise limits by as much as 25 dBA during daytime hours. It is possible that some construction projects would temporarily exceed the limits established in the city noise ordinance. In addition, construction at night could exceed the maximum noise levels. These impacts could be minimized by applying the mitigation measures listed below.

The proposed roadway improvements would not significantly increase existing noise levels in and around the park. Traffic would continue to flow generally as it does now. Upgrading pedestrian trails west of Lake Washington Boulevard East could slightly increase noise levels near the closest residences west of the park. However, none of these potential impacts would be significant.

Pedestrian and Bicycle Circulation

Construction of many of the pedestrian and bicycle circulation improvements, particularly trail and overpass improvements west of Lake Washington Boulevard East, would cause temporary noise impacts. Those primarily affected would be residents living in the neighborhoods immediately west of the park.

The system of pedestrian trails linking the Washington Park Arboretum to the neighborhoods west of Lake Washington Boulevard East would increase human activity and hence noise levels in those neighborhoods. Except during occasional times of peak usage (e.g., sunny weekend mornings and afternoons), noise levels would increase minimally, and in any event would not likely be significant.

Parking Facilities

Demolishing some of the existing parking lots, constructing new parking lots, and reconfiguring some existing parking lots would cause temporary noise impacts, especially from heavy construction equipment (see the roadways subsection above). Those primarily affected would be residents of the neighborhoods immediately west of the park and visitors in the most remote sections of the park.

Consolidating the many existing small parking lots throughout the park and increasing parking capacity would concentrate and slightly increase vehicle noise in the north end of the park. Similarly, adding a 30-car lot near Madrona Terrace in the south end of the park would bring additional vehicles and activity into a part of the park that currently experiences limited vehicular traffic and human activity and hence is relatively quiet. For comparison, the existing Graham Visitors Center has a 49-car parking lot.

Removing many of the smaller lots located throughout the park (e.g., on Arboretum Drive East) could decrease vehicle traffic and noise throughout some of the more remote areas of the park. Golfers and visitors at the adjacent Broadmoor Golf Club could experience a slight increase in noise levels from vehicles going to and from the expanded parking area near the fence west of the golf course.

Buildings

Construction and renovation of the proposed buildings would cause temporary noise impacts, affecting Washington Park Arboretum visitors, employees, and possibly residents closest to the westernmost construction projects (e.g., residents along the bluff along or near 28th Avenue East during the Japanese garden renovations). Impacts on neighborhoods, however, would not be significant, because most building construction would take place away from potentially affected neighborhoods. Golfers and other visitors at the Broadmoor Golf Club may be affected by noise during construction, because the majority of building projects would occur around the Graham Visitors Center and along other eastern parts of the park.

The proposed plan is generally designed to increase future recreational opportunities, educational activities, and overall use of the Washington Park Arboretum. The new and renovated buildings, including the Graham Visitors Center, the Japanese garden pavilion, the south-end education and visitors facility, and the operation and maintenance headquarters, would likely attract more vehicles, more human activity, and, therefore, more noise. As with construction impacts, operational activities centered around the new and renovated buildings would primarily affect golfers and visitors at the adjacent Broadmoor Golf Club and, to a lesser degree, some residential areas along the westernmost part of the park. Because more overall park activity could be expected, visitors seeking quiet walks or secluded areas may find these opportunities less frequently. In general, however, noise impacts are not expected to be significant.

Outdoor Shelters

Noise from construction of the new shelters, especially in quieter areas of the park, could be particularly distracting to park visitors in the area.

During park operations, the expected increase in visitors using the outdoor shelters would result in general increases in human noise in those areas of the park. A significant increase in educational programs, particularly those involving large groups of children, could result in increased noise levels around the shelters. For example, over the 20- to 30-year period of master plan implementation, the annual number of educational visits by K–12 students is projected to increase from approximately 2,500 up to 20,000 annually. While people attending activities at these shelters could distract some park visitors, noise would probably not be significant, because group size is not expected to exceed 30, and the number of groups per day would not be likely to exceed four. Noise from events at shelters would not likely affect surrounding neighborhoods.

Landscape Features

Some noise would occur during construction of a few of the proposed landscape improvements. During park operations, use of the woodland meadow for special events and celebrations would cause temporary increases in noise not normally experienced in that area of the park. However, these noise impacts would not be significant.

Safety Features

Spreading programmatic activities and facilities more evenly throughout the park could lessen the intensity of noise emanating from some areas under current operations, but may also introduce new noise sources to other parts of the park that traditionally have been quiet. Reducing or eliminating parking in isolated areas could make those areas somewhat quieter. No significant impacts are expected.

Alternatives to Proposed Plan Elements

Roadways

General construction and operational noise impacts associated with the alternative roadway improvements would be similar to those described above for the proposed plan. Closing Arboretum Drive East to vehicular traffic and removing the small parking lots would further reduce noise impacts within the central part of the park. No significant impacts would be expected.

Pedestrian and Bicycle Circulation

General construction and operational noise impacts associated with the alternative pedestrian and bicycle improvements would be similar to those described for the proposed plan. The proposed overpass at East Interlaken Boulevard could bring activity and associated noise to an area that has more residences than the area south of the Japanese garden. No significant impacts would be expected.

Parking

Construction and operational noise impacts from the alternative parking improvements would be similar to those described for the proposed plan. Greater expansion of the Japanese garden/Washington Park playfield parking lot and continuing use of the scattered small parking lots along Arboretum Drive East could result in slightly greater vehicle noise in those areas than would occur under the proposed plan. Fewer parking spaces and vehicle traffic in the Madrona Terrace area would result in less noise in this relatively quiet part of the park. These differences, however, would not be significant, especially if the buildings proposed for the Madrona Terrace site are constructed.

Buildings

General construction and operational noise impacts associated with the alternative building improvements would be similar to those described for the proposed plan, but would occur at varying intensities in different areas of the park. Alternatives that minimize new or expanded operations or move operations offsite and away from the Graham Visitors Center area would result in fewer noise impacts than either the proposed plan or the no-action alternative. However, noise impacts could occur elsewhere at the offsite location, depending on construction requirements and the location of the operations facility.

The educational gateway structure and parking facilities at the south end of the park would increase activity and associated noise in that area. Increasing the parking capacity west of Lake Washington Boulevard East would also increase noise levels near the Japanese garden. Under this alternative, the noise impacts of construction and operation could affect residential areas near the Japanese garden more than other alternatives. However, no significant noise impacts would be expected under any of the alternatives.

Outdoor Shelters

Construction and operational noise impacts from the alternative outdoor shelter improvements would be similar to those described for the proposed plan. Constructing and operating one additional shelter would not result in any significant additional noise impacts.

Safety

Construction and operational noise impacts from the alternative safety improvements would be similar to those described for the proposed plan. Retaining the parking lots along Arboretum Drive East would result in slightly more vehicle noise in the middle of the park than under other alternatives that eliminate those lots. No significant impacts would be expected.

No Action

In general, noise impacts under the no-action alternative would be fewer than under the proposed plan and some of the alternative elements, because fewer construction and operational activities would occur. The proposed 20-car parking lot near the intersection at Boyer Avenue East and Lake Washington Boulevard East could slightly increase vehicle activity and noise in that area, potentially affecting nearby residents. However, no significant noise impacts would occur under the no-action alternative.

Mitigation Measures

Although it is exempt from regulatory noise limits, construction noise can adversely affect people living nearby. The following measures would be used where feasible to minimize construction noise impacts:

- Use properly sized and maintained mufflers, engine intake silencers, and engine enclosures, turn off idle equipment, and confine activities to daytime hours. These measures could be specified in construction contracts as appropriate.
- Place stationary equipment as far from sensitive receiving locations as possible. Where this is infeasible, or where noise impacts are still significant, portable noise barriers providing a 10-dBA reduction in equivalent sound levels could be placed around the equipment, with the opening directed away from the sensitive receiving property.
- Substitute hydraulic or electric models for impact tools such as jackhammers, rock drills, and pavement breakers to reduce construction and demolition noise.
- Require equipment operators to drive forward rather than backward, when feasible, to minimize the noise from reverse-gear alarms. Although reverse-gear alarms are exempt from most noise ordinances, noises from such devices can be among the most annoying sounds from a construction site.
- Require operators to lift rather than drag materials, when feasible, to minimize noise from material handling.

The proponent and the Department of Parks and Recreation would work with neighborhood groups or other concerned parties as necessary during design, construction, and operation to ensure that potential noise impacts on local sensitive receptors are prevented or reduced to acceptable levels. In addition, the following measure may be considered to minimize potential noise impacts during operation:

- Remind visitors (particularly groups of children visiting the Washington Park Arboretum for educational purposes) that the arboretum is intended to be a place of relative quiet, and that noise should be kept to a minimum.

Significant Unavoidable Adverse Impacts

With the proposed mitigation measures, no significant unavoidable adverse noise impacts would be expected under any of the alternatives.

Land and Shoreline Use

Affected Environment

This section describes existing land uses, zoning regulations, and development standards in and in the near vicinity of the Washington Park Arboretum. Applicable city land and shoreline planning policies are also discussed.

Land Uses within the Study Area

Washington Park Arboretum

The Washington Park Arboretum is a 230-acre park located northeast of downtown Seattle, mostly to the south of Lake Washington's Union Bay and the SR 520 bridge (see Figure 1). A portion of the park, including Foster and Marsh islands, is located north of SR 520. The park is surrounded by the Broadmoor neighborhood to the east, the Madison Park and Madrona Park neighborhoods to the south and southeast, the Capitol Hill neighborhood to the west and southwest, and the Montlake neighborhood to the west. The University of Washington main campus is located immediately northwest of the arboretum across Union Bay and the Lake Washington ship canal (the Montlake cut).

The Washington Park Arboretum is owned by the City of Seattle and operated cooperatively with the University of Washington, with the support of the Arboretum Foundation. The city owns most of the land and buildings and manages the waterfront trail and the Japanese garden. The city owns most of the arboretum area surrounding Foster Island and Marsh Island, except for approximately 6 acres of Foster Island that emerged as land when Lake Washington was lowered in the early 1900s. These 6 acres are owned by the University of Washington. The state of Washington owns the SR 520 right-of-way. The city maintains the roads (with the exception of SR 520), pathways, lawn areas, lighting, and other park-like functions. The university owns, designs, and maintains the plant collections and displays.

While predominantly vegetated and landscaped, the Washington Park Arboretum is traversed by several paved roads and contains several built structures. Roads include Lake Washington Boulevard East, SR 520 across Foster Island and its ramps to and from Lake Washington Boulevard East, Foster Island Road East, Arboretum Drive East, and small sections of Boyer Avenue East and East Interlaken Boulevard (see Figure 1). Nineteen parking areas are located throughout the park. The buildings and structures in the park are all directly related to park maintenance, operations, and general use. These structures include the following:

- Donald G. Graham Visitors Center, used for offices, visitor and interpretive studies, meetings, and classrooms

- Maintenance barn and yard, including a compost holding area, used by both University of Washington and Seattle Parks and Recreation Department crews for maintaining the park
- Curatorial annex used for record-keeping (attached to a maintenance building)
- University greenhouse, used for classroom and demonstration space, along with an unused pesticide storage structure
- Pat Calvert greenhouse, used for plant propagation and storage
- Lath houses
- Lookout gazebo in the southern area of the park
- Teahouse and small open structures in the Japanese garden
- Wilcox footbridge across Lake Washington Boulevard East
- Several sets of steps
- Stone cottage located in the southernmost part of the park and currently used to house park security personnel.

Adjacent Land Uses and Neighborhoods

The majority of land use adjacent to the Washington Park Arboretum is residential, with some commercial uses located predominantly along a few major streets. The private Broadmoor Golf Club and the gated residential community of Broadmoor are located immediately adjacent to and east of the park in the affluent Madison Park neighborhood. A variety of businesses and shops are located along East Madison Street, which runs northeast/southwest along the southern border of the park. The Montlake neighborhood, located immediately west of the park, is primarily a residential community, with a small commercial center located along 24th Avenue East, the primary north/south street through the neighborhood.

Other uses in the vicinity include the Washington Park playfield bordering the southern end of the Washington Park Arboretum on Lake Washington Boulevard East, East Interlaken Boulevard, and Boren Park immediately west of the arboretum. Several other parks, including Madison Park, Lakeview Park, and Montlake Park are located in nearby neighborhoods.

Land Use Policies and Regulations

City of Seattle Comprehensive Plan

In response to the mandate of the 1990 Washington Growth Management Act, the City of Seattle updated its comprehensive plan. The Growth Management Act required Washington towns and cities to prepare comprehensive plans and guidelines to manage urban growth for the next 20 years, along with the growth-related issues of land use, transportation, housing, capital facilities, and utilities. Seattle adopted its comprehensive plan update in July 1994, titled *Seattle's Comprehensive Plan: Toward a Sustainable Seattle*, and has amended it several times since then.

The comprehensive plan is a citywide plan that proposes to concentrate growth within existing city neighborhoods. The plan establishes guidelines for neighborhoods to identify their uniqueness and needs and to develop neighborhood growth plans. The Washington Park Arboretum is not located within any defined urban center, urban village, residential urban village, or other area specifically designated by the comprehensive plan. The plan does indicate that single-family areas outside these designated centers and villages must continue to be protected and preserved, and that future development should occur in a manner similar to that which already characterizes the area (Seattle 1994).

Seattle's comprehensive plan also includes goals and policies regarding open space and shoreline use. The open space network section of the comprehensive plan focuses on supporting both passive and active uses of open space; establishing and accomplishing goals for the amount, types, and distribution of open space; and generally enhancing open space throughout the city. The shoreline goals and policies focus on preserving shorelines for future generations, protecting fragile shoreline areas, creating a management system of shoreline uses, and providing public access to shoreline areas. Comprehensive plan open space and shoreline policies are codified in the Seattle Municipal Code (23.12).

Seattle's Parks and Recreation Plan 2000 Update

Seattle's Parks and Recreation Plan 2000 Update (Seattle 2000) is a functional plan that broadly addresses open space, parks, and recreation services over a 10- to 20-year period. Originally developed in 1993, the updated plan was adopted in the summer of 2000. The plan is intended to provide citizens and agencies with a planning resource and framework; establish policies and actions to assist with allocation of funds; guide management efforts for Seattle's open space, parks, facilities, and programs; and complement the city's overall comprehensive plan.

Seattle's Parks and Recreation Plan 2000 Update contains the objective to complete the EIS for the new Washington Park Arboretum master plan and implement priority projects as part of its 6-year action plan. The Plan 2000 update also contains general policies regarding signage, environmental education, parking, environmental stewardship, and facilities development that, together with the master plan, comprise the framework for Seattle Parks and Recreation Department's role at Washington Park Arboretum.

The Washington Park Arboretum is part of the 1904 Olmsted Brothers plan for Seattle parks, boulevards, and playgrounds. Policies contained in the park and recreation plan indicate the city's intention to conserve and enhance Olmsted-planned and designed facilities as key elements of the citywide park system, including pursuing "opportunities to expand the system with the same attention to the original vision." These policies also include ensuring that the existing array of horticultural display gardens and facilities are maintained, and designating the arboretum and other Olmsted Brothers boulevards and parks as "Park Historic Resource Areas to be treated as a living legacy" (Seattle 2000).

1978 Master Plan for Washington Park Arboretum

The current master plan was last updated in 1978, the first and only update of the *General Plan for the University of Washington Arboretum* prepared by the Olmsted Brothers Landscape Architects in 1936. The updated plan focuses on transportation, facilities, and pedestrian circulation, specifically proposing the construction of a visitor center, parking amendments, trail enhancements, maintenance facilities, and circulation improvements. Some of the improvements proposed in the 1978 plan have been implemented.

The no-action alternative for this EIS takes into account that some features of that plan (road reconfigurations, in particular) have been found infeasible, that most of the other capital improvements have been completed, and that the increased maintenance and some plant exhibits were not completely implemented.

Parks Code

The Seattle Municipal Code contains park and recreation area regulations, including some provisions specifically relating to the Washington Park Arboretum (Seattle Municipal Code 18.16). The regulations state that public parks are in public trust to be maintained for present and future generations, and specifically require holding and preserving Washington Park and the arboretum as open-space park lands, freely accessible to all Seattle citizens. These regulations prohibit restricting access to the Washington Park Arboretum, charging admission or entry fees (except for the Japanese garden; Seattle City Council resolution #183667), leasing the park, and use of skateboards, roller-skates, or coasters. Motor craft are also prohibited on waters that are contiguous to the park, and it is unlawful to have, keep, or operate any craft on any waters within a park or land upon its shores, except where designated by the Parks and Recreation Department (Seattle Municipal Code 18.12).

The Seattle Municipal Code also contains open space policies designed to maintain, improve, and protect the existing open space system. The policies supplement and complement the recreational functions provided by the city's established system of parks and recreational facilities.

Seattle Land Use Code

The Seattle land use code was adopted as title 23 of the Seattle Municipal Code. The land use code classifies land into various land use zones and overlay districts that regulate the uses and the height and bulk of buildings, structures, and other development. The purpose of the land use code is to protect and promote public health, safety, and general welfare by implementing rules that are consistent with the comprehensive plan.

The city land use code contains residential area land use policies, which establish the residential zone designations and development standards (Seattle Municipal Code 23.44). The residential area policies contain general criteria regarding the allowable development of particular areas, including type of use, building size and height, outdoor activities, housing, density limits, parking and loading requirements, signage, noise and air emissions controls, light and glare, screening and landscaping, and other criteria. Zoning, policies, and development standards in effect in the Washington Park Arboretum and its vicinity are discussed briefly below. Regulations and standards related to parking and vehicle access are discussed in the transportation section of this EIS.

Zoning

Seattle's land use code has no separate park or open-space zone. Zoning of parks and open space typically reflects the adjacent zoning. The entire Washington Park Arboretum is zoned residential single-family 7200 (SF 7200). Parks, including associated customary buildings and activities, are permitted outright in the SF 7200 zone. Garages and service or storage areas accessory to parks are permitted, provided that they are located 100 feet or more from any other lot in a residential zone and are obscured from view from such lot (Seattle Municipal Code 23.44). Structures in single-family areas are limited to 30 feet in height, with slightly greater height allowed for the ridge lines of pitched roofs and for structures built on sloping lots.

Areas surrounding the Washington Park Arboretum are also zoned single-family residential. The Broadmoor Golf Club adjacent to and east of the park is zoned SF 7200. Marsh Island, Foster Island, and the waterfront areas immediately north of the park are also zoned SF 7200. The residential areas immediately west and south of the park are zoned SF 5000 (consisting of residences on 5,000-square-foot lots).

Shorelines

Seattle's shoreline master program (Seattle Municipal Code 23.60) implements the policies and provisions of the state Shoreline Management Act and the shoreline goals and policies of Seattle's comprehensive plan by regulating development of the city's shorelines in order to protect the ecosystems of the shoreline areas; encouraging water-dependent uses; providing for maximum public use and enjoyment of the shorelines of the city; and preserving, enhancing, and increasing views of the water and access to the water. The city's shoreline master program is discussed further in the plants and animals section of this EIS.

The northernmost area of the Washington Park Arboretum, including Duck Bay, the lagoons, and the shorelines around Foster Island and Foster Island Road East, lies within the conservancy-preservation (CP) shoreline environment. This shoreline designation carries substantial restrictions on development. Any development in the conservancy-preservation environment and other critical natural areas (e.g., marshes, fish spawning areas, and other habitats) must be designed to minimize adverse impacts on these natural areas. No uses are permitted outright on lands within the conservancy-preservation shoreline environment. Utility lines, pedestrian paths, beach protection structures, and several other uses are allowed as “special” uses. Streets, bridges, bulkheads to prevent erosion, certain types of landfilling, and several other uses are allowed as “conditional” uses. These special or conditional uses require additional approvals or permits. Except for underwater diving, bicycle and pedestrian paths, and viewpoints, most shoreline recreational uses are prohibited. Structures constructed in the conservancy-preservation environment cannot be more than 15 feet high, and signs must be limited to identification, on-premises directional signs, and interpretive signs (Seattle Municipal Code 23.60.180 through .334).

Environmentally Critical Areas Regulations

The City of Seattle regulates development in designated environmentally critical areas, including geologic hazard areas (i.e., landslide-prone and liquefaction-prone areas), flood-prone areas, riparian corridors, wetlands, fish and wildlife habitat conservation areas, and abandoned landfills (Seattle Municipal Code 25.09). Some areas within the Washington Park Arboretum are classified as environmentally critical areas. The western portion of the park through the Arboretum Creek valley, as well as the entire northern area of the park including Foster Island and Marsh Island, are classified as liquefaction-prone areas. Small, steep-sloped areas (i.e., areas with a 40 percent slope or greater) appear throughout and adjacent to the park. The western half of the park is classified as a fish and wildlife habitat area. In addition, wetlands are present in various areas of the park, including the Foster Island/Marsh Island area and Arboretum Creek.

The critical areas standards require soil engineering studies for proposed development in liquefaction-prone areas. Development on areas with a 40 percent slope is discouraged, and a 15-foot buffer from the top or toe of a slope is typically required. Vegetation removal in these areas must be minimized. Site design guidelines are also in place, focusing on locations of structures, terracing, and other factors designed to minimize adverse impacts and ensure safety. Most development in wetland and riparian areas is stringently regulated and requires permits and close coordination with resource agencies. Finally, the characteristics of fish and wildlife habitat conservation areas must be used to evaluate development within wetlands, steep slopes, and riparian corridors. However, there are exceptions to critical areas development standards under certain circumstances and when specific conditions are met. Environmentally critical areas are discussed in further detail in the geology and soils section and the plants and animals section of this EIS.

Environmental Impacts

Proposed Plan

Most of the improvements included in the proposed plan would take place on Washington Park Arboretum property, and nearly all (except some roadway improvements) are specifically related to improving the park. Many of the proposed improvements are designed to increase park use in the future. Therefore, the proposed action would generally increase pedestrian, bicycle, and vehicle traffic in the park and, to a lesser degree, in the surrounding neighborhoods. The park would continue to be compatible with the surrounding uses. Few direct or indirect impacts on existing land or shoreline uses in the park would be expected.

The proposed plan complies with the goals and policies of Seattle's comprehensive plan, including the requirement that single-family areas outside established urban and residential centers and villages develop in a manner similar to that which already characterizes the area. Similarly, the plan components proposed for the northern area of the park, such as restoring the Duck Bay shoreline, constructing a new shelter and viewing platform, and converting the SR 520 ramps, comply with the comprehensive plan's policies of maximizing and enhancing public use and access to the city's shorelines. The proposed plan also comports with the policies of the park and recreation plan, including enhancing Olmsted Brothers facilities, supporting use of parks by Seattle schools, and ensuring that horticultural display gardens and facilities are maintained.

The majority of improvements would be buildings and activities customarily associated with the Washington Park Arboretum, and these uses are therefore permitted outright according to city zoning regulations (Seattle Municipal Code 23.44). All proposed improvements comply with Seattle's land use regulations, including those relating directly to the arboretum (Seattle Municipal Code 18.16).

While the majority of the proposed improvements are compatible with existing land and shoreline uses and comply with applicable land and shoreline use policies and regulations, several minor direct and indirect impacts could occur. In general, these potential impacts relate primarily to proposals within the shoreline areas in the north end of the park and nearest to the neighborhoods immediately west of the park. Potential impacts are discussed below.

Roadways

A number of the proposed roadway improvements in the north end of the park would likely occur within 200 feet of the shoreline, thereby requiring shoreline substantial development permits from the City of Seattle. Furthermore, no uses are permitted outright on lands within the conservancy-preservation shoreline environment, so the shoreline permit would likely be a conditional use permit and require concurrence with both the city and the Washington Department of Ecology.

Most of the roadway proposals for the north end of the park and the Lake Washington Boulevard East improvements with overpasses lie within environmentally critical (liquefaction-prone)

areas. Soil engineering studies would likely be required to determine susceptibility to liquefaction. Wetlands and wildlife habitat areas could also be affected and could require other local or state permits and approvals. Standards governing development in environmentally critical areas may be modified if it is determined that no other remedies prescribed in the city's critical areas regulations would provide sufficient relief (Seattle Municipal Code 25.09.300). Some other proposed plan improvements may also fall within critical areas; development standards for these improvements may also be modified. Impacts associated with improvements in critical areas are discussed further in the geology and soils section and the plants and animals section of this EIS.

Pedestrian and Bicycle Circulation

Adding multi-use pedestrian and bicycle trails along the east and west sides of Lake Washington Boulevard East and overpasses across the boulevard and Foster Island Road East would require using additional park land and would introduce additional physical impact (i.e., more bicycles and pedestrians). The proposed new and reoriented system of pedestrian trails could also increase physical impacts on the land if the proposed plan brings substantially more visitors to the park. However, these uses are appropriate for and compatible with a public park and would not cause any significant adverse land use impact. Likewise, installing new sidewalks along Lake Washington Boulevard East would displace existing green space but would not significantly affect land use.

The proposed overpass on Foster Island Road East would invite more visitors to the shoreline areas of the north end of the park, potentially affecting this fragile environment. The proposed overpass may also require a shoreline permit. While this facility would probably be allowed as a conditional use in the shoreline district, the conditions placed on the permit could be more restrictive because of the proposed earthen fill and general construction requirements. In addition, the overpass may need to be more than 15 feet high, which would exceed the height limits of the conservancy-preservation environment, requiring a variance or other exception.

Parking Facilities

New and expanded parking lots would introduce new impervious surfaces into areas that are currently green space (e.g., the woodland meadow and the Madrona Terrace site near the south end of the park), thereby changing the existing nonintensive land use. However, many of the existing parking lots would be eliminated or consolidated. The net impact of the proposed parking improvements would be insignificant, and no land use impacts would be expected.

Buildings

The proposed new and expanded buildings would increase the overall extent of built structures in and around the Washington Park Arboretum, replacing existing green space and other existing land uses. As buildings customarily associated with a public park, however, the proposed new and renovated buildings would be permitted outright under city regulations (Seattle Municipal Code 23.44) and are not expected to introduce users that conflict with those on adjacent

properties. The expanded storage yard is proposed to be located within 100 feet of the Broadmoor Golf Club property and could conceivably be considered a conditional use under the zoning regulations. However, the facilities would be constructed primarily within the existing maintenance yard and would be generally obscured from view from the golf course. None of the proposed building improvements is expected to require a shoreline permit.

Outdoor Shelters

The proposed new shelters would introduce new uses into the Washington Park Arboretum, with associated physical impacts in areas where the shelters replace existing green space. These shelters would be relatively small, however, and would not cause significant land use impacts. Appropriate design of the structures and park management of the areas surrounding the shelters would minimize any potential adverse effects. As customary buildings associated with a public park, the new shelters would be permitted outright according to city regulations (Seattle Municipal Code 23.44).

The proposed shelter on Foster Island may require a shoreline permit. The city shoreline regulations (Seattle Municipal Code 23.60) do not specifically allow a structure such as the proposed shelter in the conservation-preservation shoreline environment. However, it is reasonable to expect that such a structure could be allowed with a shoreline permit, as either a special use or a conditional use.

Landscape Features

The thinning of considerable amounts of tall native vegetation in certain areas of the park to complement traditional taxonomic exhibits could potentially conflict with policy G73(h) of Seattle's comprehensive plan, which promotes enhancement of the tree canopy throughout Seattle. However, based on the character and legacy of the Washington Park Arboretum and its protected plant collections, it is not likely that the proposed master plan would be interpreted as contrary to the comprehensive plan's open space policies. Furthermore, policy G73(h) may be in conflict with preservation or restoration of the arboretum following the 1936 general plan developed by the Olmsted Brothers firm. This issue is discussed in greater detail under historic and cultural impacts.

Constructing a viewing platform south of Marsh Island would be allowed as a special use and would require a shoreline permit. Restoring and stabilizing the Duck Bay shoreline may require a conditional shoreline permit, depending on whether landfilling or bulkhead installation is required as part of restoration. Otherwise, restoration may be considered a special use and would not likely require conditions.

Safety Features

None of the proposed safety features would be expected to have any adverse impacts on land or shoreline use. In accordance with city development regulations governing single-family zones,

improved lighting in parking areas and other locations would need to be installed and directed so that nearby residences are not adversely affected.

