This chapter describes the past development and present conditions of the SR 520 Bridge Replacement and HOV Project area. The project extends along the SR 520 corridor from I-5 in Seattle to 124th Avenue Northeast on the Eastside.

Chapter 2: The Project Area: Then and Now

The SR 520 Bridge Replacement and HOV Project area encompasses one of the most diverse, important, and complex human and natural landscapes in the Puget Sound region. It includes areas in Seattle from I-5 to the Lake Washington shore, the waters of Lake Washington, and Eastside communities and neighborhoods from the shoreline of the lake to 124th Avenue Northeast, just east of I-405. It also includes densely developed urban and suburban areas and some of the most important natural areas and sensitive ecosystems that remain in the urban growth area. The project area includes:

- Seattle neighborhoods—Roanoke/Portage Bay, North Capitol Hill, Montlake, University District, Laurelhurst, and Madison Park
- The Lake Washington ecosystem and the bays, streams, and wetlands that are associated with it
- Eastside communities and neighborhoods—Medina, Hunts Point, Clyde Hill, Yarrow Point, Kirkland (the Lakeview neighborhood), and Bellevue (the North Bellevue, Bridle Trails, and Bel-Red/Northup neighborhoods)
- The usual and accustomed fishing areas of tribal nations—the Muckleshoot and Yakama—which historically used the area's fisheries resources and have treaty rights for their protection and use

This chapter describes how the project area developed over time and what it is like today, setting the stage for the descriptions of the project's effects in the following chapters. The discussion is generally divided into three geographic areas: Seattle, Lake Washington, and the Eastside. These are the areas into which this Draft EIS divides the detailed discussions of project effects in Chapters 5, 6, and 7.

What factors have affected the development of the project area?

A wide array of forces, both physical and human, have shaped the present form of the project area. Today, the area represents the culmination of these forces, which have affected both its physical environment and its human environment. This section describes the past and present of the project area—from the geologic forces that created the landscape, to the flora and fauna that inhabit it, to the people who have used and developed the land and water and the ways in which they have changed it.

The Physical Environment of the Lake Washington Basin

The complex landscape of the Puget Sound region, with its long north-south ridges and valleys, is the product of several powerful forces. One is the force of nature over the scale of geologic time, particularly the action of plate tectonics—the sliding and colliding of sections of the earth's crust that result in mountain-building, volcanic activity, and earthquakes. A second force, more recent on the geologic clock, is the sculpting action of the glaciers that covered the region as recently as 10,000 years ago, carving lakes and landforms and depositing soil and sediment as they scoured the land. And within the last 100 years, major civil works like the Lake Washington Ship Canal dramatically altered this natural landscape as non-native settlers of Seattle reshaped the land and the waterways. This section describes how these forces have defined the physical environment of the project area today.

How does seismic (earthquake) activity affect the project area?

Western Washington lies along the "ring of fire," the zone of earthquakes and volcanoes that encircles the Pacific Ocean. Off the Pacific coast, two tectonic plates are slowly colliding, with the Juan de Fuca plate pushing its way beneath the North American plate *(Exhibit 2-1)*. Although the speed at which the plates move is slow, the forces that drive and are produced by their motion are enormous. The collision of the plates causes stresses to build up in the earth's crust over long periods of time. When this stress is released, an earthquake occurs.

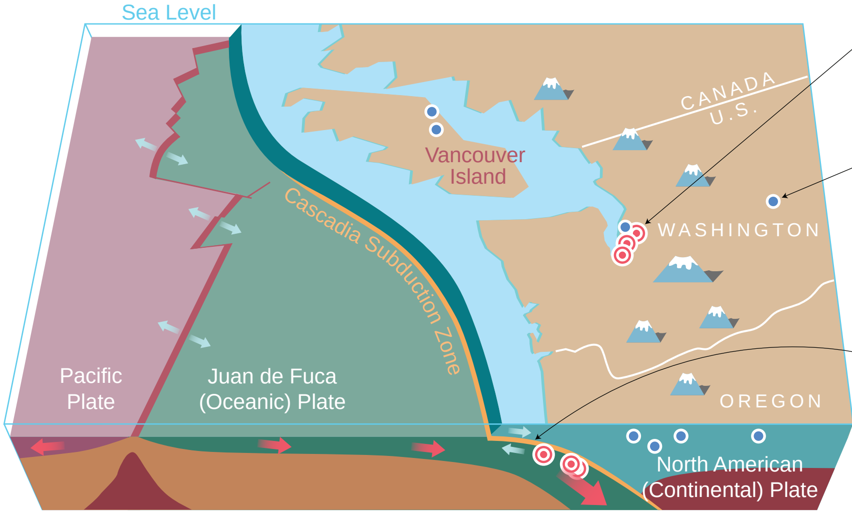
Most earthquake tremors in the Puget Sound region are small and cause little damage. They can, however, be powerful and destructive. Every 300 to 600 years or so, an extremely powerful earthquake—up to magnitude 9 or higher on the Richter scale—arises from far below the sea at the boundary of the North American and Juan de Fuca plates *(Exhibit 2-1)*. The most recent extremely powerful earthquake in 1700 sent a tsunami as far as Japan. Evidence of these "subduction" earthquakes in our area includes buried marshes or forests created by sudden sinking of the ground, traces of ancient landslides, and layers of sand that appear to have been deposited by tsunamis. A more common but less severe type of earthquake is

DEFINITION

Richter Scale

Earthquakes are often measured by their Richter magnitudes, which are based on a logarithmic scale. What this means is that for each whole number you go up on the Richter scale, the amplitude of the ground motion recorded by a seismograph goes up ten times. Using this scale, a magnitude 5 earthquake would result in ten times the level of ground shaking as a magnitude 4 earthquake (and 32 times as much energy would be released). To give you an idea how these numbers can add up, think of it in terms of the energy released by explosives: a magnitude 1 seismic wave releases as much energy as blowing up 6 ounces of TNT. A magnitude 8 earthquake releases as much energy as detonating 6 million tons of TNT. Fortunately, most of the earthquakes that occur each year are magnitude 2.5 or less, too small to be felt by most people.

Exhibit 2-1. **Major Historic Earthquakes in the Puget Sound Region and their Sources**



SOURCE: Adapted from Troost (2003). See Appendix H, Geology and Soils Discipline Report.

Deep earthquakes (30 miles below the earth's surface) occurred in 1949 (magnitude 7.1), 1965 (magnitude 6.5), and 2001 (magnitude 6.8).

Shallow earthquakes (less than 15 miles deep) have occurred along the Seattle Fault, which produced a magnitude 7+ earthquake 1,100 years ago. Other magnitude 7+ earthquakes occurred in 1872, 1918, and 1946.

Subduction earthquakes are caused by movement of the earth's plates, as one plate is forced below another. Subduction quakes are huge, up to magnitude 9. They typically occur every 300 to 500 years. The most recent subduction quake in 1700 sent a tsunami as far as Japan.

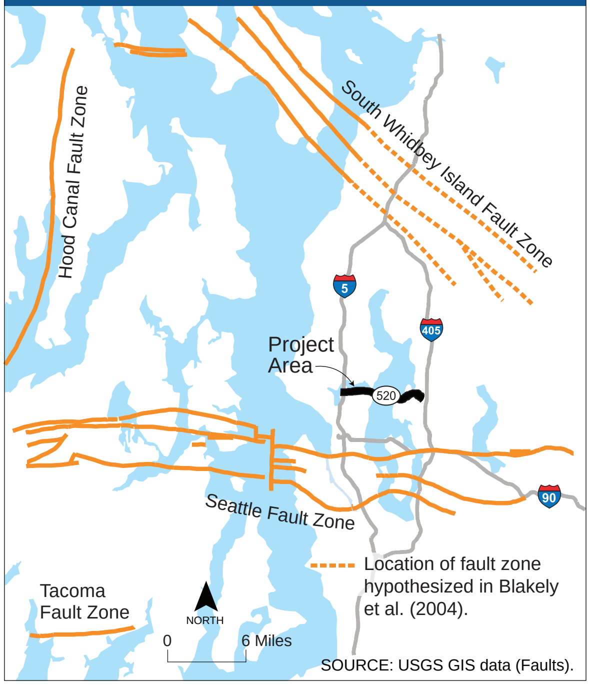
exemplified by the 2001 Nisqually earthquake, as well as the 1965 Sea-Tac earthquake and the 1949 Olympia earthquake (magnitudes 6.8, 6.5, and 7.1, respectively). These quakes originated 30 miles or more below the earth's surface. Shallow faults, such as the Seattle and South Whidbey Faults (shown on *Exhibit 2-2*), can be associated with large and destructive earthquakes, but such earthquakes happen rarely.

How have glaciers shaped the project area?

The Pleistocene period of geologic time, which lasted from about 2 million years ago to about 10,000 years ago, is the source of many of the project area's present-day landforms. Over the course of the Pleistocene, glacial ice advanced and retreated across much of the North American continent many times during successive ice ages. The most recent ice age in the Puget Sound region occurred between roughly 10,000 and 20,000 years ago. During that time, ice covered the project area to a depth of about 3,000 feet, its weight exerting intense pressure on the soil and rock below. The southward movement of the glaciers gouged deep troughs in the landscape. Later, as the ice melted and retreated north, streams and lakes—including Lake Washington—formed in the troughs left behind by the glaciers.

The soils in the project area still bear the stamp of those long-ago glaciers. The most prevalent soil type near the ground surface throughout the area is till. Till is a compact mixture of silt, clay, sand, gravel, and cobbles that the weight of glacial ice compressed to form a nearly impenetra-

Exhibit 2-2. **Earthquake Faults in the Puget Sound Area**

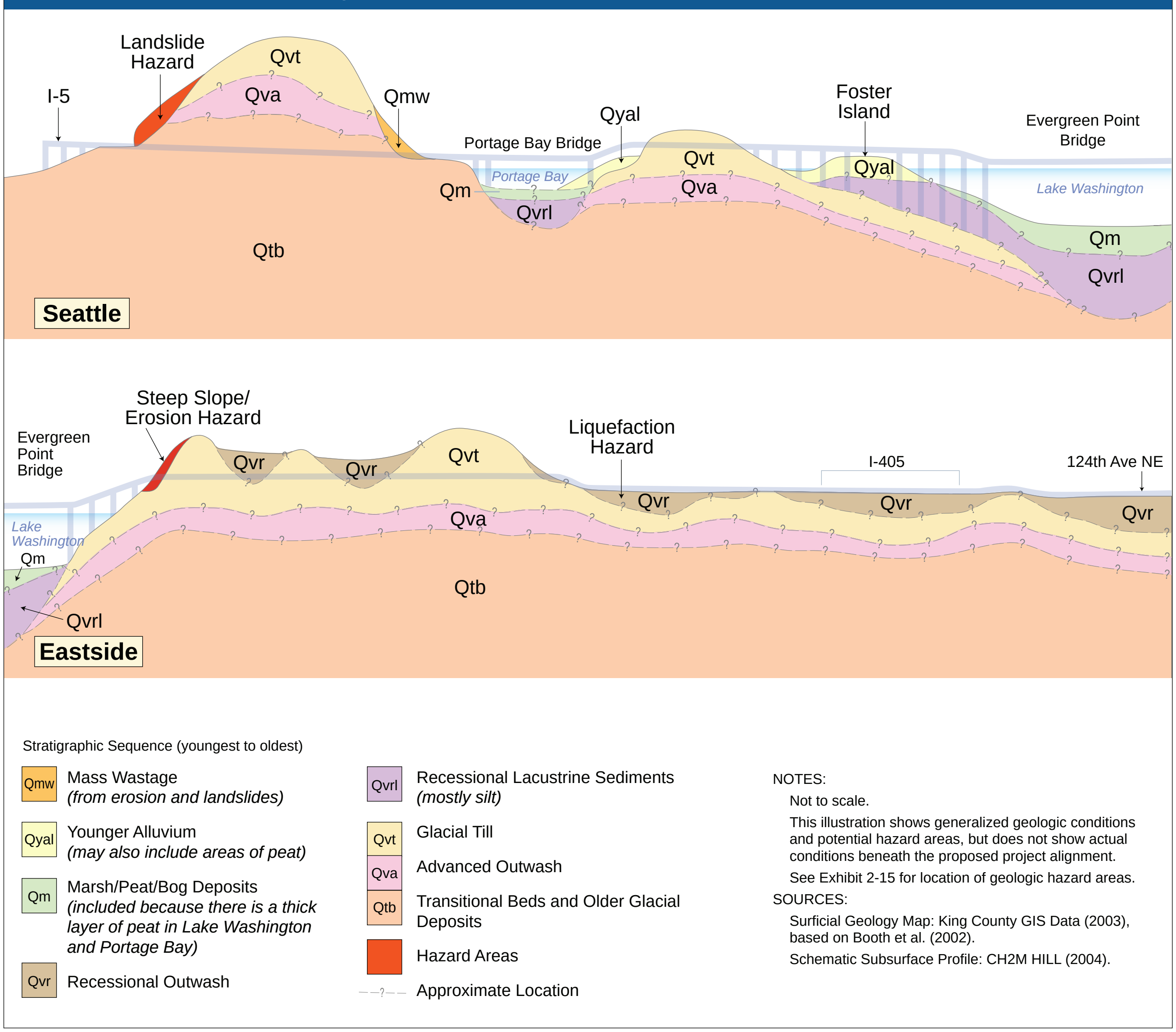


SOURCE: USGS GIS data (Faults).

ble layer. Another common soil type is outwash soils, formed by the material carried along and then left behind by a glacier during its advances and retreats. Depending on when the glacier deposited them, these soils can vary from fairly dense and hard to loose and very permeable. *Exhibit 2-3* shows a cross-section of the soil types through the SR 520 corridor and also provides a sense of the project area's complex ridges and valleys.

The beds of Lake Washington and Portage Bay contain a deep layer of fine, compressible sediments that were deposited during the last retreat of the glaciers. These soft, wet sediments are buried up to 150 feet below the bottom of Lake Washington—about 310 feet below sea level. Over the top of this layer lie more recent lakebed deposits of soft peat, silt, and clay; the peat in Portage Bay, Union Bay, and Lake Washington is up to 45 feet thick.

Exhibit 2-3. **Cross Section of Project Area Soils**



What was the project area like after the glaciers retreated?

The movement of the glaciers during the ice ages gouged deep basins into the landscape of the Puget Sound region. Their legacy is the hilly terrain dotted by lakes, and the valleys between glacial ridges. At 20 miles long, up to 4 miles wide, and some 200 feet deep, Lake Washington is by far the largest of the surviving lakes created in the region during the ice ages. Flanked by Lake Union on the west, Lake Sammamish on the east, and rivers and streams on all sides, it is a key feature of an ecosystem that provided habitat for a rich variety of animals, birds, and fish.

The regional ecosystem encompassed a wide array of habitats. Thick forests of fir and hemlock grew in upland areas along the ridges; in some of the flatter areas, native prairie grasslands flourished, including one known to have existed near Lake Union. Wetlands formed around the lake and along the shores of its tributary streams. Near the mouths of creeks and rivers, water pooled and saturated the surrounding soil, fostering plant species adapted to wet conditions. These wetland plant communities provided excellent habitat for many bird and animal species, as well as places for rainfall runoff to collect. Vegetation along the lakeshore and stream beds shaded and protected abundant runs of salmon as they traveled from fresh to salt water and back again.

Although many of the forms and features of this pre-settlement landscape would be familiar to us today, several things have changed—most notably the elevation and flow of Lake Washington. The lake originally flowed toward the south into the now-dry Black River, and then into Puget Sound. The lake's level was about 9 feet higher than today, and it covered a larger area. Despite its proximity to Lake Union, the only water connection between the two lakes was a small creek that flowed from Lake Washington into Portage Bay, which was lower than it is now. The dramatic difference between the Lake Washington ecosystem of 100 years ago and the one we know today is the result of an ambitious public works project that reconfigured a whole series of natural water bodies to support the commercial aspirations of a growing city.

How have humans shaped the physical environment of the project area?

Landscape-altering civil works within the last century have drastically changed the project area's natural landscape and created many of the key features of the physical environment that SR 520 crosses. In particular, the work of the U. S. Army Corps of Engineers (Corps), who reconfigured the hydrology of Lake Washington by constructing the Ballard Locks and other features of the Lake Washington Ship Canal, transformed Lake Washington's physical hydrology and its natural ecosystems. These changes—part of Seattle's twentieth century growth—created the conditions for the development of commerce and communities along the lake's redefined shoreline.

The project area's landscape began to change dramatically, however, soon after the arrival of Euro-American settlers in 1851. Area residents sought a convenient way to move people and goods between Seattle and the new communities on the east side of the lake. The large size of the lake posed a particular challenge: coal from Eastside mines had to be transferred up to 11 times before reaching Seattle, and timber was hauled by wagons over rough, muddy roads to the coastal mills. Ferries began carrying passengers across the lake in 1900, but the scale of the landscape made commercial transport difficult.

In the 1850s, Seattle pioneer Thomas Mercer suggested that a navigation route between Lake Washington and Puget Sound would be a benefit to regional development. The idea advanced in fits and starts over the next 50 years, as various interests debated the route's location, its costs, and whether it should be carried out by the public or private sector. In 1906, Hiram M. Chittenden, commander of the Seattle District of the Corps, championed the project, and in 1911, construction began on the Lake Washington Ship Canal and Ballard Locks (later renamed the Hiram M. Chittenden Locks). This project completely changed the natural movement of water within the Lake Washington watershed, creating the conditions that we know today.

The project began with the excavation of the Ship Canal, which followed the route of a creek between Lake Union and Puget Sound, and the Montlake Cut, which took the place of a small sluiceway that had originally been dug to move logs between Lake Washington and Lake Union. Widening and deepening these waterways entailed the replacement of existing fixed bridges with four new drawbridges: Fremont, Ballard, University, and Montlake. The Ballard Locks allowed ships to negotiate the difference in elevation between Puget Sound and the inland lakes. In 1916, workers breached a temporary dam at Portage Bay, allowing water to spill from Lake Washington into the Montlake Cut; in 1917, the Ship Canal was officially opened by a ceremonial flotilla led by the flagship

How did salmon find their way back to Lake Washington after the Ship Canal was built?

Anadromous (seagoing) salmon and steelhead hatch and spend part of their young lives in rivers and streams before migrating to the sea. Near the end of their life cycle, salmon return to spawn in the streams where they were hatched years before. Because rivers and creeks often change course over time, the salmon find their way home by following the unique scent of the stream in which they were born and raised, rather than by following a specific geographic path. This allowed salmon to return to Lake Washington even after its natural outlet to Puget Sound was replaced by the connection through Portage Bay and Lake Union. In spite of the massive alteration of the lake's hydrology and ecosystems, the adult salmon were able to find the scent of Lake Washington and its tributaries at the entrance to Shilshole Bay.

Although the salmon knew where to go, their path from salt to fresh water became much more arduous after the Ship Canal was built. The artificial channel they swim through has steep sides, little overhanging vegetation, and no cover. This raises the water temperature to dangerous levels and makes the salmon more vulnerable to predators. Instead of a gradual uphill journey through natural waterways, they must leap through a series of weirs at the Ballard Locks fish ladder. These conditions add to the stress of the salmon's long migration and diminish their numbers. For example, in 2004, about half of the returning sockeye run—some 200,000 fish—did not survive the trip between the Ballard Locks and their upstream spawning grounds. The hazards of migration through the Ship Canal are a key factor in the precipitous decline of salmon populations in the Lake Washington watershed.

Roosevelt. The Ship Canal and the locks now form a historic district that is listed on the National Register of Historic Places.

Because Lake Washington was higher than Lake Union, its water level dropped by approximately 9 feet when the two water bodies were connected. As a result, Lake Washington stopped flowing into the Black River, its historic outlet. The river dried quickly, stranding countless salmon and other fish in the remaining pools of water. The exposure of formerly submerged areas around the lakeshore created new shoreline property, but destroyed hundreds of acres of highly productive wetlands. With the lake now draining west rather than south, salmon migration routes were forced to shift from the natural river systems to a human-made canal connection to Puget Sound. Other habitat characteristics also changed: the shallow waters of Lake Washington were lost and seasonal flooding stopped; shoreline trees and vegetation no longer provided shade, refuge, or woody debris to enhance fish habitat; water quality declined; and the number of species using the lake diminished. Habitat for salmon spawning, rearing, and foraging decreased substantially, creating survival challenges that are still encountered today.

A US Geological Survey map from 1900 showing the Seattle project area before the Montlake Cut was constructed and Lake Washington was lowered

A 1916 photo showing the water level adjustment between Lake Washington and Lake Union during the creation of the Montlake Cut

The Project Area's Human Environment

Like the project area's physical environment, its human environment has become what it is today through a complex sequence of historical events. Before Euro-American settlement, Native Americans had inhabited the project area for thousands of years, developing prosperous cultures that were intimately tied to the land and the water. With the arrival of explorers and settlers, these cultures were weakened by imported diseases and native people were physically displaced from their land and their ways of life. The settlers, in their newly claimed territory, developed many of the project area's neighborhoods and institutions in the first half of the twentieth century. After World War II, a regional economic boom fueled economic prosperity and growth and transformed the project area's human geography. This section briefly describes the history of the area's habitation and development.

