



3.0 Existing Conditions & Affected Environment

This chapter provides an overview of existing conditions within the Project Area. It describes the natural and built environment that would be changed (impacted or improved) by the project alternatives. There are 14 sections to the chapter; each section describes a separate environmental discipline that was analyzed as part of the EIS. This information is summarized from the full description of existing conditions included in Attachments 5 through 18. Although the environmental disciplines are described separately, they are interrelated and together comprise the Capitol Lake – Deschutes Estuary.

3.1 HYDRODYNAMICS & SEDIMENT TRANSPORT

Hydrodynamics refers to the movement of surface water (river /stream flow as well as tides) within fluvial, estuarine, and coastal environments. The Deschutes River and other smaller streams deliver freshwater from the surrounding watersheds to Capitol Lake. These flows are temporarily stored in Capitol Lake before discharging into West Bay (part of Budd Inlet and Puget Sound) via the 5th Avenue Dam. The 5th Avenue Dam controls when, and at what rate, water can exit the lake, depending on water levels in the lake and tide elevations in Budd Inlet.

Sediment transport refers to the movement of sediment within a system. Sediments are transported from the adjacent watershed to Capitol Lake by the Deschutes River and other smaller streams. The movement of sediments to West Bay (and the greater Puget Sound) is interrupted by the 5th Avenue Dam, causing large volumes of sediment to settle within the Capitol Lake Basin. Some of the sediment, particularly fine sediment, that is transported from the upper watershed is suspended in the water and discharged into West Bay, through the 5th Avenue Dam. Periodically, when the gates are fully open, fast flows in

What are the issues associated with sediment accumulation?

Excessive sediment accumulation can influence water quality, visual resources, aquatic habitat, and recreational use in Capitol Lake by reducing lake depth.

the lake can redistribute sediments and flush even more sediment into West Bay.

The analysis of hydrodynamics and sediment transport are closely related because sediment is primarily moved by flowing surface water.

Changes in hydrodynamics and sediment transport affect the many resources addressed in the EIS, such as fish and wildlife, land use, and navigation. The daily and seasonal fluctuations in water levels and currents influence what types of aquatic plants and animals can occupy Capitol Lake. Water levels during storm events determine the extent of lowland flooding around the lake, and the movement and deposition of sediment in West Bay affects navigation for vessels using the Port of Olympia and nearby marinas.

The study area for hydrodynamics and sediment transport includes the waters and low-lying land of the Capitol Lake Basin and West Bay. The Deschutes River and Percival Creek freshwater flow, as well as tides and currents in Budd Inlet influence hydrodynamics in Capitol Lake and were considered as part of the extended study area.



Exhibit 3.1 Hydrodynamics and Sediment Transport study area

Methods for Studying Hydrodynamics & Sediment Transport

A state-of-the-art and process-based three-dimensional computer model, Delft3D, was used to predict the movement of water and sediment in the study area under different project alternatives. The numerical model uses complex systems of physics-based equations to calculate how water and sediment move in response to tides, river inflow, the lake bed, and the sediment load input. The model predicted variations among the project alternatives using the same hydrologic and tidal inputs but varying project geometries. For each alternative, two storm events were modeled: an extreme +100-year river flow event and a 100-year tide event. These events were selected as the “extreme” events for purposes of the model because riverine and tidal floods have both been documented to cause flooding in the basin under existing conditions, and the 100-year storm is the standard flood level studied in floodplain assessments.

Data used as inputs to the model include bathymetry that was collected in 2020 for the project, streamflow records, tide records, current speed measurements, water levels upstream of the dam, records of dam opening and operational rules, meteorological data, flood mapping, and climate change predictions. Historical surveys of the lake bed were also used to determine past and current sedimentation rates and patterns. Physical measurements of sediment properties were also collected. Previous studies measured incoming sediment loads carried by the Deschutes River and other tributaries to quantify the rate at which sediment enters the Capitol Lake Basin from the upper watershed.

These data sources are fully described in the Hydrodynamics and Sediment Transport Discipline Report (Attachment 5).

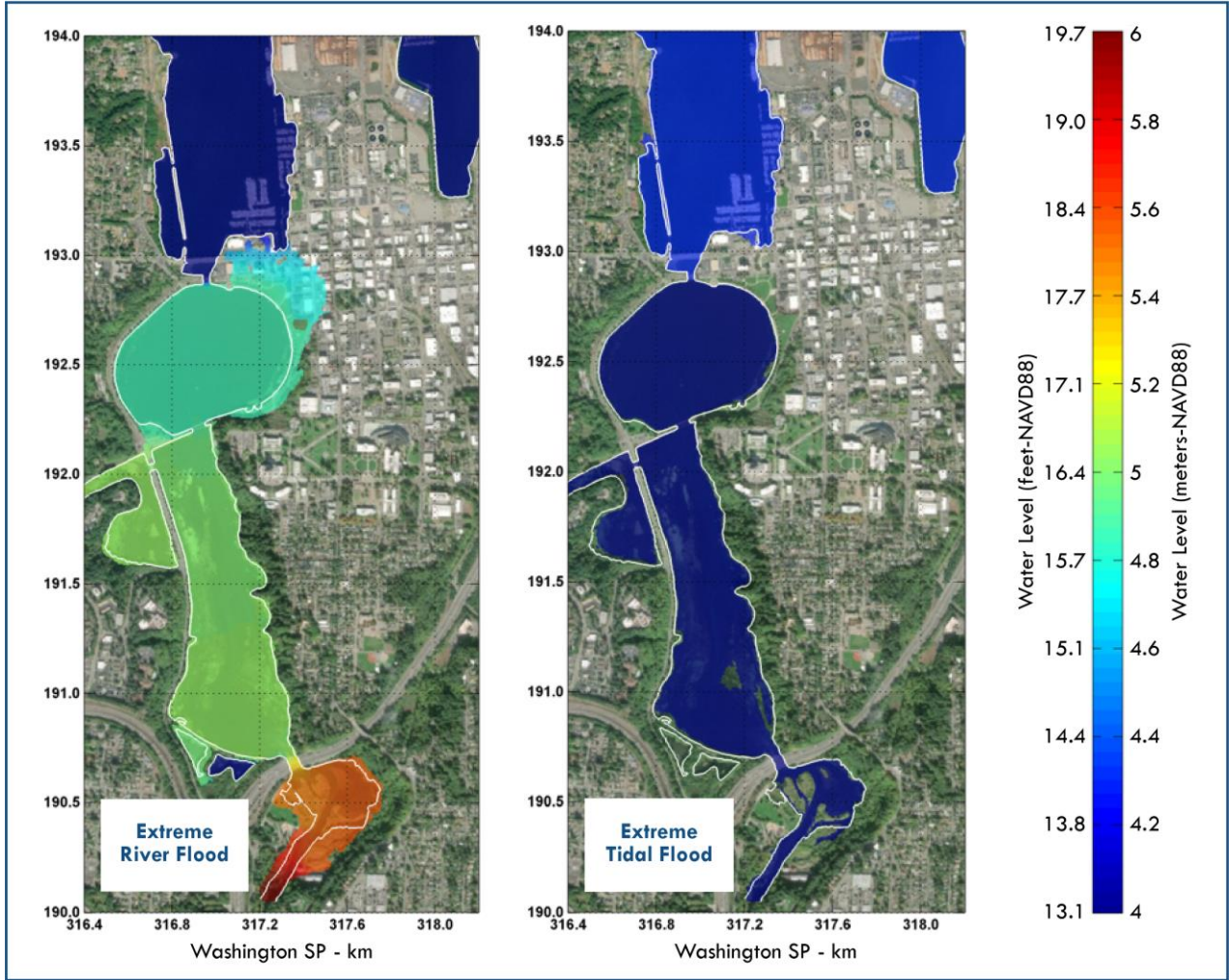
3.1.1 What are the existing water levels in Capitol Lake?

Under normal conditions, daily and seasonal water levels are relatively steady, and current speeds are low. However, during storm events, water levels (and current speeds) in Capitol Lake Basin can be elevated. Enterprise Services adjusts discharge at the dam to generally maintain a summer lake level and a winter lake level (a foot lower than the summer lake level). Figure 3.1.1 shows modeled existing water levels during an extreme river flow event and extreme tidal event. Riverine floods result in the highest current speeds and water levels under existing conditions. Water levels are presented in feet and meters referenced to NAVD 88.

NAVD 88

The North American Vertical Datum of 1988 (NAVD 88) is a vertical reference system used to measure elevations relative to the Earth's surface. In the U.S., NAVD 88 is the current official vertical datum.

Figure 3.1.1 Water Levels during Extreme River & Tidal Floods under Existing Conditions



3.1.2 Where does freshwater enter Capitol Lake?

The Deschutes River flows into Capitol Lake at Tumwater Falls in the South Basin. This river is the main source of freshwater to the Capitol Lake Basin. Typical annual peak flow rates in the Deschutes River are approximately 3,800 cubic feet (110 cubic meters) per second. Other smaller tributary streams also flow into Capitol Lake. Percival Creek, which enters the Middle Basin at Percival Cove, is the largest of these streams. Typical annual peak flow rates for Percival Creek are much lower than the Deschutes River at around 150 cubic feet (4.2 cubic meters) per second. These freshwater inflows influence flow velocity within Capitol Lake and, during high river flow events, can cause elevated water levels and flooding within the basin.

3.1.3 How does the 5th Avenue Dam work?

The 5th Avenue Dam was completed in 1951 to create Capitol Lake. The dam forms the existing northern boundary of Capitol Lake, and acts as a primary control on water levels and flow velocities in the lake. The dam operation generally blocks movement of saltwater from Budd Inlet upstream and minimizes mixing of saltwater with freshwater in the basin.



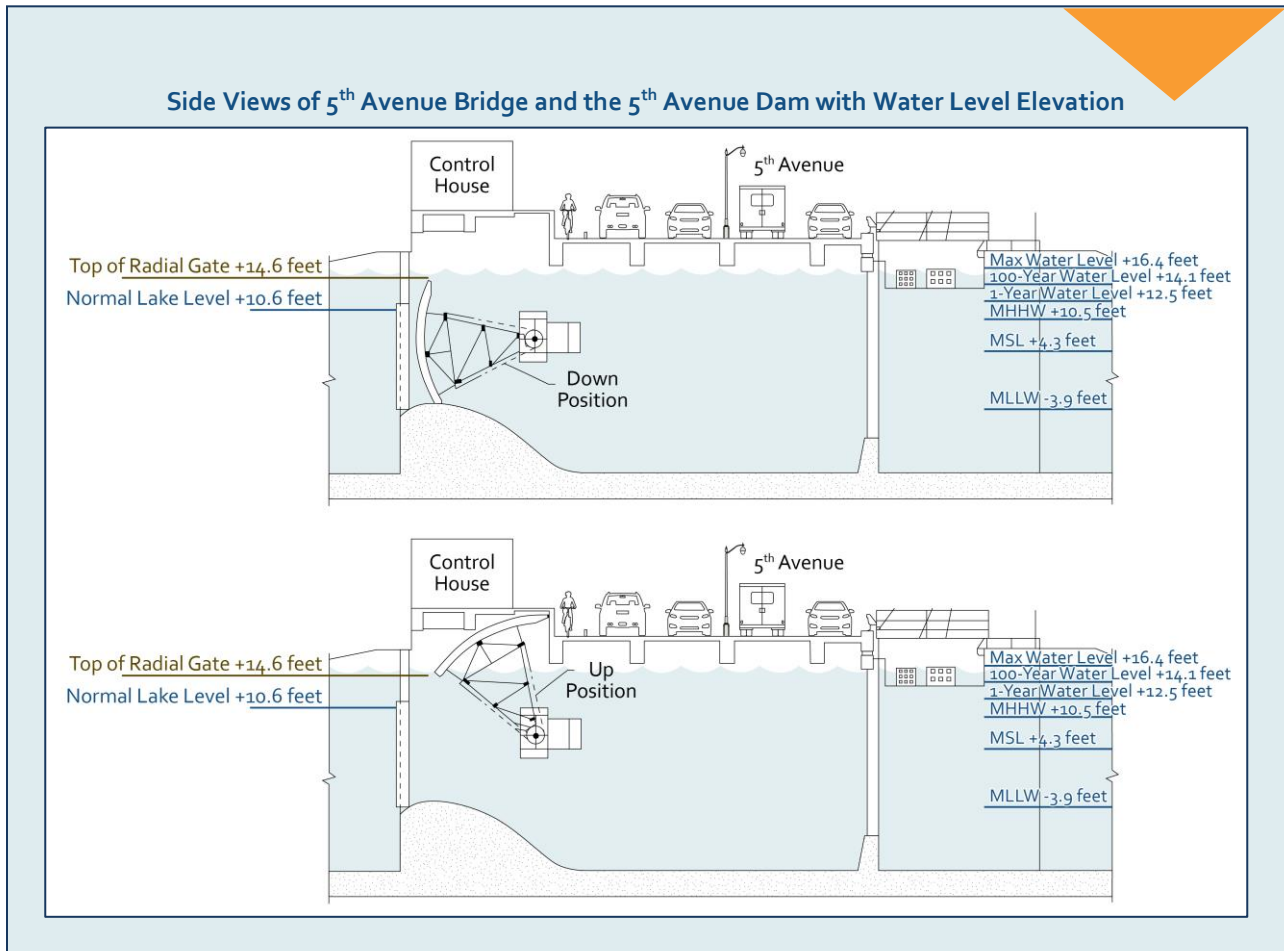
Exhibit 3.2 View of the 5th Avenue Dam from the North Basin

5th Avenue Dam Operations

The 5th Avenue Dam consists of a rock and earth embankment, a fish ladder, and two radial gates that can be raised and lowered to control the water level within Capitol Lake. The east and west gates are 24 and 36 feet wide (7.3 and 11 meters wide), respectively, with a maximum opening height of 11.9 feet (3.6 meters). The top of the east and west radial gates when fully closed is at elevation +14.6 feet NAVD 88 (+0.5 feet City of Olympia Datum). The extreme (100-year return period) water level downstream of the 5th Avenue Dam is approximately at elevation +14.1 feet NAVD 88 (0.0 feet City of Olympia Datum), and therefore it is lower than the top of the radial gates when fully closed with 0.5 feet between the waterline and the top of the gate. See the Hydrodynamics and Sediment Transport Discipline Report (Attachment 5).

The dam gates are lowered to block incoming tidal waters when the water level in Budd Inlet is greater than the lake level. Depending on the tide level, the gates will also close when lake levels drop below a minimum elevation, or open when the lake levels exceed a maximum elevation.

The 9.5-foot-wide (2.9-meter-wide) fish ladder has an adjustable weir at the upstream end that can be raised and lowered. The weir can be raised to prevent the flow of saltwater into the basin during a 100-year return period water level event, but the fish ladder can only be closed seasonally given other ecological considerations. Backflow through the fish ladder has been observed during extreme water levels, with water traveling into the North Basin for periods of time. However, given the small width of the fish ladder relative to the width of the North Basin, and small hydraulic gradient, the volume of water traveling upstream during the period of time that the downstream water level is higher than the top of the fish ladder would not affect water levels in the North Basin.



3.1.4 What is the existing sediment composition within Capitol Lake?

Within the lake, sediments are primarily composed of silt and sand. These types of sediments are typical of low-energy waterbodies such as lakes and tidal estuaries. Sediment composition is variable throughout the basin; sediments in areas of higher current speeds tend to be slightly coarser, such as near the 5th Avenue Dam and the BNSF Railway Trestle. For information on sediment characteristics and quality, see Section 3.11, Environmental Health.

3.1.5 How much sediment enters Capitol Lake each year?

The Deschutes River and Percival Creek carry the majority of sediment that reaches Capitol Lake. The estimated annual sediment load from the Deschutes River into the lake is between 29,000 and 55,000 cubic yards (22,000 and 42,000 cubic meters) each year on average. Percival Creek

delivers approximately 1,400 cubic yards (1,100 cubic meters) of sediment each year. The annual sediment load from these rivers varies significantly from year to year. The rate of sediment input is directly related to stream flows, where greater flow rates contribute greater amounts of sediment.

3.1.6 How much sediment has accumulated since the 5th Avenue Dam was constructed?

Construction of the 5th Avenue Dam affected the rate and pattern of sediment deposition throughout the basins that compose Capitol Lake. The method used to estimate the sediment deposition rates and spatial pattern was based on a comparison of a series of past bathymetric surveys. Although erosion occurs in isolated areas, most of the lake bed has accumulated between 0 and 6 feet (0 and 1.8 meters) in sediment thickness since the dam was constructed in 1951. The North and Middle Basins have experienced the highest rates of sediment deposition, as shown in Table 3.1.1 and Figure 3.1.2. There have been two dredge events in Capitol Lake since 1951 (in 1978 and 1986), with a total combined sediment removal of approximately 300,000 cubic yards (230,000 cubic meters).

Surveys are also periodically conducted in Budd Inlet in the federal navigation channel and ship turning basin. Surveys dating back to 1998 show that the navigation channel and turning basin have accumulated between 0.1 and 1.2 inches (0.3 to 3 centimeters) of sediment each year.

Bathymetric Survey

Bathymetric surveys (also referred to as hydrographic surveys) consist of measuring water depth and mapping the shape of the seafloor and coastline, and physical features of a waterbody. Survey results can be presented in terms of variations in depth are shown by color and contour lines.

Bathymetric surveys are usually conducted using a multibeam echo sounder attached to a boat. The sounder sends out beams across the floor of the waterbody. When the beams bounce back, the data are collected and processed.

Table 3.1.1 Annual Volume of Sediment Accumulation in Capitol Lake

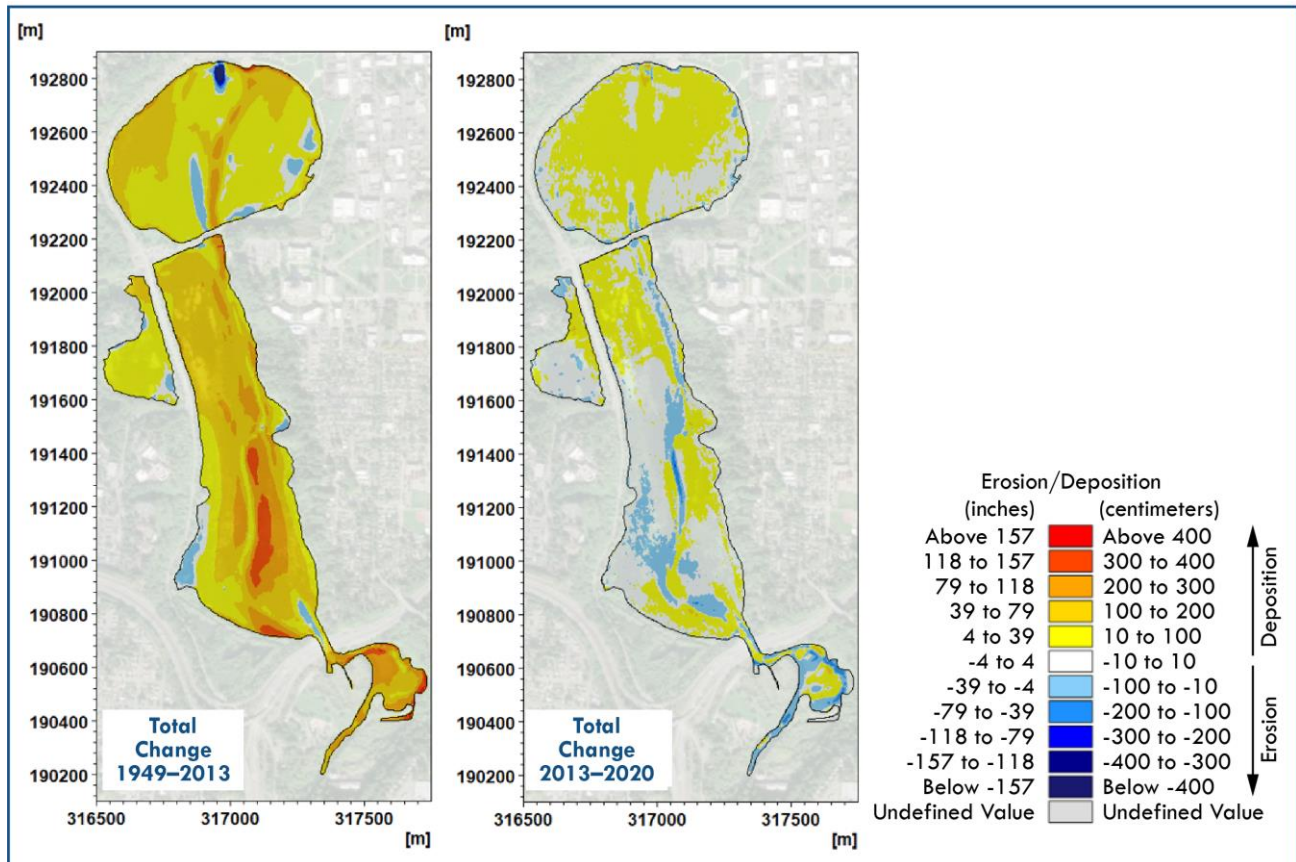
| | South Basin (cy/yr (m ³ /yr)) | Middle Basin (cy/yr (m ³ /yr)) | North Basin (cy/yr (m ³ /yr)) | Percival Cove (cy/yr (m ³ /yr)) |
|-----------|---|--|---|---|
| 1949–2013 | 3,150 (2,408) | 18,391 (14,061) | 6,133 (4,869) | 639 (489) |
| 2013–2020 | -1,265 (-967) ⁽¹⁾ | 3,586 (2,741) | 11,005 (8,414) | 668 (511) |

Note:

1. Negative values indicate areas of net erosion, rather than of net accumulation over time.

Abbreviations: cy/yr = Cubic yards each year; m³/yr = Cubic meters each year

Figure 3.1.2 Total Sediment Erosion & Deposition



3.1.7 How does climate change affect Capitol Lake?

The hydrodynamic and sediment transport numerical model simulated alternatives with and without incorporating relative sea level rise (RSLR) projections. RSLR is the sea level observed using a land-based reference frame. The numerical model used projections consistent with those used in the Olympia Sea Level Rise Response Plan (2019) developed by the City of Olympia, Port of Olympia, and LOTT Clean Water Alliance (LOTT). The Sea Level Rise Response Plan outlines how downtown Olympia can adapt to rising seas, using projections based on data from the Washington Coastal Resilience Project. Scenarios modeled for the hydrodynamics assessment of this project include 2 feet (0.61 meters) of RSLR, which is projected to occur in Olympia between 2050 and 2080, according to the Sea Level Rise Response Plan. This is the threshold level of RSLR beyond which modifications to city infrastructure would be needed.

Relative Sea Level Rise Projections

The EIS Project Team evaluated the best available science on RSLR, including the Olympia Sea Level Rise Response Plan as well as the latest projections developed for the State of Washington to define the “future condition” for the project planning horizon to include 2 feet (0.61 meters) of RSLR.

Climate change will also affect rainfall patterns and river flow rates. Climate models predict that the Deschutes Watershed may experience a

10% to 30% increase in extreme 24-hour rainfall by mid-century. Similarly, future peak flow rates in the Deschutes River may increase; however, flow rate change projections are uncertain. Increased peak flow rates have the potential to cause more frequent and substantial flooding in the Capitol Lake Basin. Increased peak flow rates will also mobilize more sediment, which may lead to higher rates of lake bed elevation change. The hydrodynamic and sediment transport numerical model simulated extreme river flow events to represent this potential future change in peak flow rates.

3.2 NAVIGATION

Navigation refers to the movement of commercial and recreational watercraft. The study area for navigation includes West Bay, with the southern boundary at the 5th Avenue Dam and the northern boundary at the end of the peninsula between West and East Bay. This is the area in which commercial and recreational navigation could be affected by changes in sediment deposition from the project alternatives. Results of the numerical model showed that changes in sediment deposition, outside of the Capitol Lake Basin, would be limited to West Bay.

Navigational resources and facilities in West Bay include the southern portion of the existing U.S. Army Corps of Engineers (USACE) federal navigation channel (FNC) and adjacent turning basin, the Port of Olympia's three marine terminal berths, private marinas along the eastern shoreline of West Bay (Fiddlehead Marina, Martin Marina, One Tree Island Marina, and Olympia Yacht Club), and public moorage facilities (Figure 3.2.1).