Alternatives to Proposed Plan Elements

Roadways

General construction and operational land and shoreline use impacts resulting from the alternative roadway improvements and associated permitting requirements would be similar to those described above for the proposed plan. No significant impacts would be expected. Demolishing the unused freeway ramp could cause adverse impacts on the shoreline in the vicinity of the ramp. Although demolition is typically exempt from shoreline substantial development permit requirements, it would be subject to a permit if the City of Seattle determines that there would be a major impact on the shoreline (Seattle Municipal Code 23.60.020(B)). Contractors would need to use best management practices to prevent damage to the shoreline during demolition activities.

Pedestrian and Bicycle Circulation

Construction and operational impacts from the alternative pedestrian and bicycle improvements would be similar to those described for the proposed plan.

Parking

Construction and operational impacts from the alternative parking improvements would be similar to those described for the proposed plan. Addition and elimination of parking areas would occur in different areas of the park, but these differences would not be significant.

Buildings

General construction and operational impacts from the alternative building improvements would be similar to those described for the proposed plan. Alternatives that move operations offsite or otherwise minimize the amount of construction and operations within the park would result in proportionally fewer land use impacts compared to either the proposed plan or the no-action alternative. In particular, the proposed building alternatives that minimize development in the Madrona Terrace area and the south end of the park would lessen land use impacts in areas that are now predominantly green space, and would achieve land use efficiency by co-locating the south end educational facility in the vicinity of the Japanese garden. Land use efficiency would result from combined utilities and shared parking among multiple facilities. Other land use impacts could occur elsewhere at offsite locations, depending on the scale of the offsite activities and operations, construction requirements, previous use of the offsite facility, and the location of the offsite facility.

Outdoor Shelters

Construction and operational impacts from the alternative outdoor shelter improvements would be similar to those described for the proposed plan. Constructing an additional shelter would further increase the intensity of land use in the south end of the park but would not result in overall significant land or shoreline use impacts.

Safety Features

Impacts would be similar to those described for the proposed plan. No significant impacts are expected.

No Action

Under the no-action alternative, the Washington Park Arboretum would continue to operate much as it does today under the general guidance of the 1978 master plan, which complies with the existing policies of Seattle's general comprehensive plan, the park and recreation plan, and the applicable land use and shoreline regulations in the Seattle Municipal Code.

Because fewer construction and operational activities would occur under the no-action alternative, land and shoreline impacts generally would be somewhat lower than under the proposed plan and some of the alternative elements. Completing the Marsh Island trail around Duck Bay could intensify use of the area, potentially affecting this relatively fragile shoreline environment. Pedestrian paths are allowed as special uses in the conservancy-preservation shoreline environment, but completion of the trail could require a shoreline permit. Redesigning and improving the 25-car parking area on the north side of Foster Island Road East could also require a shoreline permit. No significant land or shoreline use impacts would be expected under the no-action alternative.

Mitigation Measures

With the required shoreline substantial development permits and any conditions attached to them, no significant land or shoreline use impacts would be expected to result from any of the alternatives. To minimize potential adverse impacts, the following measures are recommended:

- Work with the City of Seattle and appropriate resource agencies to develop appropriate mitigation measures for project elements located within environmentally sensitive areas (see proposed mitigation in geology and soils section and plants and animals section).
- Limit the proposed Foster Island shelter to 15 feet in height to comply with shoreline development standards. If possible, limit the proposed

Foster Island Road East overpass to 15 feet in height; otherwise seek ways to relocate this overpass so that it falls outside the shoreline environment.

- Contractors should implement best management practices during construction activities on Foster and Marsh islands and along Duck Bay shoreline areas, as well as during demolition of the unused SR 520 freeway ramps, to minimize potential impacts on the sensitive shoreline environment. Similarly, arboretum staff should emphasize to visitors that the conservancy-preservation area is a sensitive and protected area, and that intensive activities around this shoreline are prohibited.

Significant Unavoidable Adverse Impacts

No significant unavoidable adverse land or shoreline use impacts would be expected under the proposed master plan or any of the alternatives.

Recreation

Affected Environment

The following sections describe recreational opportunities provided by the Washington Park Arboretum. Educational programming is discussed in the public services and utilities section. A more detailed discussion of educational programming at the arboretum is contained in Appendix D, prepared by the Arboretum and Botanical Garden Committee in response to several comments on the draft EIS.

Recreational Opportunities

A significant network of trails and paths provides access to the Washington Park Arboretum plant collections and grounds. These trails and the park's open spaces and facilities are used for walking, jogging, bird-watching, picnicking, boating, fishing, formal and informal educational tours, weddings and other gatherings, and a variety of other activities.

Because the pathways, ponds, and plant collections in the Washington Park Arboretum are vulnerable to damage, active recreation and group activities are restricted. Jogging is allowed on roadways and gravel trails, but not on grass paths or turf areas. Bicycling is restricted to paved roads and is not permitted on gravel trails or grass paths. Pets are permitted on the grounds, but their owners must obey the leash and scoop laws.

Canoeists and kayakers use the waterways around Foster Island and occasionally haul these watercraft ashore along the Duck Bay shoreline, contributing (along with overuse by geese and occasional foot traffic) to shoreline erosion in this area. Fishing also occurs along Duck Bay, and picnicking is a popular pastime throughout the park.

Bicycling occurs in the park for both recreational purposes and utilitarian purposes. Utilitarian cycling is primarily used in commuting to work, shopping, and school. Cyclists must share the roadway with other vehicles along the two paved roads through the park, Lake Washington Boulevard East and Arboretum Drive East. Cyclists occasionally ride on the footpaths, which can cause conflicts between trail users and damage to trails.

The Washington Park playfield, located adjacent to the arboretum at its southern boundary, is not managed as part of the Washington Park Arboretum and would not be affected by the proposed master plan, except insofar as roads and paths that provide access to that area would be changed. Managed by the Seattle Department of Parks and Recreation, the playfield is primarily used for team and group sports and other active recreation. It contains a soccer field and a baseball field.

The Japanese garden, located at the southwestern corner of the arboretum, consists of a traditional Japanese stroll garden in a pond setting. An admission fee is required. The Japanese

Garden also hosts several events and ceremonies throughout the year. The Japanese garden had approximately 67,000 visitors in 1999 (Peter 2000 personal communication).

The Washington Park Arboretum serves as an important bicycle link to several local recreational and utilitarian destinations in the city, including the University of Washington, Seattle University, Central Seattle Community College, Capitol Hill, Volunteer Park, Montlake Park, and downtown Seattle. Bicyclists also use the park as a link to the nearby Burke-Gilman trail; the Interstate 90 bicycle trail; and other bikeway networks including the Ravenna/Green Lake/Woodland Park system, the Montlake bicycle path, Boyer Avenue East, East Interlaken Boulevard, and signed bicycle routes along Seward Park Avenue South and Lake Washington Boulevard (Seattle 1990).

There has been no rigorous effort to determine the number of drop-in users who visit the park annually, which is particularly difficult because of its size, open boundaries, and the seasonal fluctuations of users. In the 1970s, an unofficial estimate of 580,000 visitors was published (Twight and Catton 1975). In 1990, the City of Seattle estimated that annual visits to the Washington Park Arboretum totaled about 300,000 people (Seattle 1990). Estimates of current annual usage range from 300,000 to as high as 500,000 people.

The Graham Visitors Center is used for special seasonal arboretum events including annual bulb and plant sales and book sales, each lasting about one week. The visitors center is used also by various groups for meetings and social events, including wedding receptions, memorial services, and other events. A summary of usage from July 1998 to June 1999 is presented in Table 7 (Fast 1999b personal communication). The facilities are rented for many of these events unrelated to the arboretum, contributing to Washington Park Arboretum operating revenues. The total number of visitors to Graham Visitors Center was 27,100 for the one-year period from July 1998 through June 1999.

Seattle's Parks and Recreation Plan 2000 is a functional plan adopted in the summer of 2000 to guide management efforts for Seattle's open space, parks, and recreational and environmental education services over a 10- to 20-year period, complementing the city's overall comprehensive plan (Seattle 2000). This plan has no specific policies relating to recreational programs at Washington Park Arboretum but does call for completion of the master plan process and implementation of priority projects.

Environmental Impacts

Some recreational activities at the Washington Park Arboretum could be affected during construction of the various elements of the proposed plan and its alternatives. Aside from aesthetic impacts, which can affect recreational enjoyment (as discussed in detail in the aesthetics section of the EIS), no significant long-term impacts on recreational opportunities are expected.

Table 7. Graham Visitors Center usage by groups during fiscal 1998–1999.

| | July '98 | Aug | Sept | Oct | Nov | Dec | Jan '99 | Feb | Mar | April | May | June | Totals |
|---|----------|-------|-------|----------------------|-------|---------------------------|---------|-------|------------------------|-------|-------|------------------------|--------|
| Meetings (number of uses) | | | | | | | | | | | | | |
| Arboretum Foundation groups | 14 | 16 | 9 | 21 | 11 | 10 | 11 | 19 | 17 | 16 | 12 | 6 | 162 |
| University of Washington groups | 8 | 7 | 13 | 0 | 0 | 1 | 4 | 0 | 1 | 2 | 0 | 2 | 38 |
| Seattle Parks Department | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 13 |
| Other groups | 1 | 6 | 10 | 6 | 8 | 4 | 12 | 5 | 7 | 8 | 13 | 24 | 104 |
| Total number of people: 4,000 | | | | | | | | | | | | | |
| Social Events (number of attendees) | | | | | | | | | | | | | |
| Weddings and receptions | 650 | 750 | 500 | 125 | 0 | 80 | 0 | 0 | 0 | 0 | 50 | 75 | 2230 |
| Other events | 450 | 400 | 400 | 80 | 250 | 375 | 0 | 70 | 50 | 200 | 250 | 300 | 2825 |
| Total number of events: 55 | | | | | | | | | | | | | |
| Special Events | | | | | | | | | | | | | |
| Arboretum events | | | | Bulb sale 4½ days | | Greens Galore one week | | | Book sale four days | | | Annual meeting | |
| Non-arboretum events | | | | | | | | | | | | Bamboo Society show | |
| Graham Visitors Center (number of visitors counted) – Fiscal 1998–1999 | | | | | | | | | | | | | |
| Visitors | 2,900 | 3,000 | 3,000 | 2,600 | 1,600 | 900 | 900 | 1,100 | 700 | 3,800 | 3,700 | 2,900 | 27,100 |

Proposed Plan

Roadways

The major roadway changes in the proposed plan involve revisions to the north entry of Washington Park Arboretum on Lake Washington Boulevard East, and realignment of Arboretum Drive East (see Figure 3). The north entry area is not heavily used for recreation, and the boulevard realignment is not expected to cause long-term recreational impacts. The Seattle Department of Parks and Recreation has improved and maintained the areas near the SR 520 ramps under the terms of a 1989 agreement with the Washington State Department of Transportation. The city wishes to enhance the use and appreciation of this area further in conjunction with implementation of the proposed master plan.

Arboretum Drive East currently defines the western edge of the nursery area and the woodland meadow. The woodland meadow is a popular place for group events and celebrations. The realignment would move the road to the east side of these two areas. Although the realignment would likely require some reconfiguration of the space currently devoted to these uses, it is not expected to affect their use for recreation in the long term. In addition, the realignment would require relocation of the compost area, an important element of the arboretum maintenance facilities.

Construction activities required for all of these roadway improvements would cause congestion on the streets and possibly temporary road closures, which could affect the willingness of some individuals to use the park for recreation. People who drive to the park for recreation may decide to use other parks in the area, which would result in an increase in usage to those areas. Some of the park users walk onto the grounds from the surrounding neighborhood, and their access for recreational activities may also be affected by roadway construction activities. Pedestrians may have to take alternate routes to the park during temporary road closures.

Pedestrian and Bicycle Circulation

New trails and trail improvements would occur throughout the park and would generally benefit recreational users. These trail improvements would consist primarily of realigning existing trails to better serve new exhibits and to meet Americans with Disabilities Act (ADA) requirements, and thus would not introduce new activity into these areas. (For ADA accessibility, trails would be rerouted or regraded to reduce slopes and generally would be surfaced with crushed rock, compacted to allow wheeled access.) The proposed dual-use trail would introduce a new hard-surface path along Lake Washington Boulevard that could be used by cyclists and pedestrians. The dual-use trail would introduce new activities along portions of Lake Washington Boulevard where there is currently no trail, but these areas are generally not tranquil spaces because of the presence of the boulevard traffic. Construction of these improvements would result in some trail closures or detours during construction activities.

Parking Facilities

Parking lot consolidation, expansion, and addition of lots could affect recreational activities during construction periods by limiting access to certain parking areas. Over the long term, parking reconfiguration and consolidation could have aesthetic impacts affecting recreation, could intensify the use of some areas, and could reduce parking opportunities, which may discourage some people from using portions of the park.

The proposed reduction of parking lots along Arboretum Drive and Lake Washington Boulevard, along with consolidation of lots in the north and south ends of the park, could improve the naturalistic appearance of some areas but also could limit access for the disabled. The proposed plan also includes reserving some parking specifically for disabled users in all areas, and use of low-speed electric or pedal-powered tour vehicles and other special-purpose access, such as tram tours. The intent of the plan is to improve overall barrier-free access in the park.

Changes to the south parking lot on Lake Washington Boulevard could require moving the picnic tables to a different location and would intensify activity in this area.

Buildings

New buildings proposed to be constructed in the Washington Park Arboretum would introduce some new activities into the park and intensify the use of certain areas. The introduction of new educational activities in the Madrona Terrace area would change this area from a relatively tranquil and naturalistic area to one that is used more regularly for programmed activities. This area, which is currently developed with a small parking lot, would become a hub of activity and thus would be less conducive to some activities like bird-watching and casual sightseeing.

Other buildings are proposed in areas where activity is already concentrated, and long-term impacts on recreation would intensify that activity. By providing amenities such as restrooms and shelter against inclement weather, buildings are likely to encourage some users to stay longer in the park, which could lead to larger user populations and could adversely affect the user experience, if crowding occurs in some areas. Distributing new uses to the southern portion of the park would reduce the potential for this impact.

During building renovation activities at the Graham Visitors Center, reorientation of the greenhouses, and expansion of the Japanese garden entrance, some recreational activities may be affected. Access to the facilities in the Graham Visitors Center may be interrupted, limiting rental of the meeting rooms for social gatherings and use of the rooms for educational groups. Monthly plant propagation workshops in the arboretum greenhouses could be affected during construction work to reorient those facilities. Construction activities at the Japanese garden could reduce the numbers of visitors because of congestion in the project area.

Outdoor Shelters

As with other buildings, the proposed shelters would introduce new activities. The outdoor shelters are proposed in areas that are relatively remote from other buildings. The shelters could introduce programmed activities that might discourage some recreational users, but the shelters are also likely to encourage some users to remain in the park when weather becomes inclement.

Construction of the new outdoor shelters could result in a temporary increase of truck traffic along the trails adjacent to the proposed shelter locations at Madrona Terrace, Yew Hill, and Foster Island. Construction activities could result in short-term trail closures or detours, temporarily blocking access to certain areas of the park.

Landscape Features

Recreational activities may be affected because of inaccessibility to certain areas of the park during landscape reorganization, including addition of plant exhibits and enhancement of habitat, as well as Lake Washington Boulevard landscape improvements. Minor long-term impacts on recreational activities could result from new and renovated landscape features. If these features encourage longer visitor stays, larger user populations in the park at one time could affect user experience where crowding occurs. Restoration of Duck Bay vegetation and development of a hand-boat launch area (for canoes and kayaks) would restrict but not eliminate use of the shoreline by boaters.

Safety Features

The proposed installation of additional lighting and emergency telephones would have a limited impact on recreational users both during and after construction. Trails may have to be temporarily closed or rerouted during construction activities, such as trenching for utility lines (see the public services and utilities section for additional safety impacts). Over the long term, these features are intended to increase safety and thus could contribute to longer visitor stays and wider use of portions of the park, contributing to larger user populations.

Alternatives to Proposed Plan Elements

Potential recreational impacts of alternatives to the proposed plan elements are discussed below.

Four-Way Stop at North Entry to Washington Park Arboretum

Long-term impacts resulting from this alternative would be similar to those described for the proposed master plan. Construction activities during roadway improvements would cause congestion on the streets, which could affect the willingness of some individuals to use the park for recreation. People who drive to the park for recreation and find it congested may decide to use other parks in the area, which would result in an increase in usage of those parks. Stop signs and congestion on Lake Washington Boulevard East could improve the recreational experience by reducing traffic speed and the perception of traffic hazards.

Demolition of the unused freeway ramp would cause an increase of heavy equipment and truck traffic and could temporarily affect water-dependent recreational activities (e.g., boating and swimming) in the vicinity of the ramp.

Lake Washington Boulevard Improvements with At-Grade Crossings

Long-term impacts resulting from this alternative would be similar to those described for the proposed master plan. Stop signs would cause severe traffic delays at peak hours, which could discourage recreational use at those times. On the other hand, slower traffic and easier turning movements could facilitate use of non-arterial roadways in the park by park visitors and may improve their recreational experience by reducing the perception of fast-moving traffic and traffic hazards.

Construction activities during roadway improvements would temporarily increase congestion on the streets and could result in street lane closures. The construction could affect the flow of traffic (including bicyclists) along Lake Washington Boulevard East, which could affect pedestrians as well.

Arboretum Drive Parking Lot Consolidation with Restricted Access

Closure of Arboretum Drive East to vehicular traffic and removal of parking lots along the roadway could affect recreational access to the trails and exhibits to a small degree. However, trails would still be accessible from other parking areas. This alternative could result in greater tranquility in the affected areas, which could benefit some park users.

Overpass at Interlaken

Long-term impacts resulting from this alternative would be similar to those described for the dual use trail in the proposed master plan. Construction activities during roadway improvements, including overpass construction, would temporarily increase congestion on the streets and could result in street lane closures. The construction could affect the flow of traffic along Lake Washington Boulevard East. Pedestrians walking along the boulevard and bicyclists could be affected by some trail closures or detours during construction activities.

Separated Bicycle and Pedestrian Trails

Long-term impacts resulting from this alternative would be similar to those described for the proposed master plan. Cyclists may find the separated trail safer, and thus it may be more heavily used than the dual-use trail in the other alternatives. Construction of a bicycle trail along the east side of Lake Washington Boulevard East and a separate trail for pedestrians along the west side of the boulevard could affect the flow of recreational traffic as well as other traffic along the boulevard. Pedestrians walking along the boulevard and bicyclists could be affected by some trail closures or detours during construction activities.

South-End Stop Light and Crosswalk

Long-term impacts resulting from this alternative would be similar to those described for the proposed master plan. Construction activities during roadway improvements, including overpass construction, would temporarily increase congestion on the streets and could result in street lane closures. The construction could affect the flow of traffic along Lake Washington Boulevard East. Pedestrians walking along the boulevard and bicyclists could be affected by some trail closures or detours during construction activities.

Parking Lot Expansion at Dispersed Locations

Long-term impacts resulting from this alternative would be similar to those described for the proposed master plan. Larger parking areas would have a greater potential to displace recreational uses and would intensify activity in these locations even more than under the proposed plan, although existing parking spaces could be removed in some areas, thus restoring some aesthetic value and recreational potential to those areas.

Parking lot expansion for the Japanese garden and Washington Park playfield could affect recreational activities by causing congestion and limiting access to the area during construction periods.

Building Renovations without Expansion, and South-End Structure at Madrona Terrace

Long-term impacts resulting from this alternative would be similar to those described for the proposed master plan, although the impacts would be reduced proportionally to the size of the structures. During building renovation work at the Graham Visitors Center, some recreational activities may be affected. Access to the facilities in the Graham Visitors Center may be interrupted, affecting rental of the meeting rooms for social gatherings, use of the rooms by educational groups, and other activities.

Addition of Outdoor Shelters

Long-term impacts resulting from this alternative would be similar to those described for the proposed master plan. Impacts on recreational activities resulting from construction of new outdoor shelters under this alternative would be slightly greater than from construction of the three shelters identified in the proposed plan. This alternative could result in a temporary increase of truck traffic along the trails adjacent to the proposed shelter locations, might require temporary trail closures or detours, and could prevent access to certain areas of the park.

No Action

Continued management of the Washington Park Arboretum under the no-action alternative would not adversely affect existing recreational activities.

Mitigation Measures

Implementation of the proposed plan or alternatives over several decades would minimize construction-related impacts at any one time. Construction activities should be coordinated by arboretum and Parks and Recreation Department staff with Seattle Transportation and other city departments, to include plans for site access and staging areas. Mitigation measures related to traffic congestion are identified in the transportation section of this EIS. Trail modifications and new construction areas should be clearly marked to ensure the safety of the general public.

Building renovation activities and construction schedules should be coordinated by arboretum staff and the contractors to avoid interruption of educational and recreational activities. Classroom activities may be temporarily relocated at the Center for Urban Horticulture.

Significant Unavoidable Adverse Impacts

Recreational activities at the Washington Park Arboretum are closely tied to the aesthetic qualities of the place. In the judgment of some users, certain elements of the proposal are likely to be seen as having significant adverse aesthetic impacts, and thus the recreational use and enjoyment of the park by those people would be affected. These impacts are discussed in detail in the aesthetics section of the EIS.

Aside from these related aesthetic impacts, no significant unavoidable impacts on recreational activities are expected to result from the proposed plan elements or alternatives, provided that recommended construction practices are followed.

Historic and Cultural Resources

Affected Environment

The Washington Park Arboretum contains a unique set of historic and cultural elements. The purpose of this section is to provide a brief historical perspective of Washington Park and its arboretum, describe the political, cultural, and design influences that have shaped it over the years, and summarize the existing conditions of its historic features.

A literature review was performed to investigate the history of the Washington Park Arboretum. Original documents relating to the development of the Olmsted plans for both Lake Washington Boulevard and the Washington Park Arboretum were examined. Interviews with the present arboretum director, John A. Wott, and consultation with the Seattle Landmarks Preservation Board also provided valuable information. The presence and current condition of historic elements within the park were evaluated through direct observations during site visits between November 6 and December 3, 1999, and on several dates in July, August, and September 2000. Sources used in the historical investigation include the following:

- *The Long Road Traveled* by Henry Schmitz (The Arboretum Foundation at the University of Washington 1973)
- Scot D. Medbury's masters thesis, *The Olmsted Taxonomic Arboretum and Its Application to Washington Park, Seattle* (University of Washington 1990)
- *The Arboretum Plan, A Greenprint for the Future* (Portico 1997)
- *A Collections and Landscape Master Plan for Washington Park Arboretum*, prepared by Iain M. Robertson for the Center of Urban Horticulture at the University of Washington (1991)
- Excerpts from the Library of Congress Olmsted microfilm – provided by Friends of Seattle's Olmsted Parks (1904–1943)
- *General Plan for the University of Washington Arboretum* (Olmsted Brothers Landscape Architects, Brookline, Massachusetts, 1936)

History of the Washington Park Arboretum Site

This history of the Washington Park Arboretum is organized into six time periods:

- Pre-boulevard era, prior to the construction of Lake Washington Boulevard in 1905
- Boulevard era, 1904 to 1935
- Olmsted Brothers *General Plan for the University of Washington Arboretum*, 1936
- Works Progress Administration era, 1934 to 1942
- Post-war period, 1947 to 1972, marked by the 25-year directorship of Brian O. Mulligan
- 1972 to present.

Pre-Boulevard Era

Washington Park was originally a 62-acre tract of land donated to the City of Seattle by the Puget Mill Company in 1900. Soon afterward, the city developed the present Washington Park playfield at the south end of the park and began acquiring property along the park borders. The park was used for sports and recreation, including harness racing and horseback riding on the “speedway,” an old logging road that is now Azalea Way, and bicycling and walking on numerous trails in the area. At the turn of the century, the park contained a series of wagon roads that led into the area now known as Broadmoor. Some of these roads and trails, including the trail between the rock garden and Loderi Valley, remain as footpaths today.

Boulevard Era, 1904 to 1935

In 1904, the city engaged the Olmsted Brothers Landscape Architects of Brookline, Massachusetts to develop a comprehensive plan for a public park system throughout Seattle. John C. Olmsted was the principal in charge of the project for the Olmsted firm, which had an international reputation for large-scale park planning. The dominant feature of the resulting plan was a 20-mile landscaped boulevard system linking numerous existing and planned parks, greenbelts, and playfields within the city limits, reflected in today’s Lake Washington Boulevard, Interlaken Boulevard, Ravenna Boulevard, Mount Baker Boulevard, Magnolia Boulevard, and many other boulevards and parkways linking Seattle’s public open green spaces. Lake Washington Boulevard was among the first elements of the plan to be completed.

In 1909, when the Alaska Yukon Pacific Exposition was held in Seattle, Lake Washington Boulevard served as the main entry to the exposition. The footbridge that still spans the boulevard today was designed by Walter Ross Baums Wilcox in 1910 and completed in 1914. This reinforced concrete and brick structure, which carries a sewer line, serves as the primary pedestrian entry into the park from the Montlake neighborhood. This aqueduct structure was designated as a Seattle landmark on December 31, 1976. It was also listed in the National Register of Historic Places on July 16, 1982, identified as the “arboretum sewer trestle.”

In 1917, the city purchased Foster Island. Early twentieth century anecdotal accounts indicate that Foster Island was a native American burial ground, although this has not been confirmed by archaeological research. Also in 1917, the opening of the Montlake canal lowered the level of Lake Washington, further contributing to the park's acreage. The remaining marshy area south of Foster Island was used as a refuse dump for many years. The city purchased more park land along Union Bay, and by 1934 Washington Park had grown to its present size.

Olmsted Brothers General Plan for the University of Washington Arboretum, 1936

The Washington Park Arboretum was established in 1934 by an agreement between the University of Washington Board of Regents and the Seattle City Council and mayor. This agreement gave the university the opportunity to design, construct, plant, and manage an arboretum and botanical garden in Washington Park. In 1935, the Seattle Garden Club raised \$3,000 to commission the Olmsted Brothers plan, a preliminary plan intended to guide subsequent arboretum planning. J. Frederick Dawson was the principal landscape architect for the Olmsted firm's *General Plan for the University of Washington Arboretum*, which was based on the evolutionary progression of botanical species (see Figure 10).

The sequential taxonomic collection of woody plants, along with Lake Washington Boulevard East and Azalea Way, are the three principal features of the 1936 general plan that are reflected in the Washington Park Arboretum today. Although the design intent for these features was implemented to some extent, actual development only partially resembles the 1936 general plan elements. While Azalea Way and Lake Washington Boulevard East were built in accordance with the general plan, much of the taxonomic plan was altered. Still, at least 14 major groups are located in the areas indicated in the 1936 general plan. The two relatively formal structures included in the 1936 general plan, the rose garden and the administrative complex, were never implemented. The rose garden was planned for the south end of the park, in an area currently occupied by the Washington Park playfield, and the administrative complex was to be located at the north end of the park.

Works Progress Administration Era, 1934 to 1942

Between 1936 and 1941, the Works Progress Administration (a federal work relief program during the Depression of the 1930s) carried out the basic construction of the Washington Park Arboretum. The city provided security, water systems, and lighting. The university provided the plant collections and supervised plant and seed exchanges. The Washington Park Arboretum was one of Seattle's largest work-relief projects, and contributions made by the Works Progress Administration include several trails, stone entry structures, the south entrance lodge (known as the stone cottage), the rock garden, the woodland garden, the stone bridge leading to the pinetum, the lookout gazebo, and several ponds. Although some of these features were part of the Olmsted Brothers general plan, such as the rock garden, they were not placed precisely according to the plan, but were rather developed under guidance of city and university officials who used the general plan only as a guide. In some cases, such as at Arboretum Drive, records show that the city and university disagreed with the designer on questions of layout and had

already proceeded with design and construction prior to receiving the general plan (Friends of Seattle's Olmsted Parks 1904–1943).