First People

Long before the first European explorers sailed into the Puget Sound area through the Strait of Juan de Fuca, native peoples called the lands and waters of the Lake Washington basin their home. They lived on the area's abundant natural resources, and traveled by canoe through the extensive lake and river systems. The inland waters of the project area were home to both permanent villages and seasonal encampments. The places where Native Americans made use of the project area are places where the project may uncover physical evidence of their habitation.

The Duwamish people were the Native Americans most closely associated with the Seattle portion of the project area. They lived in an interdependent network of villages located on major bodies of water, including Elliott Bay; the Duwamish, Black, Cedar, and lower White rivers; and lakes Union, Washington, and Sammamish. The Duwamish relied on salmon as their primary food source, and supplemented their diets with shellfish, plants, and land game, all plentiful in the area.

The Duwamish people settled in places that allowed them to be close to the large salmon runs that entered the Duwamish River and to the shellfish on the Elliott Bay tide flats. The winter village sites were permanent homes for each local group. The winter villages in the Duwamish valley, at the river's mouth, and on Elliott Bay had dense concentrations of houses, while villages on Lake Washington, Lake Sammamish, and Salmon Bay are thought to have had fewer, more scattered houses. In the warmer months, smaller groups moved to seasonal camps where they sought and processed other types of food, such as berries, roots, and freshwater fish. Individuals built sweat lodges along the shore of Lake Union, where they used the cold, fresh water of the lake for ritual bathing during spirit quests.

The Duwamish people lived on major bodies of water.

Although the Seattle project area was not home to large settlements of Duwamish people, a number of places in the area were important to them. They used the narrow isthmus between Lake Union and Lake Washington as a portage between the two lakes. A small creek flowed along the isthmus from Lake Washington to form a swamp at the east end of Portage Bay; a Duwamish village was located east of the mouth of this creek. Records suggest that another Duwamish settlement was once located near the present-day University of Washington steam plant.

Foster Island in Union Bay, now part of the Washington Park Arboretum, at one time was used as a resting place for the dead. The Duwamish placed their dead in canoes or boxes that were hoisted into the island's trees. Native people, working with anthropologists in the early twentieth cen-

Duwamish Indian Place Names

Sxwacugwhit (portage or narrow passage): The narrow isthmus between Lake Union and Lake Washington before the Montlake Cut was constructed.

Sta'Lal (fathom, stretch of the arms): A Duwamish village located near the east side of Portage Bay.

B^1 *skwi'Kwi*^{3}*/* (skate fish): A point of land north of the present-day location of East McGilvra Street that turned up at the tip like the nose of a skate.

Sti't^2*tci* (a small island): Foster Island.

Sli^u*Li'Uqs* (three promontories with narrow inlets between them): Hunts Point, Fairweather Point, and Yarrow Point.

Tahb-tah-byook: A group of houses at the mouth of Juanita Creek and at Yarrow Bay.

Tc^3*u:* Yarrow Creek.

Txwa'bats (pulling toward something): The swamp at the head of Yarrow Creek.

tury, recalled when the trees were full of boxes with skeletons in them. The lashings of these boxes gave way from time to time, and the ground was covered with bones that had fallen from the trees. Historians have reported that these bones were removed when the Arboretum was developed, and no traces of the island's former use are now plainly visible to present-day walkers and birdwatchers. However, it is possible that native people in earlier times may have buried their dead in the island's marshy ground.

The Eastside project area lies within the traditional territory of the Sammamish people. The Sammamish were a Puget Sound Salish group who lived along the Sammamish River, which links Lake Washington and Lake Sammamish. Until the eighteenth century, this group—known as the *Hah-tshu-absh*, or Lake People—had at least seven winter villages on the Eastside.

Native speakers had names for the promontories of Hunts Point, Fairweather Point, and Yarrow Point. A group of houses was located at the mouth of Juanita Creek and at Yarrow Bay. According to early white residents, who recalled seeing grave sites and finding beads and bones, Yarrow Point served as a burial ground for the Sammamish people.

How did Euro-American settlement affect Native Americans in the project area?

Euro-American settlers first arrived in the Seattle area in 1851, landing at Alki Point and then staking land claims on Elliott Bay in the spring of the following year. The initial relationship between the settlers and the Native Americans was cordial, and the help of the Duwamish people was essential to the newcomers' survival during their first few years. Pioneer David Denny later remarked, "I don't know what we would have done during the first two winters had it not been for the Indians."[1] The Duwamish provided food, local information, and protection to the settlers, as well as labor for activities like packing and canoe transportation. They traded salmon and shellfish for potatoes, fabric, beads, blankets, and other goods that cargo ships brought to the small settlement on Elliott Bay.

As Seattle grew, the resources that had supported the Native Americans' livelihood diminished. Filling of tidelands and platting of streets depleted many of the plant and animal species that had sustained their way of life; private ownership of property limited their access to traditional hunting, fishing, and gathering areas. Contact with the settlers disrupted Duwamish economic and social systems; as their resource base dwindled, many left the Seattle area. In 1855, the Duwamish, along with other tribes in the

What are the Treaty Rights of Native Americans in the Project Area?

In 1854 and 1855, many Indian tribes in the Pacific Northwest entered into treaties with the United States, wherein they reserved the right to fish in areas outside their reservation boundaries in "usual and accustomed" fishing and hunting grounds. In recent decades, the federal courts have affirmed these treaty fishing rights. The project area falls in the "usual and accustomed" areas of the Muckleshoot Tribe and Yakama Nation.

[1]Denny, I.E. 1909. Blazing the Way: True Stories, Songs and Sketches of Puget Sound and other Pioneers. Rainier Printing Company, Seattle, WA.

area, signed the Point Elliott Treaty, which ceded most of their traditional lands to the settlers and assigned the Native Americans to reservations. In the mid-1850s, conflict erupted between the settlers and western Washington tribes in what came to be known as the Indian Wars.

During the millennia before their displacement by the Euro-Americans, Native American tribes living around Puget Sound were among the most prosperous on the continent. At the base of their prosperity was the salmon: season after season, the rivers and streams were filled with spawning fish. The tribes traded surplus quantities of smoked salmon and other commodities in a network of commerce that spanned the entire Pacific Northwest, extending across the Cascade Mountains and far into the dry country beyond. But the effects of population decrease from disease, the competition with settlers for resources, and their ultimate displacement onto the reservations changed everything for the tribes. Although the Point Elliott Treaty explicitly guaranteed tribal members the right to harvest salmon at all of their "usual and accustomed" fishing areas, they were prohibited from both commercial and subsistence fishing off reservation lands.

How did the Seattle project area develop?

Soon after they arrived, the original settlers of the Denny party began exporting logs from Elliott Bay, quickly establishing Seattle as a lumbering center and a seaport. The city's fledgling economy was based on industries that processed and exported lumber and other natural resources. It flourished in the 1870s with the arrival of the transcontinental railroad and in the late 1890s when Seattle became the point of departure for the Klondike Gold Rush. As Seattle grew, a series of infrastructure improvements commenced: engineers and developers regraded hills, filled wetlands and tidal areas, established electric streetcar systems and other transportation systems, and constructed water lines, sewerlines, and drainage. Rapid economic development in the latter part of the 1800s attracted an influx of merchants and laborers of many ethnic backgrounds. These new settlers established communities in the project area that still retain many of their original distinctive characteristics.

As Seattle grew, citizens began seeking ways to preserve and enhance the area's natural beauty. One of the early results of these efforts was the Washington Park Arboretum. Created as a park in 1902, the Arboretum as we now know it began to take shape in 1907 when the University of Washington decided to expand its own arboretum in preparation for the Alaska-Yukon-Pacific Exposition. With the assistance of local garden clubs, the university raised enough money for preparation of a master plan by the Olmsted Brothers landscape firm. The Olmsted Brothers were well-known landscape architects who also planned Volunteer Park, a number of other Seattle parks, and many of the city's boulevards. In 1917, Foster Island became part of the Arboretum. The original Olmsted plans called

The Olmsted Plan

In 1903, the Seattle City Council contracted with the Olmsted Brothers to prepare a comprehensive plan that would guide the future development of a Seattle park system. The brothers had inherited the nation's first landscape architecture firm from their father, Frederick Law Olmsted, the designer of New York's Central Park.

John C. Olmsted spent several weeks in the summer of 1903 studying the topography of Seattle and its parks. The centerpiece of his plan was a 20-mile landscaped boulevard linking most of the existing and planned parks and greenbelts within the city limits. Roanoke Park, Interlaken Park, Volunteer Park, Lake Washington Boulevard, Washington Park Boulevard, and Montlake Boulevard are all part of this Olmsted system.

Washington Park, one of Seattle's first parks, was included in the overall Olmsted plan. The Seattle Garden Club donated $3,000 in 1936 to design the first planting plan for the Washington Park Arboretum. During the Great Depression, 500 men in the Public Works Administration constructed many of the Arboretum's historical features, such as the Stone Cottage and Azalea Way.

A 1955 photo of the Washington Park Arboretum

The National Register of Historic Places

The National Register of Historic Places (NRHP) is the official list of cultural resources worthy of preservation. Authorized under the National Historic Preservation Act of 1966, the National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect our historic and archaeological resources. Properties listed in the National Register include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archaeology, engineering, and culture.

National Register properties are distinguished by having been documented and evaluated according to uniform standards. These criteria recognize the accomplishments of all peoples who have contributed to the history and heritage of the United States and are designed to help state and local governments, federal agencies, and others identify important historic and archaeological properties worthy of preservation and consideration in planning and development decisions. The State Historic Preservation Office (SHPO) is responsible for determining whether properties are eligible for nomination to the NRHP. WSDOT will submit documentation to the SHPO regarding a number of project area properties that WSDOT believes are NRHP-eligible. If SHPO concurs that the properties are eligible, a number of them will be protected by federal regulations. Please see Chapter 4 and Appendix D, Cultural Resources Discipline Report, for additional information.

for a lagoon with Asian vegetation in this area, but despite extensive dredging and planting, this plan never succeeded.

As the Arboretum took shape, so did nearby neighborhoods. First platted in 1909, the Montlake neighborhood saw its peak of construction in the 1920s. Early developers filled the area south of the Montlake Cut with homes in the Craftsman, Tudor Revival, Colonial Revival, and California Mediterranean styles. The neighborhood's cohesiveness and integrity make it potentially eligible for the National Register of Historic Places (NRHP) as a historic district. In addition to outstanding residential architecture, noteworthy buildings and structures (some of which are outside the proposed district boundaries) include the Montlake Bridge; the Museum of History and Industry (MOHAI); the Seattle Yacht Club; the National Oceanic and Atmospheric Administration (NOAA) Northwest Fisheries Science Center; and structures such as gateways, pavilions, the Arboretum Aqueduct, and other bridges in the Washington Park Arboretum. *Exhibit 2-4* shows the proposed boundaries of the Montlake Historic District.

West of Portage Bay lies another early Seattle park surrounded by a historic neighborhood. The city of Seattle acquired the land for Roanoke Park in 1908 and developed it in 1910. Named after Roanoke, Virginia, the park was originally intended for use by hikers and bicyclists headed down the popular path to the Washington Park Arboretum and Lake Washington. The surrounding neighborhood was platted in 1890, but did not see much development until the park was created. Between 1908 and 1912, growth exploded with the construction of some 60 homes in a variety of styles, including Craftsman, Mission, Classic Box, Swiss Chalet, and various revival styles. Because of their distinctive character, their association with several notable architects, and their excellent preservation, these homes also form a historic district *(Exhibit 2-5)* that is potentially eligible for listing on the NRHP.

The NOAA Northwest Fisheries Science Center

Museum of History of Industry

Exhibit 2-4. **Historic Resources in the Montlake Area**

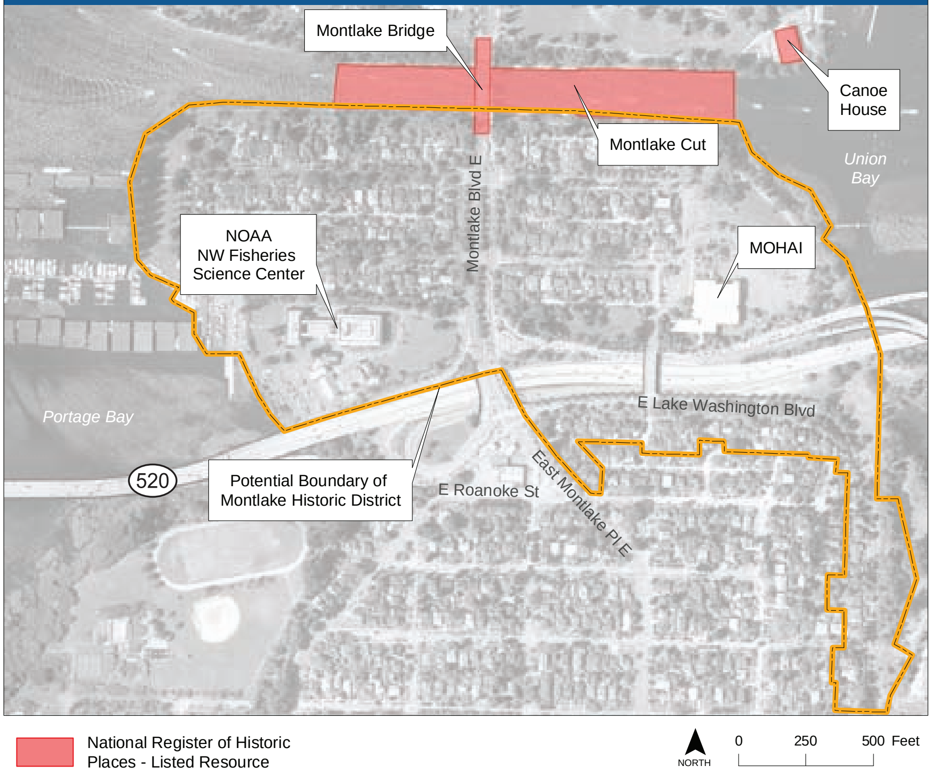


Exhibit 2-5. **Historic Resources in the Roanoke Park Area**

How did the Eastside project area develop?

On the Eastside, homesteaders began to settle in Bellevue, the Points communities, and Kirkland in the 1890s. For most of the first half of the 1900s, the Eastside remained rural. Many Eastside families were farmers, with strawberries a popular crop; the small cities, whose combined population was less than 5,000 until the 1940s, were primarily agricultural centers. Some of the prosperous Eastsiders built houses on the waterfront property along the eastern shore of Lake Washington in Medina, which became known as the Gold Coast.

A 1920 home on Evergreen Point Road in Medina, sited at the foot of a bluff near the water, appears to be one of the oldest buildings in the Eastside project area. Although it may not be eligible for the NRHP because it has been altered over the years, this house is eligible for the Washington State Historic Register as a representative element of the older houses of the community. Several more recent structures in Medina, including two other houses on Evergreen Point Road and a school on Northeast 28th Street, are potentially eligible for NRHP listing (subject to SHPO confirmation) as a result of their distinctive architectural characteristics.

Bellevue's first-ever Strawberry Festival was in June 1925.

Crossing the Lake: Connecting Seattle and the Eastside

As Seattle grew into a sizable city and more and more people settled in the Eastside, entrepreneurs and engineers tried to find a better way to cross Lake Washington. Regular ferry service moved people back and forth across the lake, but it was slow and carried too few passengers to meet the growing demand. Automobile travel, which came into its own in the 1920s, was not sufficient to solve the problem. The route between Seattle and Bellevue around the south end of the lake was over 25 miles long, a long trip on narrow roads. The lake's width—a mile and a half at its narrowest point—posed a formidable challenge to bridge designers, as did the thick layer of mud and peat 100 to 200 feet below its surface.

Medina ferry dock along the shores of Lake Washington

Public Ferries on Lake Washington

The first public ferry to cross Lake Washington was a side-wheeler called King County of Kent that ran between downtown Kirkland and Madison Park at a fare of 10 cents each way. From 1900 to 1950, ferries remained a popular way of crossing the lake. However, when tolls were removed from the first Lake Washington floating bridge, demand for ferry service fell. The ferry Leschi made the last crossing between Madison Park and Kirkland on August 31, 1950.

When was the first bridge built across Lake Washington?

In 1920, a young engineer named Homer Hadley hit upon the idea that the lake could be crossed with a bridge made up of hollow concrete pontoons supporting a roadway deck. Although pontoons had been used since ancient times for bridging bodies of water too deep for traditional spans, most people still found such bridges unconventional. Christened "Hadley's Folly," the pontoon bridge idea languished until 1931, when the Seattle City Council held hearings on four proposed bridges to cross the lake. The ensuing debate continued for years, and it was not until 1937 that a plan began to fall into place. Homer Hadley met with Lacey V. Murrow, director of the State Highway Department, and convinced him that a concrete pontoon span between Mercer Island and Seattle's Mount Baker neighborhood was the most cost-effective solution. A board of consulting engineers ratified this idea and identified a tunnel through Mount Baker Ridge as the best approach to Seattle.

Despite this endorsement, controversy swirled around the proposal. Residents of the Mount Baker and Seward Park neighborhoods opposed the plan, as did the Lake Washington Protective Association, which characterized the pontoon bridge as “a municipal eyesore and a desecration of the city’s greatest natural asset.” The federal Public Works Administration threatened to withdraw the $3.8 million it had promised for the bridge unless the Seattle City Council endorsed the proposal by the end of 1938. Finally, the Council voted 5-4 in favor of the bridge, and on December 29, 1938—2 days before the federal deadline—the ground-breaking ceremonies took place. The Lake Washington Floating Bridge (later named the Lacey V. Murrow Floating Bridge) opened a year and a half later on July 2, 1940. Cars could now cross the lake in a mere 7 minutes. In its first 24 hours of operation, some 11,600 drivers drove over the bridge to savor the newfound ease of crossing the lake. Today, two newer pontoon bridges carry vehicles across Lake Washington on I-90. The northernmost of these spans is named the Homer M. Hadley Memorial Bridge after the engineer who originally envisioned the bridging of the lake.

How did bridging the lake change the project area?

The Lake Washington Floating Bridge dramatically cut the amount of time it took to cross the lake, making the Eastside communities more attractive residential choices for people working in Seattle. Fueled by the postwar economic boom, Seattle followed the trend of cities nationwide, spawning new growth in auto-oriented city neighborhoods and suburbs where citizens could live in settings that many perceived more desirable than older, denser neighborhoods. During the 20 years following the opening of the Lake Washington Floating Bridge, the Eastside became the fastest-growing part of the metropolitan area. The bridge proved so popular that its toll proceeds retired its bonds by 1949—a full 19 years ahead of schedule.

Planners believed that the 20,000-vehicle-per-day capacity of the original floating bridge would ensure that it met the region’s needs for many years to come. However, they failed to anticipate the explosive growth of traffic across the lake. Between 1950 and 1960, Seattle’s population increased by 26 percent, while the Eastside’s more than doubled from 11,000 to 24,000 *(Exhibit 2-6)*. Medina, Hunts Point, Clyde Hill, Yarrow Point, and Bellevue incorporated in the 1950s in response to the desire to control the pressures of development. Between 1940 and 1950, the traffic on the bridge rose from 3,500 vehicles a day to almost 18,000. By 1960, some 50,000 vehicles per day crossed the span—two and a half times the number it was designed to carry.

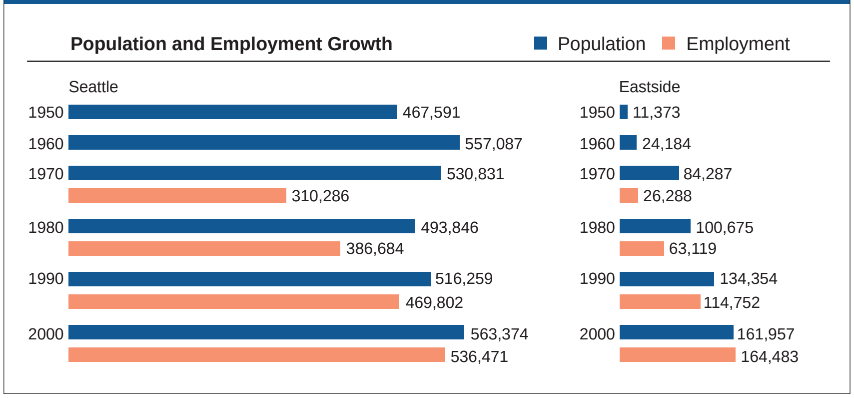
Lake Washington Bridge

In 1937, funds became available for building the first Lake Washington bridge, located where the I-90 bridge is today. About this time, the Washington Legislature created the State Toll Bridge Authority. When the Lake Washington bridge opened in 1940, it was the largest floating structure in the world, resting on 25 pontoons made of concrete (pictured above).