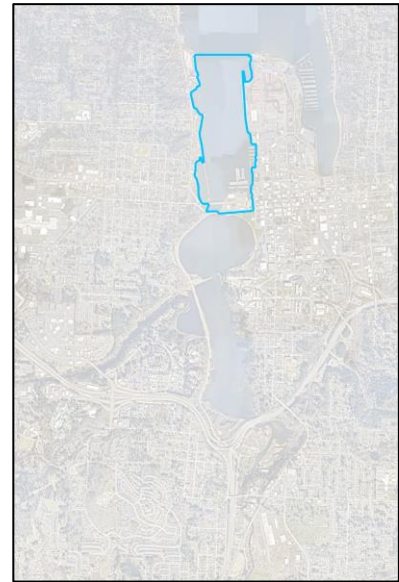


Exhibit 3.3 Navigation study area

Methods for Studying Navigation Analysis

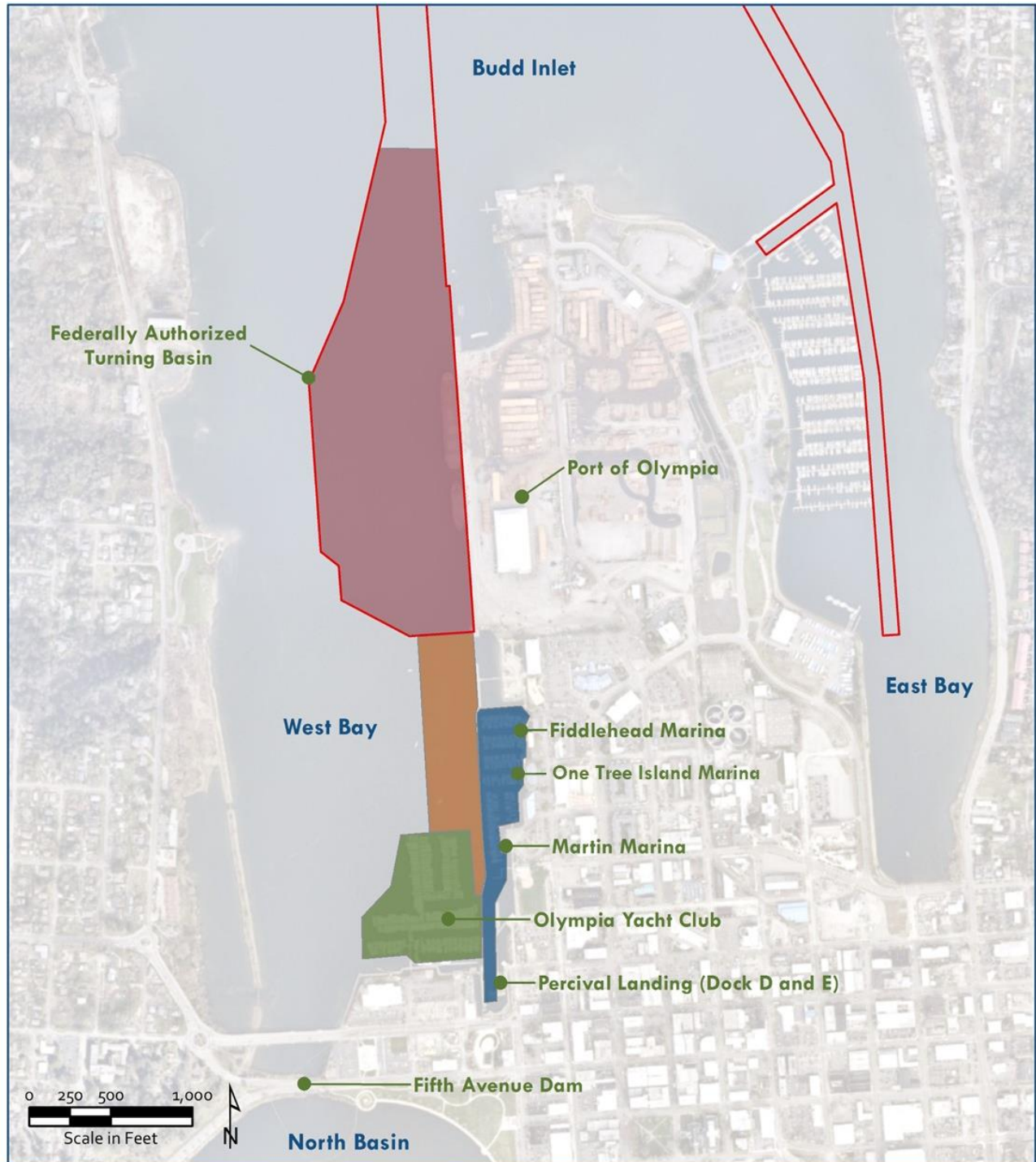
Data sources used for navigation analysis included existing navigation patterns for the study area, vessel use, depth, hydrodynamics, sediment erosion/deposition rates for the study area, and existing maintenance dredging data from the Port of Olympia, USACE, and several private marinas located in West Bay.

Navigation Patterns. Information about existing vessel navigation patterns was obtained from shipborne Automatic Identification Systems, which is a real-time network of transmitters and receivers that broadcast, track, and record vessel movement. These data were used to establish and evaluate the movement of larger vessels that use the FNC to access the Port of Olympia. Smaller vessel use throughout West Bay is well supported by the multiple recreational marinas available to users; these vessels often do not have Automatic Identification Systems.

Sediment Deposition Rates. Past and present bathymetric condition surveys and hydrodynamic and sediment transport numerical modeling were compared to determine sediment deposition rates for West Bay.

Existing Maintenance Dredging. Information on the types of vessels, incidents of vessel grounding or light-loading, operations, navigational constraints, sediment deposition, and long-term plans for accommodating different types of vessels was obtained from stakeholders. It was determined that maintenance dredging is expected to occur at most facilities within the next 10 years, prior to, or concurrent with the implementation of, any of the action alternatives.

Figure 3.2.1 Navigational Resources in West Bay



Legend






- | | | |
|--|--|---|
|  Olympia Yacht Club |  Marina Access Area |  Federal Navigation Channel |
|  Other Nearby Marinas |  Port Berth and Turning Basin (Portions of FNC) | |

Figure 3.2.2 Budd Inlet Vessel Traffic Patterns



Legend

Number of Vessel Passes (Annual)

| | | |
|---------|---------|-----------|
| 6 - 10 | 21 - 25 | 76 - 100 |
| 11 - 15 | 16 - 50 | 101 - 150 |
| 16 - 20 | 51 - 75 | 151 - 200 |

----- Limit of Federal Channel

Notes:

- AIS data was obtained from the US Coast Guard.
- Areas with 5 or fewer vessel passes per year are not shaded.
- Background nautical chart is ENC US5WA23M (April 30, 2020).

3.2.1 What are the general navigation patterns in West Bay?

Figure 3.2.2 provides a summary representation of larger vessel use from Budd Inlet into West Bay. The patterns reflect areas where larger vessel traffic generally occurs. This is known by vessel tracking beacons that are located on larger commercial vessels and some recreational vessels. Note that areas not shaded may still support extensive vessel transit because smaller recreational vessels are not universally equipped with Automatic Identification Systems tracking beacons.

It is acknowledged that navigational use of West Bay is significant and extends beyond what can be captured in a single figure that focuses on larger vessel trips tracked by Automatic Identification Systems. Of the trips tracked by Automatic Identification Systems, vessel navigation was observed to be highest within the authorized FNC and turning basin and throughout the east side of West Bay closest to the Port of Olympia, local private marinas, and marina access areas along the east shore. This also corresponds to the area of the greatest water depth.

Typical vessels calling at the Port of Olympia include bulk cargo ships about 600 feet (180 meters) long and 100 feet (30 meters) wide. The Port of Olympia usually sees between one and three cargo vessels at their facilities each month. Typical vessels calling at West Bay marinas include recreational powerboats and sailboats, with an average draft between 2 and 7 feet (0.61 and 2.1 meters).

3.2.2 How were sediment deposition and erosion rates evaluated within the study area?

Commercial and recreational navigation within West Bay occurs along the eastern shoreline, in areas of sufficient water depth. When sediment is deposited in these areas, it incrementally reduces the depth of water. When sediment continues to accumulate and is not removed by dredging, commercial and recreational navigation is adversely impacted.

For this analysis, historical patterns and rates of sediment erosion and deposition within West Bay are evaluated by comparing available bathymetric surveys dating back to 1998. This provides the existing annual rate of sediment deposition that occurs within the study area (and has impacted navigation over time). Patterns and rates of sediment deposition that may occur in the future, after project construction, are evaluated with a numerical model that was built for this project. The predicted rates of sediment deposited throughout the study area each

Three-Dimensional Modeling Study

The EIS Project Team selected the Delft3D modeling software because this state-of-the-art three-dimensional model is one of the best numerical models widely used across the world to capture sediment dynamics of estuarine systems. The numerical model was built to a very high resolution to capture project details and reasonably represent physical processes.

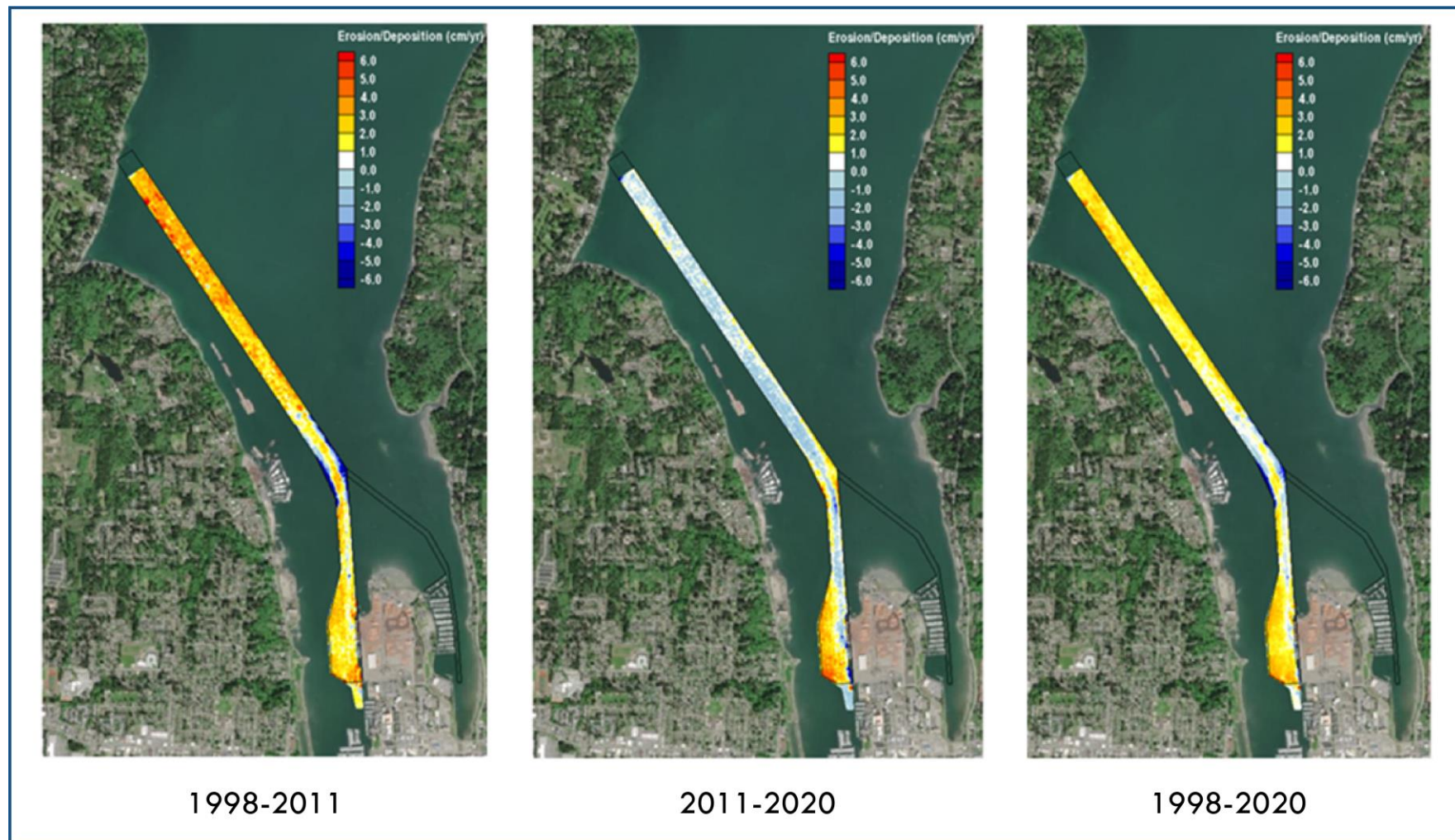
year indicate how quickly commercial and recreational navigation could be impacted. Understanding the potential sediment deposition rates informs the impact analysis and the frequency of maintenance dredging that would be needed to avoid or minimize impacts. The observed and projected total and annual rates of erosion/deposition in the study area are described below.

3.2.2.1 Federal Navigation Channel, Turning Basin and the Port of Olympia

The USACE conducts periodic bathymetric surveys of the FNC and turning basin to monitor changes in sediment deposition and erosion. Survey comparisons show that average observed rates of sediment deposition throughout the majority of the FNC ranged from 0.79 to 1.2 inches (2 to 3 centimeters each year between 1998 and 2020, although some erosion has been observed over the past 9 years. Sediment deposition within the adjacent turning basin is similar to the FNC, with an average observed rate of approximately 1.2 inches (3 centimeters) each year between 2011 and 2020.

Other sedimentation rate studies have been conducted at the Port of Olympia, and these suggest an annual deposition rate in the Port of Olympia vessel berths of approximately 0.047 to 0.43 inches (0.12 to 1.1 centimeters) each year. Considering the range of available data, the average annual rate of sediment deposition within the FNC, turning basin, and Port of Olympia vessel berths is estimated between -0.39 and +1.6 inches (-1 and +4 centimeters) each year, but varies over time and by area. Figure 3.2.3 provides details on average annual sediment erosion and deposition rates.

Figure 3.2.3 Estimated Existing Average Annual Sediment Erosion/Deposition Rates (cm/yr)



3.2.2.2 West Bay Marinas

Existing bathymetry at West Bay marinas is limited and therefore deposition rates could not be determined with measured data. However, the marina owners have reported isolated areas of sediment accumulation. In the absence of data, average annual sediment erosion and deposition rates for the Olympia Yacht Club and other West Bay marinas were estimated based on the numerical model calibrating/validating the model against the average measured sediment deposition rate in the FNC for existing conditions as a reference.

3.2.2.3 Sediment Deposition Pattern Summary for West Bay

The existing sediment deposition rates were used to calibrate and validate the sediment transport numerical model. This process confirmed that the model results were in alignment with the historical bathymetric survey, which means that the numerical model was reasonably capturing the Project Area functions. After calibrating and validating the numerical model against existing conditions, it was used to simulate sediment transport for the project alternatives.

The modeled sediment deposition rates for existing conditions are summarized in Table 3.2.1. Table 3.2.1 shows that the highest sediment deposition rate occurs closest to the 5th Avenue Dam (near the Olympia Yacht Club) and decreases with distance away from the 5th Avenue Dam, northward into West Bay and Budd Inlet. The numerical model evaluated two storm events—without and with RSLR. The deposition rates were higher without RSLR and lower with RSLR. This is likely due to the higher water levels in the Capitol Lake Basin associated with RSLR, which would reduce current velocities and would reduce erosion of sediments in the Middle Basin. For this reason, later sections describing the analysis of impacts focus on numerical model results without RSLR, because impacts are greater under this scenario.

Importantly, annual sediment deposition rates in West Bay are highly dependent on river flow events with more extreme flow events depositing more sediments. Additionally, sediment deposition rates are higher on the east side of West Bay because of an area of shallow intertidal habitat along the west side of West Bay, which directs sediment eastward.

Relative Sea Level Rise

RSLR is the rise in sea level observed using a land-based reference frame. A 2-foot (0.61-meter) RSLR was implemented in the numerical modeling study to represent future increase in the sea level due to climate change. Conditions are applied as relative (i.e., a local, upward shift in offshore water levels).

Table 3.2. 1 Average Annual Sediment Deposition in West Bay for Existing Conditions, Predicted by Numerical Model

| Location | Average Annual Sediment Deposition Without RSLR (inches each year (centimeters each year)) | Average Annual Sediment Deposition With RSLR (inches each year (centimeters each year)) |
|--|--|---|
| Olympia Yacht Club | 1.65 (4.2) | 1.3 (3.4) |
| Other West Bay Marinas and Marina Access | 0.83 (2.1) | 0.67 (1.7) |
| Port of Olympia/Turning Basin | 0.83 (2.1) | 0.59 (1.5) |
| FNC (excluding Turning Basin) | 0.039 (0.1) | 0.039 (0.1) |
| Rest of Budd Inlet (not within study area) | 0.039 (0.1) | 0.039 (0.1) |

3.2.3 What maintenance dredging is currently performed in West Bay?

The USACE is responsible for maintaining authorized water depths within the FNC and turning basin through maintenance dredging. The existing authorized depth within these channels is -30 feet (-9.1 meters) MLLW. The USACE last dredged the FNC in 2007.

The Port of Olympia is responsible for maintaining authorized water depths within their vessel berths. The average elevation within these vessel berths is -39 feet (-2.7 meters) MLLW. The Port of Olympia last dredged its vessel berths in 2014.

These two dredging events are the most recent maintenance dredging to occur within these navigational facilities within the last 40 years. Maintenance dredging is currently needed within the FNC and turning basin but it has been delayed due to known sediment contamination.

Vessel navigation is currently impacted due to the accumulated sediment; cargo vessels typically sail on rising high tides or lighten their loads because the increasingly shallow water is not sufficient for a fully loaded vessel. There is active coordination between USACE and the Port of Olympia regarding these conditions. It is expected that maintenance dredging will be conducted by the USACE in the FNC and turning basin and by the Port of Olympia in their berths within the next 10 years to reestablish authorized water depths.

Maintaining navigational water depth at the marinas is the responsibility of the marina owners. Water depth at the marinas in West Bay is estimated to average about -7 feet (-2.1 meters) MLLW. The minimum water depth of -5 to -7 feet (-1.5 to -2.1 meters) MLLW is stipulated in

environmental regulations and aquatic land leases, helping to avoid vessel contact with the underlying sediment.

The Olympia Yacht Club last completed maintenance dredging within specific shallow portions of their marina in 2014; prior to this, maintenance dredging was completed in 1987. Maintenance dredging at the Martin Marina last occurred in the 1980s.

Many West Bay marinas experience sediment accumulation to some extent and have either conducted maintenance dredging recently or plan to complete maintenance dredging within the next 10 years to maintain navigation, to comply with lease requirements, and/or in parallel with dock upgrades and/or reconfiguration. Maintenance dredging is often planned around other necessary marina upgrades focused on key areas that experience shoaling/sediment accumulation.

3.3 WATER QUALITY

For the EIS water quality analysis, the study area includes Capitol Lake and its major inflow sources of the Deschutes River and Percival Creek, as well as West Bay and East Bay of Budd Inlet. These areas are included because they would be impacted (beneficially or adversely) by the project alternatives. Upstream areas in the Deschutes River and Percival Creek are not part of the study area because these areas would not be impacted by the project alternatives.

Several federal, state, and local government policies, regulations, and ordinances protect water quality in the Deschutes River, Capitol Lake, and Budd Inlet. Ecology has been delegated authority by the U.S. Environmental Protection Agency (USEPA) to implement the federal Clean Water Act in Washington by establishing water quality standards, identifying impaired waterbodies, conducting TMDL studies, and issuing water quality permits. In July 2020, USEPA approved a TMDL for the Deschutes River (not including Capitol Lake). Ecology also recently released a draft TMDL for dissolved oxygen in Budd Inlet. The draft TMDL includes allocations for the Puget Sound outside of Budd Inlet and watershed sources including wastewater treatment systems, stormwater runoff, industrial discharges, Capitol Lake, and many other sources. Numerous discharges to the watershed are regulated through the National Pollutant Discharge Elimination System (NPDES).



Exhibit 3.4 Water Quality study area

Total Maximum Daily Load (TMDL)

A TMDL is a formal plan that establishes limits on problematic pollutants from point and non-point sources to improve water quality in an impaired waterbody.

Methods for Studying Water Quality

Previous studies, historical monitoring data, and recent data collected for this analysis were used to characterize the conditions in both Capitol Lake and Budd Inlet. For Capitol Lake, the first step was to evaluate whether any trends in water quality should be considered to ensure that the data used for the analysis are representative of existing conditions. The water quality was then compared to applicable water quality standards and thresholds, and to conditions in nearby lakes. Existing conditions within Budd Inlet were also characterized by comparing existing water quality to applicable state criteria.

The data sources used in the analysis are fully described in the Water Quality Discipline Report (Attachment 7).

3.3.1 What past work has been conducted to assess water quality?

Over the decades, government agencies and others have evaluated water quality conditions in Capitol Lake in response to visual and chemical changes. Water quality has changed within the Project Area due to inputs to the river, and lake from various sources, lake treatments, accidental spills, and a range of other factors. As a result, Capitol Lake historically experienced various water quality problems including aquatic weed infestations, algal blooms, and high bacteria concentrations that resulted in closure of the swimming area and restrictions on boating and other beneficial uses. Capitol Lake has been listed on Ecology's 303(d) list for impaired waters due to bacteria since 1998 and total phosphorus since 1996.

A number of factors affect the water quality and overall aquatic health of the aquatic ecosystem in Capitol Lake. Within this context, it is important to note that "water quality" is more than just chemicals in the water.

Capitol Lake is affected by a complex and continually changing interaction between physical (e.g., temperature, river flow and tides, erosion, and sedimentation), chemical (e.g., nutrients, dissolved oxygen, pH), and biological (e.g., algae, bacteria, and aquatic plants and animals) characteristics. The Deschutes River, which is the predominant inflow source, flows through Capitol Lake at a rate that keeps the water cool and well flushed compared to other lakes in the region, most of which become stratified in the summer with a warm layer at the surface and colder water below.

Improving Water Quality Trends in Capitol Lake

Because of the river's influence, the water in Capitol Lake is rapidly replaced, and water quality conditions commonly associated with eutrophication (e.g., high temperatures in shallow waters, oxygen depletion in deeper waters, widely fluctuating pH, toxic algal blooms) are not problematic. Despite a perception of worsening conditions, monitoring data (from 2005 to 2014, as well as in 2019 and 2021) indicate that water quality conditions are relatively good and have actually been improving in Capitol Lake.

During the summer, Capitol Lake occasionally does not comply with water quality standards for temperature, pH, total dissolved gas, and dissolved oxygen. The lake also continually exceeds the trophic state action level for total phosphorus in Puget Sound lowland lakes. A water quality trend analysis conducted for the EIS used data that were not available to Enterprise Services or the general public during preparation of the Capitol Lake Adaptive Management Plan (CLAMP) in 1999, and showed improving conditions in the lake.

The interrelationship between the various factors affecting the aquatic ecosystem in Capitol Lake are important to consider in evaluating the water quality throughout the ecosystem.

Low dissolved oxygen in Budd Inlet during the summer has also been a long-term water quality concern, leading to extensive modeling efforts to better understand the contributing factors to dissolved oxygen depletion. Recent water quality monitoring has provided further insights into the nutrient dynamics and loading from the Deschutes River and Capitol Lake inflows that contribute to marine algae productivity and oxygen depletion in Budd Inlet. Deschutes River and Capitol Lake water quality and flow inputs have historically affected Budd Inlet, along with important and substantial inputs from the greater Puget Sound.

3.3.2 What methods were used for studying existing water quality?

Previous studies, historical monitoring data, and recent data collected for this analysis were used to characterize the conditions in both Capitol Lake and Budd Inlet. The primary studies used, which are fully referenced in the Water Quality Discipline Report (Attachment 7), include:

- *Capitol Lake Restoration Analysis* (Entranco 1984): Preliminary study conducted to characterize the water quality conditions in Capitol Lake.
- *Budd Inlet Scientific Study Final Report* (LOTT 1998): Analyzed field data to quantify circulation patterns and nutrient loading to Budd Inlet.
- *Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Technical Report: Water Quality Study Findings* (Ecology 2012): Reported data and modeling results for Capitol Lake and the Deschutes River using historical data from Budd Inlet and Capitol Lake.

Algae and Aquatic Plants

This document addresses algae (in this case, phytoplankton including cyanobacteria) separate from other aquatic plants. Algae growth is fueled by nutrients in the water and energy from sunlight, and while algae contain chlorophyll like most aquatic plants, they do not have true stems, roots, leaves, and flowers. Algae types include both freshwater algae that are found in Capitol Lake and marine algae that are present in Budd Inlet and other estuaries. Many rooted aquatic plants take nutrients from the bottom sediments that may have accumulated over many years, and some species present in Capitol Lake (e.g., coontail) are floating plants that take nutrients from the water. While there are some kelp and other aquatic plants in Budd Inlet, they have not reached nuisance levels like the dense freshwater aquatic plant growth in Capitol Lake. During their life cycles, algae and other aquatic plants can each have profound effects on physical and chemical characteristics of water quality.



Exhibit 3.5 Coontail (a native floating plant) in Capitol Lake

- *South Puget Sound Dissolved Oxygen Study: Water Quality Model Calibration and Scenarios* (Ecology 2014) and *Budd Inlet TMDL – A Briefing of the Technical Analysis* (Ahmed et al. 2018): Identified anthropogenic causes of dissolved oxygen depletion in South Puget Sound, providing an overview of conditions in several inlets.
- *Deschutes River, Capitol Lake, and Budd Inlet Total Maximum Daily Load Study Supplemental Modeling Scenarios* (Ecology 2015b): Used historical data to model scenarios that predict causes of poor water quality in Budd Inlet.
- *Total Maximum Daily Loads (TMDLs) for the Deschutes River and its Tributaries* (USEPA 2020): Provided TMDLs for sediment, bacteria, dissolved oxygen, pH, and temperature in the Deschutes River and its tributaries.
- *Draft Budd Inlet Total Maximum Daily Load for Dissolved Oxygen* (Ecology 2022): Proposed load allocations for total organic carbon (TOC), dissolved inorganic nitrogen (DIN), total nitrogen, and sometimes biochemical oxygen demand (BOD) for various point and non-point discharges to Budd Inlet.

Ecology is currently developing a TMDL for Budd Inlet. This report and its findings were not available for the EIS.

Historical monitoring data used include:

- Deschutes River and Capitol Lake:
 - Stream Flow 2004–2014 (United States Geological Survey [USGS]): These data were used to develop river loading calculations.
 - Water Quality 2004 (Ecology): These data were used by Ecology for the TMDL water quality study (Ecology 2012) and to augment 2019 and 2021 data collected for the EIS.
 - Water Quality 2005–2014, 2019, and 2021 (Thurston County): This dataset was used to identify long-term trends. These data augmented the river data collected in 2019 and 2021 used to develop the phosphorus budget and support the alternatives analysis.
- Budd Inlet:
 - Water Quality 2010–2014 (Ecology): These data were used to compare the observed water quality conditions to surface water quality standards.

For this assessment, trends in water quality were first analyzed to evaluate which datasets are most representative of existing conditions. These current water quality data for Capitol Lake were then compared to surface water quality standards to evaluate existing conditions, and compared to the total phosphorus action threshold for Puget Sound lowland lakes. Conditions in Capitol Lake were compared to nearby lakes to provide a perspective for water quality conditions in the region, and also compared to Deschutes River water quality to identify differences between the river and Capitol Lake. Previous studies and data were supplemented with additional data collected in 2019 and 2021. These data and a water and phosphorus budget provide further insight into the current interactions between the Deschutes River and Capitol Lake.

