Chapter 3
Affected Environment

The Elliott Bay Seawall is located at the interface between a densely developed urban area and a marine environment that supports a wide variety of aquatic life. As a result, the project has the potential to affect many elements of the built and natural environment. This chapter identifies important features of the project area that could be affected by construction and operation of the new seawall. It summarizes information from the discipline reports appended to this Draft EIS, along with information from other technical reports that have been prepared for the project.

3.1 Transportation

Roadway Network

The study area for transportation includes the Alaskan Way corridor between Broad Street (north) and S. King Street (south). In addition, the analysis evaluates transportation facilities in the Belltown, Downtown and South of Downtown (SODO) districts, where operations would be most directly influenced by modifications to Alaskan Way. The transportation network in the vicinity of the seawall consists mainly of arterial roadways. Figure 3-1 provides an overview of the transportation facilities in the study area.

Accessibility

Alaskan Way is the westernmost surface street adjacent to Elliott Bay. As such, it serves waterfront businesses and services, including the Colman Dock Ferry Terminal, the Bell Street Pier Cruise Terminal, the Seattle Aquarium, and Fire Station No. 5. On the east side of Alaskan Way, south of Pine Street, is the Alaskan Way Viaduct (SR 99), an elevated roadway. There is surface parking and a roadway under the Alaskan Way Viaduct. North of Pine Street (where the viaduct heads east toward the Battery Street Tunnel), the east side of Alaskan Way is flanked by residential uses, parking structures, and retail/commercial uses. Due to the presence of the Alaskan Way Viaduct and the steep incline from the waterfront to downtown, there are limited connections between Alaskan Way and destinations to the east.

Arterial Roadways

Arterial roadways are those designated as the major thoroughfares for automobiles, trucks, and transit vehicles.

Principal arterials serve as primary routes for trips between urban centers and as connections to the regional transportation network. In the project area, principal arterials include Alaskan Way, Elliott Avenue, Western Avenue, Columbia Street, and Broad Street.

Minor arterials distribute traffic from the principal arterials to local streets. Examples in the project area are Wall Street, Spring Street, and Yesler Way.

Figure 3-1. Elliott Bay Seawall Project transportation context

Existing Transportation Conditions

Roadway Operations for Vehicles

This section describes existing roadway conditions for vehicles in terms of intersection operations during the morning (AM) and afternoon (PM) peak hours of traffic. The analysis was performed at 27 intersections and included the peak-hour vehicle volumes, traffic control, and lane channelization. Summertime conditions, when Alaskan Way experiences a higher volume of traffic, were analyzed to provide a conservative analysis.

Intersection Levels of Service

How well an intersection operates is measured in terms of its level of service (LOS), described in the text box to the right. LOS at existing intersections are shown in Figure 3-2. Most intersections on Alaskan Way operate at LOS A through C. Side-street traffic approaching many of the signalized intersections, particularly in the vicinity of the Colman Dock Ferry Terminal, experiences much more substantial delays than those indicated by the overall LOS for the intersection; however, because the volumes on these side streets are relatively low compared to the overall north-south volumes along Alaskan Way, the cumulative delays at the intersections are low.

At the intersection of Alaskan Way and Pine Street, a stop sign controls the westbound approach, while traffic on Alaskan Way is free flowing. Therefore, the LOS F result represents the delay experienced by relatively few drivers on the westbound approach.

Travel Times

Measuring travel times is an effective way to evaluate the level of congestion in the study area, since the measurement considers the delay experienced by travelers over a longer distance than a single city block. The results of this travel time analysis under existing conditions are shown in Figure 3-3.

On Alaskan Way, the slowest travel times under existing conditions in both the AM and PM peak hour occur southbound between the Seattle Aquarium and the Colman Dock Ferry Terminal. This slow speed is due to the closely spaced signalized intersections on this stretch of Alaskan Way.

Freight Vehicles

In addition to automobiles, Alaskan Way carries a considerable amount of truck traffic. Table 3-1 summarizes the mix of different vehicle types on Alaskan Way for a 24-hour period in October 2010. Heavy trucks (those with three or more axles) make up only a small percentage (3.3 percent or less) of daily traffic along Alaskan Way, while medium trucks (those with two axles and six tires) represent up to 6 percent of daily traffic. As with overall traffic, truck traffic shows morning and evening peaks, and there is also a peak during the middle of the day.

Peak Hour

Peak hour refers to the 60-minute period with the highest traffic volume.

Intersection Levels of Service

Level of service (LOS) is a qualitative description of traffic flow based on such factors as speed, travel time, delay, and freedom to maneuver. Traffic analysts define six levels of service, from LOS A to LOS F, with LOS A representing free-flow traffic conditions and LOS F signifying a facility where traffic volumes exceed the available capacity, resulting in stop-and-go conditions. LOS B through LOS E signify increasing levels of congestion.

Existing Travel Times in the Study Area

The travel time analysis resulted in the following overall findings:

- For most of the segments analyzed, travel times are longer during the afternoon (PM) peak hour than the morning (AM) peak hour, regardless of direction. This is due to increased levels of congestion as a result of higher overall vehicle volumes during the PM peak hour.
- The slowest travel times under existing conditions occur southbound between the Seattle Aquarium and the Colman Dock Ferry Terminal.

Alaskan Way also serves as the overlegal freight route through downtown Seattle. Overlegal freight movements require a permit from SDOT.

Parking

The parking supply in the study area includes private off-street surface lots, structured parking, spaces providing access to individual businesses, and City-owned metered spaces located on-street, as well as spaces in a linear lot under the Alaskan Way Viaduct. Time limits for on-street parking vary from 3 minutes for loading spaces to 2 hours for standard meters. South of S. Jackson Street, there are parking spaces with no time limits. All parking spaces under the Alaskan Way Viaduct are short-term parking with pay stations. The hourly rates and time limits are posted at off-street surface lots.

For purposes of the environmental analysis, the existing conditions were established by a parking inventory conducted in August 2010, prior to the start of construction on the SR 99: Bored Tunnel Project. The inventory was done over 2 days (a Thursday and a Saturday) and covered an area bounded by Broad Street, Elliott Bay, First Avenue/Occidental, and S. King Street. In total, 2,557 spaces were counted in this area, which included all types of publicly available parking whether City-owned or privately owned. Figure 3-1 shows the five areas that were included in the inventory.

Table 3-1. Existing Composition of Vehicles along Alaskan Way (Daily Counts)

Location	Direction on Alaskan Way	Cars	Light Trucks	Medium Trucks (2 axles, 6 tires)	Heavy Trucks (3+ axles)	Buses	Not Classified
Lenora Street	NB	3,786 (74.9%)	596 (11.8%)	145 (2.9%)	94 (1.9%)	49 (1.0%)	385 (7.6%)
	SB	2,791 (67.7%)	554 (13.4%)	176 (4.3%)	65 (1.6%)	63 (1.5%)	473 (11.5%)
S. Washington Street	NB	2,920 (67.5%)	731 (16.9%)	260 (6.0%)	93 (2.2%)	53 (1.2%)	268 (6.2%)
	SB	3,891 (77.5%)	431 (8.6%)	92 (1.8%)	165 (3.3%)	13 (0.3%)	430 (8.6%)
S. Royal Brougham Way	NB	3,372 (72.7%)	729 (15.7%)	188 (4.1%)	114 (2.5%)	17 (0.4%)	216 (4.7%)
	SB	2,167 (70.3%)	572 (18.5%)	152 (4.9%)	60 (1.9%)	21 (0.7%)	112 (3.6%)

Notes: NB – northbound, SB – southbound

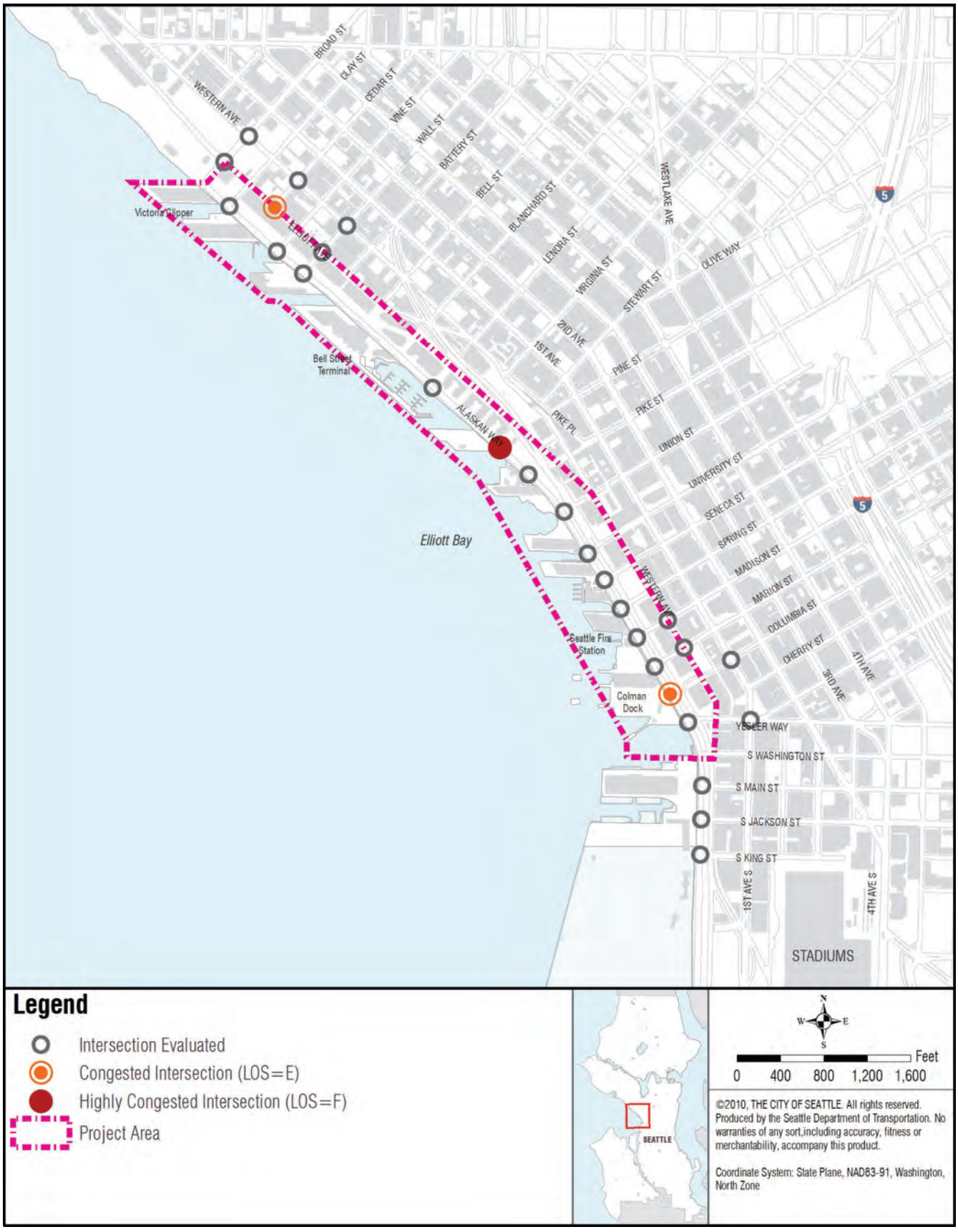


Figure 3-2. Existing intersection congestion on Alaskan Way

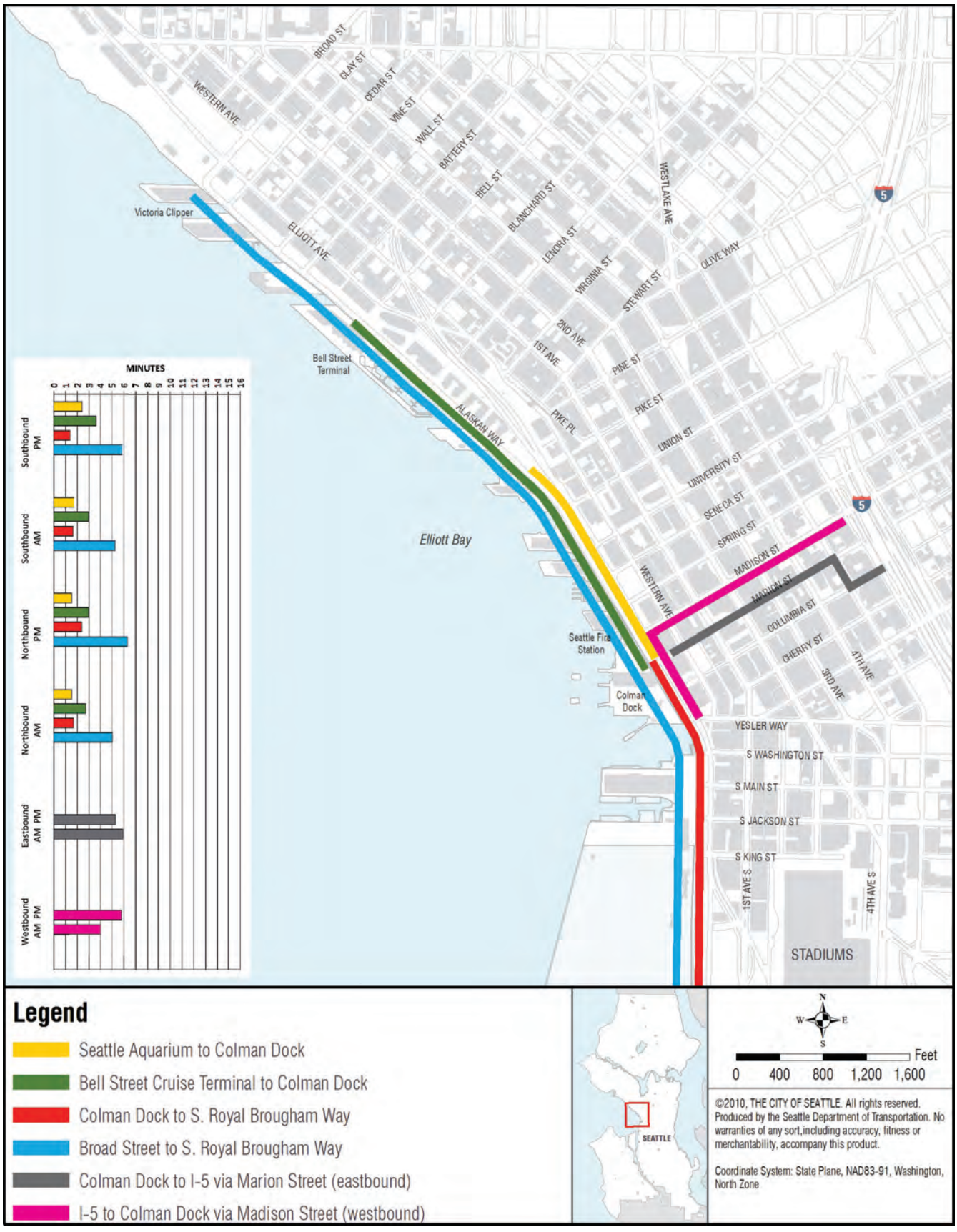


Figure 3-3. Existing travel times on Alaskan Way

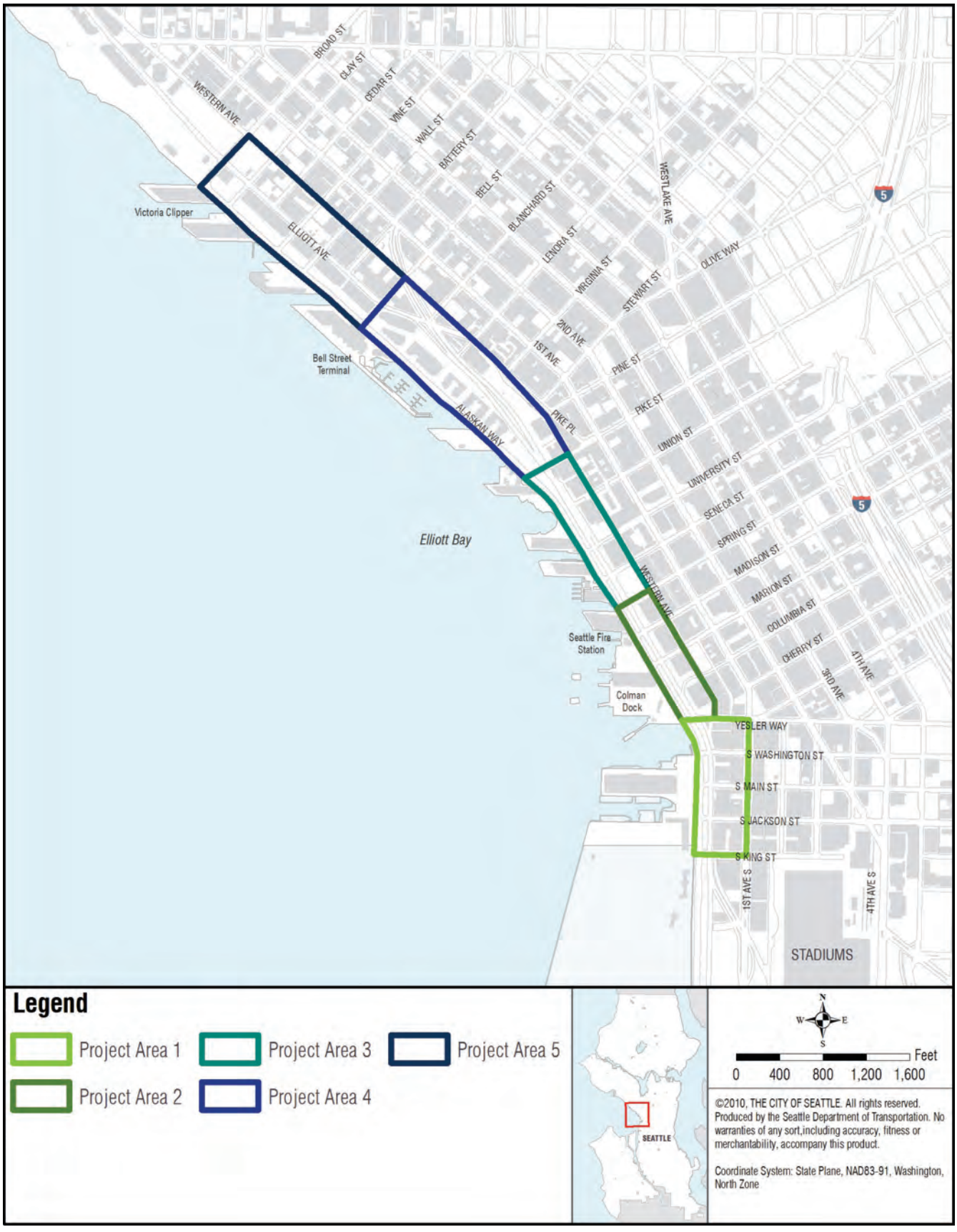


Figure 3-4. Inventory areas for parking supply

The majority of the parking supply in the area was most heavily used on Saturday, which reflects the character of the downtown Seattle waterfront as a tourist and recreational destination. The proximity to the stadium area, as well as the weather, also affects parking demand. Table 3-2 provides a summary of peak occupancy by zone, as measured during these inventories.

Table 3-2. Total Parking Supply and Peak Occupancy by Area

Area	Supply	Peak Occupancy	
		Thursday	Saturday
1	338	60%	94%
2	392	89%	90%
3	499	95%	97%
4	545	73%	80%
5	783	76%	63%
Total Supply/ Average Occupancy	**2,557**	**80%**	**84%**

Pedestrian and Bicycle Facilities

Existing Pedestrian and Bicycle Facilities

The downtown Seattle waterfront has high levels of pedestrian activity, especially in the summertime. Figure 3-1 shows the locations of key pedestrian and bicycle facilities. Sidewalks are provided along the western side of Alaskan Way for the entire length of the downtown Seattle waterfront. The sidewalks are widest along the downtown Seattle waterfront. Along the northern and southern waterfront, the sidewalks are generally slightly narrower.

On the eastern side of Alaskan Way, a shared pedestrian and bicycle path east of the waterfront trolley track extends from Bell Street to south of S. King Street. Additionally, a sidewalk on the east side of the roadway extends from Broad Street to Pike Street. North of Broad Street, Alaskan Way terminates as a roadway and becomes the Elliott Bay Trail, a shared bicycle/pedestrian path, at Olympic Sculpture Park.

Limited sidewalk facilities serve the roadway beneath the Alaskan Way Viaduct. Conditions vary; some areas have sidewalks on both sides, some have a sidewalk on only one side, and some have no sidewalk.

All cross streets from Broad Street to S. Royal Brougham Way provide sidewalks, and most have marked crosswalks across Alaskan Way. The

Pike Street Hillclimb allows direct pedestrian access between Pike Place Market and Alaskan Way. Pedestrian overpasses are provided at Bell and Marion Streets, with the latter providing access directly into the passenger terminal at Colman Dock Ferry Terminal.

Trail users along Alaskan Way

Existing Pedestrian and Bicycle Volumes

Pedestrian activity was documented at three intersections along Alaskan Way (Pike Street, Spring Street, and Yesler Way) on a Thursday and Saturday in August 2010. All three locations had higher crosswalk volumes on Saturday, peaking in the afternoon hours. Overall, the highest volume of pedestrian activity on Alaskan Way was observed at the intersection of Alaskan Way and Spring Street. Pedestrian volumes on the Marion Street overpass (which connects First Avenue to the Colman Dock Ferry Terminal) were far higher than the volumes on nearby surface crosswalks, with 824 pedestrians counted during the Thursday PM peak hour and 450 counted during the Saturday PM peak hour.

Bicycle activity was documented at the same time as pedestrian activity. Bicyclists travel in both the roadway and on the pedestrian and bicycle path east of Alaskan Way. The path is most heavily used at the north end of Alaskan Way near Broad Street. Bicycle volumes on Thursday morning and afternoon are similar, which likely reflects commuting patterns, while Saturday volumes are more concentrated in the afternoon.

Americans with Disabilities Act Accessibility

The Americans with Disabilities Act (ADA) requires that all locations accessible to able-bodied pedestrians also be accessible to those with disabilities. Generally speaking, the sidewalk width and conditions along both sides of Alaskan Way are acceptable, though not all comply with current ADA standards. Access between the waterfront and downtown is a challenge for travelers with disabilities, due to the steep incline between Alaskan Way and the downtown streets to the east. There are four accessible east-west pedestrian links between the areas: the Washington Trade Center overpass and elevator at Bell Street, the elevator at Lenora Street, the elevator at Pike Place Market, and the Colman Dock Ferry Terminal overpass at Marion Street. These facilities are shown in Figure 3-1.

Traffic Safety

Between September 2007 and August 2010 a total of 200 collisions occurred along Alaskan Way from Broad Street to S. Royal Brougham Way. Two-thirds of these collisions occurred at midblock locations and one-third at intersections. Collision types included broadside, sideswipe, right turns, and left turns. Most involved only vehicles, though pedestrians or bicyclists were involved in a few. No fatalities were reported along Alaskan Way during this period. Additional details are provided in the Transportation Discipline Report (Appendix C).

Transit

The Alaskan Way corridor is served by three transit routes, which are operated by King County Metro (Metro):

- Route 16, which runs between the Northgate Mall and the Colman Dock Ferry Terminal;
- Route 66, which runs between the Northgate Transit Center, University of Washington, and the Colman Dock Ferry Terminal; and
- Route 99, which, as of February 2011, runs as a couplet, traveling southbound on Alaskan Way and northbound on First Avenue, connecting Olympic Sculpture Park, Pier 66/Bell Street Pier Cruise Terminal, the Seattle Aquarium, and the Colman Dock Ferry Terminal.

Prior to the start of the SR 99: Bored Tunnel Project construction, Metro used two areas on the west side of Alaskan Way near Colman Dock Ferry Terminal as a bus layover location for Routes 16 and 66 (one south of Marion Street and one north of Marion Street). This layover area has been temporarily moved eastward to a new median strip. Both temporary zones can accommodate two buses. This layover location is frequently used throughout the day.

Washington State Ferry crossing Puget Sound

Water Transit Services

There are a variety of water transit services along the downtown Seattle waterfront, including the Washington State Ferries, the King County water taxi, the SoundRunner, and various commercial services, including cruise ships.

Washington State Ferries

Washington State Ferries operates two routes out of Colman Dock Ferry Terminal (Pier 52). Colman Dock Ferry Terminal stretches from Madison Street to Yesler Way. Vehicles and bicyclists enter through the tollbooth entrance at Yesler Way. Bicyclists also enter through a peak-hour tollbooth entrance at Marion Street. A pedestrian walkway from First Avenue and Marion Street leads directly into the passenger terminal. Metro Routes 16, 66, and 99 serve Colman Dock Ferry Terminal as well. There is no public parking available at the dock, but there are passenger loading areas and taxi stands on Alaskan Way in front of the pier. Colman Dock Ferry Terminal can hold 603 vehicles in its staging area.

Colman Dock Ferry Terminal has vehicle exits at Marion Street and Yesler Way. When ferry traffic exits Colman Dock Ferry Terminal, queue loops trigger an extension of eastbound green time. If two ferries are docked simultaneously, Bremerton traffic is directed to the Yesler Way exit, and Bainbridge Island traffic is directed to the Marion Street exit. According to Washington State Ferries staff, this situation occurs 10 times per day. If only one ferry is present, drivers are generally allowed to choose which exit to use.

Ferry Service in the Study Area

Colman Dock Ferry Terminal (Pier 52) is a major hub for both vessel and vehicle traffic. It serves 23 round trips to Bainbridge Island and 15 round trips to Bremerton each weekday, all operated by Washington State Ferries. During the afternoon peak hour, an estimated 600 vehicles and 1,400 foot passengers board ferries at Colman Dock Ferry Terminal. The adjacent Pier 50 serves passenger-only ferry runs to Vashon Island, West Seattle, and Kingston.

Construction of the SR 99: Bored Tunnel Project is currently affecting access to Colman Dock Ferry Terminal, with vehicle routing depending upon what activities are occurring in the area. Under non-construction conditions, vehicles may enter Colman Dock from both northbound and southbound Alaskan Way, although the signed route directs southbound traffic to continue past the dock and use a U-turn route. If the holding area on the dock is full, a Washington State Patrol trooper is stationed at the Yesler Way entrance to allow only high-occupancy and authorized vehicles to enter from the north. All other vehicles must approach the entrance from the south. Counts taken during a weekday PM peak hour in October 2010 indicate that 355 vehicles entered Colman Dock in roughly equal shares from northbound and southbound Alaskan Way. One of the northbound lanes on Alaskan Way provides dedicated ferry holding space from the Yesler Way entrance to S. Jackson Street, a distance of 840 feet or approximately 40 vehicles. If queues stretch beyond that distance, vehicles may wait farther south on Alaskan Way or in the area beneath the Alaskan Way Viaduct. During peak season, queues form along Alaskan Way. The maximum queue lengths during peak summer time periods (typically Friday evenings) can extend as far as 4,400 feet, or approximately 210 vehicles.

King County Water Taxis

King County operates water taxis from downtown Seattle to West Seattle and Vashon Island. Both water taxis dock at Pier 50, which is adjacent to Colman Dock Ferry Terminal at Yesler Way. There is no parking at the pier, but there are loading zones for dropping off and picking up passengers in front of Colman Dock Ferry Terminal. Boats can carry up to 150 passengers and 18 bicycles.

The Vashon Island water taxi runs only on weekdays; there are three round trips in the morning and three in the afternoon. The West Seattle water taxi operates seven days a week, from April through October, with weekday peak-period service year-round. Schedules vary depending on the day of the week, the time of year, and whether or not there is an event at Safeco Field or CenturyLink Field.