After its tolls were lifted in 1949, Bellevue residents, the Bellevue Chamber of Commerce, and State Highway officials (now WSDOT) started thinking about a second Lake Washington bridge to solidify the link between the east and west sides of the lake. But this idea, like the first floating bridge, was a controversial one. It took over a decade of studies, sometimes heated discussion, and three years of construction before the Evergreen Point Bridge (officially known as the Governor Albert D. Rosellini Bridge) first opened to traffic on August 28, 1963.

The Evergreen Point Bridge is considered eligible for the NRHP and the Washington State Historic Register because of its significant engineering design, and the role it has played in the development of the Eastside. The State Historic Preservation Officer must concur on this eligibility.

Exhibit 2-6. **Population and Employment Growth from 1950 to 2000**



Citizens began calling for a second bridge as early as 1946, but debate over its location delayed the project for a decade. It was not until 1957, after years of studies, that the State Toll Bridge Authority announced a plan to construct a new floating bridge between Evergreen Point and Montlake. The Evergreen Point Bridge opened in August 1963, and was immediately a success with commuters. Like its predecessor, the bridge tolls paid by ever-increasing numbers of drivers retired the bonds used to pay for it years ahead of schedule. By 1979, when the last toll was collected, four times as many vehicles were crossing the bridge each day as when it opened. Between 1980 and 1990, average daily traffic across the bridge grew from 70,000 vehicles to approximately 110,000, and the crossing became one of the state's worst traffic bottlenecks. The opening of the parallel I-90 span in 1989 provided additional traffic capacity across Lake Washington, but not enough to meet all of the growing traffic demand.

Construction of the Evergreen Point Bridge began in the early 1960s.

Much of the development in the Eastside project area in the last 40 years has been supported by SR 520 and the Evergreen Point Bridge. Between 1960 and 1970, the population of the Eastside more than tripled. A wave of office and other commercial construction in the 1980s gave Bellevue a new skyline; along SR 520, Microsoft moved to Redmond and grew, in less than two decades, to be a major regional employer. Other high-tech businesses soon congregated around the SR 520 and I-405 corridors, bringing in thousands of workers and making the morning commute from Seattle to the Eastside as common as the commute from the Eastside to Seattle.

> **Traffic Volumes**
>
> Traffic volumes across the Evergreen Point Bridge have increased quickly and substantially. In 1979, 16 years after opening, the number of vehicles crossing the bridge quadrupled. From 1980 to 1990, average daily traffic across the bridge between Seattle and the Eastside increased by 40,000 vehicles, an almost 60 percent increase.

Here and Now: A Picture of the Project Area

The sections below describe the existing project area, including the present condition of the roadway and its traffic, the natural ecosystems in the project area, and the characteristics of the human or "built" environment.

Moving the Region: SR 520 Today

What is the current condition of SR 520 in the project area?

As Chapter 1 describes, SR 520 in the project area is an aging and vulnerable facility. At 43 years old, the Evergreen Point Bridge has a remaining design life of only about 15 years, and in any major windstorm it is susceptible to catastrophic failure. Storms drive waves across the bridge deck and the bridge's motion and the waves batter the mechanisms that operate the draw span, forcing traffic closures of the bridge during storms to protect drivers and, afterward, to repair the damage. Rehabilitation and strengthening over the years have added weight to the bridge, making it float lower in the lake and requiring pumping as a routine maintenance function. Hollow columns on the Portage Bay Bridge and the western approach to the Evergreen Point Bridge were not designed to today's standards of earthquake resistance, and could collapse during an earthquake. Failure of one or more components of SR 520—and the resulting consequences to human safety and the regional transportation system—is a high likelihood within the next two decades unless the bridges are replaced.

Other features of the roadway also pose risks to safety and mobility. SR 520's narrow shoulders create hazards by forcing disabled vehicles to stop in the travel lanes. The narrow roadway also makes it difficult for drivers to see around curves. In Seattle, the short distance between the Montlake and I-5 interchanges creates a difficult weaving pattern for westbound traffic across the Portage Bay Bridge. In addition, a number of interchanges (such as the Montlake interchange) do not meet current WSDOT and FHWA design standards to ensure safe entry and exit. For these reasons, WSDOT believes that replacing the SR 520 bridges and upgrading the roadway is vital to the safety of those who use it and the regional transportation patterns that rely upon it.

Windstorms and Floating Bridges

Bridges are designed to withstand natural forces that place stresses on their structure. Wind and waves are typically the key forces that engineers must account for in the design of floating bridges. A major factor in wind and wave effects on floating bridges is called the "fetch"—the unobstructed, clear distance over the water that wind can travel to the bridge. The longer the fetch, the higher the wind and wave forces that the bridge must be designed to withstand. In Lake Washington, the critical fetch is to the southwest of the bridge, since the largest storms historically come from the southwest. Wind and wave forces cause the pontoons to bend, heave, and twist, creating large stresses in the pontoons and anchoring system. The pontoons for the proposed new Evergreen Point Bridge are designed to withstand large, rare storms that occur on average just once every 100 years. Their design would prevent large cracks from developing during these storms that would allow water to leak in and sink the bridge.

What is traffic like on SR 520 today?

The configuration of SR 520 today, with its inadequate shoulders and lack of full corridor HOV lanes, makes the corridor especially prone to traffic congestion. And, as any commuter on SR 520 knows, the Evergreen Point Bridge is overloaded with traffic. From 1970 to 2000, population and employment grew both on the Eastside and in Seattle, resulting in new travel patterns and far more vehicles crossing the Evergreen Point Bridge. Over this 30-year period, Seattle's population increased by over 32,000 and the Eastside's by over 77,000. The change in employment has been even more dramatic than the change in population: during the same 30 years, the number of Seattle jobs grew by over 226,000 and the Eastside's by over 138,000. Because of this growth, traffic on Lake Washington is now heavy in both directions throughout the day. On SR 520, traffic volumes have been virtually equal in both directions since the late 1980s. In fact, since 1993, peak afternoon traffic volumes have been slightly higher westbound than eastbound. The next two pages provide information about the growth of traffic and congestion on SR 520.

There are many factors influencing the traffic congestion on a highway during any particular morning or afternoon commute period. Traffic operations on SR 520 are affected by traffic operations on I-5, I-405, and on- and off-ramp traffic along SR 520 itself. SR 520 congestion lasts for several hours, both in the morning and the afternoon. SR 520 often becomes congested when there are backups on I-5 through downtown Seattle and on I-405 at the ramps to and from SR 520. Congestion points include "weave" areas where traffic merging onto the freeway competes for space with traffic merging right to exit, places where a lane ends (for example, the end of the westbound HOV lane at the east approach to the Evergreen Point Bridge), and locations where the high number of vehicles wanting to take a particular exit causes traffic to back up onto the freeway mainline.

A major source of congestion on SR 520 is "non-recurrent" congestion caused by unpredictable incidents such as traffic accidents or stalled vehicles. With shoulders that are too narrow to allow disabled vehicles to pull over, SR 520 today is not configured to prevent such incidents or to manage the resulting traffic congestion. Emergency vehicles and tow trucks have a difficult time getting through traffic that has backed up behind the incident; as a result, even a simple stall can snarl traffic for a long time.

What transit service is in operation or planned in the project area?

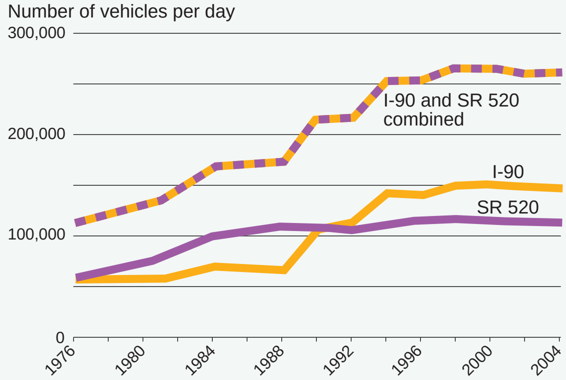
Metro Transit and Sound Transit are the two major transit operators in the project area; Snohomish County's Community Transit also operates one route across SR 520. Metro Transit provides local and express services in King County. Sound Transit's Sounder commuter rail, Regional Express bus service, and the Initial Segment of the Link light rail system (Central Link) currently under construction are designed to serve regional commuters.

People in the project area currently access transit through freeway stations, bus stops, and transit centers. At these locations, riders can board a bus or transfer between buses bound for destinations throughout the region. The project area transit access points are shown on *Exhibit 2-7* and described below.

The Growth of Traffic and Congestion on SR 520

Traffic on SR 520 grew almost continually from the 1970s until about 2000. Since 2000, total weekday vehicle trips on SR 520 have leveled off at approximately 115,000 per day. Although the demand to use SR 520 continues to increase, there is little room for traffic growth because the highway has reached its physical capacity. The chart at right shows how average weekday traffic on both Lake Washington crossings (SR 520 and I-90) has changed over time.

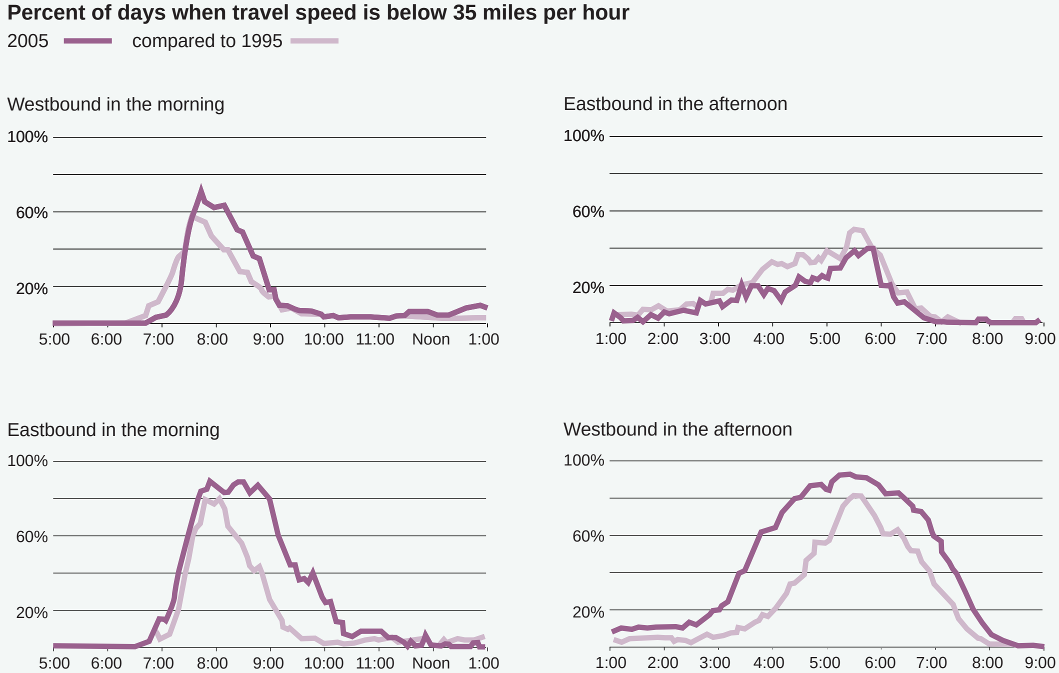
Growth of Average Weekday Crosslake Traffic
Principal Lake Washington Routes 1976-2004



SOURCE: WSDOT, 2006

When a highway reaches capacity, the result is traffic congestion. Congestion reduces travel speeds, making trips across SR 520 less reliable; speeds below about 35 miles per hour (mph) indicate that congestion is severe. Since 1995, the percentage of time when speeds are below 35 mph on the Evergreen Point Bridge has increased noticeably during peak commute hours, except for vehicles traveling east in the afternoon peak hour. Congestion is especially severe for commuters who live in Seattle and work on the Eastside. As shown in the charts below, people traveling east between 7 and 9 a.m. have a greater than 80 percent chance of moving at less than 35 mph. For westbound travelers between 5 and 6 p.m., the chances of moving at less than 35 mph are over 90 percent. The charts show that these high levels of congestion spread out over a longer period of time in 2005 than they did in 1995.

Percent of days when travel speed is below 35 miles per hour



SOURCE: WSDOT, 2006

The wider, more rounded curve of the 2005 line in the charts above indicate that as drivers try to avoid congestion—the peak period has become less of a well-defined "spike" in traffic patterns, and now spreads across a longer time frame.

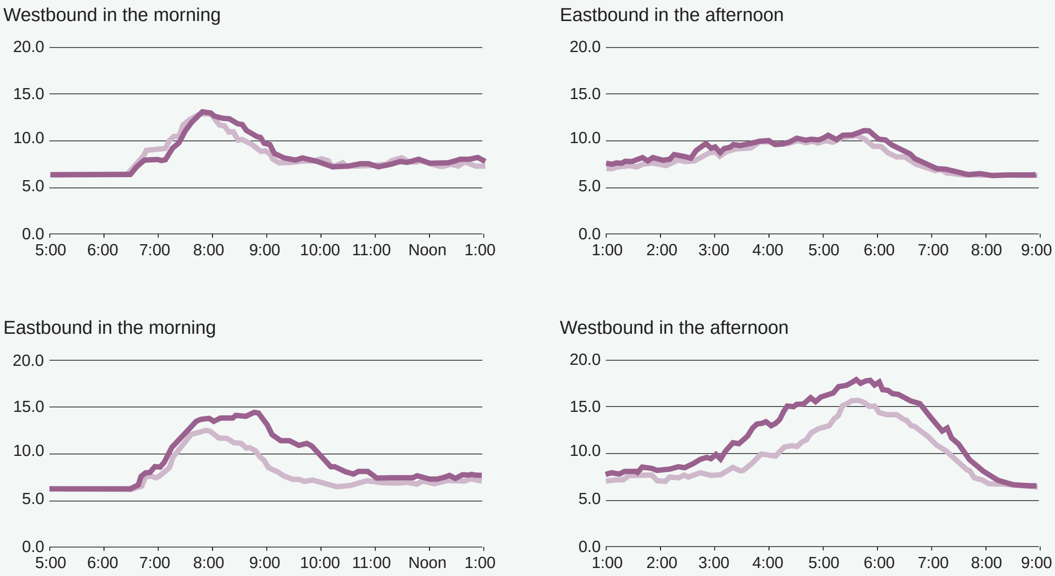
As might be expected, travel times across the bridge have followed a similar pattern. In 2005, between 8 a.m. and 10 a.m., it took eastbound SR 520 travelers 3 to 5 minutes longer to travel between I-5 and I-405 than it did in 1995, as shown in the following charts. The same was true for westbound travelers between 3 p.m. and 5 p.m.

Continued on next page

The Growth of Traffic and Congestion on SR 520 (continued)

Average travel times in minutes

2005 — compared to 1995 —

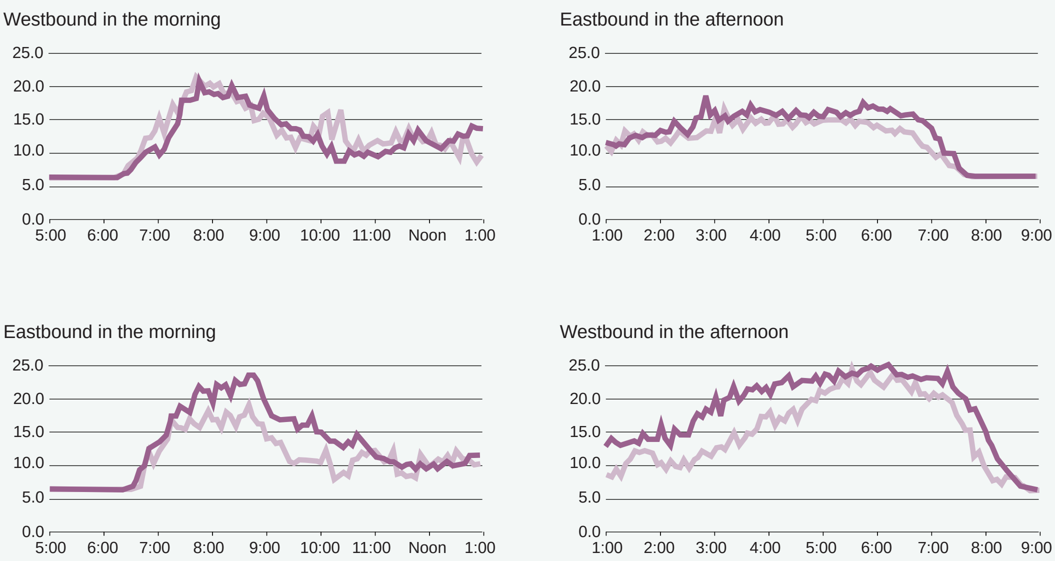


SOURCE: WSDOT, 2006

Most trips along SR 520 follow a predictable pattern—most trips across the lake tend to take the same amount of time each day. The charts below show that travel times have not changed much between 1995 and 2005 for commuters traveling westbound in the morning and eastbound in the afternoon. In 2005, however, travel times for commuters traveling to the Eastside in the morning and back to Seattle in the afternoon have increased by several minutes for a larger portion of the day. This means that more people are spending more time in their cars on the SR 520 corridor.

Reliable travel times in minutes (95% of days)

2005 — compared to 1995 —



SOURCE: WSDOT, 2006

Bus Transit

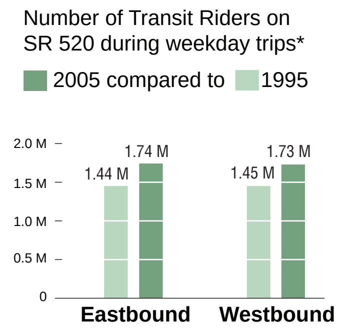
- The Pacific Street transfer point is located on Northeast Pacific Street, in front of the University of Washington Medical Center. This transfer point provides access to the University of Washington main campus, the medical center, and Husky Stadium. This stop is currently served by 10 transit routes.
- The Montlake Freeway Station is located on the west end of the Evergreen Point Bridge at the Montlake Boulevard bridge. Within walking distance of the University of Washington south campus and the University of Washington Medical Center, this stop also serves as a transfer point for routes serving Capitol Hill and as the point where many Seattle-to-Eastside bicycle commuters load and unload their bicycles for the bus ride across the bridge. It is currently served by 30 bus routes.
- The Evergreen Point Freeway Station is located on the east end of the Evergreen Point Bridge and is served by almost all of the same routes (26 of the 30 routes) as the Montlake Freeway Station. Many bicycle commuters load and unload their bicycles at this freeway station for the trip across Lake Washington.
- The Yarrow Point Freeway Station at 92nd Avenue Northeast on the Eastside provides bus access for Hunts Point, Yarrow Point, Medina, and Clyde Hill to routes crossing the lake on SR 520. This freeway station is served by 20 routes.
- The South Kirkland Park-and-Ride lot is located on the border of Bellevue and Kirkland. The lot is a short distance from SR 520 and is served by seven Metro Transit and Sound Transit routes. Some routes serve several areas of the Eastside, while other routes provide connections between the Eastside and downtown Seattle as well as the University District.
- The Bellevue Transit Center is located in Bellevue's downtown business core on Northeast 6th Street. This transit center, a major destination and transfer point for most Eastside destinations in the Metro Transit service area, is currently served by 24 Metro Transit and Sound Transit bus routes.

Rail Transit

Voters approved financing for Sound Move, the regional transit plan for the Central Puget Sound region, in November 1996. Sound Move includes the development of light rail service between the City of SeaTac and Northgate in Seattle, with committed sources of local funding for project segments providing service between SeaTac and the University District. Sound Transit is currently constructing the Initial Segment of Central Link, which will provide light rail service from downtown Seattle to International Boulevard in Tukwila near Sea-Tac Airport. In 2005, the Sound Transit Board approved the Airport Link project, which will extend

South Kirkland Park-and-Ride

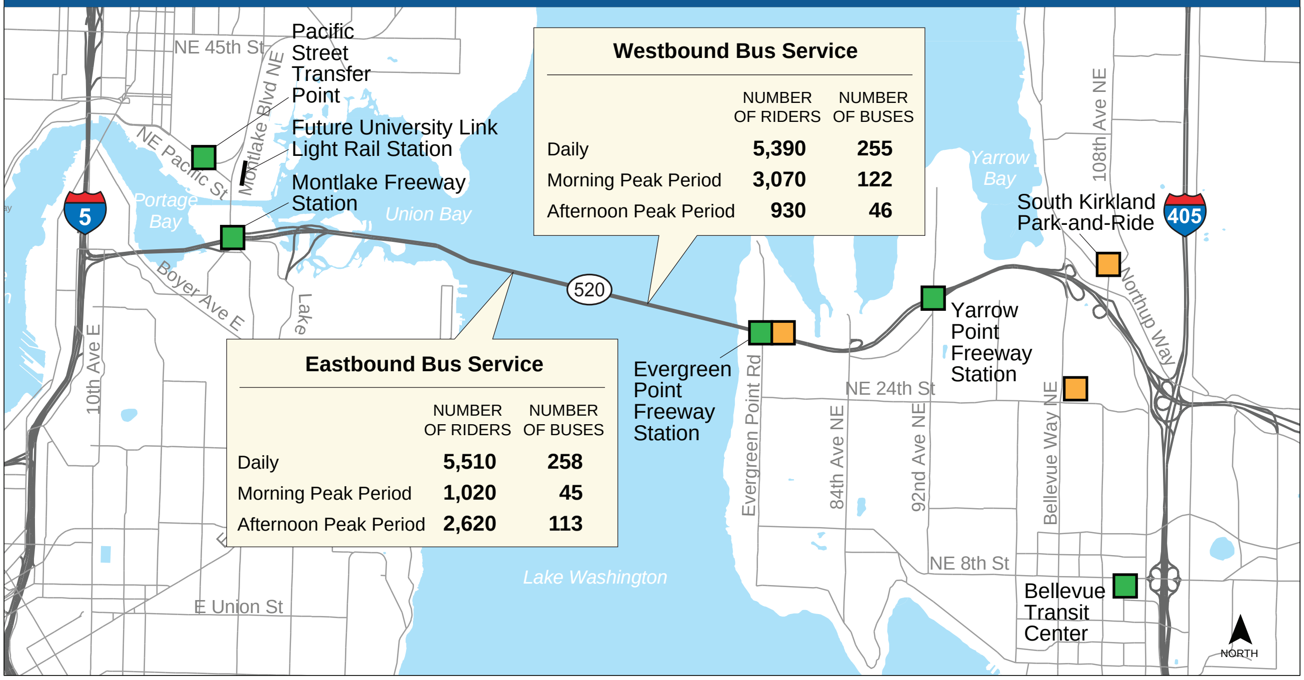
Bellevue Transit Center



*Annual total based on 254 weekdays, during fall signup; Data Source: King County Metro

As the population in the SR 520 service area and congestion in the SR 520 corridor has increased, we have seen an increase in transit use. More people are riding the bus, even though the total number of seats available has decreased by 2 percent since 1995.