Analyzing potential trends in water quality and selecting data that represent existing conditions involved examining the monitoring results from the past two decades to identify data most appropriate for this analysis. Water quality data for Capitol Lake collected by Thurston County from 2005 through 2014 were used for the trend analysis. The presence of trends for multiple key parameters indicates that earlier data are not representative of existing conditions. Therefore, only the most recent 5-year period (2010 to 2014) was used to evaluate water quality criteria, trophic status, and comparisons to nearby lakes. For the water and phosphorus budgets, data from hydrologic water years 2008 to 2012 were analyzed because this was the most recent 5-year period that contained flow, storage, and phosphorus data for the Deschutes River, Capitol Lake, and Percival Creek. Having five consecutive years of data provides an understanding of both average water quality conditions and year-to-year variability.

Similar to Capitol Lake, existing conditions for Budd Inlet were assessed based on available data. Current conditions within Budd Inlet were characterized by comparing existing water quality to applicable state criteria. Sediment quality was also analyzed, largely referencing the findings from the Sediment Quality Discipline Report (Attachment 15). Several studies and modeling efforts conducted in Budd Inlet were used to compare the waterbody to other inlets in South Puget Sound.

Multiple previous water quality studies in the Project Area were supplemented by additional data collected by the EIS Project Team in 2019 and 2021 to characterize existing conditions.

Key studies reviewed include a 2012 Ecology study with modeling results, Ecology TMDL studies, Thurston County water quality monitoring in the Deschutes River and Capitol Lake, and Ecology water

2019 and 2021 Water Quality Sampling

The EIS Project Team collected water quality samples in Capitol Lake to compare current and historical conditions to determine if current conditions are within the range of previous observations. Samples were collected from May through October to be consistent with past Thurston County-collected data. See Section 3.2.3 of the Water Quality Discipline Report (Attachment 7) for more information.

quality monitoring in Budd Inlet. The impacts assessment approach has been expanded since the Draft EIS to further emphasize the ability of project alternatives to meet water quality standards. The full description of methodology and information sources is presented in the Water Quality Discipline Report (Attachment 7).

3.3.3 What are the existing water quality conditions?

This section summarizes the information on existing water quality and forms the baseline for evaluating potential adverse impacts or beneficial effects of the project alternatives. A more detailed description of water quality is provided in the Water Quality Discipline Report (Attachment 7).

Information on dissolved oxygen and nutrients is emphasized in the EIS analysis because low dissolved oxygen concentrations have been a long-term problem in Budd Inlet, and these parameters have been the focus of water quality improvement planning efforts.

Ecology has previously modeled the lake's influence on dissolved oxygen in Budd Inlet. Ecology's model focused on: (1) nitrogen, because it typically drives algae production in marine waters, and the seasonal die-off and decomposition of algae consumes (or reduces) dissolved oxygen concentrations; and (2) TOC as an indicator of organic matter that, when decomposing, contributes to dissolved oxygen depletion. Other key parameters that influence dissolved oxygen conditions in Budd Inlet are phosphorus and BOD. Other existing water quality conditions (e.g., temperature, pH, bacteria) and sediment quality were also considered in this analysis, but with less detail.

3.3.3.1 Capitol Lake

Construction of the 5th Avenue Dam in 1951 transformed the Deschutes Estuary into a freshwater waterbody now known as Capitol Lake. Prior to that time, the Deschutes River flowed to Budd Inlet, with the current-day Capitol Lake Basin consisting of estuary habitat and tideflats. The Deschutes River, which is the predominant inflow source to the lake, now flows through the lake at a rate that replaces the water within about 1 week and keeps the water well mixed. The rapid replacement of lake water results in Capitol Lake being regulated as a surface waterbody where water quality standards for lakes are not specifically applicable. However, the EIS provides comparisons to other lakes in the region and anticipates that a lake management plan for Capitol Lake would be developed and

Dissolved Oxygen

Dissolved oxygen is a measure of how much oxygen is dissolved in the water. The amount of dissolved oxygen in a stream or lake can provide information about the waterbody's water quality. Adequate dissolved oxygen concentrations are important to aquatic habitat, particularly for cold water fish, such as salmon.

implemented under the Managed Lake Alternative, and potentially the Hybrid Alternative.

The existing conditions for water quality in Capitol Lake are presented in the following subsections by:

- Assessing water quality trends in Capitol Lake and Deschutes River.
- Comparing water quality monitoring data to regulatory standards and indicators of trophic state (biological productivity).
- Evaluating water quality and algae monitoring data from 2019 and 2021.
- Comparing Capitol Lake to other lakes in Thurston County.
- Comparing water quality in the Capitol Lake Basin to water quality entering from the Deschutes River.
- Summarizing information on lake sediment quality.
- Evaluating water and phosphorus budgets for Capitol Lake.
- Summarizing water quality modeling studies from the Deschutes River TMDL.

Water Quality Trends in Capitol Lake

Thurston County collected water quality data in Capitol Lake and other area surface waters, including the Deschutes River, for several decades until 2014 as part of an ambient water quality monitoring program. The most recent 10 consecutive years of water quality data collected by Thurston County from 2005 through 2014 for Capitol Lake and the Deschutes River, the period after large-scale aquatic plant management activities and brewery discharges ceased, were compiled to evaluate existing conditions. The data were used to assess trends in annual and summer conditions to ensure that the data used in the analysis reflect existing conditions. During these years, the Deschutes River was monitored year-round, whereas Capitol Lake was monitored only during May through October. Trends in the Deschutes River were therefore evaluated for both full years and the May through October periods. Trends in Capitol Lake were evaluated using all the available data (May through October) as well as by separating data into seasons: spring (May through June), summer (July through August), and fall (September through October). Lake monitoring was performed at two depths: near surface and near bottom.

Trophic State Definitions for Lakes

Oligotrophic: Nutrient-poor waters with minimal algal and/or plant productivity.

Mesotrophic: Moderately nutrient-enriched waters with intermediate levels of algal and/or plant productivity.

Eutrophic: Nutrient-enriched waters with high levels of algal and/or plant productivity.

Hypereutrophic: Extremely nutrient-enriched waters with very high levels of algal and/or plant productivity.

Key Water Quality Terms

Chlorophyll-a and pheophytin-a: Pigments analyzed to indicate algae productivity.

Dissolved oxygen: An important requirement for fish life.

Fecal coliform bacteria: An indicator of the potential presence of bacterial pathogens.

pH: A measure of acidity.

Secchi depth: A measure of water transparency that is sometimes decreased by algae in the water.

The following significant trends were observed in Capitol Lake during different seasons over the years from 2004 through 2014:

- During the entire spring through fall monitoring period, surface pH, surface total phosphorus, pheophytin-*a*, and Secchi depth all improved indicating an overall reduction in algal productivity. Increasing surface and bottom conductivity indicated saltwater intrusion through the dam.
- During the spring, surface total phosphorous and total nitrogen exhibited improving water quality.
- Summer surface temperature and pH both indicated improving water quality. Increasing surface conductivity indicated the influence of saltwater intrusion.
- Total phosphorous, chlorophyll-*a*, and pH all had improving water quality trends in the fall.

The following significant trends were also observed in Deschutes River water quality over the same period:

- Using both spring through fall and year-round data, pH improved, indicating lower algal productivity; and nitrate + nitrite concentrations and fecal coliform bacteria exhibited improvements.

The trend analysis results indicate that Capitol Lake exhibited improving water quality from 2005 to 2014 based on significant improvement in surface pH, surface total phosphorous, phaeophytin, and Secchi depth from May through October. Seasonally, TP and TN exhibited significant improving trends during the spring, surface temperature and pH improved in the summer, and significant improving trends were observed in the fall in surface pH, surface TP, and chlorophyll during the ten-year period. Because of the observed trends, evaluations of existing water quality data were limited to the most recent 5-year period (2010 through 2014) to better reflect current conditions in the lake and river, while still representing interannual variability.

Applicable Water Quality Standards and Existing Water Quality in Capitol Lake

Capitol Lake water quality is regulated using water quality standards and criteria for fresh waters of the state. Capitol Lake has an average detention time (i.e., the time it takes for inflows to replace the lake’s water volume) of less than the 15-day mean detention time used by the state (WAC 173-201a-020) to define a lake. For this reason, Capitol Lake is classified as a river and regulatory requirements for water quality in

Trend Analysis

Overall, the trend analyses over a 10-year period (2005–2014) indicated that water quality in Capitol Lake was significantly improving based on total phosphorus, phaeophytin, Secchi depth, and pH data.

Why do Deschutes River water quality standards apply to Capitol Lake?

Capitol Lake is strongly influenced by its major inflow source, the Deschutes River. Because of river inputs, the lake has an average detention time of 14 days or less. From regulatory and functional perspectives, Capitol Lake is a very wide and slow reach of the Deschutes River. Detention time was also calculated during development of the water budget for this study (Chapter 4.0 [Section 4.1.3]). The calculation was aimed at average conditions rather than low flow and therefore calculated detention times were much lower: ranging from 0.6 to 7.9 days. The storage estimate was based on 2013 lake bathymetry data. The lake will have filled in some since 2013; therefore, the detention time may be slightly less than calculated.

Washington lakes (WAC 173-201a-230) do not apply. Information on existing conditions for nutrients and trophic state indicators is included in the EIS because it is relevant to future lake management under the Managed Lake and Hybrid Alternatives.

Comparing water quality data from 2010 through 2014 with state surface water quality standards (WAC 173-201A-602) indicates that the lake occasionally does not meet standards for temperature, dissolved oxygen, and pH and frequently exceeds the new dissolved oxygen saturation and total dissolved gas standards (Table 3.3.1). Note that the dissolved oxygen standard was increased from 8.0 mg/L to 10 mg/L between the release of the Draft EIS and the Final EIS and a requirement that percent saturation be at least 90% was added; therefore, the summary of conditions in relation to the dissolved oxygen standard has changed since the Draft EIS.

If lake water quality standards were applied at Capitol Lake, it would continually exceed the Action Level for total phosphorous (>20 micrograms per liter [µg/L]) in lowland lakes of the Puget Sound region. The standards recommend that lakes that exceed the Action Level for total phosphorous develop specific management plans and actions to reduce algae productivity and improve water quality. By definition, all eutrophic lakes in Washington exceed the Action Level for total phosphorous, this includes most lowland lakes in the Puget Sound region.

Table 3.3.1 Comparison of Capitol Lake Data to Washington State Surface Water Quality Standards ⁽¹⁾

| Parameter | Mean | Median | Min. | Max. | Surface Water Quality Standard/Action Level |
|---|--------------|--------------|------------|--------------|---|
| Temperature (°C) (Surface) | 16.5 | 17.1 | 9.3 | 21.1 | 17.5 ⁽²⁾ |
| Temperature (°C) (Bottom) | 16.2 | 16.9 | 9.7 | 20.1 | 17.5 ⁽²⁾ |
| Dissolved oxygen (mg/L) (Surface) | 12.1 | 12.2 | 9.2 | 14.4 | 10.0 ⁽²⁾ |
| Dissolved oxygen (mg/L) (Bottom) | 10.6 | 10.5 | 7.7 | 13.1 | 10.0 ⁽²⁾ |
| Dissolved oxygen saturation (%) (Surface) | 123.1 | 123.8 | 95.3 | 153.5 | 90 |
| Dissolved oxygen saturation (%) (Bottom) | 103.3 | 108.0 | 83.0 | 133.3 | 90 |
| Total dissolved gas (%) (Surface) | 123.1 | 123.8 | 95.3 | 153.5 | 110.0 ⁽³⁾ |

| Parameter | Mean | Median | Min. | Max. | Surface Water Quality Standard/Action Level |
|------------------------------------|-------------|-------------|-------------|--------------|---|
| Total dissolved gas (%) (Bottom) | 103.3 | 108.0 | 83.0 | 133.3 | 110.0 ⁽³⁾ |
| pH (Surface) | 8.2 | 8.2 | 7.4 | 9.2 | 6.5–8.5 ⁽²⁾ |
| pH (Bottom) | 7.7 | 7.7 | 6.6 | 8.8 | 6.5–8.5 ⁽²⁾ |
| Total phosphorous (µg/L) (Surface) | 32.3 | 32.0 | 22.0 | 59.0 | 20.0 ⁽⁴⁾ |

Notes:

Data are from monthly summer (May through October) grab samples collected by Thurston County.

Bold and shaded values indicate problematic excursions from the standard or Action Level.

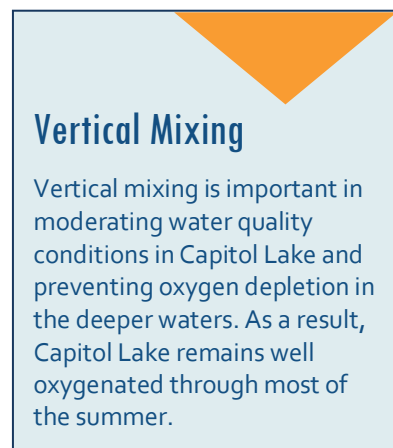
1. Based on 2010–2014 data from the North Basin.
2. Washington State Surface Water Quality Standards (WAC 173-201A: Salmonid Spawning, Rearing, and Migration) for freshwater.
3. WAC 173-201A standard for total dissolved gas.
4. Action Level listed in WAC 173-201A-230.

As presented in greater detail in the Water Quality Discipline Report (Attachment 7), very similar results for temperature and dissolved oxygen from near the surface and near the bottom show that water in Capitol Lake is well mixed, unlike many regional lakes that become thermally stratified in the summer with warmer water near the surface and cooler water at depth. The new numeric dissolved oxygen criterion and percent saturation criterion are sometimes exceeded (i.e., the dissolved oxygen content is too low) in the surface and bottom waters of the lake; however, in general these results signify well-oxygenated conditions compared to other eutrophic lakes.

Water temperature occasionally exceeds the 17.5 °C maximum criterion both near the surface and near the bottom in Capitol Lake. Because the temperature criterion is also exceeded in the main incoming water sources (Deschutes River and Percival Creek), maximum temperatures in the lake can be attributed to both the incoming water and warming in the lake basin where there is less shade and more solar exposure.

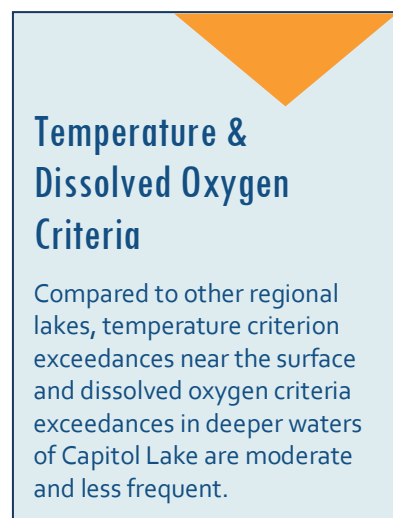
The 8.5 maximum pH criterion is also exceeded during the daytime hours when algae blooms or dense aquatic plants are undergoing photosynthesis, particularly in the near-surface waters of Capitol Lake (see Table 3.3.1.).

Table 3.3.2 compares conditions in Capitol Lake to thresholds commonly used for assigning a trophic state to lakes. Based on total phosphorous, chlorophyll-*a*, and Secchi depth, Capitol Lake would be classified as eutrophic (i.e., enriched with nutrients and productive for



Vertical Mixing

Vertical mixing is important in moderating water quality conditions in Capitol Lake and preventing oxygen depletion in the deeper waters. As a result, Capitol Lake remains well oxygenated through most of the summer.



Temperature & Dissolved Oxygen Criteria

Compared to other regional lakes, temperature criterion exceedances near the surface and dissolved oxygen criteria exceedances in deeper waters of Capitol Lake are moderate and less frequent.

algae) even after the improving trends in these parameters observed in recent years. The Action Level for total phosphorous for Washington lakes is >20 µg/L. WAC 173-201A-230 recommends for lakes that a study be initiated to develop a lake-specific standard for total phosphorous where the Action Level is exceeded. The summer mean total phosphorous concentration in Capitol Lake (32.3 mg/L) exceeds the Action Level. Although the total phosphorus Action Level is not a regulatory requirement and is not technically applicable to Capitol Lake because of its regulatory status as part of the Deschutes River, this information is included because it is anticipated that a lake management plan, including a lake-specific standard for total phosphorus, would be developed and implemented under the Managed Lake Alternative and potentially the Hybrid Alternative.

Table 3.3.2 Comparison of North Basin Capitol Lake Data & Trophic State Thresholds for Lakes


| Trophic State | Secchi Depth (m) | Chlorophyll-a (µg/L) | Total Phosphorus (µg/L) | Total Nitrogen (mg/L) |
|--------------------------|------------------|----------------------|-------------------------|-----------------------|
| Capitol Lake (2010–2014) | 1.8 | 12.3 | 32.3 | 0.60 |
| Capitol Lake (2019) | 1.6 | 14.1 | 69.0 | 0.49 |
| Capitol Lake (2021) | 1.7 | 8.9 | 38.1 | 0.51 |
| Oligotrophic | >4 | <2.6 | <12 | <0.35 |
| Mesotrophic | 2–4 | 2.6–7.3 | 12–24 | 0.35–0.65 |
| Eutrophic | 0.5–2 | 7.3–56 | 24–96 | 0.65–1.2 |
| Hypereutrophic | <0.5 | >56 | >96 | >1.2 |

Notes:

Bold and shaded values show how levels in Capitol Lake would be characterized.

Italicized values were influenced by spills and should not be used for evaluating trophic status.

An Ecology modeling study of Budd Inlet indicated that the largest human-caused contributor to low dissolved oxygen problems in Budd Inlet was loading of nutrients and TOC from Capitol Lake. For the parameters of most interest (e.g., biological indicators such as TOC and dissolved organic carbon [DOC]), the Ecology modeling study was based on data collected in Capitol Lake in 2003 and 2004. To provide more recent data and to augment the historical dataset, limited additional monitoring was conducted in Capitol Lake from May through October 2019 and 2021 as part of the EIS evaluation. The routine monitoring of the Deschutes River performed by Thurston County was also expanded to include some key analytes. More details on the monitoring results are included in the Water Quality Discipline Report (Attachment 7) and summarized below.



2019 Events Affecting Water Quality

Three events in 2019 may have affected water quality results: a spill of transformer oil in the lower Deschutes River and subsequent cleanup efforts, and two sewage spills in Percival Creek.

Importantly, three events occurred in 2019 that may have influenced water quality results. The first event occurred on February 25, 2019, when there was a large spill of transformer oil, just downriver of Tumwater Falls. The oil entered the Deschutes River from several storm drains and flowed into Capitol Lake. Ecology immediately launched an extensive cleanup that involved removing oil from the system by skimming the surface, cleaning the shoreline vegetation, and vacuuming contaminated sediment. The cleanup efforts occurred from March through July 2019. Water quality may have been affected by both the transformer oil and the site disturbances from cleanup operations. The remaining two events were associated with large sewage spills on Percival Creek in early February 2019 and near the end of May 2019.



Exhibit 3.6 Responders gather contaminated vegetation along the Capitol Lake shoreline (Source: Washington State Department of Ecology <https://ecology.wa.gov/About-us/Get-to-know-us/News/2021/Feb-11-Olympia-Brewery-Spill-to-Capitol-Lake>)

Because of concerns that the spills described above may have impacted water quality results intended for characterizing existing conditions, 2019 data were not used in long-term trend analyses but were compared with those from previous years (2010 to 2014), as summarized in Table 3.3.3. Phosphorus data from 2019 and 2021 were suspected to be influenced by spills and were thus not used in the analysis; however, data for other water quality parameters collected in 2019 and 2021 were generally within the range of historically observed values and accepted for analyses.

Table 3.3.3 Comparison of 2019 and 2021 Capitol Lake Water Quality Data to 2010–2014 Data

| Parameter | North Basin: 2010–2014 Average | North Basin: 2019 Average | North Basin: 2021 Average | Middle Basin: 2010–2014 Average | Middle Basin: 2019 Average | Middle Basin: 2021 Average |
|---|--------------------------------|---------------------------|---------------------------|---------------------------------|----------------------------|----------------------------|
| Total nitrogen (mg/L) (Surface) | 0.60 | 0.49 | 0.51 | 0.69 | 0.65 | 0.75 |
| Total phosphorous (mg/L) (Surface) | 0.032 | 0.069 ⁽²⁾ | 0.057 ⁽²⁾ | 0.032 | 0.22 | 0.066 ⁽²⁾ |
| Soluble reactive phosphorous (mg/L) (Surface) | 0.010 ⁽¹⁾ | 0.024 ⁽²⁾ | 0.020 | 0.014 ⁽¹⁾ | 0.115 ⁽²⁾ | 0.026 |
| Chlorophyll -a (µg/L) (Surface) | 12.3 | 14.1 | 8.9 | 5.2 | 3.8 | 5.5 |
| Pheophytin-a (µg/L) (Surface) | 3.0 | 3.3 | 2.0 | 3.1 | 1.7 | 2.8 |
| Secchi Depth (m) | 1.8 | 1.6 | 1.7 | 2.4 | 1.9 | 1.7 |

Notes on next page.

Table 3.3.3 Notes:

1. These values are based on the 2004 dataset because SRP was not measured from 2010 to 2014.
2. These average values reflect the elevated phosphorus concentrations that were measured in both the Middle and North Basins of the lake as a result of reported spills in 2019 and a likely unreported spill in 2021.

Overall, the monitoring data (2010 to 2014, 2019, and 2021) indicate that Capitol Lake currently has relatively good water quality in terms of physical and chemical characteristics important to aquatic life; water quality standards (such as for temperature and dissolved oxygen) are occasionally exceeded, but these are tempered by the Deschutes River. Chlorophyll-*a* concentrations are also relatively low, especially given the available nutrients in the lake, indicating that algal productivity is generally not excessive. The algal community is dominated by diatoms, an algal type that generally does not create nuisance conditions such as toxic bloom. Public perceptions of degraded water quality in Capitol Lake may be linked to aesthetic impacts of the extensive and dense aquatic plant population that becomes more exposed during summer low river flows. Monitoring data indicate that, with the exception of phosphorus, water quality in Capitol Lake in 2019 was generally consistent with results for 2010 to 2014 and characteristic of good water quality in terms of physical and chemical properties important to aquatic life.

Table 3.3.4 provides a summary of bacteria data from the 2019 field study. Overall, bacteria concentrations were low and geometric mean (an average used where values may be widely variable) values were well below the water quality standard. One sample from the North Basin (from May 28, 2019) exceeded the maximum standard due to a large sewage spill in Percival Creek on the same day that resulted in very high bacteria concentrations in Percival Creek. With the exception of the monitoring event during the spill that impacted the North Basin only, the Middle and North Basin stations had similar concentrations and geometric mean values. The station near the eastern shoreline of the North Basin had elevated bacteria concentrations compared to the other lake stations, but still met water quality standards.

Key Water Quality Terms

Total nitrogen: A critical nutrient for algae and plant growth, particularly in marine waters.

Soluble reactive phosphorous: A critical nutrient for algae growth, particularly in freshwater lakes.

Table 3.3.4 Comparison of 2019 Bacteria Concentrations in Capitol Lake to Washington State Surface Water Quality Standards

| Sample Date | Middle Basin: Fecal Coliform Bacteria (CFU/100 mL) ⁽¹⁾ | Middle Basin: E. Coli (CFU/100 mL) | North Basin: Center: Fecal Coliform Bacteria (CFU/100 mL) ⁽¹⁾ | North Basin: Center: E. Coli (CFU/100 mL) | North Basin: Shore: Fecal Coliform Bacteria (CFU/100 mL) ⁽¹⁾ | North Basin: Shore: E. Coli (CFU/100 mL) |
|--|---|------------------------------------|--|---|---|--|
| 5/28/2019 | 16 | 11 | 540 | 335 | 115 | 68 |
| 6/26/2019 | <10 ⁽²⁾ | <10 ⁽²⁾ | <2 ⁽²⁾ | <2 ⁽²⁾ | – | – |
| 7/24/2019 | 2 | 2 | <2 ⁽²⁾ | <2 ⁽²⁾ | – | – |
| 8/22/2019 | <2 ⁽²⁾ | <2 ⁽²⁾ | 4 | 4 | 78 | 66 |
| 9/24/2019 | 64 | 54 | 7 | 7 | 9 | 4 |
| 10/22/2019 | 171 | 171 | 35 | 35 | 44 | 44 |
| 5/25/2021 | 40 | 33 | 7 | 7 | – | – |
| 6/23/2021 | 13 | 13 | 15 | 13 | – | – |
| 7/22/2021 | 6 | 6 | 4 | 4 | – | – |
| 8/23/2021 | <2 ⁽²⁾ | <2 ⁽²⁾ | 2 | 2 | – | – |
| 9/20/2021 | 50 | 25 | 20 | 16 | – | – |
| 10/18/2021 | 46 | 42 | 18 | 18 | – | – |
| Geometric Mean | 15 | 13 | 10 | 9 | 43 | 30 |
| Geometric Mean Standard ⁽³⁾ | 100 | 100 | 100 | 100 | 100 | 100 |
| Maximum Standard ⁽³⁾ | 200 | 320 | 200 | 320 | 200 | 320 |

Notes:

Bold and shaded values indicate excursions from the standard or Action Level.

1. Until recently, the state water quality standards for lakes and rivers (WAC 173-201A-200) used fecal coliform bacteria and *E. coli* as alternative indicators of bacterial contamination. Both were measured during the 2019 monitoring to evaluate lake conditions. As of this year (2021), only *E. coli* bacteria will be used to determine compliance.
2. Values with a < indicate that the sample concentration was less than the detection limit.
3. WAC 173-201A-200: Table 200 (2)(b) Criteria based on datasets where there are fewer than 10 sample points.

Abbreviation: CFU = Colony forming unit

Another potentially important biological component of water quality is algae. As previously described, algae consume oxygen in the water column during respiration and decomposition. One type of algae (cyanobacteria, or blue-green algae) can cause toxic algal blooms that can result in illness and death in animals and humans if consumed.