Victoria Clipper

Clipper Navigation operates from Pier 69, located on Alaskan Way between Clay and Vine Streets. There are multiple nearby parking structures, as well as taxi loading zones. The Victoria Clipper route is passenger-only and operates year-round, with services to Victoria and the San Juan Islands. The number of trips depends on the time of year and ranges from one round trip in the winter to three round trips in the summer. From May to September, Clipper Navigation also runs one round trip daily to the San Juan Islands. The boat used on the San Juan Islands route holds 239 passengers, and the boats used on the Victoria route hold 293 to 330 passengers.

Argosy Cruises

Argosy Cruises operates from Piers 55 and 56, located on Alaskan Way between Spring and Seneca Streets. There are nearby parking structures and loading zones for passengers. Four boats typically are moored at Piers 55 and 56. Argosy Cruises operations are most active from June to August, with up to 15 cruises per day. From April to May and September to October, there are roughly seven cruises on each weekday and nine trips on weekend days. Argosy runs the fewest cruises during the winter, with two on weekdays, four on Saturdays, and three on Sundays.

Cruise Terminal

Cruise activity along the Seattle waterfront has grown substantially over the past decade. In 1999, six vessels with a total of 6,615 passengers docked in the Port of Seattle. In 2011, the number of cruise ship departures grew to an estimated 196, with a total of 886,000 passengers. Cruise ship dockings spur activity in various transportation modes as thousands of passengers arrive and depart.

Approximately 30 percent of the Seattle cruise ship departures operate out of the Bell Street Pier Cruise Terminal located at Pier 66 along the downtown Seattle waterfront. This terminal serves Celebrity Cruises and Norwegian Cruise Line, which typically have a total of three departures weekly. In 2012, the cruise terminal had 58 scheduled vessel visits from May through September. The pedestrian overpass at Bell Street allows access from the cruise terminal to the Bell Street Pier parking garage, as well as the eastern side of Alaskan Way and Elliott Avenue. There are also surface crosswalks in the vicinity of Pier 66, including the intersections at Wall, Bell, and Blanchard Streets. Metro Route 99, which runs from the International District to Belltown, provides a stop at Pier 66. Taxis and shuttles are also available.

Rail

Railroad tracks owned by BNSF Railway (BNSF) run along Alaskan Way in the north end of the study area. At-grade crossings are present just east of Alaskan Way at Broad, Clay, Vine, and Wall Streets. South of these locations the railroad is grade separated from the roadway. The tracks formerly used by the waterfront trolley run the entire length of Alaskan Way (just east of the eastern sidewalk). However, since the replacement of the trolley by Metro Route 99, no rail activity takes place on these tracks.

According to 2008 data from the Federal Railroad Administration, a total of 55 trains pass through the study area each day. Of this total, 24 are passenger trains (Amtrak, Sounder commuter rail) and the other 31 are freight trains. Trains travel at speeds of up to 30 miles per hour across the at-grade crossings located at Broad, Clay, Vine, and Wall Streets. Gate closure times range from 1 to 1.5 minutes for passenger trains and 1 to 5.5 minutes for freight trains.

Cruise terminal at Bell Street Pier

Cruise Ships in Seattle

The study area is home to the Bell Street Pier Cruise Terminal at Pier 66, which serves approximately 30 percent of the nearly 200 annual cruise ship departures in Seattle. Cruise ship activity along the Seattle waterfront has grown substantially over the past decade.

3.2 Economics

The local study area for economic impacts is generally focused between S. Jackson Street on the south, Broad Street on the north, First Avenue on the east, and Elliott Bay on the west. Regional effects are described for a broader economic impact area that includes Seattle and the surrounding central Puget Sound region (King, Snohomish, Pierce, and Kitsap counties).

The greater Seattle area and King County host a large and diverse economy. King County and its 39 cities are the center of the Puget Sound economy and home to 50 percent of the region's population, 60 percent of its workforce, and 70 percent of its economic output. King County plays a critical role in the economic well-being of both the region and Washington State as the business and population center of the Pacific Northwest.

According to the 2010 U.S. Census, King County had the largest population of any county in the state (1,931,249 residents, an 11 percent increase from 2000); its residents represent nearly 29 percent of Washington State's total population (U.S. Census Bureau 2011). The county's population has increased substantially since 1990, especially in the mid-to-late 1990s. Although its economy thrived in the late 1990s, the beginning of the next decade saw significant job losses in the technology sector from the "dot-com bust," and the recession in the late 2000s affected the Puget Sound region along with the rest of the country.

Details of the analysis of economics under existing conditions are provided in the Economics Discipline Report (Appendix D).

Gross Metropolitan Product

Gross Metropolitan Product (GMP) is one measure of the size of the economy of a metropolitan area. Similar to gross domestic product, GMP is defined as the market value of all final goods and services produced within a metropolitan area in a given period, which is usually one year.

Employment

The regional economy is diverse, with an emphasis on service industries, although employment retail trade and the government/education sector also play a major role (FHWA et al. 2004). Collectively, King, Pierce, and Snohomish counties account for 1.93 million jobs and have an estimated gross metropolitan product of $218.77 billion. The mean annual wage for all occupations in May 2009 was $51,850, which was higher than the state mean annual wage of $47,770 (BLS 2011).

Unemployment rates within King County have been consistently lower than the U.S. averages since December 2003. The latest available data show that in December 2010, the unemployment rate was 8.4 percent in King County as compared to 9.2 percent in Washington State and 9.1 percent in the nation.

Local Government Revenues

Washington State and its local governments, including the City, rely on a variety of taxes to fund state and local programs. These taxes include a combined state and local sales and use tax; business and occupation (B&O) tax; public utility tax; property tax; and other excise, real estate, and estate taxes.

Within King County, taxes support roughly two-thirds of the general fund services. Sales tax is the second largest source of general fund tax revenue after property taxes. King County collects a 1 percent general local option sales tax in the unincorporated areas and a tax of 0.15 percent inside cities. A 0.10 percent criminal justice sales tax (expended only for criminal justice) is also part of the General Fund. This revenue is shared with cities, allocated on the basis of population. King County also receives revenue from the cable franchise fee and gambling and liquor taxes. The King County food and beverage ax is collected in addition to the retail sales tax at restaurants, taverns, and bars.

3.3 Noise and Vibration

Noise and vibration conditions were evaluated by reviewing available information and performing noise monitoring in the project study area. This information was used to develop a description of the existing noise and vibration environment that may be affected by the project. In general, the study area emphasizes on-shore locations within about 1,000 feet of seawall construction but evaluates in-water and more distant on-shore locations as warranted.

Noise

Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise intrusive. Human response to noise varies depending on the type of noise and its characteristics, distance between the noise source and the receptor, receptor sensitivity, and time of day.

Noise is measured in units called decibels (dB). For the purposes of environmental analysis, noise is often quantified as "A-weighted" decibels (dBA), which correspond to the frequencies that are audible to the human ear. While the dBA measurement describes steady noise levels, very few noises are constant. Therefore, other noise metrics have been developed to measure sounds that change over time. Equivalent sound level (L_{eq}) is the average sound level during a specified period; it is often used to describe the overall noise environment. Another measurement, day-night sound level, is defined as the average sound energy in a 24-hour period, with an additional 10 dB added to the nighttime levels (10 p.m. to 7 a.m.). A measurement called maximum sound level (L_{max}) is the highest short-duration sound level that occurs during a single event and is used to describe short-term noises, such as those from heavy construction equipment or pile driving.

Measuring Noise

Environmental analyses often measure noise in units known as A-weighted decibels (dBA). A whisper measures about 30 dBA, while a typical conversation is in the range of 50 to 60 dBA, and a jet taking off at a distance of 200 feet measures about 120 dBA. The human ear perceives an increase of 10 dBA as a doubling of the noise level; an increase of 3 dBA or less is barely perceptible, and an increase of 5 dBA or more is noticeable. Noise levels drop off sharply with distance from the noise source.

Regulations and Guidelines

The Seattle Noise Ordinance (SMC 25.08) limits noise levels at property lines of neighboring properties (SMC 25.08.410). The maximum permissible sound level depends on the land uses of both the noise source and the receiving property (Table 3-3). The City's noise ordinance is consistent with the Washington State noise regulation (Washington Administratvie Code [WAC] 173-60).

Table 3-3. City of Seattle Maximum Permissible Sound Levels

Land Use of Noise Source	Land Use of Receiving Property			
	Residential (dBA)		Commercial (dBA)	Industrial (dBA)
	Day	Night		
Residential	55	45	57	60
Commercial	57	47	60	65
Industrial	60	50	65	70

Source: SMC 25.08.410
Note: dBA – A-weighted decibel

Existing Noise

Zones 1 through 4 are primarily commercial use. Traffic on the Alaskan Way Viaduct is a predominant source of noise in the project area for these zones, in addition to surface street traffic, some localized industry, and high-altitude aircraft overflights. These are augmented by natural noises such as leaves rustling, modest wave action, and bird vocalizations, which are limited. Retail, office, transportation, public services, and recreational uses predominate on the west side of Alaskan Way, where natural noises can be limited during peak commute times.

Zones 5 and 6 are more traditional mixed-use areas, with both residential and commercial uses (the Seattle Marriott Waterfront Hotel, the Edgewater Hotel, and the Port of Seattle). Traffic on the Alaskan Way Viaduct is more distant in these areas than it is in Zones 1 through 4, so overall noise levels are generally lower. Existing sources of noise are local road traffic, vessel engines, high-altitude aircraft overflights, and natural noises such as light surf and bird vocalizations.

A combination of existing and new data was used to determine baseline noise conditions in the study area. Noise was monitored and measured at a total of 36 locations, known as noise receptors. These included 25 sites for which data had been obtained to evaluate other projects in the study area. In addition, the City conducted ambient noise monitoring at 11 new sites, primarily in the immediate vicinity of planned seawall construction activities. The additional noise monitoring involved a

combination of short-term and long-term monitoring. Short-term monitoring typically lasted for 1 to 2 hours, whereas long-term monitoring typically lasted for 24 to 48 hours. Figure 3-5 shows the noise monitoring locations. Details about the noise monitoring locations can be found in Chapter 4. The monitoring results are presented in the Noise and Vibration Discipline Report (Appendix E).

Underwater noise is also important in the study area because of its potential to affect marine life. Aquatic organisms are sensitive to both the loudness of sounds and their frequency, or pitch. Underwater noise levels in the study area during the daytime are dominated by the presence of ferry traffic and occasional outboard motorboats. Background noise levels (reported in terms of the 30-second average continuous sound level) range between 105 and 145 dB, with an average of 128 dB at all frequencies measured (WSDOT 2011).

Vibration

Ground-borne vibration can be a concern for occupants of nearby buildings during construction activities. However, it is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads. The most common sources of ground-borne vibration are trains, buses on rough roads, and construction activities such as blasting, pile driving, and operation of heavy earth-moving equipment. The effects of ground-borne vibration at high levels can include perceptible movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. Vibration is measured in terms of peak particle velocity (PPV), which is expressed in inches per second. In general, PPVs of under 0.5 inch per second are considered to present a low risk for damage to structures more than 100 feet away.

Regulations and Guidelines

Ground vibration levels were evaluated using the California Department of Transportation (Caltrans) vibration criteria, which vary according to the repetition pattern of vibration events, the potential for human response versus cosmetic building damage, and type of building for issues related to cosmetic building damage. Seattle Public Utilities has in-house vibration criteria for the protection of cast-iron water mains with lead joints, which are consistent with the Caltrans criteria.

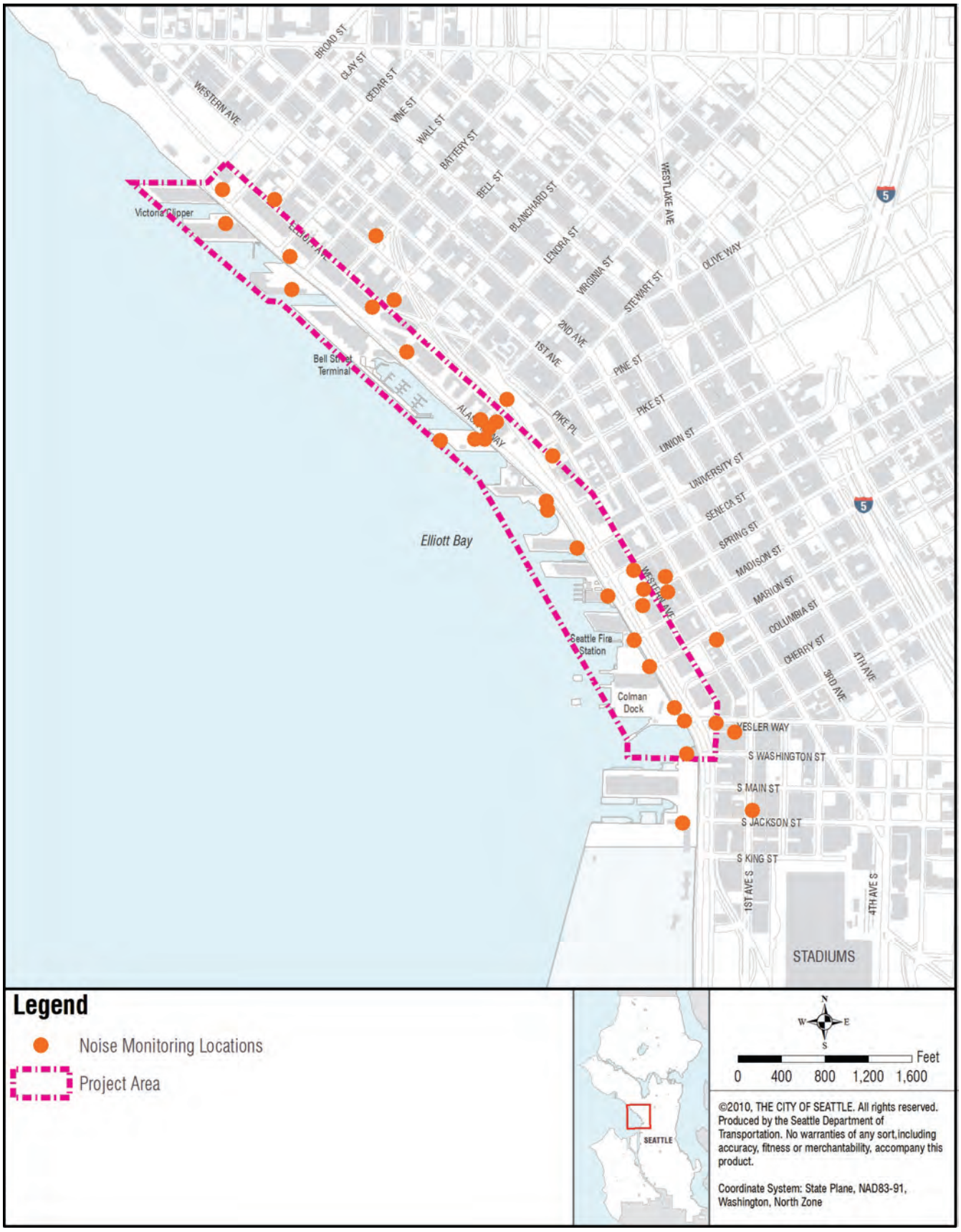


Figure 3-5. Noise monitoring locations used for the noise effects analysis

Existing Vibration

Vibration data collected for the Alaskan Way Viaduct Replacement Project were used to characterize existing conditions in the study area. Because the viaduct is the primary source of vibration within the study area, background vibrations within the project area are expected to be lower than those shown here, especially in Zones 5 and 6.

Background vibration was measured at 17 sites along the viaduct and within 3,000 feet of the existing seawall. The average PPV of all measurements was 0.040 inch per second, with a maximum PPV of 0.128 inch per second and minimum PPV of 0.017 inch per second. All levels are well below the standard of 0.5 inch per second noted above; human response to these vibration levels ranges from "not perceptible" to "barely perceptible."

3.4 Cultural, Historic, and Archaeological Resources

Archaeological evidence indicates that the Pacific Northwest was occupied by humans soon after the last glacial retreat at the end of the Pleistocene Epoch. Changes induced by processes such as global sea-level rise, climatic warming, earthquakes, and volcanic activity continued to shape the landscape and influence the lives of people who lived in the Puget Lowland. These processes affected the distribution of potential resources and contributed to the creation of landforms suitable for human occupation. Past interaction between humans and the environment also modified the nature of the archaeological record, especially during the large-scale construction projects that characterized the Seattle waterfront during the historic period.

Area of Potential Effects

The study area for cultural, historic, and archaeological resources is also referred to as the Area of Potential Affects (APE). The APE extends up to 600 feet east (landward) and 400 feet west (waterward) of the 7,166-foot-long study area (Figure 3-6).

Although the southern extent of the seawall is at S. Washington Street, the APE extends one block farther to S. Main Street to allow the consideration of potential adverse effects on the built environment. The northern boundary of the APE is generally the north side of Broad Street. The eastern boundary is one to two blocks from the existing seawall to incorporate historic properties that may be affected by ground disturbance, noise, vibrations, and other project elements. The western boundary extends into Elliott Bay and is based on the waterward limit of the proposed ecosystem restoration and water-access elements of the project.

Cultural, Historic, and Archaeological Resources

- Cultural resources include, but are not necessarily limited to, archaeological sites, Native American and traditional cultural properties, historic buildings and structures, historic districts, and planned landscapes
- Historic resources may include buildings and features that are not buildings, such as bridges, docks, objects, landscapes, or sites
- Archaeological resources are places where past peoples left physical evidence of their occupation, and may include the remains of dwellings or other structures along with physical artifacts

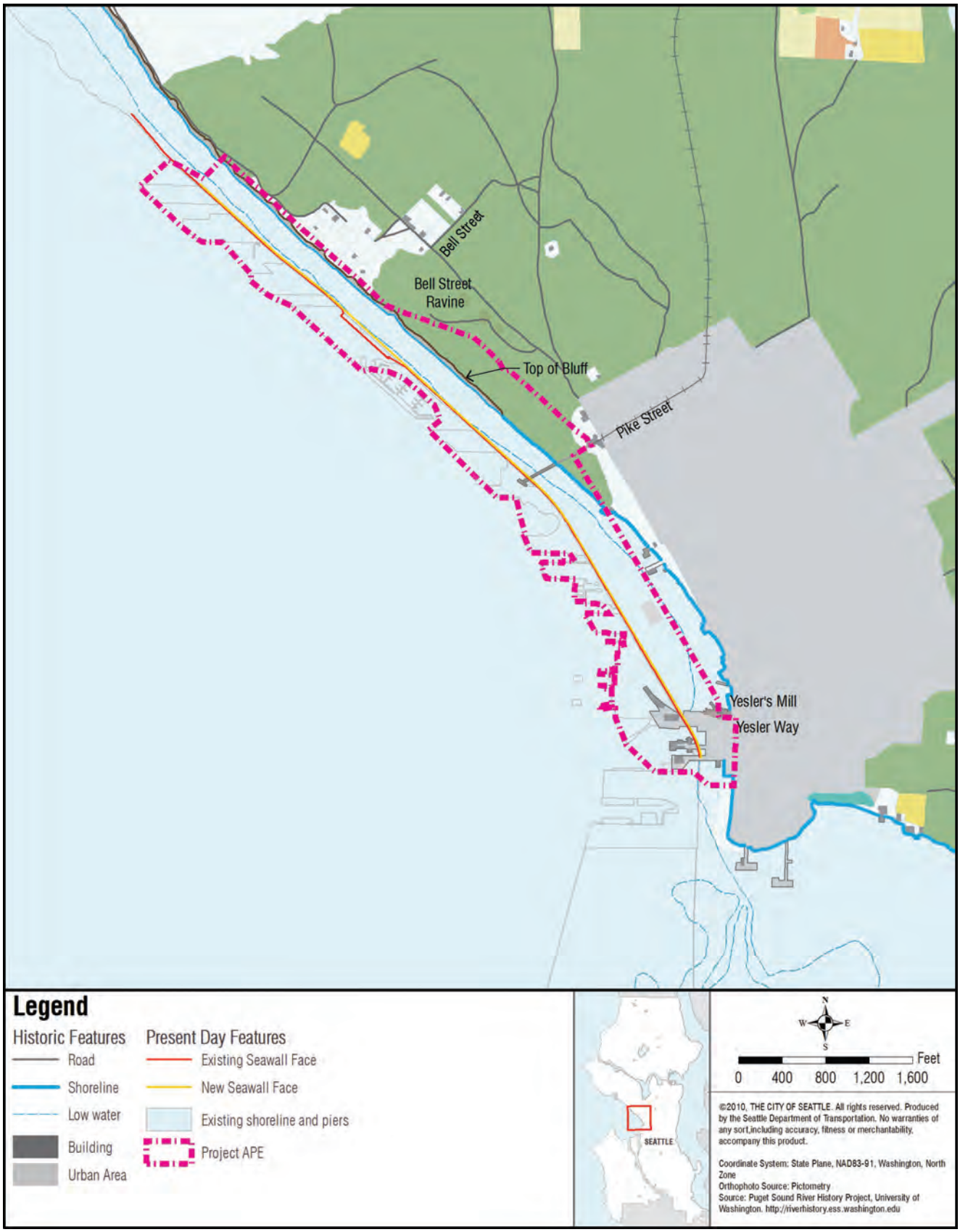


Figure 3-6. Historical map showing the predevelopment shoreline in relation to the Elliott Bay Seawall and the area of potential effects (1875)

Cultural Setting

The earliest settlement of the region occurred in the early postglacial period, at least 11,000 years ago, based on artifacts found in association with extinct animals like the Manis Mastodon near Sequim, Washington. Pre-Contact period sites from around the Pacific Northwest suggest continuous habitation throughout the ensuing 11,000 years (Ames and Maschner 1999; Matson and Coupland 1995).

Native American shelter dug into bank at Ballast Island (foot of S. Washington Street), c. 1895 (Source: Museum of History and Industry, Indians Collection)

Shorelines that might have hosted early inhabitants were inundated by about 5,000 years before present (5,000 BP), counted from the year 1950, as rising sea levels accompanied continued postglacial warming, making evidence of marine-oriented settlement before this time difficult to find. Sites dating after about 5,000 BP are more common. During this period, groups began to organize themselves in more complex ways. The subsistence base included a broad spectrum of locally available resources. The period from 3,000 to 1,000 BP saw the emergence of a semi-sedentary settlement pattern based on central villages with highly specialized seasonal camps. The final 1,000 years of coast prehistory are characterized by permanent houses in central villages, a salmon-based economy, and ascribed social status (Matson and Coupland 1995; Morgan 1999).

Ship leaving Seattle waterfront for Alaska during Klondike Gold Rush, 1898

The first non-Native settlements within the current city limits of Seattle were established along the Duwamish River and on the forested Alki peninsula in 1851. Donation land claims were established around eastern Elliott Bay by early 1852, and early the next year, Henry Yesler's first mill began producing lumber on the thin strip of land that connected Denny Island to the mainland (Figure 3-6). The city's development continued from this early start, interrupted briefly by the Indian Wars in 1856 and spurred on by events of the nineteenth and twentieth centuries, including the Yukon Gold Rush, the Spanish-American War, World War I, World War II, and the development of railroad transportation and national fortunes.

Yesler's Wharf and Colman's Columbia Street Wharf, c. 1885 (Source: University of Washington Special Collections)

In May 1882, the Columbia and Puget Sound Railway (a subsidiary of the Northern Pacific Railroad) was granted a 30-foot right-of-way along the shoreline of Elliott Bay. In 1885, the Seattle, Lakeshore, and Eastern Railroad constructed a small terminal at the foot of Columbia Street and a trestle to the west of the earlier line, extending from S. King Street to Smith Cove at the northern end of Elliott Bay. To accommodate additional rail traffic, the City passed Ordinance 804, establishing a 2-mile-long trestle along Railroad Avenue, in January 1887. Once the trestle was completed, additional wharf construction took place.

On July 17, 1897, the steamer *S.S. Portland* arrived from Alaska with the fabled "ton of gold" from the Klondike. Fortune seekers streamed to Seattle from throughout the world. The city, with its new transcontinental railroad terminus and deep harbor, was the logical point of departure for Alaska. Seattle residents staged a strong campaign promoting their city as the place to buy supplies and prepare for the trip to the gold fields, and it soon became the warehousing

center for groceries, dry goods, clothing, and hardware shipped to the north. By spring 1898, local merchants had reached $25 million in Klondike trade. This activity brought Seattle out of the depression and established it as the commercial center of the Northwest. The population more than tripled between 1900 and 1910.

Seawall construction, view north along Railroad Avenue from University Street, 1935

The increased Alaska trade encouraged further growth along the waterfront, although much of it was haphazard. By 1900, the chaotic growth emphasized the need to rebuild the waterfront piers, although most were no more than 10 years old. By 1895, most of the piers were owned by the three transcontinental railroads (Great Northern, Northern Pacific, and Union Pacific). In 1903, construction began on the north approach to a tunnel that would carry rail traffic under the city rather than adding further congestion to Railroad Avenue. The Great Northern Railway, in partnership with the Northern Pacific Railroad, built the mile-long tunnel from Virginia Street to the south portal of the tunnel located near Washington Street, between Third and Fourth Avenues. Hydraulic pumps were used to remove much of the earth on Denny Hill between Stewart and Virginia Streets and northward to Blanchard Street.

Wharf space was in high demand during the huge mobilization for World War I. Because of the decrease in Atlantic trade, Seattle became the principal port on the West Coast, with 47 piers and wharves and an annual trade of 5.7 million tons valued at more than $650 million.

The trestles and planked roadways of Railroad Avenue were not only inefficient and unsafe, but the pilings were being attacked by wood-boring worms known as gribbles. Between 1911 and 1917, the City constructed a concrete gravity-type seawall from S. Washington Street north to Madison Street to prevent some of this type of damage. A structural sidewalk supported by pilings was constructed to provide access to the piers. Railroad Avenue was then gradually backfilled with materials removed during the regrading of S. Jackson Street. This structure established the present shoreline between S. Washington Street and Madison Street (Dorpat 2006). Budget problems prevented construction north of Madison Street; therefore, those pilings continued to deteriorate.

In 1933, funding was secured for the City's Engineering Department to continue the seawall north to Broad Street, with construction beginning in 1934. The design involved an assembly of several components including steel sheet piling, wooden piling, a relieving platform, and three types of precast-concrete panels. A distinctive precast-concrete railing system was mounted on top of the wall to complete the assembly.

As the seawall was constructed, Railroad Avenue was filled and then paved to Broad Street. After the road's completion in 1936, its name was changed to Alaskan Way. Although the main purpose of the seawall was to protect the pilings from the effects of water and the gribbles, it

also served to establish the permanent shoreline (Dorpat 2006; *Engineering News-Record* 1934; Phelps 1978).

During World War II, Seattle's port served primarily as a supply point for Alaska. Members of the Quartermaster Corps purchased sleeping bags, cold weather gear, and other equipment, often from companies that had started during the Klondike Gold Rush (Berner 1999). By the late 1950s, shippers began consolidating cargo in large shipping containers, which completely revolutionized shipping and pier design. Freight sheds and warehouses on the piers were no longer needed because cargo, secure in containers, was moved by large cranes directly from the ship to trucks or railcars. Instead of the narrow piers with transit sheds found on the downtown Seattle waterfront, large parking areas were required to accommodate cranes, trucks, and containers. South of Pier 48, the Terminal 37/46 complex was created by filling and joining several piers (Hershman et al. 1981).