Exhibit 2-7. **Transit System Characteristics**



Westbound Bus Service

	NUMBER OF RIDERS	NUMBER OF BUSES
Daily	**5,390**	**255**
Morning Peak Period	**3,070**	**122**
Afternoon Peak Period	**930**	**46**

Eastbound Bus Service

	NUMBER OF RIDERS	NUMBER OF BUSES
Daily	**5,510**	**258**
Morning Peak Period	**1,020**	**45**
Afternoon Peak Period	**2,620**	**113**

Park-and-Ride Transit Facility

SOURCE: Metro Transit System Map (September 2002).

Central Link light rail from Tukwila International Boulevard to Sea-Tac Airport. On April 27, 2006, the Board selected the final route, profile, and station locations for North Link, which will provide light rail service between downtown Seattle, Capitol Hill, the University District, and Northgate. The Sound Transit Board also authorized the steps necessary to complete final design and construction of University Link, that portion of North Link between the Pine Street stub tunnel in downtown Seattle and the University of Washington station at Husky Stadium.

The University Link project will be built as part of the Central Link project. Its primary feature in the SR 520 project area is the University of Washington station, which will be located underground just west of Husky Stadium. Key features of the station include a platform about 110 feet below ground with two or three entrances; elevators, escalators and stairs at each entrance; vents and emergency access/exit points incorporated into the south entrance, east plaza, and Husky Stadium edge; a pedestrian plaza; and station amenities. A remote vent facility to meet system operational requirements is also included at the Hop-In Market property in the Montlake neighborhood near SR 520. Specific station configurations will be determined in final design, which will begin in 2006.

The Human Landscape: Project Area Communities and Economy

What is the visual character of the project area?

The rolling terrain of the Seattle project area is due to a north-south system of ridges and valleys that slope toward the basins containing Lake Union, Portage Bay, Union Bay, and Lake Washington. To negotiate this terrain, SR 520 alternates between cut (i.e., sunken), elevated, and bridged sections. The SR 520 bridges and roadway figure prominently in many views toward SR 520 in this area. For some viewers north and south of the highway, the columns and deck of the Portage Bay Bridge and the western approach and highrise of the Evergreen Point Bridge are a dominant part of the foreground.

Urban development in this area is almost continuous and includes residential and commercial areas, institutions such as the University of Washington, and many varied uses along the waterways. Along the shores of Union Bay, the large natural spaces of the Arboretum provide a transition to the open expanse of Lake Washington. Trees throughout the project area and along SR 520 screen the freeway from surrounding neighborhoods.

Views from the Portage Bay and Evergreen Point bridges are scenic, with panoramic vistas of Portage Bay, Union Bay, Lake Washington, and the Cascade and Olympic mountains. The west approach to the Evergreen Point Bridge is visible from most of the shoreline neighborhoods around Union Bay and dominates the view from nearby locations in the Arboretum. Views of SR 520 from the Montlake neighborhood are seasonal and depend on the condition of the foliage screening the neighborhood from the roadway.

In the Lake Washington project area, the Evergreen Point Bridge and the sculptures just east of the Arboretum are the only human-made structures. The road deck of the bridge, about 10 feet above the water, gives drivers the impression of being at the water level and commands expansive views of the Cascade and Olympic mountains, Mount Rainier, the University of Washington's Husky Stadium, and the hillside communities around the lake. The floating portion of the bridge and its approaches are visible from many of the shoreline neighborhoods. For most of these viewers, the bridge is a small feature in the distance. To boats on the lake near the bridge, the floating portion appears as a low concrete wall.

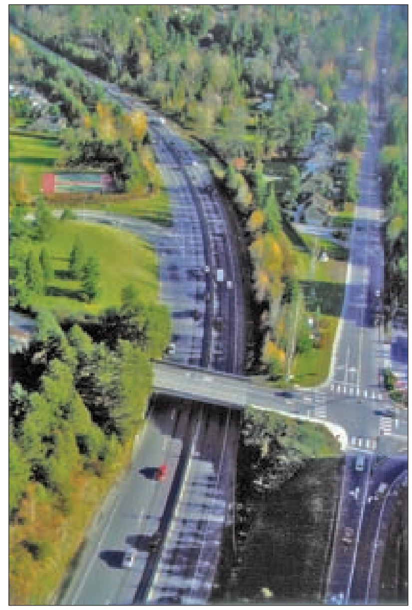
Like Seattle, the Eastside project area is made up of ridges and valleys. In the western portion of this area, the ridges slope into the Lake Washington basin, creating an alternating ridge-bay topography where the valleys are submerged. Near Lake Washington Boulevard East/Bellevue Way, the terrain flattens. Development along the SR 520 corridor west of Bellevue Way primarily consists of single-family homes on large plots, waterfront residences with private docks on the water, a few small commercial estab-

The road deck of the bridge, about 10 feet above the water, gives drivers the impression of being at the water level and commands expansive views of the Cascade and Olympic mountains, Mount Rainier, Husky Stadium, and the hillside communities around the lake.

Views of SR 520 from the Montlake neighborhood are seasonal and depend on the condition of the foliage screening the neighborhood from the roadway.

lishments, and an elementary school. East of the Bellevue Way interchange lie relatively new, low-rise office and commercial buildings with institutional plantings.

From the Evergreen Point Bridge to I-405, trees and shrubs line the corridor, merging with and screening the parks and residential neighborhoods on both sides of the roadway. These trees screen the nearby residential neighborhoods from the highway from late spring through late fall. Although the heavy vegetation limits views to and from the SR 520 Eastside corridor, westbound drivers at the Evergreen Point Bridge approach see the Olympic Mountains in the distance on clear days and Husky Stadium and the Seattle shoreline in the middle distance. For viewers on the shoreline north and south of the bridge, the columns and roadbed of the east approach are a dominant part of the foreground.



From the Evergreen Point Bridge to I-405, trees and shrubs line the corridor, merging with and screening the parks and residential neighborhoods on both sides of the roadway.

Which Seattle neighborhoods are in the project area?

Seattle is the leading commercial and cultural city of the Pacific Northwest. It is the largest city in Washington and a major employment center in the Puget Sound region. Growth in Seattle is directed by the city's Comprehensive Plan; between 2000 and 2030, population is projected to increase from about 563,000 to slightly over 640,000, and employment from approximately 536,000 to over 703,000 jobs. The city's population is expected to grow at a faster rate in the first decade of this century than it did in the 1990s, but at a slower pace than many Eastside communities. This is because Seattle has an extensive central business district, and its residential areas are largely built out. New growth will mainly result from increasingly dense development in neighborhoods designated as Urban Centers and Urban Villages in the Comprehensive Plan. Overall, Seattle neighborhoods are more ethnically diverse and have a higher proportion of renters than most Eastside project area neighborhoods. Median home values and household incomes are generally lower than in Eastside communities.

Seattle is the leading commercial and cultural city of the Pacific Northwest. It is the largest city in Washington and a major employment center in the Puget Sound region.

Within Seattle, the project area crosses and/or affects six distinct neighborhoods: Roanoke/Portage Bay, North Capitol Hill, Montlake, the University District, Laurelhurst, and Madison Park. The sections below describe each of these neighborhoods briefly and depict their boundaries, community resources, and key characteristics of their populations.

Roanoke/Portage Bay

The Roanoke/Portage Bay neighborhood is almost completely residential, a remnant of a larger residential area that was divided by construction of I-5 and SR 520 in the 1950s and 1960s. There are some isolated commercial businesses, mainly small retail stores and restaurants at the corner of Eastlake Avenue East and Fuhrman Avenue East. Roanoke Park lies near I-5 on East Roanoke Street, surrounded by the stately homes in the Roanoke Park Historic District, which has been identified as potentially eligible for the National Register of Historic Places. Fuhrman and Boyer Avenues East connect this neighborhood to the Montlake neighborhood and provide access to SR 520, while East Lynn Street connects to I-5. *Exhibits 2-8 and 2-9* show the neighborhood boundaries and demographic information, respectively.

North Capitol Hill

North Capitol Hill *(Exhibits 2-8 and 2-9)* is a densely populated urban neighborhood made up of single-family and multifamily residential areas and storefront commercial streets. It can be described as a cluster of districts that run in a north-south orientation, following the topography of the hill. North Capitol Hill contains one of the "anchor districts" of the larger Capitol Hill neighborhood, with concentrations of cultural facilities, businesses, schools, and open space. Its community services include Volunteer Park, Seattle Preparatory High School, and Boren Park, as well as St. Mark's Cathedral toward the neighborhood's south end. Tenth Avenue East is the major north-south arterial providing access to I-5 and SR 520, while East Aloha Street runs east-west, connecting 10th Avenue East with 24th Avenue East. This neighborhood has extensive and well-used transit services.

Montlake

The Montlake neighborhood, with its tree-lined streets, nestles between the waters of Portage Bay and the Washington Park Arboretum *(Exhibits 2-8 and 2-9)*. The homes in this residential area were built primarily in the first two decades of the twentieth century. Before SR 520 was built, the neighborhood formed a unified whole. Now SR 520 isolates a small, mostly residential portion of Montlake that includes the Seattle Yacht Club and NOAA Northwest Fisheries Science Center. The Museum of History and Industry (MOHAI) also lies north of SR 520, connected only by the 24th Avenue East bridge. Montlake Playfield, McCurdy Park, East Montlake Park, and the Washington Park Arboretum encircle the neighborhood and provide a substantial amount of public open space. Montlake Boulevard/24th Avenue East is the main arterial, connecting Montlake to the University of Washington, SR 520, and downtown neighborhoods like First Hill and the Central District.

University District

Densely developed with campus buildings, housing, and businesses to support its large student population, employees, and residents, the University District lies north of Portage Bay and west of Union Bay *(Exhibits 2-8 and 2-9)*. Most of the neighborhood's businesses front Northeast 45th Street and University Way Northeast, which are crowded with pedestrian as well as vehicle traffic. Montlake Boulevard Northeast fronts the university's sports complexes and also leads to the University Village shopping center. At the south end of the neighborhood is the University of Washington

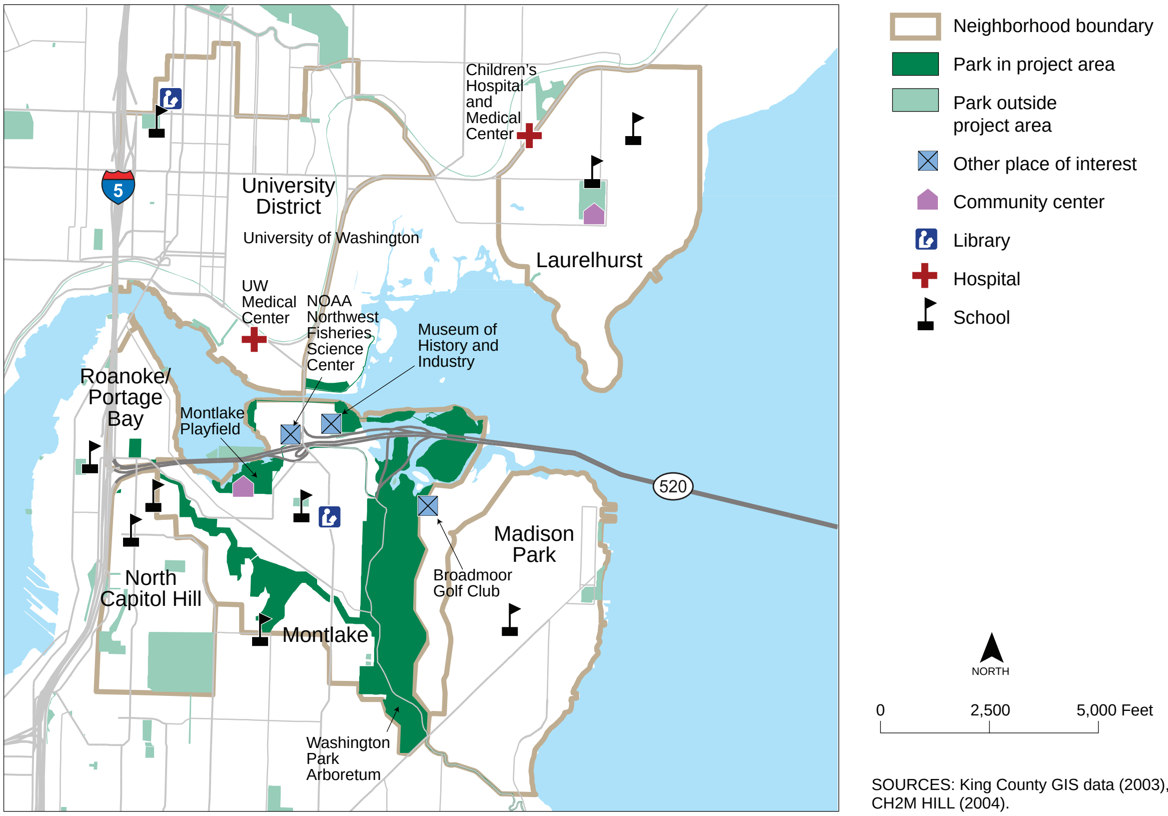
What role does the University of Washington play in the project area?

As the state's major institution of higher learning, the University of Washington is a dominant presence in the Seattle project area, affecting such aspects of the built environment as land use, views, and travel patterns. Founded in 1861 as the Territorial University of Washington, the University moved to its present campus on Union Bay in 1895. The 640-acre campus now serves a population of over 55,000 students, faculty, and staff in 14.9 million square feet of space. By 2012, this population is expected to grow to 64,645, an increase of about 17 percent. To accommodate this growth, the recently adopted Campus Master Plan anticipates adding approximately 3 million square feet of new space. The plan also identifies potential longer-term growth needs of up to 5 million additional square feet and identifies 68 sites for potential future development.

The University is a major generator of traffic in the project area, with students, faculty, staff, patients, visitors, and other campus users making daily car and bus trips to and from campus. To limit traffic effects, the University has adopted an aggressive demand management program that strongly encourages transit use. However, even with these measures, according to the University's current Transportation Management Plan, over 80,000 daily vehicle trips were generated by the campus population in 1999 (the most recent year for which data were provided). As a comparison, about 115,000 vehicles cross the Evergreen Point Bridge each day.

Source: University of Washington Capital Projects Office Seattle, Washington. University of Washington Master Plan Seattle Campus 2002-2012. September 2001.

Exhibit 2-8. **Neighborhoods and Community Facilities in the Seattle Project Area**



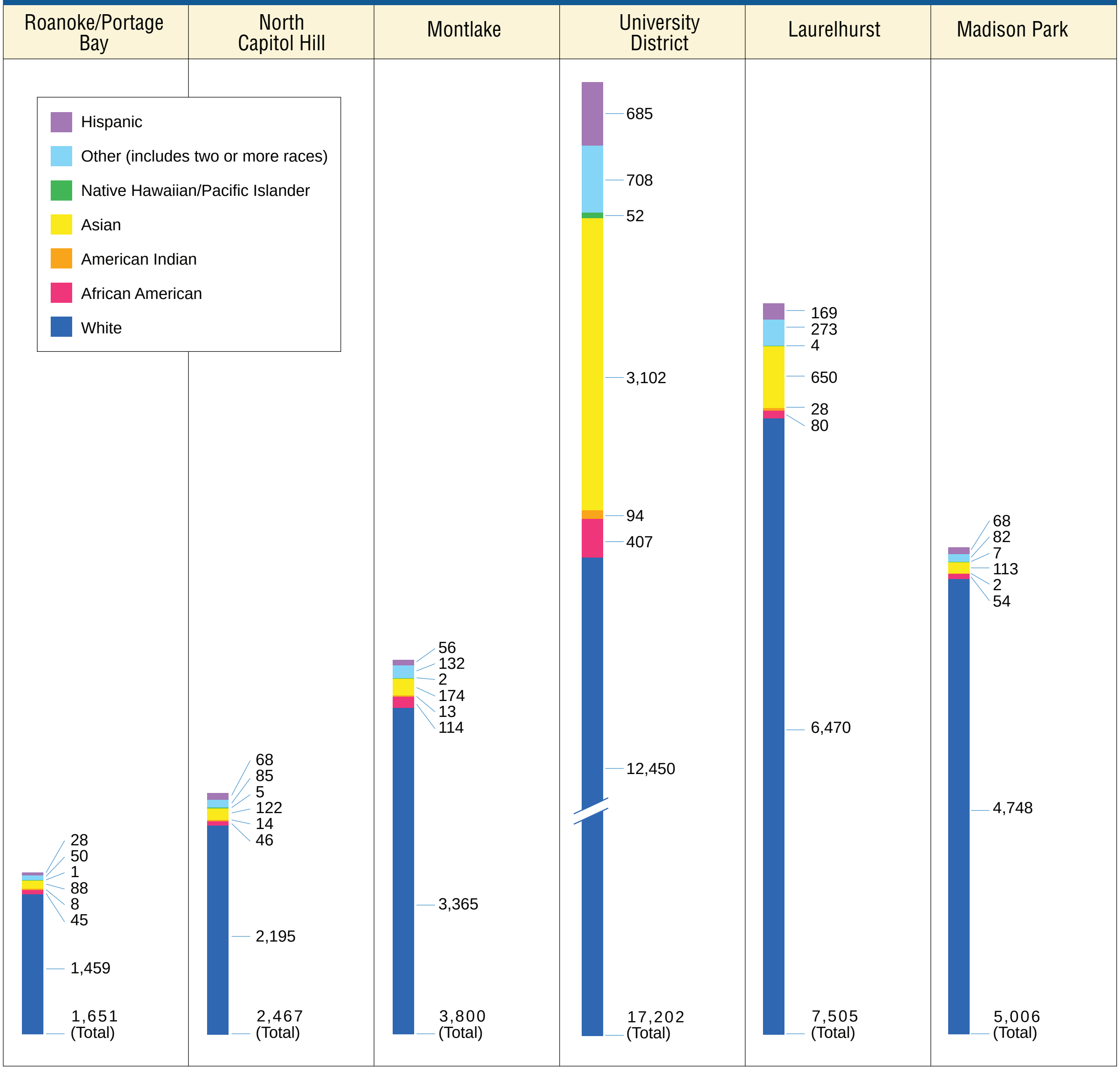
SOURCES: King County GIS data (2003), CH2M HILL (2004).

Medical Center on Northeast Pacific Street. The university campus itself, with its mix of neo-Gothic and modern architecture and its large landscaped areas, serves as a major open space. Along Montlake Boulevard and Northeast Pacific Street, the Burke-Gilman Trail carries bicyclists and pedestrians from throughout the region.

Laurelhurst

In Laurelhurst, single-family homes lie along a south-facing hillside on a peninsula that juts into Lake Washington. Many of the residents enjoy excellent views of the lake, the Evergreen Point Bridge, and Mount Rainier *(Exhibits 2-8 and 2-9)*. Laurelhurst's commercial areas, mainly consisting of restaurants and small retail shops, are located along Northeast 45th Street and Sand Point Way Northeast, the neighborhood's main arterial. Children's Hospital and Medical Center, on the east side of Sand Point Way Northeast, is a major regional medical facility. Recreational areas include Laurelhurst Park—located in the middle of the neighborhood, across the street from Laurelhurst Elementary School—and the Burke-Gilman Trail, which runs parallel to Sand Point Way.