Monitoring in 2019 indicated that blue-green algae, when present in samples, represented only 5% to 10% of the total algae community. The predominant algae in 2019 were diatoms (not a toxin-producing algae), representing 70% to 95% of the total algae population. In 2004, the lake algae population was also dominated by diatoms; there were two algae blooms: one caused by green algae (July) and one caused by blue-green algae (August).

Water Quality in Capitol Lake Compared to Other Local Lakes

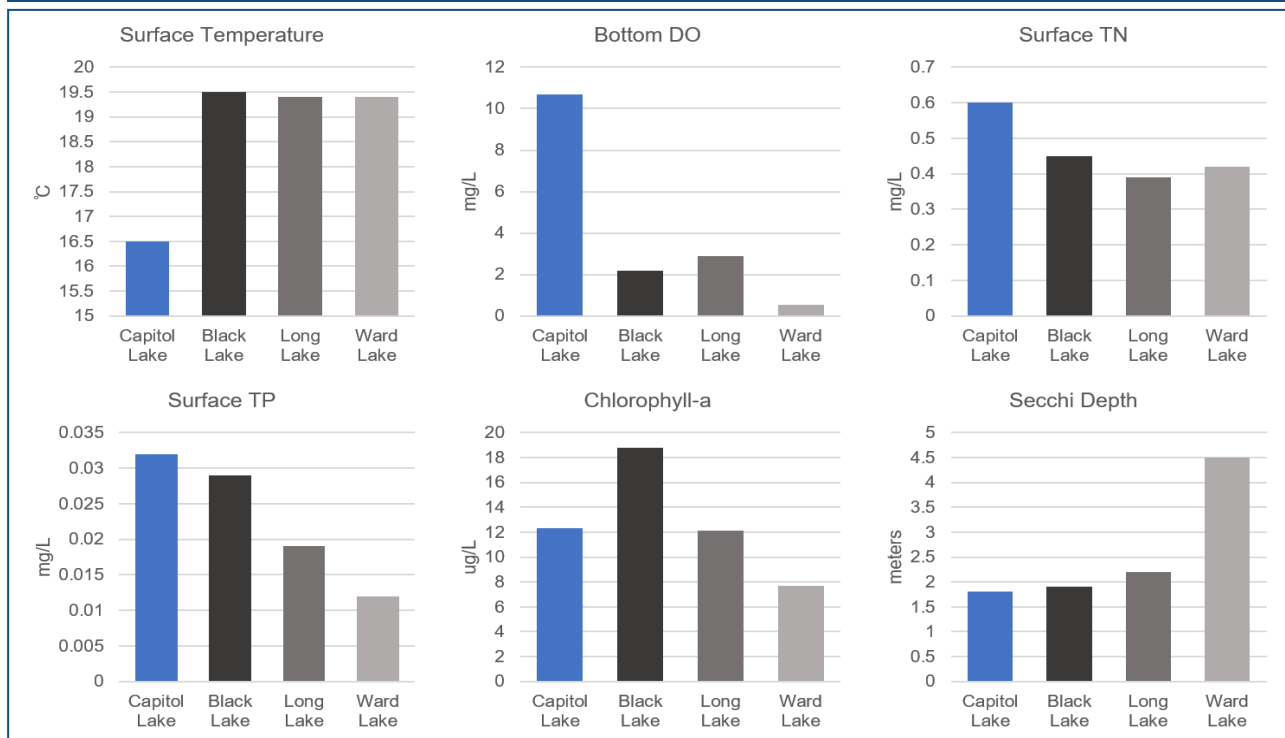
Figure 3.3.1 compares average measured conditions in Capitol Lake to other lakes in Thurston County using data from 2010 to 2014. Better water quality is indicated by cooler surface temperatures and higher dissolved oxygen near the lake. While phosphorus concentrations were high relative to other lakes (largely driven by phosphorus from the incoming river and other tributary streams), chlorophyll-*a* concentrations and Secchi depths were similar, indicating that algae growth is being constrained by something other than phosphorus.

The lakes selected for comparison were chosen because they represent a range of conditions and are familiar to Thurston County residents. Black Lake and Long Lake are eutrophic like Capitol Lake (i.e., nutrient enriched), while Ward Lake is likely mesotrophic (i.e., moderately nutrient enriched). It is acknowledged that while other Thurston County lakes may have similar characteristics to Capitol Lake, they have differing hydrologic conditions and trophic status. Black and Long Lakes are long, narrow water bodies like Capitol Lake, but shallower. Ward Lake is deeper than the other area lakes and has no river inflow. Capitol Lake is cooler and has more oxygen than the other lakes (Figure 3.3.1). It has higher concentrations of both total phosphorous and total nitrogen; however, these high nutrient concentrations have not resulted in commensurately high algal productivity compared to the other lakes. These differences are likely due to the different hydrodynamics of Capitol Lake: the large inflow from the river and low residence time (i.e., the time it takes to replace the water volume). Capitol Lake is typically well mixed and therefore does not stratify into layers with warm, oxygenated water near the surface and cooler, oxygen-depleted waters at depth as is common in most Puget Sound lowland lakes. Further, the Capitol Lake algae community is dominated by diatoms and does not experience the toxic algae blooms that have been detected in other Thurston County lakes.

Capitol Lake Water Quality

Overall, Capitol Lake exhibits relatively good water quality when compared to other lakes in the area and to eutrophic lakes in general. Ecologically, the low temperatures and high dissolved oxygen are more supportive of cold water fish than other local lakes.

Figure 3.3.1 Comparison of Capitol Lake to Other Thurston County Lakes Using Summer 2010 to 2014 Data



Water Quality in Capitol Lake Compared to the Deschutes River

One of the main objectives of the 2019 and 2021 data collection effort was to compare BOD, total nitrogen, and TOC between the lake and river to evaluate the extent to which Capitol Lake, rather than the river, primarily: (1) contributes to the delivery of these materials into Budd Inlet, and (2) is a principal contributor to low dissolved oxygen conditions in Budd Inlet. Before this comparison could be made, it was necessary to evaluate the extent to which the 2019 transformer oil spill and/or spill-related activities may have resulted in increases in BOD, total nitrogen, or TOC due directly to the release or movement of additional organic matter that would increase carbon, or due indirectly to increased algae. Based on comparisons between the 2010 to 2014 data and 2019 data, the spills did not appear to have substantial effects on BOD, total nitrogen, and TOC; therefore, the datasets were considered representative for comparisons between Capitol Lake and the inflowing Deschutes River.

Table 3.3.5 compares Deschutes River and Capitol Lake summer water quality data from monitoring in 2019 and 2021. As summarized in the table, total nitrogen and DIN decreases as the water moves from the

Key Water Quality Terms

Dissolved inorganic nitrogen: The nitrate, nitrite, and ammonium forms of nitrogen most readily available to algae growth.

Total organic carbon: A measure of organic material primarily from decomposing algae and plants.

Dissolved organic carbon: The portion of the organic material that is dissolved in water.

Biochemical oxygen demand: A measure of oxygen consumption needs.

Total suspended solids: A measure of the particles suspended in water.

river, through the South Basin to the Middle Basin and then the North Basin of the lake. The data also indicate increases in BOD, total suspended solids (TSS), volatile suspended solids (VSS), and TOC between the river and lake, but overall the concentrations of these constituents were low in both the river and lake. Chlorophyll-*a* was not measured in the river, but a comparison between the Middle and North Basin results indicates that chlorophyll-*a* increases as the water moves from the river through the lake. Thus, the increases in BOD, TSS, and TOC are likely due in part to increased algae growth as well as inputs from Percival Creek.

Nutrients and Low Dissolved Oxygen in Budd Inlet

Ecology studies and modeling have indicated the primary contributing role of nutrients in the depletion of oxygen in Budd Inlet. Phosphorus and nitrogen fuel the growth of algae and aquatic plants (sources of TOC) in Capitol Lake, which consume oxygen when they are decomposed in the lake or in Budd Inlet. The Deschutes River and Capitol Lake are important sources of nutrients to Budd Inlet and can therefore help to fuel the growth of marine algae that also contributes to oxygen depletion.

Table 3.3-5 Average Summer Water Quality Conditions in the Deschutes River & Capitol Lake in 2019 and 2021

| Parameter | Deschutes River (2019) | Deschutes River (2021) | Middle Basin Surface (2019) | Middle Basin Surface (2021) | North Basin Surface (2019) | North Basin Surface (2021) | North Basin Bottom (2019) | North Basin Bottom (2021) |
|-------------------------------------|------------------------|------------------------|-----------------------------|-----------------------------|----------------------------|----------------------------|---------------------------|---------------------------|
| Total phosphorous (mg/L) | 0.033 | 0.033 | 0.031 ⁽¹⁾ | 0.043 ⁽²⁾ | 0.032 ⁽¹⁾ | 0.038 ⁽²⁾ | – | 0.044 |
| Soluble reactive phosphorous (mg/L) | 0.017 | 0.016 | 0.014 ⁽¹⁾ | 0.013 ⁽²⁾ | 0.010 ⁽¹⁾ | 0.009 ⁽²⁾ | ND ⁽³⁾ | 0.008 |
| Total nitrogen (mg/L) | 0.79 | 0.90 | 0.65 | 0.74 | 0.49 ⁽¹⁾ | 0.51 | 0.51 | 0.52 |
| Ammonia (mg/L) | – | 0.022 | 0.075 | 0.083 | <0.055 ⁽⁴⁾ | 0.030 | <0.030 ⁽⁴⁾ | 0.037 |
| Nitrogen dioxide + nitrate (mg/L) | – | 0.65 | 0.42 | 0.42 | <0.20 ⁽⁴⁾ | 0.22 | 0.22 | 0.22 |
| Chlorophyll- <i>a</i> (µg/L) | – | 2.48 | 3.83 | 5.51 | 14.1 | 8.9 | 10.1 | 11.3 |
| Pheophytin- <i>a</i> (µg/L) | – | 1.7 | 1.7 | 2.79 | 3.3 | 2.0 | 3.0 | 2.9 |
| TSS (mg/L) | 1.70 | 2.58 | 1.81 | 2.12 | 2.63 | 2.48 | 2.83 | 2.42 |
| VSS (mg/L) | <1.00 ⁽⁴⁾ | 1.18 | 1.11 | 1.35 | 1.70 | 1.69 | <1.66 ⁽⁴⁾ | 1.65 |
| TOC (mg/L) | 1.83 | 1.47 | 2.22 | 1.97 | 2.55 | 2.15 | 2.94 | 2.08 |
| DOC (mg/L) | – | 1.31 | 2.00 | 1.70 | 2.44 | 1.87 | 2.10 | 1.83 |
| BOD (mg/L) | <2.00 ⁽⁴⁾ | <2.11 ⁽⁴⁾ | <2.06 ⁽⁴⁾ | <2.23 ⁽⁴⁾ | <2.25 ⁽⁴⁾ | <2.25 ⁽⁴⁾ | <2.08 ⁽⁴⁾ | <2.04 ⁽⁴⁾ |

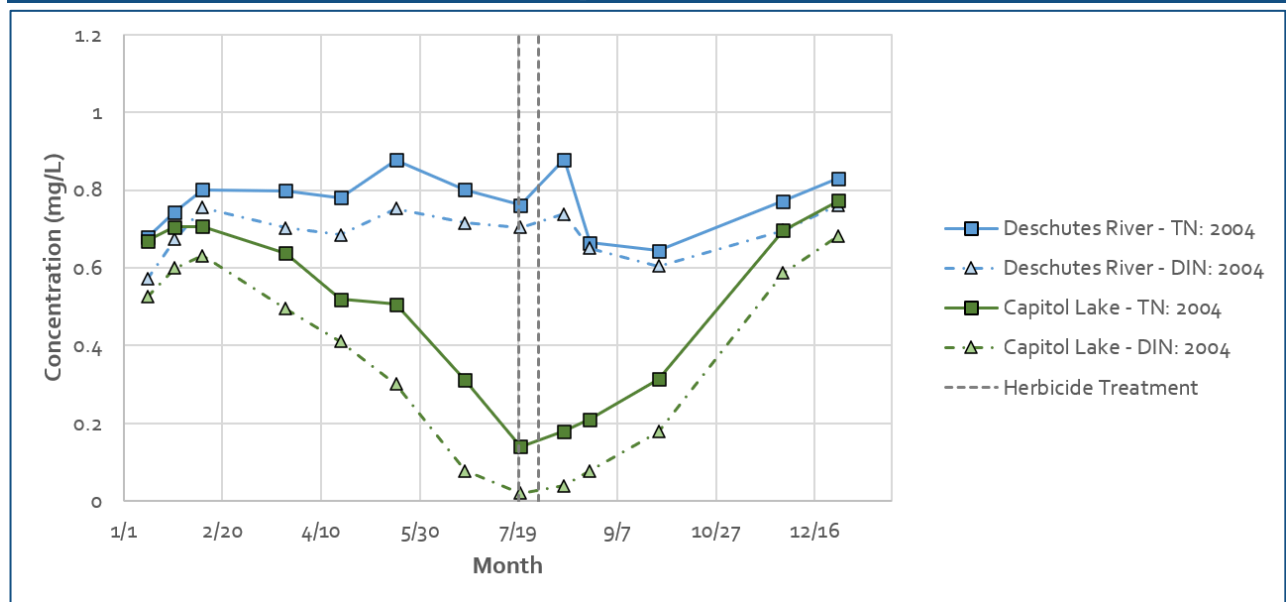
Notes:

- 1 For these parameters, 2019 data were determined to be different than data from 2010 to 2014. In these cases, average values from 2010 to 2014 are shown.
- 2 Excludes the surface phosphorus samples collected on 9/20/2021 that were outliers.
- 3 SRP data that were collected in 2019 did not represent typical conditions due to extensive spill cleanup efforts.
- 4 Values with a < indicate the sample set had at least one sample at concentrations less than the detection limit:
BOD = 2 mg/L; TSS = 0.5 mg/L; ammonia = 0.01 mg/L; nitrogen dioxide + nitrate = 0.01 mg/L.

Abbreviation: ND = No data

Previous Ecology modeling studies concluded that Capitol Lake increased the load of TOC and decreased the DIN load to Budd Inlet as compared to the river, and these findings are supported by monitoring data. Figure 3.3.2 compares the total nitrogen and DIN concentrations in the river and lake. As shown, the concentrations are consistently lower in the lake during the growing season, and they steadily decrease relative to the river as the growing season progresses. This indicates that the lake basin acts as a “sink” for nitrogen; that is nitrogen is removed and therefore there is less nitrogen entering Budd Inlet. The decrease in total nitrogen and DIN over the growing season has been attributed to uptake by plants and algae in the lake (Ecology 2015b).

Figure 3.3.2 2004 Total Nitrogen and DIN Concentrations in the Deschutes River near Tumwater Falls & the North Basin of Capitol Lake



The conversion of DIN into algae and aquatic plants in Capitol Lake corresponds to higher TOC concentrations in the lake than the Deschutes River. Figure 3.3.3 displays TOC concentrations in the river and lake through the summer season for the 3 years with data. As shown, there were notable peaks in TOC in late summer (2004) or fall (2019). These peaks have been attributed to aquatic plant die-off (Ecology 2015b). Due to the two summer herbicide applications conducted in July of 2004 to kill aquatic plants, 2004 was not a typical year for plant die-off (graph a). The applications would have resulted in atypical spikes in TOC in terms of both concentration and the timing of the spike. The herbicide applications would have resulted in nearly immediate die-off of the majority of the plants resulting in a large

release of TOC in the few days or week after the applications, as shown in Figure 3.3.3. Under natural conditions, aquatic plants would die off slowly over a more extended period and this would happen in late summer and fall, similar to timing of increased TOC observed in 2019 (Figure 3.3.3, graph b). A peak was not evident in 2021 (Figure 3.3.3, graph c).

As shown in Figure 3.3.3, except for the herbicide treatment period in 2004, the lake and river TOC concentrations are closely synced, including during the critical period of peak TOC concentrations in late summer/early fall of 2019. This indicates that the seasonal increases in TOC are driven first by increases from the river. To examine this relationship and to account for the Percival Creek input of TOC, monthly loads for 2019 were calculated. The year 2019 was selected because it was the year that clearly showed a late season TOC spike caused by end-of-season plant die-off, and it was not impacted by an herbicide application. During July and August of 2019, when TOC concentrations and therefore loads were low throughout the system (Figure 3.3.4), the contribution from Capitol Lake represented approximately 20% to 25% of the TOC load to Budd Inlet. While the TOC load increased substantially in September and October (Figure 3.3.4), most of the increase was from the Deschutes River and Percival Creek. Between September and October 2019 when TOC concentrations peaked, the total TOC load increased from approximately 38,000 kilograms (kg) to 98,000 kg. However, the large majority of the increase was from the Deschutes River. TOC load from the river increased from approximately 12,000 kg to 49,000 kg; a 62% increase. The lake TOC load increased from approximately 18,000 to 32,000 kg; a 23% increase. During the peak in TOC load in October of 2019, 33% of the load was attributed to Capitol Lake (Figure 3.3.4). In 2021, the differences in load contributions and influence of the lake would have been smaller, because the differences between TOC concentration in the lake and river were smaller. These results support Ecology's model findings that while the lake contributes to the increase in the load of TOC to Budd Inlet, it accounts for 23% to 33% of that increase.

Figure 3.3.3 Deschutes River and Capitol Lake TOC Concentrations from 2004 (a), 2019 (b), and 2021 (c)

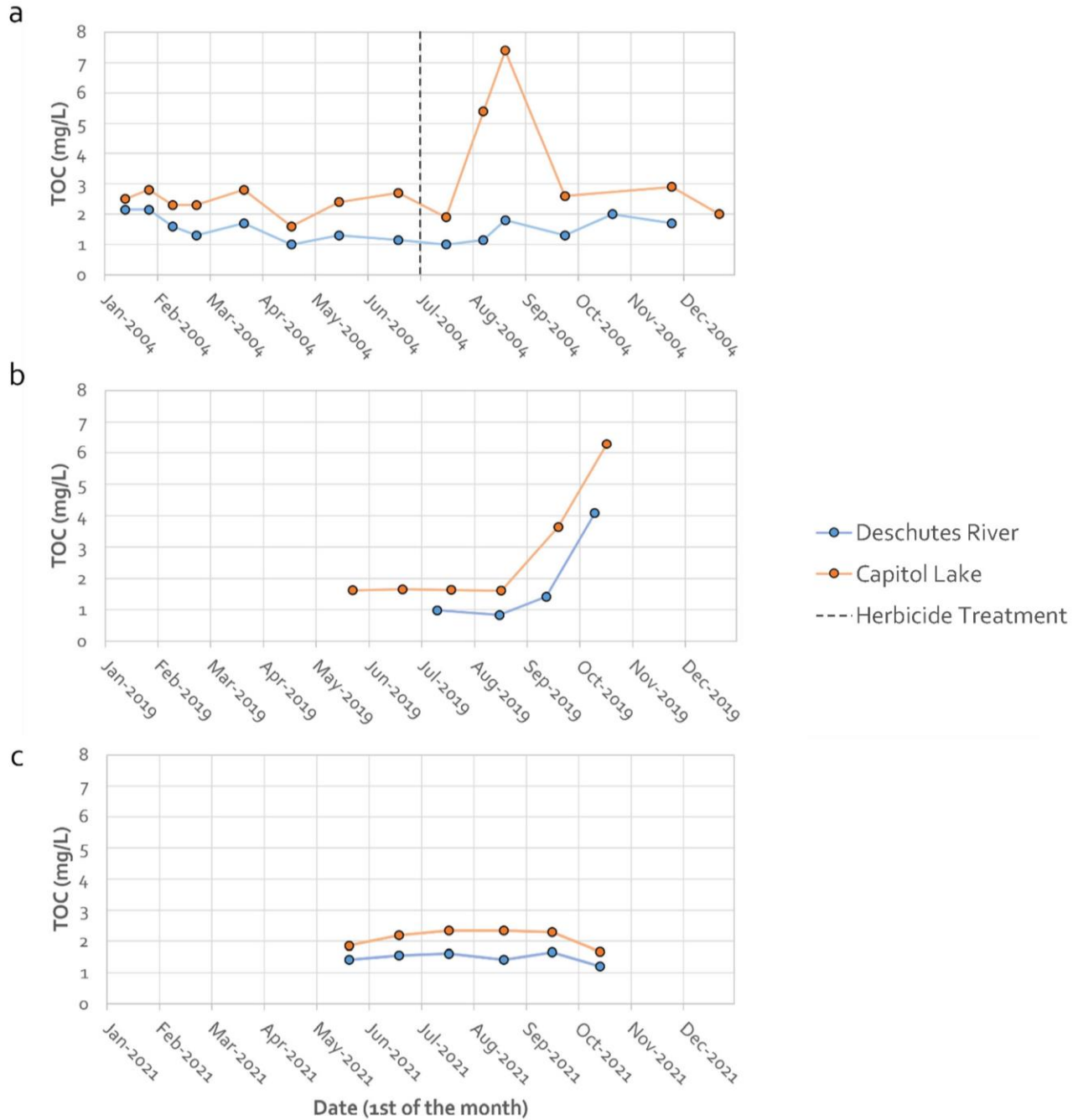
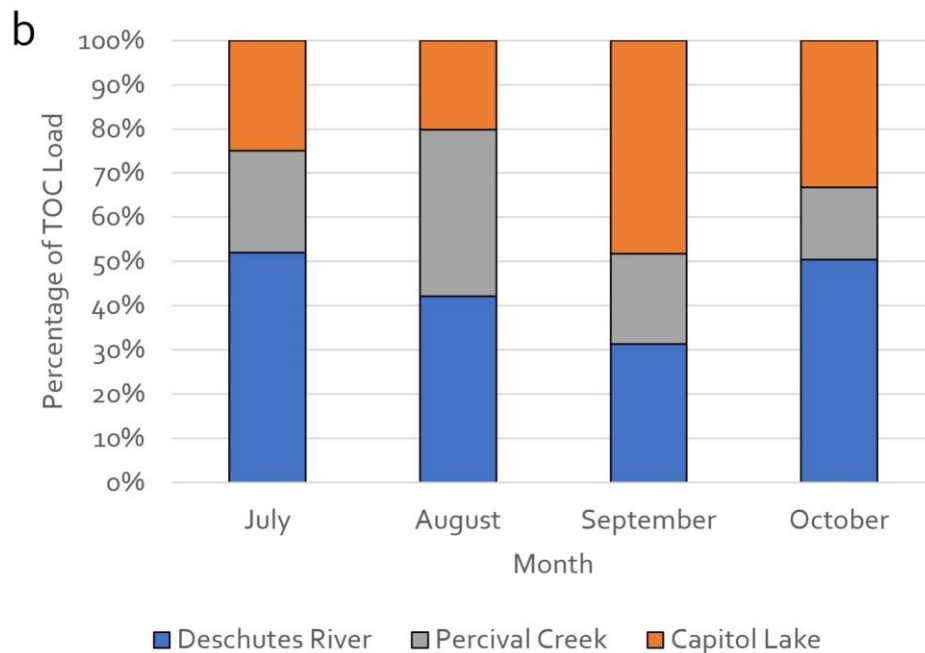
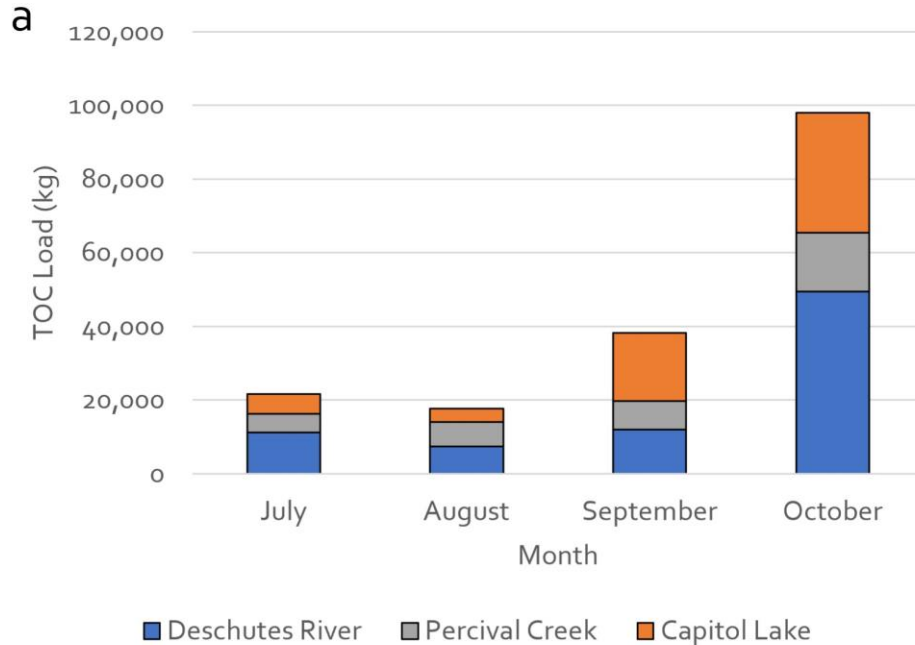


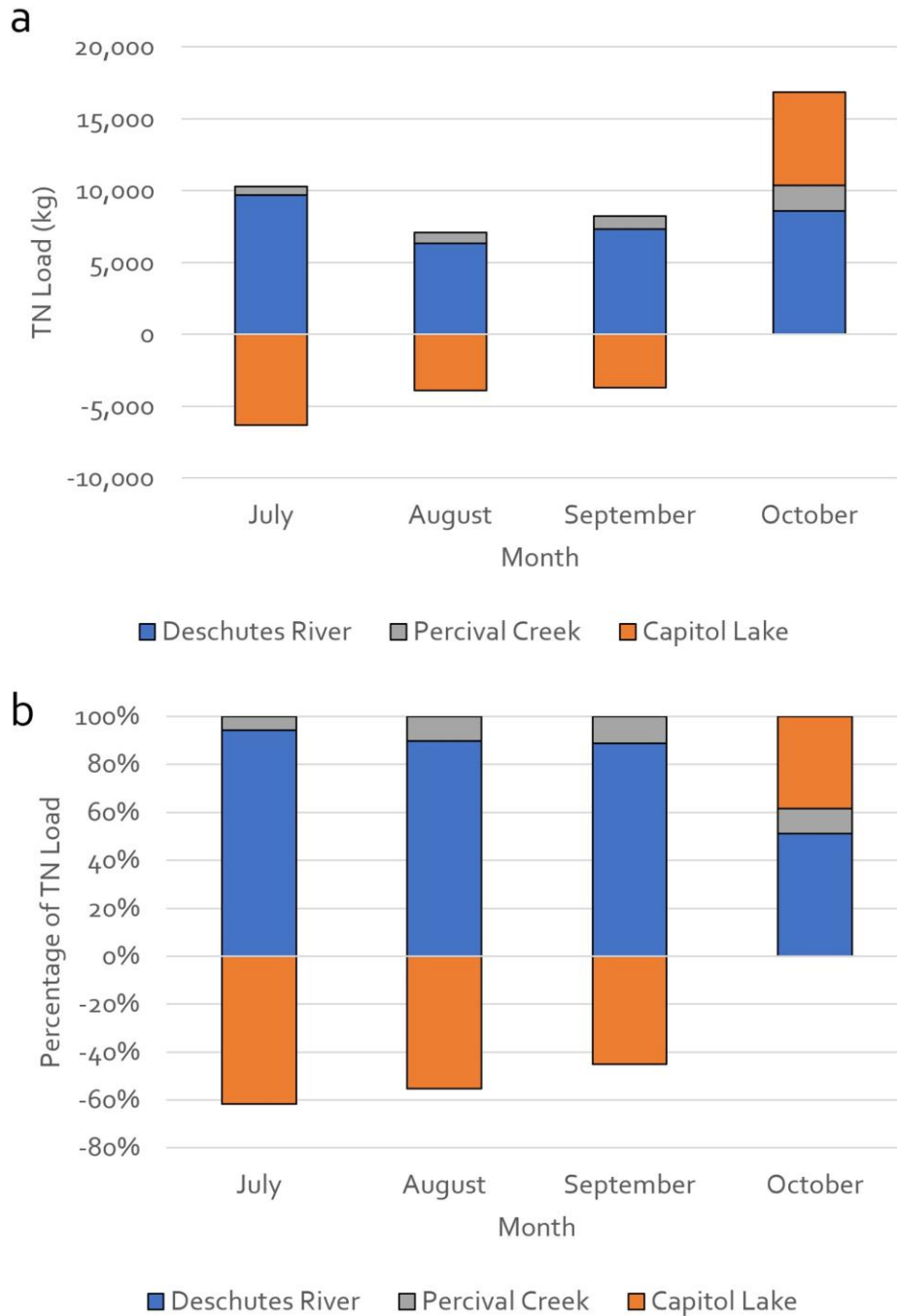
Figure 3.3.4 Comparisons of TOC Load (a) and Percent Load (b) for the Deschutes River, Percival Creek, and Capitol Lake in 2019



Due to the emphasis on nitrogen sources to Puget Sound through the Puget Sound Nutrient Reduction Program, the relationship between Capitol Lake and the Deschutes River and Percival Creek loads of nitrogen (based on 2019 data) were compared (Figure 3.3.5) using the same method as applied to the TOC load estimates. As shown in Figure 3.3.5, during most of the summer the Deschutes River provides the majority of the total nitrogen load to the system, while Capitol Lake reduces the total nitrogen load by 40% to 60% during most of the summer (as shown by the negative numbers on the graphs). In October, the lake too became a loading source of total nitrogen, likely as a result of die-off of plants and algae and resultant conversion of organic material to nitrogen. However, even in October, over 60% of the total nitrogen load was from the Deschutes River and Percival Creek systems (Figure 3.3.5).