Cultural, Historic, and Archaeological Resources within the Area of Potential Effects

The APE contains numerous historically significant properties, including the downtown Seattle waterfront piers and the seawall. It also passes through the Pioneer Square Historic District and is adjacent to the Pike Place Market Historic District, both of which are listed in the National Register of Historic Places (NRHP; Figure 3-7) and are also local historic districts. Archaeological resources—both Pre-Contact Native American and historical period—have also been identified in the APE, and additional archaeological resources could lie buried beneath surface streets. Five archaeological resources have been identified within the project study area: Baba'kwob Site (45KI456), World Trade Center North Site (45KI482), Pier 54 Submerged Debris Site (45KI1011), Washington State Ferry Submerged Pier Site (45KI1012), and the Washington Street Submerged Historic Scatter Site (45KI1013).

Geoarchaeological investigations and an underwater survey were conducted as part of the project to identify cultural resources within the APE and to highlight areas within the APE that may yet have a potential for significant undiscovered cultural resources. In addition to previously recorded sites, three historic archaeological sites were identified during the underwater survey and have been recommended for eligibility for the NRHP. The USACE, as lead federal agency, is reviewing the recommendations that would then go to the Department of Archaeology and Historic Preservation (DAHP) for final concurrence,

Cultural materials were observed during archaeological borings conducted for this project and are tangible evidence of early historic settlement buried within the fill along the waterfront. Yesler's Mill is a known site near the southern end of the APE. Artifacts from Seattle's participation in the market economy are evidenced by patent medicines and mass-marketed products such as Pond's cold cream. Early Euro-American influence during the ethnohistoric period is suggested by

The National Register of Historic Places

The National Register of Historic Places (NRHP) is an official list of historic resources deemed worthy of preservation, authorized under the National Historic Preservation Act of 1966 (NHPA). Properties listed in the NRHP include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archaeology, engineering, and culture. NRHP-listed properties have been documented and determined eligible for listing according to established criteria for historical significance; once listed, they receive protection under Section 106 of the NHPA and under Washington State Executive Order 05-05. Properties that are determined eligible for listing receive the same protection as those already listed.

peanut shells and a pig bone found at the interface of the native and fill sediments. Finally, pre-1915 materials found throughout thick cinders and sand deposits are likely associated with the Great Fire of 1889 and the City's many regrade projects. Additional details are provided in the Cultural, Historic, and Archaeological Discipline Report (Appendix F).

Figure 3-7 and Table 3-4 show the properties within the APE that were built in 1963 or earlier with their historic designation. Properties are listed generally from south to north and west to east. Eligibility for Seattle landmark designation is only an opinion; it can be confirmed only by the Seattle Landmarks Preservation Board.

Section 106 has a specific review process for NRHP eligibility:

- A cultural resources professional makes a recommendation about eligibility
- The federal lead agency reviews and concurs (or not) with this recommendation
- DAHP then reviews and concurs (or not)

Once this is done, DAHP's opinion has the legal weight of actual listing (or not) in the NRHP for Section 106 purposes.

There are no known traditional cultural properties within or immediately adjacent to the APE. Ethnographic, ethnohistorical, historical, and other recent studies have discussed the occupation and use of the tidelands and surrounding area by Indian peoples (Miss and Sheridan 2010; Miss and Hodges 2007). The City is coordinating with the USACE, who is leading the consultation with Native American tribes that have cultural resource interests in the study area. These include the Suquamish Tribe, the Muckleshoot Indian Tribe, the Tulalip Tribes, the Snoqualmie Indian Tribe, the Sauk-Suiattle Tribe, the Duwamish Tribe, and the Confederated Tribes and Bands of the Yakama Nation. Chapter 4 of this Draft EIS includes more information on coordination with the tribes.

Seattle Landmarks

Since 1973, Seattle has designated more than 450 individual sites, buildings, vehicles, vessels, and street clocks as landmarks subject to protection by City of Seattle ordinance. In order to be designated, the building, object, or site must be at least 25 years old and must meet at least one of six criteria for designation outlined in the Seattle Landmarks Preservation Ordinance (Seattle Municipal Code [SMC] 25.12.350). These criteria are similar to those for the NRHP. Proposals for landmark designation are developed by the Seattle Landmarks Preservation Board and approved by the Seattle City Council.

Figure 3-7. Historic properties within the area of potential effects

Table 3-4. Historic Properties within the Area of Potential Effects and Their Historic Designations

ID[1]	Address	Current Name (Historic Name)	Historic Designation
H1	Alaskan Way	Elliott Bay Seawall	Eligible NRHP
H2	Alaskan Way/Battery Street	Alaskan Way Viaduct and Battery Street Tunnel	Eligible NRHP
H3	S. Main Street to Bell Street	Burlington Northern Railroad Tunnel (Great Northern Railway Tunnel)	Eligible NRHP
H4	Foot of S. Washington Street	Washington Street Boat Landing Pergola	NRHP, PSPD
H5	1 Yesler Way	1 Yesler Building (Bedford Hotel)	PSHD, PSPD
H6	619 Western Avenue	Western Building	PSHD, PSPD
H7	61 Columbia Street	Polson Building	PSHD, PSPD
H8	801 Alaskan Way	Piers 52/53 (Colman Dock Ferry Terminal)	Not eligible
H9	809 Western Avenue	Commuter Building Garage (Mutual Creamery)	Not eligible
H10	815 Western Avenue	Commuter Building (Carstens Building)	Not eligible
H11	925 Alaskan Way	Fire Station No. 5	Eligible NRHP and SL
H12	911 Western Avenue	Maritime Building	Eligible NRHP
H13	1001 Alaskan Way	Pier 54 (Northern Pacific Railroad 3/Galbraith Dock)	SL; eligible NRHP
H14	1101 Alaskan Way	Pier 55 (Northern Pacific Railroad 4/ Arlington Dock)	SL; eligible NRHP
H15	1201 Alaskan Way	Pier 56 (Frank Waterhouse House)	SL; eligible NRHP
H16	1203–1207 Western Avenue	(Olympic Warehouse)	NRHP, SL
H17	51 University Street	(Pacific Net and Twine Building)	SL; eligible NRHP
H18	1301 Alaskan Way	Pier 57 (John P. Agen's/ Milwaukee Dock)	SL; eligible NRHP

ID[1]	Address	Current Name (Historic Name)	Historic Designation
H19	1319 Western Avenue	Seattle Steam (Mutual Light and Heating Company)	Not eligible
H20	55 Union Street	Shurgard Storage (Diamond Ice & Storage Company)	Not eligible
H21	1414 Alaskan Way	Market Square (Schwabacher Warehouse No. 2)	Not eligible
H22	1426 Alaskan Way	Bakun Building (A.C. Frye Company)	Not eligible
H23	1483 Alaskan Way	Pier 59/Seattle Aquarium (Ainsworth & Dunn Pike St. Wharf)	SL
H24	1401 Western Avenue	Antique Warehouse (G.J. Callahan Warehouse)	Not eligible
H25	1501 Western Avenue	Madore Building	Not eligible
H26	1507 Western Avenue	Fix Building	Eligible NRHP and SL
H27	1527–1531 Western Avenue	Heritage House/garage	PPMHD (local)
H28	2411 Alaskan Way	Edgewater Hotel	Not eligible
H29	2501 Elliott Avenue/ 10 Wall Street	Mars Hill School Skyway Luggage	Not eligible
H30	11 Vine Street	Vine Street Storage (Chlopeck Fish Co.)	Not eligible
H31	2611 Alaskan Way	Pier 69 Port of Seattle	Not eligible
H32	2601 Elliott Avenue	Real Networks (American Can Company)	Not eligible
H33	2801 Alaskan Way	Pier 70 (Ainsworth and Dunn)	Not eligible
H34	2800 Elliott Avenue	Old Spaghetti Factory (Ainsworth & Dunn)	Eligible NRHP and SL

Notes: NRHP – National Register of Historic Places, PPMHD – Pike Place Market Historic District, PSHD – Pioneer Square Historic District, PSPD – Pioneer Square Preservation District, SL – Seattle Landmark

[1] ID corresponds to historic properties designated on Figure 3-7.

3.5 Energy Resources

The study area for energy use and greenhouse gas (GHG) emissions extends from Pier 48 northward to the south end of Olympic Sculpture Park. In general, the analysis of GHG emissions focused primarily in the construction activity zone, augmented by analyses reflecting vehicle travel associated with construction workers and construction-related traffic. Details of the analysis of energy resources under existing conditions are provided in the Energy Resources Discipline Report (Appendix H).

Energy Use

Seattle City Light serves the energy needs for residential, commercial, industrial, and institutional customers throughout Seattle and the project area. Table 3-5 shows the Seattle City Light fuel mix in 2011.

Emissions attributable to power generation come from power purchases and operations, including the use of vehicles and the heating of facilities (City of Seattle 2008a).

The Elliott Bay Seawall is a fixed structure and itself does not require a constant source of energy to serve its primary function; however, any project to replace the seawall will involve energy use during construction.

Table 3-5. Seattle City Light 2011 Fuel Mix

Generation Type	Percentage
Hydroelectric	92.4
Wind	4.1
Nuclear	2.5
Coal	0.5
Landfill Gases	0.3
Natural gas	0.2
Biomass	0.1

Source: Seattle City Light 2012

Greenhouse Gases

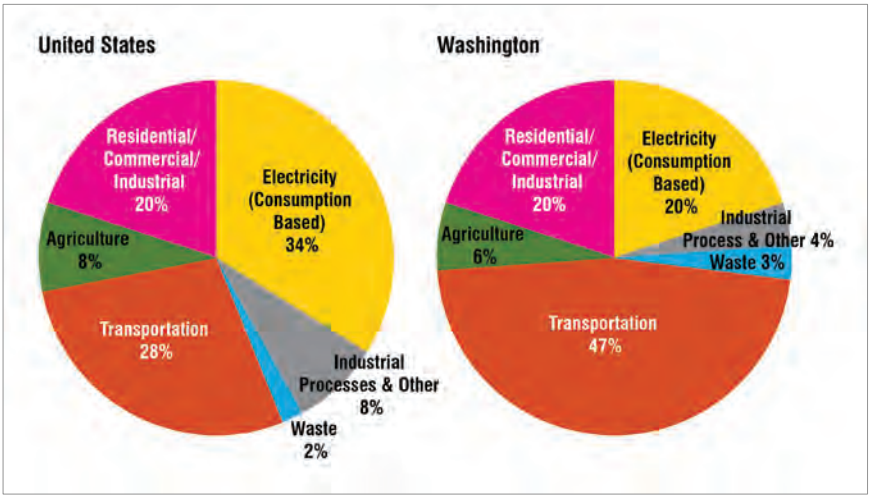
Naturally occurring and human-made gases that trap heat in the earth's atmosphere are commonly referred to as greenhouse gases, or GHGs. Some GHGs, such as carbon dioxide, occur naturally and are emitted through both natural processes and human activities. Other GHGs are created and emitted solely through human activities. The principal GHGs that enter the atmosphere because of human activities are carbon dioxide, methane, nitrous oxide, and fluorinated gases (hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride).

Greenhouse Gas Emissions

On a national scale, the electricity sector is the largest contributor to GHGs. As shown in Figure 3-8, transportation, consumption-based electricity use, and residential/commercial/industrial fossil fuel

combustion are Washington's principal sources of GHG emissions, while agriculture, waste, and industrial process emissions contribute marginal amounts. Because Washington uses hydropower for much of its electricity (nearly three-fourths of the state electricity generation), the electricity sector is less significant compared to the national average. The transportation sector is Washington's most significant contributor of GHGs (Center for Climate Studies 2007).

Seattle's GHG emissions are produced from three main sources: transportation, buildings, and industry. At 62 percent, the transportation sector is the largest source of emissions, and fully two-thirds of transportation emissions come from cars and trucks on Seattle streets.



Source: Center for Climate Studies 2007

Figure 3-8. Gross greenhouse gas emissions by sector in Washington and the United States in 2005

3.6 Land Use, Shorelines, and Parks and Recreation

The study area for analyzing land uses and shorelines was determined according to neighborhood planning areas and is generally focused between S. Washington Street on the south, Broad Street on the north, First Avenue on the east, and Elliott Bay on the west. The area includes the piers that extend waterward from the Elliott Bay Seawall as well as the immediate shoreline along Elliott Bay adjacent to Alaskan Way. Details of the analysis of land uses, shorelines, and parks and recreational facilities under existing conditions are provided in the Land Use, Shorelines, and Parks and Recreation Discipline Report (Appendix I).

Land Use

Existing Land Uses

The study area accommodates a wide range of land uses, including office, commercial, hotel, retail, government, and residential uses. Figure 3-9 shows the existing land uses in and around the study area. Plans and policies related to land use and shorelines are discussed in Chapter 7.

Residences along the waterfront

The study area contains approximately 5.2 million usable square feet of lot area. This space is made up of 4.1 million square feet of strictly nonresidential parcels (77 percent of total parcels), 0.6 million square feet of mixed-use lot space (11 percent), and 0.6 million square feet of residential lot space (11 percent). All residential development in the study area is in the form of condominiums and apartment units distributed across 50 properties, for a total of 4,718 units with approximately 4.2 million square feet of residential space (King County 2011).

Recent and Planned Development

Development along the Seattle waterfront has changed substantially in recent years from its historic commercial and industrial maritime uses. The focus has broadened to becoming a major center for tourism and recreation, retail shopping, meeting and convention activities, and entertainment. Increasingly, the area is providing space for new residences and businesses, although the recent economic downturn has, at least temporarily, slowed or stopped new development.

New development in the vicinity of the seawall is likely to occur concurrently with the seawall construction activities. In the immediate vicinity of the Elliott Bay Seawall Project, planned projects whose construction may coincide with that of the seawall are shown in Table 3-6.

Table 3-6. Projects Planned in the Vicinity of the Elliott Bay Seawall Project

Project Address	Description	Status
888 Western Avenue	Sixteen-story building with commercial space and 208 residential units plus 124 parking spaces	Under construction
201 Alaskan Way South	New temporary maintenance and moorage barge for King County Passenger ferries, adjacent to and north of Pier 48	Under construction
3031 Western Avenue	Eight-story residential building with 64 units and parking for 46 vehicles	In permitting and design review
2700 Elliott Avenue (Joseph Arnold Lofts)	Thirteen-story building with 132 residential units and parking for 76 vehicles below grade	In permitting
2334 Elliott Avenue	Seven-story structure with 139 residential units above 3,262 square feet of retail plus parking for 83 vehicles	Land use application pending

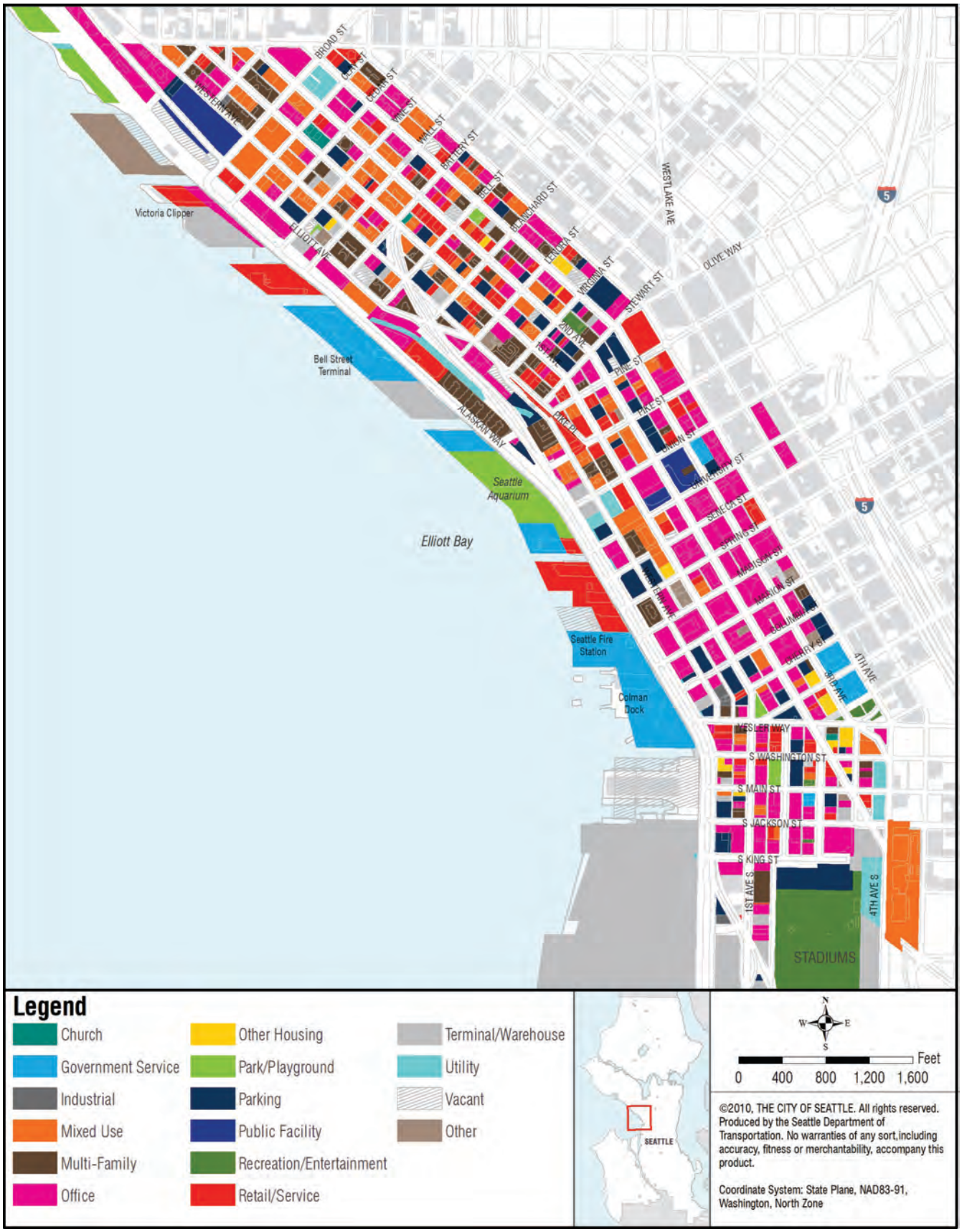


Figure 3-9. Existing land uses in the project vicinity

Zoning

Zoning along Alaskan Way consists of a number of urban zones, including industrial, commercial, and mixed use (Figure 3-10), that allow various potential uses at different intensities along the waterfront. The zoning code specifies allowable uses and standards for parking and building size, shape, and location within each zone. In addition, piers 54 through 59 are within the Historic Character Area, and several buildings on the east side of Alaskan Way are designated as Seattle landmarks. All development applications that include modification to a designated landmark must be referred to the Landmarks Preservation Board and the Seattle Department of Neighborhoods before permits will be issued.

Special Districts

Two special districts are located partially within the study area: the Pioneer Square Preservation District and the Pike Place Market Historic District. Both are shown on Figure 3-10 as the Pioneer Square Mixed and the Pike Place Market Mixed zones, respectively.

Pioneer Square Preservation District

The Pioneer Square Preservation District (SMC 23.66.115) was established as both a national and local preservation district in 1970. Design guidelines for the district focus on preserving its unique historic and architectural character; preventing demolition of historic buildings; ensuring the sensitive rehabilitation of buildings; promoting development of residential uses for all income levels; and enhancing the economic climate for residents, employers, workers, and visitors. Alaskan Way runs through the Pioneer Square Preservation District from S. King Street to Columbia Street.

Pike Place Market Historic District

Pike Place Market was established as a historic district in 1971 and is on the NRHP. The Pike Place Market Historic District (SMC 25.24.060) is protected by Seattle Ordinance 100475. Design guidelines specified in the ordinance focus on the continued existence and preservation of historic areas and buildings; continued construction and use of buildings for market activities, especially on street levels; and a general harmony between existing buildings and new construction. Alaskan Way runs just to the west of the Pike Place Market Historic District in the vicinity of Pike Street.

Pioneer Square Preservation District and Pike Place Market Historic District

These two districts, each important to Seattle's history, are protected by City of Seattle ordinance as well as by their listing on the NRHP. Distinct design guidelines for each district focus on preserving their unique historic and architectural character, as well as allowing for economic activity.

Shoreline Designations

The Seattle Shoreline Master Program (SMC 23.60) defines shoreline environments. In these areas, special development standards must be met in addition to the standard zoning requirements in the Seattle Land Use Code (SMC Title 23). The additional requirements establish the types of land uses permitted within the shoreline areas. The shoreline along the entire length of the seawall is designated as Urban Harborfront (Figure 3-9).

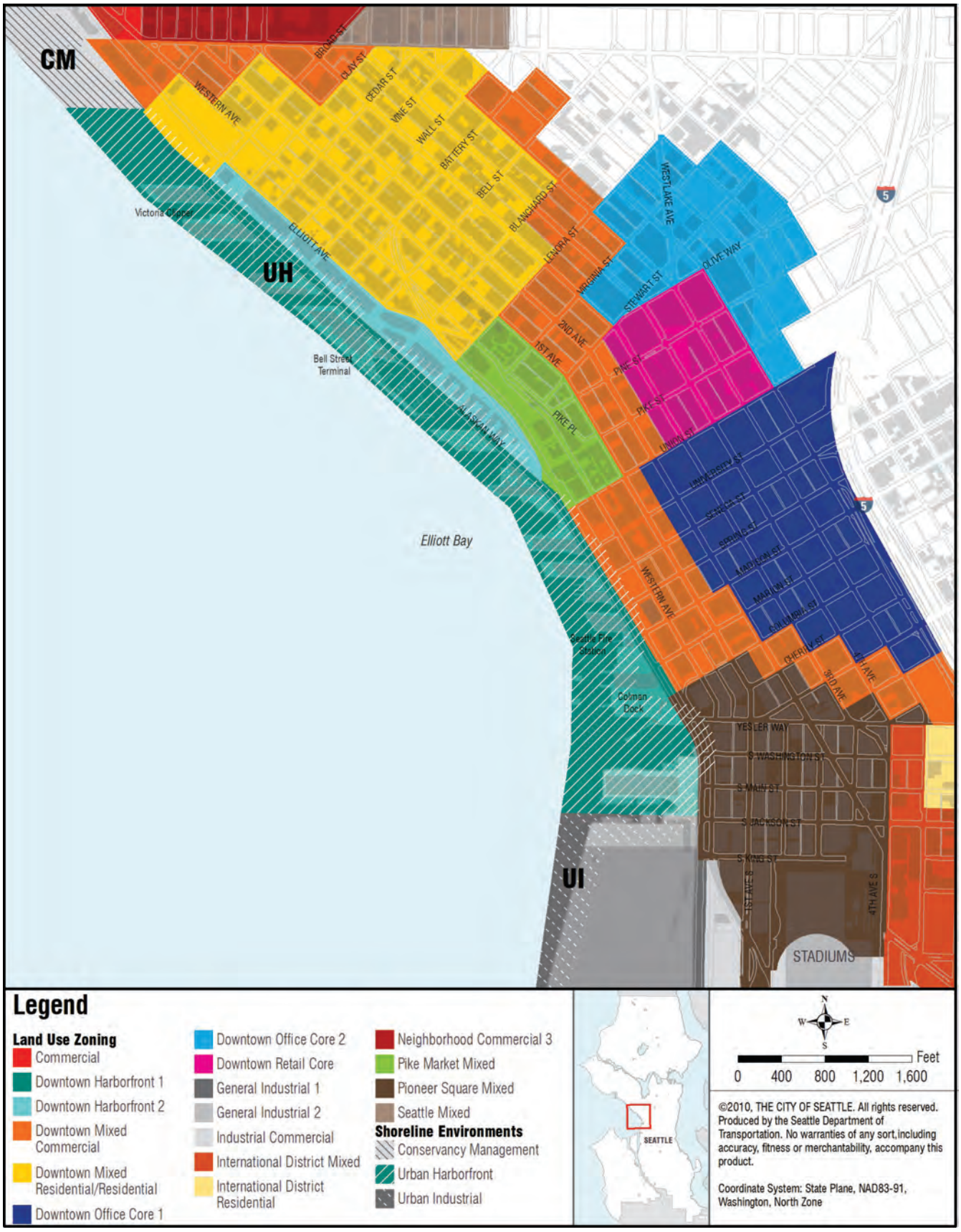


Figure 3-10. Zoning and shoreline environments in the study area

The purpose of the Urban Harborfront shoreline environment is to encourage economically viable, water-dependent uses to meet the needs of waterborne commerce, facilitate the revitalization of the downtown Seattle waterfront, provide opportunities for public access and recreational enjoyment of the shoreline, preserve and enhance elements of historic and cultural significance, and preserve views of Elliott Bay and the landforms beyond.

The Shoreline Master Program is currently being updated to comply with recent revisions to the state's Shoreline Management Act. The proposed updates and associated Shoreline Code amendments have undergone a SEPA review and are awaiting consideration by the Seattle City Council. After the council takes action (anticipated in fall 2012), the Washington State Department of Ecology (Ecology) is expected to approve the update in late 2012 or early 2013.

Environmentally Critical Areas

Seattle's Environmentally Critical Areas Ordinance (SMC 25.09) regulates development within landslide-prone areas, steep slopes, potential seismic liquefaction zones, abandoned landfills, flood-prone areas, wetlands, riparian corridors, shoreline habitat and other fish and wildlife habitat conservation areas, and their buffers. Identified critical areas within the study area include landslide-prone areas, liquefaction zones, and steep slope areas, as well as shoreline habitat (Figure 3-11).

Much of the Elliott Bay Seawall is located within a liquefaction zone. Specific development standards for liquefaction-prone areas provided in SMC 25.09.10 allow the City to require soils engineering studies to determine the physical properties of the surficial soils, especially the thickness of unconsolidated deposits and their liquefaction potential, as provided in the 2003 International Building Code. The City may also impose mitigation requirements pursuant to the International Building Code.

The project is also located within a Shoreline Habitat Environmentally Critical Area, and development standards are required by SMC 25.09.60. These standards include, but are not limited to, using best management practices for all construction activity on parcels within or adjacent to environmentally critical areas or buffers to prevent sediment and other pollutants from entering the riparian corridor watercourses or other fish and wildlife habitat conservation areas. Both the Critical Areas Ordinance and the Shoreline Management Act apply in the current code. The project must demonstrate that it will adhere to the applicable development standards as part of its shoreline substantial development permit application.

Seattle's Shoreline Master Program

As required by the Washington State Shoreline Management Act, Seattle has adopted a Shoreline Master Program that documents the policies and regulations governing the use and development of marine and freshwater shorelines. The program includes a range of "shoreline environment" designations that regulate the uses and activities permissible within a given zone.

An update of the Shoreline Master Program is nearing completion, with Seattle City Council action expected in late 2012.

Figure 3-11. Environmentally critical areas identified in the study area

Parks and Recreation

Parks and Recreation Facilities

Seattle Parks and Recreation and the Port of Seattle own most park and/or public access sites. In some instances, however, facilities consist of public access rights over private property. In addition to formally designated parks, public shoreline access is recognized as providing open-space functions. Many of the piers along the shoreline are also located within publicly owned aquatic lands between the Inner and Outer Harbor Lines, and therefore afford opportunities for shoreline public access. Plans and policies related to parks and recreation, including Seattle's Parks and Recreation 2011 Development Plan, are discussed in Chapter 7 of this Draft EIS.