Exhibit 2-9. **Demographics in the Seattle Project Area**



	Roanoke/Portage Bay	North Capitol Hill	Montlake	University District	Laurelhurst	Madison Park
Average Household Size:	1.9	1.95	2.45	1.90*	2.48	1.86
Over 65:	251	238	334	606	1,088	1,114
Median Household Income:	$63,834	$80,194	$101,319	$22,411	$81,866	$75,034
Median House Value:	$440,550	$602,862	$450,800	$296,341	$532,900	$719,900

Population (5 years and older) with Sensory and Physical Disabilities

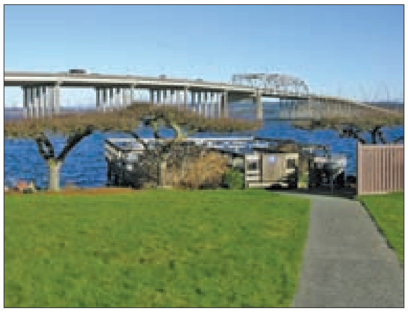
	Roanoke/Portage Bay	North Capitol Hill	Montlake	University District	Laurelhurst	Madison Park
Total	133	132	156	238	370	494
Sensory	32	84	47	146	173	162
Physical	101	48	109	92	197	332

SOURCES: U.S. Census (2000), CH2M HILL (2004).

*The average household size does not include the dormitories at the University of Washington.

Madison Park

The residential neighborhood of Madison Park *(Exhibits 2-8 and 2-9)* lies south of Union Bay and east of Lake Washington. Its west side encompasses the gated Broadmoor enclave, which includes the Broadmoor Golf Club and large residences. Madison Park's buildings vary from mansions east of East Madison Street and near Denny Blaine Park to shops, restaurants, and multifamily buildings at East Madison Street's northern end near the lakeshore. Madison Park itself, after which the neighborhood is named, sits on the shoreline at the eastern end of East Madison Street, near where the Lake Washington ferries once docked at the end of a streetcar line. At the southern end of the neighborhood, Lake Washington Boulevard East intersects East Madison Street and runs east through Washington Park Arboretum to provide access to SR 520.



The Madison Park neighborhood sits on the shoreline of Lake Washington.

Which Eastside cities and neighborhoods are in the project area?

The Eastside project area includes the Points communities of Medina, Hunts Point, Clyde Hill, and Yarrow Point, as well as neighborhoods within the cities of Kirkland and Bellevue. The sections below describe these communities briefly and depict their boundaries, community resources, and key characteristics of their populations *(Exhibits 2-10 and 2-11)*. Many of these areas were developed as residential communities in the mid-twentieth century, after the Lake Washington Floating Bridge and the Evergreen Point Bridge opened up access between Seattle and the Eastside.

Bellevue is the second largest center of employment in the Puget Sound region.

In contrast with project area neighborhoods in Seattle, where little new growth is expected other than the expansion of the University of Washington under its master plan, the greater Eastside is expected to grow considerably in the coming decades. This is especially true for Bellevue, the second largest center of employment in the Puget Sound region, which is slated to absorb a large share of employment growth. The Eastside includes many "new economy" jobs in high-tech industries, as well as retail and service jobs, including financial, real estate, medical, and professional. Medina, Hunts Point, Clyde Hill, and Yarrow Point are notably more affluent than most other project area neighborhoods. Overall, the Eastside is less ethnically diverse than Seattle, although the Bellevue and Kirkland project area neighborhoods do have substantial Asian populations.

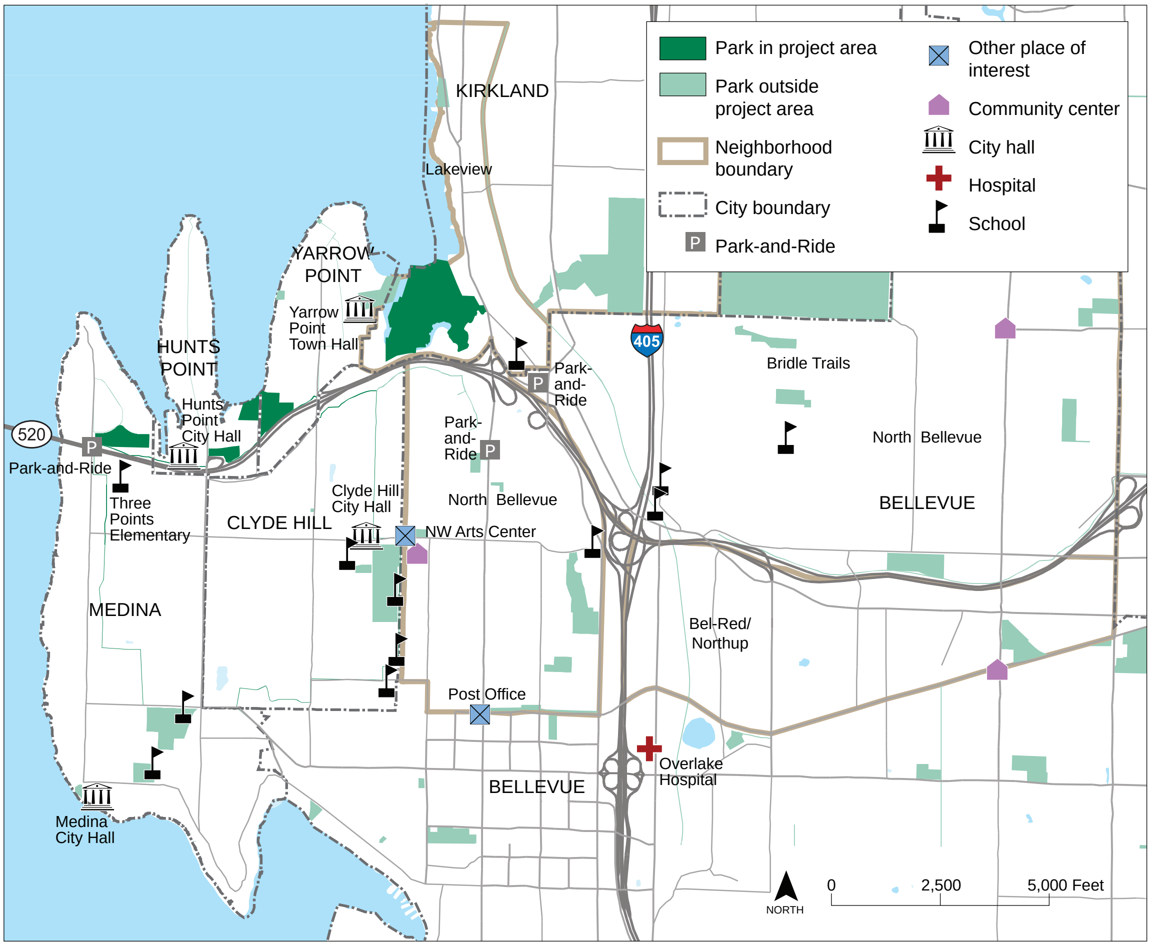
Medina

Medina occupies a peninsula projecting into Lake Washington. As shown in *Exhibit 2-10,* the lake frames Medina to the south, west, and north; 84th Avenue Northeast borders it to the east. Built out primarily during the 1950s and 1960s, Medina consists of single-family homes along with a few commercial businesses. Most of its properties are semi-wooded and heavily landscaped.

The construction of SR 520 in the 1960s split Medina in two. The highway separates the north portion from the larger southern portion except for a single bridge over SR 520 on Evergreen Point Road. The only other north-south arterial, 84th Avenue Northeast, provides direct access to westbound SR 520. Northeast 12th Street and 24th Street carry traffic east and west and connect Medina to neighboring Clyde Hill and to downtown Bellevue. Fairweather Park, a nature preserve, borders SR 520 between Evergreen Point Road and 80th Avenue Northeast; the Points Loop Trail travels past the park on its way to Hunts Point, with a side trail splitting off into the preserve and looping around the northern point of the peninsula. Bellevue Christian School/Three Points Elementary is a private school located just south of SR 520.

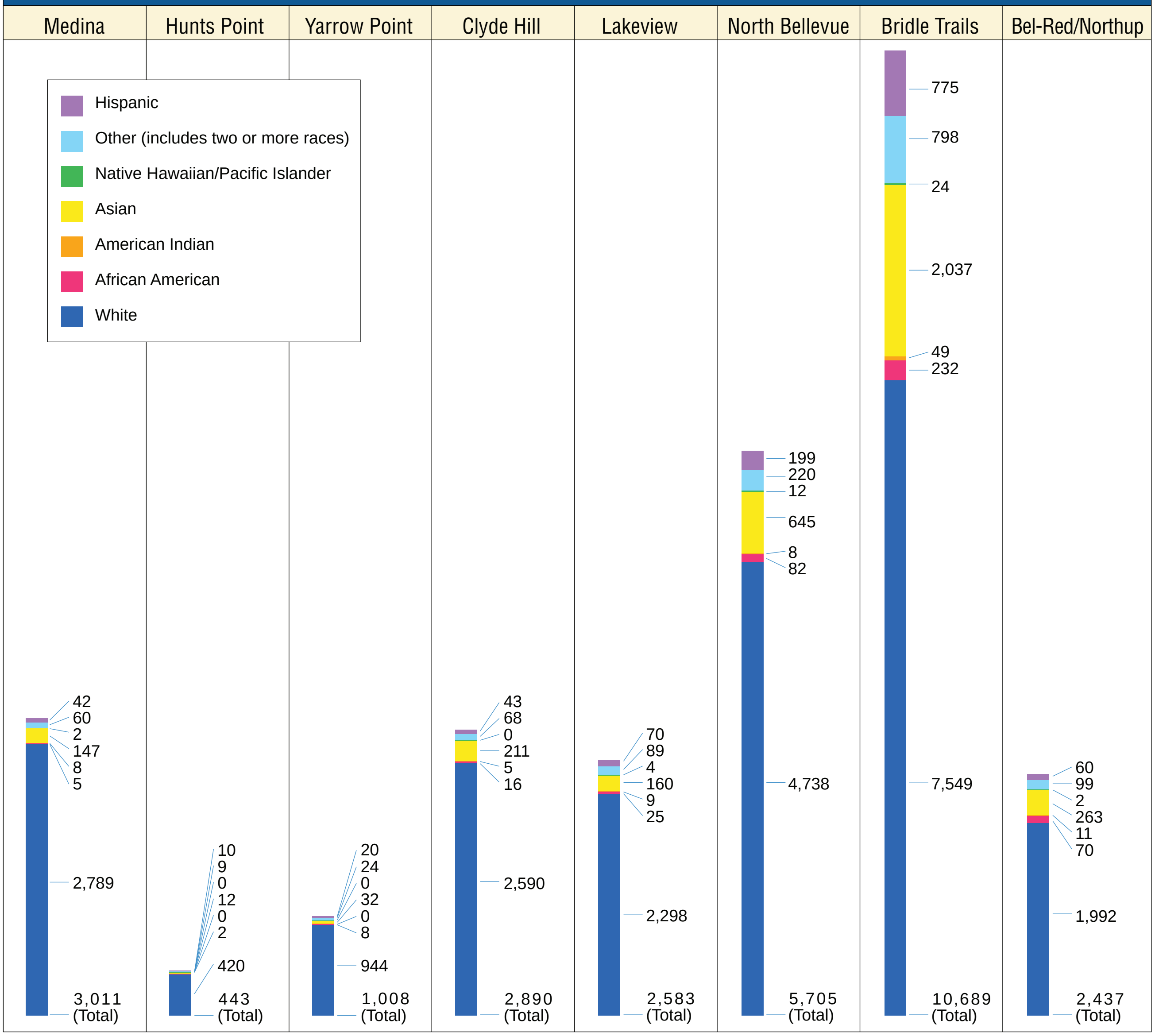
Bellevue Christian School/Three Points Elementary lies just south of SR 520 in Medina.

Exhibit 2-10. **Neighborhoods and Community Facilities in the Eastside Project Area**



SOURCES: King County GIS data (2003), Bellevue GIS data (2003), CH2M HILL (2004).

Exhibit 2-11. **Demographics in the Eastside Project Area**



	Medina	Hunts Point	Yarrow Point	Clyde Hill	Lakeview	North Bellevue	Bridle Trails	Bel-Red/Northup
Average Household Size:	2.71	2.71	2.64	2.74	1.64	2.12	2.24	2.2
Over 65:	485	76	186	528	479	1,138	877	183
Median Household Income:	$133,756	$179,898	$117,940	$132,468	$60,758	$60,286	$59,462	$60,718
Median House Value:	$789,600	$1,000,000+	$767,200	$677,200	$412,300	$320,258	$446,220	$423,576

Population (5 years and older) with Sensory and Physical Disabilities

	Medina	Hunts Point	Yarrow Point	Clyde Hill	Lakeview	North Bellevue	Bridle Trails	Bel-Red/Northup
Total	120	13	46	168	206	606	708	88
Sensory	47	4	20	71	91	229	195	18
Physical	73	9	26	97	115	377	513	70

SOURCES: U.S. Census (2000), CH2M HILL (2004).

Hunts Point

Hunts Point sits east of Medina on another peninsula extending into Lake Washington *(Exhibit 2-10).* Northeast 28th Street is its southern boundary; Fairweather Bay and Cozy Cove define its east and west sides. Like Medina, Hunts Point consists mainly of single-family homes on large lots—in fact, it contains no commercial establishments and no multi-family dwellings. Hunts Point Road is the town's single arterial street, traveling the length of the peninsula to connect to 84th Avenue Northeast and SR 520. Like Medina, Hunts Point was split by the construction of SR 520, which stranded 14 parcels within the town limits on the south side of the highway.

Wetherill Park is one of two parks in Hunts Point.

The town has two parks. Hunts Point Park has tennis courts, a children's play area, and an open sports field. Wetherill Park, at the south end of Cozy Cove, affords opportunities for hiking and birdwatching in its large wetland. The Points Loop Trail along the north side of SR 520 connects Hunts Point to Medina and Yarrow Point. A side trail from the Points Loop Trail extends the length of Hunts Point Road.

Clyde Hill

Clyde Hill is almost exclusively residential.

Encompassing nearly a square mile of land on a hilltop that overlooks Lake Washington and Bellevue *(Exhibit 2-10),* Clyde Hill is almost exclusively residential. Like other Points communities, it was also split in two when SR 520 was constructed. A small area of commercial development lies on Points Drive near SR 520, but the busiest street is 84th Avenue Northeast, which leads to the westbound on-ramp of the freeway. Northeast 24th Street connects Clyde Hill to Medina and Bellevue; 92nd Avenue Northeast connects the city to Yarrow Point and eastbound SR 520. The city contains one small park—Clyde Hill City park—and the Points Loop Trail, which enters the town on 96th Avenue Northeast and travels its full length.

Yarrow Point

The only arterial in Yarrow Point is 92nd Avenue Northeast. It runs north and south through town and provides access to the eastbound on-ramp of SR 520 and to Clyde Hill farther south.

Located on the peninsula just east of Hunts Point *(Exhibit 2-10),* Yarrow Point was incorporated in response to impending commercial development at the head of Yarrow Bay. The town was zoned for single-family residences only. To this day, no commercial businesses exist there. Yarrow Bay and Cozy Cove border Yarrow Point to the east and west; Kirkland lies east of Yarrow Bay and abuts Yarrow Point on the east as well. Like Hunts Point, Yarrow Point was bisected by the construction of SR 520, leaving a narrow strip of the town wedged between Points Drive Northeast and the south side of the highway.

Yarrow Point shares a residential character similar to the surrounding communities of Hunts Point and Clyde Hill, with large houses on large lots. The only arterial is 92nd Avenue Northeast, also known as Yarrow Point

Road. It runs north and south through town and provides access to the eastbound on-ramp of SR 520 and to Clyde Hill farther south. Wetherill Park (discussed above under Hunts Point) lies partly within Yarrow Point, and a branch of the Points Loop Trail runs the length of the Yarrow Point peninsula.

Kirkland

One of the oldest cities on the Eastside, Kirkland is primarily a residential community, although its downtown (located north of the project area) is a lively arts and shopping district. The Kirkland neighborhood within the project area is known as Lakeview *(Exhibit 2-10).* It features a mix of uses, including single-family and multifamily housing, businesses, parks, and marinas. Lakeview Drive Northeast and Lake Washington Boulevard Northeast are the primary streets in the neighborhood; the latter carries heavy commuter traffic between Kirkland and destinations south and affords access to SR 520. Yarrow Bay Wetland is a large wildlife conservancy that covers 66 acres at the south end of Yarrow Bay. It provides recreation for nonmotorized boats such as canoes and kayaks.

Bellevue

The fifth largest city in Washington, Bellevue is the financial, retail, and office center of the Eastside. Three Bellevue neighborhoods are in the SR 520 project area: North Bellevue, Bridle Trails, and Bel-Red/Northup.

Just south of SR 520 and framing downtown Bellevue to the north and west, North Bellevue *(Exhibit 2-10)* is composed mostly of mixed single-family and multifamily housing. Its main arterial street is Bellevue Way Northeast, along which lies the North Bellevue Shopping Center. Neighborhoods west of Bellevue Way blend into adjacent Clyde Hill, while the areas nearer I-405 and downtown Bellevue include more mixed-use buildings and office space. The Northwest Community Center lies on Northeast 24th Street, near the western edge of the neighborhood, and Hidden Valley Park is west of 112th Avenue Northeast and I-405.

Bridle Trails *(Exhibit 2-10)* is a neighborhood of single-family homes on large lots, bordered by I-405 on the west and SR 520 on the south. What distinguishes Bridle Trails is its wooded character—some two-thirds of the area is covered by second-growth timber. As the neighborhoods name suggests, many people regularly enjoy riding horses in Bridle Trails State Park, located in its northern portion. Bridle Trails residents access SR 520 from 108th Avenue Northeast, 124th Avenue Northeast, and 148th Avenue Northeast.

The **Bel-Red/Northup** neighborhood *(Exhibits 2-10),* unlike other Eastside project area neighborhoods, is largely commercial. A variety of light industrial and commercial businesses line its major arterial streets, which include Northeast 20th Street, Northeast Bel-Red Road, and 116th,

The Bel-Red/Northup neighborhood is largely commercial.

124th, 140th, and 148th Avenues Northeast. Although the area contains a 1950s residential area known as Dogwood Park, housing is generally being phased out in this neighborhood in favor of commercial redevelopment. There is a community center on Northeast Bel-Red Road near 140th Avenue Northeast. Residents and employees can gain access to SR 520 from 124th Avenue Northeast and 148th Avenue Northeast.

What are noise levels like in the project area?

Many communities and recreational areas along the SR 520 corridor are severely affected by traffic noise. Much of this noise comes from vehicles on SR 520, although some results from other heavily traveled roadways like I-5 and local arterial streets.

Traffic noise is generally not regulated by state and local jurisdictions, but FHWA has established a set of noise abatement criteria designed to help limit the worst levels of highway noise on people living, playing, or working near the highway. The sidebar at right provides more information on noise and the FHWA criteria.

Within the SR 520 project area, 406 noise-sensitive locations, including homes and parks, now experience noise levels that approach or exceed FHWA's noise abatement criteria. Places with high noise levels in the project area include the Seattle neighborhoods of Roanoke/Portage Bay, North Capitol Hill, Montlake, and Madison Park; the Eastside communities of Medina, Hunts Point, Clyde Hill, Yarrow Point, and Bellevue; and several parks, most notably the Washington Park Arboretum. *Exhibit 2-12* shows the existing locations where noise levels approach or exceed the criteria.

In Seattle, existing levels of noise from SR 520 in many areas affect people's enjoyment of their homes and yards, the Washington Park Arboretum, and the recreational use of the lake itself. The noise affects individuals' quality of life, diminishes the integrity of historic areas, and also reduces the quality of natural habitat areas near the highway. On the Eastside, the residential properties next to the highway experience the greatest effects. Appendix M, Noise Discipline Report, provides detailed information on existing and future noise levels in the project area, including noise measurements and modeling results for the noise-sensitive locations studied for this Draft EIS.

What are the state, regional, and local plans and policies relevant to this project?