This analysis, and modeling by Ecology, indicates that Capitol Lake increases the load of TOC and decreases the load of total nitrogen and DIN to Budd Inlet as compared to the river or conditions without the dam. However, the data indicate that the primary driver of the seasonal TOC load including during the critical late summer/early fall period is the river.

Figure 3.3.5 Comparisons of Total Nitrogen Load (a) and Percent Load (b) for the Deschutes River, Percival Creek, and Capitol Lake in 2019



Sediment Quality in Capitol Lake

In some lakes, sediments are a major source of nutrients for aquatic plants or algae. Sediments may also contain toxic constituents accumulated over many years that can be harmful to aquatic life. When sediments are disturbed by dredging or other activities, nutrients and chemicals may reenter the water and stimulate algal blooms or cause harm to fish and plankton.

Sediment samples were collected from the Middle and North Basins of Capitol Lake by the EIS Project Team in March 2020 and analyzed for multiple chemicals of potential concern, including metals, organic chemicals (e.g., petroleum hydrocarbons), and phosphorous. Samples were collected from near the sediment surface, from the depth ranges proposed for dredging, and from deeper sediments that would become the new sediment surface after dredging. Sediment quality was found to be generally good with low chemical concentrations in all three layers of both sampled lake basins. No organic chemicals were found to exceed sediment management standards. Average metal concentrations did not exceed any freshwater benthic criteria except nickel, which exceeded the freshwater Sediment Cleanup Objective in the surface layer of the North Basin and in the surface and dredge layers of the Middle Basin. Sulfide was the only chemical exceeding the freshwater Cleanup Screening Level (CSL) protective of benthic invertebrates. High sulfide concentrations are common in lake sediments due to microbial decay of natural organic matter present in algae and aquatic plants.

The amount of bioavailable phosphorus for potential release and algal uptake in the lake is higher in surface sediments in the North Basin than the Middle Basin and much lower in buried sediments that could become exposed by dredging. See Section 3.11.2 for more information on existing sediment quality.

Capitol Lake Water and Phosphorus Budgets

Water and total phosphorous budgets were developed to quantify sources of total phosphorous to the lake. The budgets were developed using data from water years 2008 to 2012, as this was the most recent 5-year period containing data for all major sources (e.g., both rivers and lake). A water budget is necessary to develop a budget for phosphorus, an important nutrient that can control algae productivity in Capitol Lake, which in turn contributes to the TOC that is part of the oxygen depletion process in Budd Inlet.

Water and Phosphorous Budgets

A water budget is an accounting of all the water that flows into and out of a Project Area. The phosphorus budget is an accounting of the sources and amounts of phosphorus entering and leaving the lake.

The results of both the water and total phosphorous budgets are described in Section 4.1.4 of the Water Quality Discipline Report (Attachment 7). In many lakes, internal loading of phosphorus from sediments is a substantial source of summer total phosphorous. In Capitol Lake, the high dissolved oxygen and relatively low phosphorus concentrations measured in the bottom waters indicate that loading from sediments is negligible, which is also a finding of the phosphorus budget. Total phosphorous discharged over the dam represents a large portion of the total phosphorous loss during summer. Sedimentation (i.e., loss) of total phosphorous in Capitol Lake appears to be largely a function of the load of phosphorus entering the lake from the Deschutes River.

In summary, the total phosphorus budget indicated that 96% of the phosphorus entering Capitol Lake during the summer growing season comes from the Deschutes River and Percival Creek, and 56% of phosphorus exits the lake via the tide gate outlet while 44% is retained in lake sediments. Water and sediment budgets support the notion that the Deschutes River strongly influences Capitol Lake physically and ecologically.

3.3.4 What modeling studies have been performed in the study area?

There have been several modeling studies of the Deschutes River over the past 10 to 15 years. Although they have primarily focused on the river and its watershed, each has predictions and assumptions that help with understanding existing conditions in Capitol Lake and Budd Inlet. The findings and model predictions related to both Capitol Lake and Budd Inlet are described further in Section 4.1.5 of the Water Quality Discipline Report (Attachment 7). A TMDL is currently being prepared for Budd Inlet that addresses loadings and allocations associated with Capitol Lake and a draft TMDL document was released by Ecology earlier in 2022. The modeling studies are focused on understanding the relative contributions of anthropogenic sources to the Deschutes River, Capitol Lake, and Budd Inlet, so that those human-caused impacts can be regulated. That is a different objective and focus than the EIS analysis, which evaluates changes to water quality resulting from long-term management alternatives, reflective of both naturally occurring conditions and human-caused impacts. Although the objectives are different, the modeling studies provide important information for this water quality evaluation.

3.3.4.1 What were the findings of the Deschutes River TMDL Water Quality Study?

In 2012, Ecology issued a Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Technical Report: Water Quality Study Findings Report. The results from the study were used to provide the technical basis to support development of Deschutes River TMDL allocations designed to move the river toward compliance with water quality standards. The water quality analytes addressed by the TMDL include fecal coliform bacteria, temperature, dissolved oxygen, pH, and fine sediment. The study used historical data, as well as supplemental data collected from July 2003 to December 2004, to develop an analytical model of river water quality.

The supplemental data collected represent the only recent comprehensive dataset for some of the analytes such as TOC, BOD, and DIN that are critical to model predictions. As documented in the study, an herbicide treatment was performed in the summer of 2004 to eliminate Eurasian watermilfoil. This treatment resulted in an immediate die-off of a large stand of the Eurasian watermilfoil as well as other aquatic plants. The resultant decomposition would have increased TOC and nutrients and produced immediate algae growth in the lake, as was noted by the researchers. Nutrient and TOC concentrations were likely affected throughout the summer. As documented in the same study, the aquatic plant biomass grew back entirely over the summer and therefore was present to decompose in the fall, and again result in TOC release from the lake. Thus, the magnitude and seasonal relationships for nutrient and TOC discharges to Budd Inlet in 2004 were not representative of a typical year.

The TMDL Water Quality Study Findings Report concluded that the combined effects of nonpoint and point sources of pollutant loads from the Deschutes River Watershed exceed the pollutant loading capacity of Budd Inlet and Capitol Lake for nutrients, and reductions in pollutant load were required to meet water quality standards for dissolved oxygen in Budd Inlet. Model results predicted that, "If the lake were to revert to an estuary, a smaller portion of Budd Inlet would violate standards for dissolved oxygen, and the geographic area that is currently Capitol Lake would meet marine water quality standards for dissolved oxygen under all nutrient loading alternatives" (Ecology 2012).

3.3.4.2 Deschutes River TMDL

Following Ecology's development of a TMDL for multiple water quality indicators in the Deschutes River and other Budd Inlet tributaries, USEPA revised and reissued the TMDL in 2020. These documents and supplemental water quality modeling by Ecology provide information that informs our understanding of existing conditions in Capitol Lake and Budd Inlet.

In 2015, Ecology released the Deschutes River, Percival Creek, and Budd Inlet Tributaries TMDL. The parameters assessed in the TMDL included fine sediment, bacteria, dissolved oxygen, pH, and temperature. In 2018, the USEPA disapproved some portions of the TMDL and then released a revised version in 2020; the revised version from USEPA is the source of information provided in this section unless otherwise indicated.

For this assessment, the TMDL results are primarily of interest for characterizing the quality of water entering Capitol Lake. The TMDL also identifies upstream sources of pollutants that need to be controlled to improve water quality downstream in Capitol Lake and Budd Inlet (e.g., municipal stormwater, hatchery effluent, industrial and construction stormwater, sand and gravel operations). To improve dissolved oxygen levels, the TMDL set allocation targets for total nitrogen and total phosphorous.

While the Project Area was not included in the Deschutes River TMDL, implementation of measures to meet TMDL nutrient targets are expected to improve water quality in the Project Area. Under existing conditions, the Deschutes River and Percival Creek comprise 61% and 7% of the summer total phosphorous load to Capitol Lake, respectively. By replacing the existing concentrations of total phosphorous in these streams with the target concentrations recommended by the TMDL, the summer load of total phosphorous from these sources would decrease by over 30%. Based on limited summer 2019 monitoring, average total nitrogen concentrations in the Deschutes River are already very near the target set by the TMDL. Therefore, implementation of the TMDL is predicted to contribute to the substantial decline in phosphorus loading to the lake, which is likely to result in decreased algae and chlorophyll; however, the decrease is not expected to change the lake's trophic status.

3.3.4.3 Supplemental Modeling Scenarios for the Deschutes River TMDL

Ecology performed additional modeling to evaluate 15 different management scenarios for Budd Inlet. The model focused on nitrogen because it typically drives algae production in marine waters, and algae production and decomposition in Budd Inlet is believed to be the major driver of low dissolved oxygen there. The model also focused on TOC as an indicator of organic matter that, when decomposed, contributes to dissolved oxygen depletion. The scenario modeling predicted the magnitude of human-caused dissolved oxygen depletion compared to the modeled natural conditions.

Relevant to understanding existing conditions, the model attributed dissolved oxygen depletion in Budd Inlet to the 5th Avenue Dam due to a combination of factors:

- The 5th Avenue Dam creates a pulsed flow that alters circulation in southern Budd Inlet.
- The 5th Avenue Dam and Capitol Lake alter concentrations and loads of carbon.
- The 5th Avenue Dam and Capitol Lake alter concentrations and loads of nitrogen.

The model, which was based on 1997 data and conditions, predicts TOC and DIN concentrations in the lake and estuary. The model indicated that TOC was higher with the dam in place than without the dam, and this was attributed to predicted growth of algae and aquatic macrophytes in the lake. Ecology estimated TOC concentrations would be approximately 2 mg/L without the dam as compared to 5 mg/L with the dam under 1997 conditions. Conversely, the model predicted higher loads of DIN to Budd Inlet during summer months without the dam. This prediction was attributed to the conversion of DIN to organic nitrogen after uptake by plants and algae. Figure 3.3.2 shows concentrations of total nitrogen and DIN in the Deschutes River and Capitol Lake as measured in 2004. The concentrations of nitrogen were higher in the Deschutes River than in Capitol Lake. Similarly, in 2019 (Table 3.3.5), the mean total nitrogen concentration in Capitol Lake was roughly 62% of what was measured in the Deschutes River.

Ecology summarized that the net effect of Capitol Lake and the dam was to decrease dissolved oxygen by approximately 0.2 mg/L throughout much of Budd Inlet to as much as 2.0 mg/L in portions of East Bay. By comparison, other human sources of pollutants from wastewater and local rivers was estimated to decrease dissolved oxygen

by approximately 0.3 mg/L, and human sources of dissolved oxygen depletion from outside Budd Inlet were estimated to decrease dissolved oxygen by approximately 0.4 mg/L. All of these sources of dissolved oxygen depletion also contribute to non-attainment of the narrative dissolved oxygen standard.

Monitoring data and model results both support a conclusion that Capitol Lake decreases the total nitrogen and DIN load to Budd Inlet during the summer; therefore, removal of the dam would increase the total nitrogen and DIN load to Budd Inlet. Increased DIN load would supply additional nutrients for algal production in Budd Inlet.

3.3.4.4 Budd Inlet Dissolved Oxygen TMDL

The recently released Draft Budd Inlet dissolved oxygen TMDL (Ecology 2022) calculated the loading capacity for TOC, total nitrogen, and DIN to Budd Inlet. These analytes were selected because of their relationship to dissolved oxygen depletion. Then, using existing models as the framework, wasteload allocations and load allocations were assigned to the multiple point and non-point loading sources to Budd Inlet. The TMDL states that Capitol Lake is the largest source of dissolved oxygen depletion to Budd Inlet and that this is due to both its organic material production (e.g., algae and aquatic plants) and the impact of the dam on circulation patterns. The draft TMDL states that, per Ecology's modeling, water quality standards cannot be met in Budd Inlet if the existing dam remains in place with its current design. The modeling shows that if the dam is removed and additional action is taken by others in the watershed to control sources, then water quality standards could be met in Budd Inlet. Ecology did not determine whether any alternate designs or lake management scenarios can meet water quality standards if the dam and Capitol Lake are retained but redesigned. However, the TMDL clearly identifies removal of the 5th Avenue Dam as the single most important action that can be taken to restore water quality in Budd Inlet. Ecology has stated that if Enterprise Services retains the lake, then it must be managed so that it does not deplete dissolved oxygen levels in Budd Inlet at any time or in any location beyond that of the natural estuary condition. The TMDL summarized that the dissolved oxygen depletion the lake could be allowed would range from 0.0 to 0.9 mg/L, depending upon location in Budd Inlet. The determination of dissolved oxygen depletion would need to be made through mechanistic modeling.

3.3.5 How is existing water quality in Budd Inlet evaluated?

The hydrodynamics of Budd Inlet are dominated by tidal exchange but are also influenced by inflow from the Deschutes River and Capitol Lake. In Budd Inlet, 75% of the water originates from Puget Sound, and the remaining 25% is from freshwater sources. Budd Inlet has a relatively short residence time (the average time dissolved or suspended matter resides in an estuary), ranging from 8 to 12 days. The rate of discharge over the 5th Avenue Dam is highly variable and depends on Deschutes River discharge. On some days, no water is released; on other days, high volumes of water are released for several hours. The combination of tides and Capitol Lake inflow support a counterclockwise circulation pattern within Budd Inlet.

Water circulation and water quality in Budd Inlet have been altered by the filling of much of the historic estuary (the Port of Olympia peninsula and much of downtown Olympia are part of the historic estuary), the 5th Avenue Dam, Puget Sound conditions, point and nonpoint sources of pollution, and watershed modifications. Studies over the past 20 years or more have focused on the relative importance of many of these factors and how they influence the low dissolved oxygen problems that occur in much of Budd Inlet.

Information on existing conditions in Budd Inlet relevant to evaluating potential project effects include data from water quality monitoring and sediment quality studies, and water quality modeling used to predict dissolved oxygen conditions under different scenarios with or without the 5th Avenue Dam. Existing water quality in Budd Inlet is characterized by comparing monitoring data to water quality standards, comparing water quality conditions in Budd Inlet to other inlets and embayments in Puget Sound, and summarizing nutrient loading information from a previous study.

3.3.5.1 How does the water quality compare to water quality standards?

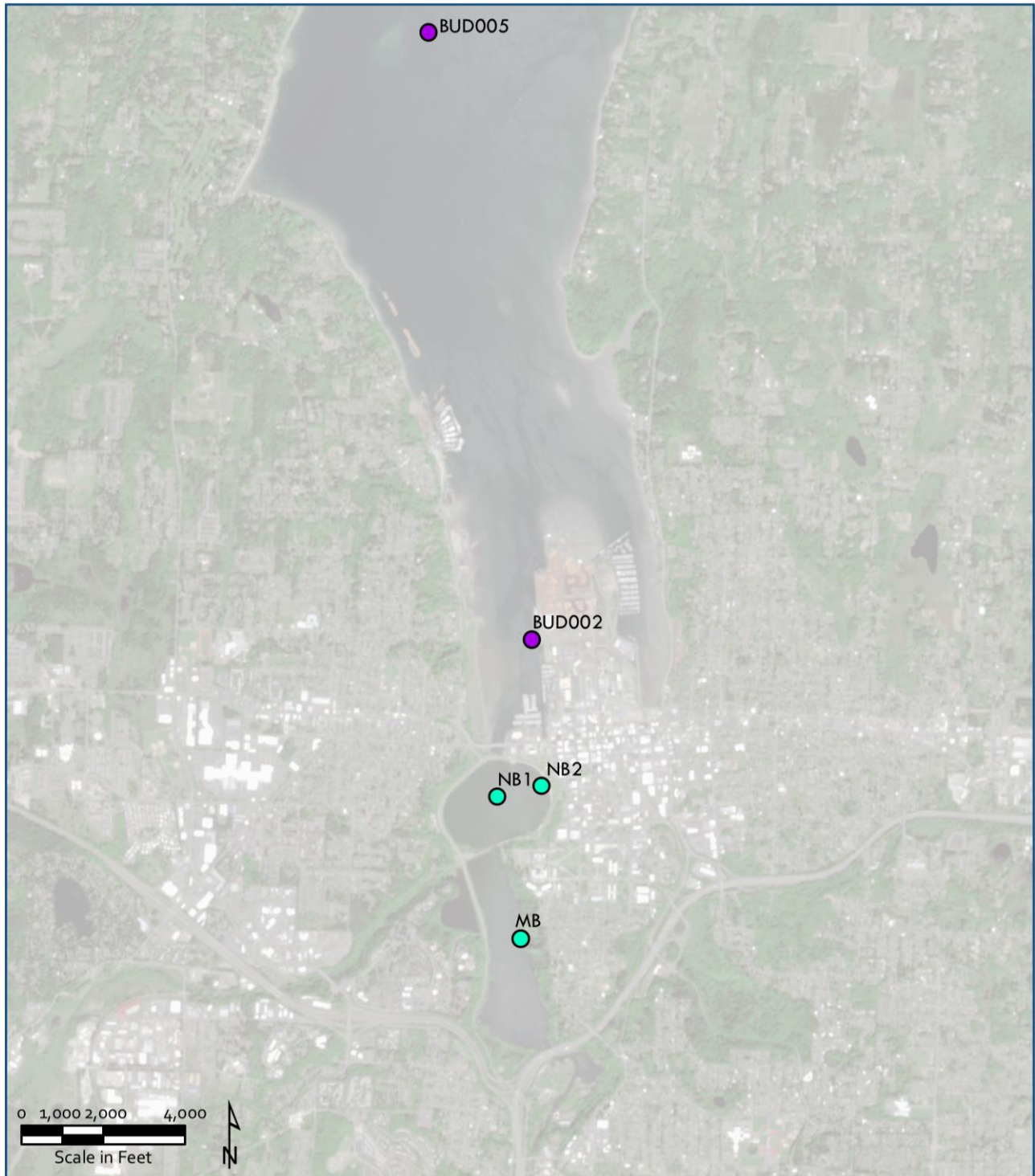
The current conditions of Budd Inlet were evaluated using data collected from Ecology's Marine Waters Monitoring program at two stations in Budd Inlet: BUD005 (outer inlet) and BUD002 (inner inlet) (Figure 3.3.6).

The water quality standards designate two categories for protection of aquatic life in Budd Inlet. Inner Budd Inlet (south of Squaxin Park) is categorized as "good quality," whereas waters north of Squaxin Park are categorized as "excellent quality," with each category having different

water quality standards. For dissolved oxygen, there are two parts to the standards: the first are 1-day minimum dissolved oxygen criteria that apply to most marine waters (5.0 mg/L minimum in inner Budd Inlet and 6.0 mg/L minimum in outer Budd Inlet). However, the developers of the state standards recognized that many marine waters, including the long narrow inlets that comprise much of South Puget Sound, have naturally low dissolved oxygen concentrations that are all below the criteria. For these areas, a second part to the standard was developed to limit the amount of decrease in dissolved oxygen that could be caused by human activity. In both parts of Budd Inlet, water quality standards apply that limit all human-caused dissolved oxygen depletion to no more than 0.2 mg/L.

For consistency with the evaluation of existing conditions presented for Capitol Lake (Section 3.3.3.1), water quality characteristics from the same period (May through October from 2010 to 2014) are presented for Budd Inlet (Table 3.3.6). Temperature, dissolved oxygen, and pH are typically the worst in summer to early fall, making it an important period for evaluation. For this date range, only data collected in 2014 were available for the BUD002 site.

Figure 3.3.6 Areas of Interest to Water Quality Discipline Study



Legend

- Freshwater monitoring station
- Marine monitoring station

Both Ecology monitoring stations exceeded (did not comply with) the water quality standards for temperature and dissolved oxygen, and the Outer Budd Inlet site (BUD005) also exceeded the pH standard (Table 3.3.6). Inner Budd Inlet experiences consistently lower dissolved oxygen than Outer Budd Inlet.

Table 3.3.6 Comparison of Budd Inlet Water Quality with Applicable Standards Numeric Water Quality (May through October)

| Station | Parameter | Mean | Median | Min | Max | Standard ⁽¹⁾ |
|---|---|-------|--------|-------------|--------------|-------------------------|
| BUD002 Inner Budd Inlet (2014) | Temp. (°C) | 13.97 | 13.47 | 10.94 | 19.64 | 19 |
| BUD002 Inner Budd Inlet (2014) | Top dissolved oxygen (mg/L) ⁽²⁾ | 7.21 | 6.10 | 1.97 | 13.54 | 5.0 |
| BUD002 Inner Budd Inlet (2014) | Bot. dissolved oxygen (mg/L) ⁽²⁾ | 6.55 | 5.82 | 3.05 | 10.66 | 5.0 |
| BUD002 Inner Budd Inlet (2014) | pH | 7.55 | 7.53 | 7.21 | 8.04 | 7.0–8.5 |
| BUD005 Outer Budd Inlet (2010–2014) | Temp. (°C) | 13.37 | 13.56 | 9.00 | 19.36 | 16 |
| BUD005 Outer Budd Inlet (2010–2014) | Top dissolved oxygen (mg/L) ⁽²⁾ | 10.23 | 9.95 | 5.10 | 18.08 | 6.0 |
| BUD005 Outer Budd Inlet (2010–2014) | Bot. dissolved oxygen (mg/L) ⁽²⁾ | 7.49 | 6.99 | 4.83 | 12.80 | 6.0 |
| BUD005 Outer Budd Inlet (2010–2014) | pH | 7.83 | 7.82 | 7.14 | 8.87 | 7.0–8.5 |

Notes:

Bold and shaded values indicate problematic excursions from the standard or Action Level.

1. WAC 173-201A-210 for “excellent” and “good” water quality criteria for BUD005 and BUD002, respectively.
2. Top: 0.0–6.0 m depth; Bottom: 6.5–12 m depth.

Based on mean concentrations, results from the Budd Inlet monitoring stations indicate that surface dissolved oxygen concentrations were more than 3 mg/L lower in inner Budd Inlet than in the outer inlet. Dissolved oxygen problems normally occur late summer to early fall at both stations.

At the outer station (BUD005), dissolved oxygen appears to be plentiful in the upper portions of the water column most of the time, although the minimum value measured (5.1 mg/L dissolved oxygen) was less than the 6.0 mg/L criterion. In the lower portion of the water column, concentrations were also less than the criterion starting in July and lasting through November. At the inner station (BUD002), dissolved oxygen concentrations were much lower. The period of low dissolved oxygen in the deeper waters below the minimum dissolved oxygen criterion of 5.0 mg/L is shorter than at the outer station, but this difference is primarily a function of the lower dissolved oxygen criterion that applies in inner Budd Inlet (see Figure 4.13 in the Water Quality Discipline Report [Attachment 7]).