The following parks and recreational facilities, including public shoreline access points, are located in the study area (from south to north; Figure 3-12):

- Waterfront bicycle/pedestrian facility
- Waterfront promenade
- Washington Street Boat Landing
- Colman Dock Ferry Terminal (shoreline public access)
- Fire Station No. 5 (shoreline public access)
- Pier 54 (shoreline public access)
- Pier 55 (public access to Blake Island/Tillicum Village)
- Piers 55 and 56 (shoreline public access)
- Pier 57 (shoreline public access)
- Waterfront Park
- Seattle Aquarium
- Pier 62/63 (shoreline public access)
- Bell Street Cruise Terminal/Pier 66 (shoreline public access)
- Edgewater Hotel (shoreline public access)
- Pier 69 (shoreline public access)
- Pier 70 (shoreline public access)
- Olympic Sculpture Park
- Lake to Bay Loop Trail

Green Streets

Green Streets are sections of streets that are designated for pedestrian circulation to provide pedestrian and bicycle mobility. They are designed to serve as gathering places or corridors connecting activity areas and open spaces in an attractive urban setting. There are five

designated Green Streets that intersect with the Alaskan Way right-of-way: Marion, Spring, University, Vine, and Clay Streets.

Public Art

Seattle was one of the first cities in the United States to adopt a percent-for-art ordinance in 1973. The program specifies that 1 percent of the City's eligible capital improvement project funds be set aside for the commission, purchase, and installation of artworks in a variety of settings. This provides opportunities for individuals to encounter art in parks, libraries, community centers, on roadways, bridges, and other public venues. The collection includes more than 350 permanently sited and integrated works and 2,600 portable works. The City stewards and maintains its artworks through an ongoing program of coordinated conservation activities, which include inspections, major restorative work and routine maintenance. The study area hosts 11 permanant public art installations, whose locations and titles are shown in Figure 3-13.

3.7 Public Services and Utilities

The study area for evaluating the effects on public services and utilities generally extends eastward from the Elliott Bay Seawall to First Avenue and northward from S. Washington Street to Broad Street. Certain services—including fire and emergency services—have a larger impact area that encompasses the greater downtown Seattle/Belltown/SODO area. Details of the analysis of public services and utilities under existing conditions are provided in the Public Services and Utilities Discipline Report (Appendix J).

Public Services

Public services and facilities include fire suppression and emergency medical services, law enforcement services, disaster preparedness, and solid waste disposal and recycling.

Fire Suppression and Emergency Medical Services

The Seattle Fire Department provides fire suppression and emergency medical services to Seattle residents within a land area of approximately 83.9 square miles and approximately 193 miles of the waterfront (FHWA et al. 2004). The only station within the study area is Fire Station No. 5, located adjacent to Colman Dock Ferry Terminal at 925 Alaskan Way. This station houses an engine company, a medical unit, and two fireboats. All fireboats, including a third boat moored in Ballard, are staffed from Fire Station No. 5.

Fireboat at Fire Station No. 5

Figure 3-12. Parks, recreation, and public access facilities in the study area

Figure 3-13. Public art in the study area

Seattle's fire alarm center is located at 400 S. Washington Street. Emergency fire and medical units are generally dispatched from the station closest to the call site, although units can be dispatched from other stations as well. The department's average response times in 2008 (from the time units were dispatched after a 911 call to their arrival at the site) are as follows: 4.32 minutes for fire and hazardous materials responses, 3.75 minutes for basic life support responses (fire and aid cars), and 3.76 minutes for advanced life support (Medic One) (Seattle Fire Department 2010).

In addition to the emergency medical units provided by the Seattle Fire Department, several hospitals located outside the study area provide emergency medical services to individuals in the study area, who are transported by the Seattle Fire Department and other private ambulance service providers.

Law Enforcement Services

The Seattle Police Department provides law enforcement and responds to 911 emergency calls throughout Seattle. The department is divided into five precincts: South, Southwest, East, West, and North. The study area is located entirely within the West Precinct, whose offices are at 810 Virginia Street.

The Port of Seattle police patrol major portions of the downtown Seattle waterfront and Elliott Bay. Railroad police have been granted police authority from the state and local governments and interstate authority from the federal government. The Coast Guard 14th District also patrols the waters in the study area.

Disaster Preparedness

The City has a comprehensive Disaster Readiness and Response Plan, which allows the City to coordinate resources as quickly and efficiently as possible. The Seattle Office of Emergency Management is an emergency-preparedness bureau of the Seattle Police Department that is devoted to citywide disaster preparedness, response, recovery, and mitigation. The office partners with the community to prepare for, respond to, and recover from disasters.

Washington State Ferries has an operations center located at Colman Dock. The center operates 24 hours per day, 365 days per year; its primary role is to respond in times of crisis, such as bomb threats, severe regional weather, emergency-vehicle transport coordination, and vessel/terminal accidents.

The Port of Seattle maintains an emergency response plan for all of its facilities, including marine and seaport facilities within the study area. In the Central Harbor area, these facilities include Pier 69, which accommodates the Port of Seattle headquarters and the terminal for the Victoria Clipper, and Pier 66, which accommodates a cruise ship terminal, conference center, and marina.

Solid Waste Collection, Disposal, and Recycling

The City contracts with CleanScapes, Inc. for garbage, recycling, and food and yard-waste collection services in the project area. Commercial garbage generated in the city, as well as construction, demolition, and land-clearing waste, is delivered to two private transfer stations: Waste Management's Eastmont Station (located in the South Park area near the City's South Recycling and Disposal Station) and the Rabanco-owned station (at Third Avenue S. and S. Lander Street). Contaminated soils are handled by Rabanco and Waste Management. Municipal solid waste and construction-demolition waste are transferred by truck and rail from the transfer stations to the Argo Intermodal Facility in south Seattle, where the waste is then transported by rail to landfills.

Recycling along the waterfront

Public Schools

There are no public schools in the immediate project area, nor do public school buses normally use Alaskan Way in their daily transport of students to and from school. Public school buses do periodically serve downtown Seattle waterfront locations, especially the Seattle Aquarium, as part of field trips.

Utilities

Public and private utilities in the study area provide electricity, water, wastewater management, stormwater collection, natural gas, steam, communications, and telecommunications services. Major providers in the study area are described in the following subsections. Records indicate that there are no petroleum pipelines currently in operation in the study area.

Electrical Power

Seattle City Light maintains a system of substations, primary voltage feeder lines, numerous smaller distribution substations, and overhead and underground transformers, which reduce voltage to required levels for customers. The utility currently has the capacity to generate an annual average output of approximately 1,900 megawatts (MW) of hydroelectric generation. In the study area, the Seattle City Light system uses a combination of overhead and underground electrical transmission and distribution lines.

Electrical power for the downtown Seattle waterfront is supplied by Seattle City Light and currently is fed by distribution feeders from the Union Substation at Western Avenue and Union Street, the only substation within the study area. Substations near the study area include the Massachusetts Substation at Colorado Avenue and Massachusetts Street and the Broad Substation at Sixth Avenue and Broad Street. Four 115-kilovolt transmission circuits emanate from the Massachusetts Substation, running north through the study area.

Although the system is designed and operated to minimize the likelihood of a problem in one area cascading into other areas, the system must still be approached as an integrated whole; impacts on one

area could lead to impacts on other areas. Seattle City Light has increased its system security and provision for continued reliability to minimize the potential impacts of both criminal acts and natural disasters.

Water Supply

Seattle Public Utilities supplies water to 1.3 million people and businesses in the region. Nearly all this water is from the 90,000-acre Cedar River Watershed and the 13,300-acre South Fork Tolt River Watershed in eastern King County (SPU 2011). The water mains within the study area generally run parallel to the Elliott Bay Seawall, providing service to commercial and residential properties on both sides of Alaskan Way and providing water for fire response throughout the project area. The water main includes sections of 12-, 20-, and 21-inch-diameter pipe, running along the west side of Alaskan Way between S. Washington Street and Columbia Street and along the east side of Alaskan Way between Columbia Street and Bay Street. The water main connects to downtown Seattle's looped water supply system at Broad Street, Madison Street, Yesler Way, and S. Washington Street.

Stormwater Drainage

Seattle Public Utilities is responsible for stormwater drainage in the project area. Stormwater runoff within the area currently is not treated to improve water quality before it is discharged into Elliott Bay. Depending upon where it is collected, stormwater flows to either the separated stormwater system or the combined sewer system, in which stormwater mixes with sanitary sewage. Additional discussion about stormwater drainage and stormwater treatment is included Section 3.11.

Wastewater

Seattle Public Utilities and King County Wastewater Treatment Division each own and operate portions of the sewer system within the project area. As discussed above, this system includes combined sewers, which collect stormwater runoff in addition to wastewater. Within the project area, the City's combined sewer system is designed and authorized to overflow at four combined sewer overflows (CSOs) located near the western ends of Vine, University, Madison, and S. Washington Streets. Nearly all of the land area that drains to these four City-owned CSOs is located outside the project area. The majority of the combined sewage collected within the project area is conveyed through King County interceptors to the West Point Treatment Plant for treatment. Additional discussion about wastewater and wastewater treatment is included in Section 3.11.

Natural Gas

Puget Sound Energy provides natural gas service along Alaskan Way. Its network consists of transmission and distribution pipes, pressure controls, meters, and service lines. Natural gas mains, along with

Combined Sewer Outfalls

Combined sewer outfalls are sewers that are designed to collect stormwater runoff and wastewater discharges in the same pipe. They are typical of older urban areas such as downtown Seattle; new development must separate stormwater and wastewater flows. During heavy rains, combined sewers may overflow into adjacent water bodies. To protect public health and the environment, the United States Environmental Protection Agency requires local agencies to limit the location and frequency of such discharges.

distribution and service lines, are located within the study area. A 12-inch-diameter high-pressure gas line is located between Blanchard and S. Washington Streets within the Alaskan Way right-of-way. This line is part of Puget Sound Energy's gas-transmission system that provides natural gas to the Seattle Steam Plant and other businesses along Alaskan Way.

Steam

The privately held Seattle Steam Company provides steam service in the study area via a franchise agreement with the City. The main plant is located on Western Avenue just south of Pike Place Market. The plant pumps steam through four main boilers that service an 18-mile system of underground pipes dating back to the late 1880s. Seattle Steam Company serves almost 200 customers, including businesses located on piers within the study area. Seattle Steam Company's service area extends from Blanchard Street to King Street and from the waterfront to First Hill.

Seattle Steam plant

A 6-inch-diameter steam line extends along the water side of the seawall face from Union Street to Bell Street. It provides service to the Seattle Aquarium and the Bell Harbor area. Between Union and University Streets is a line that connects the steam plant with a blow-off at the seawall. In the same location are 2-inch and 6-inch-diameter service lines that extend beyond the seawall and continue north. At S. Washington Street, a 4-inch-diameter steam service line extends from Western Avenue to the seawall; at Marion Street, a 4-inch-diameter steam service line extends from a line in Western Avenue to the service on the west side of the seawall (USACE 2008). Seattle Steam Company also owns and operates an outfall under Pier 57, which discharges to Elliott Bay (Cosmopolitan Engineering Group et al. 2007).

Telecommunications

CenturyLink provides local telephone service to the study area and throughout Seattle. Telephone lines in urban areas are typically located within street rights-of-way, above ground on utility poles in most areas and underground in others. CenturyLink also has fiber-optic lines in the study area. It has underground feeders located along Broad, Wall, Pike, Spring, Marion, and S. Washington Streets (FHWA et al. 2004) and provides service to the Port of Seattle.

Several private companies and public utilities also own fiber-optic cable and/or provide long-distance and other telecommunication services in downtown Seattle and in the study area. The Office of Cable Communications oversees the City's non-exclusive cable television franchises with Comcast and Broadstripe through enforcement of the franchise agreements (City of Seattle 2011). The Seattle Department of Information Technology builds and operates the City's corporate communications and computing assets. The basic fiber-optic system typically consists of manholes, conduits, and switching stations. Switching stations are usually located inside buildings. Conduits are

either buried or mounted under the existing Alaskan Way Viaduct, then routed down the columns into the manholes to allow connection to the buried system.

3.8 Social Resources and Environmental Justice

The study area for the analysis of social resources and environmental justice populations was determined by neighborhood planning areas and census tracts, and focused on the area between S. Washington Street on the south, Broad Street on the north, First Avenue on the east, and Elliott Bay on the west. The social resources described in this section include population and demographics, neighborhoods, housing, community facilities, religious institutions, social and employment services, cultural and social institutions, government institutions, and military installations. Figure 3-14 shows the community resources in the project vicinity. Details of the analysis of social resources and environmental justice under existing conditions are provided in the Social Resources and Environmental Justice Discipline Report (Appendix B).

Population and Demographics

The study area includes three city neighborhood planning areas. From south to north, these are the Pioneer Square, Commercial Core, and Belltown neighborhoods, each of which are distinct and have their own characteristics.

The most comprehensive source of demographic information for the study area is the 2010 U.S. Census and the 2006–2010 American Community Survey datasets, which are published by the U.S. Census Bureau. The study area is located within four 2010 census tracts (Census Tracts 80.01, 80.02, 81, and 92). Figure 3-15 illustrates population growth from 2000 to 2010 for the state, county, and city.

Minority and Low-Income Populations

At the federal level, low-income and minority persons are protected under Executive Order 12898 (1994), which directs each federal agency to make environmental justice part of its mission. For the purposes of this analysis, the demographic characteristics of the study area are compared to the demographics of Seattle. The residents and businesses located in the study area would directly experience the effects of the seawall construction activities.

Minority Populations

Minority populations are defined as individuals considering themselves to be non-White (Black or African American, American Indian and Alaskan Native, Asian, Native Hawaiian or other Pacific Islander, or other race) or a member of another ethnic group. In 2010, the overall percentage of minority populations in the study area was slightly less than the percentage of minority populations in Seattle. However, the

Environmental Justice

The concept of environmental justice acknowledges that the quality of our environment affects the quality of our lives and that minority and low-income populations should not suffer disproportionately high and adverse effects from federal projects. Although SEPA, as a state regulation, does not specifically require the analysis of environmental justice in an Environmental Impact Statement, a discussion of it is included in recognition of the City of Seattle's Race and Social Justice Initiative and to facilitate future National Environmental Policy Act analysis by the U.S. Army Corps of Engineers.

Seattle's Race and Social Justice Initiative

The Race and Social Justice Initiative is a citywide effort to realize the vision of racial equity. The initiative works within the City of Seattle government and with community leaders to get to the root cause of racial inequity: institutional racism. The initiative is led by the Seattle Office of Civil Rights and an interdepartmental team of City of Seattle staff. All elected officials in Seattle have endorsed and are promoting the initiative.

study area has two census tract block groups in which the percentage of minorities is higher than that for Seattle.

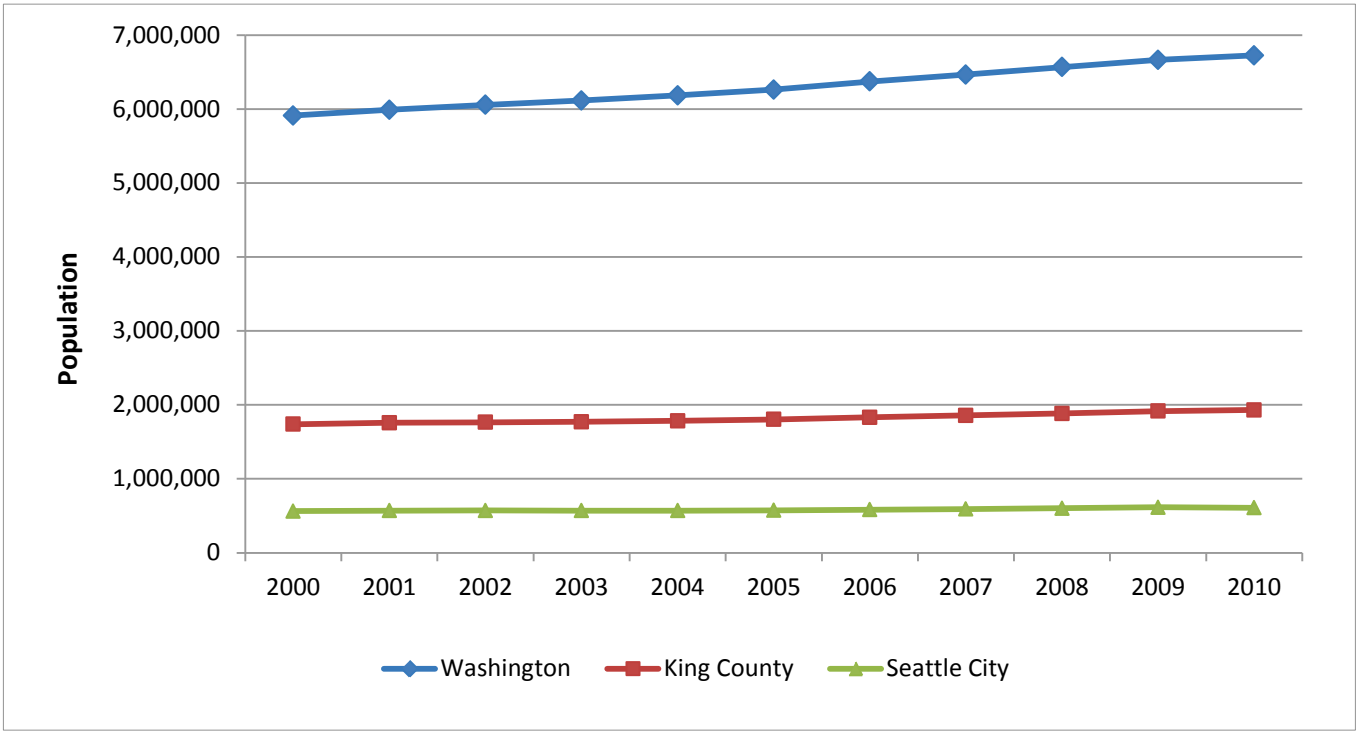
Figure 3-16 illustrates racial diversity of the project vicinity. The census tract block groups in the study area have minority populations that are comparable to those of Seattle (approximately 25 percent).

Although the project would not cross or directly affect tribal lands, minority populations in the study area include Native Americans, and a number of tribes have cultural and/or natural resource interests in the area. These tribes include the Muckleshoot Indian Tribe, the Suquamish Tribe, the Duwamish Tribe, the Tulalip Tribes, the Snohomish Tribe of Indians, the Snoqualmie Indian Tribe, and the Confederated Tribes and Bands of the Yakama Nation.

The right of tribal members to fish for salmon at all of their "usual and accustomed" fishing sites is explicitly guaranteed by treaty. In 1974, the Boldt Decision reaffirmed tribal treaty-protected fishing rights and established that the tribes, as co-managers of the resource, are entitled to 50 percent of the harvestable salmon returning to Washington waters. Elliott Bay is within the usual and accustomed fishing area of the Muckleshoot Indian Tribe and the Suquamish Tribe.

Low-Income Populations in the Study Area

The U.S. Department of Health and Human Services defines the poverty level for various household sizes. Households below this level are considered low-income. In 2011, the poverty level was $10,890 for one person and $22,350 for a family of four. The study area includes a higher percentage of people living below the poverty level than Seattle as a whole, including one census block group with 48 percent of its population living in poverty.



Source: U.S. Census Bureau 2012

Figure 3-14. Populations of Seattle, King County, and Washington State, 2000–2010

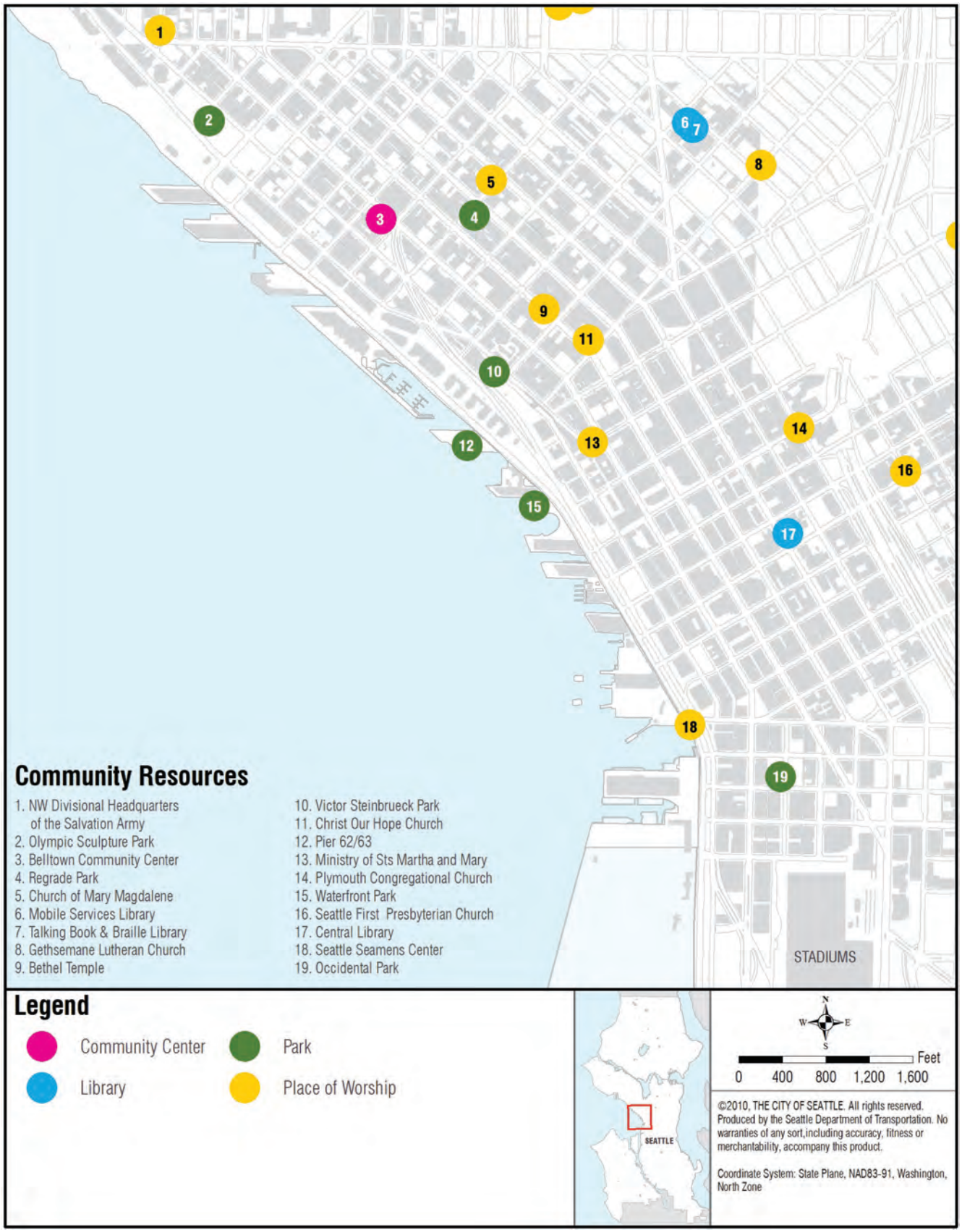


Figure 3-15. Community resources in the project vicinity

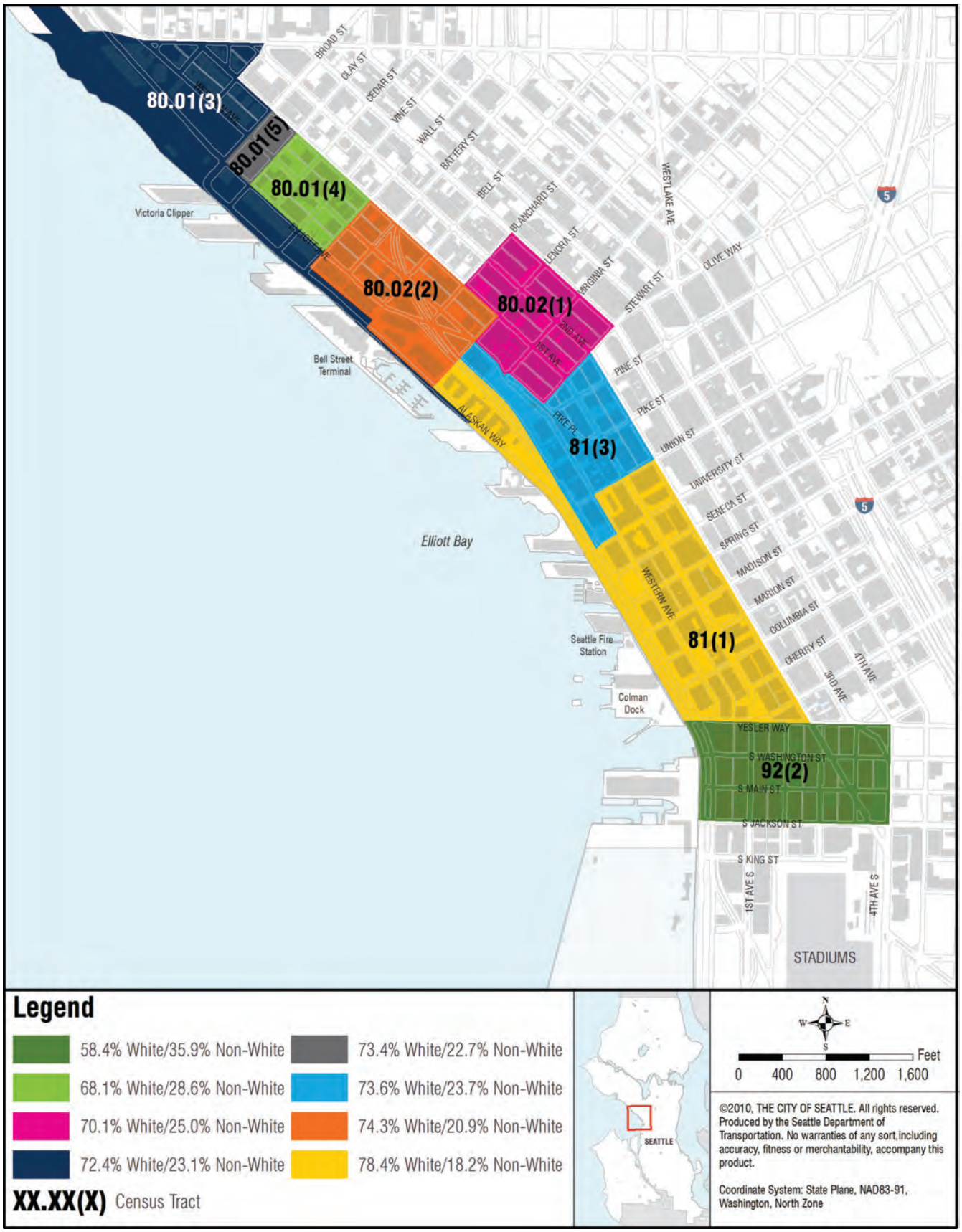


Figure 3-16. Distribution of race in the project vicinity

Low-Income Populations

The term "low income" is used for household incomes that are at or below the United States Department of Health and Human Services poverty guidelines for that size of household (FHWA et al. 2010). These poverty guidelines are a simplified version of the poverty thresholds used by the U.S. Census Bureau. In 2011, the Department of Health and Human Services poverty guidelines in the continental United States were $10,890 for one person and $22,350 for a family of four.

Residents of the study area are less well off than residents of Seattle as a whole (Table 3-7). In 2010, the median household income in the study area was considerably less than the median income of households in Seattle. The study area also includes a higher percentage of the population living at or below the poverty level, especially Census Tracts 81 and 92, which have 39 and 48 percent of their population living in poverty, respectively.