Post-War Period, 1947 to 1972

In 1947, Brian O. Mulligan became the director of the Washington Park Arboretum and held this position for 25 years. He was assisted by curator Joseph Witt and other arboretum staff during his directorship, a period during which the extensive woody plant collections were largely developed, and gardens such as the winter garden and woodland garden were completed. Although the 1936 Olmsted Brothers plan guided Mulligan and Witt, they made extensive modifications to the plan that improved the siting of many plants. Most of the existing collections were planted during the post-war period, at a time when the Washington Park Arboretum was developing into a major regional, national, and international resource.

The Japanese garden, completed in 1960, is among the historically important contributions from this period. The garden is a significant symbol of international friendship and cooperation, and its features include two stone lanterns donated by the City of Kobe, Japan, and a ceremonial teahouse, a gift from the City of Tokyo. The teahouse was first built in 1972, then replaced in 1981 after a 1973 fire destroyed the original building.

1972 to Present

In the early 1970s, discussions concerning the various roles and interests of the university, the city, and the immediate neighborhood of the park resulted in the negotiation of a detailed working partnership between the university and the city. Following adoption of the Jones & Jones arboretum master plan update in 1979, the University of Washington, in an effort to reaffirm its managerial role, created the Center for Urban Horticulture. The center, located across Union Bay about 1.5 miles from the park, would become the university's management office for the arboretum, providing physical facilities, programs, and staff. The Graham Visitors Center, constructed in the northeastern portion of the park in 1985 as a gift to the city from the Arboretum Foundation, provides an information lobby, a gift shop, a public meeting room, and administrative offices.

Existing Conditions

Existing historic features in the Washington Park Arboretum are also organized into the six time periods noted above. Table 8 summarizes existing historic elements, the period in which each was built, and their present condition.

Pre-Boulevard Era Features

The existing trail between the present rock garden and Loderi Valley, the east/west Loderi Valley path, and various narrow foot trails such as the path near the dwarf conifer beds are all relics of early wagon, equestrian, and bicycle trails that have been in place since the turn of the past century. These walkways, which are in fair condition and have not been obstructed or

Table 8. Historic features of the Washington Park Arboretum and their condition as observed in November 1999.

| Period | Feature | Year Built or Planted | General Condition | Landmark Status |
|-----------------------------------|---|--|---|---|
| Pre-boulevard era | Various trails | Pre 1900s | Those existing are in good condition | Not listed |
| Boulevard era | Lake Washington Boulevard (also an Olmsted Brothers feature) | 1904 | Good | Not listed |
| | Arboretum aqueduct structure | 1914 | Good; needs basic maintenance | Designated Seattle landmark in 1976; listed in National Register of Historic Places in 1982 |
| 1936 Olmsted Brothers plan | Partially implemented taxonomic arrangement of the woody plant collection | 1940–1970 | Woody plant collection declining due to understaffed horticultural crew | Not listed |
| | Azalea Way | Presented in 1936 plan; detail design and planting began in 1939 | Olmsted Brothers color scheme lost due to plant cost and availability; dogwoods lost to anthracnose disease | Not listed |
| | Ponds in woodland garden and near lookout gazebo | Constructed by Works Progress Administration from 1934 to 1942 | Good | Not listed |
| Works Progress Administration era | Stone cottage | 1938 | Good condition considering age | Not listed |
| | Lookout gazebo | 1939 | Good condition considering age; new metal roof built in 1980s | Not listed |
| | Basalt pillar and gate posts at the Madison Street entrance | Between 1937 and 1942 | Fair; recently lost its wooden arm announcing <i>The Arboretum</i> | Not listed |
| | Basalt pillar and gate posts in courtyard south of Graham Visitors Center | Between 1937 and 1942 | Good condition considering age; relocated to present location from north park entrance | Not listed |
| | Basalt pillar and gate posts near stone cottage | Between 1937 and 1942 | Good condition considering age | Not listed |
| | Rock garden (shown on 1936 general plan at Foster Island) and woodland garden | Between 1937 and 1942 | Woodland garden in good condition; rock garden in moderate to poor condition | Not listed |
| | Stone bridge leading to pinetum and stone bridge in Japanese garden | Between 1937 and 1942 | Good | Not listed |
| Post-war era | Three memorial stone seating areas (one with a fountain) | One built in 1947 and two built in 1961 | Good | Not listed |
| | Japanese garden and historic elements within | 1960 | Excellent | Not listed. |
| 1972 to present | Tsutakawa gate | 1976 | Excellent | Not listed |
| | Graham Visitors Center | 1985 | Excellent | Not listed |

compromised by built structures, are still used today by visitors to the park. In addition, the current broad and grassy promenade through Azalea Way was a logging skid route in the late nineteenth century, and later became a popular speedway for carriage and horse racing.

Boulevard Era Features

Lake Washington Boulevard was built in 1904 as part of the Olmsted Brothers plan for Seattle parks and boulevards, and its present location is a legacy of this plan. The 1904 Olmsted Brothers parks plan was separate from the 1936 Washington Park Arboretum plan, although Lake Washington Boulevard is an element of both of these plans.

The arboretum aqueduct structure, known as the Wilcox footbridge, provides a footpath over Lake Washington Boulevard East. The footbridge was designed by W. R. B. Wilcox in 1910 to specifications prepared by the city. This reinforced concrete and brick structure, completed in 1914, was designated as a Seattle landmark on December 31, 1976, and was listed in the National Register of Historic Places on July 16, 1982, identified as the “arboretum sewer trestle.”

As a footbridge, the Wilcox bridge provides a popular access route to the park from the east, and as a sewer viaduct, the structure carries a 180-foot-long gravity-flow sewer line over Lake Washington Boulevard East. Six reinforced-concrete arches support the bridge, and a decorative pattern was created by inset bricks on both the north and south faces. The bridge also features iron light posts and brick railings along its footpath. The bridge is in good condition, and in 1963 it received a citation for “professional excellence and enduring quality in an older structure” from the Seattle chapter of the American Institute of Architects. Renovation work over the years, such as sandblasting and tuck pointing, has helped to preserve the historic nature of this structure.

Features of the Olmsted Brothers Plan for Lake Washington Boulevard and the Washington Park Arboretum

Perhaps the most important and enduring element of both the 1904 Lake Washington Boulevard plan and the 1936 *General Plan for the University of Washington Arboretum* is the natural planting design and vegetation management philosophy. Another principal feature of the 1936 plan is the (partially implemented) sequential taxonomic arrangement for the arboretum’s woody plant collection. Although the sequential taxonomic plan was largely abandoned due to placement issues, evidence of its partial implementation still exists. The arrangement and installation of the woody plant collection as it is seen today was completed under the directorship of Brian O. Mulligan (1947–1972), based on the ecological preferences of each taxonomic family and individual species.

Azalea Way, which remains one of the most notable features of the Washington Park Arboretum, was a focal point in Dawson’s *General Plan for the University of Washington Arboretum* presented to the city in 1936. The plant list for the wide, grassy promenade included dogwoods, cherries, and azaleas, and species were chosen specifically to adhere to a pastel color scheme. Although the Olmsted Brothers firm based its plan for Azalea Way on plant availability in local

nurseries, cost increases and slowed production during World War II led to departures from the intended color scheme. Further, loss of the initial dogwood plantings to anthracnose disease resulted in their virtual absence today. Azalea Way is presently in poor condition, and large portions of this promenade may require replanting. Many of the azaleas are showing signs of age and deterioration, and brown rot has taken its toll on the cherry trees along this path.

The 1904 boulevard planting plan along Lake Washington Boulevard East was not closely adhered to; however, a few of the trees on the Olmsted Brothers list, including eastern white pines and plane trees, line the boulevard today. The spatial sequence and views included in that plan are also evident as one moves along the boulevard, despite additions such as the Japanese garden and the SR 520 intersection that have altered the original character of the boulevard in places.

Features of the Olmsted Brothers 1936 general plan that still exist today include the following:

- The general location of Arboretum Drive East
- Two ponds in the woodland garden area, two ponds west of the rhododendron glen, and a pond in the Japanese garden
- The concept of a south entrance lodge (the stone cottage)
- The rock garden (design revised by Otto Holmdahl)
- The location of the maintenance area and the greenhouses
- The locations of approximately 14 of the taxonomic family collections.

Existing ponds that were inspired by the 1936 Olmsted Brothers plan have been recently renovated and are in good condition. The stone cottage and the lookout gazebo are both in very good condition considering their age. The rock garden, which was relocated from its intended site on Foster Island, is in moderate to poor condition and requires maintenance.

Works Progress Administration Features

The Works Progress Administration employed as many as 700 workers at a time on the Washington Park Arboretum site, preparing the site by clearing brush and stumps, installing drainage and irrigation pipes, and grading roads and trails. The most prominent existing feature built during the Works Progress Administration era is the 1937–1938 south entrance lodge. This structure was designed in a Cotswold or French Normandy style incorporating Douglas fir timbering and copper roofing. Commonly called the stone cottage, this petite entrance lodge greets visitors as they enter the park from the south, and still serves as a gatekeeper’s house. This building has aged handsomely and appears to be sturdy and in good condition. Although a south entrance lodge was specified in the 1936 Olmsted Brothers plan, its planned location was closer to East Madison Street.

Other stone structures that were built by the Works Progress Administration include the 1939 stone bridge leading to the pinetum, the 1939 lookout gazebo (an Olmsted Brothers feature), the basalt gate posts on both sides of Lake Washington Boulevard East next to the stone cottage, and a similar pair located in the courtyard of the Graham Visitors Center (these were likely moved from the Montlake area during construction of SR 520). There is also a basalt pillar at Lake Washington Boulevard East and East Madison Street, which at one time supported a wooden arm from which a carved wooden sign announced *The Washington Park Arboretum*.

Most of the stone structures from this era were built exceptionally well and remain in good condition. The lookout gazebo has lost some of its sense of serenity due to increased traffic on Lake Washington Boulevard East, but the stonework appears solid and the upper log structure has aged well. A new metal roof was added to the gazebo in the mid 1980s to replace its deteriorating wood shingles.

The road known today as Arboretum Drive East was constructed by Works Progress Administration crews, although it was first proposed at the time of the 1904 parks and boulevard plan. On survey maps made prior to development of the plan for Lake Washington Boulevard, trails are shown that follow a portion of the eastern boundary of Washington Park. The Olmsted firm sketched in a road, identified on at least one plan as the “boundary road,” that ran along a portion of the eastern fence line of the park.

In 1935 field notes produced for the arboretum plan, and in the 1936 general plan itself, the Olmsted Brothers firm called out a road running roughly parallel to the eastern property line that differs from the earlier survey and plan in that substantial perimeter planting areas are provided between the road and the eastern park boundary for most of its length. Moving north along the road the perimeter planting areas become wider, with several taxonomic exhibits, the nursery area, and the maintenance yard all proposed on the eastern side of the road. Although the Olmsted Brothers firm produced a detailed layout plan for this road, there was a dispute about whether that plan was used. In any case, when the road was built by the Works Progress Administration crews in the 1930s, it was located almost exactly as laid out on the 1936 general plan over its northern half. As built, the southern half deviates slightly from the general plan by including more pronounced curves and providing more area to the east of the road.

Works Progress Administration crews also planted an evergreen hedgerow, which was not called out on the general plan, between the road and the nursery area. A portion of the hedgerow remains today. The trees are tall, and the lower branches have fallen off or have been removed, so that it now resembles a closely spaced row of trees rather than a hedge.

Post-War Features

Most of the Washington Park Arboretum’s woody plant collection was planted in the post-war period during Brian O. Mulligan’s directorship. The arboretum staff characterizes the general condition of the woody plant collection as one of overall decline, which can be attributed largely to understaffing of the horticultural crew. In addition to the effects of inadequate maintenance, trees and shrubs are dying from old age, storm damage, overcrowding, disease, shading by fast-

growing native trees such as western red cedar and big-leaf maple, and the introduction of invasive species such as English ivy and Himalayan blackberry.

Built structures that are considered historic elements from this period include three stone seating areas: the 1947 Anna Thomsen Milburn memorial off Azalea Way, the 1961 Isabel McCormick Preston memorial south of Loderi Valley, and the 1961 Maude Sawyer memorial (with drinking fountain) on Arboretum Drive East near the rhododendron glen. These memorial structures are in good condition.

The Japanese garden, completed in 1960 under the direction of Japanese landscape architect Juki Tida, also belongs to the post-war period. Funded by a donation from an anonymous foundation member in 1959, the stroll garden was based on popular Japanese designs from the late sixteenth and early seventeenth centuries. Among its most historically significant elements are a wooden ceremonial teahouse that is a focal point in the garden, and an inscribed stone lantern that was a gift from the City of Kobe, Japan. Other historic features in the Japanese garden include a pond (part of the 1936 Olmsted Brothers plan), a stone footbridge built by the Works Progress Administration, and several trees and shrubs that have been groomed and maintained in a traditional Japanese style. The Japanese garden has been well maintained and is in excellent condition.

Features from 1972 to the Present

The Donald G. Graham Visitors Center, completed in 1985 as a gift to the city from the Arboretum Foundation, provides an information lobby, a gift shop, a large meeting room for education and public events, and administrative offices. The building is in excellent condition. One of the few art objects in the park is a decorative cast iron gate by George Tsutakawa, originally installed across Arboretum Drive East in 1976, and now located at the entrance to the Graham Visitors Center parking lot. The Tsutakawa gate is also in excellent condition, although it may not be optimally located for public viewing.

Applicable Regulations and Policies

A variety of regulations and policies addressing historic and cultural sites and structures potentially apply to the master plan and its implementation.

National Register of Historic Places

The National Register of Historic Places has established criteria that serve as the basis for evaluating a property's eligibility for landmark listing at the national, state, and local levels (36 Code of Federal Regulations [CFR] 60). These criteria include the quality of architecture and significance in American history, archaeology, and culture. The criteria are applicable to districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, material, workmanship, feeling, and association. The criteria are also defined to include the following:

- Places associated with events that have made a significant contribution to the broad patterns of history
- Places associated with the lives of persons significant in history
- Places that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values
- Places that have yielded or may be likely to yield information important in prehistory or history.

Seattle Historic Preservation Policies

The City of Seattle has adopted the following environmental policies related to historic preservation (summarized from the Seattle Municipal Code 25.05.665):

- Maintain and preserve significant historic sites and structures
- Comply with Landmarks Preservation Ordinance for projects involving structures and sites that have been designated as historic landmarks
- Refer any sites or structures that appear to meet the criteria for designation to the Landmarks Preservation Board for consideration
- Refer all proposed actions located adjacent to or across the street from a designated site or structure to the city historic preservation officer for an assessment of adverse impacts on the designated landmark and for comments on possible mitigating measures.

Seattle Landmark Designation

The Seattle Municipal Code (25.12) also contains guidelines for designating historic and cultural sites and landmarks. An object, site, or improvement that is more than 25 years old may be designated for preservation as a landmark site or landmark if it has significant character, interest, or value as part of the development, heritage, or cultural characteristics of the city, state, or nation, and if it falls into one of the following categories:

- It is in the location of or is associated in a significant way with a historic event with a significant effect upon the community, city, state, or nation
- It is associated in a significant way with the life of a person important in the history of the city, state, or nation

- It is associated in a significant way with a significant aspect of the cultural, political, or economic heritage of the community, city, state, or nation
- It embodies the distinctive visible characteristics of an architectural style, period, or method of construction
- It is an outstanding work of a designer or builder
- Because of prominence of spatial location, contrasts of siting, age, or scale, it is an easily identifiable visual feature of its neighborhood or the city and contributes to the distinctive quality or identity of its neighborhood or the city.

Guidelines and Policies for Mitigation of Impacts on Historic and Cultural Resources

The U.S. Department of the Interior publishes *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Treatment of Cultural Landscapes* (1996). This publication describes four possible treatments: preservation, rehabilitation, restoration, and reconstruction. These are described as follows:

Of the four, Preservation standards require retention of the greatest amount of historic fabric including the landscapes historic form, features and details as they have evolved over time. Rehabilitation standards acknowledge the need to alter or add to a cultural landscape to meet continuing or new uses while retaining the landscape's historic character. Restoration allows for the depiction of a landscape at a particular time in its history by preserving materials from a particular period of significance and removing materials from other periods. Reconstruction standards establish a framework for recreating a vanished or non-surviving landscape with new material, primarily for interpretive purposes.

These terms are used in the analysis below, where appropriate, to describe the intent of the proposed master plan, or to describe a general means of mitigating impacts on historic and cultural resources. The guidelines developed by the Department of the Interior are not repeated in entirety here, but examples are given to illustrate how a particular treatment may be applied. In general, the Seattle Department of Parks and Recreation has determined that *rehabilitation* best describes the approach that the city intends to take toward historic resources in the Washington Park Arboretum.

The City of Seattle's State Environmental Policy Act (SEPA) policies also include the following direction with regard to mitigation for impacts on historic and archaeological resources. Where the project site is a designated city landmark, compliance with the landmarks regulations for that site is deemed adequate mitigation, and no other mitigation for impacts on historic resources may be required. For projects that are not designated city landmarks, mitigation may not be required

unless the project is adjacent to a landmark or contains archaeological resources. For projects located adjacent to a designated landmark, the following policy applies:

Mitigation may be required to insure the compatibility of the proposed project with the color, material and architectural character of the designated landmark and to reduce impacts on the character of the landmark's site. Subject to the Overview Policy set forth in SMC Section 25.05.665, mitigating measures may be required and are limited to the following:

- i. Sympathetic facade treatment;*
- ii. Sympathetic street treatment;*
- iii. Sympathetic design treatment; and*
- iv. Reconfiguration of the project and/or relocation of the project on the project site; provided, that mitigating measures shall not include reductions in a project's gross floor area. [SMC 25.05.675H.2d]*

Regarding archaeological resources, unlawful removal or mutilation of artifacts or burial sites is a felony in Washington state. For sites that contain archaeological resources, the following city code provisions also apply:

Subject to the criteria of the Overview Policy set forth in SMC Section 25.05.665, mitigating measures which may be required to mitigate adverse impacts to an archaeological site include, but are not limited to:

- i. Relocation of the project on the site;*
- ii. Providing markers, plaques, or recognition of discovery;*
- iii. Imposing a delay of as much as ninety (90) days (or more than ninety (90) days for extraordinary circumstances) to allow archaeological artifacts and information to be analyzed; and*
- iv. Excavation and recovery of artifacts. [SMC 25.05.675H.2e]*

This policy is clarified in the Department of Design, Construction, and Land Use Director's Rule 2-98. This rule requires that at the time a master use permit is applied for, specific information must be provided for projects that are located either within 200 feet of the U.S. government meander line, or in other areas where information (for example, on previous development permits) suggests a potential for archeologically significant resources.

For this Washington Park Arboretum master plan EIS, no specific archaeological information has been compiled, although the Department of Parks and Recreation notes that, at least for Foster Island, there is anecdotal information that could trigger the need for additional information on specific elements of the plan.

Historic Resources within the Area of Potential Effect

This section describes the historic properties that lie within the *area of potential effect* in and around the Washington Park Arboretum. The area of potential effect is defined in 36 CFR 800.2(c) as the geographic area within which an action may cause changes in the character or use of historic properties. For the master plan, the area of potential effect consists of the Washington

Park Arboretum itself and any historic structures located on each full block surrounding the park, including diagonal-facing blocks. The area of potential effect also includes structures within a two-block distance of the park that have already been identified as historic in previous surveys by other sources.

The only structure currently designated as a Seattle landmark within the area of potential effect is the arboretum aqueduct (i.e., the Wilcox footbridge over Lake Washington Boulevard East). This reinforced concrete and brick structure, completed in 1914, was designated as a Seattle landmark on December 31, 1976, and was listed (as the arboretum sewer trestle) in the National Register of Historic Places on July 16, 1982. Consultation with the Urban Conservation Division of the Seattle Department of Neighborhoods revealed no other properties designated as Seattle landmarks within the area of potential effect. A nomination package for the entire Washington Park Arboretum has been submitted to the Department of Neighborhoods. At the printing of this document, no action has been taken by the Seattle Landmarks Board on that application.

Environmental Impacts

The Washington Park Arboretum is a cultural landscape that is likely to be eligible for city landmark status as a whole, and it also contains elements that may be considered landmarks in themselves. These historic resources could be affected by major changes to its plant collections, landscaping, or structures. It is also possible that archeological artifacts could be uncovered during construction projects in various areas of the park, particularly in locations of proposed buildings requiring excavation. The intent of the proposal is to develop the master plan elements in a manner that is consistent with rehabilitation of existing historic features of the site. Potential impacts associated with each of the elements of the proposed plan and alternatives are described below.

Proposed Plan

Many aspects of the Washington Park Arboretum have historic or cultural significance. If individual renovation or construction projects are implemented under the proposed master plan without detailed knowledge of the historic and cultural elements that would be affected by a specific design, some historic and cultural resources could be significantly altered or even lost. If implementation of the master plan is approached, in part, as a rehabilitation of a cultural landscape, as some of the project objectives intend, then significant impacts on historic resources can be avoided.

The following sections provide detailed discussion of ways in which elements of the proposed master plan could affect features of the park that have cultural or historic value.

Roadway Modifications to Lake Washington Boulevard

As discussed above, Lake Washington Boulevard East is a central feature of the Washington Park Arboretum and was part of a larger boulevard and park system envisioned in a 1904 plan also prepared by the Olmsted Brothers firm. In the 1904 plan, the boulevard was laid out more or less in its current configuration, except that at the north end it was to connect to Lakeside Boulevard. SR 520 and its associated ramps did not exist at that time, and these massive structures and their associated traffic have a large impact on both the appearance and the use of the boulevard.

The proposal would realign the north end of Lake Washington Boulevard East and revise the connections between the SR 520 ramps, Lake Washington Boulevard, and Foster Island Road East. The proposed roundabout configuration, which was a part of the proposed plan presented in the draft EIS, has been eliminated from further consideration in the master plan. Please see the Transportation for more information.

The proposed realignment would include a wider, sweeping curve west of the SR 520 intersection, creating a parkway character to replace the abrupt fill and alignment at the SR 520 ramps (see Figure 3). This proposed alignment could affect some plantings in the conifer meadow just south of this segment of Lake Washington Boulevard, an area of the park that was planted relatively recently.

The existing intersection arrangement at the northern end of the park is not found in the Olmsted Brothers plans of either 1904 or 1936. Although the configurations of Lake Washington Boulevard and Foster Island Road are not far horizontally from the 1936 general plan, a considerable amount of fill and some road realignment was necessary to connect the SR 520 ramps. While the proposed master plan would modify the alignment of Lake Washington Boulevard, it could be accomplished as a more appropriate rehabilitation effort than maintaining the current alignment. The original Lake Washington Boulevard plans laid out a graceful approach to the valley of Washington Park, with parkland dominating views on both sides. Redesign of this intersection could result in reducing the visual presence of the freeway ramps by providing new plantings. In the short term, plantings in the area of this intersection would be altered, and both the ramps and the roadways would be more conspicuous.

The character of Lake Washington Boulevard would also be affected by the addition of the proposed multi-use trail on its eastern side. Those impacts are discussed in detail below under pedestrian and bicycle circulation.

Arboretum Drive Realignment

The intent of the Olmsted Brothers plan for Arboretum Drive East appears to have been a “boundary road” kept “pretty free of through traffic,” according to letters written on the subject (Dawson 1935 personal communication). That would remain the intent under the proposed plan. The proposed realignment is intended to unite the Graham Visitors Center with the rest of the park by placing Arboretum Drive on the east side of the visitors center. The northern one-third

of the road would be most affected. The road would generally follow the path of an existing service road past the visitors center parking lot and the maintenance yard. South of the woodland meadow it would curve back to rejoin the existing alignment.

As noted above, this portion of Arboretum Drive closely follows the alignment established in the 1936 general plan. Some perimeter planting would be provided on the east side of the road where it comes closest to the park boundary. Although an exact layout of the realigned road has not been designed, it appears the planting areas to the south and along the east side of the meadow would be the areas most affected.

The visual character of Arboretum Drive would change, in that the road would not pass the woodland garden in the manner it currently does, nor would it pass the evergreen hedgerow lining the west side of the road next to the nursery. A determination as to whether the evergreen hedgerow would remain, or be replaced with a hedge like the original one, or be eliminated, would be made at the design stage, but some portions would likely be affected by new buildings in this area. Elimination and consolidation of existing parking areas would also affect the character of the drive, as discussed further below.

Pedestrian and Bicycle Circulation

The Washington Park Arboretum area was apparently a popular place for walking, bicycling, and horseback riding even before the 1904 parks and boulevard plan was developed. A survey made at the time the parks and boulevard plan was being developed shows numerous trails crossing the site, some of which were incorporated into the roadway and trail system. Portions of those paths remain today in the park, although there has been neither a complete survey of existing trails, nor a complete effort to correlate existing paths with those shown on the early surveys of the site. Because the entire park has undergone extensive clearing, grading, and replanting since 1904, undertaking an extensive survey would be complicated and would go beyond the level of detail of this master plan.

The proposed changes include providing a paved multi-use recreational bicycle and pedestrian path that runs roughly parallel to Lake Washington Boulevard, as well as other path realignments, regrading, and resurfacing, along with the addition of some bridges, signage, and structures along the paths. Figure 3 shows the general concept for the proposed trail system.

The concept behind the proposed dual-use trail is similar to that employed by the Olmsted Brothers firm in laying out other trails that parallel Lake Washington Boulevard; that is, the trail would meander informally along the side of the boulevard and would be generally sited to avoid removal of significant trees. The dual-use trail is intended to provide a continuous, hard-surface, barrier-free path 8 to 12 feet wide for the length of the park, that does not require crossing Lake Washington Boulevard and that maintains separation and a planting area between the boulevard and the path.

In order to meet these objectives, the dual-use path would cross Arboretum Creek twice and would require grading and removal of some trees. The path would follow some existing trail

segments and may also follow historical trail alignments that are no longer in use. Where necessary to minimize cutting and filling grades, the trail would be narrowed to 8 feet. If the intent of the proposed plan is realized in development of this path, impacts on the historic character of Lake Washington Boulevard would be limited to areas where the path is visible from the boulevard, primarily in the middle one-third of the path's length, and to areas where trees that are visible from the boulevard would need to be removed.

The 1936 general plan also shows some of the same trails that were included in the 1904 Lake Washington Boulevard plan, including some trails paralleling portions of the boulevard. Portions of some trails proposed in 1936 throughout the arboretum also can be traced back to trails that predate the Lake Washington boulevard plan. The proposed dual-use trail would likely include portions of these older trails as well as new trail segments not contemplated in any previous plan.

In many places the proposed trail would follow existing paths, would be sited out of view of the boulevard, and would require no trees to be removed. The most pronounced impacts on the historic character of Lake Washington Boulevard would occur where topography requires the trail to be placed almost immediately adjacent to the road (generally near Yew Hill and Honeysuckle Hill). Some moderately sized trees would be removed, and it is possible that retention walls would be necessary.

Some vegetation removal associated with trail construction could serve to restore views from Lake Washington Boulevard that were contemplated in the historic Olmsted Brothers plans but have since been obstructed by overgrowth; or conversely, removal of vegetation in some areas could open views that were not intended to be open.

A letter that explained the desired character of the Lake Washington Boulevard trails states that the decision of whether the trails would be "macadamized" or graveled could come later (Friends of Seattle's Olmsted Parks 1904–1943). The Olmsted Brothers firm was most concerned in 1904 with establishing the plantings so that they would not need to be disturbed later for trail construction. More detailed research would be required to determine whether, when, and where this design intent was carried out, and whether either the grades or the trails laid out by the Olmsted Brothers firm still exist beside Lake Washington Boulevard. This research could be accomplished as part of the detailed planning for implementation of the proposed dual-use trail.

Other notable differences between the proposed plan and the Olmsted Brothers general plan of 1936 are the proposed pedestrian overpasses and canopy walk. While grade-separated pedestrian walks are common in Olmsted Brothers designs throughout the world, none are shown in the 1936 *General Plan for the University of Washington Arboretum*, other than the existing overpass now known as the Wilcox footbridge. The proposed southern overpass would, like the Wilcox footbridge, pass between two hills, although the hills are farther apart and the bridge would cross a parking lot, making it potentially more visible from some vantage points along the boulevard and in the park. The proposed overpass would create a portal or gateway effect that could be similar in character to the Wilcox footbridge, depending on the final design.