Nutrient and chlorophyll-*a* data from Ecology's ambient monitoring for the Budd Inlet sites, summarized in the Water Quality Discipline Report (Attachment 7), indicate that the two stations have similar nutrient concentrations that do not vary substantially between depths, indicating well-mixed conditions. Chlorophyll-*a* concentrations appear to be higher at the outer station (BUD005) based on average values, and the outer station experiences substantially higher maximum concentrations.

3.3.5.2 How does Budd Inlet compare to other South Puget Sound inlets?

Figure 3.3.7 provides context for dissolved oxygen conditions in Budd Inlet relative to other inlets and embayments in Puget Sound, as predicted by Ecology's Salish Sea model. The figure shows the predicted number of days and areas in Puget Sound that would not meet dissolved oxygen water quality standards based on modeled conditions that existed during 2006, 2008, and 2014. Budd Inlet, along with most inlets in South Puget Sound, frequently does not meet the water quality standard for dissolved oxygen. The model also showed that Budd Inlet had a relatively high maximum daily depletion of dissolved oxygen due to anthropogenic sources compared to other South Puget Sound inlets. These model results indicate that the low dissolved oxygen issues of Budd Inlet are not atypical for inlets in South Puget Sound and they also emphasize the importance of the Deschutes River in moderating dissolved oxygen conditions in Budd Inlet.

contributor of DIN to Budd Inlet and that the load from sediments was the next largest source. Combined, these two major sources were predicted to contribute all but 3% to 14% of the summer DIN load to Budd Inlet. Both Capitol Lake and LOTT are predicted to have a larger influence in inner Budd Inlet compared to the entire inlet, where combined they were predicted to contribute 5% to 22% of the summer DIN load.

Table 3.3.7 Percent of Total DIN Loading to Budd Inlet by Source & Season

| Source | Whole Inlet: Winter | Whole Inlet: Summer | Inner Inlet: Winter | Inner Inlet: Summer |
|-----------------------------|---------------------|---------------------|---------------------|---------------------|
| Puget Sound | 78–83% | 60–84% | 73–78% | 47–82% |
| Sediments | 2–11% | 6–34% | 0.4–6.0% | 0.7–37% |
| Capitol Lake ⁽¹⁾ | 7–11% | 1–8% | 12–17% | 3–14% |
| LOTT | 2–5% | 1–3% | 3–7% | 2–8% |
| Other Inputs | 1–2% | 1–3% | 1–2% | 1–5% |

Notes:

1. The Capitol Lake DIN load includes contributions from the Deschutes River and Percival Creek.
Winter: November–January; Summer: July–September.

3.3.6 What is the sediment quality in Budd Inlet?

Sediments can release nutrients and other chemicals into the water column, affecting water quality. Sediment quality criteria include thresholds for effects on benthic (i.e., bottom-dwelling) marine life and criteria to protect human and ecological health from harmful exposures to bioaccumulative chemicals (e.g., dioxins and carcinogenic hydrocarbon chemicals that become more concentrated moving up the food chain). Based on recent studies, sediment chemical concentrations generally do not exceed Sediment Management Standards (SMS) and DMMP criteria for marine benthic toxicity in West Bay of Budd Inlet except for a few chemicals in some samples collected near stormwater outfalls in marinas and at the Port of Olympia along the eastern shoreline of West Bay. Additional information can be found in Section 3.1, Hydrodynamics & Sediment Transport, Section 3.11, Environmental Health, and the Sediment Quality Discipline Report (Attachment 15). In general, lower concentrations of organic chemicals and metals were found in the central and southwest areas of West Bay. Generally, sediment quality in Budd Inlet has not met human and ecological health criteria for bioaccumulative chemicals in West Bay. Some carcinogenic hydrocarbons slightly exceed regional background levels and may increase risks to wildlife and people.

The benthic invertebrate community in West Bay is currently impacted from the high organic matter content of surface sediments, not the low chemical concentrations (PSP 2020). The average TOC concentration in Budd Inlet sediments is 3.7%, which exceeds the typical range of 0.5% to 3.5% for Puget Sound (Ecology 2019a). Budd Inlet sediment TOC percentages were the highest of all the long-term sediment monitoring stations in Puget Sound (Partridge et al. 2018).

3.3.7 How were potential human-caused impacts to water quality in Budd Inlet evaluated?

The most detailed information on existing conditions in Budd Inlet relevant to the project is from Ecology's Deschutes River, Capitol Lake, and Budd Inlet TMDL Study (2015). This Ecology model was used to predict current and natural conditions in Budd Inlet and evaluate various scenarios to quantify the effects of different anthropogenic sources on dissolved oxygen in Budd Inlet. The results focused largely on predicting the magnitude of human-caused dissolved oxygen depletion in comparison to the modeled natural conditions. Model outcomes for both the cumulative effects of all human-caused influences and for effects attributed solely to the presence of the 5th Avenue Dam are described under the evaluation of long-term water quality impacts (see Chapter 4.0 (Section 4.3, Water Quality)).

3.3.8 How would existing water quality in the Project Area be summarized?

Capitol Lake is a small, eutrophic (i.e., biologically productive) waterbody that experiences dense aquatic plant growth and algal blooms typical of many lowland lakes in Puget Sound. Conditions in Capitol Lake are strongly influenced by inflows from the Deschutes River, which result in rapid flushing of the lake and well-mixed water. Recent monitoring and past studies indicate improving trends in water quality in the Deschutes River and Capitol Lake. Capitol Lake does not meet all applicable water quality standards; relative to other lakes in the region and eutrophic lakes in general, however, Capitol Lake exhibits better water quality (based on temperature, dissolved oxygen, chlorophyll-*a* levels, and algae composition). Because these Capitol Lake water quality attributes are important to cold water fish and people, the lake is characterized as having generally good water quality.

Budd Inlet is also a biologically productive system that supports extensive algal blooms, a characteristic generally associated with poor water quality. Dissolved oxygen is routinely less than the numeric

minimum criteria (primarily in the bottom waters) at both the outer and inner Budd Inlet monitoring stations in the summer and early fall. To a large extent, the low dissolved oxygen is a natural condition that occurs in other inlets and embayments in South Puget Sound. The water quality standards acknowledge that dissolved oxygen concentrations may be naturally low, and in those cases a narrative water quality standard is applied to limit human-induced sources of dissolved oxygen depletion. The narrative standard allows for a human-induced dissolved oxygen depletion of no more than 0.2 mg/L. Ecology modeling has indicated that human-induced sources in Budd Inlet are responsible for up to 3.1 mg/L of dissolved oxygen depletion (based on the worst-case model outcome in East Bay), and therefore Budd Inlet does not meet either the numeric or narrative water quality standard for dissolved oxygen.

Recent modeling by Ecology has predicted that Capitol Lake and the 5th Avenue Dam contributed the majority of human-induced depletion of dissolved oxygen in Budd Inlet, and that they may account for up to 1.8 mg/L of depletion (based on the worst-case model outcome for a location in East Bay). The Ecology model attributes dissolved oxygen depletion as due to altered circulation caused by operation of the 5th Avenue Dam, but more so due to loading of carbon (i.e., TOC) from Capitol Lake. For Capitol Lake, Ecology's model results indicated that "the production and decomposition of organic carbon is the process that is most responsible for depletion of dissolved oxygen in Budd Inlet."

Despite having different objectives, it was important for the EIS water quality analysis to consider Ecology's modeling efforts because the modeling included a variety of complex factors. The Ecology model synthesizes many factors that promote low dissolved oxygen events, including temperature, stratification, and sediment and water column fluxes, to simulate the existing relationship between Capitol Lake and Budd Inlet. It provides estimates of the impact of the 5th Avenue Dam or dam removal on dissolved oxygen in Budd Inlet, with particular focus on anthropogenic inputs.

The approach for the water quality analysis in the EIS is to support a comparative evaluation of water quality conditions under the long-term management alternatives by providing a qualitative comparison of field data and model predictions. Recent data evaluated within this analysis indicate that water quality conditions may have changed since model development, and that, overall, there is a lack of field data for key parameters affecting modeling results. Consistent with SEPA requirements, when there are data gaps or uncertainties, an analysis should identify a worst-case outcome (WAC 197-11-080). In this case,

“worst-case” can mean lower levels of water quality improvement than predicted by other analyses. Therefore, this analysis estimates impacts of the 5th Avenue Dam or improvements from dam removal conservatively relative to modeled results.

Monitoring data summarized above and Ecology’s model both indicate that total nitrogen and DIN is higher in the Deschutes River compared to Capitol Lake. Conversely, the data and model also indicate that TOC is lower in the Deschutes River compared to Capitol Lake. This relationship is likely a result of the uptake of inorganic nitrogen by algae growth in Capitol Lake that then increases TOC, which is eventually discharged to Budd Inlet. Ecology’s model predictions for scenarios looking at removal of the 5th Avenue Dam are described in the section evaluating long-term water quality impacts of alternatives (see Chapter 4.0 [Section 4.3, Water Quality]).

3.4 AQUATIC INVASIVE SPECIES

Aquatic invasive species (AIS) are non-native plants and animals that rely on the aquatic environment for a portion of their life cycle and can spread to new aquatic areas, causing economic or environmental harm.

The study area for AIS includes the Capitol Lake Basin, Percival Creek up to US Highway 101, the Deschutes River upstream of Tumwater Falls, and West Bay extending north from the 5th Avenue Dam to the southern end of Squaxin Park near the mouth of Mission Creek (47°07’N). This area is based on the local aquatic resources where AIS could be directly affected by the project and does not include distant waterbodies where AIS potentially could be transported to by project-related activities.

Capitol Lake has a well-documented presence of AIS including plants, invertebrates, fish, and aquatic mammal species. The presence of AIS has resulted in closure of Capitol Lake to all water-based use.

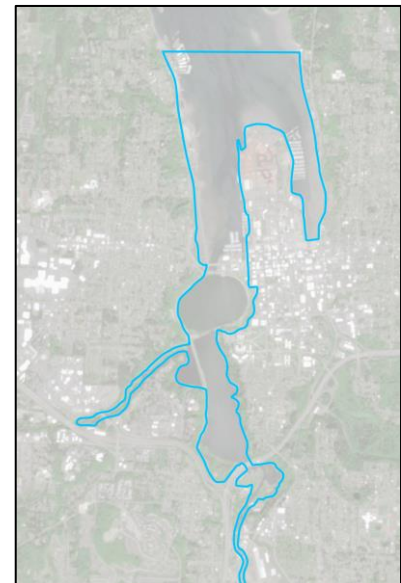


Exhibit 3.7 Aquatic Invasive Species study area

Methods for Studying Aquatic Invasive Species

An extensive literature review was conducted to evaluate AIS in the study area. Information was derived from existing management plans (e.g., vegetation management, annual reports of aquatic weed treatments, and recommendations for invasive species treatments), surveys that have been conducted to monitor the presence and distribution of AIS in Capitol Lake, databases on invasive species, and research papers and studies that focused on detection, species biology, population fluctuations, transport and spread, and treatment options and effectiveness.

For further information on data sources, see the Aquatic Invasive Species Discipline Report (Attachment 8).

3.4.1 What AIS species are discussed in the EIS?

Although there are numerous species of plant and animal AIS in Capitol Lake and within the study area, the EIS focuses on the four high-priority AIS in the Capitol Lake Basin: purple loosestrife, Eurasian watermilfoil, New Zealand mudsnail, and nutria (see Table 3.4.1). This section provides a summary of their documented presence in the study area, the ecological impact of their presence, and previous and current management efforts to control their presence and spread. For more detailed information on the full analysis of the high-priority AIS, including additional tables and figures, see the Aquatic Invasive Species Discipline Report (Attachment 8).

For a brief summary of the non-high priority AIS within the study area, which include plants, invertebrates, fish, and aquatic mammal species, see Section 3.4.4. These species are discussed in full detail in the Aquatic Invasive Species Discipline Report (Attachment 8).

How many AIS exist in Capitol Lake?

Fourteen different AIS have been documented in Capitol Lake in recent survey efforts.

These include:

- 3 emergent plant species
- 1 floating leaved plant
- 2 submersed plant species
- 3 invertebrates
- 4 fish species
- 1 mammal

Table 3.4.1 High Priority Aquatic Invasive Species Observed in the Study Area

| Scientific/ Common Name | State Status ⁽¹⁾ | Waterbody | Relative Abundance |
|---|-------------------------------|---|--|
| Aquatic Invasive Plant: <i>Lythrum salicaria</i> Purple loosestrife | Class B High Priority | Capitol Lake, Deschutes River, Budd Inlet | High in the South Basin; low in other basins |
| Aquatic Invasive Plant: <i>Myriophyllum spicatum</i> Eurasian watermilfoil | Class B High Priority | Capitol Lake | Moderate in the South Basin and Middle Basin; low in the North Basin and Percival Cove |
| Aquatic Invasive Animal: <i>Potamopyrgus antipodarum</i> New Zealand mudsnail | Prohibited Level 3 Species | Capitol Lake | 20,000 snails per square meter in limited areas of the North Basin |
| Aquatic Invasive Animal: <i>Myocastor coypus</i> Nutria | Prohibited Level 3 Species | Capitol Lake | Fewer than 25 animals |

Note:

- 1 Washington State Noxious Weed Class (WNWCB 2020), Aquatic Invasive Species (WDFW 2020b), or High Priority Invasive Species (WISC 2020c).

3.4.2 What are the high-priority invasive plants in the study area?

3.4.2.1 Purple Loosestrife

Purple loosestrife (*L. salicaria*) is a non-native emergent species typically found in freshwater and brackish wetlands, along streams, and in other wet areas. It has narrow, lance-shaped leaves; showy purple flowers that occur in erect spikes at the top of stems from late June through October; and a rhizomatous growth pattern.

The plant is a vigorous grower that spreads by rhizomes or by seed. Purple loosestrife forms dense colonies that outcompete native plant species and provide minimal wildlife habitat. These dense colonies can also be detrimental to aesthetics and inhibit access to shorelines for recreation. Management of purple loosestrife is a costly effort requiring repeated monitoring and removal efforts to prevent its spread. The seeds can be viable for several years.



Exhibit 3.8 Purple Loosestrife
(Source: [gailhampshire](https://creativecommons.org/licenses/by/2.0/deed.en)
<https://creativecommons.org/licenses/by/2.0/deed.en>)

Current Distribution of Purple Loosestrife within the Study Area

Purple loosestrife was first discovered in Capitol Lake in 1986. Figure 3.4.1 presents the most current map of purple loosestrife distribution in the study area, as of 2021. Observation points and areas where purple loosestrife was observed are colored in purple. In a 2018 study, purple loosestrife was most abundant in the South Basin but was present along the shorelines of all three basins, at the Interpretive Center wetland areas, and Percival Cove. Only one plant was observed in the North Basin, and no plants were observed along the east shoreline of the Middle Basin. Survey results from 2021 were similar, although no survey was conducted in the South Basin where purple loosestrife is known to be most abundant.

Although purple loosestrife is a high-priority species based on its aggressive growth and potential impacts on native species, it is not likely significantly impacting native wildlife or recreation in and around the Capitol Lake Basin based on its current abundance and the emergent plant diversity.

Management of Purple Loosestrife

Over the years, the Thurston County Noxious Weed Control Board and the Washington State Department of General Administration (GA; now Enterprise Services) have employed numerous mitigation efforts to decrease the spread of purple loosestrife in Capitol Lake.

Purple Loosestrife

Purple loosestrife is a wetland plant native to Europe and Asia that was brought to North America in the early 19th century. This highly invasive plant was likely introduced when its seeds were included in soil used as ballast in European sailing ships and discarded in North America.

It reproduces primarily by seed. Each plant may produce up to 2.7 million seeds annually. It can also spread through stem cuttings and root fragmentation.

The seeds can be viable for several years, but because the seeds are small and carry little food reserves, germination must occur when photosynthesis can occur immediately.

Starting in 1989, removal techniques such as flowerhead removal, aquatic herbicide treatment, impacted soil removal, and beetle application were conducted. In general, although the presence of purple loosestrife would sometime decrease after treatment, the lack of continuity in treatments from year to year and the lack of monitoring after control efforts were implemented limited the understanding of the efficacy of management actions.

In 2001, under direction from the CLAMP Steering Committee, the Capitol Lake Integrated Purple Loosestrife Management Plan was adopted, which established the goal to eradicate purple loosestrife from Capitol Lake and adjacent areas. In this plan, a combination of monitoring, public education, chemical control with glyphosate spot-treatment, biological controls (insect introductions), and manual removal were recommended.

Since 2001, the primary methods to remove purple loosestrife have been through the application of glyphosate and later, application of the herbicide imazapyr and seed head removal. The populations and densities of purple loosestrife have decreased and increased throughout Capitol Lake since 2001. In 2019, continued use of surveys, seed head removal, and imazapyr treatments was recommended for future years because purple loosestrife has continued to persist throughout the basin. Surveys conducted in 2016, 2017, and 2018 indicate density and numbers of purple loosestrife have stabilized.

Figure 3.4.1 Purple Loosestrife Distribution in Capitol Lake in 2021



Legend

- Study Area
- Purple Loosestrife

3.4.2.2 Eurasian Watermilfoil

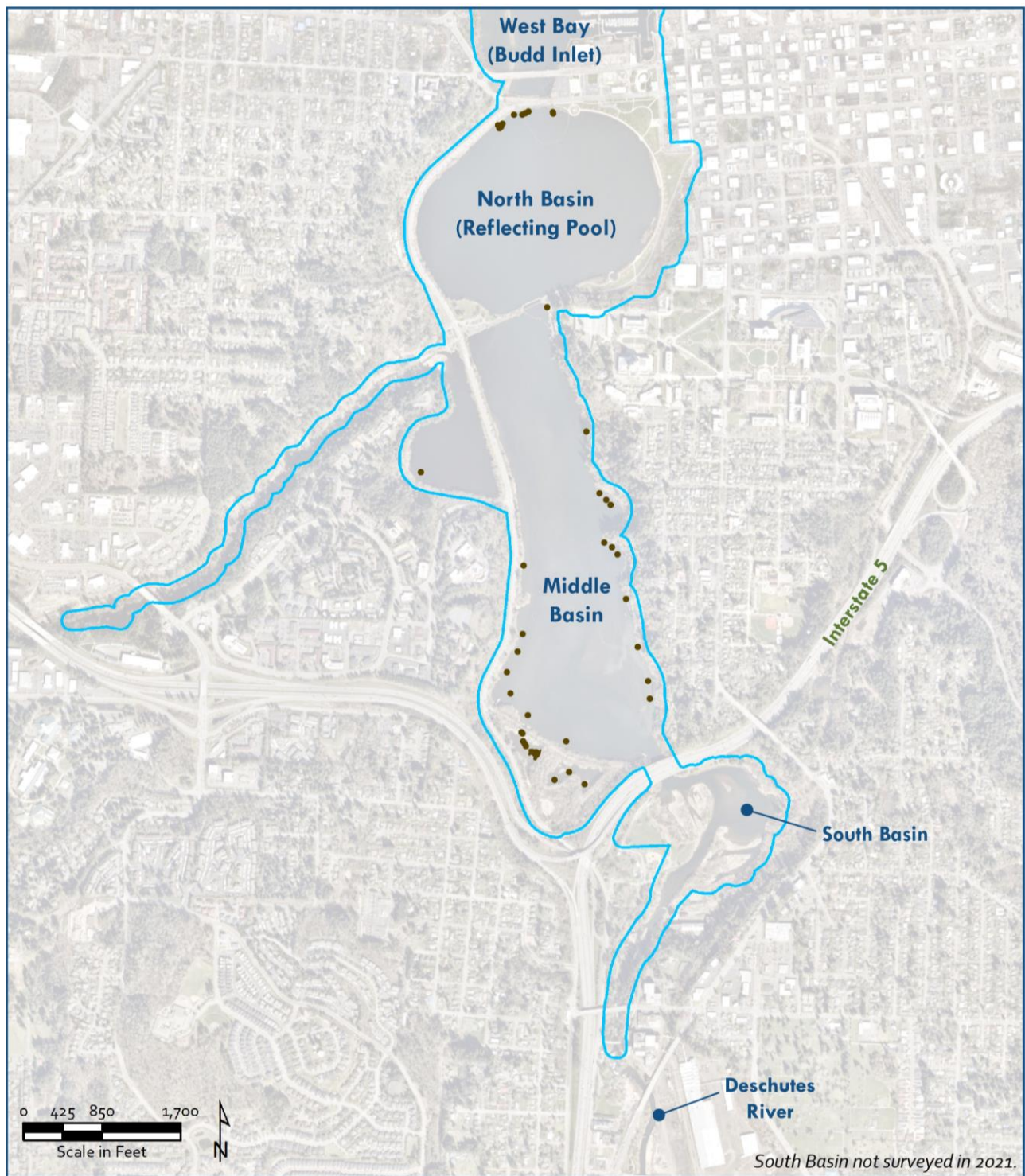
Eurasian watermilfoil (*M. spicatum*) grows submersed below water surfaces. The plant has feather-like underwater leaves, emergent flower spikes, and many fibrous roots. Roots may form on broken plant fragments, enabling the plant to spread by plant fragments in addition to spreading by rhizomes. The abundance of viable plant fragments allows this plant to rapidly spread and colonize new areas and it commonly forms dense, thick mats early in the growing season due to its rapid growth rate of up to 1 foot per week. These mats reduce sunlight and oxygen in underlying waters, which degrade water quality, outcompete native vegetation, decrease habitat quality for native fish species, and inhibit recreational activities. Management of Eurasian watermilfoil is costly, requiring repeated monitoring and removal efforts to prevent its spread.

Current Distribution of Eurasian Watermilfoil within the Study Area

The Eurasian watermilfoil was first reported in Capitol Lake in September 2001. Figure 3.4.2 presents the most current map of Eurasian watermilfoil distribution in the study area, as of 2021. Observation points and areas where Eurasian watermilfoil was observed are colored in brown. In a 2018 survey, individual plants and patches of plants were observed in all three basins, the Interpretive Center wetland areas, and Percival Cove. A large patch observed in the North Basin adjacent to the 5th Avenue Dam had not been observed in previous surveys prior to 2018. Survey results from 2021 were similar, except for fewer locations along the west shore of the Middle Basin and only one plant in Percival Cove. The 2021 survey did not include the South Basin.

Although Eurasian watermilfoil is a high-priority species based on its aggressive growth and potential impact on native species, it is likely not significantly impacting native wildlife or recreation in and around the Capitol Lake Basin based on its current abundance and the aquatic plant habitat diversity.

Figure 3.4.2 Eurasian Watermilfoil Distribution in Capitol Lake in 2021



Legend

- Study Area
- Eurasian Watermilfoil
- Eurasian Watermilfoil Area

Native submersed plants currently impact the ability of maintenance vessels to navigate within Capitol Lake in summer, because they grow up to the water surface over most of the lake area. This dense vegetation is coontail (*Ceratophyllum demersum*) not Eurasian watermilfoil.



Exhibit 3.9 Coontail as seen from survey vessel

Management of Eurasian Watermilfoil

Similar to the purple loosestrife, numerous management efforts have been employed to decrease the spread of Eurasian watermilfoil in the study area.

Shortly after Eurasian watermilfoil was discovered in Capitol Lake, the CLAMP Steering Committee adopted an Invasive Aquatic Vegetation Management Plan in 2002 that included application of an herbicide triclopyr and subsequent monitoring to determine whether it was successful.

In 2004, triclopyr was applied to Eurasian watermilfoil throughout the study area. The Washington State Department of Agriculture monitored the application process and noted that triclopyr was effective in killing Eurasian watermilfoil, and it dissipated quickly, and did not harm native aquatic vegetation.

In 2005, the GA would periodically monitor and remove observed plants manually using contracted divers, equipped with a water vacuum to capture any floating fragments.

From 2007 to 2018, Eurasian watermilfoil was surveyed annually and removed manually by a boat and/or snorkel team. In 2007, 1,386 plants were removed from the South and Middle Basins. The number of plants removed from these basins decreased annually thereafter, with only six plants requiring removal in 2013 and 2014. However, the number of plants removed then increased each year up until 2018 when 105 plants required removal.

Other control strategies were employed throughout the study area, such as biocontrol (i.e., through application of the watermilfoil weevil) and installation of bottom barriers. However, neither method was very successful in controlling the spread of the Eurasian watermilfoil over time. Barriers installed on the lake bed were initially thought to be effective but require ongoing maintenance because they are susceptible to displacement, degradation, and sediment accumulation.

How pervasive can Eurasian watermilfoil be in the environment?

In 2009, only one Eurasian watermilfoil plant was reported in Capitol Lake (in Percival Cove). Between 2012 and 2013, approximately 4,820 pounds of Eurasian watermilfoil were removed by divers, indicative of the fast rate of spread for Eurasian watermilfoil.



Exhibit 3.10 Example of Eurasian watermilfoil removal by hand at Green Lake in Seattle, Washington

3.4.3 What are the high-priority invasive animals in the study area?

3.4.3.1 New Zealand Mudsail

The New Zealand mudsnail (*P. antipodarum*) is an invertebrate AIS. It is a very small (4 to 6 millimeters [mm]) freshwater snail with an elongated shell. The opening of the shell has an operculum, which is a retractable lid that can seal the shell. The operculum allows the mudsnail to protect itself from short-term exposure to chemicals and allows them to survive outside water for long periods of time (i.e., up to several months).



Exhibit 3.11 New Zealand mudsnail (Source: WDFW)

The New Zealand mudsnail is self-cloning and one female is enough to initiate a new population. New Zealand mudsnails are found in shallow freshwater and brackish water ecosystems. Due to their ability to survive outside the aquatic environment for several weeks to months, new populations can be established through inadvertent transport on boots, gear, and equipment.