From a state and regional perspective, several key planning documents establish the framework for local land use plans and programs. These planning documents are the Washington State Growth Management

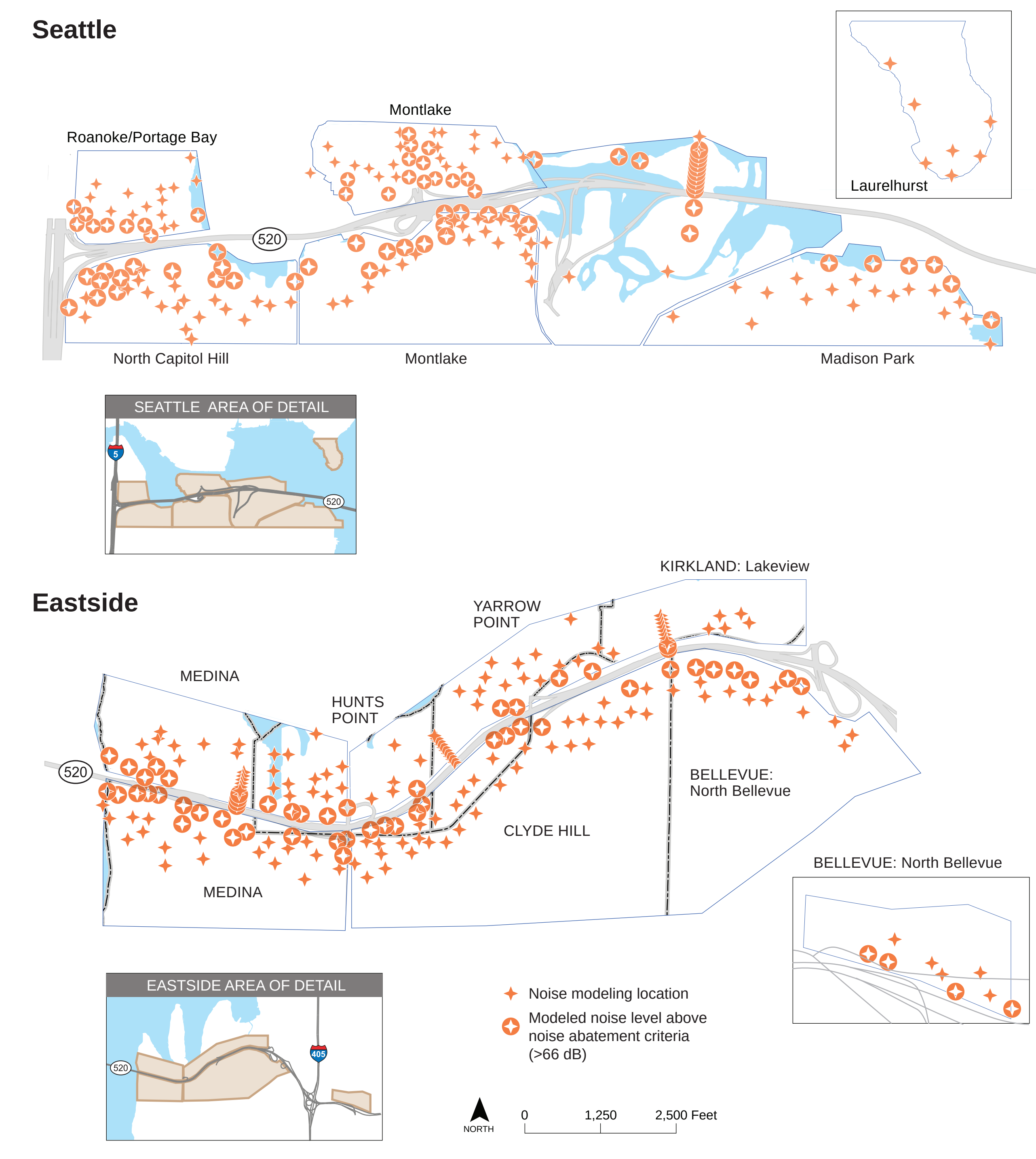
DEFINITION

Noise

Noise—defined as "unwanted sound"—affects most people in urban areas to some degree. It is measured in units called A-weighted decibels, which correspond to the frequencies that are audible to the human ear. For ease of reference, we refer to these A-weighted decibels simply as "decibels" in this Draft EIS. The human ear perceives every 10-decibel increase as a doubling of the noise level. People find a noise level increase of 3 decibels or more barely perceptible, and perceive a 5 decibel increase as noticeable. The loudness of highway noise is related to the volume of traffic, the distance of the listener from the highway, and whether there is a direct line of sight between the noise source and the listener.

While state and local laws regulate noise from commercial, industrial, and construction activities, they do not regulate noise from traffic on public roadways. FHWA has established noise abatement criteria for new highway projects. These criteria require WSDOT to consider mitigation measures such as sound walls if noise levels near a highway would approach or exceed FHWA's noise abatement criteria, or if there is a substantial increase (10 decibels or more) over existing noise levels. For residential areas and parks, the criterion is 67 decibels—about the same volume as a vacuum cleaner 10 feet from the listener. FHWA considers noise levels of 66 decibels or above to approach or exceed the noise abatement criteria.

Exhibit 2-12. **Noise Levels in the Project Area**



Act (GMA); Vision 2020[1] and its transportation element, Destination 2030[2]; and King County's Countywide Planning Policies. In addition, Sound Transit's Sound Move plan, adopted in 1996, provides a multi-year regional transit plan. This plan is the regional transit plan for the Central Puget Sound Region, funding for which was approved by voters in November 1996.

Washington State's GMA attempts to provide a comprehensive framework for managing growth and coordinating land use planning with infrastructure. The GMA's planning goals are intended to guide development of local comprehensive plans and development regulations, such as directing growth to urban areas, reducing sprawl, and encouraging efficient transportation systems. Local, county, and regional plans are required to be consistent with the GMA.

Vision 2020 is the Puget Sound Regional Council's long-range growth management, economic, and transportation strategy for the central Puget Sound region, which encompasses King, Kitsap, Pierce, and Snohomish counties. Vision 2020 identifies numerous transportation-related policies that emphasize concentrating growth in urban centers and connecting those centers with an efficient, transit-oriented, multimodal transportation system. Designated urban centers near the project area are First Hill/Capitol Hill, the University District, and downtown Bellevue. Vision 2020 calls for maintaining existing transportation systems and for providing improvements to the regional HOV system that improve travel time for transit and other high-occupancy vehicles. Destination 2030, which is the transportation element of Vision 2020, is a transportation action plan. Destination 2030 identifies widening SR 520 from the Evergreen Point Bridge to Redmond for HOV facilities as an approved project and SR 202/SR 520 interchange improvements as a candidate project.

Sound Move, the Ten-Year Regional Transit System Plan, is an integral part of Destination 2030. It seeks to increase the capacity, utility, and convenience of public transit by offering the prospect of an integrated package of new transit options. Elements of Sound Move include:

- A regional system of HOV improvements, including new transit centers, park-and-ride lots, and HOV access projects
- New Regional Express bus routes that serve major regional centers and provide transit connections
- The development of light rail service between the City of SeaTac and Northgate in Seattle, with committed sources of local funding for project segments providing service between SeaTac and the University District
- Commuter rail service between Everett, Seattle, Tacoma, and Lakewood.

[1] Puget Sound Regional Council. 1995. *Vision 2020.*
[2] Puget Sound Regional Council. 2004. *Destination 2030 - 2004 Review and Progress Report.*

Seattle, Medina, Hunts Point, Yarrow Point, Clyde Hill, Kirkland, and Bellevue all have comprehensive plans consistent with the GMA. These plans provide the overall policy guidance for future development and they describe how their city should evolve over time. They address topics such as land use, housing, parks and open space, transportation, and the environment. The transportation policies relevant to the project are described briefly below:

- Seattle's Comprehensive Plan policies support protecting neighborhoods, developing a transit network that serves activity centers in the city and the region, expanding roadway and freeway facilities primarily to accommodate HOV traffic, and providing a high-capacity transit system that connects urban centers.
- Medina's Comprehensive Plan policies support developing a bicycle path along SR 520 and across the Evergreen Point Bridge, improving access to transit and pedestrian facilities, increasing public transit and HOV use within the SR 520 corridor, and mitigating the noise and appearance of SR 520.
- Hunts Point's Comprehensive Plan has one policy applicable to the proposed project: the plan calls for the installation of noise baffling or construction of a lid over SR 520.
- Yarrow Point's Comprehensive Plan calls for transportation capabilities ranging from single-occupant vehicles to HOVs to regional transit that would provide an efficient system, minimizing the demand for new streets and highways. The plan also advocates pedestrian and bicycle travel.
- Clyde Hill's Comprehensive Plan presents policies aimed at encouraging alternative modes of travel, increasing transit accessibility, developing a bicycle and pedestrian path that connects Seattle and the Eastside, and decreasing through-traffic on local streets.
- Kirkland's Comprehensive Plan policy pertaining to transportation emphasizes development of pedestrian and bicycle facilities, linking to a future regional high-capacity transit system, and working with Metro Transit to provide local bus service and connections to the regional transit system. The transportation element of Kirkland's Comprehensive Plan also supports promotion of transit and ridesharing on a local and regional basis.
- Bellevue's Comprehensive Plan policies relating to highways and transit support adequate highway capacity for general-purpose and HOV traffic, downtown Bellevue as a major urban center with multimodal transit facilities, and local and regional transit services.

Two institutions in the project area—the University of Washington and Washington Park Arboretum—have adopted master plans that will affect development in the project area.

- The University of Washington's Campus Master Plan,[1] guides proposed campus development through 2012. The plan provides for development of approximately 3 million square feet at 68 potential sites to accommodate nearly 10,000 more students, faculty, and staff. The plan identifies which areas of the campus are to be preserved as open space; establishes circulation patterns including internal streets, transit circulation, pedestrian and bicycle pathways, and parking areas; identifies potential new building locations; identifies how the University will manage its transportation needs and mitigate traffic effects; and determines how University-related development will integrate with the University District's recently adopted neighborhood plan and Sound Transit's North Link light rail system.
- The Washington Park Arboretum Master Plan[2] includes new trails and exhibits, revised roadways and parking, new and replacement buildings, and expanded maintenance and education programs. New structures include a south gateway education and visitor center, education and curation buildings near the Graham Visitors Center, a pavilion and an entry building for the Japanese garden, expanded maintenance facilities, greenhouse and bathhouse replacement, and use of part of the present MOHAI building as administrative space.

How good is the air quality in the project area?

Several air pollutants are associated with vehicle emissions from heavy traffic congestion in the project area. These pollutants include oxides of nitrogen, carbon monoxide, particulate matter (any liquid or solid particles present in the atmosphere), ozone, hazardous air pollutants, and greenhouse gases, primarily carbon dioxide. Carbon monoxide is a colorless, odorless, and poisonous gas generated by automobiles that reduces the oxygen-carrying capability of the blood. Nitrogen oxides and hydrocarbons contribute to the formation of ozone on a regional scale. Ozone, one of the primary contributors to smog, is an irritant, reduces lung function, and can damage plants and materials. Particulate matter includes small dust particles and diesel emissions. The small particles can be inhaled deeply into the lungs, potentially leading to respiratory diseases. Particulate matter is an important concern during construction**.**

Since 1996, the Puget Sound region, including the project area, has met all applicable federal and state standards for air quality. Although the Puget Sound lowland is the most densely populated and industrialized area in the state, air movement most of the year tends to disperse pollutants and prevent pollutant concentrations from violating the standards.

What is the Clean Air Act?

The Clean Air Act of 1970, 42 USC 7401 et seq., was enacted to protect and enhance air quality and to assist state and local governments with air pollution prevention programs. Under the Clean Air Act Amendments of 1990, USDOT cannot fund, authorize, or approve federal actions to support programs or projects that are not first found to conform to Clean Air Act requirements.

[1] Adopted by the University's Board of Regents and the Seattle City Council in 2003.
[2] Approved by the Seattle City Council in May 2001.

Episodes of poor air quality usually occur in the late fall and winter, under conditions of clear skies, light wind, and a sharp temperature inversion. *Exhibit 2-13* shows that, for the last several years, levels of carbon monoxide in the project area have been well below the limits set by federal air quality standards.

Although the region currently complies with air quality standards, in the early 1990s it violated the standards for carbon monoxide and ozone. For this reason, the U. S. Environmental Protection Agency (U.S. EPA) designates the region as a "maintenance area" in which extra care must be taken to prevent future violations. To minimize the amount of pollution generated by traffic, Washington state must prepare and conform to the State Implementation Plan, a plan for meeting and maintaining compliance with air quality standards. Transportation projects, including the SR 520 Bridge Replacement and HOV Project, must demonstrate that they conform with the State Implementation Plan in order to obtain approvals and funding.

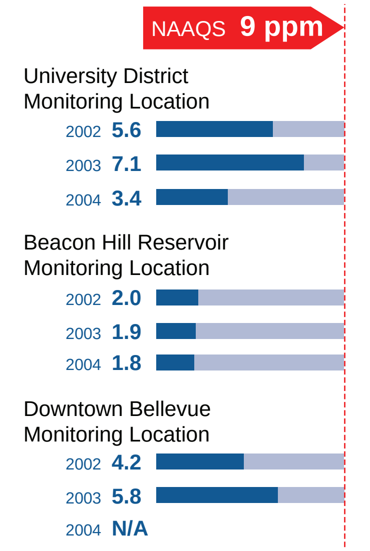
Ongoing monitoring of air quality throughout the central Puget Sound region indicates that levels of carbon monoxide and particulate matter have been decreasing over the last decade, while ozone levels have remained steady. The decline in pollutants results primarily from improved emission controls on newer vehicles. However, over time, other factors have the potential to counteract this downward trend. Estimates by the Puget Sound Regional Council suggest that emissions of particulate matter will gradually increase between 2010 and 2030 as traffic volumes increase. This is because emissions controls focus mainly on reducing carbon monoxide and do little to reduce particulate matter. But ultimately all pollutants will increase because each year more vehicles travel on the region's highways, and people in the area are making more trips of longer distances. However, estimates by the Puget Sound Clean Air Agency indicate that this region should not exceed the U. S. EPA's revised standards for particulate matter.

Vehicles in the project area also emit "air toxics," which are compounds found primarily in diesel exhaust that are known to have negative health effects. Air toxic emissions are currently not regulated, but the U.S. EPA will soon impose stricter regulations on diesel fuel and vehicles. The diesel exhaust contribution to the area's toxic air pollutants should be reduced in the near future as a result of federal regulations that require the following:

- Cleaner-burning diesel fuel for on-road vehicles by mid-2006
- Cleaner-burning diesel fuel for off-road diesel engines by 2010

Although not regulated under the Clean Air Act, greenhouse gases are pollutants that can affect the environment. Greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and other manmade chemicals. Analysis by the Puget Sound Clean Air Agency indicates that cars, trucks, and sport utility vehicles add more greenhouse gases (primarily carbon dioxide) than any other source in our region. Greenhouse gases

Exhibit 2-13. **Carbon Monoxide Levels Measured in the Project Vicinity, 2002-2004**



NOTE:
All units in parts per million (ppm).
National Ambient Air Quality Standards (NAAQS) maximum level = 9 ppm.
N/A = Not available

are predicted to continue increasing rapidly due to economic growth, increased movement of freight by trucks and aircraft, and personal travel. U. S. EPA test data indicate that greenhouse gas emissions decrease with increasing speed up to approximately 45 mph. Thus, reducing traffic congestion would increase average vehicle speeds and reduce emissions of greenhouse gases from vehicles.

What are the risks from geologic hazards in the project area?

Major geologic hazards in the project area are erosion (the weathering away of soils by wind and/or water), landslides, and earthquakes. Local jurisdictions in the project area map geologic hazard areas to ensure that development in these areas, including highway construction, avoids these risks and/or makes use of appropriate design and construction techniques to minimize them. *Exhibit 2-14* shows the geologic hazard areas that have been mapped in the project area.

Erosion and landslides are functions of the area's soil type and topography; the steeper the slope and the finer or more layered the soil, the likelier both are to occur. Engineers can take precautions in highway design and construction to stabilize erosion- and slide-prone areas and maintain the integrity of the roadway. As *Exhibit 2-14* shows, SR 520 passes through erosion-prone soils southwest of Portage Bay, on the eastern shoreline of Lake Washington, and at the south end of Cozy Cove and Yarrow Bay.

Earthquakes' most characteristic physical effect is ground shaking caused by the passage of seismic waves. The amount of ground motion varies with the magnitude of the earthquake, the distance from its source, and the type of soil through which the seismic waves are traveling. If it is strong enough, this motion can damage or destroy buildings, roads, bridges, and other facilities. Earthquakes can also cause permanent movement of the ground, either through slippage along fault lines and steep slopes or through the way the shaking affects the soils. One of the most damaging effects of earthquakes is liquefaction, which results when seismic shaking causes certain soils to act like liquids (see definition at right). As shown in *Exhibit 2-14,* several liquefaction zones are present in the project area.

In the Puget Sound region, engineers must take seismic risks into account when they design new facilities or rebuild existing ones. Under current codes and design standards, these facilities are constructed to withstand the level of motion caused by a specified theoretical earthquake. Known as the "design acceleration," this level of motion is based on the probability of an earthquake happening during the useful life of the facility and the type of ground motion likely to occur.

Bridges are structures of particular concern in planning for earthquakes. As shown in *Exhibit 1-2,* the Portage Bay Bridge and west approach to the Evergreen Point Bridge in the Seattle project area were built at an earlier stage in the development of seismic design standards, and their features

Earthquakes and Floating Bridges

Floating bridges aren't affected directly by ground shaking from earthquakes like land-supported bridges. However, some very deep, low-frequency earthquakes can cause surface waves on the lake similar to a tsunami. This is referred to as a "seiche." Typically, the waves from a seiche create less stress in the pontoons of the bridge than wind-induced waves from a rare severe storm—a once-in-100-year event. If the anchors are located on a soft slope on the lake bottom, an earthquake can create an underwater landslide, causing the anchors to slip or move. Slippage in the anchors could create large bending stresses in the pontoons.

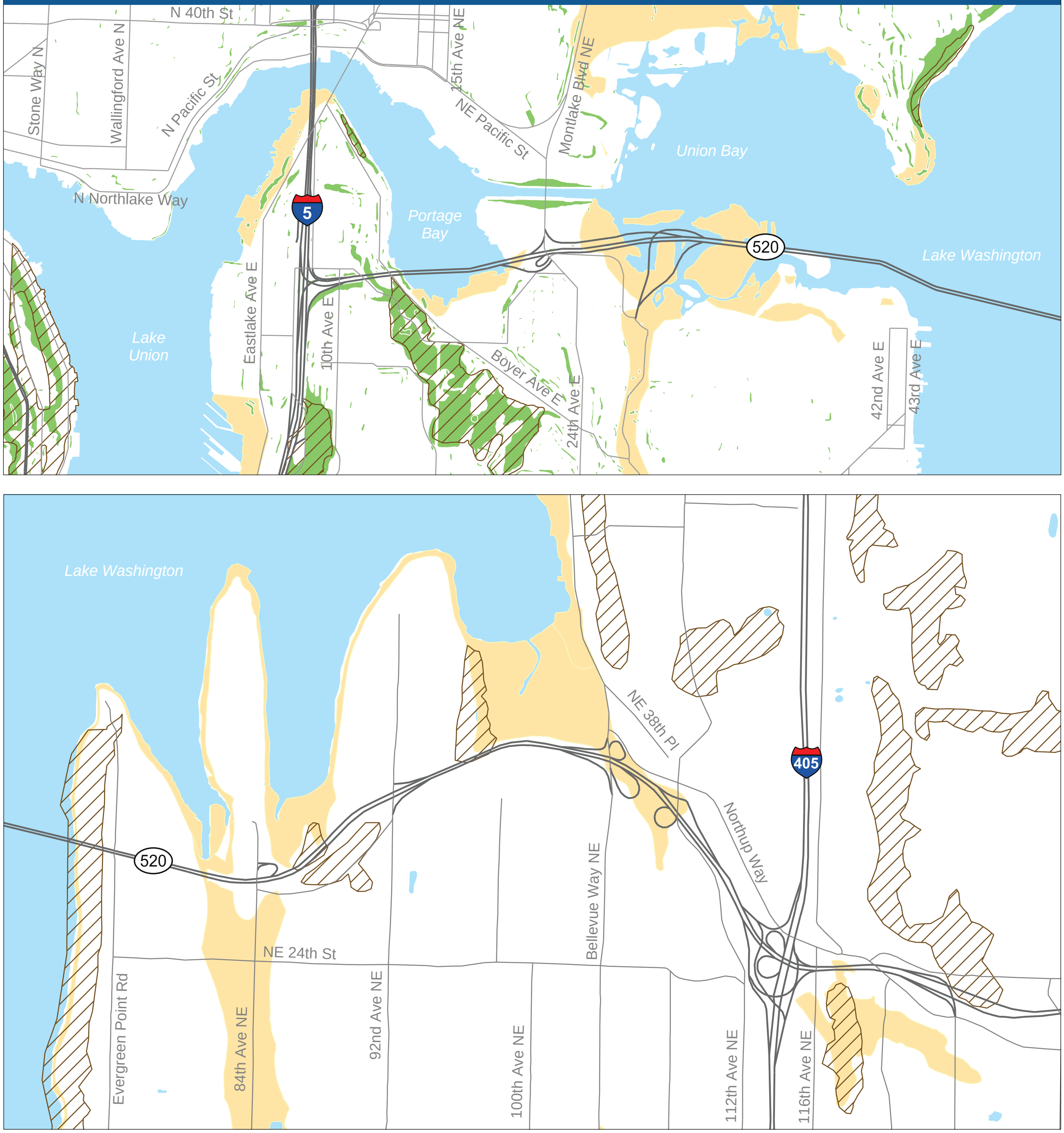
DEFINITION

Liquefaction and Landslide Hazards

Liquefaction occurs when an earthquake shakes loose, fine-grained soils (such as sand) that are saturated with water. Seismic waves from the earthquake create changes in the soil that cause it to behave like a liquid. Structures on top of these soils, such as bridges, can collapse during earthquakes because the soil no longer supports them. Fortunately, soils that are likely to liquefy are easy to identify, and have been widely mapped in the Puget Sound region.