Table 3-7. Household and Income Characteristics, 2010

Area	Median Household Income (2010)	Per Capita Income (2010)	Population for Whom Poverty Status is Determined	Individuals Below the Poverty Level	Percent Below Poverty Level
Washington	57,244	29,733	6,430,231	780,009	12.1
King County, WA	68,065	38,211	1,850,930	188,539	10.2
Seattle, WA	60,665	40,868	575,700	73,338	12.7
Study Area Census Tracts					
CT 80.01	70,641	68,550	5,003	609	12.2
CT 80.02	41,197	73,892	2,731	711	26.0
CT 81	33,592	63,084	4,185	1,643	39.3
CT 92	31,098	24,089	2,187	1,004	45.9
Totals	–	–	**14,106**	**3,967**	**23.5**

Source: U.S. Census Bureau 2010, American Community Survey

Notes: Data were not available at the block group level and are reported at the tract level. The study area row is likely an overestimate, as it includes a larger area than only those block groups in the study area. Percentages may not sum to 100 due to rounding.

Primary Language Spoken at Home

Approximately 22 percent of the households in the study area primarily speak a language other than English at home. A linguistically isolated household is one in which there is no household member (14 years or older) who speaks only English or speaks a non-English language but also speaks English "very well." In addition, the U.S. Census data

identified the number of households that were linguistically isolated from the community due to the lack of any adult member with a good command of the English language. In 2010, approximately 5 percent of the census tracts containing the study area households were linguistically isolated (U.S. Census Bureau 2010).

People with Disabilities

Three of the four study area census tracts have a slightly higher proportion of people with disabilities than Seattle as a whole (6.7 percent, compared to 6.4 percent overall). A person with mobility limitations, as defined by the U.S. Census Bureau, is a person 16 years or older who has a disability that affects his or her ability to go outside of the home alone. This information is available only at the census tract level. In Census Tract 80.01, over 6 percent of the population is mobility-limited to an extent that affects their ability to go outside the home, whereas this population makes up roughly 17 percent of Census Tract 92.

Veteran Status

The percentage of veterans is much higher in the study area (10.4%) than in Seattle as a whole (6.9%). This is true for all four census tracts.

Auto Ownership

The 2000 U.S. Census reported that half of all households in the study area had no access to a private vehicle. This demographic characteristic sharply contrasts with an estimated 16 percent of all households in Seattle that do not have access to a vehicle for personal use. Residents with no access to a vehicle rely on walking, bicycling, and public transit (trains, light rail, streetcar, paratransit, monorail, buses, and taxis) for their transportation needs.

Linguistically Isolated Household

A linguistically isolated household is a household in which all members age 14 years and over speak a non-English language and also speak English less than "very well" (have difficulty with English).

Regional and Community Growth

Regional Population and Employment

The Seattle-Tacoma-Bellevue, WA Metropolitan Statistical Area, which is defined by the U.S. Census Bureau to include the city of Seattle, King County, Snohomish County, and Pierce County within the Puget Sound region, has an estimated population of over 3.5 million. This is more than half of Washington's population and constitutes the 15th largest Metropolitan Statistical Area in the United States. Seattle is the most populated city in King County, with a 2010 population of 608,660 (U.S. Census Bureau 2010).

Both Seattle and the region experienced substantial population growth in the 1990s, with more gradual increases between 2000 and 2010 (Figure 3-15). According to the Washington State Office of Financial Management's most recent population forecast, the population of Washington State is expected to increase to over 8.5 million by 2020, a 25 percent increase from 2010, while King County's population is forecasted to grow during the same period by 17 percent.

In 2009, the Puget Sound Regional Council reported a total of 1,723,200 jobs in the four-county region. The largest sector was Services, with almost half (44 percent) of the regional employment. The next sector was Government and Education, which accounted for 16 percent, and Manufacturing and Retail each accounted for 10 percent of the employment. As the largest city in King County, Seattle provides the majority of all jobs in the county.

Regional Economic Stability

Despite a difficult economy over the past few years, the central Puget Sound region continues to provide a favorable environment for existing and new businesses. Seattle is an important business and commercial center for the region and plays a major role in Pacific Rim trade. Key factors that attract businesses include the highly skilled workforce, well-recognized major educational institutions, manufacturing capabilities, access to both domestic and international markets, and a diverse regional economy. For residents, the Puget Sound region offers a high quality of life, nationally recognized performing arts, professional sports teams, and scenic beauty. All of these factors contribute to conditions that are expected to result in continued employment and population growth in the region for the foreseeable future.

Community Facilities

Educational Facilities

There are three education facilities located at the north end of the study area: Argosy University, the Art Institute of Seattle, and the Seattle School of Theology and Psychology.

Social and Employment Services

Social and employment service providers within the study area provide hot meals, food bank services, drop-in hygiene facilities, clothing, employment and mental health counseling and legal services, and referrals for other social services and employment. Figure 3-17 shows the names and locations of these service providers.

Government Institutions

Federal, state, regional, and local government agency offices are located in downtown Seattle; however, few are located within the study area. The exceptions are the Port of Seattle facilities at Pier 69, which accommodate the Port of Seattle headquarters and the terminal for the Victoria Clipper; Bell Street Pier Cruise Terminal at Pier 66, which is home to a cruise ship terminal, conference center, and marina; and the Seattle Aquarium. The only state facility in the study area is Colman Dock Ferry Terminal.

Figure 3-17. Social resource agency outreach locations

Neighborhood Cohesion

A key aspect of neighborhood cohesion is the connectivity of land uses, facilities, services, and population, and the interrelationships between these elements that define the human environment. Transportation services and infrastructure define accessibility within and between the neighborhoods. The following subsections highlight the elements that define the cohesiveness of the study area as a whole and the neighborhoods included in the project area.

Transportation Services

Alaskan Way is downtown Seattle's westernmost arterial along the shores of Elliott Bay. It carries approximately 12,000 vehicles per day and is designated by the City as a major truck street. Sidewalks and the multi-use trail provide pedestrian and bicycle access to, through, and within the project area.

Buses and taxis provide transportation service throughout the Commercial Core and waterfront area. Most of the project area is accessible by public transit from outside the downtown area. Frequent and comprehensive transit service is a critical support service to downtown residents, especially those who are low income, homeless, and/or reliant on public transit.

Community Identity

The Pioneer Square neighborhood, in the south end of the project area, is an important symbol of Seattle and served as the staging area in the late 1800s for thousands of miners heading for the Klondike Gold Rush in Alaska. In particular, Washington Street Boat Landing is considered an important historic resource.

The Commercial Core, which is Seattle's major downtown area, extends along the waterfront between Columbia and Stewart Streets. The neighborhood is set apart from adjacent neighborhoods by a change in the orientation of the street network north and south of the neighborhood. It is characterized by many high-rise office buildings and includes the financial district and retail core. Hotels, restaurants, museums, theaters, and the symphony are concentrated between First and Fifth Avenues.

Along the downtown Seattle waterfront, the historic piers, railings, and ferries are unique symbols of Seattle. During the day, the area is occupied mainly by employees of retail, restaurant, and commercial establishments, along with visitors; in recent years, condominium and townhouse development has resulted in a growing residential population east of Alaskan Way.

The Belltown neighborhood is located immediately north of the downtown area, generally from Stewart Street north to Denny Way. It encompasses the waterfront area and extends east to approximately Fifth Avenue, immediately north of the Commercial Core. The

neighborhood is characterized by medium-density business, commercial, and residential land uses (FHWA et al. 2010).

Interaction Between People

The downtown Seattle waterfront is typically the domain of tourists, with downtown workers crossing from the ferries to offices in the Commercial Core during commute hours. On warmer days, downtown workers may exercise along the waterfront or eat lunch at one of the many outdoor restaurants on the waterfront piers. Every year from May through October, thousands of cruise line passengers embark and disembark at the Bell Street Pier Cruise Terminal (Pier 66).

Housing

Although located in downtown Seattle, the project area has a considerable amount and variety of housing. Downtown Seattle has many high-rise and large residential buildings, particularly in the Belltown and Commercial Core neighborhoods. In 2000, compared to Seattle as a whole, a higher percentage of study area residents rented rather than owned their homes; 81 percent lived in rental units in the study area versus just 52 percent in Seattle. Residential, retail commercial, office, and industrial land uses may be located in adjacent buildings on the same block or even in the same building in the study area.

Subsidized, Transitional, and Emergency Housing

The study area, particularly Pioneer Square and Belltown, includes much of Seattle's subsidized, special needs, and emergency housing. The special needs housing includes low-cost and low-income housing, senior housing, transitional and long-term residential services, emergency temporary housing, and shelters. Together, these facilities can serve over 1,300 people, including battered women and their children, persons with developmental disabilities and mental health issues, and chronically homeless and transient persons. Several local government buildings and existing homeless shelters provide emergency shelter during severe winter weather (FHWA et al. 2010).

There are many social services that operate in the study area to provide emergency housing, counseling, hot meals, food banks, health clinics, employment referrals, and other services for a large number of downtown residents (Crisis Clinic 2011). Some of these services provide assistance to people residing outside the study area. The vast majority of these services, however, help support the substantial low-income and homeless populations residing in the study area.

Unsheltered Homeless Population

Some individuals in downtown Seattle use building overhangs, porticos, elevated walkways, and roadways for weather protection while sleeping. In the study area, homeless people sleep in the sheltered space under the Alaskan Way Viaduct structure, which during the day is used for parking and roadways (FHWA et al. 2010).

The "One Night Count" is an annual event to determine the number of people sleeping outdoors in King County. An estimated 70 percent of the county's unsheltered homeless people live on the streets of downtown Seattle; from 2007 through 2010, the annual One Night Count in Seattle found an average of nearly 1,900 people sleeping unsheltered in the city (SKCCH 2007, 2008, 2009, and 2011). In the 2009 count, approximately 23 percent were found in or under structures or roadways; an additional 1 percent were found sleeping in their cars or trucks, including many who were assumed to be located under the Alaskan Way Viaduct (SKCCH 2009).

3.9 Visual Quality

The existing visual character and quality of the project area are formed by a composition of natural features—water, mountains, vegetation, and sky—framed and complemented by constructed features, including historic piers, parks, new and historic buildings, boats, street furnishings, artwork, the surrounding Seattle skyline, and the activity of the working waterfront. Each feature that contributes to this composition is a visual resource.

For purposes of the visual quality assessment, the study area is divided into two large landscape character units: Central Waterfront and North Waterfront. These are then subdivided into four smaller character units: Pioneer Square, Commercial Core, Pike Place Market, and Belltown.

The visual quality assessment considered 19 visual resources, some of which are of regional importance, and some of which are of more local interest. Details of this assessment are provided in the Visual Quality Assessment (Appendix K).

Scenic wiews of Elliott Bay and the downtown Seattle waterfront, 2008

Project Area Visual Resources

At a regional scale, Elliott Bay is surrounded by the visible landforms of Mount Rainier, West Seattle, Magnolia Bluff, Bainbridge Island, the Kitsap Peninsula, and the Olympic Mountains, which are all significant visual resources. Together these landforms create the foreground, middle ground, and background that are visible when looking west through unobstructed portions of the project area. To the east, the project area is framed by the downtown Seattle skyline. The Olympic Mountains, Elliott Bay, and the Seattle skyline are protected visual resources (SMC 25.05.675).

Three regional visual resources were identified:

- Olympic Mountains – Forming a dramatic background to the viewshed (an area visible from a specific location), the mountains define the Pacific Northwest character of the project area.

- Elliott Bay – Open water is a highly valued visual resource, and Elliott Bay establishes the waterfront character of the project area. Although landforms surrounding Elliott Bay are not specifically identified as protected visual resources (SMC 25.05.675), the visual quality assessment addressed them as part of the Elliott Bay visual resource.
- Seattle Skyline – Historic brick facades contrasted by newer glass and steel skyscrapers and Seattle's iconic Space Needle northeast of the project area contribute to the urban character and context.

Mount Rainier is also a protected visual resource that is visible from several locations, such as the Bell Street Pier and the Bell Street overpass, although it is not directly visible from the Elliott Bay Seawall.

Within the project area, the piers, Bell Harbor Marina, Waterfront Park, Colman Dock Ferry Terminal, and the Washington Street Boat Landing—as well as the existing Elliott Bay Seawall, railing, and exposed riprap stone revetment along the base of the seawall—all contribute to Seattle's unique waterfront character. The angled piers reflect the waterfront's historical commerce and rail yard origins and contrast with Seattle's street grid and seawall.

Protected Visual Resources

In recent years, protecting and preserving Seattle's vistas and viewscapes has become an issue of concern. The SMC identifies specific views that are protected by ordinance (SMC 25.05.675P). Effects on these protected views must be considered during the review and conditioning of development through the Master Use Permit and SEPA review processes.

Viewer Exposure and Sensitivity to Improvements

Viewer exposure maps were developed to identify key views experienced by viewer groups that may be affected by the project (Figure 3-18 and Figure 3-19). Four viewer exposures were analyzed:

- Views (generally to the west) from the project area toward Elliott Bay and landforms beyond. This is the view experienced by motorists and pedestrians along Alaskan Way and in or on the waterfront piers.
- Views (generally to the west) from the project area toward the piers and waterfront structures. This view is also experienced by motorists and pedestrians along Alaskan Way. In these spaces, piers or other structures obstruct views toward Elliott Bay. However, the pier facades, boats, and other nautical elements are visual resources that contribute to the waterfront character.
- Views (generally to the west) from downtown Seattle to the project area. This view is experienced by motorists and pedestrians along east-west streets, many of which are protected view corridors (SMC 25.05.675), and by people in west-facing buildings or spaces. Viewer sensitivity from this exposure is lower because the views are partially obscured by the Alaskan Way Viaduct.

Views to and from the Waterfront

For this Environmental Impact Statement, four sets of views were considered:

- Views from the project area toward Elliott Bay and the landforms beyond
- Views from the project area toward the piers and waterfront structures
- Views from downtown Seattle toward the project area
- Views toward the seawall from the piers and from watercraft on Elliott Bay

- Views (generally to the east) from the piers and Elliott Bay watercraft. From this exposure, viewers see exposed seawall areas, railings, street furnishings, plants, etc. These views also include the Seattle skyline, which is partially obscured by the Alaskan Way Viaduct.

Another viewer exposure is the view toward the downtown Seattle skyline from the project area. This view is significant and protected (SMC 25.05.675), but because the seawall improvements would have little influence on this view, it is not included in the viewer exposure map. Also of significance is Alaskan Way, which is a designated scenic route (SMC 25.05.675); therefore, the proposed seawall improvements were evaluated for their contribution to or impact on the viewer experience traveling along this roadway.

Figure 3-20 through Figure 3-23 show the existing conditions as viewed from the four viewpoints.

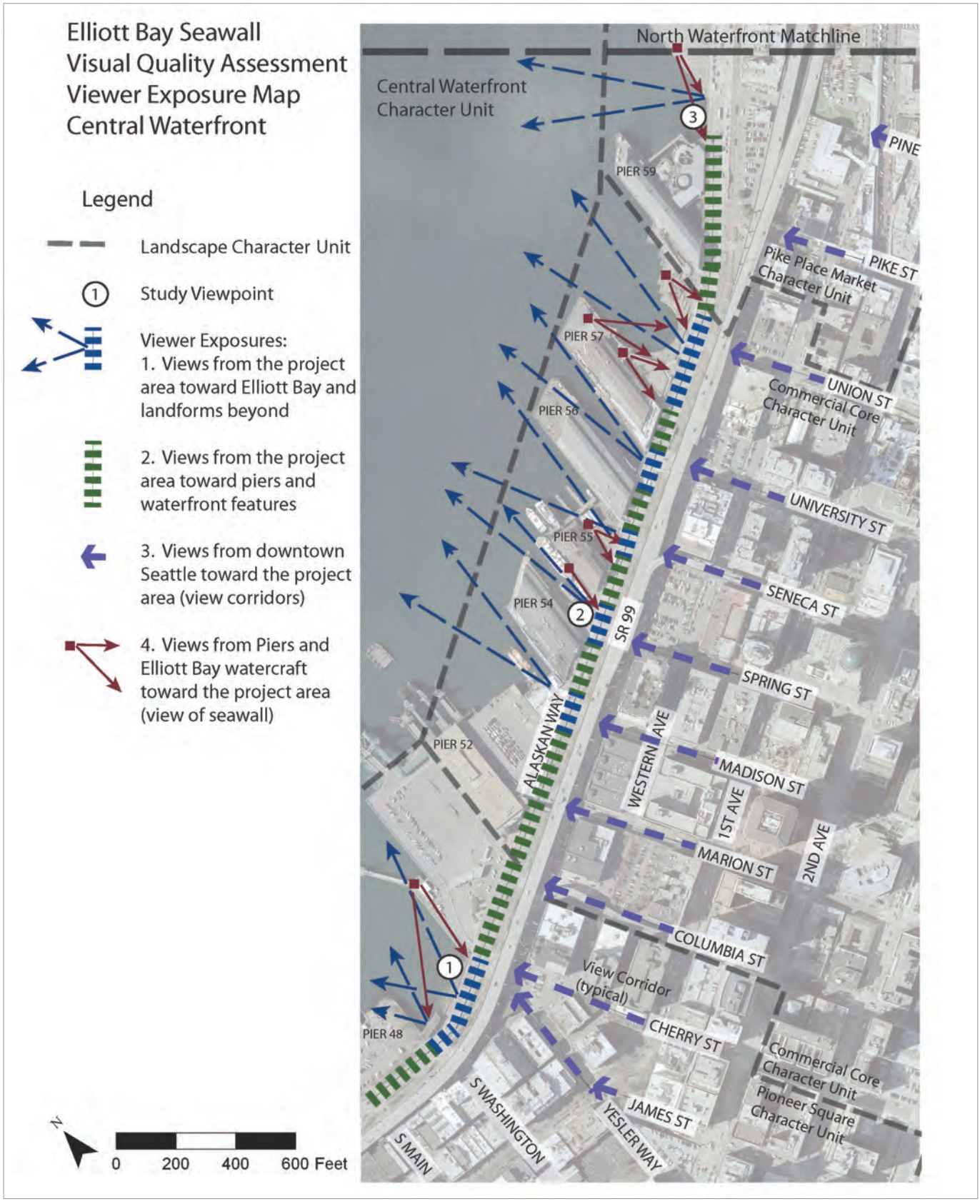


Figure 3-18. Viewer exposure map, central waterfront

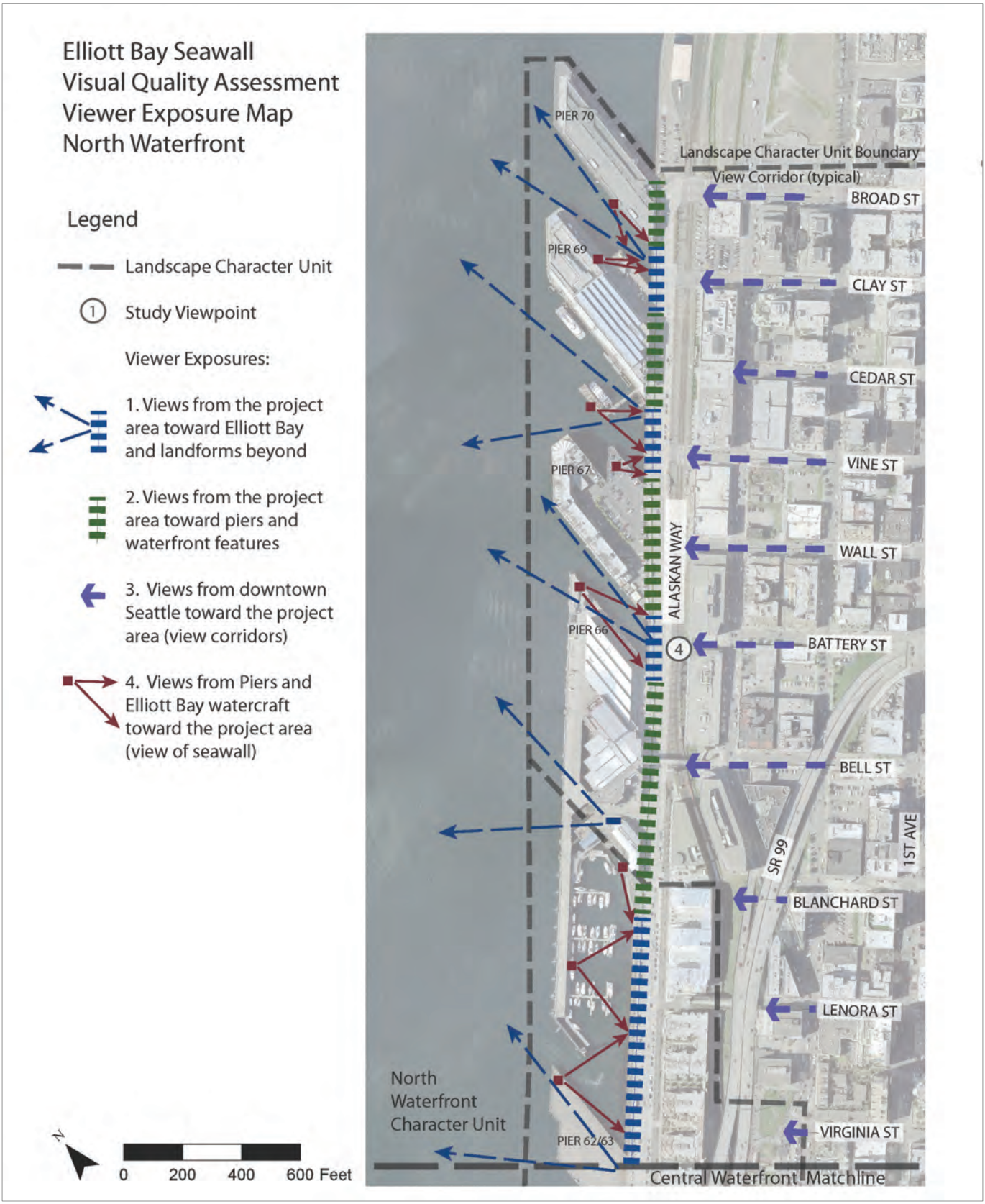


Figure 3-19. Viewer exposure map, north waterfront

Figure 3-20. Viewpoint 1, between Pier 48 and Colman Dock Ferry Terminal, seen from Alaskan Way sidewalk looking north (top) and from Pier 50 looking southeast (bottom)

Figure 3-21. Viewpoint 2, between Piers 54 and 55, seen from Alaskan Way sidewalk looking north (top) and from Pier 54 looking east (bottom)

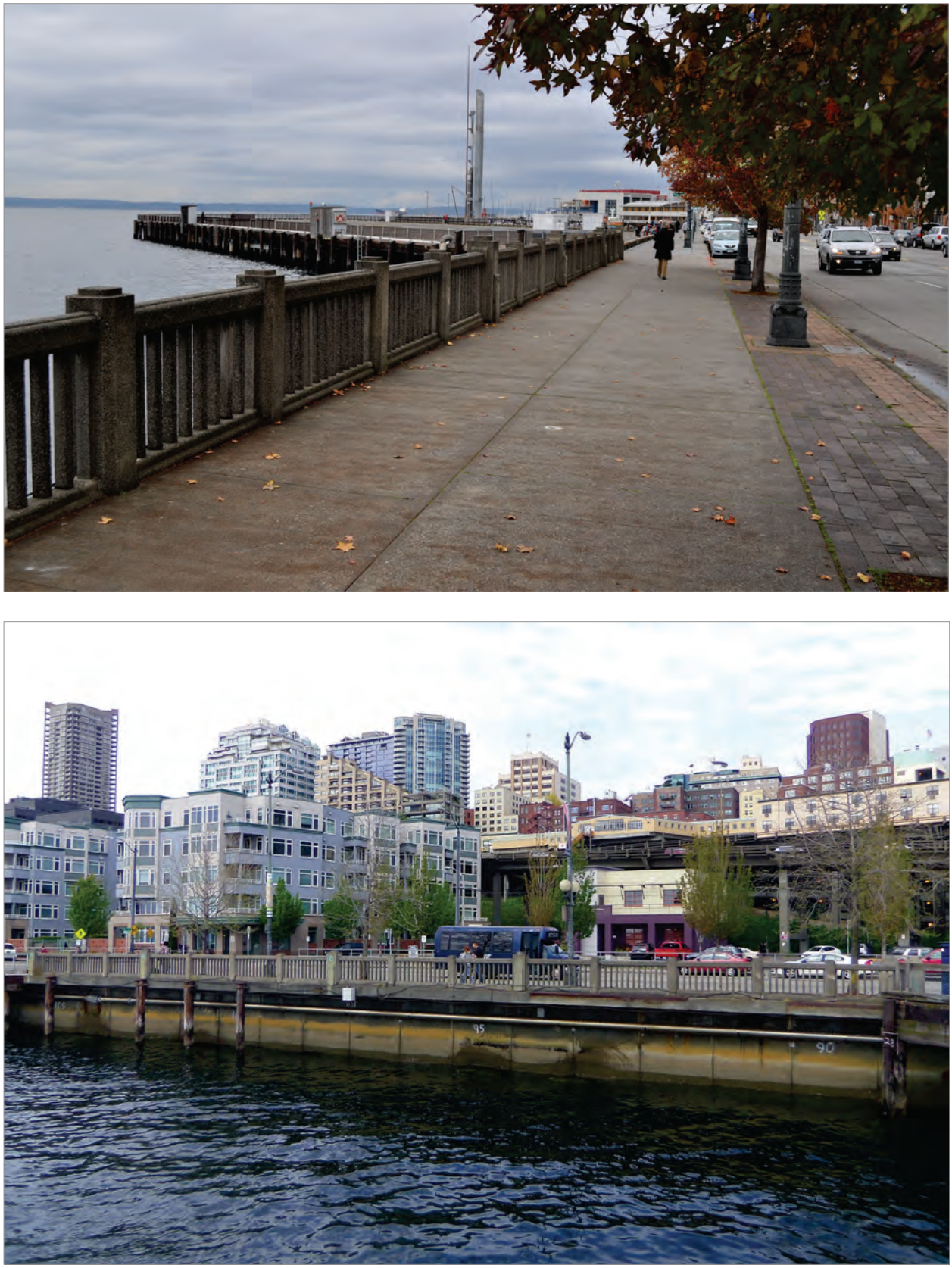


Figure 3-22. Viewpoint 3, between Seattle Aquarium and Pier 62/63, seen from Alaskan Way sidewalk looking north (top) and from Seattle Aquarium looking northeast (bottom)

Figure 3-23. Viewpoint 4, between Pier 66 and Pier 67, seen from Alaskan Way sidewalk looking north (top) and from Pier 67, Edgewater Hotel, looking southeast (bottom)

3.10 Fish, Wildlife, and Vegetation

The study area evaluated for fish, wildlife, and vegetation focused primarily on the area extending from S. Washington Street in the south to Broad Street in the north, Western Avenue in the east, and the approximate 50-foot bathymetric contour to the west. However, because impacts on local biological resources could potentially extend farther into Elliott Bay, organisms and habitats found in deeper waters were also considered. Reference sources for the discussion below are provided in the Fish, Wildlife, and Vegetation Discipline Report (Appendix L).

Existing Conditions

The project area is located on the eastern shore of central Puget Sound, forming part of one of the world's largest and deepest estuaries. Elliott Bay is one of the most heavily urbanized and polluted areas in Puget Sound. Historically, the study area consisted of extensive intertidal mud flats, sand flats, and vegetated wetlands bordered by steep bluffs. Through more than 100 years of urbanization, the study area was fundamentally altered by filling, dredging, and grading along the shoreline and the construction of infrastructure including the Elliott Bay Seawall, bulkheads, and piers.