The proposed pedestrian overpass at the northern end of the park would cross Foster Island Drive East from the ridge on the south side of the road. Fill would be placed on the north side of the road to create the effect of passing between two hills, or to appear that the road is cut through a hill. This, too, could create another portal effect, similar to the Wilcox footbridge.

The proposed canopy walk would also extend between two hills. However, it would be elevated above grade, even at the top of the hills, with the intent to provide an opportunity to educate visitors about life in the tree canopy, and to provide a focal point to discuss the organizing concept used by the Olmsted Brothers to lay out the arboretum. Their system had Yew Hill as a starting point. After following a circuitous route through the exhibits, one would arrive at Honeysuckle Hill, having traced what was then believed to be the trajectory plants had followed in their evolution. This organizing concept has cultural and historic significance. In the design of the Washington Park Arboretum, it was adapted from the organizing principle used at the Arnold Arboretum in Boston. The Arnold Arboretum was well-known in Seattle and was where the principal designer of the Washington Park Arboretum, James Frederick Dawson, had grown up as the son of its superintendent of many years. The proposed canopy walk is intended, in part, to draw attention to this little-known aspect of the park's design and thus contribute to a better understanding of its history. The canopy walk also would impose a structure in an area where that original design for the park had not contemplated one.

Parking Facilities

Most of the parking facilities that exist in the Washington Park Arboretum would be affected by the proposed master plan. Parking areas were proposed in the 1936 general plan, which was the first comprehensive plan for the arboretum and the first to lay out parking areas. Over the years since that plan was adopted, parking facilities have been added and reconfigured in several ways.

The 1936 general plan included angle parking lining both sides of Lake Washington Boulevard near the south end of the park, accommodating approximately 90 cars. Instead, the existing parking lot was developed on the west side of Lake Washington Boulevard, with access via driveways at each end. The proposed plan would expand the existing lot from 84 spaces to 128, plus space for four buses, eliminating access at the north end.

The 1936 general plan shows four additional parking areas with a total of 52 parking spaces along Lake Washington Boulevard, ranging in size from 10 to 18 spaces. Several parking areas were constructed, although they were developed in different configurations and locations than those shown in the 1936 general plan. The proposal would reconfigure and expand by two spaces the existing lot immediately north of East Interlaken Boulevard. The proposal would also eliminate the existing parking lot located north of the Wilcox footbridge in order to facilitate the rerouting of Arboretum Creek in a surface channel at that location.

The existing parking area south of the Japanese garden holds approximately the same number of cars as shown on the 1936 general plan, although the parking lot was developed west of Lake Washington Boulevard, rather than straddling both sides of it as shown in that plan. The proposed parking lot expansion would affect an area originally proposed for plant families that

were ultimately located elsewhere. The area is currently an open lawn with trees and shrubs loosely defining its western edges and a small wooded hill at the southern end of the lot. Expanding the parking lot in this location could require grading of the edge of the hill as well as removal of existing vegetation, most of which appears to be of relatively young age. The parking lot would be landscaped so that some of the wooded quality would be restored, but the character of the lawn area would be changed substantially. At the same time, new lawn and planting areas would be created by closing the northern entrance of the parking lot nearest the Japanese garden.

The 1936 general plan shows parking areas at the north end of the park at the proposed “administration building” (14 spaces), and along Foster Island Road in two roadside lots totaling 50 spaces, including the “auto overlook.” The administration building was not built in that location, and the associated parking was never provided. Otherwise, parking at the north end of the park has been provided in roughly the areas shown on the 1936 Olmsted Brothers plan, although there are more spaces and the auto overlook is not configured as planned. In all, 108 parking spaces were created in the north end of the park, some by habit of motorists pulling off the road, and some by deliberate layout of parking areas. Under the proposed master plan, all but 10 of the approximately 108 parking spaces in this area would be removed from the roadsides and partially replaced near the Graham Visitors Center.

No parking areas are shown along Arboretum Drive in the 1936 Olmsted plan. Over the years, approximately 89 spaces have been provided in several small lots along this drive, although it is not clear that any of these parking areas have any historic significance. Under the proposed master plan, these spaces would be consolidated into three of these lots accommodating a total of 30 cars, and one additional lot for 18 cars would be added near the woodland garden. The specific locations of the consolidated lots are not shown in the proposed master plan, and would be determined during implementation.

The parking lots that have been developed along Arboretum Drive could be seen as incremental changes to the Olmsted Brothers general plan, and thus their elimination and consolidation could be regarded as a partial rehabilitation of the Olmsted Brothers design, in the area where the drive would not be relocated. The area where the 18-car lot is proposed is called out on the 1936 general plan as part of the nursery, which was necessarily much larger in the early days of the arboretum than it is today. The lot proposed at the south end of the park would be located in the vicinity of the *Aquifoliaceae* (holly family) collection in the 1936 general plan. The holly collection, which is an important part of the arboretum collection, is not expected to be adversely affected by the development of the lot. The parking lots proposed for the north end would be near the woodland meadow and adjacent to the Graham Visitors Center. The 1936 general plan shows nursery and greenhouses in the vicinity where these lots are proposed. The character of the north end of Arboretum Drive East was changed substantially in the 1980s with the development of the visitors center.

Buildings

Like most other structures in the Washington Park Arboretum today, most of the structures included in the proposal and the alternatives cannot be found on the historical Olmsted Brothers plan and thus could be seen by some as additional departures from that plan. Whether seen as departures from that plan or simply as an interpretation of it, the primary impacts of the proposed structures on historic resources would be the displacement of plants and the modification of open space.

The structures proposed for the Japanese garden would be located in an area designated in the 1936 Olmsted Brothers plan for maple, buckeye, and other plant families. These plantings, which followed a planting plan developed on the Olmsted Brothers naturalistic concept by Otto Holmdahl in 1938, were substantially altered when the Japanese garden was developed in 1960. The 1936 plan shows only one structure in the area, a small comfort station, and does not anticipate the addition of the Japanese garden (although the pond in the Japanese garden is in roughly the same location as ponds shown in the Olmsted Brothers plan). The proposed buildings would not affect the Works Progress Administration-built footbridge in the Japanese garden.

The Japanese garden itself has historic significance. First considered as a possible element in the Washington Park Arboretum as early as 1936, it was developed in 1960, although not all elements originally proposed in 1936 were constructed. The proposed structures, which would displace some plantings in the garden and at its entry, are intended to add to the desired ambiance of the garden, using traditional materials and building forms. The degree of impact these structures could have on historical resources would be evaluated further during the design and permitting process for these building projects.

The proposed education and visitor service building that would be located near the south parking lot would, as with the expanded parking lot, be located in an area slated in the 1936 Olmsted Brothers general plan for collections that were ultimately sited elsewhere in the arboretum. It would be within view of Lake Washington Boulevard East but would stand at a distance of approximately 200 feet and thus have a relatively minor effect on the character of the view from the road.

The Olmsted Brothers plan shows several structures surrounding a service area in approximately the location where the arboretum maintenance yard is found today. The proposal would retain one structure, replace the existing shed, and add two other buildings in this area, all for maintenance and operations. This expansion is proposed to occur within approximately the same area as the existing maintenance yard, and to be designed, as with other structures proposed in the master plan, with siting, form, and materials similar to the existing structures in the park. No determination has been made whether any of the existing structure would qualify for landmark protection under Seattle's regulations, and it is not known at this stage to what degree the existing structures would have to be modified to accommodate program needs. Further assessment of the historic significance of these buildings would be appropriate during design development.

The Olmsted Brothers plan shows greenhouse structures and experimental grounds in the area where the Graham Visitors Center, with its associated greenhouses and parking facilities, now stands. New curation and education buildings would be added adjacent to the Graham Visitors Center. The greenhouses to the south would be replaced with similar sized facilities. This group of improvements would be located generally within the area designated for greenhouse, experimental ground, and nursery in the 1936 general plan. The greenhouses are in poor condition and have not been assessed for their potential as historic landmarks. Further assessment of the historic significance of these buildings would be appropriate during design development.

Outdoor Shelters

The proposal includes the addition of three shelters, to be located in the center of the park and on Foster Island, and a viewing platform south of Marsh Island. These smaller structures are not shown in the Olmsted Brothers plan but are similar in scale to some of the structures that were proposed but not built.

Landscape Features

The plantings and open spaces of the Washington Park Arboretum are probably the most prominent, character-defining features of the park. Since most of the existing vegetation in the park has been manipulated in some way to conform to plans of a historical nature, changes to planting areas and exhibits could potentially alter landscape features that have historic or cultural significance. Both native vegetation and plant collections have cultural and historic significance in the arboretum, both being linked to the Olmsted Brothers plans and the efforts of other individuals and the community to create and maintain a large-scale urban park and arboretum of regional importance over nearly a century.

The landscape is of historic and cultural importance on several levels. At a regional level, the large naturalistic park provides a significant visual landmark in an otherwise urbanized area. At the level of the casual visitor, the series of spaces in, around, and through the planting areas of the park were designed to provide a naturalistic setting for recreation. The arboretum was also designed by a firm of international importance and by individuals with national and international reputations. The arboretum collection is also among the most diverse and mature collections of woody plants anywhere in the world, containing many plants that cannot be seen anywhere else in the region.

The impacts of the proposed master plan are not likely to significantly affect the Washington Park Arboretum as a visual landmark on the regional scale, because the vast majority of the park would remain vegetated. Also, the overall diversity of the horticultural collections would not be adversely affected, because they are expected to continue to grow, and many unique plants that are in poor condition would benefit from the changes proposed.

The most potentially significant impacts on historically and culturally important landscape features are those associated with changes to the experience of the recreational visitor, and the

potential that mature trees or plant groups designed by important designers could be inadvertently removed in the process of implementing the proposed master plan.

There is no simple measure of significance in this context. For example, the 1904 Olmsted Brothers plan for Lake Washington Boulevard called for native plantings, some of which were carried out while others were not. In 1936, exotic (i.e., nonnative) species in the arboretum collections were added or supplanted under the guidance of the *General Plan for the University of Washington Arboretum*, also provided by the Olmsted Brothers firm. At the same time, the 1936 general plan included the concept of using native plantings to provide a naturalistic setting for the collection. Plan notations made in the field during development of the arboretum design suggest that in some places native plants were being preserved (although thinning would be required later), without identifying specific trees or indicating timeframes. A comparison of the 1904 and 1936 Olmsted Brothers plans suggests that some continuity between the plans was contemplated, with certain areas remaining open, and planting areas defined in the earlier plan retained in the later one. Relief project work in the 1930s and the development of the arboretum under the direction of Brian O. Mulligan for over two decades can also be seen as historic efforts warranting recognition in future designs.

The current master plan proposes more aggressively managing native vegetation to enhance exhibits that have been planted at various times. This could mean that some of the thinning that the Olmsted Brothers firm thought would be needed later may finally occur, or it could result in removal of trees the Olmsted Brothers recommended planting in 1904. In order to avoid inadvertent removal of significant plantings, additional research into the date and purpose of the plantings could occur prior to removal, although judgment would still be required to determine whether the removal would be consistent with the intent of the historical plans. Because tens of thousands of plants have been planted in the arboretum, and no designs have yet been developed for the proposed master plan elements, this EIS does not attempt to assess the significance of every planting that could be affected.

In some areas of the park, the natural vegetation is crowding out significant botanical collections. Proposed rehabilitation of these areas is intended to both retain existing collections and follow the naturalistic concept prescribed in the Olmsted Brothers' general plan, by retaining native plants as a backdrop to the collections, with thinning to occur on a regular basis. Because some of the native plants have grown quite large, immediately following their removal some areas may appear bare. Plantings in these areas are expected to recover their naturalistic appearance in a relatively short period of time, although in many cases the height of the tree canopy could be reduced over the long run, simply because the exotic species do not grow as tall as native species. The 1936 general plan suggests a less extensive tree canopy than generally exists today; thus renovated plantings that reduce the native canopy would be in keeping with the apparent design intent of that plan, provided that the design also follows the other general principles established in the plan.

The sequence of spaces experienced by the casual visitor to the Washington Park Arboretum is not intended to change dramatically. For example, Azalea Way would be rehabilitated following the principles and dimensions of the original Olmsted Brothers design.

The proposed master plan calls for a new south terminus on Azalea Way at the pond below the rhododendron glen. Design of this terminus and the area south of the pond, which is proposed to be expanded westward across Azalea Way, is intended to be sensitive to the historic character of Azalea Way. As a design for this area is developed, impacts on the historic Azalea Way path alignment and plantings would be assessed. The area south of the terminus, which extends approximately 700 feet to Lake Washington Boulevard East, historically has been planted and used as part of Azalea Way. Substantial alteration to this area could be considered a significant impact if Azalea Way is designated as a landmark feature within the park.

Other new exhibits could potentially fill existing open areas or open up existing planting areas. Impacts of this sort can be very subtle, because in a naturalistic design, a view axis or prominent feature may appear accidental rather than deliberate. In other words, the hand of the designer may be invisible.

As noted above, the overall tree canopy has increased beyond what is shown in the 1936 general plan, and one of the objectives of the proposed master plan is to restore the health of the collections by reducing the crowded canopy. Historical plans and correspondence provide insight into design intent for the spaces that make up the arboretum. Unless these documents are consulted during design development, landscape features of historic significance could be inadvertently altered.

The proposal would introduce new ecographic exhibits, grouping collections of plants from a particular ecological and geographical zone, rather than by family as proposed in the 1936 general plan. The new ecographic exhibits would be located primarily near the southern end of Arboretum Drive. This area was chosen because it can meet the horticultural needs of the exhibits and would provide a new locus for educational activities away from the heavily used north end of the park. Affected portions of the holly collection, which was planted in this location in accord with the 1936 general plan, would be moved farther north and in some cases repropagated.

The proposed ecographic exhibits would not follow the taxonomic organization of the 1936 general plan. However, the use of a taxonomic plan as an organizing concept for the arboretum reflects an intent to make the arboretum current with the latest scientific understanding of the time, and also assists in its use for educational and scientific purposes. In this context, the introduction of ecographic plantings may be seen as a continuation of that philosophy.

In other areas, horticultural themes would be introduced in areas where native vegetation or minor plant collections currently exist (for example, the summer garden, color garden, children's arboretum, landscape for wildlife, and Reclamation Point [planting on a former landfill]). Some of the plantings in areas where the horticultural exhibits are proposed would likely be retained and incorporated into future exhibits; some valuable plants would be moved to new locations; and some native and introduced plants would be destroyed.

The stream now known as Arboretum Creek was a central feature in laying out Lake Washington Boulevard in 1904. Studies for planting and road layout show creek views that were to be

opened up by clearing underbrush, and other areas where native vegetation was to be retained and augmented. At that time, the creek flowed on the surface all the way to Lake Washington. The creek is also shown in the Olmsted Brothers' 1936 general plan flowing north to the Wilcox footbridge as a continuous surface water feature, then going into a culvert until it crosses under Lake Washington Boulevard.

Currently Arboretum Creek flows in a culvert from the Wilcox footbridge to the lake. One proposed element of the master plan is to restore the surface channel with some streamflow. Wetlands and ponds would be constructed in three locations along the stream. The proposed creation of a pond east of Lake Washington Boulevard opposite the Japanese garden is consistent with the 1936 general plan, which shows a series of small ponds in that area. This action could be seen as finally implementing that plan. Conversely, because this aspect of the plan was not carried out historically, it may be seen as disrupting the historical fabric of the park.

The other two proposed ponds do not appear in the 1936 general plan. They are intended to follow the naturalistic character of the 1936 plan, with native vegetation added in areas that are currently maintained as open space (and in some cases mowed grass). Overall, the proposed changes to Arboretum Creek would restore the design emphasis placed on the creek in both the 1904 and 1936 Olmsted Brothers plans. These proposed alterations to the creek could significantly affect the sequence of open views along Lake Washington Boulevard. At the same time, they could be designed to preserve or even restore the design intent of that sequence, if undertaken in part as a rehabilitation of the original Lake Washington Boulevard design.

The outdoor shelters proposed for four locations in the park are not shown in any historic plans. They are intended to be sympathetic in design with the character of the park and would be relatively small in scale. The shelters nevertheless would become focal points in the landscape and would change the character of the places where they are placed. As with other landscape alterations, historically important landscape features could be affected by these structures, either by displacing plantings or open space, or by adding elements that could detract from historic or cultural resources that remain. If the proposed shelters are well-sited and designed as intended, these impacts should be minimal.

One shelter is proposed on Foster Island. Anecdotal accounts from the early twentieth century suggest that a native burial ground was located on Foster Island (McConaghy 2000 personal communication). An archaeological assessment has not been conducted for this EIS. Construction of the proposed shelter is not expected to involve much excavation, although it could potentially affect this resource. If development of the shelter is completed in accordance with current city, state, and federal regulations regarding such archaeological resources, significant impacts could be avoided. City regulations require an archaeological assessment prior to permitting in this location.

In all new exhibits proposed under the master plan, interpretive signs could affect the overall naturalistic appearance of portions of the arboretum. *Seattle's Parks & Recreation Plan 2000* has policies that guide the use of signs and express an intent to use signs in parks in a limited

way, especially where the signs could be easily vandalized. No specific new policy for signage is proposed in the master plan; thus the master plan is not expected to have significant impacts.

Alternatives to Proposed Plan Elements

Four-Way Stop at North Entry to Washington Park Arboretum

A four-way traffic stop would have impacts similar to those described for the proposed plan, in that it would require realignment of Lake Washington Boulevard and Foster Island Road in an area where the historic character has been altered significantly already. Early plans do not indicate whether any stop signs were to be installed on the boulevard. This alternative could serve to slow traffic in the park, which may be seen as more consistent with the historically intended use of the boulevard. However, it appears that the problems presented by today's higher traffic speeds and volumes simply were not anticipated at the time the boulevard and the park were developed.

Lake Washington Boulevard Improvements with At-Grade Crossings

At-grade crossings would be in keeping with the crossings proposed in the early plans for the boulevard. Stop signs were not indicated in any plans for the boulevard and so may be seen as out of character. These changes could slow traffic, making pedestrian crossings easier than at present. Similar to the four-way stop alternative, the effect of this alternative may be seen as more consistent with the historically intended use of the boulevard, if not with its intended visual character.

Arboretum Drive Parking Lot Consolidation with Restricted Access

Consolidation of parking lots under this alternative would be similar to the proposed plan. Restricted access to the road would be at odds with the circulation pattern anticipated by the Olmsted Brothers plan, although it would reduce traffic activity on the road, which may be viewed as a benefit to the historic character of the road. The degree of this potential benefit in terms of historic character is difficult to determine, for two reasons. Arboretum Drive is not heavily used today, except during limited periods of the year. Moreover, the level of use anticipated in the Olmsted Brothers plans is not explicit on any of the plans or correspondence reviewed.

Overpass at Interlaken Boulevard East

This alternative would have impacts on historic resources related to the 1904 and 1936 boulevard and arboretum plans similar to those impacts described for the overpasses in the proposed plan. Because the abutting hills at Interlaken Boulevard are more gently sloping, this overpass would likely be longer and potentially more visible from Lake Washington Boulevard than the overpass proposed in the more southerly location in the master plan. It also could adversely affect views from within the Japanese garden. Unless carefully sited to avoid such views, the overpass could introduce a prominent architectural element that would contrast with the traditional Japanese

designs and naturalistic landscape that dominate views within the Japanese garden. This overpass alternative would have less impact on Lake Washington Boulevard than the dual-use trail in the area near Yew Hill.

Separated Bicycle and Pedestrian Trails

This alternative would have impacts on the historic character of the boulevard similar to those described for the proposed dual-use trail. A trail designed to accommodate commuter bicycles would likely be up to twice as wide because of the speeds expected; thus grading, paving, and retention walls would be commensurately larger, and impacts on the boulevard would cover greater distances. Separating bicycle traffic completely from vehicular traffic may be more consistent with Olmsted Brothers design principles; however, this issue is not explicitly discussed in any plans or correspondence reviewed.

Building Renovations without Expansion, and South-End Structure at Madrona Terrace

Under this alternative, the 2,500-square-foot education and visitor center would be located at Madrona Terrace, in place of the 300-square-foot outdoor shelter specified for that location in the proposed master plan. Impacts on historic resources would be similar to those anticipated under the proposed plan, except that greater activity would be associated with the larger structure in this alternative, and siting the structure would increase impacts on existing plantings.

No Action

Under the 1978 master plan, a realignment of the north end of Lake Washington Boulevard was recommended, to create separated roadways for northbound and southbound traffic, changing the overall road system in the park to a one-way couplet with Lake Washington Boulevard northbound and Arboretum Drive southbound. Arboretum Drive was also proposed to be moved to the east side of the then-proposed visitors center. None of these actions has been implemented, and for the purposes of this analysis, no major changes to roadways in the park are anticipated under the no-action alternative. Therefore, no significant impacts on historic resources are anticipated.

Changes that have affected the historic character of Lake Washington Boulevard incrementally over time, such as the added parking areas, would remain. The 1978 master plan does not include any special focus on the series of open spaces planned along this boulevard by the Olmsted Brothers, and thus the continued gradual change in the visual experience along the route might continue, or additional changes may be made without reference to earlier plans.

Parking areas would remain largely as they are, with no addition or removal of spaces. In 1978 Boyer Avenue East just west of Lake Washington Boulevard was proposed to be closed and used as a parking lot serving the park. For the purposes of this analysis, however, that closure is not expected to occur.

The 1978 master plan update does not call for major changes to the 1936 general plan. Under the provisions of the 1978 plan update, no new structures would be constructed and no new programs would be provided, although some new exhibits were contemplated. The 1978 plan update also discusses renovation of several exhibits, and some of those renovations would be expected to occur eventually. The 1936 general plan could be expected to continue to guide maintenance and exhibit decisions in a manner similar to the way it has done since 1936. Exhibit work would include thinning of vegetation and other maintenance activities, which, as mentioned above, could inadvertently affect historically significant landscape features, unless a sufficient understanding of the historic resource is developed and considered before removal or modifications occur.

Mitigation Measures

Conformance with the policies in *Seattle's Parks & Recreation Plan 2000* would help to avoid or mitigate adverse impacts on historic and cultural resources in the Washington Park Arboretum. Pertinent policies set forth in that plan are summarized below:

- For park amenities and signage, strive for consistency throughout the system as a means both of establishing identity and of reducing maintenance costs, while recognizing special needs associated with future designation of historic and natural resource areas. (Development #13)
- Coordinate planning for boulevards and trails with planning for natural and historic resources. (Management and Maintenance #14)
- Park Natural resource areas and park historic resource areas will be designated and managed with use limited as necessary to conserve natural and historic resources within parks, including the conservation and enhancement of wildlife habitat. (Stewardship, Primary, #7)
- The Olmsted Brothers system and individual boulevards and parks comprising the system will be designated as park historic resource areas to be treated as a living legacy. Park features developed through the Works Progress Administration will be given similar treatment. Procedures for adequately considering historic planning and design intent in current management practices will be part of the planning for future restoration and improvements. (Stewardship, Primary, #8)
- A conservation and historic preservation ethic will be incorporated into staff training and procedures. (Stewardship, Primary, #9)
- Tree management and maintenance will include considerations of tree health, long-term reforestation needs, historical context, and tree impacts

such as public safety, views, aesthetics, street or sidewalk damage, and maintenance requirements. (Stewardship, Primary, #14)

- Park boulevards and trails will be managed and maintained in accordance with boulevard and trail agreements with Seattle Transportation. (Stewardship, Primary, #15)
- Increased emphasis will be placed on maintenance of design intent, access and continuity, and visual character of the boulevards. (Stewardship, Primary, #16)
- Park maintenance will be based upon available funding and measurable maintenance objectives established for park categories as supplemented by special procedures for park natural and historic resource areas. (Stewardship, Secondary, #12)
- Provide for restoration of ornamental landscapes throughout the Seattle park system. Provide particular attention to historic landscapes of the Olmsted Brothers tradition. (Landscaping, L1)
- Designate park historic areas within appropriate parks, including consideration of 1930s Works Progress Administration-era landmark improvements as well as Olmsted Brothers planned and/or designed parks. Establish development and maintenance guidelines for such areas. Consider establishment of a Department conservator position to maintain historical information, records, and documents as well as coordinate review of major maintenance and development proposals (Olmsted Brothers parks, Works Progress Administration improvements, etc). (Historic, PH-1)
- Designate and protect natural and historic resources (including wildlife habitat) within parks, focusing on sensitive resource management, public information, staff training, and maintenance procedures. (Environmental Protection, EP-2)
- Expand and incorporate historical programming and interpretation into environmental education efforts. (Environmental Education Programs, EEP-4)

The following mitigation measures would be implemented during future projects within the Washington Park Arboretum to minimize impacts on historic and cultural resources. These measures apply to all alternatives.

- Employ methods recommended by the U.S. Department of the Interior in *Guidelines for the Treatment of Cultural Landscapes (1996)*.

- Conduct additional assessment of the history of affected areas in the early stage of design development, and consider retention or renovation of elements of historic significance (this could include substantial adjustments to plan elements such as road and parking layout, and siting of buildings and new exhibits).
- Document locations of cultivated plants to be moved or removed prior to removal.
- Conduct additional assessment of the design intent for the sequence of spaces and views along Lake Washington Boulevard and other portions of the park, and retain or restore that intent where feasible.
- Comply with the Seattle Department of Design, Construction, and Land Use Director's Rule 2-98 where required.
- Cease construction activities immediately and contact the state historic preservation officer if archaeological artifacts are uncovered during construction or demolition activities.
- Follow the consultation requirements set forth in section 106 of the National Historic Preservation Act in cases where properties that are listed on or eligible for the National Register of Historic Places could be affected by proposed development or renovation projects, or if any archeological artifacts are uncovered during construction or demolition activities.

In addition, the Department of Parks and Recreation is currently studying the possibility of city landmark nominations for numerous parks and boulevards throughout Seattle, including Washington Park Arboretum and Lake Washington Boulevard. If features within the park are nominated for city landmark status, a determination would be made by the Landmarks Preservation Board and the city council. For newly designated landmarks, specific measures for compliance (known as a controls and incentives agreement) would be determined by the city council.

Significant Unavoidable Adverse Impacts

The proposed master plan for the Washington Park Arboretum contains elements that would alter portions of a historically and culturally important landscape. If the specific impacts of individual projects under the proposed plan are studied in greater detail prior to implementation of each element of this plan, and if the mitigation measures discussed above are employed, the proposal should not impose significant impacts on historic or cultural resources.

Aesthetics

Affected Environment

The Washington Park Arboretum is a 230-acre living plant museum and regional park that extends from the south shore of Union Bay to East Madison Street in Seattle. The principal physical features surrounding the park include portions of the Union Bay shoreline to the north, the Broadmoor Golf Club to the east, the Montlake and Capitol Hill neighborhoods to the west and south, and the Madison Park and Madrona Park neighborhoods to the east and south.

Visual Character of the Washington Park Arboretum and Surroundings

Visually, the Washington Park Arboretum is a large, wooded green space in the midst of urban residential neighborhoods. The park consists of gently rolling hills that are dominated by plant collections and a backdrop of native forest species such as western red cedar and big-leaf maple. The dominance of these large native trees gives a unified theme to the park despite the wide variety of plant collections among them. Most areas of the park are well-screened from surrounding urban activity, providing visitors a relatively quiet atmosphere that is intruded upon only by traffic along Lake Washington Boulevard East, and by the noise and visual presence of SR 520 on Foster Island.

The Washington Park Arboretum has few buildings. The Graham Visitors Center, the principal visitor service facility in the arboretum, is its most modern building, constructed in 1985. Nearly all other built structures within the park were constructed between 1914 and 1942, including the stone cottage, the stone lookout gazebo, two stone footbridges, several basalt masonry columns placed at entryways, and the Wilcox footbridge over Lake Washington Boulevard East. These solid, well-built historical structures have aged nicely and contribute to the grace and distinction of the Washington Park Arboretum.