In addition to outcompeting native species for natural resources, their ability to withstand highly variable environmental conditions allows New Zealand mudsnails to take advantage of changing environmental conditions, including climate change, to further spread and outcompete native species. By outcompeting native species, the New Zealand mudsnail reduces prey species for native fish, resulting in reduced body weight and health of native salmonids.

Biofouling is the major economic impact associated with the introduction of New Zealand mudsnails, as they can pass through water pipes and emerge from domestic taps, and can ultimately block pipes and meters.

Current Distribution of New Zealand Mudsail within the Study Area

New Zealand mudsnails were first observed in Capitol Lake in 2009. Multiple surveys over the years have shown them to be present throughout the study area, including the North Basin, Middle Basin, and the mouth of the Deschutes River, but they have not been found extending into nearby creeks and tributaries.

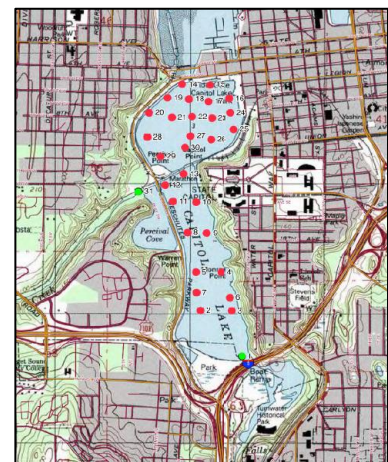


Exhibit 3.12 New Zealand mudsnail distribution in Capitol Lake in 2011 (red points positive, green points negative) (Source Johannes 2011)

In 2015, a survey did not find any New Zealand mudsnails in the five new sites in streams and lakes that were surveyed within a 5-mile radius of Capitol Lake, including Percival Creek. Since the 2015 survey, there have been no reported sightings of the New Zealand mudsnail in

Percival Creek or other nearby waters, suggesting that the spread of mudsnails from the lake has been very limited over the past 10 years. This suggests that the New Zealand mudsnail has effectively been contained within the Capitol Lake Basin by prohibiting public access to the lake.

In April 2022, in response to comments received on the Draft EIS, Enterprise Services elected to conduct a second shoreline survey of Budd Inlet (the last survey of Budd Inlet was conducted in 2011) to evaluate whether New Zealand mudsnails had spread into Budd Inlet. The investigation included 21 survey sites, 16 of which were previously surveyed in 2011 and included several sites adjacent to various freshwater inputs. Existing transport of New Zealand Mudsnails suspended in water and attached to debris through the 5th Avenue Dam during high river flow events, has provided an ongoing pathway for New Zealand mudsnails to move from Capitol Lake into West Bay and Budd Inlet. New Zealand mudsnails were not found in West Bay, East Bay, or adjacent freshwater inputs during this survey.

New Zealand mudsnails are currently affecting recreational opportunities in the Project Area because active use of the Capitol Lake Basin was prohibited as a result of their presence. The impact of New Zealand mudsnails on native wildlife is unclear. Several native species of snails are also abundant in Capitol Lake, and, as of the last survey conducted, the New Zealand mudsnail population had not overtaken the benthic community in the lake as was expected.

Management of New Zealand Mudsnails

Given the persistence of the New Zealand mudsnail, avoiding or minimizing further spread will rely heavily on public outreach and education. Other potentially effective management approaches were identified through literature review, preliminary testing, past experience within Capitol Lake, and professional judgement. Some of the most common management approaches are described in this section.

Freezing

Freezing has increased the mortality of the New Zealand mudsnail when the lake bed has been drained and exposed to hard freezing weather conditions for a few consecutive days. However, this is highly dependent upon the weather being cold and dry without insulating snow, which is an unusual combination of conditions for the Capitol Lake area.

In December 2016, Enterprise Services lowered the level of Capitol Lake as a management approach. The New Zealand mudsnail mortality varied

New Zealand Mudsnail

There are several factors that contribute to the difficulty in controlling New Zealand mudsnail.

Per WDFW, a single female self-clones at a rate that results in a colony of 40 million snails over the course of one year. Mudsnails are often found in densities up to 500,000 snails per square meter and can travel at a rate of up to 10 feet per hour.

The New Zealand mudsnail can completely seal its shell, which allows the snail to survive out of water for several weeks in cool, damp conditions.

depending on location. For example, mortality near Marathon Park was approximately 50%, while mortality along Powerhouse Road SW was approximately 90%. These differences were attributed to the proportion of the survey areas exposed to freezing conditions, where less mortality was observed when more area was below ice cover.

Heat and Desiccation

Heat and desiccation through local weather conditions is more frequently achieved than dry and freezing conditions. However, this seasonally dependent action requires several consecutive hot-dry days and has been shown in productive lakes to cause nuisance odors from decaying algae and aquatic plants and animals. Both the freezing and heat factors are limited in Capitol Lake by the mild climate and constant inflow from the Deschutes River.

Chemical Agents

Two chemical agents have been examined for use in Capitol Lake (1) Bayluscide (with niclosamide as the active ingredient) and (2) sodium chloride. Bayluscide acts quickly, killing the New Zealand mudsnail before they have a chance to respond or find protection. Sodium chloride is much slower, allowing the snail to close its operculum and wait for the toxic level of the introduced agent to dissipate. However, further study is needed to better understand how it might perform in a field application.

Neither chemical is currently allowed for aquatic use under the Aquatic Invasive Species Management Permit, but application of either chemical may be allowed by an experimental use permit or addition of the chemical to the existing permit as part of its 5-year update, which is next due in 2026.

In addition to treatment efforts to control the New Zealand mudsnail population growth and spread, public outreach and education can help to prevent the spread by human activity. Existing signage warns recreational users at Marathon Park of New Zealand mudsnail infestations. Although educational outreach is a helpful approach to encourage public awareness and control, signs alone are not effective to prevent the spread of invasive species.

3.4.3.2 Nutria

Nutria (*M. coypus*) is a mammal AIS. Nutria are semiaquatic rodents native to South America. Adults are approximately 2 feet long with dark brown fur and large orange teeth. Although they are often mistaken for beavers, nutria have a thin tail. Nutria breed year-round and can produce

Are New Zealand mudsnails tolerant to salinity?

A 50% mortality rate for New Zealand mudsnails from a freshwater environment begins at 22 parts per thousand salinity (ppt or practical salinity unit); whereas the 50% mortality rate of New Zealand mudsnails from estuary environments averages at 38 ppt salinity.

Salinity levels in West Bay are observed at 26 to 30 ppt.

Although New Zealand mudsnails have been shown to tolerate salinities greater than the 26 to 30 ppt, there are limited data, Best Available Science studies, or literature regarding the adaptation of this freshwater species to high salinity environments. The New Zealand mudsnail's salinity tolerance has been shown to increase with marine water exposure, with overall tolerance dependent on temperature and the rate of acclimatization.

Refer to the Aquatic Invasive Species Discipline Report (Attachment 8) for additional information on a literature review of salinity tolerances for New Zealand mudsnails.



Exhibit 3.13 Nutria (Source: WDFW)

up to three litters a year, with a litter size ranging from 2 to 9 young. In their introduced range, nutria have few natural predators.

Although they are well adapted for movement on land, nutria are more at home in the water and prefer slow-flowing streams, lakes, and freshwater marshes as well as brackish and saltwater habitats. Nutria are herbivores and feed mostly on wetland plants, targeting the base of plant stems, and they dig for roots and rhizomes in the winter. They often construct circular platforms of compacted, coarse emergent vegetation for use during feeding, birthing, resting, and grooming. They also construct burrows in levees, dikes, and embankments.

Nutria negatively impact invaded ecosystems. Their feeding activity destroys marsh vegetation, transforming marsh areas into open water, displacing native species; their burrows undermine water-management infrastructure and destabilize banks, increasing erosion along shorelines; and they host infectious diseases that affect humans, livestock, and wildlife.

Current Distribution of Nutria within the Study Area

In 1935, nutria were brought to Washington for use in the fur industry. It is unknown whether they escaped or were intentionally released when fur farming was no longer profitable; however, they spread rapidly throughout western Washington. Nutria observations in Capitol Lake were first recorded in 1975.

Although nutria are a high-priority species based on their potential impacts, they are not likely significantly impacting water quality or native plants and wildlife in the Capitol Lake Basin based on the current abundance.

Management of Nutria

Typically, feral populations of nutria are managed by shooting and trapping. Eradication is preferable for small- to medium-sized populations, but some level of control is essential in most cases if eradication is not feasible. Fences, walls, and other structures can reduce nutria damage, but high costs usually limit their use. No chemical repellents for nutria are currently registered. Other rodent repellents (such as Thiram) may repel nutria, but their effectiveness has not been evaluated.

The U.S. Department of Agriculture Wildlife Service was under contract with Enterprise Services from 2014 to 2019 to manually control the population in and around Capitol Lake. A total of 23 nutria were

removed from August 2014 through August 2017. In 2017, they conducted a survey for areas of fresh nutria activity and removed one nutria. No nutria were observed during night survey efforts, and an estimated number of nutria in the basin was not determined.

3.4.4 What other aquatic invasive plants and animals are in the study area?

Although the EIS focuses on the four high-priority AIS in the Capitol Lake Basin, Capitol Lake has a well-documented presence of other non-high priority AIS that include plants, invertebrates, fish, waterfowl, and aquatic mammal species.

Table 3.4.2 provides a summary of their classification status, abundance in the study area, and previous and current management efforts to control their presence and spread. For more detailed information on the remaining AIS in the study area, including additional tables and figures, see the Aquatic Invasive Species Discipline Report (Attachment 8).

Table 3.4.2 Non-High Priority Aquatic Invasive Species Observed in the Study Area

| Scientific/Common Name/State Status | Relative or Estimated Abundance ^(a) | Previous Management Techniques | Current Management Techniques |
|--|---|--|--|
| Plants: <i>Iris pseudacorus</i> / Yellow flag iris/ Class C | High in the South Basin; moderate in the Middle Basin and Percival Cove; low in the North Basin | Annual surveys Treatment with 3% solution of glyphosate | Annual surveys Treatment with 1.5% solution of imazapyr Seed removal from plants |
| Plants: <i>Phalaris arundinacea</i> Reed canary grass/ Class C | Present at unknown locations in 2006 | No management or monitoring efforts have been conducted | No management or monitoring efforts have been conducted |
| Plants: <i>Nymphaea odorata</i> / Fragrant waterlily/ Class C | Low in the North Basin and Percival Cove; low to zero in the Middle and South Basins | Annual surveys Cutting of leaves and tops of stems to stress the plants | Annual surveys Cutting of leaves and tops of stems to stress the plants |
| Plants: <i>Potamogeton crispus</i> / Curlyleaf pondweed/ Class C | High in the Middle Basin; moderate in the North Basin and Percival Cove; unknown in the South Basin | Low abundance; no management or monitoring efforts have been conducted | Low abundance; no management or monitoring efforts have been conducted |
| Invertebrates: <i>Corbicula fluminea</i> Asiatic clam/ Not listed | Present in 2003 along the west shoreline of the North Basin | Low abundance; no management or monitoring efforts have been conducted | Low abundance; no management or monitoring efforts have been conducted |

| Scientific/Common Name/State Status | Relative or Estimated Abundance ⁽¹⁾ | Previous Management Techniques | Current Management Techniques |
|---|--|--|--|
| Invertebrates: <i>Radix auricularia</i> / European ear snail/ Not listed | Present in 2003 in Capitol Lake | Low abundance; no management or monitoring efforts have been conducted | Low abundance; no management or monitoring efforts have been conducted |
| Fish: <i>Cyprinus carpio</i> / Common carp/ Regulated | Fewer than 200 fish | No management or monitoring efforts have been conducted | No management or monitoring efforts have been conducted |
| Fish: <i>Ameiurus nebulosus</i> / Brown bullhead/ Not listed | Fewer than 50 fish | Enhancing native predation | Physical removal and chemical agents (but can affect native species) |
| Fish: <i>Micropterus salmoides</i> Largemouth bass/ Not listed | Fewer than 200 fish | Low abundance; no management or monitoring efforts have been conducted | Low abundance; no management or monitoring efforts have been conducted |
| Fish: <i>Perca flavescens</i> / Yellow perch/ Not listed | Fewer than 50 fish | Low abundance; no management or monitoring efforts have been conducted | Low abundance; no management or monitoring efforts have been conducted |

Note:

- 1 Relative estimated abundance considering 2018 and 2020 AIS surveys.

3.5 FISH & WILDLIFE

Aquatic and terrestrial habitats in the Capitol Lake Basin support a variety of native and non-native fish and wildlife species, including aquatic invasive species. The presence, abundance, and distribution of these species reflect the current habitat conditions, which differ from historical conditions because of the construction of the 5th Avenue Dam in 1951, and other development actions.

The study area for fish and wildlife includes the Capitol Lake Basin from Tumwater Falls to West Bay and the marine waters of West Bay, including associated riparian, wetland, and upland terrestrial habitats. The study area also encompasses Percival Cove and Percival Creek to where changes could occur as a result of the action alternatives.

Fish, wildlife, and the habitats on which they depend are protected by various federal, state, and local laws and regulations. These include (among others) the federal Endangered Species Act (ESA), Magnuson–Stevens Fishery Conservation and Management Act, the Migratory Bird



Exhibit 3.14 Fish and Wildlife study area

Treaty Act, the Washington State Hydraulic Code, and local critical area regulations.

Additional information on the regulatory context for fish and wildlife resources is presented in the Fish and Wildlife Discipline Report (Attachment 9).

Methods for Studying Fish & Wildlife

Information on fish and wildlife species in the study area was derived from available scientific literature, technical reports, and data from various federal, tribal, state, and local agencies. Because of particular interest in how the project alternatives would affect Chinook salmon and bats from the Woodard Bay bat colony, annotated bibliographies were developed and applied to the analysis in the Final EIS (see Attachment 9, Fish and Wildlife Discipline Report). The EIS Project Team also facilitated discussions with a panel of WDFW biologists, and a local bat expert, during development of the bibliographies for the Final EIS.

The analysis for fish and wildlife is organized by specific species groups for fish (based on similar habitat preferences) or indicator species for wildlife (specifically selected for this project) whose response to impacts is representative of a larger group of species.

For further information on data sources, see the Fish and Wildlife Discipline Report (Attachment 9).

3.5.1 Fish

3.5.1.1 *What are current aquatic habitat conditions in the study area?*

The construction of the 5th Avenue Dam in 1951 changed the Capitol Lake Basin from an estuary to a freshwater impoundment. Prior to that time, the Deschutes River flowed to Budd Inlet, with the current-day Capitol Lake Basin consisting of estuary habitat and substantial tideflats (also called mudflats). Construction of the 5th Avenue Dam limited anadromous fish passage, created a barrier to tidal exchange, and altered natural hydrological and sediment transport processes. The study area now includes riverine, lacustrine (lake), and estuarine fish habitat. Each of these habitats provides important ecological functions that support a variety of freshwater and marine fish.

Sediment deposition in Capitol Lake has promoted the development of freshwater wetland habitat, especially along the margins of the basins. These changes, in combination with nutrient sources from the Deschutes River, contributed to phosphorus levels and caused an increase in algae and plant growth, which can alter water quality and freshwater habitat conditions, potentially affecting freshwater fish species. Development in the basin altered habitat conditions and has

also contributed to the proliferation of both invasive and nuisance species in the study area, especially Eurasian watermilfoil, purple loosestrife, New Zealand mudsnail, and Canada geese.

Development in the watershed has also degraded water quality and altered the marine habitat conditions in the study area. Within West Bay, dredge and fill activities and the presence of the 5th Avenue Dam have reduced habitat for important juvenile salmonid food sources and Olympia oysters. Fill placed between the East and West Bays of Budd Inlet and associated bulkheads and overwater structures have displaced tideflat habitat and degraded intertidal habitat. Dissolved oxygen is routinely at levels less than the numeric minimum criteria (primarily in the bottom waters) in the summer and early fall. While dissolved oxygen levels are naturally low in many inlets and embayments in South Puget Sound, oxygen depletion can be harmful for fish and other aquatic species.

3.5.1.2 How are fish using the study area?

West Bay and Capitol Lake, as well as the riverine habitats of the Deschutes River and Percival Creek, support a diverse group of native and non-native fish species, including several species and stocks of native salmon and trout (Table 3.5.1). Additional information on individual species is presented in the Fish and Wildlife Discipline Report (Attachment 9). Many of these species, particularly salmon, have significant ecological, cultural, economic, and recreational value in Washington. Capitol Lake is located within the traditional territory of the Southern Coast Salish and Southwestern Coast Salish cultural groups, which includes, but is not limited, to the Steh-chass, Nusehchatl, Squaxin, Nisqually, and the Chehalis.

Aquatic Invasive Species in Capitol Lake

Capitol Lake has well-documented presence of invasive species including plants, invertebrates, amphibians, fish, waterfowl, and aquatic mammal species. Their presence has ecological effects and has resulted in closure of Capitol Lake to all public use. Information on aquatic invasive species in Capitol Lake is included in Section 3.4, Aquatic Invasive Species, and the Aquatic Invasive Species Discipline Report (Attachment 8).

Table 3.5.1 Fish Species Potentially Present in the Study Area

| Species Sub-Group | Species / Status |
|---|--|
| Anadromous Fish: Hatchery-origin and ESA-Listed Salmonids | Hatchery-origin Chinook salmon, native population Chinook salmon (FT, SC), steelhead trout (FT), bull trout (FT) |
| Anadromous Fish: Other Salmonids | Coho salmon, chum salmon, sea-run cutthroat trout, sockeye salmon |
| Anadromous Fish: Non-Salmonids | Starry flounder, three-spined stickleback |

| Species Sub-Group | Species / Status |
|---|---|
| Freshwater Fish: Native Fish (resident) | Resident cutthroat trout, rainbow trout, peamouth, Northern pikeminnow, speckled dace, redbside shiner, largescale sucker, prickly sculpin, largescale sucker, prickly sculpin, riffle sculpin, Western brook lamprey, Olympic mudminnow (SS) |
| Freshwater Fish: Exotic/Non-native | Common carp, brown bullhead, smallmouth bass, largemouth bass, yellow perch |
| Marine Fish: Native Fish | Pacific sand lance, shiner perch, surf smelt, arrow goby, pile perch, bay pipefish, staghorn sculpin, tidepool sculpin, sand sole, specked sand dab |

Abbreviations: FT= Federally Threatened, SC = State Candidate, SS = State Sensitive.

Anadromous Fish

Seven anadromous (fish that migrate from freshwater to and from the ocean) salmonid species may occur in the Capitol Lake Basin or its vicinity at different stages of their life history. Historically, use of the Project Area by anadromous salmonids only extended to Tumwater Falls. No naturally reproducing native populations of Chinook salmon, steelhead, or bull trout are present within the Deschutes River because Tumwater Falls is a natural fish barrier. If any spawning of native salmonids occurred below the falls, this would have likely been minimal due to the small amount of suitable, freshwater spawning habitat that would have existed between the falls and the estuary. Anecdotally, there are reports that fly fishing for salmon and trout species within the estuary was relatively common prior to dam installation, indicating Percival Creek supported populations of anadromous salmon and trout, including coho salmon.

All anadromous salmonids produced in the Deschutes River watershed migrate through the fish ladders (fishway) at the 5th Avenue Dam and at Tumwater Falls. Some juvenile rearing is assumed to occur in Capitol Lake during the spring outmigration and possibly extending into summer or later. Adult anadromous salmonids returning to the basin continue their upstream migration by moving into the Deschutes River or Percival Creek. The Chinook salmon returning to the Deschutes River and Percival Creek are fall-run Chinook salmon of hatchery origin. Very low numbers of steelhead are thought to return to the Deschutes River, and they are presumed to occur in Percival Creek. The steelhead returning to the Deschutes River are winter-run steelhead and are a distinct non-native stock. Coho salmon spawn and rear in both the Deschutes River and Percival Creek. Coho salmon in the Deschutes River are of non-native origin. The river was historically inaccessible to coho salmon due to the natural barrier at Tumwater Falls. With the

Salmonids

Salmonids are any fish that belong to the family Salmonidae, including salmon, trout, and char.

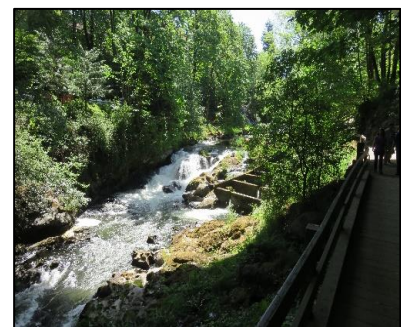


Exhibit 3.15 Fish ladder at Tumwater Falls near the Tumwater Hatchery

installation of a series of fish ladders that allow fish past Tumwater Falls and the release of hatchery-origin coho salmon, a population was established in the Deschutes River.

Historically, Percival Creek likely supported a native coho salmon run. Various stocks of coho salmon have been planted in Percival Creek since 1953 and there are little data on the current stock origin and status of the species in Percival Creek. There is also little information on the total abundance or the number of spawners for coho salmon in Percival Creek.

The 5th Avenue Dam fishway meets WDFW fish passage criteria and is considered 100% passable following improvements made in 2002. Based on information provided by the Squaxin Island Tribe, movement of juveniles may still be somewhat impaired under certain tidal and streamflow conditions. When the tide gate is open, the exchange of water during certain conditions creates the potential to entrain fish and move them into areas that are not suitable for them (i.e., freshwater fish into Budd Inlet and marine fish into Capitol Lake). No information is available about whether this actually occurs and, if so, the number and species of fish that may be impacted by the tide gate openings.

Under existing conditions, a predation point exists at the outlet of the 5th Avenue Dam, where anadromous fish must enter and exit the lake through a small fish ladder, thus exposing such fish to predation from marine mammal, avian, and piscivorous fish predators that congregate at the existing bottleneck created at the dam outlet.

Outmigrating salmonids in the lake also encounter several structures that span the lake, with both in-water and overwater components. Although the crossings may contribute to some increased predation on salmonids, the structures also maintain substantial open water segments between bents/piers that provide a more protected route for migrating salmonids.

In 1954, a fish ladder was constructed to allow anadromous salmonids to access habitats in the Deschutes River upstream of Tumwater Falls. WDFW operates a hatchery at Tumwater Falls with a production goal of 3.8 million juvenile Chinook salmon each year. These salmon are released into the Deschutes River. Chinook salmon from the Tumwater Falls Hatchery are not listed under ESA. Limited release of coho into the upper watershed is a continuing operation.

Two species of anadromous non-salmonids occur in Capitol Lake: three-spined stickleback and starry flounder. Three-spined stickleback



Exhibit 3.16 Fish ladder at 5th Avenue Dam, at left

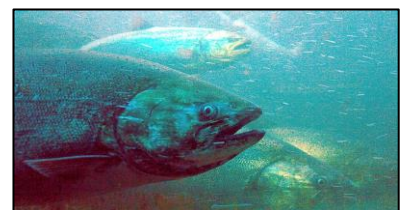


Exhibit 3.17 Chinook salmon in the fish ladder at the Hiram M. Chittenden Locks (Source: Josh Larios <https://creativecommons.org/licenses/by-sa/2.0/deed.en>)

have both anadromous and resident life history forms. It is not known how much of the current population in Capitol Lake is the anadromous form. Studies indicate that three-spined stickleback comprise an overwhelming majority of the fish population in Capitol Lake.

Freshwater Fish

Limited information is available on the freshwater fish community of Capitol Lake, which includes both native and non-native (exotic) species. Table 3.5.1 lists the documented freshwater fish in Capitol Lake. Many of the freshwater species are either competitors of or prey on juvenile salmonids, and some provide prey for larger fish. Freshwater habitats include the lake basins created by the 5th Avenue Dam, as well as the riverine environments in Percival Creek and the Deschutes River.

Marine Fish

West Bay and the lower portion of Budd Inlet provide marine water habitat for anadromous fish, forage fish, saltwater fish species, and shellfish. Like the freshwater species in the Capitol Lake Basin, some of the saltwater fish species found in Budd Inlet are either competitors of or prey on juvenile salmonids, and some provide an important prey base for salmonids.

Table 3.5.1 lists the documented marine species of West Bay. It should be noted that many more marine species inhabit Puget Sound than are listed. For example, the marine waters of Puget Sound are home to dozens of species of bottomfish, including dogfish, skates, rockfish (at least 14 species), greenlings, sculpins, surfperches, and flatfish (sanddab, halibut, sole, and flounder). While any of these species may occasionally be present in the waters of West Bay, this analysis focuses on those marine fish that have been documented in the study area and are likely to occur.

Marine Salmonid Habitat

The shallow, nutrient-rich waters of the South Sound are optimal rearing conditions for wild Chinook salmon natal to other rivers, as this habitat is known to support wild juvenile Chinook salmon from watersheds as far north as the Green River. In addition, juvenile salmonids originating from hatcheries as far north in Puget Sound as the Wallace River, a tributary to the Skykomish River, have been detected in the South Sound, including within Budd Inlet. Estuaries are critical habitat features for both juvenile and adult Chinook salmon, providing habitat conditions that support juvenile salmonids in their physiological transitions (smolting), refugia from predators, and available prey

How many Chinook salmon return to the Tumwater Falls Hatchery each year?

The number of Chinook salmon adults returning to the Tumwater Falls Hatchery between 2013 and 2018 is presented below.

- 2013 – 10,729
- 2014 – 3,084
- 2015 – 5,012
- 2016 – 13,890
- 2017 – 33,887
- 2018 – 12,412

resources. Additional information about the role of estuaries in supporting juvenile salmonids is included in the Fish and Wildlife Discipline Report (Attachment 9), as well as an annotated bibliography of reviewed literature (Appendix A of the Discipline Report).

3.5.1.3 What threatened or endangered fish species and habitats are present in the study area?

Puget Sound Chinook salmon are listed as threatened under the ESA; however, this applies to native populations, which are not present in the Deschutes River or Percival Creek watersheds. The estuarine waters of Budd Inlet are designated as critical habitat for Chinook salmon.

Puget Sound steelhead are also listed as threatened under the ESA. Capitol Lake and the Deschutes River are designated as critical habitat for steelhead, although the steelhead returning to the Deschutes River are a distinct non-native stock.