Landslide hazards are generally defined as any slopes steeper than 40 percent. In some cases, landslides can occur on less-steep slopes where sand is layered with silt or clay, where there are springs or seeps, or where there is other evidence of past landslides, such as deposits of debris at the bottom of the slope. All jurisdictions in King County are required to map landslide and seismic hazard areas within their boundaries, along with other environmentally critical areas.

Exhibit 2-14. **Geologic Hazard Areas**



Erosion/Potential Landslide Area

Liquefaction Zone

Steep Slope
(Data available for City of Seattle only)

NORTH

0 1,000 2,000 Feet

SOURCES:
King County (2003) GIS Data (Erosion/Potential Landslides); City of Seattle (2003) GIS Data (Erosion/Potential Landslides, Liquefaction Zones, and Steep Slopes); City of Bellevue (2004) GIS Data (Liquefaction Zones).

as designed and constructed are highly vulnerable to earthquake damage. Although seismic retrofitting has addressed some of the problems, these bridges are still twice as likely to be damaged by an earthquake as bridges built to today's minimum design standards.

The Natural Systems of the SR 520 Project Area

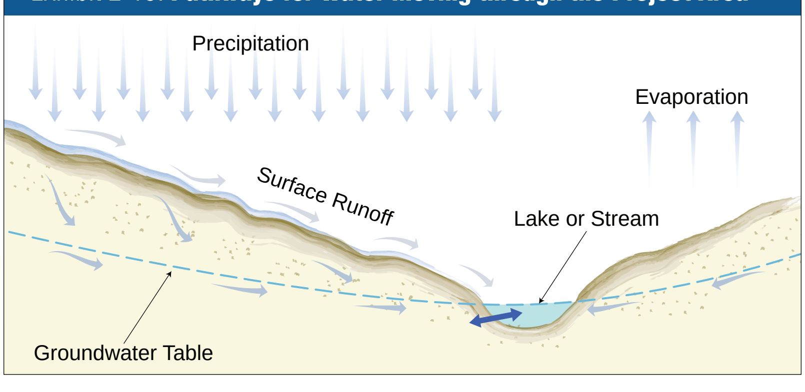
The present-day water bodies of the project area, which occupy basins and channels left behind by the glaciers, are central to the area's ecosystems. Human engineering and development has had major effects on the character of these water bodies and ecosystems. Nevertheless, a wide variety of species makes use of habitats in Seattle, Lake Washington, and the Eastside. This section gives an overview of the types and functions of environmental features found in the project area —water bodies, wetlands, fish, and wildlife. Subsequent chapters provide more detail on specific ecosystems in the Seattle, Lake Washington, and Eastside project areas.

How do water bodies function in an ecosystem?

Water flows through the project area in numerous surface water bodies such as streams, lakes, and wetlands. It flows across soil, vegetated areas, and pavement as stormwater; and it flows below the earth's surface as groundwater. While surface water, stormwater, and groundwater are all regulated and managed separately, all of them are interconnected and interdependent. *Exhibit 2-15* shows how stormwater runoff percolates into the ground and becomes groundwater, and how groundwater moves in and out of surface water bodies.

The entire project area is characterized by urban development, but the level of development differs from one location to another. Seattle encompasses intense commercial, industrial, and residential development and a dense grid of roadways. The Eastside contains both urban and suburban areas that are somewhat less densely developed than Seattle. Urban and suburban development covers the landscape with sidewalks, streets, parking lots, and buildings—impervious surfaces that change the flow of water dramatically from natural conditions. These surfaces prevent

Exhibit 2-15. **Pathways for Water Moving through the Project Area**



Water Quality Problems in the SR 520 Project Area

The Washington State Department of Ecology maintains a list of lakes, streams, and ponds in Washington state whose water quality doesn't meet regulatory standards. This list is known as the "303(d) list," after the section of the Clean Water Act that requires states to track this information. You can view the 303(d) list at *http://www.ecy.wa.gov/ programs/wq/303(d)/index.html*

All three sections of the project area have water bodies on the 303(d) list, with the most common pollutant being fecal coliforms (the bacteria present in animal feces). Lake Washington, Fairweather Creek, the West Tributary of Kelsey Creek, and Yarrow Creek are all on the 303(d) list for exceeding fecal coliform standards. Fairweather Creek and the West Tributary to Kelsey Creek also exceed the standard for temperature, which is a key factor in fish habitat. Lake Union is on the 303(d) list because it exceeds the standard for dieldrin (a pesticide). The lake also failed to meet standards for sediment bioassays, meaning that test organisms placed in Lake Union sediments did not survive or grow when compared with control sediments.

rain from percolating into the ground, lowering groundwater levels and summer stream flows. They also alter the distribution and movement of both surface water and groundwater. The rapid discharge of rain runoff from paved areas into receiving water bodies—very different from natural conditions, where rain absorbed into the ground or runoff is slowed by vegetation—results in high, fast stream flows during rainstorms that can damage streambeds and flood surrounding areas. These conditions also reduce the quality of habitat in urban streams and lakes.

If not treated, runoff (stormwater) from roadways, parking lots, and other paved areas carries pollutants like oil, sediment, and dissolved or particulate metals directly into surface waters. Pollutants in runoff are one of a number of reasons that water quality in the project area and the region is degraded. The Washington State Department of Ecology maintains a list of water bodies where water quality has deteriorated to the point that it impairs swimming, fishing, and/or use by aquatic species. A number of water bodies in the project area are on this list because of high pollutant levels, high temperatures, and/or low levels of oxygen. All these characteristics are common symptoms of urban waters, and all lower the water bodies' value as habitat for fish and wildlife.

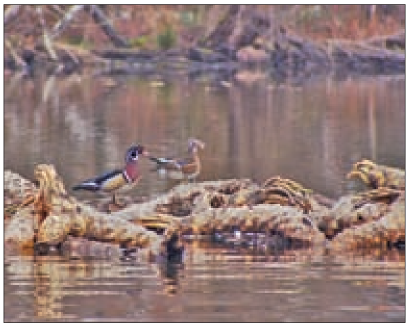
What are wetlands, and what types of wetlands are found in the project area?

The defining feature of a wetland is the presence of water at or near the soil surface, either constantly or at certain times of year. By saturating the soil, the water alters its chemistry, helping to determine the types of plants and wildlife that can live there. Agencies that regulate wetlands, including the Corps of Engineers and Ecology, consider an area a wetland only if it meets specific criteria for hydrology (i.e., saturation), soil types, and plant communities. A wetland must have water for a sufficient period of time during the growing season to create anaerobic soil conditions (i.e., soils with little or no oxygen) and to support plant communities adapted to those conditions.

Wetlands provide economic and ecological benefits through a number of physical, chemical, biological, and social functions. For example, the ability of wetlands to store water and remove sediments can reduce downstream flooding and improve overall water quality. The presence of wetland vegetation slows water as it flows, reducing streambank and shoreline erosion. Many wetlands support diverse types of vegetation that provide food and habitat for wildlife. Wetlands in the project area receive water from several sources. Some are located along the shores of Lake Washington and Portage Bay, where water is present throughout the year. Others are located along streams, on hill slopes, or in depressions in the ground surface. These wetlands receive water when the streams overflow their banks, from subsurface flow when groundwater is close to the surface, and/or directly from rainfall. Many form in fine, poorly drained

Forested wetland on Lake Washington

Forest, shrub, and emergent wetland



Wood ducks in the Arboretum

soils, like those found along the shore of the lake, or in areas where water perches atop impermeable layers such as glacial till.

Scientists classify wetlands according to a complex system that defines categories based on size, vegetation, and water source. In addition, many federal, state, and local agencies have developed guidelines and regulations for the rating and protection of wetland systems. Appendix E, Ecosystems Discipline Report, provides a summary of the applicable standards for jurisdictions in the project area**.**

What kinds of animals, birds, and fish live in project area habitats?

Lakes, streams, and wetlands—as well as the upland areas of the SR 520 corridor—support many species of mammals, reptiles, amphibians, and birds. Although the diversity of these species is much diminished from pre-settlement times, the project area contains some high-quality habitat and a wide array of animal and bird life. Biologists identify three general types of habitat along the corridor: urban matrix, open water, and parks and other protected areas.

Urban landscapes make up almost two-thirds of the project area. They are dominated by commercial and residential land uses with buildings, pavement, ornamental gardens, lawns, and scattered trees. Wildlife habitat in these areas is limited, although roadside and ornamental trees provide some habitat for common birds. Open water, which makes up 29 percent of the project area, is notable for its prevalence of waterfowl. (The proximity of water is also important for bald eagles.) Although they make up only about 7 percent of the total area, forested parks are an important habitat because they often preserve complex, intact upland, riparian, and wetland plant communities. Because of this, the forested parks contain some of the urban area's most diverse wildlife.

The Lake Washington watershed also supports diverse fish species, including several species of native salmon and trout. Puget Sound salmon are anadromous, which means that they migrate from fresh water to salt water as juveniles, then return from the sea as adults to spawn in their native freshwater streams. In the Lake Washington system, all these fish pass through Lake Washington and the Ship Canal on their way to and from the ocean, making these project area waters a critical resource for fisheries. Although urban development over the last century has destroyed or degraded much of the habitat that once supported salmon life cycles and migration patterns, project area water bodies—especially the Lake Washington shoreline—remain important resources for salmon rearing and migration.

Different types of salmon have different habitat requirements, but most species share some common needs: cool, clean water; stream channels with gravelly riffles upon which to spawn and for feeding and resting; and large pieces of woody debris, which provide both shelter for the fish and food for the insects they eat. Except for sockeye, which spawn in some loca-

Fish Species in Urban Streams

In spite of the challenges of urban waterways—pollution, altered stream channels, and barriers to passage—many fish species inhabit the Lake Washington watershed. They include several species of salmon that migrate from fresh to salt water and back, along with other fish that remain in fresh water throughout their life cycle.

Native salmon species that occur within the project area include Chinook, coho, and sockeye (kokanee) salmon; steelhead/rainbow trout; and cutthroat and bull trout. Other native fish include threespine stickleback, peamouth chub, and several species of sculpin. Introduced species, such as smallmouth and largemouth bass, yellow perch, and northern pikeminnow, are also found in large numbers in Lake Washington.

A great blue heron

tions on the Lake Washington shoreline, the salmon migrate from the lake up the rivers and streams that drain into it as they prepare to reproduce. Young salmon mature in the lake, and juvenile Chinook salmon seek food and refuge from larger fish in the natural areas of the shoreline, where they seek out areas of water less than 3 feet deep with sandy gravel beneath. Shoreline areas armored with bulkheads and riprap, on the other hand, generally have deeper water that is favored by predator species. Broad, muddy shorelines that support water lilies, Eurasian milfoil, and other introduced species also provide habitat more suitable for juvenile salmon predators than for the salmon themselves.

What species are specially protected by law?

The federal Endangered Species Act (ESA) protects plant and animal species that are in danger of extinction. The ESA establishes a formal process for "listing" a species as threatened or endangered. Once a species is listed, anyone proposing to develop a project that uses federal money or needs a federal permit must consult with the federal resource agency in charge of managing that species and prepare studies to determine if the species and its habitat will be harmed as a result of the project. Anyone who kills or harms a listed species or its habitat without consulting with the resource agencies can be prosecuted under the law. The ESA defines a process that identifies species as candidates for listing before they are formally proposed for listing. Once a species is proposed, the public and agencies have a chance to comment before the listing becomes final. This process generally takes 1 to 2 years.

Three species found in the project area are listed under the ESA: Chinook salmon, bull trout, and bald eagle. A fourth species—steelhead, which are the sea-going form of rainbow trout—were proposed for listing as threatened in March 2006.

The state of Washington also keeps a list of threatened and endangered species that might not qualify for federal listing but are protected by state laws. Those species found in the project area—all birds—include peregrine falcon, western grebe, common loon, great blue heron, hooded mergansers and wood ducks, band-tailed pigeon, pileated woodpecker, and red-tailed hawk. Raptor nests and eggs are also protected by the federal Migratory Bird Treaty Act and by Washington state law.

What water bodies and wetlands are present in Seattle, and what species use them?

Project area water bodies in Seattle include Lake Union, Portage Bay, the Montlake Cut, Union Bay, and Lake Washington. Like all waters in the project area, they are part of the Lake Washington/Cedar River Watershed, which is within the state's Water Resource Inventory Area (WRIA) 8. The Seattle project area contains a number of smaller basins,

KEY POINT

Endangered Species Act

Three Endangered Species Act (ESA)-listed species are found in the project area: Chinook salmon, bull trout, and bald eagle. Steelhead, a species of salmonid, have recently been proposed for listing as threatened.

Bald eagle's nest in the project area

as shown in *Exhibit 2-16.* These basins are defined by the local topography that determines where surface water flows. For example, stormwater within the Portage Bay basin, if not diverted by drainage or into sewage, will flow by gravity into Portage Bay. Wetlands located in the Seattle project area are shown in *Exhibit 2-17.* In the sections below, water bodies, wetlands, and their plant and animal resources in the project area are discussed by basin.

Exhibit 2-16. **Basins and Streams Located in the Seattle Project Area**

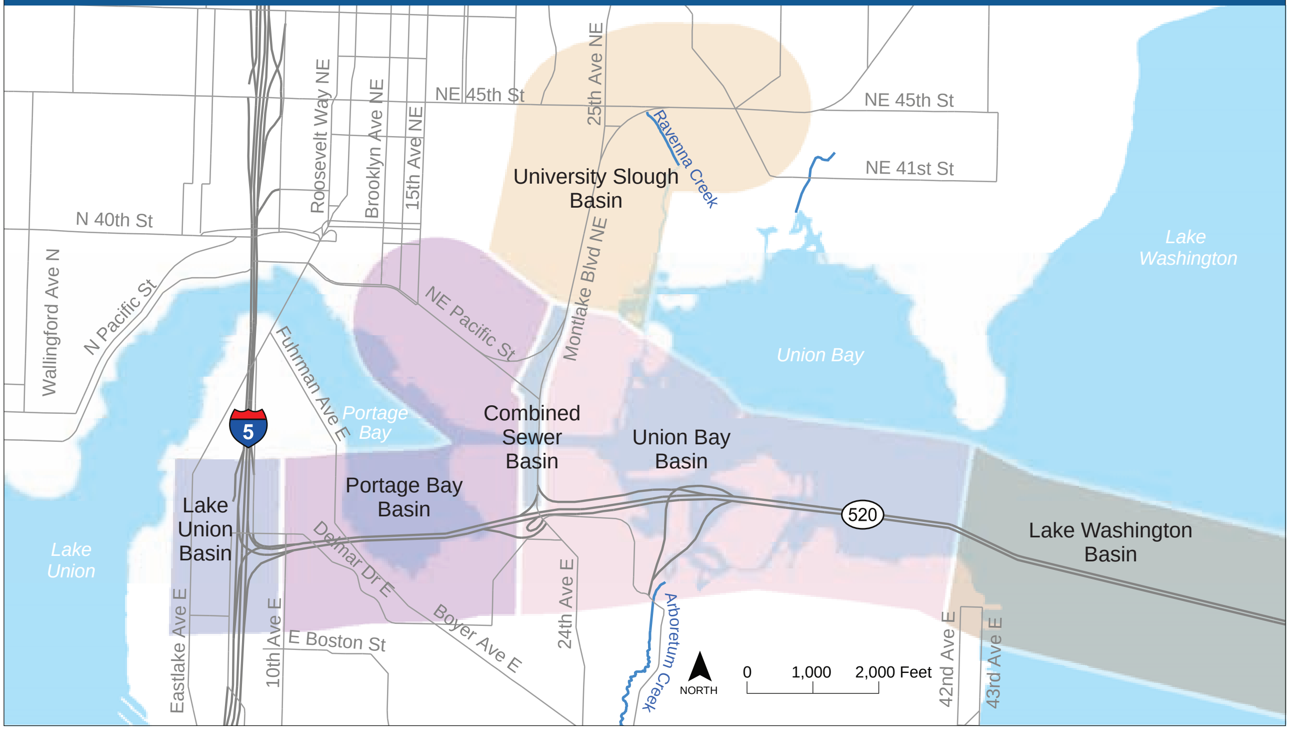
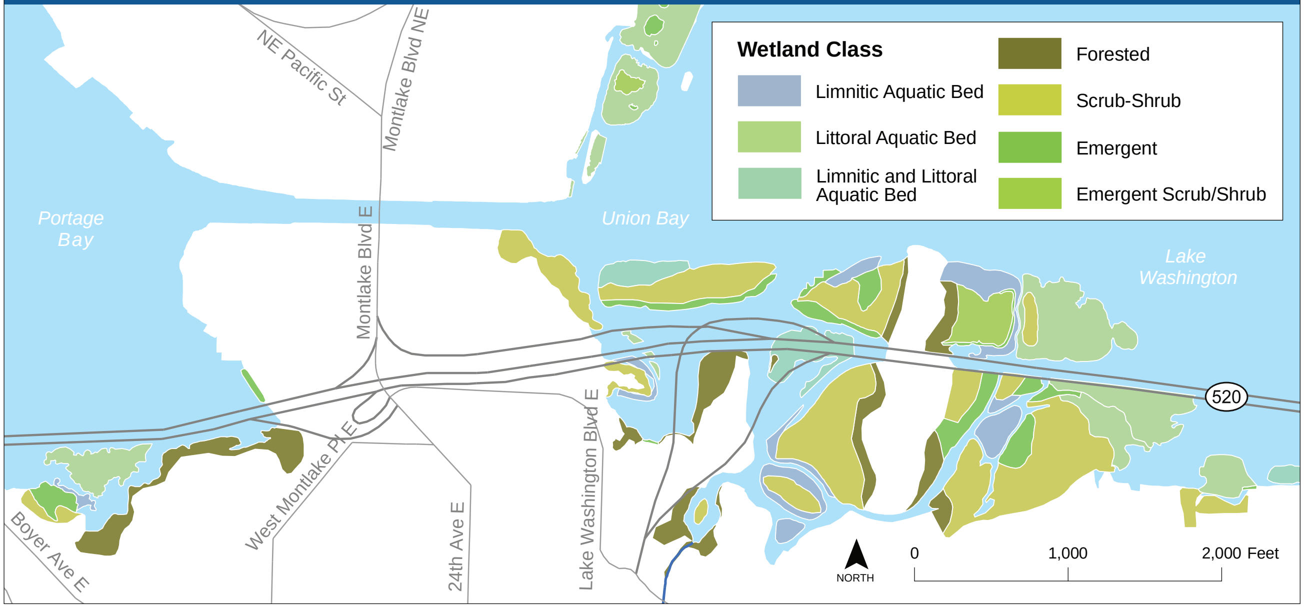


Exhibit 2-17. **Wetlands in the Seattle Project Area**

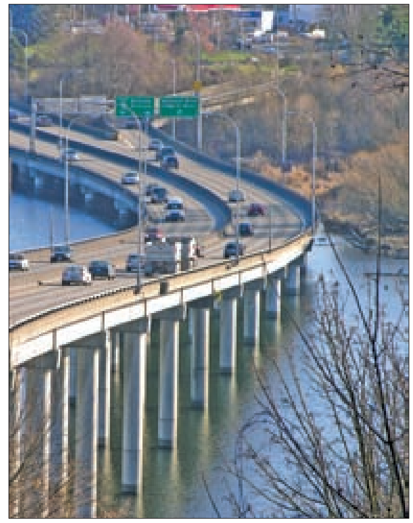


SOURCE: City of Seattle (2003) GIS data (wetlands); Field updates by Parametrix, 2002-2004.

Lake Union and Portage Bay Basins

The quality of the water in Lake Union and Portage Bay is influenced by pollutants carried in urban stormwater, discharges from boats, and releases of mixed stormwater and sanitary sewage that occasionally overflow from Seattle's old sewer system during heavy rains. In the deep sediments at the lake bottom, metals and toxic organic compounds have accumulated over many decades of past industrial operations, like those that occurred at the "Gas Works" (now a Seattle park). Lake Union contains contaminated sediments and exceeds the state's water quality standards for dieldrin (a pesticide).

Lake Union, Portage Bay, and the Montlake Cut are critical passageways between the fresh water (where salmon spawn and develop) and the salt water salmon seek as adults. These water bodies, surrounded by highly developed urban areas, receive most of the stormwater discharge from the surrounding basins. In most areas, shorelines are heavily armored with riprap, and water levels are controlled (as is also the case for Lake Washington) by the U.S. Army Corps of Engineers through the operation of the Ballard Locks. All salmon species in the Lake Washington watershed travel through the water bodies as they migrate to and from Puget Sound, but the highly altered characteristics of their banks and shallow water areas limit their value as habitat.



Two wetlands lie along the Portage Bay shoreline in the project area. The northernmost is a 0.3-acre wetland with vegetation composed primarily of cattails, while the other—much larger—wraps around the entire southern shoreline of the bay and includes several plant communities.