Azalea Way

Azalea Way is one of the most recognizable features in the Washington Park Arboretum. This north/south footpath, which lies in a wide valley along the base of a forested ridge, stretches a half-mile from the Graham Visitors Center to Lake Washington Boulevard East (see Figure 1). The wide and leisurely grass promenade is bordered by a variety of azaleas, rhododendrons, and Japanese flowering cherries showing their most brilliant color in the spring.

The Forested Ridge

The forested ridge above Azalea Way presents an assemblage of trails connecting the winter garden, the woodland garden, Loderi Valley, and the rhododendron glen. There are few signs in this area, and limited sight distances sometimes make orientation difficult for visitors, according

to some park staff and other observers. There are a few notable viewpoints from the top of this ridge, including a mid- to distant view of Capitol Hill from the lookout, and distant views northward toward the University District. From the perspective of the Japanese garden, viewers have an unobstructed vista of this ridge, which appears to be densely forested and undeveloped. The clearing at the winter garden offers one of a few places within the Washington Park Arboretum where visitors can view the surrounding forest at a moderate distance.

Foster Island

Foster Island, a peat and marsh landscape that was enlarged by the lowering of Lake Washington in 1917, occupies the southern shore of Union Bay and is a prominent and unique landscape feature in the Washington Park Arboretum. The waterways surrounding the island consist of marshes and open water containing forms of vegetation that cannot be seen in the main portion of the park, providing habitat for a range of wildlife, particularly birds. The wood-chip trail leading to a meandering walkway on a series of floating piers and structures through the marsh gives the island a sense of remoteness and separateness from the rest of the park.

In contrast to the rest of the Washington Park Arboretum, Foster Island has been greatly altered by urban freeway construction. Although portions of the island have maintained a sense of wilderness, many areas are severely affected by the noise and visual intrusion of SR 520. The elevated freeway ramps dominate the landscape, and the freeway itself divides Foster Island in half, making passage to the north end of the island a less than calm experience through a narrow, dark pedestrian underpass.

Influence of the Olmsted Plans

On a citywide scale, the Washington Park Arboretum represents an important aesthetic element in Seattle's urban environment, providing visual relief that is part of a system of scenic routes and large open spaces envisioned in a park and boulevard plan commissioned by the city in 1904 and prepared by the Olmsted Brothers Landscape Architects. The visual character of the park was further influenced by the natural planting design and vegetation management philosophy of the 1936 *General Plan for the University of Washington Arboretum* (also prepared by the Olmsted Brothers firm), which are evident in the inviting and informal spatial character and elegantly flowing plant masses throughout the park. The two formal spaces and structures included in the 1936 Olmsted Brothers plan, the rose garden and the visitors center and floral hall, as well as some of the roads proposed, were never implemented. As described by Robertson (1991), the principles that guided the plan and influenced the layout and plant collections include the following:

- Passages of scenery
- Enhanced sense of space, with indefinite boundaries and successive opening of new views
- Avoidance of hard-edge or specimen planting
- Complexity of light and shadow near the eye or obscurity of detail farther away.

The present visual character of the Washington Park Arboretum is also influenced by the continued growth of native trees. The 1936 Olmsted Brothers plan suggests a predominantly open site that is far less densely vegetated than what exists today. Over the past 20 years, the continually growing matrix of native trees has obscured many of the views through the site that may have been intended in the 1936 plan. Self-sown trees and other vegetation have outgrown collection plants in several areas.

Environmental Impacts

Aesthetic values and the perception of visual impact are subjective and may vary from one person to another. This assessment of visual impact is therefore based on ideas of contrast and harmony underlying most systems of aesthetic evaluation. For the purposes of this evaluation, the following elements of the Washington Park Arboretum are taken to be crucial for the preservation or enhancement of its aesthetic character:

- Open green space
- A diverse landscape dominated by natural features
- A variety of view corridors
- A relatively quiet atmosphere
- Built structures in which scale and character are harmonious with the surrounding natural landscape.

Under any of the alternatives, the Washington Park Arboretum would be retained as a living plant museum, and its scale and aesthetic character following implementation of the proposed plan would be generally consistent with existing elements and features. The intent of the proposed plan is that the area surrounding all built structures would be carefully landscaped to emphasize natural features, and each structure would be designed sensitively to merge harmoniously with its surroundings. For this reason, aesthetic impacts of new structures and parking areas would be limited, and some users of the park are expected to view them as beneficial in the long term.

User survey information that touches on issues of aesthetic concern indicates that a significant portion of the users of the Washington Park Arboretum appreciate the existing scenic quality of the naturalistic landscape found in the park. The strong visual (and in some places, auditory) contrast between the naturalistic park and the surrounding urban area is valued highly by many, and enjoyment of the naturalism of the park is a form of recreation that may be the dominant use of the park. Within the City of Seattle, only some of the largest parks, such as Ravenna, Discovery, Carkeek, Seward, Lincoln, Camp Long, and portions of some recent greenbelt acquisitions, offer comparably large naturalistic areas.

A study conducted in the late 1960s found that a substantial portion of Washington Park Arboretum visitors, a majority of those surveyed, use the park because of the naturalistic landscape design and prefer that the park remain as it is (Twight 1968). Public comments on the proposed master plan confirm that these types of visual preferences remain for many users today.

Thus, for many users, the proposed additional structures, larger parking areas, changes to the plant exhibits and signage, and new activity areas pose adverse aesthetic impacts that in some cases are likely to be considered significant.

There are thus differing perceptions of aesthetic qualities to be found in the Washington Park Arboretum. Some users consider the arboretum's scientific and educational functions as its primary purpose, while regarding the naturalistic appearance of the park as an important supplemental benefit. These users generally do not object to changes that benefit the arboretum's educational and scientific functions. Those park users who place higher value on the existing naturalistic appearance and tranquility of the park generally believe that educational activities are appropriate only when they can be accomplished without changing the appearance that makes the park unique, in their view.

This dichotomy in viewpoints precludes a single conclusion about the significance of the potential aesthetic impacts of the proposal, or even about the benefit versus harm of the proposed alterations. The discussion of aesthetic impacts below characterizes both perceptions and the likely severity of impact from each viewpoint.

Aesthetic impacts that may be perceived during the construction phase, when vegetation is altered and visitors see the park in transition, are likely to be seen as adverse from either of the viewpoints described above, but these impacts are expected to be of short duration.

In addition, noise from Lake Washington Boulevard and SR 520 has been estimated to affect the quality of approximately 24 percent of the park area excluding Foster Island (Robertson 1991). As mentioned above, virtually all of Foster Island, which comprises another 18 percent of the park area according to Robertson (1991), is affected by traffic noise. Further discussion of noise impacts can be found in the noise section of the EIS.

The City of Seattle has a SEPA policy to protect public views of certain specific natural and human-made features from certain specified locations and routes. Those locations include the Washington Park Arboretum (generally) and the intersection of Lake Washington Boulevard and East Madison Street. The only feature listed in the SEPA policies that can be viewed from the park is Lake Washington. None of the listed features can be seen from the intersection at East Madison Street.

The City of Seattle SEPA policy for height, bulk and scale reads:

The height, bulk and scale of development projects should be reasonably compatible with the general character of development anticipated by the adopted land use policies set forth in SMC Chapter 23.12, the shoreline goals and policies set forth in the land use element of the Seattle comprehensive plan, and the procedures and locational criteria for shoreline environment redesignations set forth in SMC Sections 23.60.060, respectively, for the area in which they are located, and to provide for a reasonable transition between areas of less intensive zoning and more intensive zoning.

All development proposed for the Washington Park Arboretum would be on land where adjacent zoning is the same as within the park. Thus, the height, bulk, and scale policy would apply only insofar as any proposed development must be reasonably compatible with other anticipated uses. Compatibility is discussed further below.

Seattle also has a SEPA policy of limiting light and glare impacts from development. Discussion of light and glare impacts of the proposal and alternatives is included below.

Proposed Plan

An analysis of areas in the Washington Park Arboretum from which structures, roads, or parking lots are visible indicates that 46.8 acres within the park are affected by such views of built elements at present. Figure 11 illustrates the areas in the park that currently have views of structures, roads, or parking areas, by contrast with more naturalistic areas where only paths and vegetation are visible. With full implementation of the proposed master plan, a total of 49.4 acres within the park would have views of structures, roads, or parking lots, for a net increase of 2.6 acres affected. Figure 12 shows areas in the park that would have views of structures, roads, or parking lots under the preferred alternative.

Comparison of the areas currently affected by such views with the areas that would be affected under the proposed master plan shows that implementation of the proposed plan would not expose a substantially greater area to views of structures, roads, or parking lots, and hence would not greatly alter the naturalistic character of Washington Park Arboretum. Some areas would be affected, particularly south of Graham Visitors Center where Arboretum Drive would be relocated, around the new shelters, and at the canopy walk. In areas where roads or parking would be removed, the area affected by views of these features would be reduced.

The following sections describe the visual changes that may occur under the proposed plan and alternatives, focusing on plan elements that would result in the most apparent visual changes. As an aid in illustrating expected visual impacts, photographs were taken from various selected viewpoints within the park, shown in Figure 13. The photographs were then modified to simulate these scenes after construction of the proposed or alternative plan elements, for comparison with the original photographs.

Roadway Modifications to Lake Washington Boulevard

The proposed roadway changes to Lake Washington Boulevard East, including the north entry to the park and the addition of pedestrian and bicycle trails along the boulevard, would alter the visual character of the boulevard in several ways. Where sidewalks are proposed next to the boulevard, between Madison Street and Arboretum Drive, the existing trees are expected to remain, the walks would be outside the trees, in a similar location to existing less formal trails. Where the dual-use trail is proposed immediately parallel to the existing roadway, existing trails would be used or renovated where possible. Because the trail is intended for bicycles, the entire trail would likely be paved with asphalt. A landscaped area would be maintained along the

roadside, and the trail would be sited to avoid removal of existing trees wherever possible, which would help to limit visual impacts on the boulevard area. However, the trail would be visible from the boulevard over approximately 25 percent of its length, and in some cases mature vegetation immediately next to the road would have to be removed to accommodate the trail (see Figure 3 for general trail location).

Some elements of the proposed changes along Lake Washington Boulevard East, such as creating a gracefully curving alignment leading to the intersections with SR 520 and Foster Island Road East, and modifying the unused freeway ramp for bicycle, cart, and pedestrian use, may result in a more visually pleasing environment compared to the present condition of these areas. The change would affect a relatively open area currently dominated by the presence of Lake Washington Boulevard, and thus the change would generally not be viewed as adverse.

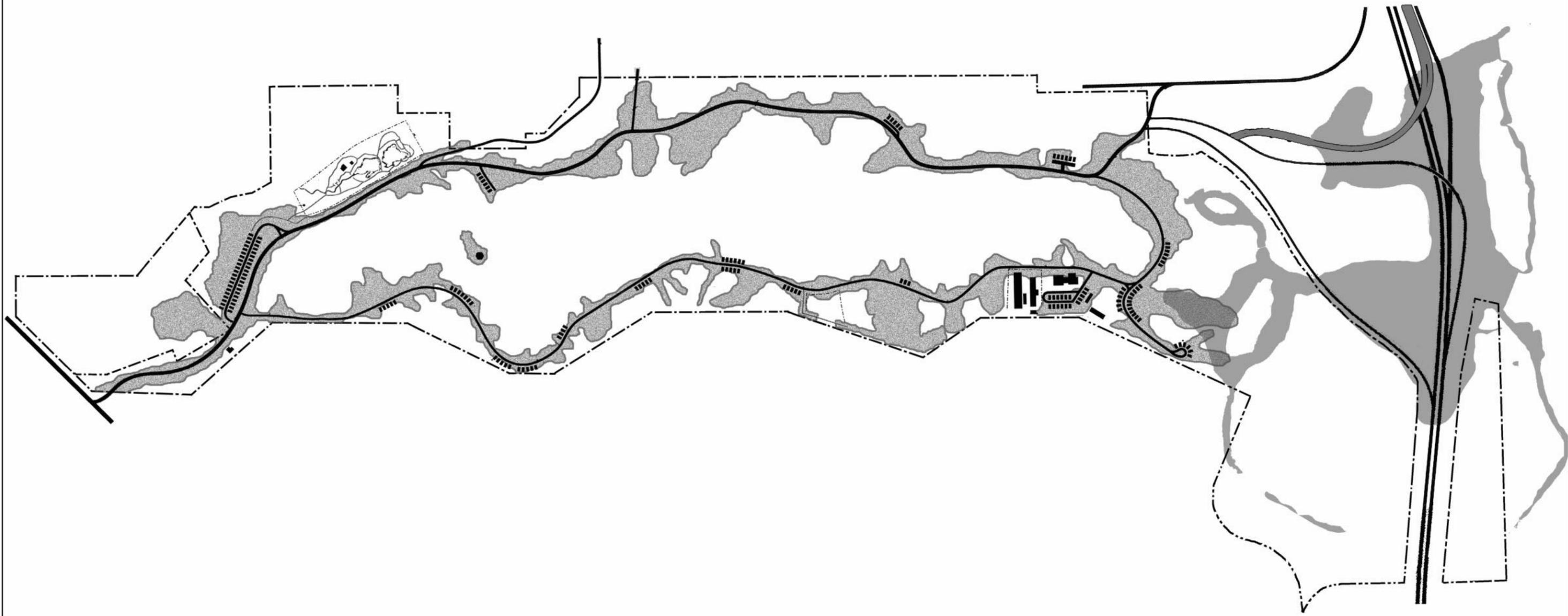
Arboretum Drive Realignment

The relocation of the northern one-third of Arboretum Drive eastward, from the Graham Visitors Center to just north of the Picea (spruce) display (see Figure 3), would result in a substantial visual change in this area. The proposed realignment would pass between the chainlink fence on the eastern boundary of the park and the expanded Graham Visitors Center parking lot and relocated greenhouses. From the vantage point of the motorist, the realigned roadway may appear more developed and narrow than the current alignment and may offer only limited views. Plantings are proposed as a screen between the road and the boundary fence; thus, both views to the east and impacts on the adjacent property would be minimal.

The realigned roadway would also create open green space west of the Graham Visitors Center, providing the opportunity for a trailhead through which visitors could reach the trail system without crossing Arboretum Drive East (Figures 14 and 15). Because the realigned roadway would be located in an area that is not currently naturalistic and does not provide other significant aesthetic features, the aesthetic impacts are not likely to be viewed as significantly adverse. For most users it is expected that the overall aesthetic impact of the proposed Arboretum Drive realignment, and development of open space in its place, would be beneficial. The structures shown in all simulation figures are provided for general illustrative purposes only. No structures have been designed, and exact siting has not been determined. The figures provide a qualitative sense of the relative scale of and design intent for the buildings in the approximate locations where they are proposed.

Pedestrian and Bicycle Circulation

The visual impacts of the proposed pedestrian/bicycle overpass on Lake Washington Boulevard south of the Japanese garden (see Figure 3) would depend on the scale and design of this structure, which have not yet been determined. As with the Wilcox footbridge, the proposed overpass would provide visitors on foot or bicycle an uninterrupted route across Lake Washington Boulevard and may also serve as a lookout providing new opportunities for viewing the surrounding area. This safer route across Lake Washington Boulevard would likely be perceived as a positive visual addition by those who use it to access more remote parts of the collections and park, if it is designed and sited as sensitively as the Wilcox structure.

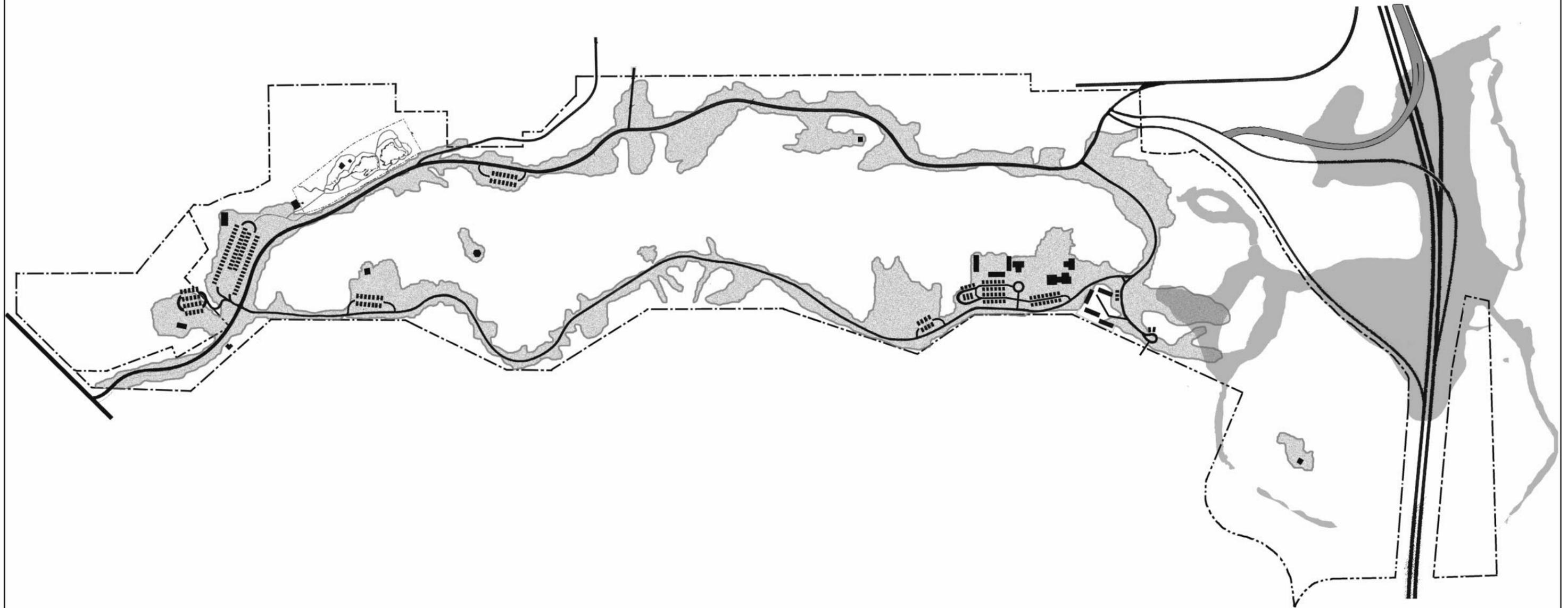


Legend

 Areas within the Washington Park Arboretum from which structures, roads, or parking lots currently are visible

Note: Views of SR 520 and associated ramps are not included in this assessment, and are not expected to change substantially as a result of the master plan.

Figure 11. Areas within the Washington Park Arboretum from which structures, roads, or parking lots currently are visible.



Legend

 Areas within the Washington Park Arboretum from which structures, roads, or parking lots would be visible under the proposed master plan

Note: Views of SR 520 and associated ramps are not included in this assessment, and are not expected to change substantially as a result of the master plan.

Source: The Portico Group

Figure 12. Areas within the Washington Park Arboretum from which structures, roads, or parking lots would be visible under the proposed master plan.

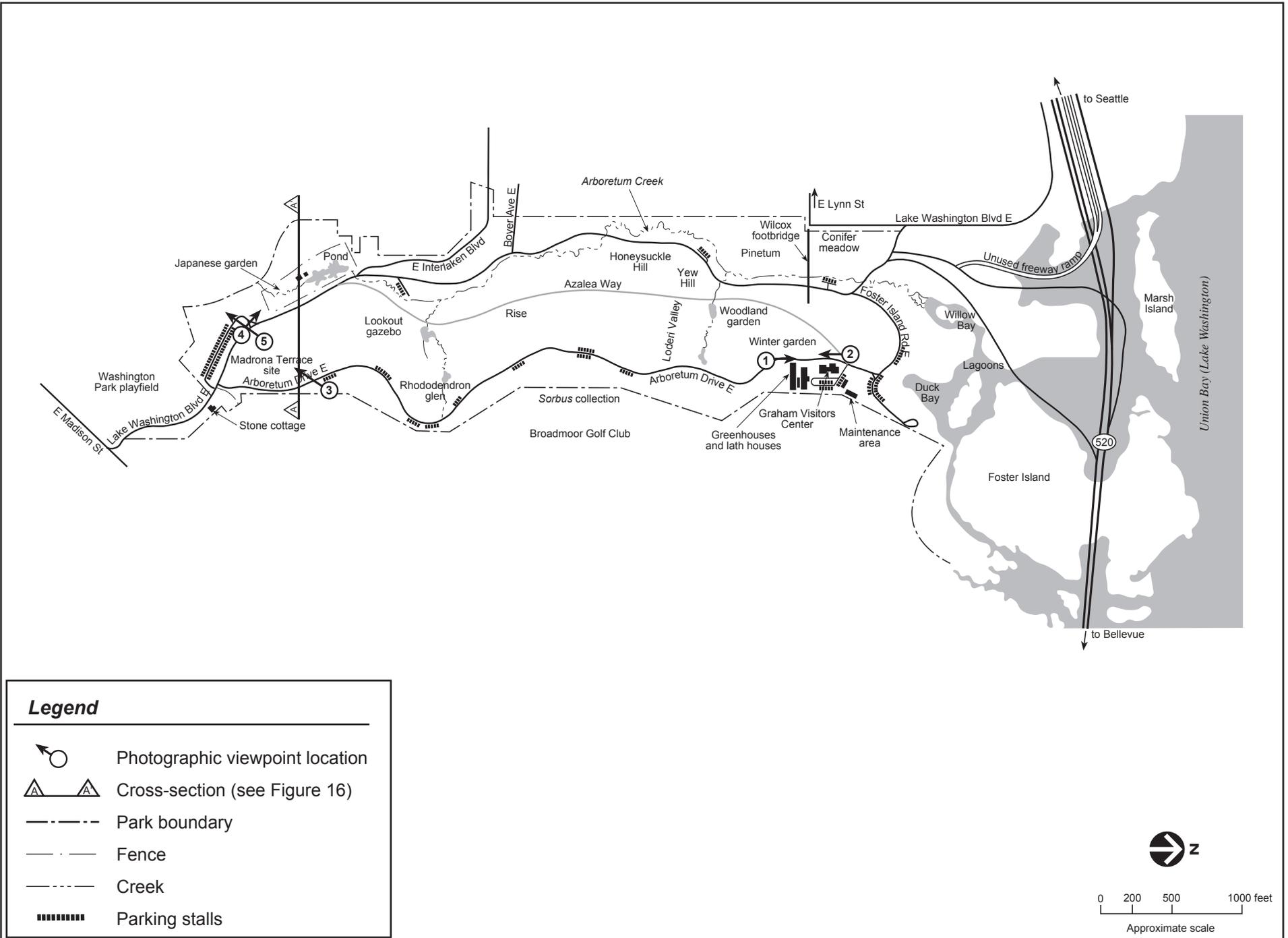


Figure 13. Locations of selected photographic viewpoints in the Washington Park Arboretum.



Existing



Proposed

Source: The Portico Group

Figure 14. Existing scene at viewpoint #1, looking north along Arboretum Drive East at Graham Visitors Center in the Washington Park Arboretum, compared with photographic simulation of proposed expansion of Graham Visitors Center from the same viewpoint.



Existing



Proposed

Source: The Portico Group

Figure 15. Existing scene at viewpoint #2, looking south along Arboretum Drive East at Graham Visitors Center in the Washington Park Arboretum, compared with photographic simulation of proposed expansion of Graham Visitors Center from the same viewpoint.

Like the Wilcox footbridge, the proposed structure would be located between two wooded hillsides. However, the proposed overpass location has a hillside on the east but must cross the relatively flat parking area on the west, which poses a challenge for matching the natural way in which the Wilcox footbridge fits into the landscape. For motorists and pedestrians at grade, the overpass may obstruct distant views of Lake Washington Boulevard and the forested ridge east of the boulevard. The area where the overpass is proposed is already affected by views of parking lots and roads. Nonetheless, the addition of another structure along the boulevard would likely be viewed as aesthetically adverse by some, because it may constrict views of the naturalistic landscape that form part of the character of the boulevard. It is unlikely that the proposed overpass would obstruct views of the ridge from the Japanese garden.

The proposed wheelchair-accessible overpass crossing Foster Island Road East (see Figure 3) has not yet been designed. The overpass would have impacts similar to those described for the Lake Washington Boulevard overpass above, except that it would also involve adding a considerable amount of soil to support the northern end of the overpass. The area where this overpass is proposed is also affected by views of roads and parking to the north, but has a wooded hillside close to the road on the south. The intent is to design the overpass to be visually compatible with the surroundings, so that it would appear as a bridge over a cut through a forested hill. As with the Lake Washington Boulevard overpass, the required grading and addition of a new structure to the landscape is likely to be perceived as adverse by some, and others would view it as beneficial if it enhances access and is sensitively designed and sited.

The proposed dual-use pedestrian and bicycle trail running the length of the east side of Lake Washington Boulevard may, by increasing the area of paved surface, create a slightly more developed appearance where it is adjacent to the boulevard. However, this trail alignment is located adjacent and parallel to Lake Washington Boulevard and would not require a separate corridor or extensive alterations to the existing landscape (see Figures 2 and 3). For pedestrians and bicyclists touring the park along Lake Washington Boulevard, the trail would likely provide a more relaxed and safer route for enjoying the surrounding landscape than the current options of bicycling on the edge of this heavily traveled boulevard or walking on the grass next to the road.

Parking Facilities

The addition of a 30-car parking lot near the outdoor shelter proposed at the Madrona Terrace site in the southern part of the park would alter the appearance of this open green landscape, which is currently bisected by Arboretum Drive East and has a small parking area. The proposed parking lot would increase the area of paved surface while reducing the amount of vegetation and open space along this portion of Arboretum Drive. The associated lighting, glare from cars and signage, and increased traffic and noise may be perceived by some visitors as a substantial adverse aesthetic impact.

The proposed expansion of the Graham Visitors Center parking lot southward to increase capacity to 109 cars and four buses (see Figure 3) would increase the paved surface area and would result in some increase in lighting, glare, signage, and presence of cars, resulting in a more developed appearance south and east of the Graham Visitors Center. This area currently offers

very limited views and aesthetic potential, however. The area has no plant collections and is already dominated by built structures and paved surfaces. The parking area would be approximately double the size of the existing lot at this location. Although landscaping could reduce its apparent size, this change in scale may be perceived as an adverse visual impact.

The visual quality of areas where small parking lots would be completely removed would generally improve, as vegetation and open green space would be restored to these locations. Existing parking areas vary in their visual quality. Some, where landscaping around them is mature and healthy, are viewed as attractive, appropriately scaled, and convenient. Removal of these parking areas would likely be perceived by some people as an adverse aesthetic impact, primarily because of the larger lots that would replace them elsewhere. Other parking areas have the appearance of being formed by people pulling off the road, and have not been carefully planned or planted to fit in with the landscape. Removal or reconfiguration of these lots could improve the appearance of these areas. The parking areas that would remain on Arboretum Drive and Foster Island Road East would be landscaped. Generally, the adverse visual impacts from the removal of parking areas are not expected to be significant.

At the Japanese garden/Washington Park playfield parking lot, the proposed elimination of the north vehicle entrance and expansion of the parking lot (see Figure 3) would affect the visual quality of this area. The impact on the Japanese garden entrance would likely be perceived as beneficial by most people, because existing paving in that area would be replaced by plantings and a pedestrian path (Figure 16). Expansion of the parking capacity would increase the scale of the parking lot by approximately 45 percent. While this area is already affected by views of parking and roads, the parking expansion could be viewed as a significant adverse impact, simply because of the increased scale of the lot and its visibility from Washington Park Boulevard East. Landscaping that is planned to be part of any redesign of this area would serve to reduce the apparent scale of the parking lot, reducing the severity of this impact.

Buildings

The proposed educational and visitor services building near the south end of the park (see Figure 3) would incorporate architectural elements similar to those of the other structures in the park. Figures 17 and 18 show the existing and proposed conditions at the Japanese garden parking lot, with the proposed education and visitor services building sited on the west side (viewpoint #5 in Figure 13). As plantings associated with the parking area and the new structure mature, the structure is expected to have minimal impact on the visual character of this area.