Very little natural shoreline, upland, or intertidal aquatic habitat remains in the study area. Overwater structures occupy over 65 percent of the shoreline of Elliott Bay, preventing light from penetrating into much of the nearshore area during the day and exposing the nearshore area to artificial light from urban sources at night. Substrates in the nearshore area include riprap, cobble, gravel, sand, silt, concrete, and other debris. Riprap (consisting of large rocks) is commonly found at the base of the Elliott Bay Seawall, whereas quarry spalls (irregular rocks 4 to 8 inches in diameter) are scattered from the lower portion of the intertidal zone down through the subtidal zone. Sand is found primarily in the deeper subtidal zone but is also present beneath most piers and in the intertidal habitat bench located immediately north of Pier 48. Rocky substrate larger than gravel size provides a source of attachment for algae.

The nearshore bathymetry has been greatly altered by urbanization of the waterfront and maintenance of vessel moorage. Dredging for vessel access has restricted shallow areas of the sea bottom to the areas under the existing piers or former pier sites, leaving deep water between the piers. One exception is the area north of Pier 48, which is generally shallow and has a gravel intertidal bench. Substrates found throughout the littoral and shallow subtidal zones are largely composed of either riprap lying at the base of the seawall or a mix of sand, silt, and shell hash that dominates the deep subtidal in most locations, although there are also areas with accumulations of miscellaneous rubble and downed pilings.

Suspended fine sediments from multiple sources, including the Duwamish River, stormwater runoff, CSO outfalls, and past industrial and commercial activities, have accumulated in the nearshore area.

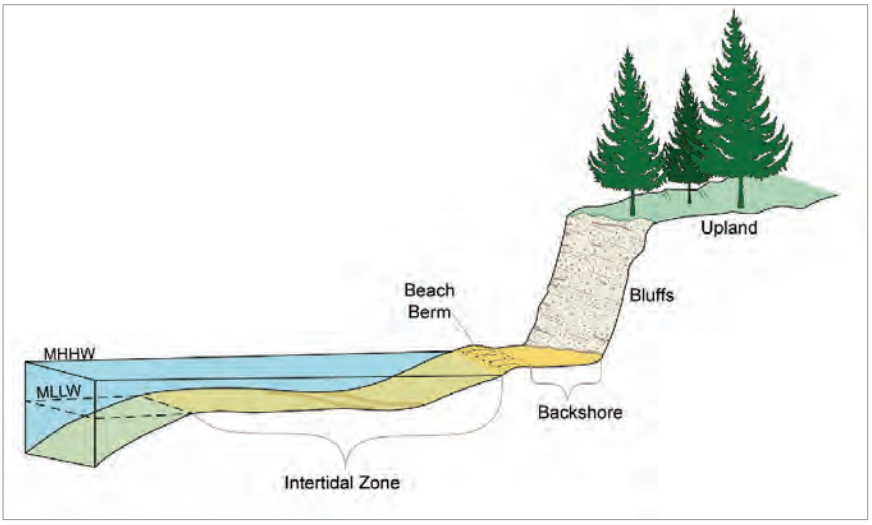
Littoral and Subtidal Zones

The littoral zone, also referred to as the intertidal zone, is the area where water elevation fluctuates with the tides. It extends from the high water mark, which is rarely inundated, to the mean lower low water elevation. The subtidal zone is the area that is permanently inundated by water.

Existing intertidal area north of Pier 48

Examples of macroalgae in the study area

These sediments are known to contain various pollutants such as polycyclic aromatic hydrocarbons (PAHs), including benzo(a)pyrene, benzo(a)anthracene, chrysene, fluoranthene, naphthalene, phenanthrene, or pyrene; and metals, including arsenic, cadmium, copper, lead, mercury, silver, or zinc.



Schematic of historical shoreline showing bluff, beach berm, backshore, and intertidal depositional environments (modeled after Downing 1983)

Pelagic and Benthic Zones

The pelagic zone is offshore in deeper water than the nearshore. It provides habitat for many invertebrate species, including zooplankton, squid, and jellyfish.

The benthic zone is the area at the ocean bottom, including the upper layer of sediments. In Elliott Bay, the benthic environment is home to species such as barnacles, mussels, crabs, oysters, and snails.

Vegetation

Although the vegetation in the study area has been substantially altered from its historical and natural state, numerous species have become established in the marine and upland habitats. The upland plant community is composed mainly of planted nonnative species. However, native species dominate the aquatic nearshore plant community. A detailed discussion of marine and upland habitats is provided in the Fish, Wildlife, and Vegetation Discipline Report (Appendix L).

Marine Vegetation

Numerous species of green, red, and brown algae live in the nearshore area. Artificial structures such as floating docks and wood pilings are dominated by sea lettuce and rockweed in addition to various Rhodophyta species and sugar wrack. Mats of bull kelp are present along the seawall in discrete patches between piers. No eelgrass has been observed in the study area.

Areas with more intact native vegetation surround the study area. The shallow subtidal sand flats and other remnant sandy subtidal areas between Alki Point and Duwamish Head support productive eelgrass beds that are important to a variety of marine organisms, including juvenile anadromous fish. Underwater surveys performed along the Olympic Sculpture Park shoreline north of the study area documented 23 species of algae on and near the created habitat bench.

Top photo shows macroalgae in the study area; bottom photo shows lack of marine plants and other organisms beneath overwater structures

Upland Vegetation

The upland plants in the study area are almost exclusively exotic species that are adapted to areas frequently disturbed by human activities or that have been planted as ornamentals. Some hardy exotic species documented in the area include English ivy, Himalayan blackberry, and butterfly bush. Native species such as western brackenfern, leathery polypody, sword fern, and trailing blackberry also grow in the same areas as the exotic species. Nonvascular plants such as mosses and lichens grow on a variety of hard surfaces. Planted ornamental exotic species are the dominant vegetative features of the upland; common trees include maples and liquidambar as well as ornamental cherry and arborvitae.

Examples of upland vegetation in the study area

Invertebrates

Various invertebrate species live in the study area, including species of jellyfish and anemones, sponges, mollusks, crustaceans and barnacles, starfish and allies, annelids, and tunicates. Marine borers have substantially contributed to the deterioration of the seawall. Terrestrial insects, which are important in the greater ecosystem as prey both in and upland of the nearshore, are also found in the study area. A detailed discussion of invertebrates is provided in the Fish, Wildlife, and Vegetation Discipline Report (Appendix L).

Pelagic Invertebrates

The pelagic zone hosts invertebrates that primarily move passively (i.e., with water movement) or by active propulsion. Species of zooplankton, an extremely diverse group of mostly passively moving animals, are abundant in the study area.

Squid species are common nocturnal visitors to the pelagic zone. They are most common in the nearshore area in October and November, when they move into shallow waters to feed, breed, and lay eggs. They are known to be attracted to artificial light and are lured to the piers by anglers with spotlights. Squid species constitute a popular fishery, with most of the fishing occurring off Pier 86 (outside the study area), although all the piers in the study area are used for angling. Jellyfish

Marine Invertebrates in the Project Area

Common native species include the acorn barnacle, little brown barnacle, Pacific blue mussel, black turban snail, frosted nudibranch, jingleshell oyster, ochre starfish, sea snail, mask limpet, giant green anemone, hairy crab, coonstripe shrimp, and Pacific octopus. Nonnative invertebrates include the club tunicate, Manila clam, European green crab, freshwater hydroid, mud snail, slipper limpet, mouse-ear marsh snail, giant oyster, soft-shelled clam, and purple varnish clam.

make up a large component of the pelagic community in Puget Sound and Elliott Bay during the spring.

Benthic Invertebrates

Benthic invertebrates live on or in the ocean bottom or associated substrate and are common throughout the study area. At least 28 species of benthic invertebrates have been documented in the study area. One species that is widespread is the acorn barnacle, which is found blanketing the entire intertidal zone. Another barnacle that occurs less frequently is the little brown barnacle. Gastropods such as the Pacific blue mussel and black turban snail are commonly associated with pilings and other constructed surfaces in the study area. The frosted nudibranch and jingleshell oyster are both mollusks common to the nearshore area.

North of Pier 55, the diversity of marine invertebrates increases. Species such as the ochre starfish, sea snail, mask limpet, and giant green anemone are present in low densities in this area. Hairy crabs, coonstripe shrimp, and Pacific octopus are often present around Pier 59. Species of echinoderms (starfish and similar organisms) such as the sunflower star, bat star, and Pacific henricia are present in protected areas such as Bell Harbor Marina, near Pier 66. Occasionally, the Dungeness crab, spider crab, shore crab, and helmet crab are also found in this area. The giant Pacific octopus, a significant predator of many other invertebrates and fish, is also present throughout the nearshore area.

Non-rocky substrate such as pilings and other structures associated with docks and piers host most of the same species found on other substrates; however, the densities of the species differ. Blue mussels and acorn barnacles dominate these areas, while giant green anemones, ochre starfish, black turban snails, and mask limpets are present at relatively lower densities. Various nonnative invertebrates have also been reported in the nearshore portion of the study area. These include the club tunicate, Manila clam, European green crab, freshwater hydroid, mud snail, slipper limpet, mouse-ear marsh snail, giant oyster, soft-shelled clam, and purple varnish clam. Two species of sea squirts are also present in the area. The effects of these species on the native species are currently unknown.

Examples of benthic invertebrates in the study area

Terrestrial Invertebrates

Terrestrial insects are an important source of prey for many insectivores in the nearshore area, including salmonids and various crab species. Insect species in the study area include spiders, dipteran flies, springtails, bark lice, aphids, ants, and mites. The densities of terrestrial insects in the nearshore area are at their lowest where overhanging terrestrial vegetation has been replaced by structures. Because minimal vegetation is present along the entire length of the seawall, it is assumed that the densities of terrestrial insects are low.

Fish

The study area and surrounding landscape have been substantially altered from historical conditions, as described previously. The modifications in the study area have primarily occurred along the nearshore area that juvenile salmon rely on in their critical early marine life stage.

All marine waters in the study area provide habitat for various fish species. Included are species of skates, rays and sharks, lamprey, salmon and trout, perch and gunnels, herring and anchovies, sandlances, sculpins, lingcod and rockfish, clingfishes, pricklebacks, flatfishes, flounders, and soles. Fishes in general are very important to many aspects of the local ecosystem and to the local economy for sport and as a food resource. The degraded habitat in the study area, among other pressures, contributes to depressed fish populations and a reduction in individual viability. Several fish species and associated habitats that occur in the study area have been listed as species of concern under the federal Endangered Species Act, the Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species program, or both. These species are described further later in this section.

The distribution of fish types tends to differ between shallow and deep water. Average fish densities are generally highest in deep water and associated with riprap, although high densities of a few species may drive this pattern. Also, their position in the water column and their behavior appear to vary by species. For salmonids, the water-column position usually ranges from the middle to the surface, and most other fish occur at middle to bottom depths.

Resident Marine and Estuarine Fish

Results from various surveys indicate that the fish assemblage in the nearshore portion of the study area has a diversity of resident species. Across all habitats, the most commonly observed species include the shiner perch, pile perch, striped seaperch, tube-snout, kelp perch, brown rockfish, and spotted ratfish. Other common species are found in specific areas or zones of the marine environment. Species common to the deeper zones include the Dover sole, English sole, kelp greenling, Pacific tomcod, blackbelly eelpout, bay pipefish, quillback rockfish, copper rockfish, and Pacific staghorn sculpin. Species common to the area between the benthic zone and the water surface include the spiny dogfish, walleye pollock, snake prickleback, Pacific sand lance, lingcod, yellowtail rockfish, black rockfish, Pacific hake, and surf smelt.

Anadromous Salmonids

At least nine species of native anadromous salmonids occur in the study area and may frequent the nearshore and offshore waters as juveniles and adults. These species include Chinook salmon, chum salmon, pink salmon, sockeye salmon, coho salmon, steelhead trout, bull trout, Dolly Varden, and sea-run coastal cutthroat trout. The proximity of the study

Fish in the Study Area

Despite the urbanized nature of Elliott Bay, many fish species are found there. Included are species of skates, rays and sharks, lamprey, salmon and trout, perch and gunnels, herring and anchovies, sandlances, sculpins, lingcod and rockfish, clingfishes, pricklebacks, flatfishes, flounders, and soles. However, the degraded conditions in the study area have reduced fish populations over time, and several fish species have been listed under the federal Endangered Species Act and/or identified as species of concern under the Washington Department of Fish and Wildlife Priority Habitats and Species Program.

The Importance of Light in the Nearshore Environment

Studies have shown that there are fewer fish, and lower overall biodiversity, in areas shaded by overwater structures. It is also known that areas with strong light contrast, such as shadows cast by nearshore docks on a sunny day, are barriers to juvenile salmon movement. This results in altered migration patterns, as well as increased stress levels and exposure to predators.

area to the Duwamish estuary and other stream systems causes the nearshore and offshore waters to be a migration corridor, which could also serve as a rearing area. Spawning adults returning from the ocean migrate through Elliott Bay and along the downtown Seattle waterfront. Juveniles move from spawning and rearing areas in the Green River into the Duwamish estuary and out through the study area during outmigration. Adults and juveniles from other basins, such as Lake Washington/Cedar River, the Puyallup River, and the Snohomish River, likely also use Elliott Bay and the study area (Brennan et al. 2004).

Salmonids use the waters of the study area during transient phases of their life cycles, causing each to be present at different times and virtually ensuring that at least one species can be found in the nearshore at all times of the year. Juveniles typically rear and migrate through the study area during spring and summer, although juvenile Chinook salmon have been observed in Elliott Bay as early as January and in the nearshore as late as October. Juvenile coho salmon are generally present in mid-February to mid-June, with some remaining until October. The timing of adults in the nearshore area also varies. This complex pattern of the occurrence of juveniles and adults of each species in the nearshore portion of the study area is illustrated in Table 3-8.

Anadromous Fish

Anadromous fish are those that are born in fresh water, spend most of their lives in the ocean, and return to fresh water to spawn. Salmon, along with smelt and several other fish species, are anadromous.

Table 3-8. Approximate Salmonid Seasonal Timing in the Waters of Elliott Bay, Including the Study Area

Species	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Chinook Salmon			J	J	J	A+J	A+J	A+J	A	A	A	
Coho Salmon			J	J	J	J	J	A	A	A	A	
Chum Salmon			J	J	J	J	A+J	A	A			
Pink Salmon		J	J	J	J	J	A	A	A	A		
Sockeye Salmon				A	A	A+J	A+J	A	A	A		
Steelhead Trout	A	A	A	A+J	J	A	A	A	A	A	A	A
Sea-run Coastal Cutthroat Trout	A			J	J	J	J	J	A	A	A	A
Bull Trout		J	J	J	J	J	A	A	A	A		

Notes: J = *Juveniles*; A = *Adults*; A+J = *Adults and Juveniles*

Sources: Grette and Salo 1986; Anchor QEA 2012; see the Fish, Wildlife, and Vegetation Discipline Report (Appendix L)

Salmonids maintain somewhat predictable spatial distributions in the study area, but these distributions vary across life stages. Juvenile salmonids are generally more abundant in the shallow waters of the nearshore area but increase in densities during periods of high tide. In contrast, adult salmonids prefer areas above the middle of the water column. As a group, juveniles have been shown to have some of the highest densities in the shallow waters near the seawall during the spring and early summer. In contrast, adult Chinook are generally found farther from shore, in the middle of the water column or near the surface, while adult chum are also found in deeper waters near the surface.

Salmonids in the study area usually avoid waters beneath overwater structures. However, they do school near piling edges at the shade line, as well as in open, unshaded water.

Wildlife

Wildlife in the study area is composed of species that are well adapted to living in an urban landscape, as well as marine birds that use the study area seasonally.

Birds

Many species of birds use the study area during at least part of the year, including a diverse mix of waterbirds, waterfowl, seabirds, waders, passerines, shorebirds, and raptors. In general, this assemblage can be divided into two groups: those associated with the nearshore environment and those associated with the surrounding upland area. Several birds have been listed as species of concern by federal and state agencies.

The study area contains a diverse mix of bird species. Gulls, such as the herring gull, California gull, and ring-billed gull, are common at the waterfront. Other common species that often swim on the water surface or dive offshore include the double-crested cormorant, pigeon guillemot, common goldeneye, surf scoter, common merganser, and western grebe. Killdeer and great blue heron are sometimes seen foraging along the exposed shoreline, while belted kingfishers fish along the waterfront. Populations of water birds increase in winter and include the red-necked grebe, lesser scaup, American wigeon, hooded merganser, glaucous gull, glaucous-winged gull, pigeon guillemot, common murre, rhinoceros auklet, and Canada goose.

Elliott Bay typically hosts the highest numbers of water birds in winter. This is attributed to a large influx of migrants that seek shelter and feeding grounds in the mostly protected waters of the bay. Some species regularly seen in the study area during the winter season include the red-necked grebe, lesser scaup, American wigeon, hooded merganser, glaucous gull, glaucous-winged gull, pigeon guillemot, common murre, rhinoceros auklet, and Canada goose.

The Migratory Bird Treaty Act

Protection has been afforded to all migratory birds under the Migratory Bird Treaty Act (United States Code, Title 16, Sections 703–712 [16 USC 703–712]), which states that all migratory birds and their parts, nests, and eggs are fully protected. Bald eagles receive additional protection under the Bald and Golden Eagle Protection Act (16 USC 668–668d), which protects the bald eagle and golden eagle by prohibiting, except under certain specified conditions, the "take," possession, and commerce of such birds. Take includes pursuing, shooting, poisoning, wounding, killing, capturing, trapping, collecting, molesting, or disturbing the protected eagles.

Some of the most common upland bird species in the study area are exotic species such as the house sparrow, European starling, and rock pigeon, which are ubiquitous throughout the waterfront. Some native species are also common, including the American crow, Northwestern crow, and Brewer's blackbird. Black-capped chickadees, another native species, commonly nest in ornamental trees planted along Alaskan Way. Purple martins and violet-green swallows also nest in the area, although they typically rely on artificial nest structures or cavities in buildings.

Four raptor species are seen periodically in the study area: the bald eagle, peregrine falcon, osprey, and red-tailed hawk. The relative infrequency of sightings is attributed to the use of the study area by these species only for hunting. Peregrine falcons tend to nest in upland areas on tall human-made structures such as high-rise buildings. Red-tailed hawks are infrequent raptors in the study area; their low frequency is due to their requirement for open terrestrial areas with natural substrate for hunting. Similar to peregrine falcons, red-tailed hawks have been documented nesting on various structures around Elliott Bay.

Mammals

Marine and Aquatic Mammals

Several marine mammals have been listed as species of concern by federal and state agencies. Marine mammals are afforded protection under the Marine Mammal Protection Act (16 USC 1361) (see Chapter 7 for details).

Various marine and aquatic mammals use Elliott Bay and the waters of the study area. Cetaceans such as the killer whale, Dall's porpoise, harbor porpoise, and gray whale are seen at times in the offshore waters of Elliott Bay. Of these species, gray whale sightings are least common, occurring primarily between March and May during their northward migration, with some whales possibly using the greater Puget Sound as a summering ground. Pinnipeds such as harbor seals and California sea lions are common and can be found around piers near the seawall and Olympic Sculpture Park, where they use intertidal benches, spits, bars, rocks, and log rafts as haul-out areas to bask in the sun and sleep. Harbor seals are the only pinniped found in Elliott Bay year-round and the only seal that breeds in the area. The northern river otter is known to frequent many areas of nearshore Elliott Bay and is assumed to use the study area.

Upland Mammals

Very few species of upland mammals are present within the urbanized study area. Of those present, many are nonnative species. Common nonnative species include the black rat, Norway rat, house mouse, and eastern gray squirrel.

Native upland mammal species that may occasionally be present in the study area include the opossum, raccoon, and coyote. These species typically frequent nearby parks, but also venture into more urbanized

Species Listed under the Endangered Species Act

As defined by the federal Endangered Species Act, "endangered" refers to species that are in danger of extinction within the foreseeable future throughout all or a significant portion of their ranges, while "threatened" refers to those animals and plants likely to become endangered within the foreseeable future throughout all or a significant portion of their ranges. A "candidate species" is a species of plants or animals classified as a candidate for possible listing as endangered or threatened by a government agency.

Unlisted "species of concern" are those species about which there are concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the Endangered Species Act.

areas to seek food. Native bat species occasionally roost in buildings or other structures and forage in the study area. Eight species of bats may occur in the area, the most common being the big brown bat. One other species that may occur in the study area, the Pacific Townsend's big-eared bat, is a species of concern in Washington State.

Threatened, Endangered, and Candidate Species

Section 7 of the Endangered Species Act requires federal agencies to ensure that any action authorized, funded, or carried out by a federal agency is not likely to jeopardize the continued existence of any threatened or endangered species. The Endangered Species Act further requires the federal government to designate "critical habitat" for any species it lists under the act.

Section 6 of the Endangered Species Act provides a mechanism for cooperation between federal agencies and states in the conservation of threatened and endangered species. The species considered in this discussion are those listed as "endangered," "threatened," "proposed," or "candidate" species by the federal agencies (National Oceanic and Atmospheric Administration [NOAA], or National Marine Fisheries Service, and U.S. Fish and Wildlife Service [USFWS]) and those listed as "endangered," "threatened," or "species of concern" by WDFW.

Table 3-9 lists 17 endangered, threatened, and candidate species with the potential to occur in King County. Only 11 of these 17 species have the potential to occur in the study area, although the presence of some of these species is unlikely. Nine federally listed species have the potential to be in the project area: two are endangered and seven are threatened (NOAA-NMFS 2009, 2010a, 2010b, 2010c; USFWS 2010). Through its Priority Habitats and Species program, WDFW has identified two additional species that have the potential to occur in the study area; both are listed as candidate species (WDFW 2008, 2011b). More information on these species and their critical habitat are discussed in the Fish, Wildlife, and Vegetation Discipline Report (Appendix L).

Table 3-9. Endangered, Threatened, and Candidate Species in and around the Study Area

Common Name (Scientific Name)	Status (Federal/State)	Potential of Occurrence
Bocaccio (*Sebastes paucispinis*); Puget Sound/ Georgia Basin DPS[1]	Endangered/candidate	Unlikely
Leatherback sea turtle (*Dermochelys coriacea*)[2]	Endangered/none	Not present
Green sea turtle (*Chelonia mydas*)[2]	Endangered/none	Not present
Olive Ridley sea turtle (*Lepidochelys olivacea*)[2]	Endangered/none	Not present
Northern spotted owl (*Strix occidentalis caurina*)[3]	Endangered/threatened	Not present

Common Name (Scientific Name)	Status (Federal/State)	Potential of Occurrence
Southern resident killer whale (*Orcinus orca*)[4]	Endangered/endangered	Unlikely
Humpback whale (*Megaptera novaeangliae*)[4]	Endangered/endangered	Not present
Bull trout (*Salvelinus confluentus*); Coastal-Puget Sound DPS[3]	Threatened/candidate	Likely
Chinook salmon (*Oncorhynchus tshawytscha*); Puget Sound ESU[5]	Threatened/candidate	Likely
Steelhead (*Oncorhynchus mykiss*); Puget Sound DPS[5]	Threatened/candidate	Likely
Canary rockfish (*Sebastes pinniger*); Puget Sound/Georgia Basin DPS[1]	Threatened/candidate	Unlikely
Yelloweye rockfish (*Sebastes ruberrimus*); Puget Sound/Georgia Basin DPS[1]	Threatened/candidate	Unlikely
Loggerhead sea turtle (*Caretta caretta*)[2]	Threatened/none	Not present
Marbled murrelet (*Brachyramphus marmoratus*)[3]	Threatened/threatened	Unlikely
Steller sea lion (*Eumetopias jubatus*); eastern population[4]	Threatened/threatened	Unlikely
Coho salmon (*Oncorhynchus kisutch*); Puget Sound/Georgia Basin ESU[6]	Species of concern/candidate	Likely
Chum salmon (*Oncorhynchus keta*); Puget Sound/Strait of Georgia ESU[6]	None/candidate	Likely

Sources: [1] *NOAA-NMFS 2010b;* [2] *NOAA-NMFS 2010a;* [3] *USFWS 2010;* [4] *NOAA-NMFS 2010c;* [5] *NOAA-NMFS 2009; and* [6] *WDFW 2008, 2011a.*

Notes: *DPS – distinct population segment, ESU – evolutionarily significant unit*

Essential Fish Habitat

As required by the Magnuson-Stevens Fishery Conservation and Management Act and the 1996 Sustainable Fisheries Act, an evaluation of impacts on essential fish habitat was necessary for the project.

Both essential fish habitat and habitat areas of particular concern have been identified in the study area. There are two types of essential fish habitat (Pacific Coast groundfish essential fish habitat and West Coast salmon essential fish habitat) and four habitat areas of particular concern (estuaries, canopy kelp, seagrass, and rocky reefs) (PFMC 1999, 2005; NOAA-NMFS 2011). In addition to the discussion below, details about essential fish habitat and habitat areas of particular concern in

the study area are discussed in the Fish, Wildlife, and Vegetation Discipline Report (Appendix L).

Essential Fish Habitat in the Study Area

Essential fish habitat for Pacific Coast groundfish in the study area includes all waters and substrates of Elliott Bay. Eighty-one groundfish species have the potential to occur within the study area. Essential fish habitat for the West Coast salmon fishery refers to those waters and substrate necessary for salmon production to support a long-term sustainable fishery and contribute to a healthy ecosystem. To achieve that level of production, essential fish habitat must include all water bodies and most of the habitat historically accessible to salmon in Washington, Oregon, Idaho, and California (PFMC 1999). In the estuarine and marine areas, salmon essential fish habitat extends from the nearshore and tidal submerged environments within state territorial waters out to 200 nautical miles offshore of Washington, Oregon, and northern California (PFMC 1999). Seventy-six West Coast salmon stocks have been identified as using the designated West Coast salmon essential fish habitat (NOAA-NMFS 2011), nine of which have the potential to occur in the study area.

Habitat Areas of Particular Concern in the Study Area

Four habitat areas of particular concern are found in the study area: estuary, canopy kelp, seagrass, and rocky reefs. These habitat types are described in detail in the Fish, Wildlife, and Vegetation Discipline Report (Appendix L).

3.11 Water Resources

The study area for the water resources analysis is Elliott Bay in proximity to the seawall project limits. Stormwater runoff from nearly all of the drainage area within the project limits enters the City's separated stormwater system, with several drainage outfalls to Elliott Bay through the seawall. A small portion of the area within the project limits drains to the combined sewer system, which conveys stormwater and wastewater flows from an area far greater than the project limits to the King County West Point Treatment Plant.

Physical Environment

Elliott Bay is an estuary in central Puget Sound, its primary freshwater source being the Duwamish River, which discharges as the Duwamish Waterway into the south end of the bay. Elliott Bay has a surface area of approximately 7.7 square miles and a volume of approximately 20,200 acre-feet (Baker 1982). Depths range to more than 600 feet (Baker 1982).

The average tidal range in Elliott Bay is 11.3 feet. Mean higher high water is 9.02 feet and mean lower low water is -2.34 feet (relative to the North American Vertical Datum of 1988 [NAVD 88]). The maximum recorded high-tide elevation in Elliott Bay is 12.124 feet (NAVD 88). For

Essential Fish Habitat

Essential fish habitat is defined by the Magnuson-Stevens Fishery Conservation and Management Act (Code of Federal Regulations, Title 50, Sections 600.905–930 [50 CFR 600.905–930]) as "…those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

Guidelines for essential fish habitat published in federal regulations (50 CFR 600.815(a)(8)) identify habitat areas of particular concern based on one or more of the following considerations (PFMC 2005): (1) the importance of the ecological function provided by the habitat; (2) the extent to which the habitat is sensitive to human-induced environmental degradation; (3) whether, and to what extent, development activities are or will be stressing the habitat type; and (4) the rarity of the habitat type.