Two wetlands lie along the Portage Bay shoreline in the project area *(Exhibit 2-16).* The northernmost is a 0.3-acre wetland with vegetation composed primarily of cattails, while the other wetland—about 9 acres altogether—wraps around the entire southern shoreline of the bay and includes several plant communities that provide some habitat for animals.

Union Bay Basin

East of Portage Bay, along the shores of Union Bay, lies a large wetland complex that includes portions of the University of Washington campus and the Washington Park Arboretum. *Exhibit 2-17* shows this wetland complex. Vegetation in these wetlands helps to control erosion and stabilize the shoreline, which is an important feature because of wakes from the area's heavy boat traffic. The wetlands also filter sediments and pollutants from the water, produce organic matter that nourishes aquatic life, and provide habitat for a variety of birds and other wildlife. In addition, the wetlands provide social value, offering opportunities for educational and recreational use—particularly in the Washington Park Arboretum.

Vegetation in the Union Bay Basin wetlands helps to control erosion and stabilize the shoreline, which is an important feature because of the area's heavy boat traffic.

The Union Bay wetland ecosystems include a wide variety of wildlife species. Red-eared slider turtles can often be seen sunning at Foster Island, and Pacific tree frogs live in the wetlands that surround the island. Numerous waterfowl also use the wetlands; great blue heron and kingfisher hunt here and in the nearby waters. Wetland-dependent mammals include river otter and beaver, while more casual wetland users include opossum, raccoon, mice, moles, rats, and voles. A bald eagle territory encompasses the Union Bay wetlands and areas to the south, with three nest sites located in the Arboretum. Here, peregrine falcons prey on pigeons and waterfowl, while pileated woodpecker and red-tailed hawk forage in the Arboretum from time to time. Despite the closeness of the city and the noise of traffic on the highway, diverse plant and animal communities survive in these small remnants of high-quality habitat.

How healthy is Lake Washington, and what species use it?

Over the last half-century, Lake Washington's water quality has improved dramatically. Until the 1950s, communities on all sides discharged sewage directly into the lake. The nutrients in the sewage provided food for blue-green algae, resulting in burgeoning algae growth and a corresponding drop in the lake's oxygen level. These changes, known as eutrophication, are symptoms of an unhealthy lake because the low oxygen levels in the water do not allow fish to survive. Citizen and government concern about the plight of the lake prompted the creation of Metro, a government agency that constructed a regional sewage collection and treatment system. Between 1963 and 1967, Metro diverted old septic system discharges from Lake Washington to the West Point and Renton Treatment Plants, dramatically improving water quality in the lake.

Today, water quality in Lake Washington is considered acceptable for most fish, wildlife, and human uses. However, the lake is included on Ecology's 303(d) list because it exceeds the standard for fecal coliform bacteria. Other potential sources of pollutants in stormwater runoff include lawn and yard-care chemicals, vehicle pollutants, and wastes from pets and other animals.

As discussed earlier, Lake Washington is an extremely important habitat area for salmon and other fish. Juvenile Chinook salmon swim in shallow water along the shoreline; sockeye salmon have been known to spawn directly under the east end of the Evergreen Point Bridge; and juvenile sockeye commonly live in the lake's open water for a year before venturing out to sea. The U.S. Fish and Wildlife Service identifies the lake as critical foraging, migration, and overwintering habitat for threatened bull trout. Along the shorelines and shallow water areas of Portage Bay and Union Bay, species adapted to shallow water habitats—many of them non-native predators of salmon and other native fish—thrive amid the abundant aquatic vegetation. Wildlife species that favor open-water habitats make extensive use of the lake; among these are waterfowl, eagles, great blue herons, kingfishers, river otters, and beaver.

What water bodies and wetlands are present on the Eastside, and what species use them?

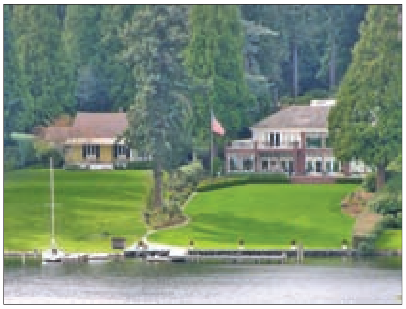
Water bodies in the Eastside project area are very different than those in Seattle, consisting mainly of small streams that drain into Lake

Urban Pollutants

Urban and suburban areas generate a wide range of pollutants from many sources. The pollutants include sediments from development and new construction; oil, grease, and chemicals from motor vehicles; nutrients and pesticides from turf management and gardening; viruses and bacteria from failing septic systems; road salts; and heavy metals from automobile tire and brake wear.

Sediments and solids make up most of the pollutants that flow into urban surface waters during storms.

Automobile, truck, and bus traffic traveling on SR 520 would likely generate only a small subset of this list of potential pollutants. Vehicles could act as sources of metal (such as copper, zinc, and cadmium from brake and tire wear), hydrocarbons (oil and grease from leaky engines and pollutants from engine exhaust), and suspended solids (from dirt on car exteriors and tires, and brake and tire wear particles).



Potential sources of pollutants in stormwater runoff include lawn and yard-care chemicals.

Washington and wetlands at the margins of the streams and the lake. SR 520 crosses five basins in the Eastside project area: Fairweather Creek, Cozy Cove, Yarrow Bay Wetland, Yarrow Creek, and the West Tributary to Kelsey Creek. All have lower proportions of impervious surface to overall area than the Seattle basins. *Exhibit 2-18* shows the locations of the basins, and *Exhibit 2-19* shows the locations of wetlands in the Eastside project area.

Despite the less developed condition of the Eastside basins, their streams face water quality and habitat challenges. Most have characteristics that violate state water quality standards because of high temperatures and bacterial contamination. Because these streams flow through suburban residential areas, many have lost their protective fringe of riparian vegetation and been forced into engineered channels. This alteration increases the speed of the stream and reduces the areas where fish can rest. And in places where the streams pass beneath roads, culverts carrying the water under the roadway often pose barriers to fish passage because they are misaligned, clogged with debris, or flow so forcefully that they sweep fish back downstream. As a result, habitat conditions are compromised in most of the Eastside streams—especially for salmon, which are sensitive to instream habitat conditions.

Water bodies in the Eastside project area are very different than those in Seattle, consisting mainly of small streams that drain into Lake Washington and wetlands at the margins of the streams and the lake.

Exhibit 2-18. **Basins and Streams in the Eastside Project Area**

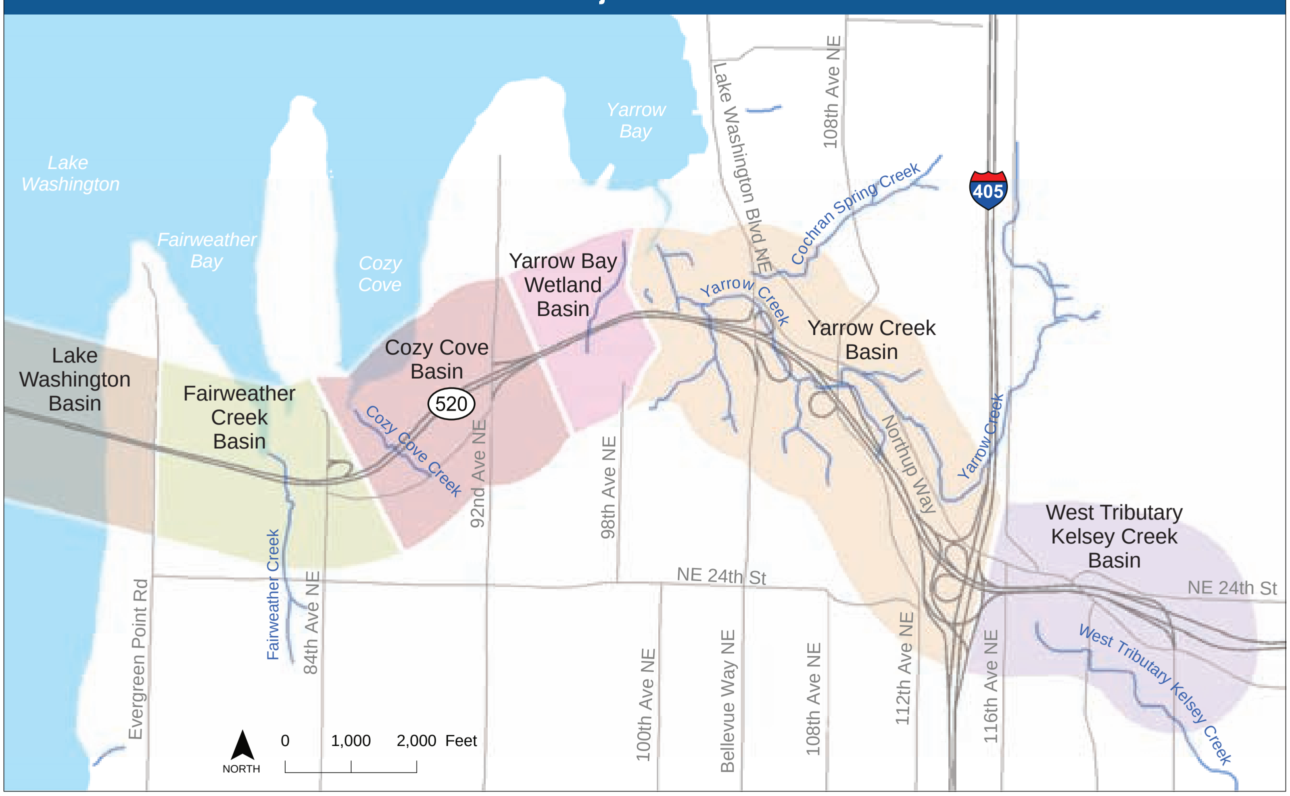
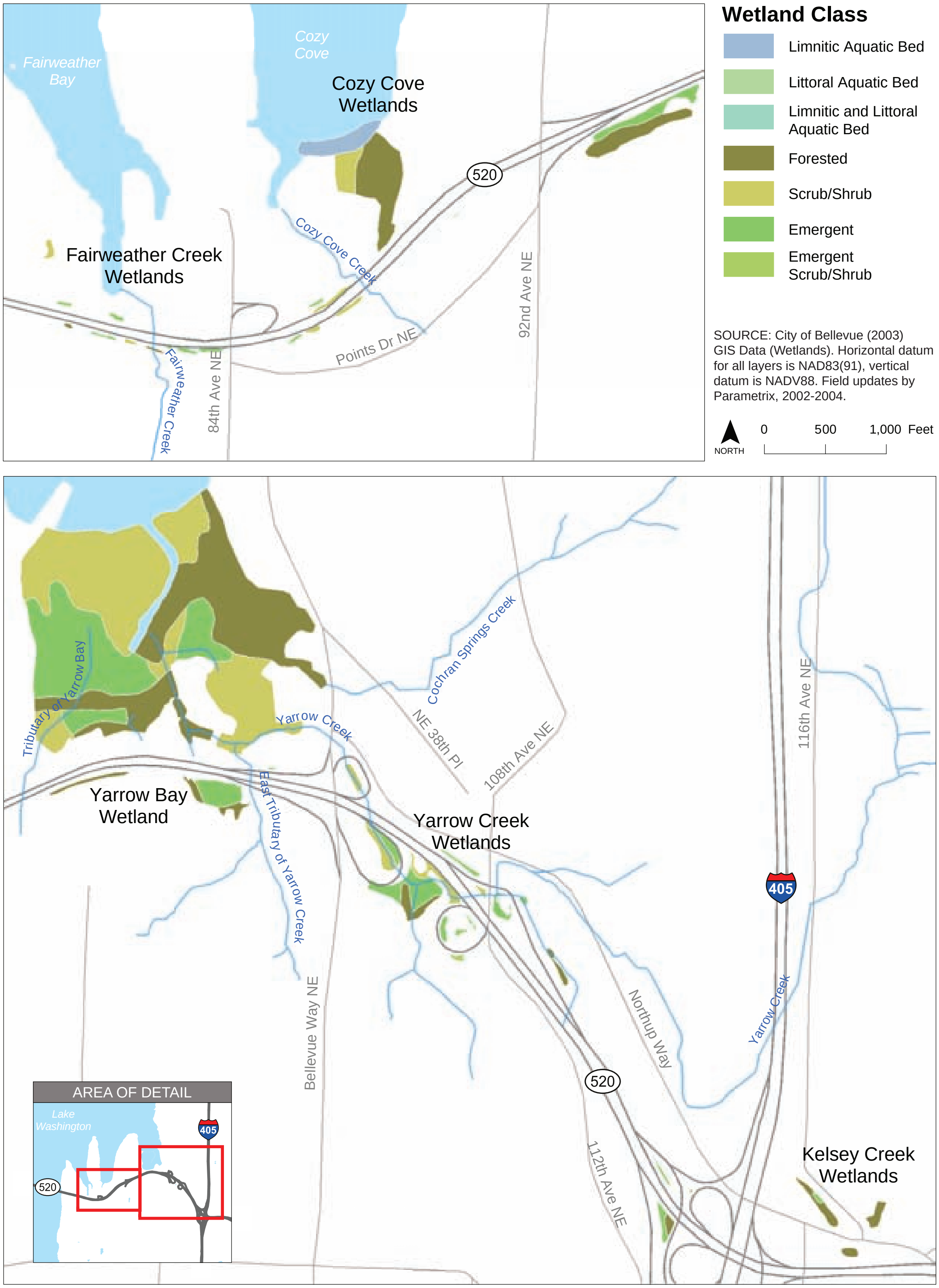


Exhibit 2-19. **Wetlands in the Eastside Project Area**



Fairweather Creek Basin

Fairweather Creek, for which the westernmost of the Eastside basins is named, is a 1.4-mile-long stream located in Medina and Hunts Point. Originating at the Overlake Golf Course ponds, the creek flows generally north into Fairweather Bay through its small, urban residential basin. Development has greatly altered conditions in the creek. It is rock-lined in places, and little native vegetation remains along its banks. Beginning at the golf course ponds, Fairweather Creek passes through four culverts (including one under SR 520) before entering Lake Washington at Fairweather Bay. *Exhibits 2-18* and *2-19* show the basin, creek, and wetlands.

Development has greatly altered conditions in Fairweather Creek.

The altered channel conditions combine with poor water quality so that Fairweather Creek is only marginal habitat for salmon. The creek's temperatures and fecal coliform bacteria levels sometimes exceed state standards. In spite of this, coho salmon and cutthroat trout have been known to use the stream for rearing. Chinook salmon are not known to rear in the creek, and the degraded condition of the stream channel makes it unlikely that salmon spawn there. No salmon have been reported recently upstream of SR 520, probably because fast flows during storms impede fish passage through the two culverts under the highway.

The Fairweather Creek basin in the project area contains six small wetlands, most of which parallel SR 520 to the north and south. Because of their small size—the largest is only 0.2 acre—they generally do not provide extensive habitat, but may support bullfrogs, tree frogs, and common birds.

The Cozy Cove basin contains one large, high-quality wetland, located in Wetherill Park.

Cozy Cove Basin

East of the Fairweather Creek basin is the smaller Cozy Cove basin *(Exhibit 2-18),* through which 0.5-mile Cozy Cove Creek flows northwest into Lake Washington. SR 520 crosses the creek about 1,000 feet south of where it reaches the lake. Upstream of SR 520, the creek flows between several homes through a landscaped trail system. For most of its length downstream from the highway, the channel has been extensively altered, and most of the bank is armored by riprap. Just before flowing into the cove, the creek passes through a wetland.

The fish resources of Cozy Cove Creek have not been thoroughly inventoried, but scientists observed juvenile cutthroat trout during a survey in 2002. Young coho and possibly Chinook salmon migrating along Lake Washington's shoreline may use the stream's lower reaches or the wetland at its mouth for rearing, although the habitat is quite degraded from its natural conditions. About 540 feet upstream of SR 520, a culvert under Northeast 28th Street prevents fish passage because its outlet is perched over 4 feet above the stream channel. The creek receives runoff from landscaped lawns, residential streets, and SR 520, and probably contains similar types and levels of pollutants to other streams in the area.

The Cozy Cove basin contains one large, high-quality wetland, located in Wetherill Park, and several smaller wetlands near SR 520 *(see Exhibit 2-18).* The Wetherill Park wetland provides good habitat for invertebrates and amphibians. Wood ducks use this wetland, as do other bird species similar to those found in the Seattle project area wetlands.

Yarrow Bay Wetland Basin

The Yarrow Bay wetland basin lies east of the Cozy Cove basin *(Exhibit 2-19).* The Yarrow Bay wetland basin is named for an extensive wetland system that covers more than 75 acres at the south end of Yarrow Bay. A 0.6-mile-long, unnamed creek originates from a storm drainage pipe in Clyde Hill, crosses under SR 520, and flows down a steep, wooded ravine to discharge into the wetland. Upstream of SR 520, a long culvert under the highway and Northeast Points Drive forms a complete barrier to fish. Downstream from the culvert, well-developed riparian vegetation surrounds the creek as it flows through the ravine into the Yarrow Bay wetland. Fish have not been inventoried in this creek, but based on its size and condition, it could support cutthroat trout and perhaps coho salmon.

The large Yarrow Bay wetland is located in the city limits of Kirkland *(see Exhibit 2-19).* It contains diverse plant communities, with a wider range of vegetation than is found in other project area wetlands. Like the Wetherill Park wetland, this wetland is extremely valuable as habitat, for providing erosion control and shoreline stabilization, and for public education and recreation. Species found in this wetland are similar to those in the Wetherill Park wetland, but the larger and more complex plant communities here are likely to support more diverse animal and bird life. Four other wetlands of varying sizes in the Yarrow Bay basin provide less habitat value than the large Yarrow Bay wetland.

Yarrow Creek Basin

Yarrow Creek also drains into the Yarrow Bay wetland, but it flows through a different basin, most of which lies east of Lake Washington Boulevard. Yarrow Creek originates in Bridle Trails State Park and the surrounding residential area. In the project area, it flows in roadside ditches along Northup Way and crosses SR 520 twice in pipes. A portion of it passes through an open channel located in the cloverleaf interchange at the Lake Washington Boulevard westbound on-ramp. Yarrow Creek crosses several municipal boundaries, including Yarrow Point, Kirkland, and Bellevue. Several small tributaries join the creek just before it reaches Lake Washington. *Exhibit 2-18* shows the basin, the creek, and its tributaries.

Conditions in the stream vary greatly from one reach to another. The middle reaches of the creek, where it crosses SR 520 and two other roads in six culverts, are degraded. The upstream and downstream reaches, however, provide good habitat. The east tributary of the creek also has good habitat conditions, but a culvert that carries the stream under SR 520 blocks fish passage to habitat in the upper creek. State records document the Yarrow Creek mainstem as having high levels of fecal coliform bacteria. Otherwise, the creek's water is relatively clean.

Although Yarrow Creek and its tributaries have some of the best fish habitat of the Eastside project area streams, the fish resources of the creek have not been extensively studied. Historical records show that coho salmon spawned in the mainstem, and juvenile coho have been found in Cochran Springs Creek *(see Exhibit 2-18),* suggesting that they use the stream channels through the wetland. Cutthroat trout live all along Yarrow Creek from Yarrow Bay to Bridle Trails State Park. Chinook salmon migrating along the Lake Washington shoreline may use the mouth of the creek and the Yarrow Bay wetland for rearing. Despite the good habitat conditions on the east tributary, the impassable culvert makes it unlikely that any salmon can reach either tributary for spawning.

Of all the Eastside basins, the Yarrow Creek basin is notable for its large number of riparian wetlands *(see Exhibit 2-19).* These wetlands form an intricate pattern around the mainstem of the creek. Many vegetation communities are represented, with typical species including red alder, willows, hardhack, cattails, and non-native reed canarygrass and blackberry. By slowing stream flows and providing storage space for flood waters, these riparian wetlands help keep the stream channel from eroding. Their vegetation feeds a variety of wildlife and provides connections to other habitat areas upstream and downstream. Their usefulness for recreation and education is limited, however, since most are located on private land.

Of all the Eastside basins, the Yarrow Creek basin is notable for its large number of riparian wetlands.

Kelsey Creek Basin

At the eastern edge of the Eastside project area lies the Kelsey Creek basin, shown in *Exhibit 2-18.* Kelsey Creek and several tributaries drain this basin, flowing south through Bellevue and eventually entering Lake Washington just north of I-90. In the project area, the 2.4-mile-long West Tributary to Kelsey Creek originates southeast of the interchange of I-405 and SR 520 and flows south to meet the Kelsey Creek mainstem at Kelsey Creek Park. Its upper reaches, west of 124th Avenue Northeast, are confined to culverts with no fish habitat. Although Chinook and coho salmon use downstream areas of the creek for all life stages, the culverts deter fish from accessing the project area.

Several wetlands lie in the Kelsey Creek basin within the project area *(see Exhibit 2-19).* Scattered among the ramps of the I-405/SR 520 interchange and the nearby street network, they range in size from one-hundredth to seven-tenths of an acre. The small size and isolation of these wetlands limit the functions and habitat values they provide.