Two new buildings proposed near the Graham Visitors Center include an education building and a facility to support curation (see Figures 3, 14, and 15). These buildings, to be sited west of the existing building where Arboretum Drive is currently located, would increase the bulk and scale of development by approximately doubling the size of the existing visitors center complex, potentially blocking some views within and through the area. As with the existing Graham Visitors Center, the expanded structures and relocated greenhouses would stand between a portion of the expanded parking area and the areas of the arboretum where visitors generally walk, screening parking and traffic activity. Although the additional structures are intended to be



Existing



Proposed

Source: The Portico Group

Figure 16. Existing scene at viewpoint #4, looking northwest toward Japanese garden entrance and Lake Washington Boulevard East in the Washington Park Arboretum, compared with photographic simulation of proposed Japanese garden entrance from the same viewpoint.

designed with sensitivity to scale and setting similar to the existing Graham Visitors Center, they would create a more developed appearance that some visitors might find undesirable.

As with other structures proposed in the plan, the perception of whether the visual impacts of these buildings are adverse would be influenced by whether the perceiver finds that the structures facilitate their enjoyment of and access to the plant collection or finds them an impediment to enjoying the park's naturalistic experience. Because the area surrounding the existing Graham Visitors Center is currently affected by views of structures and parking, and the new structures would not be visible from a substantially wider area, the perception of the severity of these impacts would likely be moderated somewhat for those concerned primarily about maintaining a naturalistic park experience. For users whose preference is to keep the park as it is, the additions would represent an undesirable change, and the scale of the proposed development would likely be considered a significant impact.

The proposed expansion of the operation and maintenance headquarters buildings would be fully contained within the maintenance yard (see Figure 3) and should not significantly affect the visitor's visual experience. Some increase in the apparent bulk and scale of buildings is likely, although the location of the yard is outside the main visitor areas where the changes are not likely to be noticed by most visitors. Furthermore, most users likely recognize the need for maintenance facilities to care for the features of the park they enjoy, and thus do not find the presence of such structures objectionable if they are well-designed and maintained and generally out of view.

The renovation of the Graham Visitors Center itself would not increase the size of the building or substantially change its present visual character, nor would it require further development of open green space. Therefore, adverse aesthetic impacts are not likely.

The proposed addition of a Japanese garden pavilion and veranda against the hillside north of the pond would result in a reduction of vegetation on this slope. The proposed structure would be consistent with the present traditional Japanese design of the garden and would introduce a covered resting place for visitors. Some visitors may find that this greatly enhances their visit to the Japanese garden, which currently has no public shelter. With careful design and landscaping, this addition to the Japanese garden may add to the visual uniqueness and cultural experience of the garden.

The proposed pavilion would also likely be visible outside the Japanese garden. The extent to which the visual impact of this structure would be perceived as adverse depends on both the scale and character of the final pavilion design and on the viewer's perception of the appropriateness of the structure in the park. Views of the pavilion from outside would be limited by the fence and planting around it, and these would likely moderate the perception of the severity of the visual impact on the naturalism in that area of the park. Among users who prefer to see no additional development of structures in the park, the proposed pavilion is likely to be perceived as a small impact relative to others proposed in the plan, because the structure would be located within the enclosure of the existing Japanese garden.



Source: The Portico Group

Figure 17. Existing scene at viewpoint #5, looking southwest toward entrance to Japanese garden/Washington Park playfield parking lot in the Washington Park Arboretum.



Source: The Portico Group

Figure 18. Photographic simulation of scene at viewpoint #5, looking southwest toward the educational gateway facility proposed to be located south of Japanese garden in the Washington Park Arboretum (compare with existing scene in Figure 17).

The proposed expansion of the Japanese garden entrance facility to include a ticket window, gift shop, restrooms, and a small reading room (see Figure 3) would result in a much larger entrance structure (1,700 square feet) compared to the existing small fee booth. The existing entry area also includes portable toilets partially hidden from view by a fence and plantings, and these facilities would be eliminated. Some users may find that the expanded entrance building enhances their experience by providing the opportunity to browse in the gift shop and relax in the reading room. The removal of the existing portable toilets would likely be viewed as a positive visual impact by most user groups, provided permanent facilities take their place.

The Japanese garden is located in a relatively developed area within the park, near the Washington Park playfield and adjacent to Lake Washington Boulevard and the playfield parking lot. This area is already affected by views of parking and roads, and the amount of paving would increase with the proposed expansion of the parking area. Some users would view the addition of a structure in this area as relatively benign because of its location in an already affected portion of the park. However, the cumulative effects of parking expansion, a new pedestrian overpass, and an expanded Japanese garden entry facility are likely to be perceived as significantly intensifying development in this area, and these would be considered significant adverse impacts by those whose first preference is to preserve the park as it is. Landscape treatment and building design that are consistent with the design of the Japanese garden would lessen this perception to a degree.

Outdoor Shelters

The proposed addition of four 300 square foot educational shelters could introduce built elements similar in scale to the existing overlook gazebo into landscapes that are currently relatively remote from roads and generally out of view of other structures (see Figure 3). While relatively small, these structures would be a departure from the naturalistic character of the areas they are proposed for, and they would presumably also draw more activity to these areas. As a result, some users would consider the visual impact of these structures to be adverse. If well-designed and sited, the shelters are likely to be viewed as beneficial additions to the landscape for users who would rely on them for classes or use them for recreation. The proposed shelter at Foster Island would appear as a small structure in an expansive open green space. While it would not dominate the space, is not likely to alter the overall appearance of the area. It would be the only built element visible in this area other than the distant Broadmoor golf clubhouse and fountain.

The proposed shelters at Yew Hill (near the proposed canopy walk), at the rise with the alpine plant display, and at Madrona Terrace and would not impose greatly upon the surrounding landscapes. At Yew Hill the proposed shelter would be located within a mature stand of trees, not visible from any great distance. It would, however, impose a structure in an area that is largely naturalistic at present. Both shelters on Arboretum Drive would be in wooded areas and might be visible from the road, depending on how they are sited and landscaped.

Landscape Features

The proposed changes to landscape features would likely enhance the visual quality of the Washington Park Arboretum by creating a more complex and diverse plant community, improving habitat areas, and providing new viewing opportunities for visitors to enjoy the park's aquatic resources.

New plantings and intensified maintenance efforts would have some short-term adverse impacts on aesthetics, but these are not likely to be significant. Generally, new plantings themselves are expected to be attractive once they are established, and are not likely to have adverse impacts.

Long-term visual impacts could result from intensified maintenance activities and installation of new exhibits. Tree canopy heights could be lowered in some areas through planned elimination of mature native vegetation; opening or closing off views, view corridors, or open spaces; and introduction of signage that is not compatible with the naturalistic appearance of the park. Because specific vegetation removal and planting plans have not yet been developed, the exact location of all proposed changes cannot be identified at this time.

The intent of the proposed master plan is to maintain the "Olmstedian ideal of plants displayed in a naturalistic manner accessible to people for educational purposes and for esthetic respite from urban stresses." To achieve this intent under the plan, concern would be given to maintaining the characteristic variety of views and open spaces in the park as new exhibits are introduced, and to ensuring that undesirable views are not inadvertently exposed with removal of vegetation. In execution, this objective may not be met completely and some adverse impacts could result, although these impacts are not anticipated to be significant.

New tree plantings proposed at the northern park entrance along Lake Washington Boulevard East would eventually create a fuller canopy over the boulevard, giving this area a more established and formal appearance, similar to the area between Arboretum Drive East and East Madison Street. These new trees may, as they grow, limit the view corridors along Lake Washington Boulevard East.

Proposed signage associated with new exhibits could affect the naturalistic character of the Washington Park Arboretum. Seattle Parks and Recreation Department policies would limit the use of signs that are not readily seen near roads and are not needed for wayfinding on paths. Some interpretive signs are anticipated with new exhibits, although the proposed master plan does not include any new policies regarding signs. If developed within the guidelines of existing Parks and Recreation policies, no significant visual impacts are anticipated to result from signage.

The proposed viewing platform on the southern shore of the small bay south of Marsh Island (see Figure 3) would provide a new opportunity for visitors to enjoy the wildlife in this area. The platform itself would introduce a built feature to the area, although if it is designed with a minimum of vertical features, it should not intrude greatly on the surrounding waterscape.

The restoration work proposed for watercourses within the park is expected to enhance the natural appearance and ecological function of the streambed, and improve the stream's visual quality and in-water habitat. Natural streams in this region generally have taller vegetation than that existing along the stream at present. Vegetation added under this element of the plan may block views across the stream toward adjacent open areas.

Safety Features

Proposed additions to improve the safety features of the park might result in adverse visual impacts in certain areas. Added parking, lighting, and signage may result in glare that would detract from the natural environment and give the surrounding area a more developed appearance. Safety devices such as call boxes or alarms must be conspicuous to be effective. These devices are relatively small but could be viewed as conflicting with the naturalistic appearance of the park, particularly if it is necessary to locate them away from buildings and parking areas. The visual impacts of these devices, while adverse, would not be significant.

Alternatives to Proposed Plan Elements

Potential impacts of the alternatives to specific elements of the proposed master plan are described separately below.

Four-Way Stop at North Entry to Washington Park Arboretum

Development of a four-way traffic stop to connect the SR 520 on/off-ramps with Lake Washington Boulevard East and Foster Island Road East may create a more urban appearance, particularly if a traffic signal is incorporated. If a traffic light were to be installed across the roadway, it would likely intrude upon the natural landscape and reduce the aesthetic value of surrounding views.

The unused freeway ramp at the northern end of the park is a relatively unattractive feature that intrudes upon the natural landscape. Demolishing the unused ramp would likely enhance the aesthetic value of this area by restoring open space and view corridors, revealing natural features.

Lake Washington Boulevard Improvements with At-Grade Crossings

The installation of at-grade pedestrian crossings with stop signs on Lake Washington Boulevard East at the Arboretum Drive East and Boyer Avenue East intersections, as well as across Foster Island Road East, would not substantially affect view corridors or reduce open green space in these areas. Therefore, it is not likely that these crossings would alter the aesthetic character of the park.

Arboretum Drive Parking Lot Consolidation with Restricted Access

Closing Arboretum Drive East to all vehicular traffic except low-speed or pedal-powered tour vehicles and special-purpose access would tend to provide a beneficial aesthetic effect by reducing noise levels and eliminating the physical and visual intrusion associated with automobiles along the roadway.

The removal of all small parking lots along Arboretum Drive East would restore open green space along the roadway, eliminate the visual intrusion of parked cars and associated glare, and enhance the visual quality of the roadway. This action, along with closing Arboretum Drive East to most vehicular traffic, would likely enhance the aesthetic experience of visitors touring the park on foot.

Consolidating parking in the north parking area at the Graham Visitors Center and the south parking area near the Japanese garden would not substantially alter the visual quality of these already developed areas.

Overpass at East Interlaken Boulevard

A pedestrian overpass across Lake Washington Boulevard East near the East Interlaken Boulevard intersection would have aesthetic impacts and benefits similar to those described above for a pedestrian overpass at the south end of the Japanese garden under the proposed plan. Although the overpass would provide users an uninterrupted walking route across Lake Washington Boulevard and new opportunities for viewing the surrounding area, motorists and pedestrians at grade may perceive the overpass as an obstruction to distant views of the boulevard and the densely vegetated slope east of the boulevard.

Separated Bicycle and Pedestrian Trails

The alternative of developing a commuting bicycle trail on the east side of Lake Washington Boulevard East with a separate pedestrian trail on the west side of the boulevard would require a greater area of paved surface immediately adjacent to the boulevard than would the alternative of a dual-use pedestrian/bicycle trail along the east side of the boulevard. A dedicated bicycle path is required to be wider than the proposed dual-use trail and thus could require greater cut and fill, potentially resulting in a greater visual impact.

Parking Lot Expansion at Dispersed Locations

The area of the Japanese garden and Washington Park playfield is already fairly developed, and expanding the shared parking lot from its approximate existing capacity of 84 cars to accommodate 158 cars and four buses could alter the overall aesthetic value of this busy area. This action would require increasing the area of paved surface and may also slightly increase glare from parked cars. However, the parking lot would be landscaped so that the scale of the lot would be somewhat obscured, once the vegetation is mature.

Building Renovations without Expansion, and South-End Structure at Madrona Terrace

This alternative to the proposed plan includes a 2,500-square-foot education and visitor service center at Madrona Terrace, with parking similar to that in the proposed plan. The structure would be located in a relatively tranquil portion of the park that gets little use at present. Figure 19 shows existing conditions at Madrona Terrace (viewpoint #3 in Figure 13), for comparison with Figure 20 showing the Madrona Terrace area under this alternative. The structure, which would incorporate design and materials similar to the Graham Visitors Center and would be sited just below and east of the crest of the hill, would not affect views from the Japanese garden or Lake Washington Boulevard East. Figure 21 shows the relationship of the Madrona Terrace site in a cross-section view running through Lake Washington Boulevard East and the Japanese garden. The alternative 2,500-square-foot building would introduce into the Madrona Terrace area a larger structure and more activity compared to the proposed master plan. Users who place a high value on the tranquil and naturalistic quality of this area at present would be likely to view these impacts as adverse.

Cumulative Effects

As described in the sections above, many of the elements in the proposed master plan and alternatives are expected to have adverse impacts that, with thoughtful implementation, would not be significant. Taken together, however, a large number of small aesthetic impacts may become significant. For example, if signs, shelters, safety devices, lighting, and structures are dispersed throughout the park, each may appear to have only a minor impact, but this may leave few areas of the park devoid of one or more of these elements. As discussed above, where several elements are located in one area, the change to that area appears more dramatic.

For those who prefer the park to remain as it is, these cumulative impacts present the most significant aesthetic impact, and it is unlikely that any level of mitigation would reduce that perception.

Because many of the larger elements of the proposed plan and alternatives would require additional environmental review at the time they are implemented, the cumulative impacts of those projects on the aesthetic character of the park will also be assessed in greater detail in the future.

No Action

Under the no-action alternative, the Washington Park Arboretum would continue to operate much as it does today under the general guidance of the 1978 master plan. The general recommendations of the 1978 plan would not substantially affect the existing aesthetic integrity or style of the arboretum. The 1978 master plan calls for additional maintenance and vegetation removal in older exhibit areas, some of which has not yet occurred. Impacts from this activity would be similar to the intensified maintenance activities called for in the proposed master plan.

Mitigation Measures

Because of the high-quality naturalistic setting in the Washington Park Arboretum, mitigation for aesthetic impacts can be accomplished by minimizing visual change in such ways as faithfully restoring disturbed landscapes, retaining of mature landscaping wherever feasible, siting structures where they would be least intrusive, and using unified architectural and signage treatments. Planning for removal of unwanted canopy trees could take into consideration the possibility of inadvertently opening undesirable views, and steps such as phased removal could be employed to avoid such impacts.

Because of the Master Plan's extended period of implementation over two to three decades, aesthetic impacts of maintenance, construction, or planting activity occurring at any one time would be limited, with changes occurring at a gradual pace. In addition, proposed work would be limited to discrete portions of the park at any given time, so that visitors may avoid areas of active construction while still finding undisturbed areas of the park to enjoy.

Significant Unavoidable Adverse Impacts

Some visitors prefer that no changes be made in the Washington Park Arboretum. For these people, significant adverse aesthetic impacts would occur if almost any of the alternatives (other than no action) were implemented, even with mitigation such as careful siting and compatible design. Impacts are likely to be perceived by users as more significant in areas that currently are most naturalistic in appearance. For example, many people have expressed the view that the change in aesthetic character resulting from the addition of the Madrona Terrace educational gateway facility and its associated parking lot would be a significant adverse impact in that otherwise low-use area. The perception that this and other changes would be adverse is not universally shared.



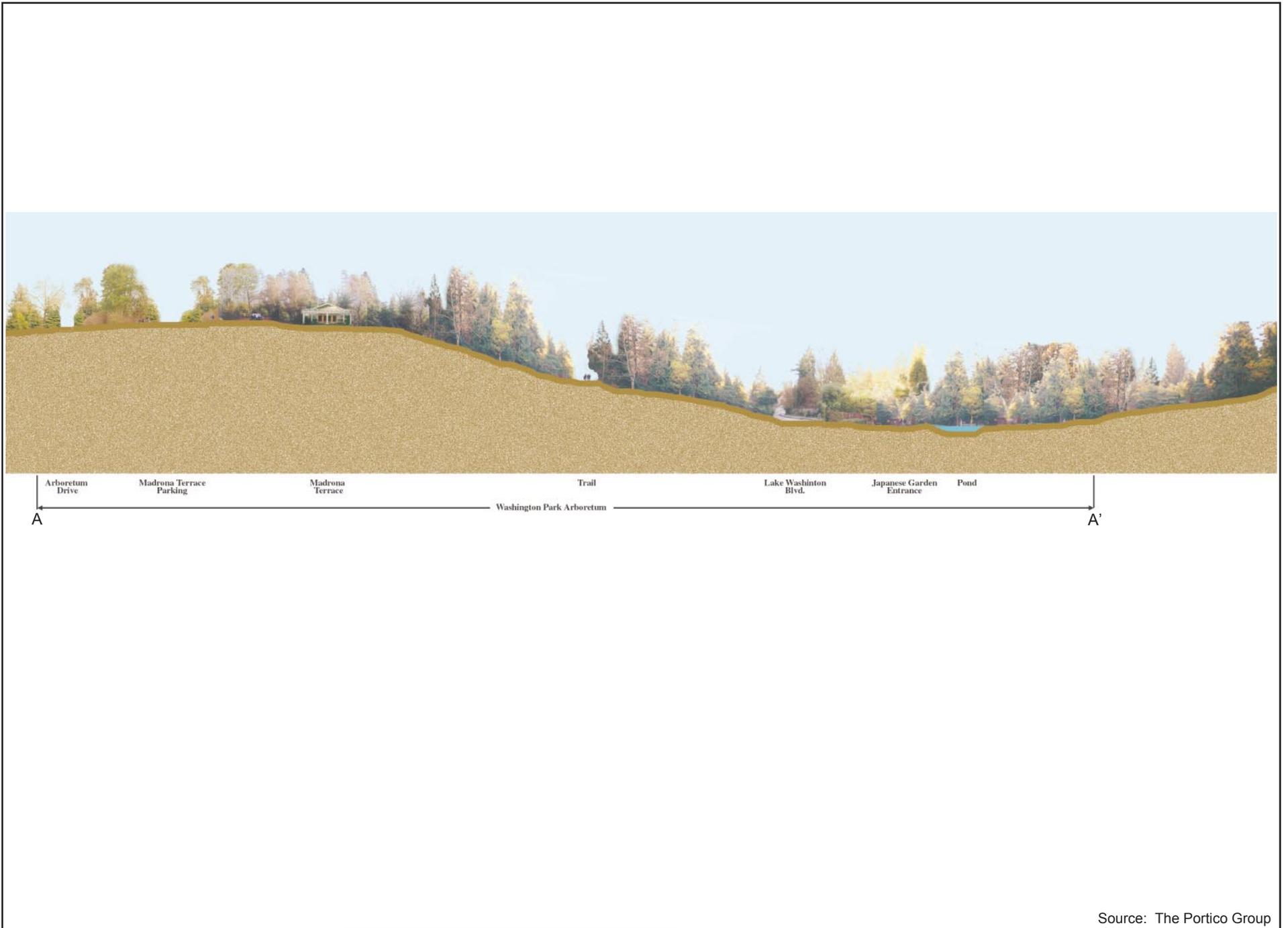
Source: The Portico Group

Figure 19. Existing scene at viewpoint #3, looking southwest across Arboretum Drive East at the Madrona Terrace site in the Washington Park Arboretum.



Source: The Portico Group

Figure 20. Photographic simulation of scene at viewpoint #3, looking southwest at Madrona Terrace alternative educational gateway facility in the Washington Park Arboretum (compare with existing scene in Figure 19).



Source: The Portico Group

Figure 21. Cross-section A-A' through Madrona Terrace area and Japanese garden in the Washington Park Arboretum (see Figure 13).

Transportation

Affected Environment

Roadway Network and Conditions

Access to the Washington Park Arboretum is provided by Lake Washington Boulevard East, which runs through the park and in turn provides vehicular connections to the regional freeway system and the Seattle arterial street system. The connections to the freeway system are provided at SR 520 (to and from the east via direct ramps, and to and from the west via the Montlake Boulevard interchange at the north terminus of Lake Washington Boulevard). Connections to the arterial street system are made via Montlake Boulevard–24th Avenue, East Madison Street, and Boyer Avenue East.

In addition to providing Washington Park Arboretum access, Lake Washington Boulevard also provides the primary connection to SR 520, the Montlake Bridge, and the University Bridge (via Boyer Avenue) for Madison Park and other neighborhoods to the south along Lake Washington and the Martin Luther King Jr Boulevard corridor. These neighborhoods have limited or no access to 23rd–24th Avenue, the principal arterial that provides the only alternative route for these trips. Between Union Street (an east-west arterial street about a mile south of the Washington Park Arboretum) and Boyer Avenue, there are no convenient or appropriate connections to 23rd–24th Avenue.

Lake Washington Boulevard East and Arboretum Drive East are the main north/south streets that run through the Washington Park Arboretum. Lake Washington Boulevard is a heavily traveled, two-lane arterial connecting Madison Street in the south with SR 520 and Montlake Boulevard–24th Avenue in the north. Arboretum Drive is a two-lane, narrow local access street that loops through the eastern portion of the park, connecting directly to Lake Washington Boulevard at the south end, and connecting to Lake Washington Boulevard via Foster Island Road East at the north end.

Boyer Avenue and East Interlaken Boulevard provide two additional vehicular access points into the Washington Park Arboretum from the west. Boyer Avenue provides a connection to and from the residential neighborhood immediately west of the park, to and from 24th Avenue (via a signalized intersection), to and from the Montlake and Roanoke Park neighborhoods west of 24th, and to and from the University Bridge. Interlaken Boulevard provides only a local street connection for a portion of the residential area between the park and 24th Avenue south of Boyer Avenue.

Roadway Characteristics

Lake Washington Boulevard is classified by the City of Seattle as both a class I boulevard with natural landscaping and a collector arterial. It is a two-lane roadway that provides circulation

and direct access to the adjacent park land and provides access to and from neighborhoods along the western shore of Lake Washington and the Montlake and Madison Park neighborhoods, and the Washington Park Arboretum itself. The roadway is narrow for two lanes (24 feet in width), but the pavement is in good condition. There are curbs on both sides of the roadway but no shoulders. The posted speed limit is 25 miles per hour (mph).

The Lake Washington Boulevard intersections at Madison Street and at Montlake Boulevard (where eastbound SR 520 on- and off-ramps also connect) are signalized. The Lake Washington Boulevard approach to the Montlake Boulevard intersection has adequate width, lane configuration, and queue storage. However, the Lake Washington Boulevard approach to the Madison Street intersection has an extremely short left turn pocket with inadequate queue storage capacity and does not have a separate right turn lane.

The intersection of Lake Washington Boulevard and the SR 520 ramps to and from the east has all-way stop control for through movements on Lake Washington Boulevard and the SR 520 westbound off-ramp traffic. Traffic from northbound Lake Washington Boulevard en route to the eastbound SR 520 on-ramp has a free right turn at the intersection, while access from southbound Lake Washington Boulevard to the eastbound SR 520 on-ramp is prohibited.

Madison Street is classified as a minor arterial by the City of Seattle. Its primary function is to connect the Madison Park and Lake Washington areas with the city arterial system and the regional highway system to the west (e.g., 23rd Avenue, 12th Avenue, and the Interstate 5 (I-5) freeway), and to First Hill and downtown Seattle. Near the Washington Park Arboretum south entrance at the signalized Lake Washington Boulevard intersection, Madison Street consists of two lanes with parking on both sides of the street. The pavement is in good condition.

Montlake Boulevard–24th Avenue is a north-south principal arterial located about ¼ mile west of the Washington Park Arboretum that provides access to the SR 520 freeway and, via the Montlake Bridge, to the University of Washington and northeast Seattle. The roadway has four travel lanes with sidewalks on both sides of the street. There is limited shoulder space and no on-street parking. Pavement conditions are good.

Boyer Avenue is classified as a two-lane collector arterial by the City of Seattle. Boyer Avenue provides a direct connection from Lake Washington Boulevard to 24th Avenue, where there is a signalized intersection. Boyer is stop-controlled at its eastern terminus at Lake Washington Boulevard. West of 24th Avenue, Boyer runs northwestward through the Montlake neighborhood, terminating at Eastlake Avenue and the University Bridge.

East of 24th Avenue, on the segment of Boyer that connects Lake Washington Boulevard to the city arterial system, the roadway is quite narrow and has sharp curves at the oblique-angle local street intersections at 25th Avenue and 26th Avenue. Traffic circles have been installed at each of these two intersections to help control traffic flow. There are no shoulders, and on-street parking is prohibited between 24th and 25th avenues and permitted only on the east side of the street between 25th and 26th avenues. The Boyer Avenue roadway between 25th and 26th avenues is so narrow that although two-way traffic is permitted, many motorists are reluctant to approach an

on-coming vehicle where there is a car parked on the street; on such occasions, Boyer functions like a one-lane roadway. The pavement is in good condition, and the posted speed limit is 25 mph.

Arboretum Drive, classified by the City of Seattle as a local access street, is a two-lane, north/south roadway that passes through the Washington Park Arboretum. The roadway has a pavement width of 18 to 19 feet and is in good condition. Arboretum Drive primarily serves park-usage traffic, and there are many small parking lots for park users located along the roadway.

Foster Island Road is classified as a local access street and provides access to the Broadmoor Golf Club (one of two access points to the Broadmoor subdivision) and to a parking lot for Foster Island. Total pavement width is 23 to 24 feet. The pavement is in fair to good condition, and the posted speed limit is 15 mph.

Interlaken Boulevard, classified as a local access street, links Lake Washington Boulevard to 24th Avenue with no intermediate street connections. Interlaken Boulevard's northwest/southeast alignment makes it an out-of-direction connection for northbound travel from 24th Avenue to Lake Washington Boulevard and for southbound travel from Lake Washington Boulevard to 24th Avenue; however, it can be a convenient short-cut route from southbound 24th Avenue or from northbound Lake Washington Boulevard. Interlaken Boulevard is stop-controlled at its intersection with 24th Avenue and at its eastern terminus at Lake Washington Boulevard. East of 24th Avenue, chokers (which reduce the street width and create a one-lane roadway) have been installed in two locations on Interlaken Boulevard, and there is a one-lane bridge over 26th Avenue. Pavement east of 24th Avenue is in good condition, while the pavement west of Lake Washington Boulevard is in fair to poor condition.

Trans-Lake Washington Study

The *Trans-Lake Washington Study* was authorized by the State Transportation Commission and funded by the state legislature in 1997. The purpose of the study was to identify a set of “reasonable and feasible solutions” to improve mobility across and around Lake Washington. The study considered improvements throughout the entire SR 520 corridor from I-5 in Seattle to SR 202 in Redmond, as well as in the area from SR 522 to I-90.

In July 1999, the 47-member Trans-Lake Washington Study Committee recommended a wide array of conceptual solutions. The next step in the process is the preparation of an environmental impact study to support a decision on a preferred solution. It is within the regional context of the upcoming SR 520 environmental and design studies that examinations of and decisions about the disposition of the existing Lake Washington Boulevard and Montlake Boulevard SR 520 ramps will be made.

Traffic Volumes and Patterns

Traffic volumes and patterns in the Washington Park Arboretum area were evaluated by collecting and reviewing average weekday daily traffic volume counts on selected key street segments, along with morning and evening peak hour volume counts at selected key intersections. The average weekday daily traffic is the average number of vehicles that use a given street segment during a 24-hour period on a weekday. The peak hour intersection volumes are the numbers of turning and through movements (counted separately) that pass through a given intersection during the highest-volume 60-minute period during the morning and evening peak commute periods. Average weekday daily traffic volumes are shown in Figure 1 in Appendix C, evening peak hour traffic volumes are shown in Figure 2 in Appendix C, and morning peak hour traffic volumes are shown in Figure 3 in Appendix C. Figures 4 and 5 in Appendix C show the travel paths of peak hour Lake Washington Boulevard traffic.