Mean Higher High Water

Mean higher high water is the long-term average of the higher of the two high tides each day.

Mean Lower Low Water

Mean lower low water is the long-term average of the lower of the two low tides each day.

comparison, the elevation of the top of the existing Elliott Bay Seawall and the adjacent Alaskan Way road surface is approximately 16 feet.

Future sea-level rise related to climate change is predicted to occur throughout Puget Sound, thereby increasing the design sea-level elevation for the purposes of project design and long-term operation. The City uses the predictions of sea-level rise made by the University of Washington's Climate Impacts Group to guide the design of capital projects. These predictions vary considerably, ranging from a low of 6 inches to a high of 50 inches of water surface elevation rise in Elliott Bay by the year 2100 (Mote et al. 2008). At the higher end of this range of predicted sea-level rise, the still water surface elevation (not accounting for wave action) could exceed the top elevation of the proposed seawall during extreme high tide events under any one of the build alternatives. At the lower end of this range of predicted sea-level rise, the still water surface elevation during a 6-month storm event could be approximately 10 feet.

Regulatory Environment

Water Quality Standards for Surface Waters of Washington State

Standards for surface water quality in Washington State are established by Ecology (WAC 173-201A). The purpose of the standards is to identify designated beneficial uses, establish specific criteria, and establish policies for anti-degradation to protect the state's surface water bodies. The marine water quality standards apply to Elliott Bay (WAC 173-201A-210, 612).

State Water Quality Assessment and Section 303(d) List

Section 303(d) of the Clean Water Act requires all states to prepare a water quality assessment and develop a list of surface waters (marine and fresh water) that are impaired. In Washington State, this list is periodically prepared by Ecology and submitted to the U.S. Environmental Protection Agency (EPA) for review and approval. Ecology currently submits these lists on a 2-year alternating cycle of the freshwater listing and the marine water listing. The listings described later in the section are from the 2010 water quality assessment prepared by Ecology that was under a final review by EPA at the time this Draft EIS was prepared.

The Section 303(d) list identifies five categories of water quality impairments:

- Category 1 – meets tested standards for clean waters
- Category 2 – waters of concern
- Category 3 – insufficient data

- Category 4 – polluted waters that do not require the establishment of a total maximum daily load (TMDL) for targeted pollutant(s) to allow the achievement of the surface water quality standards
- Category 5 – polluted waters that require a TMDL program to establish maximum allowable pollutant discharges

Seattle Stormwater Manual (2009)

The City enforces a stormwater code (SMC 22.800–22.808) that includes stormwater rules specifying stormwater runoff treatment and flow control requirements for new projects and redevelopment projects, in addition to requirements for the protection of water resources during construction.

Surface Water Permits and Approvals

The City has a municipal stormwater and waste discharge general permit issued by Ecology. This permit authorizes stormwater and, in some cases, non-stormwater discharges to surface water and groundwater. It requires the City to establish and implement a comprehensive stormwater management program, including regulations for development projects such as the Elliott Bay Seawall Project. These regulations are codified in the Seattle Stormwater Code, which includes criteria for stormwater flow control and treatment as well as construction-related stormwater controls.

Ecology issued the City a NPDES permit specifically for its CSO discharges and associated infrastructure. This permit allows the City to discharge both stormwater and untreated wastewater during wet weather events when the existing combined sewer conveyance system exceeds its capacity. The City is engaged in a variety of activities to reduce the occurrence of CSOs along the downtown Seattle waterfront and elsewhere to meet the requirements of this permit. There are two existing City-owned CSO outfalls and two shared (storm drainage and combined sewer) City-owned outfalls within the project area. The land areas contributing to CSOs at these outfalls lie almost entirely outside the project area.

Existing Surface Water Conditions

Ambient Water Quality

Water quality in Elliott Bay is generally good and meets the Washington State standards. Designated uses for Elliott Bay in the state surface water quality standards include excellent aquatic life uses, shellfish harvest, primary contact recreation, and miscellaneous uses (wildlife habitat, harvesting, commerce/navigation, boating, and aesthetics) (WAC 173-201A-612). However, there are several Section 303(d) listings for impaired water quality, which are discussed below. Baseline water quality in the bay is affected by both localized and more distant sources of pollutants.

Ecology and King County have ambient marine water quality monitoring stations in Elliott Bay. Based on 2007 findings, King County classified Elliott Bay as a water of "moderate concern" for water quality because of low concentrations of dissolved oxygen (KCDNRP 2011). To some degree, the low concentrations of dissolved oxygen may be natural, but they are a concern because additional reductions caused by pollution could harm aquatic life.

Eight regions of Elliott Bay have been classified as Category 5 polluted waters that require a TMDL allocation. These areas are distributed mainly along the perimeter of Elliott Bay from West Seattle, around the Port of Seattle, and along the shoreline north of the project area (Figure 3-24). Other areas in Elliott Bay have been classified as Category 1 and 2.

In addition to the monitoring of conventional water quality parameters, Ecology has performed limited monitoring of the biological effects of pollution in Elliott Bay and Puget Sound. Among 16 sites around Puget Sound, the highest levels of unnatural estrogen exposure in Puget Sound were at one of Ecology's monitoring stations in Elliott Bay (Johnson et al. 2008). Studies have indicated that such pollutants as PAHs, polychlorinated biphenyls (PCBs), and mercury bioaccumulate in marine animals of Puget Sound and Elliott Bay, including mussels, squid, fish larvae, Chinook salmon, coho salmon, ospreys, grey whales, orcas, and harbor seals.

Water Quality in Elliott Bay

Water quality in Elliott Bay is generally good and, with several exceptions, meets Washington State standards. Five areas of the bay have been classified as Category 2 waters of concern under Section 303(d) of the Clean Water Act to reflect elevated levels of fecal coliform bacteria, low concentrations of dissolved oxygen, and/or concentrations of the insecticide endosulfan. Four additional areas of the bay have sufficiently high levels of fecal coliform bacteria that they are classified as Category 5 polluted waters, requiring the establishment of a total maximum daily load.

Storm Drainage System

The stormwater collection and conveyance network along the downtown Seattle waterfront was generally constructed in the 1930s and 1980s as part of the improvements to the Alaskan Way road surface, sidewalk, and seawall. Nearly all the Alaskan Way road surface drains to the separated stormwater system, and subsequently to Elliott Bay or to shallow groundwater by means of infiltration. Stormwater collected by catch basins or inlets in the project area enters the separated stormwater system or the combined sewer system. Stormwater entering the separated system discharges directly into Elliott Bay without treatment, while discharges into the combined system are treated at King County's West Point Treatment Plant except during exceptionally high flows, when they are discharged into the bay as CSOs.

There are two shared (storm drainage and combined sewer) outfalls and four separated stormwater outfalls (City-owned) along the downtown Seattle waterfront (Figure 3-25). In several locations along the waterfront, diversion structures allow low stormwater flows to enter the combined sewer system and route higher stormwater flows into Elliott Bay. Additionally, there are approximately 50 individual outfalls from drainage catch basins that discharge stormwater runoff directly to Elliott Bay (USACE 2008).

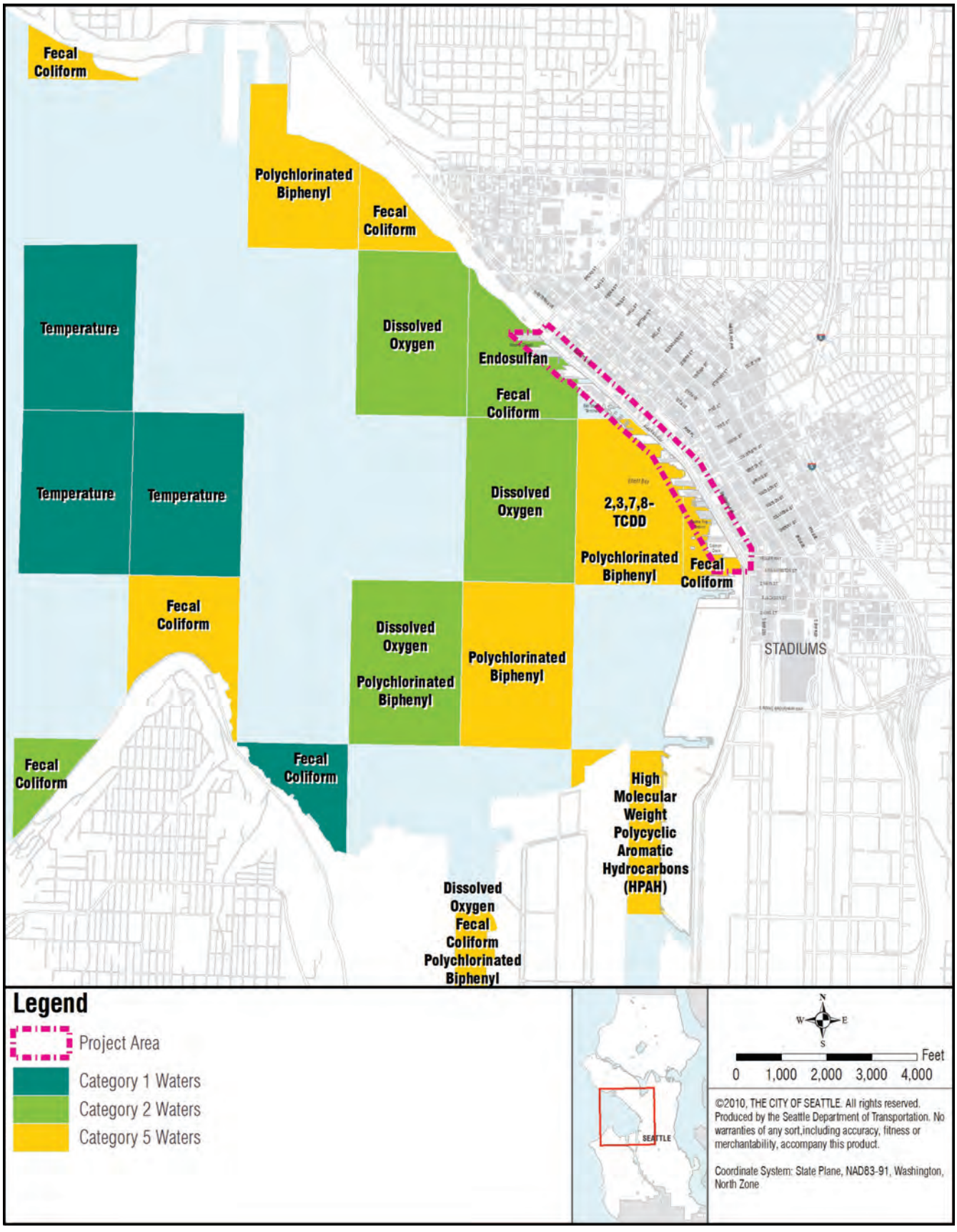


Figure 3-24. Category 1, 2, and 5 waters in Elliott Bay and vicinity

The stormwater collection and conveyance system between Yesler Way and S. Washington Street includes modern inlets (shallow, rectangular drainage structures without a sump), catch basins (which have a sump), and a public storm drain main. The public storm drain main was extended in the 1980s. It discharges to a dedicated 72-inch-diameter outfall at S. Washington Street that conveys runoff from an area extending beyond the project area.

A public storm drain main was built from Yesler Way to Madison Street as part of the City's improvements to Alaskan Way in 1988. The main was constructed to discharge to a new 60-inch-diameter shared storm drainage and combined sewer outfall at Madison Street, built as part of the same project. Catch basins and modern inlets were constructed in Alaskan Way to collect runoff and route it to the public storm drain main.

Stormwater runoff between University and Madison Streets is captured in inlets and discharged directly through the seawall to Elliott Bay. In the 1980s when Alaskan Way was improved, the original inlets were abandoned and replaced by modern inlets connected to catch basins. The original 6-inch-diameter cast-iron outfall pipes through the seawall were maintained during these improvements and connected to the new catch basins. A 10-inch-diameter separated storm drainage outfall at Seneca Street conveys runoff from a small drainage area within the project area.

Drainage Network

The stormwater collection and conveyance system between Pine Street and University Street primarily consists of the original inlets that were constructed in the mid-1930s and discharge into the bay through 6-inch cast-iron pipes. In two locations north of University Street, the existing inlets were replaced in the 1980s with modern inlets and connected to new catch basin structures. A 49-inch-diameter shared (storm drainage and combined sewer) outfall at University Street conveys runoff from a relatively large area extending beyond the project area. This outfall connects to a 24-inch-diameter drop structure waterward of the seawall face.

The City-owned stormwater collection and conveyance network between Bell Harbor and Pine Street includes primarily individual drain inlets that were installed in the 1930s. There is also a 12-inch-diameter private storm drainage outfall at Blanchard Street that serves the parcels at 2100 Alaskan Way and 2200 Elliott Avenue.

Figure 3-25. Locations of major separated stormwater system and combined sewer overflow outfalls

A stormwater conveyance network consisting of inlets, catch basins, and an 8-inch-diameter public storm drain main is located on the west side of Alaskan Way along the frontage of Bell Harbor. Drainage from Alaskan Way is connected to this system. It is unclear from existing information where stormwater outfalls to the nearshore area are located in this area, or if the stormwater conveyance pipes serving the Bell Harbor facility are connected to the City's drainage system along Alaskan Way. It is likely that there are several small Port of Seattle-owned storm drainage outfalls that discharge directly to Elliott Bay in this area.

The stormwater collection and conveyance network between Broad Street and Bell Harbor includes the original inlets built during the 1930s; several inlets have been replaced south of Broad Street. Individual outfall inlets in this area typically have a 6-inch-diameter cast-iron outlet pipe that discharges directly through the seawall. There are approximately 16 individual outfalls between Broad Street and north of Bell Harbor (SDOT 2011a).

Outfall Locations

Figure 3-25 shows the locations of outfalls in the project area. Where the separated storm drainage system and the combined sewer system share an outfall along the seawall, at University Street and Madison Street, the separated storm drainage connection to the outfall pipe is located downstream of the CSO diversion structure; therefore, the separated storm drainage does not affect the occurrence or magnitude of discharge at those outfalls.

Stormwater Quality

Common pollutants in urban stormwater runoff include suspended solids, heavy metals (e.g. lead, copper, zinc, and mercury), phthalates, PAHs, and other petroleum hydrocarbons, as well as other organic pollutants that are human-made (Herrera Environmental Consultants 2011). The project area is almost entirely impervious. Nearly all precipitation landing in the project area runs off to Elliott Bay without treatment, or it enters the combined sewer system.

Combined Sewer System

The City owns and operates the combined sewer system within the project area, which collects stormwater runoff in addition to wastewater. Within the project area, the City's combined sewer system is designed and authorized to overflow at four outfalls located near the western ends of Vine, University, Madison, and S. Washington Streets. Nearly all of the land area that drains to the four City-owned CSO outfalls within the project area is located outside the project area. The only area within the project limits that drains to the combined sewer system is comprised of approximately 1.4 acres of roadside land use in the vicinity of Pike and Pine Streets. Most of the combined sewage collected in the project area is conveyed through King County interceptors to the West Point Treatment Plant.

Since the 1970s, Seattle Public Utilities and King County have been working on CSO control programs. The City and County are currently collaborating on plans to reduce CSO volume and frequency in the project area as part of the Central Waterfront CSO Reduction Program. As of the writing of this Draft EIS, Seattle Public Utilities was in the midst of conducting an alternatives analysis for long-term CSO reduction that will lead to selection of a design alternative for the central downtown waterfront area by 2015, with implementation expected by 2025. CSO control project implementation is being undertaken separately from the Elliott Bay Seawall Project.

Groundwater

Groundwater can be found 7 to 15 feet below the ground surface (bgs) in the project area. Groundwater flows horizontally toward Elliott Bay; its levels along the existing seawall vary with tide fluctuations and may depend in part on the type and integrity of the existing seawall (see the Geology and Soils Discipline Report (Appendix N)). Groundwater flows depend on subsurface soils; coarse-grained sand and gravel layers result in higher groundwater discharge rates than the rates in fine-grained soils. For the most part, the water table (shallow groundwater surface) is flat, but it is connected hydrologically to Elliott Bay tides (FHWA et al. 2010).

Near the intersection of Alaskan Way and Yesler Way where the existing seawall is a gravity structure, data collected in observation wells indicated that for an 11-foot tidal range, groundwater levels fluctuated 8 feet. However, where the existing seawall is a 1934 Type A or Type B wall the fluctuations in groundwater level were much less, typically in the 3-foot range.

Low to moderate levels of soil and groundwater contamination occur throughout the downtown Seattle waterfront within the project area. Concentrations of contaminants in soils are generally greater than the Model Toxics Control Act (MTCA) residential or general use cleanup levels, based on the history of industrial activity along the waterfront. The sources of contamination are not well defined. More information about groundwater contamination in the study area is provided in Section 3.12, Contaminated Materials.

The Model Toxics Control Act

The Model Toxics Control Act (MTCA) is Washington's counterpart to the federal Superfund law. MTCA establishes cleanup levels for different types of land uses to ensure the protection of human health and the environment. Where contamination is known to exist in the study area, its levels were compared to MTCA residential and general-use cleanup levels for the chemicals of concern.

3.12 Contaminated Materials

The study area for the contaminated materials evaluation extends north to south from approximately Broad Street to S. Washington Street, and east to west from approximately Western Avenue to the outer harbor line in Elliott Bay.

Both the physical composition of the Elliott Bay Seawall and the historical uses along the seawall contribute to the potential for contaminated materials in the study area. Much of the downtown Seattle waterfront area is underlain by fill that was placed in the early 1900s. This fill covered and incorporated timber and debris previously

used in the construction of piers, wharves, and trestles. In addition, industrial and commercial land uses developed along the waterfront since the 1870s used a number of potential contaminants, some of which may have been released into the surrounding environment.

This section discusses previously identified and potential sources of contamination within the study area that could be released during project construction and operation. Details are provided in the Contaminated Materials Discipline Report (Appendix O).

Historical Land Uses

Activities associated with historical land uses in the study area were reviewed to identify areas that may be affected by contaminated materials. Cinder (likely from the Seattle Fire of 1889) and coal and lubricating oil associated with railroad operations may be encountered in fill soils, because these materials have been documented in recent investigations in fill along the waterfront area (FHWA et al. 2010). Historical use of the area for industrial purposes also contributes to the potential for contaminants to be present in soil and groundwater.

Table 3-10 lists some of the industries that have been located in the study area and the associated chemicals that have the potential to be released into the environment. Although a variety of contaminants may have been used at some sites, only the contaminants most likely to be encountered are identified.

Historical Fills

From 1910 to the 1920s, fill materials were placed in the tidelands around pile-supported railroad lines and around a parallel, wood-planked timber trestle roadway that extended along the waterfront. The fill materials likely contain a variety of contaminants and contaminant sources, including creosote and timbers, petroleum hydrocarbons, metals, and construction debris. With the use of hydraulic sluicing technologies borrowed from the mining industry, material from the regrading of First Avenue and Jackson Street in the late 1800s and early 1900s was used to fill in the tidelands. Over 1,400 acres of tidelands were reclaimed using the material from the Jackson Street regrade alone (NWAA 2007).

Between 1934 and 1936, large volumes of fill were placed to support the seawall construction north of Madison Street. Fill was hydraulically placed in the tideland areas below the relieving platform. In addition, roadway fill material was placed and compacted above the level of the relieving platform to support Alaskan Way.

Contaminated Materials in the Study Area

The land behind the Elliott Bay Seawall was formed by the placement of timbers and fill behind the seawall face. Much of the fill consisted of various types of debris. Early land uses in this area were largely commercial and industrial. These factors increase the potential for encountering contaminated materials in the study area.

Table 3-10. Historical Businesses and Potential Contaminants

Historical Business	Potential Contaminants	Potential Analytes[1]
Automotive Services	Petroleum and solvents	Kerosene, turpentine, methylene chloride, BTEX, TCE, PCE, Stoddard solvent, and hydrofluoric acid, asbestos
Cleaners/Laundry Services	Solvents and phosphates	Carbon tetrachloride, TCE, PCE, cis-1,2-DCE, vinyl chloride, and Stoddard solvent
Coal Storage/Bunkers	Petroleum, PAHs, and metals	Arsenic, mercury, cadmium, and boron
Foundry/Metal Plating	Metals and solvents	Chromium, cadmium, lead, copper, nickel, mercury, zinc, iron, phenols, BTEX, TCE, and PCE
Gas Stations/Automotive Services	Petroleum and solvents	BTEX, TCE, and PCE
Machinists	Metals, solvents, and petroleum	Oil, TCE, PCE, cis-1,2-DCE, and vinyl chloride
Printers/Painters	Solvents and metals	BTEX, TCE, PCE, cis-1,2-DCE, vinyl chloride, turpentine, and mineral spirits
Railroads	Petroleum, PAHs, solvents, paint, fungicides, and pesticides	Creosote, oil, and BTEX
Subsurface Utilities	Oils	Oils

Notes: BTEX – benzene, toluene, ethylbenzene, and xylenes, cis-1,2-DCE – cis-1,2-dichloroethene (daughter product of tetrachloroethene), PAHs – polycyclic aromatic hydrocarbons PCE – tetrachloroethene, TCE – trichloroethene, Vinyl chloride – daughter product of tetrachloroethene. [1] These potential analytes were selected based on the historical uses of sites within and adjacent to the study area.

Priority Chemicals of Concern and Screening-Level Criteria

Based on the historical land uses, existing environmental data, and the typical contaminants found in the urban environment, priority chemicals of concern (COCs) in the study area have been identified. These priority COCs have varying levels of toxicity and mobility that determine the significance of their presence in the study area.

The four priority COCs are the following:

- **Total petroleum hydrocarbons (in the gasoline and diesel range):** Total petroleum hydrocarbons include gasoline, diesel fuel, bunker fuel oil, and lubrication oils. The historical uses of total petroleum hydrocarbons were widespread and associated with a variety of land uses.

Priority Chemicals of Concern

Chemicals of concern are frequent targets of monitoring efforts because they persist in the environment, they build up in animal tissues, and they can be toxic.

- **Metals:** Heavy metals, including arsenic, cadmium, copper, lead, mercury, silver, and zinc, are associated with shipyards and boat maintenance facilities, metal works, foundries, and plating operations. Metals have the greatest effect on the soil and groundwater directly underlying the contaminated site and are relatively immobile.
- **PAHs:** PAHs are present in heavy-range petroleum hydrocarbons and are also created during burning as a result of incomplete combustion. They are also found in creosote, which was historically used to treat timber and/or wood pilings.
- **PCBs:** PCBs were used in a variety of materials. Low levels of PCBs are now common in the urban environment. In general, PCBs tend to adhere to organic matter in soil and are insoluble in water.

Where COCs are present within the study area, their concentrations were compared to criteria established by the Washington State Sediment Management Standards (SMS; WAC 173-204) for in-water areas and cleanup levels established by MTCA for unrestricted land use in upland areas (WAC 173-340). These criteria were selected because of the predominant commercial and residential land uses in the study area. MTCA cleanup levels are designed to protect human and ecological health.

Upland Soil and Groundwater Conditions

The primary contaminants in the study area are metals and PAHs. The contamination appears to be at levels less than the MTCA cleanup levels in all but a few locations. This has been confirmed by exploratory borings and test pits. Nevertheless, there is still a potential for encountering contaminated soil and groundwater and debris below the relieving platform structure in the upland area. Figure 3-26 and Figure 3-27 show areas of concern for soil and groundwater contamination in the Central Seawall and North Seawall areas.

In the Central Seawall study area, widespread contamination with metals and PAHs at concentrations less than the MTCA cleanup levels have been identified in soil and groundwater. Existing data indicate that creosote-treated wood debris is in the fill located along the waterfront area. The primary COCs in creosote compounds are PAHs, phenols, and creosols, which adhere to soil and sediment particles and tend to not migrate far from the source area. Existing data indicate that in Zones 1 and 2 between Yesler Way and Marion Street, petroleum-contaminated soil with concentrations greater than the MTCA cleanup levels may be present. The Seattle Steam Company Site, an active Ecology MTCA cleanup site located in Zones 3 and 4, is contaminated at shallower levels and is currently included in Ecology's Voluntary Cleanup Program.