Daily Traffic

The daily traffic counts on Lake Washington Boulevard ranged from 11,300 vehicles per day north of the SR 520 ramps to 19,900 vehicles per day south of the SR 520 ramps. Volumes were 16,700 vehicles per day north of Boyer Avenue and 19,300 vehicles per day north of Madison Street. Although Lake Washington Boulevard is classified as a collector arterial, the volumes it is carrying are larger than the average weekday daily traffic volumes on Madison Street (17,100 vehicles per day), a minor arterial, and on 23rd Avenue (15,900 vehicles per day), a principal arterial. The Lake Washington Boulevard volumes also greatly exceed the 1,000 to 5,000 vehicles per day range recommended for collector arterials in *the Seattle Comprehensive Transportation Program – Street Classification*.

Evening Peak Traffic

In the evening peak, Lake Washington Boulevard carries 650 to 800 vehicles per hour in each direction between the SR 520 ramps and Madison Street; north of the SR 520 ramps Lake Washington Boulevard carries directional volumes of 400 to 500 vehicles per hour. Directional volumes are fairly well balanced, with around 52 percent of total peak hour traffic traveling northbound and 48 percent southbound. For a more detailed description of evening peak hour traffic, see section II.2.2 of Appendix C.

In the evening peak hour, a large majority of southbound Lake Washington Boulevard traffic is traveling to the Madison Park area and other Seattle neighborhoods along Lake Washington and the Martin Luther King Jr Boulevard corridor. This traffic largely comes from SR 520 and the Montlake Bridge, and to a lesser extent from Eastlake and the University Bridge (via Boyer Avenue). A modest number of vehicles use Lake Washington Boulevard and Boyer Avenue en route from westbound SR 520 to Capitol Hill and the Central District (via 24th Avenue).

In the evening peak hour, a large majority of northbound Lake Washington Boulevard traffic is coming from Madison Park and other Seattle neighborhoods along Lake Washington and the Martin Luther King Jr Boulevard corridor. Much of this traffic is traveling to SR 520 and the

Montlake Bridge, with a modest number traveling to Eastlake and the University Bridge (via Boyer). A small number are traveling to eastbound SR 520 from Capitol Hill, First Hill, and the Central District via 24th Avenue and Boyer Avenue.

Morning Peak Traffic

In the morning peak, Lake Washington Boulevard carries 1,000 to 1,200 vehicles per hour northbound and 500 to 600 vehicles per hour southbound between the SR 520 ramps and Madison Street; north of the SR 520 ramps Lake Washington Boulevard carries directional volumes of 400 to 450 vehicles per hour. Directional volumes are strongly peaked, with around 65 percent of total peak hour traffic traveling northbound and 35 percent southbound. For a more detailed description of morning peak hour traffic, see section II.2.3 of Appendix C.

In the morning peak hour, a large majority of northbound Lake Washington Boulevard traffic comes from Madison Park and other Seattle neighborhoods along Lake Washington and the Martin Luther King Jr Boulevard corridor. Much of this traffic is traveling to eastbound SR 520, with modest numbers traveling to westbound SR 520, the Montlake Bridge, and (via Boyer) to Eastlake and the University Bridge. A significant number (over 200) are traveling to eastbound SR 520 from Capitol Hill, First Hill, and the Central District via 24th Avenue and Boyer Avenue.

In the morning peak hour, a large majority of southbound Lake Washington Boulevard traffic is traveling to Madison Park and other Seattle neighborhoods along Lake Washington and the Martin Luther King Jr Boulevard corridor. This traffic largely comes from SR 520 and the Montlake Bridge, and to a lesser extent from Eastlake and the University Bridge (via Boyer). A very small number of vehicles are using Lake Washington Boulevard and Boyer Avenue en route from westbound SR 520 to Capitol Hill and the Central District (via 24th Avenue).

Trucks

Few heavy trucks use Lake Washington Boulevard through the Washington Park Arboretum. The city has posted a truck prohibition, and the 9-foot height limit of the Wilcox footbridge just south of Foster Island Road imposes a physical obstruction for large vehicles. Some medium-sized commercial (single-unit) trucks use Lake Washington Boulevard en route to and from SR 520. The evening peak traffic count conducted by TDG Inc. in November 1999 found that trucks comprised 1 percent of the total vehicular traffic.

According to Washington Park Arboretum staff, some over-height trucks traveling to and from the south use Arboretum Drive and Foster Island Road en route to and from the SR 520 on- and off-ramps in order to bypass the 9-foot-clearance Wilcox footbridge over Lake Washington Boulevard. Also, some trucks use Foster Island Road for access to and from the Broadmoor northwest entrance gate.

Traffic Operations

Traffic operations on the Washington Park Arboretum area roadway system were evaluated by determining the level of service at key intersections and by reviewing observed traffic speeds on Lake Washington Boulevard.

Intersection Level of Service

The level of service (LOS) is a qualitative measure of traffic operations, which ranges from LOS A, indicating free flow, to LOS E, indicating capacity, to LOS F, indicating forced flow or jammed conditions. Level of service criteria are compiled in Table 1 of Appendix C. The existing levels of service at key intersections in the site vicinity are compiled in Table 2 of Appendix C.

Lake Washington Boulevard/SR 520 east ramps—The intersection of Lake Washington Boulevard and the SR 520 westbound off-ramp is all-way-stop-controlled. Although the eastbound SR 520 on-ramp also is connected to the intersection, left turns from southbound Lake Washington Boulevard onto the ramp are prohibited, and there is an uncontrolled free right turn onto the ramp from northbound Lake Washington Boulevard. The all-way-stop operated at LOS F under 1999 evening peak hour volumes; however, the congestion and delay at the intersection was experienced disproportionately by the off-ramp traffic, which operated at LOS F while the Lake Washington Boulevard intersection approaches were operating at LOS D. During periods of severe congestion on SR 520, queues at the on-ramp meter can accumulate onto (northbound) Lake Washington Boulevard.

Lake Washington Boulevard/Foster Island Road—The computed 1999 evening peak hour level of service for this intersection was LOS C (for left turns onto southbound Lake Washington Boulevard from the stop-controlled Foster Island Road intersection approach). However, despite the computed LOS C (good level of service), there are periods when the difficulty and delay for left turns from Foster Island Road onto southbound Lake Washington Boulevard are becoming excessive and beginning to affect the general accessibility of the park.

Lake Washington Boulevard/Boyer Avenue—The stop-controlled Boyer Avenue approach to the intersection operates at LOS F under 1999 evening peak hour volumes. The delays for Boyer Avenue traffic at Lake Washington Boulevard often create queues on Boyer that can back up beyond (i.e., west of) 26th Avenue. These queues generate some neighborhood infiltration on surrounding streets by motorists too impatient to wait in the queue, but the delays and the queues also help discourage and limit the use of Boyer Avenue by through traffic.

Lake Washington Boulevard/Arboretum Drive—Similar to conditions at the Boyer Avenue intersection, left turns onto Lake Washington Boulevard from the stop-controlled Arboretum Drive approach to the intersection operate at LOS F under 1999 evening peak hour volumes. However, little traffic uses Arboretum Drive to get to Lake Washington Boulevard during the evening peak, as queues on southbound Lake Washington Boulevard backing up from Madison

Street often extend through and beyond the Arboretum Drive intersection, effectively making Arboretum Drive a right-turn-in/right-turn-out only connection.

The queues and heavy traffic flows also make turns difficult into and out of the Japanese garden/Washington Park playfield parking lot. (Left turns out of the lot operate at LOS F under 1999 volumes.) This lot driveway congestion and delay are particularly problematic on spring weekday afternoons when the Montlake/Madrona baseball league has multiple ball games scheduled for youth at the playfield.

Lake Washington Boulevard/Madison Street—The computed 1999 evening peak hour level of service for this intersection was LOS C. However, the level of service methods presume that traffic can move through the intersection when it has a green signal, and this is not always the case. Southbound Lake Washington Boulevard coming out of the park is narrow; it has a single lane with no shoulder or parking lane, and it has no right turn lane at the Madison Street intersection. At Madison Street there is a short left turn pocket, with space to store three cars while they wait to make the turn. With the volume of traffic turning left from southbound Lake Washington Boulevard onto northeast-bound Madison, the limited left turn storage capacity is inadequate, and the queue of motorists waiting to make the left turn often backs up into the through lane, effectively blocking all movement on southbound Lake Washington Boulevard. When this happens, the level of service drops to LOS F, and queues form on southbound Lake Washington Boulevard, accumulating beyond Arboretum Drive and the Japanese garden, often as far north as Interlaken Boulevard.

Lake Washington Boulevard Traffic Speeds

Informal observation of Lake Washington Boulevard traffic flow gives the clear impression that despite the narrow roadway and curving alignment, traffic is moving quite fast, with most vehicles exceeding the 25 mph speed limit by a significant margin. In order to determine actual traffic speeds, weekday 24-hour speed data were collected in March 2000.

The traffic data confirm the informal observations: over the 24-hour count period, less than 2 percent of the Lake Washington Boulevard traffic was traveling below 25 mph, nearly 60 percent was traveling at speeds between 30 and 35 mph, and over 20 percent was traveling above 35 mph. The 50th percentile speed (i.e., the speed below which half the motorists travel) was 33 mph, and the 85th percentile speed was 38 mph southbound and 35 mph northbound.

Traffic Accidents

Intersection Accidents

Table 3 of Appendix C summarizes the traffic accident history at the Lake Washington Boulevard intersections in the Washington Park Arboretum. The intersection accident data reflect the 3-year period from January 1, 1994 to December 31, 1996, the most recent period for which data are available.

The highest number of accidents during the 3-year analysis period occurred at the Lake Washington Boulevard/Madison Street intersection, where there were 19 accidents between 1994 and 1996. Most of these accidents involved vehicles making turning movements at the intersection (63 percent). Turning movement accidents usually are attributable to driver inattention or drivers refusing to yield to other vehicles. Although this intersection experiences a relatively high number of accidents (6.33 per year), it is not considered a high accident location, because with its high volume of traffic, its accident rate is a relatively low 0.67 per million entering vehicles. Other intersections in the site vicinity did not experience notable accident rates or exhibit obvious safety problems.

Arterial Accidents

The 1994–1996 traffic accident records also indicate that the approximately 1-mile segment of Lake Washington Boulevard between the SR 520 ramps and Madison Street experienced a total of 101 accidents, for an average of 33.7 accidents per year. This accident experience, in terms of a volume-related rate, translates to an accident rate of 4.0 accidents per million vehicle miles. This accident rate is significantly higher than the rate for state roads in King County. The *1996 Washington State Highway Accident Report* reports a 1996 accident rate of 2.3 per million vehicle miles for state roadways in King County, and the *1994 to 1996 Washington State Highway Accident Reports* indicate an average rate of 2.1 accidents per million vehicle miles for state roadways in King County.

The sharply curving alignment of Lake Washington Boulevard and the oblique angles at several intersections and driveways create limited sight distances along the roadway. In addition, the narrow roadway, excessive speeds, and peak hour queuing on the roadway contribute to the accident problems.

Parking

There are a total of 19 scattered parking lots located throughout the Washington Park Arboretum, as shown in Table 5 and Figure 6, both in Appendix C. There are two main parking lots within the park. The Graham Visitors Center has a total of 49 parking spaces at the north end of the park, which includes a parking lot located on the southeast corner of the Arboretum Drive and Foster Island Road intersection. The Japanese garden/Washington Park playfield lot located at the south end of the park has about 84 parking spaces.

Near the Graham Visitors Center, there are three parking areas located on Foster Island Road, two on the north side of the roadway and another at the roadway terminus. These parking areas contain a total of about 70 spaces. Along Arboretum Drive, there are about ten parking areas with a total of 89 parking spaces. Four other parking areas are located along Lake Washington Boulevard, with approximately 85 parking spaces.

On weekdays and weekends in nice weather during the spring and fall, parking supply is reportedly inadequate to meet the visitor demand.

Public Transportation Services

King County Metro Transit provides public transportation services in the Washington Park Arboretum area. No bus routes actually enter the park, but several routes operate at or near the park periphery:

- Route 11, which serves Madison Park, First Hill, and downtown Seattle, has a stop at the south end of the park at the Lake Washington Boulevard/Madison Street intersection.
- North Seattle, Bellevue, and downtown Seattle bus routes that travel on SR 520 provide park access at the Montlake flyer stop on SR 520 at Montlake Boulevard, near the northwest corner of the park.
- Routes 44 and 48, which serve downtown Seattle, the Central District, Capitol Hill, Montlake, and the University District, operate on 24th Avenue and Montlake Boulevard, providing access to the park's west-side pedestrian entrances via the east/west local streets (Boyer, Lynn, McGraw, Calhoun, Miller, and Roanoke streets).

All of these bus stops are located far from the center of Washington Park Arboretum activities.

Nonmotorized Transportation (Pedestrian and Bicycle)

Washington Park Arboretum Ingress and Egress

There are several pedestrian and bicycle access points into the Washington Park Arboretum, all of which are arrayed along the west side of the park and at its southern end. Pedestrians and bicyclists can enter and exit the park on Lake Washington Boulevard at the park's south end (at Madison Street) and at its northwest corner. The other access points are at the western boundary at local street ends (Roanoke, Miller, Calhoun, McGraw, and Lynn streets) and where local streets actually enter the park (Boyer Avenue and Interlaken Boulevard). Pedestrians and bicyclists also can enter the park from the north via the Foster Island trail, but access to this trail is from the Museum of History and Industry and from Montlake Boulevard between SR 520 and the Montlake Bridge. The City of Seattle's Bicycling Guide Map identifies Lake Washington Boulevard and Boyer Avenue as "streets commonly used by bicyclists."

There are no public pedestrian access points along the eastern boundary, aside from a small path near the stone cottage at the south end of the park.

The local street-end access points (on the northerly portion of the western side of the park) connect directly to the Washington Park Arboretum trail system, and the local streets leading to these access points all have sidewalks. Lake Washington Boulevard at the northwest corner of the park also has sidewalks.

Conversely, the pedestrian/bicycle accesses that are on-street (i.e., on Lake Washington Boulevard at Madison Street, on Boyer Avenue, and on Interlaken Boulevard) are neither safe nor convenient. None of these accesses have sidewalks, and in each case bicyclists must share a narrow roadway with motorized traffic.

Circulation within the Washington Park Arboretum

The Washington Park Arboretum has an extensive system of trails that provides convenient internal circulation throughout the park. However, Lake Washington Boulevard forms a formidable barrier against safe, convenient pedestrian circulation through virtually the entire length of the park. There are three signed and posted crosswalk locations on Lake Washington Boulevard between the SR 520 ramps and Madison Street. One crosswalk is located between Interlaken Boulevard and the northernmost driveway for the Japanese garden/Washington Park playfield parking lot, and the other two crosswalks are located at the intersection of Boyer Avenue. There also is a marked crosswalk at Roanoke Street, north of the SR 520 ramps intersection. The marked crosswalks do little to help pedestrians cross the fast, heavy Lake Washington Boulevard traffic stream. The only safe, convenient pedestrian crossings are the Wilcox footbridge that crosses over Lake Washington Boulevard just south of Foster Island Road, and to some extent the signalized intersection at Madison Street.

Pedestrian facilities along Lake Washington Boulevard are limited. A sidewalk is located on Lake Washington Boulevard between Interlaken Boulevard and the northernmost driveway for the Japanese garden/Washington Park playfield parking lot. There is an unpaved pathway leading from the northernmost driveway for the Japanese garden/Washington Park playfield parking lot to Madison Street.

There are no designated bicycle paths or lanes through the Washington Park Arboretum. The City of Seattle's Bicycling Guide Map identifies Lake Washington Boulevard, Boyer Avenue, and Arboretum Drive as "streets commonly used by bicyclists." However, bicyclists use all of the roadways in the area and often share the roadway with motorized vehicles in order to reach and pass through the park. Bicycle usage of Lake Washington Boulevard creates hazardous situations, resulting from the combination of heavy traffic volumes, a narrow and curving roadway, and a high proportion of impatient motorists.

Environmental Impacts

The transportation impact analysis for the Washington Park Arboretum proposed master plan and alternatives, included in Appendix C, addresses impacts of and impacts on traffic volumes and patterns, traffic operations, traffic safety, parking, public transportation services, and pedestrian and bicycle access and circulation. The findings of that study are summarized in this section.

Traffic Volumes

The traffic impact analysis for the Washington Park Arboretum proposed master plan and alternatives focuses on year 2005 evening peak hour conditions. Current background traffic volumes (i.e., traffic unrelated to the Washington Park Arboretum) were projected to 2005, and the traffic generated by the Washington Park Arboretum was estimated for a maximum-use scenario for the proposed master plan.

Background Traffic Volumes

Background traffic volumes were estimated by assuming that current evening peak hour traffic volumes would grow at a rate of 1 percent per year. Under such conditions, peak period traffic volume increases occur mainly during the hours before and after the peak hour, while the volumes during the peak hour do not tend to increase greatly. The background volumes plus existing Washington Park Arboretum volumes are the volumes used for the analysis of the no-action alternative.

Traffic Generation

The evening peak hour traffic generated by the Washington Park Arboretum under the proposed master plan was estimated for a maximum-use scenario. The maximum-use scenario traffic generation comprises several components: employees and typical day-to-day users, attendees of meetings and events at the expanded Graham Visitors Center, attendees of meetings and events at the new educational center at the Madrona Terrace site, attendees of meetings and events at the new Japanese garden pavilion, and Washington Park playfield participants and spectators. This method of determining Washington Park Arboretum traffic generation yields an estimate (265 outbound and 245 inbound trips) that is conservatively high, as it is highly unlikely that all of these capacity events would ever occur simultaneously.

Parking Demand

Parking demand for general Washington Park Arboretum visitation is expected to increase over time with increasing numbers of visitors. In addition, new facilities and the new programs they support would generate increased parking demand, as detailed below:

- Expanded Graham Visitors Center—At full occupancy, the new meeting room would generate the need for 40 additional parking spaces (100 people at 2.5 persons per car).
- New south-end education and visitor center—At full occupancy, the new educational center would generate the need for 30 additional parking spaces (75 people at 2.5 persons per car).

- Japanese garden pavilion—At full occupancy, the new pavilion would generate the need for 10 additional parking spaces (25 people at 2.5 persons per car).

This additional parking demand could result in inconveniences for some visitors during peak usage times, because parking lots are already fully utilized at these times. These peak periods are infrequent and of short enough duration that impacts are not expected to be significant.

Impacts of No-Action Alternative

Traffic Volumes and Patterns

The 2005 evening peak hour traffic volumes for the no-action alternative are compiled in Figure 8 of Appendix C. Because background volumes were assumed to increase 1 percent per year between 1999 and 2005, and Washington Park Arboretum traffic was assumed not to increase, the no-action alternative traffic volumes and patterns are similar to existing volumes and patterns.

Traffic Operations

Traffic operations on the Washington Park Arboretum area roadway system for the no-action alternative were evaluated by determining the level of service (LOS) at key intersections. The 2005 evening peak hour levels of service at key intersections in the site vicinity are compiled in Table 9.

Traffic Safety

The number of traffic accidents on Lake Washington Boulevard can be expected to increase with increasing background traffic volumes, while the closure of the small parking lots near the Wilcox footbridge and at Interlaken Boulevard would reduce traffic conflicts on Lake Washington Boulevard. Other than these minor impacts, the no-action alternative would have little or no impact (adverse or beneficial) on traffic safety.

Parking

The parking lot closures, relocations, and reconfigurations encompassed by the no-action alternative would modestly improve parking access and convenience but would have no significant impact on parking supply or demand.

Public Transportation Services

The no-action alternative would have no impact on public transportation services or their convenience and availability.

Table 9. No-action alternative, 2005 evening peak hour intersection levels of service.

| Lake Washington Boulevard Intersection | Intersection Control | LOS (Average Delay) |
|---|---|------------------------|
| SR 520 ramps | | |
| Westbound SR 520 off-ramp | All-way stop control | E (40 sec/veh) |
| Southbound Lake Washington Blvd through | All-way stop control | F (59 sec/veh) |
| Northbound Lake Washington Blvd through | All-way stop control | D (30 sec/veh) |
| Northbound Lake Washington Blvd right to eastbound on-ramp | Free right turn | D (26 sec/veh) |
| Foster Island Road East | | |
| Left turn from Foster Island Road | Two-way stop control | C (20 sec/veh) |
| Right turn from Foster Island Road | Two-way stop control | B (10 sec/veh) |
| Boyer Avenue East | | |
| Boyer approach | Two-way stop control | F (539 sec/veh) |
| Arboretum Drive East | | |
| Left turn from Japanese garden/playfield lot | Two-way stop control | F (97 sec/veh) |
| Left turn from Arboretum Drive | Two-way stop control | F (88 sec/veh) |
| East Madison Street | | |
| | Actuated signal | D (45 sec/veh) |
| | Southbound Lake Washington Boulevard left turn lane full | F (118 sec/veh) |

LOS = level of service.

Pedestrian Access and Circulation

The no-action alternative would have no impact on pedestrian access and circulation, although pedestrian safety and convenience (where affected by Lake Washington Boulevard traffic) would continue to deteriorate with increasing background traffic volumes.

Bicycle Access and Circulation

The no-action alternative would have no impact on bicycle access and circulation, although bicycle safety and convenience (where affected by Lake Washington Boulevard traffic) would continue to deteriorate with increasing background traffic volumes.

Impacts of Proposed Master Plan

Traffic Volumes and Patterns

The 2005 evening peak hour traffic volumes generated by the Washington Park Arboretum under the proposed master plan are compiled in Figure 9 of Appendix C, and the total traffic volumes (background traffic and park traffic) for the proposed plan are compiled in Figure 10 of Appendix C. Under the maximum-use scenario used for this analysis, the Washington Park Arboretum generates only a modest amount of traffic during the weekday evening peak period; this traffic uses the same routes to and from the park (i.e., Lake Washington Boulevard to and from Montlake Boulevard, SR 520, Boyer Avenue, and Madison Street) as does existing traffic.

Background volumes were assumed to increase 1 percent per year between 1999 and 2005 (the same assumption used for the no-action alternative), and this traffic would have little impact on Washington Park Arboretum access routes.

The draft EIS analyzed both a roundabout and a four-way stop option at the intersection of Lake Washington Boulevard East, Foster Island Road East, and the SR 520 ramps. After recognizing that either of these traffic revisions could produce significant impacts outside the Washington Park Arboretum, and might also exacerbate problems at the metered on-ramp to SR 520, alternatives that allow left turns from southbound Lake Washington Boulevard onto SR 520 have been eliminated from further consideration at this time. Instead, a reconfigured north entry drive into the park is proposed that allows all movements currently allowed at this intersection, and no new turning movements (see Figure 3).

Traffic assignments prepared using the City of Seattle's EMME/2 traffic forecasting model indicate that introduction of the proposed new linkage (southbound Lake Washington Boulevard to the eastbound SR 520 on-ramp) would result in a 30 percent increase in on-ramp traffic, all of which would come from Montlake Boulevard after shifting from other freeway access routes. In addition, the traffic assignments show that an equal volume of traffic *en route* to the eastbound SR 520 on-ramp would shift from northbound Lake Washington Boulevard (coming from Madison Street) to a 24th Avenue–Montlake Boulevard–southbound Lake Washington Boulevard ramp access route.

Traffic Operations

Traffic operations on the Washington Park Arboretum area roadway system for the proposed master plan were evaluated by determining the level of service at key intersections.

The proposed master plan includes recommendations to the Seattle Transportation Department to install pedestrian-activated controls on Lake Washington Boulevard East at Arboretum Drive and at Boyer Avenue. These controls would stop traffic on an intermittent basis, and they could affect peak levels of service if a substantial number of pedestrians use them. Current volumes of pedestrian traffic crossing during peak hours are small, and the impacts on traffic from these signals are not expected to be significant at these times. During off-peak times such as weekends, higher pedestrian volumes crossing at these intersections could slow traffic. With eventual development of a pedestrian bridge near Arboretum Drive, some pedestrian traffic would be inclined to avoid the at-grade crossing altogether, which would reduce the frequency of traffic flow interruptions by pedestrians.

The proponents have also concluded that while traffic solutions studied in this planning process would have adverse impacts that go beyond the scope of this effort, the Seattle Transportation Department should be asked to look for solutions that would facilitate use of Foster Island Road and Arboretum Drive by park users, even if this means inconveniencing Lake Washington Boulevard traffic to a degree. Such changes could affect the levels of service at some intersections.

Because no changes to traffic controls are proposed, other than pedestrian-activated lights, peak-hour levels of service under the proposal are expected to be similar to those for the no-action alternative.

Under the proposed plan, the projected 2005 evening peak hour traffic volumes would cause the Lake Washington Boulevard/Madison Street intersection to operate at LOS D when the southbound Lake Washington Boulevard left turn lane is not full. When this short left turn lane is full (which happens frequently during peak periods), the left turn queue would block the southbound Lake Washington Boulevard through lane, and intersection conditions would drop to LOS F. Under such conditions, southbound Lake Washington Boulevard queues rapidly accumulate beyond Arboretum Drive and the Japanese garden/playfield parking lot driveway.

Traffic Safety

The number of traffic accidents on Lake Washington Boulevard can be expected to increase with increasing background and park-generated traffic volumes, while the closure of small parking lots and driveway consolidation along Lake Washington Boulevard would reduce traffic conflicts and improve safety. The pedestrian signals at the Boyer Avenue and Arboretum Drive intersections with Lake Washington Boulevard would improve pedestrian safety but would also likely result in some rear-end collisions. Other than these relatively minor impacts, the proposed master plan would have little or no impact (adverse or beneficial) on traffic safety.

Parking

The parking lot closures, relocations, and reconfigurations included in the proposed plan (see Table 2) would affect parking access and convenience but would have no significant impact on parking supply or demand. No parking areas would be removed before replacement parking is constructed. Increased staffing would increase parking demand, and this impact would be concentrated in the north end of the park where the maintenance facilities are located. Staffing would increase gradually, and this impact would be evaluated as parking facilities and new structures are developed. The park has adequate parking to accommodate additional staff except at peak use times, which do not generally coincide with peak weekday staff parking demand.

Public Transportation Services

The improvement of Lake Washington Boulevard pedestrian crossings would improve Washington Park Arboretum accessibility to and from 24th Avenue bus stops. The proposed plan would have no other impact on public transportation services or their convenience and availability.

Pedestrian Access and Circulation

The new and improved pedestrian/bicycle trails, the overpasses, and the at-grade street crossing improvements included in the proposed master plan all would reduce conflicts with automobile traffic and significantly improve the safety and convenience of pedestrian circulation in the park.

Bicycle Access and Circulation

The new and improved pedestrian/bicycle trails, the overpasses, and the at-grade street crossing improvements included in the proposed plan all would reduce conflicts with automobile traffic and significantly improve the safety and convenience of bicycle circulation within and through the park.

Impacts of Alternatives to Proposed Plan

All-Way Stop at Washington Park Arboretum North Entry

This alternative has been eliminated from further consideration, for reasons similar to those behind elimination of the roundabout analyzed in the draft EIS.

Lake Washington Boulevard Pedestrian Crossing Improvements at Foster Island Road

The installation of pedestrian crossing improvements on Lake Washington Boulevard at Foster Island Road would improve the safety and convenience of pedestrian circulation within the Washington Park Arboretum, especially for pedestrians en route to and from Montlake Boulevard, Montlake Boulevard and SR 520 transit stops and stations, and the Montlake neighborhood. The crossing improvements (which may be marked crosswalks, a pedestrian (on-demand) signal, pedestrian refuge islands, or some other device) can be designed and located to provide a safe, convenient pedestrian crossing with minimal impact on Lake Washington Boulevard traffic flow.

Close Arboretum Drive to Through Traffic

Closure of Arboretum Drive to through traffic would improve pedestrian and bicycle circulation within the Washington Park Arboretum by eliminating pedestrian/auto and bicycle/auto conflicts. Any traffic that normally would use Arboretum Drive to travel through the park would instead use Lake Washington Boulevard. Shifting this limited volume of traffic onto Lake Washington Boulevard would have no noticeable effect on Lake Washington Boulevard traffic operations.

Lake Washington Boulevard Pedestrian/Bicycle Overpass at Interlaken

A pedestrian/bicycle overpass at Interlaken Boulevard would provide improved access between the Washington Park Arboretum and the Interlaken trail. (Although 24th Avenue is difficult to cross on Interlaken Boulevard, west of 24th Avenue Interlaken Boulevard is a heavily used pedestrian/bicycle route through Interlaken Park, which includes a segment between 22nd Avenue and 19th Avenue that is closed to motorized traffic.) However, this Lake Washington Boulevard overpass is proposed not in addition to, but in place of an overpass south of the Japanese garden. Because Interlaken Boulevard has limited use as a park access route, and because a crossing of Lake Washington Boulevard south of the Japanese garden would serve greater use for park access and internal circulation, it can be concluded that the pedestrian/bicycle overpass at

Interlaken Boulevard would provide less benefit to pedestrian/bicycle safety and convenience than would an overpass south of the Japanese garden.

Lake Washington Boulevard Commuter Bicycle Path

A separated bicycle-only path (called a commuter bicycle path) along the east side of Lake Washington Boulevard may provide some improvement of traffic flow and bicycle safety by reducing on-street bicycle/auto conflicts. However, safety would be improved only to the extent that bicyclists actually use the commuter path instead of riding on-street. Because there would be some inconvenience for bicyclists getting on and off the path at its termini, because pedestrians would be inclined to use the path as a sidewalk, and because many commuter cyclists prefer to ride in the street (and many travel at or near the vehicular speed limit on Lake Washington Boulevard), it is unlikely that the commuter bicycle path would be effective in diverting bicycles off Lake Washington Boulevard and eliminating bicycle/auto conflicts.

Lake Washington Boulevard Pedestrian Signal at Arboretum Drive

A pedestrian (on-demand) signal on Lake Washington Boulevard at Arboretum Drive would significantly improve pedestrian circulation within the park by providing a safe, convenient connection between the Japanese garden/Washington Park playfield (with their shared parking lot) and the main body of the park north and east of Lake Washington Boulevard.

Because the Madison Street intersection effectively controls the capacity and operation of the Lake Washington Boulevard corridor, a pedestrian signal at or near Arboretum Drive would have minimal impact on overall traffic flow through the corridor. In order to minimize traffic disruption, such a signal should be coordinated with the Madison Street traffic signal. However, if it is to be effective in its primary function of moving pedestrians safely across Lake Washington Boulevard, the signal must be responsive and convenient to use.

Building Renovations without Expansion, and South-End Structure at Madrona Terrace

Impacts under this alternative would be similar to those under the proposed master plan, except that traffic using the alternative Madrona Terrace building would be more likely to use Arboretum Drive. Impacts would not be significant.

Reduce Size and Function of Visitors Center

Under this alternative, traffic on Foster Island Road and its intersection with Lake Washington Boulevard would be reduced by a small amount, and the impact on traffic operations would not be significant.

Mitigation Measures

A series of mitigation measures that address the identified impacts of the proposed plan and alternatives are described in this section.

Lake Washington Boulevard Traffic Speeds

Potential mitigation measure: Install speed humps, speed lumps, or traffic-calming circles on Lake Washington Boulevard East within the park. (Speed lumps are speed humps that do not extend all the way across a lane. Wide-wheelbase trucks and buses can straddle the lump, while at least one wheel of an automobile must roll over it.) The design of speed humps and other traffic calming devices must safely accommodate bicycle traffic.

Lake Washington Boulevard traffic speeds greatly exceed the 25-mph speed limit, despite roadway characteristics (narrow width and curving alignment) that tend to reduce speeds. Although the installation of stop signs at Lake Washington Boulevard intersections (Arboretum Drive, Interlaken Boulevard, and Boyer Avenue) may reduce speeds in the immediate vicinity of the stop signs, it would have little or no effect on speeds between the stop-controlled intersections, and the congestion created by the stop signs can create air quality and noise problems. Furthermore, the improved access to Lake Washington Boulevard from the side streets at all-way stops can encourage and hence increase neighborhood infiltration by through traffic.

Lake Washington Boulevard Pedestrian Crossings

Potential mitigation measure: Install mid-block crossings with median refuge islands (raised, with flashing inset lights, or with pedestrian signals if appropriate) in place of crossings at intersections.

Improved pedestrian crossings are needed on Lake Washington Boulevard to enable safe and convenient pedestrian access and circulation in the park. However, placing such crossings at intersections exposes pedestrians to conflicts with turning traffic and motorists whose attention is focused on other vehicles and their maneuvers. Placing crossings away from intersections eliminates these conflicts, and the refuge islands allow pedestrians to cross one lane or one direction of traffic at a time. Realigning the Lake Washington Boulevard travel lanes around a refuge island also can help reduce traffic speeds.

Lake Washington Boulevard Commuter Bicycle Lane

Potential mitigation measure: Widen Lake Washington Boulevard to provide a striped bicycle lane on both sides of the road.

Such a class II bicycle lane would allow commuter bicycle traffic to continue to use Lake Washington Boulevard while reducing conflict between bicyclists and vehicular traffic and

avoiding the creation of new pedestrian/bicycle conflicts. This could have impacts on the historic character of the boulevard, however.

Lake Washington Boulevard/Madison Street Intersection

Potential mitigation measure: Lengthen the southbound Lake Washington Boulevard left turn lane at Madison Street.

Provision of adequate left turn queue storage on southbound Lake Washington Boulevard at Madison Street would allow the intersection to operate at LOS C and eliminate the southbound peak period queues that can strangle access to and from the Japanese garden/Washington Park playfield parking lot and Arboretum Drive. This could require removal of trees and could affect the historic character of the boulevard.

Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts are anticipated.

Public Services and Utilities

Affected Environment

This section describes existing public services and utilities serving the Washington Park Arboretum. Public services include education, firefighting and emergency medical services, local law enforcement services, and the organization and staff that maintain and operate the park. Utilities include electricity, natural gas, water supply, wastewater and stormwater collection, solid waste collection and disposal, telecommunication services, and cable television. In addition, existing safety and security conditions in the park are described, including security of personal property and protection of plant collections, as well as personal safety.

Information presented in this section was obtained using existing plans and documents from the City of Seattle, King County, and the University of Washington; existing environmental documentation prepared for other projects in the area; telephone interviews with public service, utility, and agency representatives; utility location maps; police reports; and discussions with arboretum staff and volunteers.

Education

More detailed information regarding education programming at the Washington Park Arboretum is provided in Appendix D, prepared in response to several draft EIS comments.

Seattle's Parks and Recreation Plan 2000 is a functional plan adopted in the summer of 2000 to guide management efforts for Seattle's open space, parks, and recreational and environmental education services over a 10- to 20-year period, complementing the city's overall comprehensive plan (Seattle 2000). This plan has no specific policies relating to educational programs or opportunities at Washington Park Arboretum but does call for completion of the master plan process and implementation of priority projects. The plan has general policies calling for participation by the Department of Parks and Recreation in school-age environmental education programs.

The current educational offerings at the Washington Park Arboretum include programs for adults, professionals, schools, families, volunteers, educators, youth groups, and casual visitors. The University of Washington provides staff leadership and resources for most of these programs, which are administered by the Center for Urban Horticulture under the direction of the College of Forest Resources.

As part of its expanding K-12 educational program, the University of Washington has fostered a substantial increase in school-age programs at Washington Park Arboretum during the past 5 years. Additionally, the arboretum staff is leading program development for plant science-based inquiry programs in cooperation with the Seattle Public Schools, the University of Washington, and six other local schools. See Appendix D for more background on the educational mission at

the Washington Park Arboretum. South Seattle Community College, Edmonds Community College, and other schools bring students onsite for self-guided programs. The Washington Park Arboretum has limited facilities for classes, workshops, plant propagation, and research. Many of the educational programs occur at the University of Washington Center for Urban Horticulture.

The Washington Park Arboretum adult education programs include:

- Guided tours
- Weekend walks
- University of Washington extension courses
- Lectures
- Plant propagation workshops
- Plant study program
- Construction demonstrations
- Symposia.

Educational programs for professionals include seminars and degree programs through the University of Washington College of Forest Resources.

Youth and community outreach educational programs include:

- School Programs
 - Saplings School Tours
 - Arboretum Explorer Packs
- Youth and Family Programs
 - Family Explorer Packs
 - Arboretum Adventures
 - Storyvine
 - Summer Nature Day Camps (expected to begin in summer 2000)
- Outreach
 - Branching Out Program.

In addition to the above, the Washington Park Arboretum provides interpretive materials and self-guided learning opportunities.

Fire and Emergency Medical Services

The Seattle Fire Department responds to emergency calls that require firefighting and medical assistance. The fire department has 900 uniformed firefighters in 33 stations located throughout the city. Seattle fire stations serving the Washington Park Arboretum include stations #22 and #34, each having one engine; and stations #17 and #25, each having one engine, one ladder

truck, and one aid van. The nearest station, station #34, is located at 633 32nd Avenue East, approximately one block southwest of the park's southern entrance.

The Seattle fire alarm center is equipped with a computer-aided dispatch system linked to an enhanced 911 emergency call system. Emergency firefighting and medical aid units are generally dispatched from the station nearest the call site, although response units can come from other stations as well. In 1998, the average emergency medical response time from fire stations serving the park ranged from 2.99 minutes (station #25) to 4.31 minutes (station #17). The average fire call response time ranged from 3.4 minutes (station #25) to 4.5 minutes (station #34) (Seattle Fire Department 1998). Industry standards require a response time within 4 to 6 minutes for emergency medical calls and within 5 minutes for fire emergencies (Seattle Fire Department 1999).

Local Law Enforcement Services

The Seattle Police Department serves the Washington Park Arboretum area from its east precinct station at 1519 12th Avenue on Capitol Hill, with 128 officers serving an 8.5-square-mile area. The police department allocates available patrol officers to sectors and watches (beats) within a precinct based on several variables, including the area patrolled, total length of streets, average number of runs per hour, number of calls received in a particular area, and average response speed. Beat C3 is located within the east precinct and serves the Washington Park Arboretum as well as a residential population of 9,970. During summer months, police officers on bicycles or horseback occasionally patrol the park. The University of Washington police do not respond to calls within the park.

In 1998 the Seattle Police Department responded 2,866 times to incidents in beat C3, for a total of 483 Part 1 offenses, which are those identified by the department as the most serious crimes, including felonies, violent crimes, and property damage or theft (Seattle Police Department 1998). From January 1 to November 20, 1998, there were 48 dispatched calls to the Washington Park Arboretum, as listed in Table 10 (Fast 1999a personal communication).

Washington Park Arboretum Personnel

Three organizations provide administrative, maintenance, and program staffing for the Washington Park Arboretum. The total staff includes approximately 23½ full time equivalent employees (FTE), consisting of approximately six administrative and program FTE and 17½ maintenance FTE. The City of Seattle contributes slightly fewer than 7½ maintenance FTE, the University of Washington contributes approximately 3½ administrative and program FTE and 10 maintenance FTE, and the Arboretum Foundation contributes slightly more than 2½ administrative and program FTE. These figures do not include some additional administrative time spent by the Seattle Parks and Recreation Department or limited contractual services paid for by the Arboretum Foundation.

Table 10. Dispatched calls to Washington Park Arboretum, January 1 to November 20, 1998.

| Offense or Subject of Call | Number of Calls |
|--|-----------------|
| Assault | 1 |
| Car prowler | 28 |
| Drug-related | 1 |
| Reported prowler | 1 |
| Sex offender | 1 |
| Traffic investigation | 7 |
| Property damage (to arboretum property, approximately \$2,500) | 4 |
| Theft (of arboretum property, approximately \$1,200) | 3 |
| Driving while intoxicated | 1 |
| Suspicious vehicle | 1 |

Electrical Service

Electric power in Seattle is provided by Seattle City Light. The utility currently has an average annual load of 1,100 megawatts, which is projected to grow by more than 200 megawatts per year. Electricity serving the Washington Park Arboretum and the surrounding area is provided by two primary power lines. The first is routed across the Wilcox footbridge at East Lynn Street, from 26th Avenue East to the Graham Visitors Center. The second power line enters the park near the intersection of 28th Avenue East and East Ward Street, then continues to the intersection of Lake Washington Boulevard East and Arboretum Drive East.

Natural Gas Service

Puget Sound Energy provides natural gas and energy-related services to more than 1 million customers in the Puget Sound region, transporting natural gas through supply mains to district regulators throughout its service area. Supply mains vary in size from 4 to 20 inches in diameter and are rated at 80 to 300 pounds per square inch pressure. An 8-inch-diameter supply main traverses the Washington Park Arboretum from the intersection of 28th Avenue East and East Ward Street, past the intersection of Lake Washington Boulevard East and Arboretum Drive East, continuing on toward East Prospect Street. A 2-inch-diameter natural gas line extends service from the Broadmoor north gate to the Graham Visitors Center and surrounding buildings.

Water Supply

Seattle Public Utilities, Water Services Division provides drinking water to the greater central Puget Sound region from two unfiltered surface water sources, the Cedar River and the South Fork Tolt River. Water is supplied within the Washington Park Arboretum from one 16-inch-diameter water main between Boyer Avenue East and East Interlaken Boulevard, which extends

through the park toward the northeast and into the Broadmoor residential community. The 16-inch-diameter water main has been tapped for irrigation at the lilac collection and for drinking water at the rhododendron glen.

In addition, an 8-inch-diameter water main extends east along East McGraw Street into the conifer meadow, where it narrows to 4 inches in diameter extending southeast across Lake Washington Boulevard, then continues east along the trail from the Wilcox footbridge to the Graham Visitors Center. The 4-inch line provides water service to both the visitors center and the maintenance building. A 6-inch water supply line for fire protection was recently installed from a connection at 26th Avenue East and East McGraw Street, running along Lake Washington Boulevard East to Foster Island Road East, extending to the Graham Visitors Center.

Most of the park's irrigation system is served by coupler lines, while automated irrigation systems provide water on Azalea Way, in Loderi Valley, in the rhododendron glen, and at the visitor center. Components of both systems are old and require a great deal of maintenance to keep them in operating condition. Generally, the layout of the irrigation system and its operational capabilities make water use inefficient. Past installations and upgrades have not been consistently mapped or recorded (Kanyer 1999 personal communication).

Wastewater and Stormwater Collection

The King County Department of Natural Resources, Wastewater Treatment Division provides sewage treatment services to most of King County. The Washington Park Arboretum is located within the utility's west region service area, from which flows are conveyed to the West Point wastewater treatment plant. This plant was upgraded in 1995 to provide secondary treatment of 133 million gallons per day of average wet-weather flow. Effluent from West Point is discharged to Puget Sound through port-diffuser pipes. Local side sewers and storm drains are inspected, maintained, and regulated by Seattle Public Utilities.

Combined sanitary wastewater and stormwater flow from the Washington Park Arboretum is collected and conveyed to the West Point facility through two branches of the north trunk sewer. A 60-inch-diameter line collects flow in the residential area south of the park and extends north from East Madison Street adjacent to the Washington Park playfield, through the western portion of the park. Side sewers and drains direct flow to this line from the Washington Park playfield and restrooms, the Japanese garden, and the residential area west of the park.

North of the stone cottage, immediately east of Arboretum Drive East, a stream that flows year-round enters a culvert conveying flow to the combined sewer. A short distance north of Boyer Avenue East the sewer diameter increases to 72 inches, remaining this size as far as the branch connection at East Lynn Street, where a 66-inch-diameter line collects and conveys flows from the area east of the Wilcox footbridge, the Broadmoor Golf Club, and the Graham Visitors Center and surrounding buildings. The two branch lines are joined in one 90-inch-diameter sewer line at East Lynn Street, which continues north to eventually reach the West Point wastewater treatment facility.

A separate stormwater conveyance and drainage system exists within the park; however, lack of available as-built drawings or plans creates difficulty in tracing this local network of piping, ditches, and culverts. Apart from the combined sewer and storm drain system described above, one large storm drain, approximately 72 inches in diameter, discharges stormwater flows from the Montlake neighborhood into Willow Bay. Manholes and catch basins are visible in the Graham Visitors Center parking area, in satellite parking strips adjacent to Azalea Way, and along Azalea Way. This stormwater drainage system appears to convey flows westward through the woodland garden and rhododendron glen wetlands in surface channels and culverts along the steep slopes.

Solid Waste Collection and Disposal

Solid waste generated within Seattle is collected and transported by private haulers to the city-owned north and south recycling and disposal stations and to privately owned and operated transfer stations. Waste is then transferred by truck and rail to landfills in the region, including the Columbia Ridge landfill in Oregon. Recyclable materials and construction, demolition, and land clearing wastes are also collected for processing and transfer for appropriate reuse.

The Washington Park Arboretum uses University of Washington waste management services for its facility and maintenance solid waste disposal and recycling. Vegetation waste is composted at the compost site south of the greenhouses along the east boundary fence, and wood chips are recycled in an open area adjacent to Azalea Way south of the Graham Visitors Center. Recycled materials are used as mulch for the plant collections and general landscaping. The Seattle Parks and Recreation Department provides collection services for trash receptacles located throughout the park.

Telecommunication Services

US West Communications provides local telephone service within Seattle. Telephone lines are typically located in conduits within street rights-of-way. Washington Park Arboretum telephone facilities, which are shared by the University of Washington and the Arboretum Foundation, are located at the Graham Visitors Center and the Japanese garden ticket booth. Two underground lines installed at the Graham Visitors Center are connected through the Broadmoor neighborhood on the east. Telephone service lines in the vicinity of the Graham Visitors Center currently are operating at capacity (Wott 2000 communication).

Several private companies and the City of Seattle maintain fiber-optic networks throughout the city, although not within the Washington Park Arboretum project area.

Cable Television Service

AT&T Cable Services, formerly TCI, provides cable television services to the area surrounding the Washington Park Arboretum. Currently, there are no underground cable facilities within the park.

Safety and Security

A variety of deficiencies can be identified in existing safety and security conditions in the Washington Park Arboretum. Safety and security issues can be divided into two areas of concern: public safety, and security of the plant collections. Response in emergency situations is reliant upon 911 calls or the presence of police officers during routine patrols. Incident reports are kept on file at the Graham Visitors Center and shared with Seattle Police Department staff to coordinate policing efforts within the park. This system includes tracking of incidents not reported to police but of concern to the Washington Park Arboretum as a unique public space containing rare plant collections.

Common public safety issues include personal safety while using the park at night (particularly because of inadequate lighting during organized events), automobile break-ins, traffic hazards along the Foster Island Road route to the Broadmoor golf clubhouse, and illegal activities in the park. Although vehicular traffic is blocked by the barricades at the north and south entrances of Arboretum Drive after dusk, pedestrian traffic remains unchecked during nighttime hours. Washington Park Arboretum personnel have observed that visitors tend to avoid the park during evening hours, because of confusing signage, the lack of lighted trails, and the absence of staff (work crews leave at 3 p.m. daily). Events scheduled after dark, whether at one of the main buildings or elsewhere within the park, are difficult to reach for visitors using public transportation. The two bus stops serving the park are located on East Madison Street at the south end of the park and on East Lynn Street at the Wilcox footbridge, up to one mile from the main buildings.

The second general area of concern is vandalism and theft of Washington Park Arboretum property and theft of or damage to plant collections. Valuable plants have been stolen or damaged. The arboretum does not have adequate staff to control vandalism and theft of plants within the park. Although these incidents are reported to police, it can be difficult to track every occurrence.

Environmental Impacts

Proposed Plan

Roadways, Pedestrian and Bicycle Circulation, and Parking Facilities

Impacts on fire and emergency medical services during construction of roadways, pedestrian and bicycle trail systems, and parking facilities in the Washington Park Arboretum would be limited to some rerouting or possible delays. Roadway rerouting and delays would be limited to areas

within the park. At times when construction focuses on the south end or north end of the park, access may require rerouting from the opposite end of the park. Impacts on law enforcement services also would be limited to some rerouting or delays.

Existing electrical service has adequate capacity to accommodate the proposed development with the addition of service drop or transformer upgrades. Water supply and sewer utilities have adequate capacity to accommodate development under the proposed plan. Tunneling under East Madison Street for a dual-use pedestrian/bicycle trail may affect existing utilities located in that area.

Within areas containing underground utilities, any new construction or modification to existing roadways would require excavation and trenching. Depending upon piping depths and limits of the excavations, field verification would be required to avoid disruption of service. In the cases where roadway development or improvement does not directly overlap a utility's path, future development or upgrades to the existing utility service may be affected by the proposed master plan's roadway elements.

Fiber-optic cables may be present in areas proposed for construction within the park. The locations would be determined after construction permits are applied for and utility locations are identified.

The proposed plan would have beneficial effects on public safety and security, with redesigned intersections on Lake Washington Boulevard East, overpasses, and pedestrian and bicycle trails separated from the boulevard. Reducing the number of small parking lots in relatively secluded areas, such as Arboretum Drive East, would beneficially affect personal safety and property security.

Buildings and Outdoor Shelters

Temporary disruptions of educational activities may occur during building construction, but this impact is not expected to be significant.

Firefighting and emergency medical services would not be adversely affected by any of the proposed building and outdoor shelter renovations, expansions, or additions. It is possible that placing outdoor shelters in areas where it is difficult to maintain police surveillance could encourage vandalism or use by transients. Conversely, by bringing additional activity to these areas of the park, natural surveillance by park users and staff could reduce the likelihood of some crimes in these areas. Otherwise, structures are not likely to have an adverse effect on law enforcement. Delays in responding to emergency calls may occur if streets are blocked or circulation is rerouted. The proposed additional staff and capacity for an increase in visitors at the Washington Park Arboretum may increase the number of calls to both the fire and police departments.

Existing electrical service is adequate to supply the amount of power necessary for the additional buildings and program services described in the proposed plan. Electrical service drops may

require upgrades for wire or transformer size, and installation of some additional service lines would be required (Futtrup 2000 personal communication).

Existing natural gas service has the capacity to supply the amount of gas necessary for heat and hot water generation for the additional buildings described in the proposed plan. Recent upgrades to the system would facilitate any reconfiguration or mechanical upgrades needed for additional safety features, service lines, or regulators (Jainga 2000 personal communication).

With additional service lines and some mechanical upgrades, the existing water and sewer utilities have adequate capacity to accommodate development of the components of the proposed plan (Kanyer 2000 personal communication).

The Seattle Parks and Recreation Department manages a 7-cubic-yard waste container at the maintenance building and 64 trash receptacles throughout the park. This capacity is adequate for current needs. The University of Washington manages the 3-cubic-yard waste container located at the Graham Visitors Center. This size has also proven adequate with weekly service. The proposed plan would increase the amount of solid waste generated within the support buildings and throughout the park to a level that could be accommodated by the current service with additional receptacles of appropriate sizes. Additional solid waste and recycling waste from the maintenance area would continue to be collected by the University of Washington. Composting operations would have to be relocated to accommodate the realignment of Arboretum Drive.

Telephone and cable services would be connected to the existing lines near the Graham Visitors Center or brought from adjacent neighborhoods for proposed improvements at the south end of the park.

Some park personnel would have office headquarters offsite. These personnel would require additional time to travel to and from activities in the park. Overall, staffing levels would increase, so the presence of personnel in the park would be unlikely to decline.

Landscape Features

Public perceptions regarding safety could be affected by landscape modifications included in the proposed plan if poorly lighted or secluded areas conducive to criminal activity were to be created.

The existing water supply service has adequate capacity to supply the proposed landscape elements. Landscape and planting alterations may affect the volumes and patterns of stormwater flow in the park.

A new site/plant-specific irrigation system would substantially reduce total water demand for irrigation in the park.

Safety Features

As intended, the proposed plan would beneficially affect current safety and security conditions in the Washington Park Arboretum. Improved lighting and the addition of emergency telephones would require electricity and telephone service, which could be accommodated through existing and upgraded service connections.

Distributing program activities and facilities more evenly throughout the park and improving signage along trails would provide benefits to public safety. Greater dispersal of activities and facilities throughout the park may reduce the amount of unsupervised area open to illegal uses. Reducing or eliminating parking in isolated areas would also help to reduce the amount of property exposed to theft and vandalism in unsupervised space. These changes would improve security for the arboretum plant collections. On the other hand, the proposed distribution of activities and expansion of facilities may increase demands on park personnel to manage safety and security in areas scattered across the park and used by greater numbers of patrons.

Alternatives to Proposed Plan Elements

Roadways, Pedestrian and Bicycle Circulation, and Parking Facilities

Impacts on public services and utilities resulting from construction and operation of alternatives to the proposed plan elements would be very similar to those described above for the proposed plan.

Compared to a dual-use trail, separate bicycle and pedestrian trails parallel to Lake Washington Boulevard East would decrease the risk of accidents involving conflicts between cyclists and foot traffic.

Compared to the proposed plan, additional law enforcement supervision or park security efforts could be required if the existing scattered small parking lots are retained.

Buildings and Outdoor Shelters

As in the proposed plan, temporary disruptions to educational activities may occur during building construction, but these impacts are not expected to be significant.

Compared to the proposed plan, the alternative plan elements involving building renovations without expansion generally would have lower impacts on public services and utilities. Two possible exceptions are related to stormwater runoff and law enforcement. Expanding the existing parking lot west of Lake Washington Boulevard East would increase the impervious surface area and hence the amount of stormwater drainage to the existing sewer system. Moving arboretum operations offsite would entail decreasing the presence of park personnel, in turn possibly increasing the need for local law enforcement services during park operating hours.

In addition, placing more of the full-time staff of 72 at an offsite location (such as the Museum of History and Industry) could result in administrative and operational inefficiencies, possibly

leading to increased costs. The extent or significance of this impact would depend on the location of remotely located personnel and the ease of communication, interaction, and mobility among the staff. In any case, overall service levels in the park are expected to increase.

Construction and operational impacts related to the outdoor shelters would be nearly identical to those described above for the proposed plan.

Limited Lighting and Telephone Improvements for Safety

Limited lighting and telephone service improvements would provide fewer security and safety benefits than the improvements described above for the proposed plan. Installing call boxes at a few selected sites and adding security lighting only in evening high-use areas would not address public safety deficiencies on the trail system, in parking areas, and along pedestrian routes into the park from transit stops. Moreover, these limited improvements would not address security requirements for the arboretum plant collections.

No Action

No significant impacts on utilities would result from the no-action alternative. Minor changes in the amount of stormwater flow could result from modifications to parking facilities.

Security of the plant collections and public safety concerns would not be addressed by the no-action alternative. The 1978 master plan does not include significant improvements to the existing trail system and does not address traffic hazards, vandalism and theft of arboretum property, or personal safety while using the park at night.

Mitigation Measures

Proposed Plan

Law enforcement, firefighting, and emergency medical services could be given advance notice of construction activities to minimize potential impacts on service or response time. Emergency management plans for both the police and fire departments should be coordinated with the Parks Department and the University of Washington for reliable emergency access.

The principles of crime prevention through environmental design can be incorporated into the design of new and renovated facilities to improve safety and security within the park. These principles are based on natural surveillance, maximization of visibility, natural access control, and defensible space, and measures employed would have to be evaluated against other purposes of the Washington Park Arboretum.

Utility relocation agreements can be established with the involved agencies to specify procedures to be followed during construction within the park. These agreements would coordinate utility relocation, replacement, temporary connections, protection, and monitoring plans during final

design development and construction. All utility locations would be checked with existing utility plans and also field-verified before construction to minimize any impacts on existing utilities.

To minimize the potential for damage to exposed utilities during construction, provisions should be included in the construction plans to use engineering controls such as shoring and conduit support systems. During construction, construction debris and waste materials can be recycled to the extent possible to reduce environmental impacts. A construction-phase drainage plan and a temporary parking plan may help to reduce impacts on adjacent neighborhoods during construction.

Alternatives to Proposed Plan Elements

For the alternative elements, mitigation measures would be the same as those described above for the proposed plan, with the possible addition of increased law enforcement services due to the reduced level of public safety and park security measures included in the alternative elements.

No Action

In the absence of safety and security improvements, the need for police protection services and arboretum staff presence on the grounds would be expected to continue under the no-action alternative.

Significant Unavoidable Adverse Impacts

With implementation of the proposed mitigation measures, no significant unavoidable adverse impacts on public services or utilities would be expected under the proposed plan or alternatives.