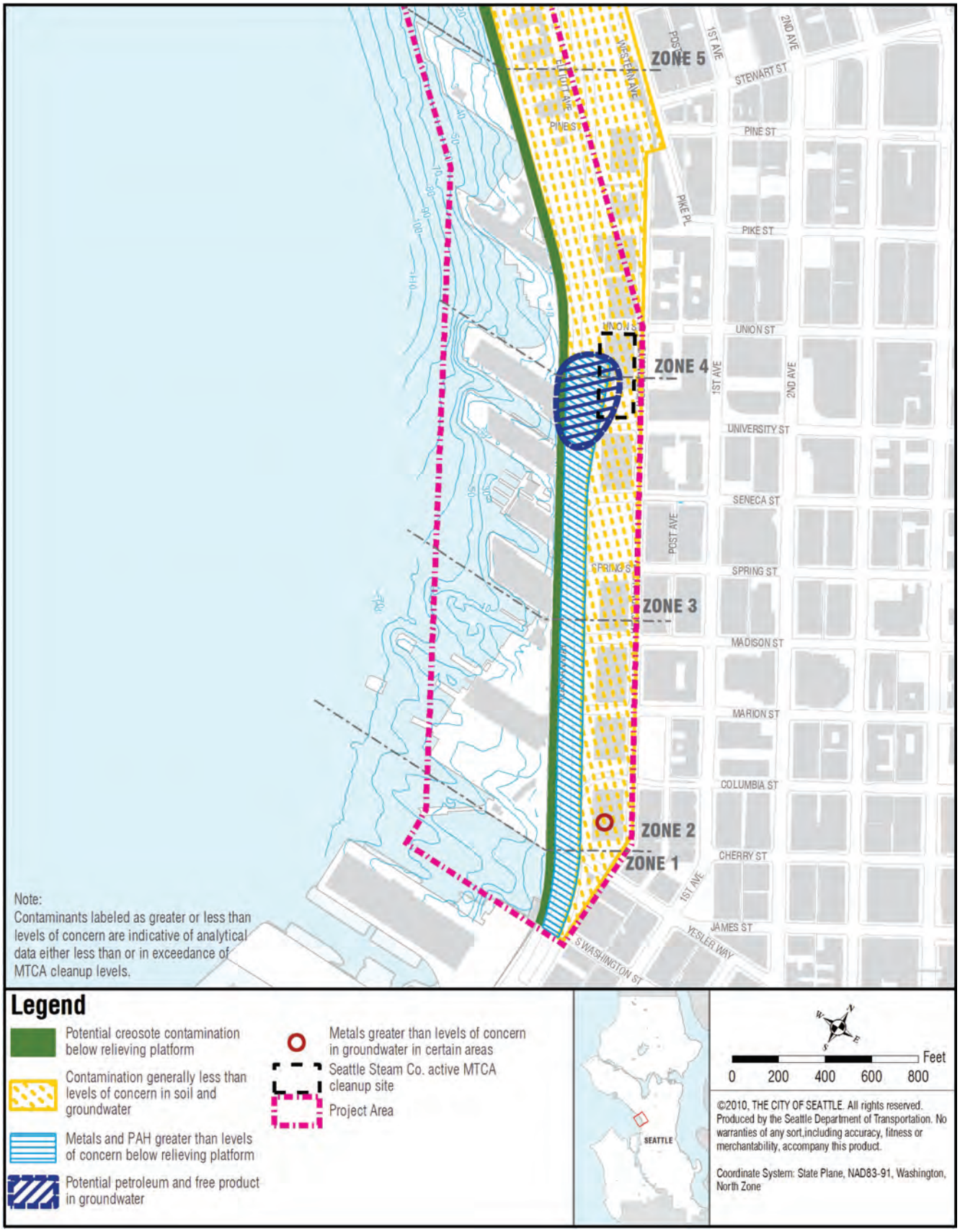


Figure 3-26. Upland soil and groundwater conditions, Central Seawall

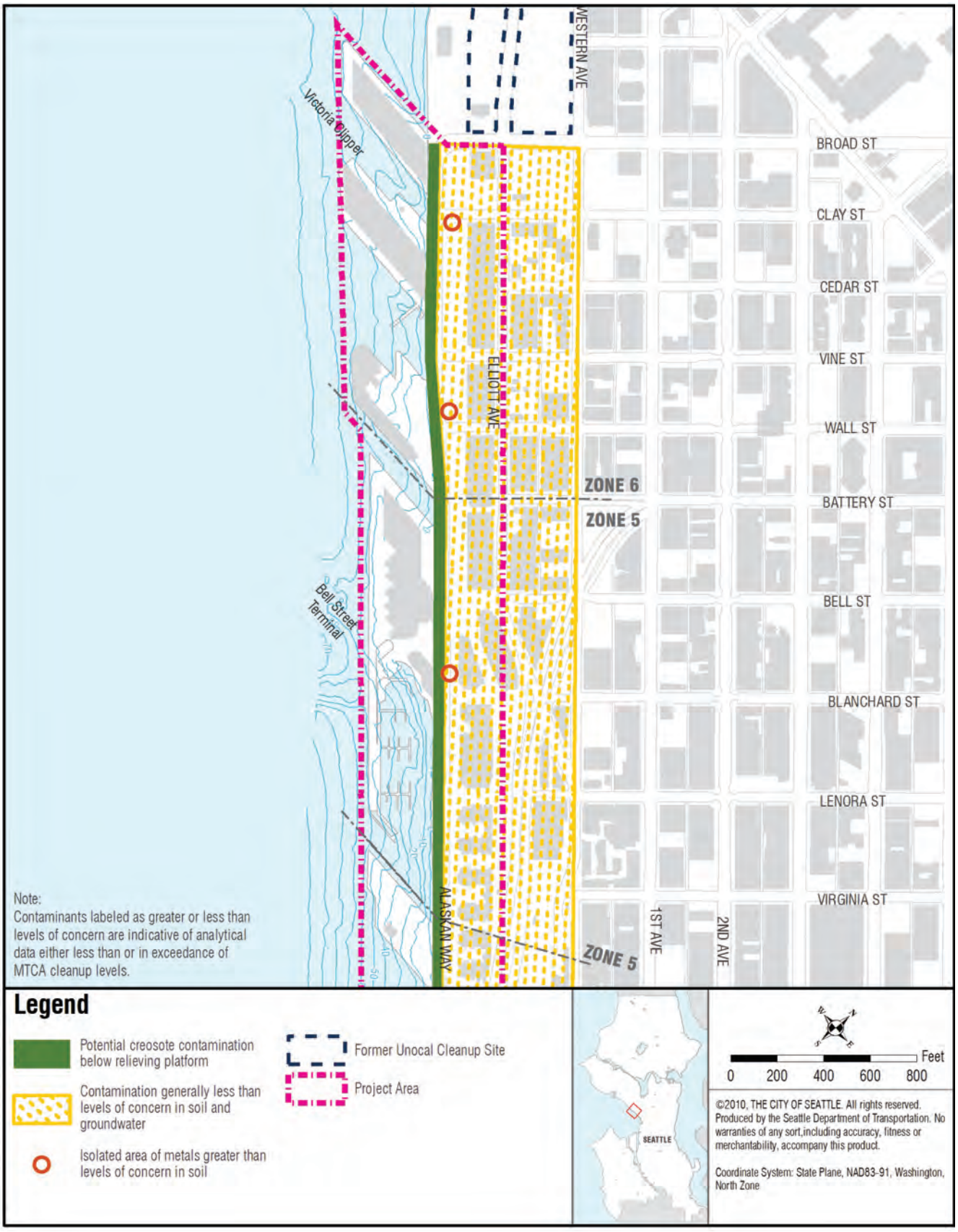


Figure 3-27. Upland soil and groundwater conditions, North Seawall

Along the North Seawall, isolated areas of contamination with metals and PAHs have been identified. In general, metals and PAHs are present at concentrations less than the MTCA cleanup levels, with the exception of two areas. Metals in shallow soil exceed the MTCA cleanup levels in Zone 5 just north of Blanchard Street and in deep soil in Zone 6 between Wall and Vine Streets. PAHs in deep soil exceed the MTCA cleanup level in Zone 5 just south of Lenora Street and in Zone 6 between Wall and Vine Streets. Petroleum hydrocarbons have been detected in Zones 5 and 6 at concentrations generally less than the MTCA cleanup levels in shallow and deep soil, with the exception of one exceedance at Clay Street.

In-Water Sediment Conditions

Several broad in-water areas of concern have been identified in Elliott Bay by the regulatory agencies. Generally, these areas contain concentrations of surface and subsurface sediment contaminants greater than the cleanup screening levels (CSLs) and the Sediment Quality Standards (SQS) chemical screening criteria (SQS criteria) found in the SMS (WAC 173-204). Areas of concern for the Central Seawall and North Seawall are shown in Figure 3-28 and Figure 3-29. Overall concentrations of contaminants in sediment have declined over time due to source controls and ongoing natural recovery processes, as well as cleanup actions such as the placement of sediment caps.

Environmental Data and Areas of Concern

The predominant contaminants in sediments in the Central Seawall study area are metals, which exceed the CSLs and the SQS criteria in surface and subsurface sediments in much of the Central Seawall study area. The primary areas of concern are several areas of known contamination, including the sediments associated with the Colman Dock Cleanup Site (Piers 51 and 52) in Zone 2 and the Central Waterfront Cleanup Site (Piers 54 through 57) in Zone 3. Metals with concentrations exceeding only the SQS criteria occur in isolated areas farther north in Zone 4. Levels of PAHs are below the CSLs and/or the SQS criteria throughout the Central Seawall study area, with some exceptions in Zones 1 and 2 and a few isolated locations in Zone 4. PCBs are also below the CSLs and/or the SQS criteria, except in isolated areas in Zones 1, 3, and 4.

In the North Seawall study area, concentrations of metals exceed the CSLs and the SQS criteria in surface and subsurface sediments in Zones 5 and 6. The concentrations of PAHs and PCBs are generally less than the CSLs and the SQS criteria, except for isolated locations as shown in Figure 3-29. The sediments under Pier 66 in Zone 5 were classified as clean for open-water disposal in 1999, suggesting that the contaminant concentrations may be lower in the northernmost portion of the North Seawall study area.

Sediment Contamination

Due to past industrial activities and contaminants from stormwater and wastewater, much of the sediment in the project area contains contaminants at concentrations greater than the established cleanup levels. Typical contaminants are metals, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs). Two major sediment cleanups have occurred in the Central Seawall Study Area; in other areas, the conditions have been improving over time through natural recovery processes and the implementation of source controls.

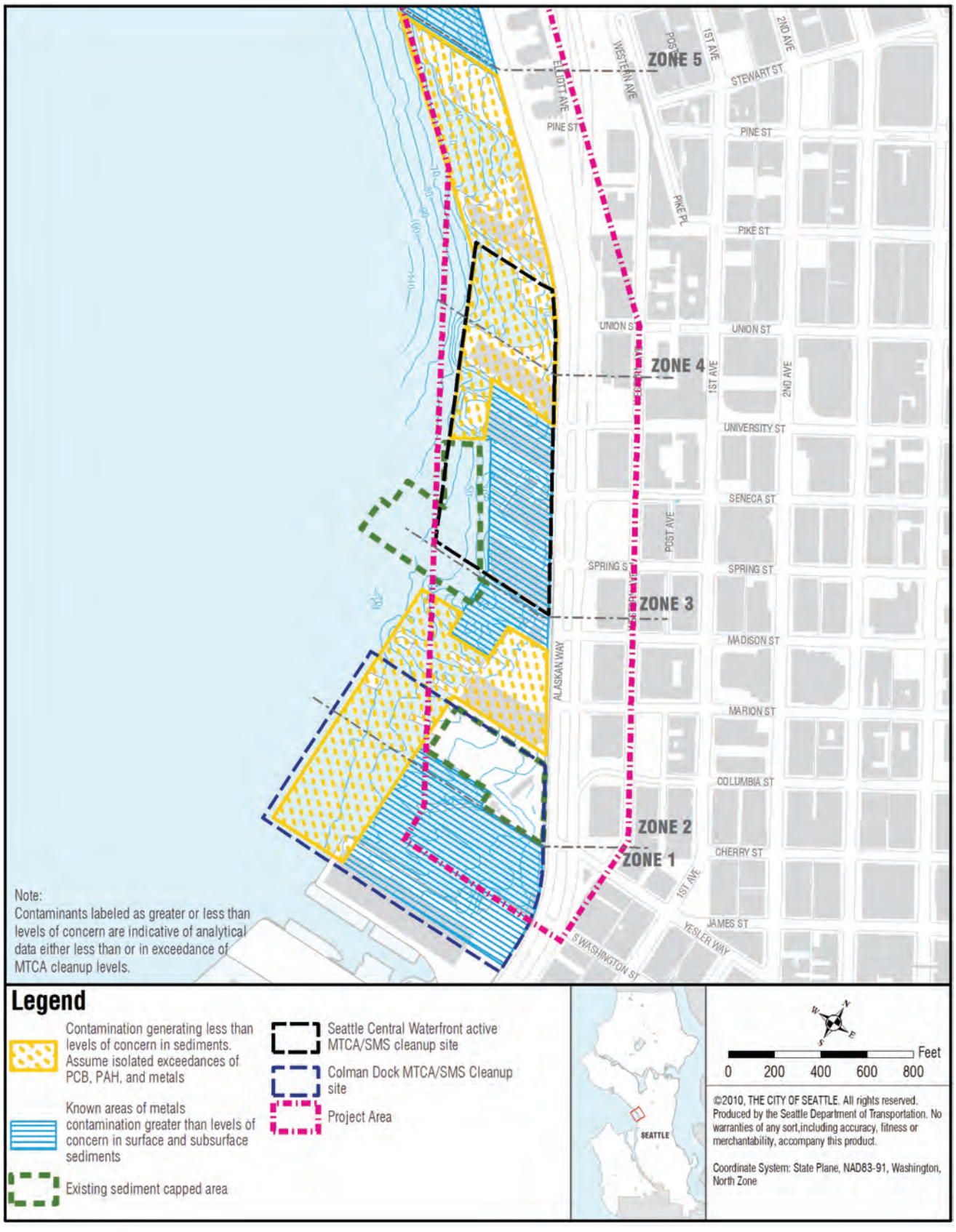


Figure 3-28. In-water sediment conditions, Central Seawall

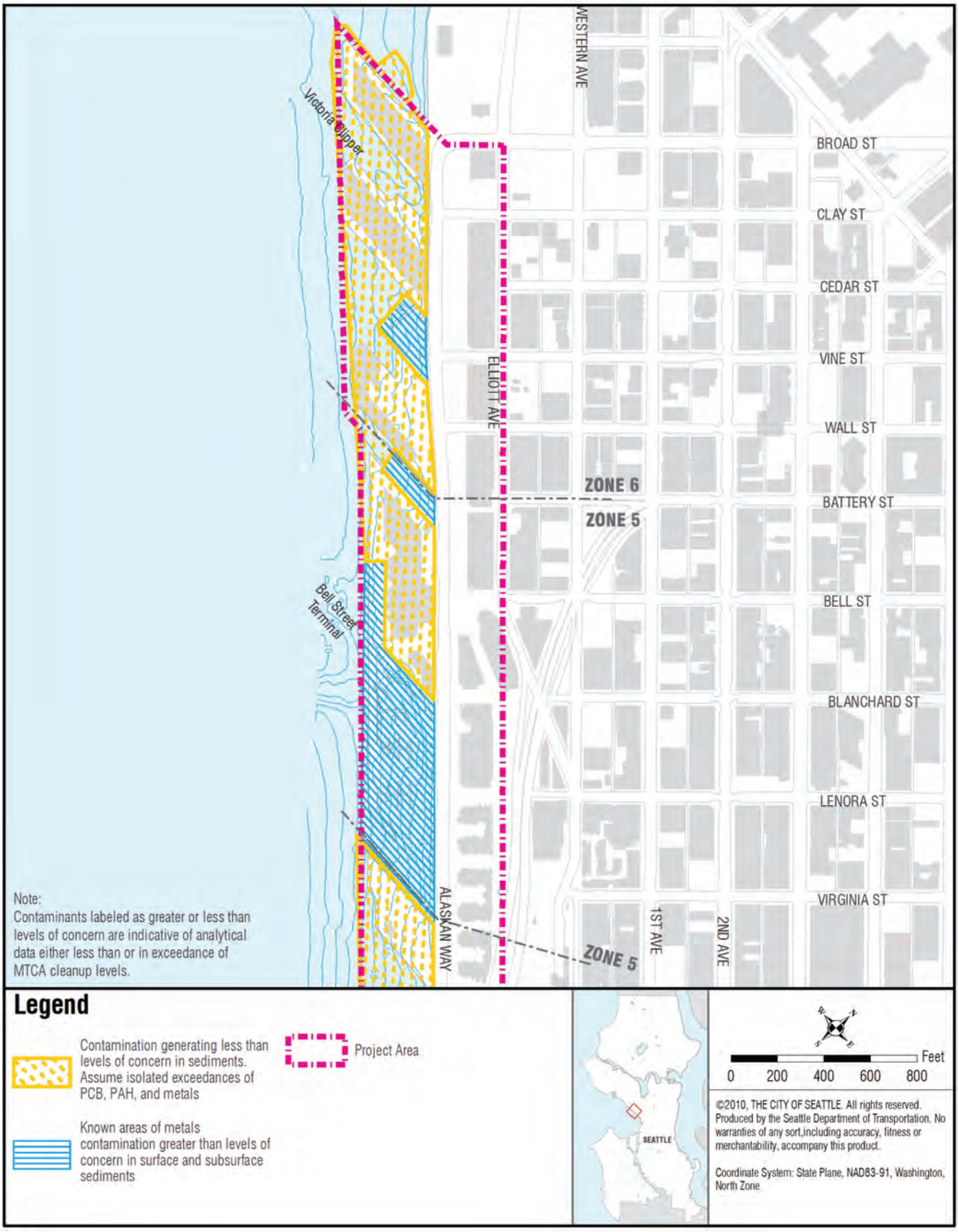


Figure 3-29. In-water sediment conditions, North Seawall

Ecology- or EPA-Regulated Sediment Cleanup Sites

The Colman Dock Cleanup Site (Site ID 2554), which is located at 801 Alaskan Way, encompasses the sediments under Piers 50 and 52 (Zone 2). The COCs in this area include copper, mercury, and PAHs. The site was capped south of Colman Dock in 1999 with coarse sand; monitoring suggests that the cap is intactand is effectively isolating the more highly contaminated subsurface sediments.

The Central Waterfront Cleanup Site (Site ID 2553) encompasses sediments under Piers 53 through 58. The most widespread contaminant at this site is mercury. Other COCs in sediments include PAHs, other semivolatile organic compounds, metals, PCBs, petroleum hydrocarbons, and phenolic compounds. A Natural Resource Damage Assessment (NRDA) restoration was conducted under a consent decree with the City and King County as part of the Elliott Bay/Duwamish River Restoration Program. The City and King County jointly established a trust account from 1992 to 1997 for sediment remediation. Approximately 22,000 cubic yards of clean sand was placed in the offshore area of Piers 53, 54, and 55. After the sediment cap was placed, it was monitored until 2002. An enhanced natural recovery project was also completed according to the scope of work in the NRDA settlement agreement (USDOJ 1991). The available data indicate that the sediment cap is working effectively.

There are no Ecology- or EPA-regulated sediment cleanup sites in Zones 5 and 6.

Potential for Hazardous Materials in Existing Structures and Utilities

The only structures that will be demolished within the study area are portions of the existing seawall. During demolition, it is possible that lead-based paint may be encountered in the existing seawall face. Although asbestos was commonly used for waterproofing materials, there was no evidence of asbestos noted during excavations behind portions of the existing concrete face panels. Other demolition activities involve construction-related removal and replacement of sign structures and awnings, which could contain hazardous materials, along business building fronts.

Work on the seawall may involve disturbance and/or relocation of water and wastewater pipelines and electrical distribution lines. These facilities may have asbestos-containing material associated with them. Existing water lines that will be replaced may also have lead joints. Hydrogen sulfide gases have been encountered in excavations within the Central Seawall area. Hydrogen sulfide can result from the decay of wood and sawdust, which are prevalent in subsurface fill along the seawall.

3.13 Geology and Soils

The study area for evaluation of geology- and soils-related effects extends along the seawall from Western Avenue or Elliott Avenue on the east to the ends of the piers on the west. The south and north ends of the study area are S. Washington Street and Broad Street, respectively. Details of existing geology and soils conditions are provided in the Geology and Soils Discipline Report (Appendix N).

Topographic and Geologic Setting

Repeated glacial events in this region, as recently as about 13,500 years ago, strongly influenced the present-day topography, geology, and groundwater conditions in the Seattle area. The topography is dominated by a series of north-south ridges and troughs that were formed by glacial erosion and sediment deposition. Puget Sound, Lake Washington, and other large water bodies now occupy the major troughs. These ridges slope down into Elliott Bay, with a maximum local relief of about 400 feet.

According to historical information about the topography of Seattle, a bluff originally rose above Elliott Bay between Pike and Broad Streets, although the slopes were gentle south of Columbia Street. Beneath Elliott Bay, the slopes were fairly uniform. This topography has been modified by shoreline erosion, localized landslides, and deposits from rivers and volcanic mud flows. The greatest postglacial changes in topography, however, have been caused by human activities that began around 1900, during the early development of Seattle. Large-scale earth-moving projects over the past 100 years in support of urban development and growth in the Puget Sound region have modified the landscape and created land where there was once Puget Sound and slight inclines where there were once steep hills. The existing Elliott Bay Seawall is founded in the original beach soils and is backfilled with granular soils obtained from the Cedar River to the current street elevation.

Tectonics and Seismicity

The study area is located in a region where numerous small to moderate earthquakes and occasional strong shocks have occurred in recorded history. Much of this seismicity is the result of ongoing relative movement and collision between tectonic plates, the Juan de Fuca Plate and the North American Plate, whose intersection is called the Cascadia Subduction Zone. As these two plates collide, the Juan de Fuca Plate is being driven to the northeast, beneath the North American Plate.

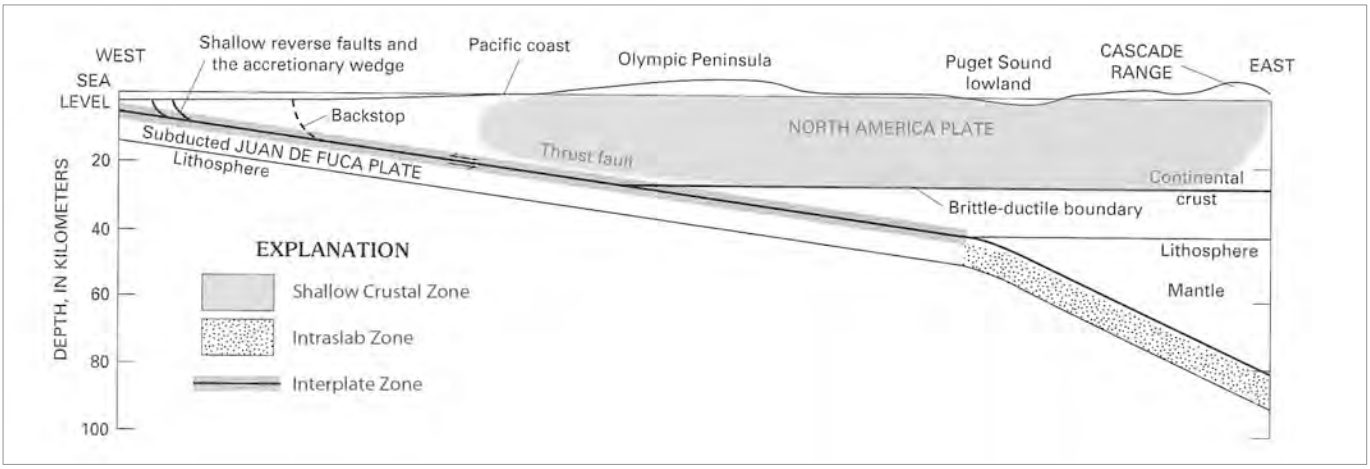
Within the current understanding of the regional tectonic framework and historical seismicity, three broad earthquake source zones have been identified: (1) a shallow crustal source zone, (2) a deep source zone within the portion of the Juan de Fuca Plate that is sliding beneath the North American Plate (deep intraslab zone), and (3) an interplate zone where the brittle portions of the Juan de Fuca and North American

Earthquakes and the Seawall

Because of its location above two colliding tectonic plates, the Puget Sound region is prone to seismic activity. The fill behind the existing seawall consists of loose sediments and debris that are subject to liquefaction during an earthquake. Unless stabilized or removed, these deposits lose their load-bearing capacity when they liquefy, resulting in damage to structures supported by them.

Plates are in contact in the Cascadia Subduction Zone. The locations of these earthquake source zones are shown in Figure 3-30.

Two of these zones, the shallow crustal zone and the deep intraslab zone, have produced most of the historical seismic activity in the region. The majority of the historical earthquakes have occurred within the shallow crustal zone at depths of about 12 miles or less, and the largest historical earthquakes to affect the study area originated in the subducted Juan de Fuca Plate (deep intraslab zone) at depths of 32 miles or greater.



(Adapted from Rogers et al. 1996)

Figure 3-30. Locations of earthquake source zones

Site Geology

The study area is situated in the Seattle Basin, which is filled with over 1,500 feet of glacial and nonglacial sediments overlying bedrock. Glacial deposits are sediments that were carried to their present location by the action of glaciers. Nonglacial deposits are those that form when glaciers are not present, such as through natural water flow processes, landsliding, and wave action. Many of the sediments have been glacially overridden, which means that the soils were compacted by the overriding weight of glacial ice as the glaciers advanced through the region. These glacially overridden soils are present in the subsurface below downtown Seattle and also underlie the younger, relatively loose and soft postglacial soils that were deposited along the downtown Seattle waterfront and the Duwamish River delta.

Geologic Hazards

Geologically hazardous areas are defined as areas that are not suitable for commercial, residential, or industrial development consistent with public health or safety concerns because of their susceptibility to erosion, sliding, earthquakes, or other geological events (WAC 365-190-030). Washington State's Growth Management Act (Revised Code of Washington [RCW] 36.70A) requires all cities and counties to identify

geologically hazardous areas within their jurisdictions and formulate development regulations for their protection. Seismic codes and other building code standards have been developed to reduce the risk of catastrophic failure of structures due to geologic events and conditions such as liquefaction, earthquakes, and subsidence.

The City's environmentally critical area regulations require detailed geotechnical studies to address specific standards relating to site soils and geology, seismic hazards, and facility design. The following geologic hazards were identified along the alignment of the Elliott Bay Seawall in the project area:

- **Landslides:** Steep slopes are generally located more than 350 feet east of the seawall; therefore, the potential for landslides is low. The risk of landslides on the submarine slopes west of the seawall is also low.
- **Erosion:** The study area is classified primarily as urban development and is, therefore, not a mapped erosion hazard area. However, erosion via coastal storm-driven and localized wave action through corroded gaps in the steel sheet pile of the seawall is occurring (PBPower/BJT Associates 2003).
- **Fault rupture:** Because the northernmost extent of the Seattle Fault is located about 1.4 miles south of the study area, rupture of the ground surface and vertical offset in the project area is not expected.
- **Liquefaction:** Soils in the study area that are susceptible to liquefaction include loose to medium-dense coarse-grained soils located below the groundwater table (such as the fill deposits along the seawall). The entire seawall alignment in the project area is located within the liquefaction hazard area that has been mapped by the City.
- **Ground motion amplification:** For small or distant earthquakes that cause low intensities of shaking, the soft soils along the seawall alignment in the project area are likely to amplify the ground shaking. For large, nearby earthquakes that cause more intense shaking, little amplification or even attenuation of higher-frequency ground motions is possible.
- **Seiches and tsunamis:** Recent studies (Walsh et al. 2003) indicate that a magnitude 7.3 to 7.6 earthquake caused by a rupture of the Seattle Fault may result in a wave that would inundate much of the waterfront to depths in excess of 6 feet. Tsunamis generated from large earthquakes in the Pacific Ocean basin could also result in runup along the waterfront.

Regional Groundwater Systems

The two main aquifer systems in the Seattle area are within glacially overridden river deposits composed of coarse-grained sediments, such as sand and gravel that were deposited by glacially fed streams. In addition to the two main aquifers, several other near-surface geologic units may yield sufficient water for domestic use. Recent alluvial soils deposited by modern rivers and streams may be a local source of groundwater, depending on the thickness and permeability of the soils. Hydraulic connection between the near-surface alluvial deposits and the underlying aquifers is often limited by the presence of fine-grained deposits, including layers of clay and silt.

3.14 Air Quality

The study area is along the downtown Seattle waterfront from Broad Street in the north to S. Washington Street in the south. Given the nature of air quality, areas of attainment and non-attainment are on the regional scale. Air quality is regulated by the federal Clean Air Act, which in Washington State is administered by Ecology and the Puget Sound Clean Air Agency.

Ecology and the Puget Sound Clean Air Agency operate a network of ambient air quality monitoring stations in the Seattle area. Data from the four monitoring stations nearest the Elliott Bay Seawall indicate that no violations of the air quality standards have occurred since 2003. However, the Puget Sound area as a whole is designated as a maintenance area for carbon monoxide. A pollutant associated with motor vehicle emissions, carbon monoxide is further controlled in many urban areas through air quality conformity regulations. These regulations come into play when an area is designated as a nonattainment area or a maintenance area for carbon monoxide. They require that projects that generate additional vehicle traffic demonstrate that they will not cause a violation of the National Ambient Air Quality Standards, contribute to an existing violation, or delay timely attainment of the federal carbon monoxide standard. The carbon monoxide maintenance area designation for the urbanized western portion of King County means that the project is subject to the conformity regulations.

The 2005 King County emissions inventory, discussed in the Air Quality Discipline Report (Appendix G), provides a more detailed summary of pollutant emissions estimates throughout the county (PSCAA 2008). The various pollutants have different types of emission sources as the predominant contributors. The major emissions sources are on-road vehicle traffic; aircraft, rail, and maritime equipment; dust from roadways, construction sites, and other sources; and indoor wood burning.

Air Quality in the Study Area

The Clean Air Act establishes National Ambient Air Quality Standards for a range of pollutants known to be harmful to human health and/or the environment when present in concentrations greater than the standards. Areas that meet these air quality standards are referred to as attainment areas, and areas that exceed the limits for one or more pollutants are referred to as nonattainment areas. When an area is designated as a nonattainment area, measures must be taken to bring it back into compliance; after achieving compliance, it becomes a maintenance area. This designation requires that Ecology, in coordination with the Puget Sound Clean Air Agency, develop an attainment plan to demonstrate how the area will maintain compliance with the particular standard.

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