Bull trout, listed as federally threatened, may occasionally be present in the marine waters of West Bay, but there is no bull trout habitat in Capitol Lake or its tributaries. No designated critical habitat for bull trout is present in the study area.

Two species of ESA-listed rockfish occur in Puget Sound. The bocaccio rockfish is listed as endangered, while the yelloweye rockfish is listed as threatened under the ESA. Although larval and juvenile rockfish could occasionally be present in the study area, adults and juvenile rockfish are not likely to occur in the relatively shallow waters of West Bay.

3.5.2 Wildlife

The study area contains a mix of terrestrial and aquatic habitats important for numerous wildlife species.

3.5.2.1 What habitats can be found along the shoreline of Capitol Lake?

As with the aquatic environment, development in the basin has substantially altered the habitats along the Capitol Lake shoreline compared to historical, natural conditions. Existing conditions include riparian, wetland, and contiguous terrestrial habitats along the shorelines, which now support shorebirds, waterbirds, raptors, songbirds, and terrestrial mammals that have adapted to these relatively disturbed habitation conditions. Human development has resulted in armored shorelines and decreased the quality and quantity of riparian vegetation, reducing the habitat value for native species.

Endangered Species Act

The ESA is an act of Congress passed in 1973 that governs how animal and plant species whose populations are dangerously in decline or close to extinction will be protected and recovered. The federal agencies with jurisdiction over endangered species in the Project Area are the National Oceanic and Atmospheric Administration (NOAA) Fisheries (responsible for protecting Chinook salmon and steelhead trout) and the U.S. Fish and Wildlife Service (responsible for protecting bull trout).

Riparian conditions around Capitol Lake vary substantially. In the North Basin, the Arc of Statehood path and adjacent roadways are so close to the shore that there is only a narrow strip of riparian vegetation. Although some trees are present, these are generally ornamental like native deciduous trees, with few to no tall trees or coniferous trees. These provide less valuable riparian functions compared to what occurred before the lake was created. Although conditions on the west bank of the Middle Basin are similar, this area contains larger deciduous and some coniferous trees. In addition, the vast majority of the east bank of the Middle Basin provides a 300-foot-wide (91-meter-wide) riparian zone, consisting of mature mixed forest, including overhanging vegetation. The South Basin also has somewhat-more natural riparian conditions, consisting of emergent and scrub-shrub vegetation as well as some patches of deciduous trees.



Exhibit 3.18 Riparian vegetation along the Arc of Statehood in the North Basin

The area, including Capitol Lake, Percival Cove, and the riparian corridor associated with Percival Creek, is considered a biodiversity area by WDFW Priority Habitats and Species (PHS) mapping because of its terrestrial habitat and remnant wooded shoreline, which provide nesting and foraging habitat for wildlife. WDFW considers biodiversity areas as areas within a city or an urban growth area that contain habitat that is valuable to fish or wildlife and is mostly composed of native vegetation.



Exhibit 3.19 Riparian vegetation in the South Basin

Wetland areas are important for many wildlife species. As described in Section 3.6, Wetlands, wetland types in the study area include freshwater wetlands and estuarine wetlands.

Terrestrial habitats in the study area include primarily open space (developed) areas, shrublands, and some small patches of forested habitat.

Wildlife habitat types in the study area are shown in Figures 3.5.1A and 3.5.1B.

Figure 3.5.1A Wildlife Habitats – North



Legend

Wetland Habitats

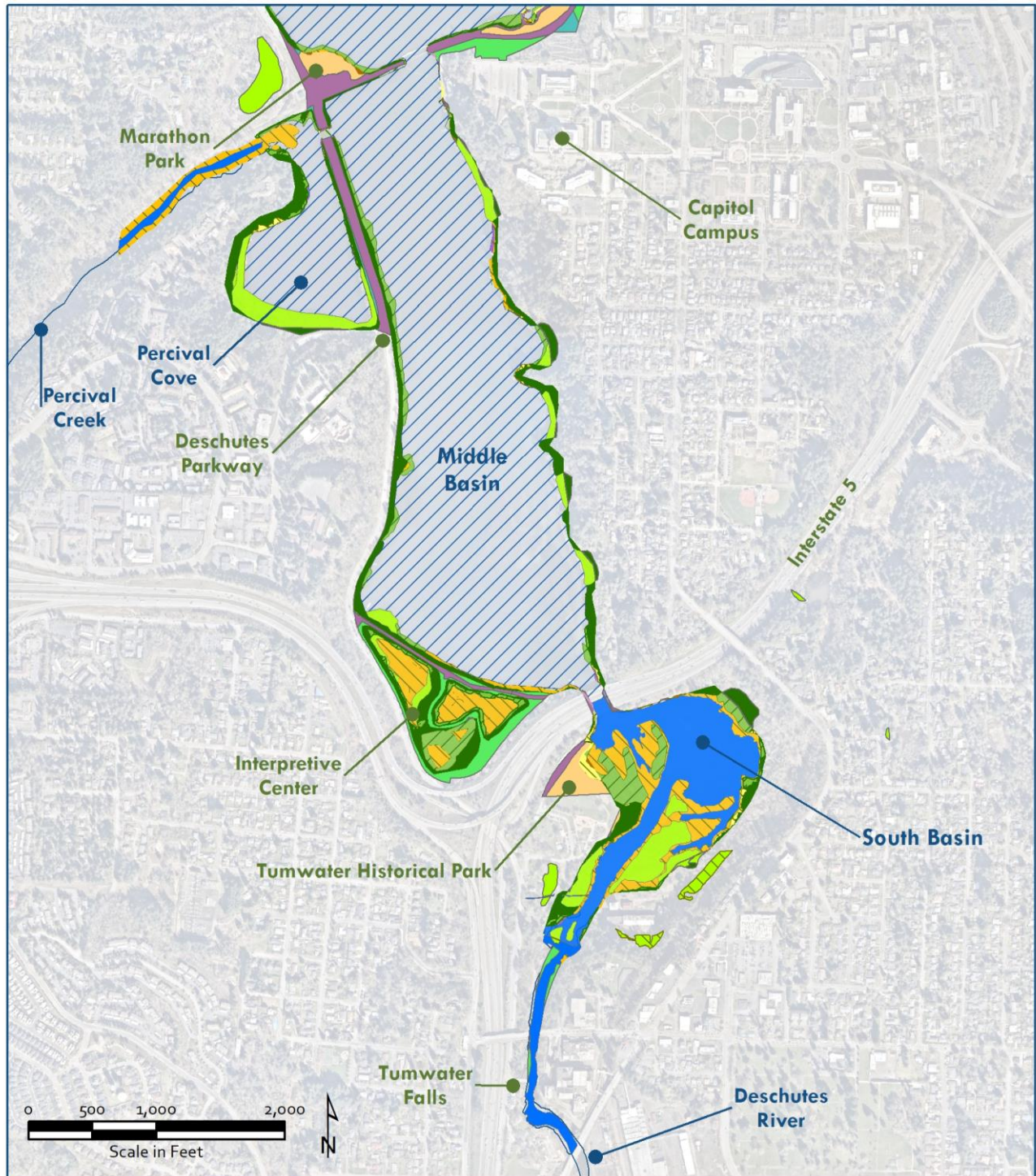
- Deepwater habitat - estuarine
- Deepwater habitat - freshwater
- Tideflat

- River channel
- Vegetated wetland - freshwater (PEM)
- Vegetated wetland - freshwater (PFO)
- Vegetated wetland - freshwater (PSS)
- Vegetated wetland - estuarine (high marsh)
- Upland

Upland Habitats

- Developed
- Grassland
- Mixed forest
- Shrub

Figure 3.5.1B Wildlife Habitats – South



Legend

Wetland Habitats

- Deepwater habitat - estuarine
- Deepwater habitat - freshwater
- Tideflat

- River channel
- Vegetated wetland - freshwater (PEM)
- Vegetated wetland - freshwater (PFO)
- Vegetated wetland - freshwater (PSS)
- Vegetated wetland - estuarine (high marsh)
- Upland

Upland Habitats

- Developed
- Grassland
- Mixed forest
- Shrub

3.5.2.2 What shellfish can be found in the study area?

Shellfish include freshwater mussels (within Capitol Lake) and crabs, numerous clams, the Olympia oyster, marine mussels, shrimp, abalone, and more (within Budd Inlet).

Western freshwater mussel (*Anodonta oregonensis*) have been observed in Capitol Lake.

Native marine shellfish are of high ecological, economic, cultural, and recreational value in Washington. Olympia oysters occur as scattered individuals and small patches throughout the low intertidal and shallow subtidal habitats of Budd Inlet. Restoration efforts to re-establish this native species in the study area are ongoing. Shellfish recorded by WDFW in Budd Inlet also include geoduck, green shore crab, humpy shrimp, bay ghost shrimp, blue mud shrimp, heart cockle, bent-nose macoma, soft-shell clam, native littleneck clam, butter clam, manila littleneck clam, gaper clam, northern gaper clam, and moon snail. Due to the impaired water quality from multiple pollution sources and low flushing in Budd Inlet, there are no safe public harvest sites in the majority of Budd Inlet, and WDFW has not conducted general surveys of shellfish.

Shellfish in Budd Inlet

Shellfish recorded by WDFW in Budd Inlet include scattered patches of Olympia oysters, green shore crab, native littleneck clam, and geoduck, among others. Water quality conditions and low flushing restrict shellfish harvest in Budd Inlet.

3.5.2.3 What birds can be found in the study area?

Birds in the study area can be described in five groups: shorebirds/wading birds, waterfowl, aerial feeders, raptors, and songbirds (Table 3.5.2). Numerous species in each group use the study area year-round or seasonally for breeding or wintering.

Table 3.5.2 Bird Species & Species Groups Present in the Study Area

| Species Group | Habitat Association and Use |
|---|---|
| Shorebirds / Wading Birds (e.g., western sandpiper, great blue heron) | Forage on small invertebrates in shallow water or exposed substrates during low tide; use Capitol Lake only during drawdowns or summer low flows that expose foraging substrates; herons forage on fish, amphibians, and invertebrates; most shorebirds are migratory and only seasonally present, while herons are year-round residents. |
| Waterfowl (e.g., common goldeneye, American wigeon, American coot) | Forage on aquatic plants in fresh and saltwater, plant seeds and tubers, weeds, aquatic invertebrates (insects, crustaceans, and mollusks); use habitats associated with open water and/or riparian sites for roosting and breeding. |
| Aerial Feeders (e.g., violet-green swallow) | Seasonal (spring and summer); forage on flying insects; Capitol Lake is important source for insect production and emerging prey. |

| Species Group | Habitat Association and Use |
|---|---|
| Raptors (e.g., osprey, bald eagle*) | Year-round and seasonal use of Capitol Lake and shoreline habitats; prey on shorebirds and ducks (peregrine falcon), small shorebirds (merlin), fish (osprey), and birds and fish (bald eagle). |
| Songbirds (e.g., yellow warbler, willow flycatcher) | Use a wide variety of terrestrial and wetland habitats (freshwater and nearshore) to forage, breed, and over-winter; many permanent residents with some seasonal migrants using habitats for breeding (e.g., warblers, thrushes). |

* Protected under the federal Bald and Golden Eagle Protection Act.

3.5.2.4 What bats can be found in the study area?

The study area is an important source of emerging flying insects that are prey for multiple species of bats. Capitol Lake appears to be an important feeding area for two bat species in particular, little brown bat and Yuma myotis. Both species have been radio-tagged from large breeding colonies located at Woodard Bay in Henderson Inlet and at the Evergreen State College. An estimated 3,000 bats occupy the Woodard Bay bat colony, located approximately 7 miles (11 km) from Capitol Lake, but the proportion of the colony that forages at the Capitol Lake is not known. These bats use Capitol Lake to forage and for drinking. Evidence is limited that bats roosting at the Woodard Bay trestle (or other bats in the region) rely only on Capitol Lake for foraging and/or drinking. Most bat species (including Yuma myotis and little brown bat) are habitat generalists, foraging generalists, and have capacity to prey-switch opportunistically. In addition to Yuma myotis and little brown bats, Townsend’s big eared bat, a state candidate species, has been detected in the South Basin area, but no information is available about the specific habitats used by the species or its frequency of occurrence in the study area.



Exhibit 3.20 Little Brown Bat (Source: WDFW)

Additional information about bat use of the study area has been included in the Fish and Wildlife Discipline Report (Attachment g), as well as an annotated bibliography of reviewed literature (Appendix B of the Fish and Wildlife Discipline Report).

3.5.2.5 What other mammals can be found in the study area?

Apart from bats, most mammals that use the study area are aquatic or semiaquatic and primarily visit the area to find prey or forage. WDFW noted 11 species of freshwater aquatic and marine mammals that have been recorded in the Capitol Lake area; no formal surveys have been

conducted and all records are anecdotal. Table 3.5.3 summarizes the species and species groups of mammals.

Table 3.5.3 Mammal Species & Species Groups Present in the Study Area

| Species Group | Habitat Association & Use |
|--|--|
| Freshwater Aquatic Mammals: (e.g., nutria ⁽¹⁾ , muskrat, beaver, northern river otter, mink, raccoon) | Some forage on aquatic plants and emergent vegetation of wetlands and generally use freshwater wetlands and streams (nutria, beaver, raccoon); some use estuarine and nearshore habitats to prey on aquatic birds, crayfish, fish, and amphibians (otter, mink). |
| Marine Mammals ⁽²⁾: (e.g., orca ⁽³⁾ , harbor seal, California sea lion) | Seasonal and migratory use of marine waters to prey on salmon and other fish species during seasonal runs. |


Notes:

1. Nutria are considered an aquatic invasive species in Washington State.
2. All marine mammals are protected under the federal Marine Mammal Protection Act.
3. Southern resident orca are listed as Endangered under the federal ESA.

3.5.2.6 *Are there threatened, endangered, or sensitive wildlife species and habitats in the Capitol Lake Basin?*

The Southern resident orca population is listed as endangered under the federal ESA, and critical habitat is currently designated for inland waters of Washington State including Budd Inlet. Washington State, under the direction of Governor Inslee, recently completed a final report and recommendations for ensuring the survival of orcas in Puget Sound. The Southern Resident Killer Whale Recovery Task Force led this work, which was completed in 2019, some of which became legislation.

Little brown bat and Yuma myotis are not listed as threatened, endangered, or candidate species by the state. However, myotis roosting concentrations are listed as a Priority Habitat. Townsend’s big-eared bat, a state candidate species, has been detected in the South Basin area through acoustical detection. No information is available about the specific habitats used by the species or its frequency of occurrence.



Orcas (Killer Whales)

A priority focus of the **Southern Resident Killer Whale Recovery Task Force** is to increase Chinook salmon abundance through habitat protection and restoration, and increased hatchery production, while minimizing competition with wild stocks and decreased predation.

3.5.3 Tribal Resources

Capitol Lake is located within the ancestral lands of the Southern Coast Salish and Southwestern Coast Salish cultural groups, which include, but are not limited to, the Steh-Chass, Nusehchatl, Squaxin, Nisqually, and the Chehalis. These groups have used the area since time immemorial

for various levels of habitation, ceremony, and resource gathering. Descendants of these people are members of today's federally recognized Squaxin Island Tribe, Nisqually Indian Tribe, and Confederated Tribes of the Chehalis Reservation.

Many of the fish, shellfish, and wildlife species in the study area (particularly the salmonids) have significant cultural and economic value to area tribes. The traditional diet of the Southern Coast Salish and Southwester Coast Salish relies heavily upon salmon, but also includes other important saltwater, freshwater, and terrestrial resources. Historically, the inlets surrounding the southernmost portion of Puget Sound provided abundant resources.

West Bay provides fish harvesting opportunities for some tribes, which are protected treaty rights acknowledged under the Medicine Creek Treaty of 1859. These treaty rights are referred to today as "Usual and Accustomed Areas" or "U&A areas." These rights for Indigenous people in the South Puget Sound region were affirmed in a landmark court case decided by Judge Boldt and upheld by the U.S. Supreme Court in 1979. Capitol Lake is closed to all active use, including tribal fishing. The Washington State Attorney General's Office describes adjudicated U&A areas for the Squaxin Island Tribe that coincide with the Project Area boundaries.

3.6 WETLANDS

Wetlands are important natural resources that perform vital ecological functions and provide many societal benefits and ecosystem services, such as water storage and flood protection, groundwater recharge, water quality improvements, sediment retention, habitat for fish and wildlife, recreation, and others. Wetlands are protected by a variety of federal, state, and local laws, plans, and policies. These laws, plans, and policies have different, but overlapping, requirements to protect and maintain these habitats and their functions. The Clean Water Act (CWA) is the primary federal law protecting wetland resources; the CWA regulates the discharge of dredge and fill materials into wetlands and other waters of the U.S. The CWA is administered by the U.S. Army Corps of Engineers (USACE), with support in Washington State from Ecology. Project proponents are required to avoid and minimize impacts on wetlands and must compensate for any unavoidable impacts. Additional information on the regulatory context for wetland resources is presented in the Wetlands Discipline Report (Attachment 10).

Regulatory Wetland

As defined by both federal and state laws, wetlands are "areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."

The wetlands study area includes the Capitol Lake Basin and associated wetlands from Tumwater Falls to West Bay. The study area also encompasses Percival Cove and Percival Creek and associated wetlands to where changes could occur as a result of the action alternatives.

Methods for Studying Wetlands

Existing conditions in the study area were determined based on the available geographic information system (GIS) data, aerial imagery, critical area and shoreline maps, the bathymetric survey, and previous readily accessible wetland studies applicable to the study area. This information was used to estimate the presence, extent, and type of wetlands, deep water habitats, and tideflats in the study area. This planning-level analysis was supplemented with a site reconnaissance to the Project Area in the summer of 2019, but wetlands were not delineated, rated, surveyed, or sampled for the EIS analysis.

For further information on wetlands, see the [Wetlands Discipline Report \(Attachment 10\)](#).

3.6.1 What types of wetlands are present in the study area?

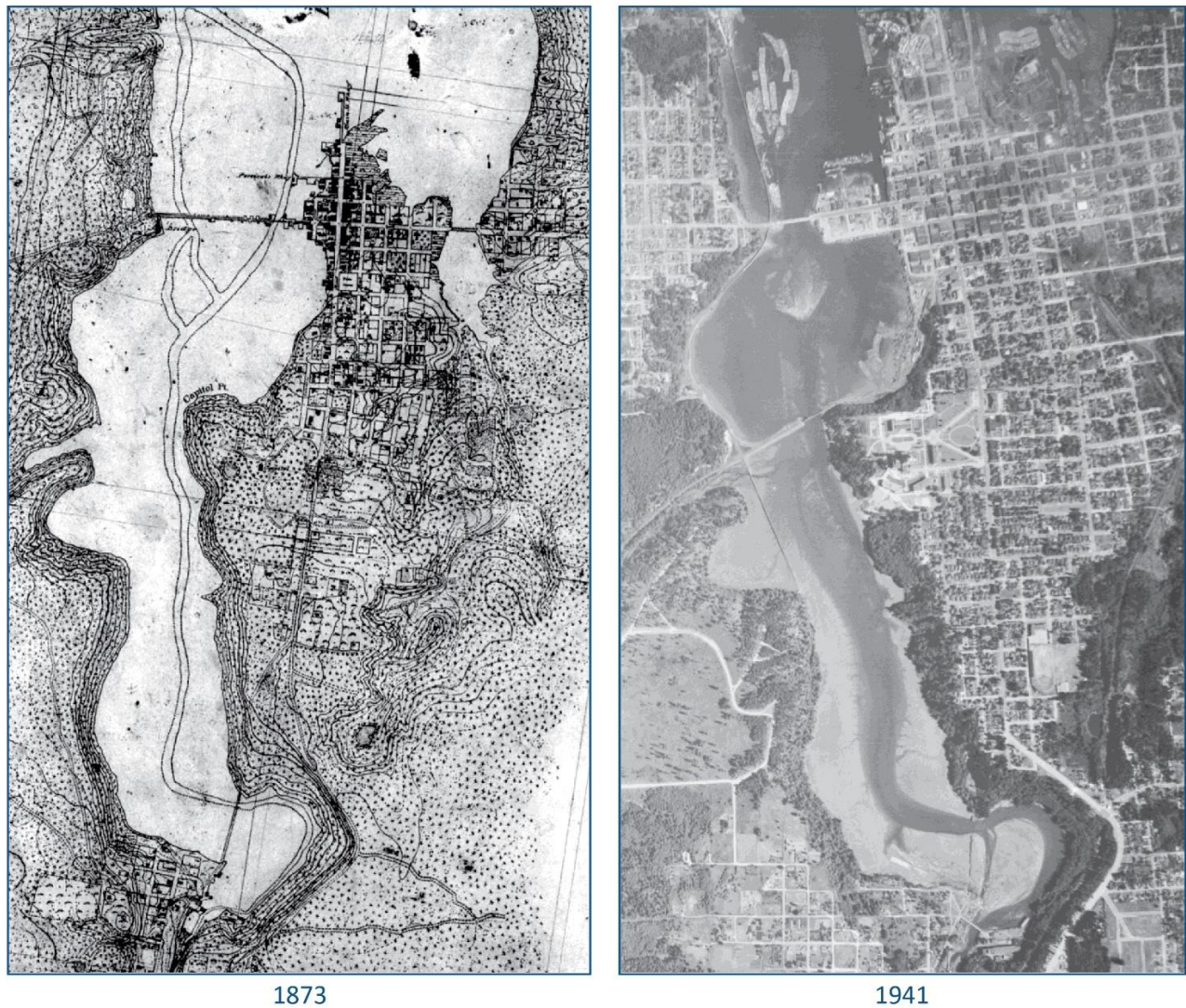
3.6.1.1 Historical Conditions

Historically, the Deschutes River formed a broad estuary as it flowed into Budd Inlet in the area that is now Capitol Lake (Figure 3.6.1). The historic delta consisted of river deposits, with braided channels and scattered tidal marshes.

Construction of the 5th Avenue Dam in 1951 blocked the tidal exchange between the Deschutes River and Budd Inlet. It also altered the morphology and ecology of the lower river system. Other development throughout the basin (e.g., construction of I-5, development of Olympia and Tumwater, port-related facilities) have similarly altered wetland conditions in the study area. Although different from their historic condition, Capitol Lake Basin and West Bay include wetlands that provide habitat for a range of birds, fish, bats, aquatic and semiaquatic mammals, and invertebrates.



Exhibit 3.21 Wetlands study area

Figure 3.6.1 Historic Condition of Capitol Lake Basin

3.6.1.2 Wetland Types in the Study Area

For the EIS analysis, the term “wetland” encompasses five broad types to characterize both the freshwater and estuarine habitats present in the Capitol Lake Basin and West Bay:

- Vegetated wetlands – freshwater
- Vegetated wetlands – estuarine
- Tidelands
- Deepwater habitats – freshwater (i.e., Capitol Lake)
- Deepwater habitats – estuarine (i.e., West Bay)

Tidelands and deepwater areas are not technically considered “wetlands” but are protected and regulated by multiple federal, state, and local laws

as waters of the U.S., waters of the state, and/or critical areas. Streams and rivers, such as the Deschutes River and Percival Creek, are also waters of the U.S., waters of the state, and critical areas (see Section 3.3, Water Quality, and Section 3.5, Fish & Wildlife, for more information on these waters).

The wetland types present in the study area are defined and described in this section. Wetland acreage is summarized by type in Table 3.6.1, and Figures 3.6.2A and 3.6.2B show the approximate location of these wetland types in the basin. More information is presented on the location of these types by basin in the Wetlands Discipline Report (Attachment 10).

Table 3.6.1 Wetland & Other Habitat Types in the Study Area under Existing Conditions

| Wetland Types | Location | Estimated Acreage ¹ |
|--|---------------------------------|--------------------------------|
| Deepwater Habitat – Estuarine | West Bay | 208 |
| Tideflat | West Bay | <1 |
| Vegetated Wetland – Estuarine (High Marsh) | West Bay | 3 |
| Deepwater Habitat – Freshwater | North and Middle Basins | 240 |
| Vegetated Wetland Freshwater (emergent) | North, Middle, and South Basins | 19 |
| Vegetated Wetland Freshwater (scrub-shrub) | North, Middle, and South Basins | 16 |
| Vegetated Wetland Freshwater (forested) | North, Middle, and South Basins | 18 |
| River Channel – Freshwater | Middle and South Basins | 25 |
| Upland | North, Middle, and South Basins | 19 |
| Total | | 549 |

Note:

Areas are approximate, based on National Wetlands Inventory data and a high-level reconnaissance investigation.

Figure 3.6.2A Existing Wetland Types – North



Legend

- | | |
|--|--|
| Deepwater Habitat - Estuarine | Vegetated Wetland - Freshwater (emergent) |
| Tideflat | Vegetated Wetland - Freshwater (scrub-shrub) |
| Vegetated Wetland - Estuarine (High Marsh) | Vegetated Wetland - Freshwater (forested) |
| Deepwater Habitat - Freshwater | Upland |

Figure 3.6.2B Existing Wetland Types – South



Legend

- Deepwater Habitat - Estuarine
- Tidelat
- Deepwater Habitat - Freshwater
- Vegetated Wetland - Freshwater (emergent)
- Vegetated Wetland - Freshwater (scrub-shrub)
- Vegetated Wetland - Freshwater (forested)
- River Channel
- Upland

Vegetated Wetlands – Freshwater

These wetlands are dominated by trees, such as willow, red alder, and Western red cedar; shrubs such as spirea, twinberry, and dogwood; and/or emergent vegetation, such as slough sedge, soft rush, and piggyback plant. They are fed by surface or groundwater and occur on the edges of lakes or rivers, on slopes, or in shallow depressions. Vegetated freshwater wetlands may or may not have standing water, and when they do, it is typically shallow. Vegetated freshwater wetland types include forested, scrub-shrub, and emergent wetlands.

Vegetated freshwater wetlands make up about 10% of the wetland acreage in the study area and are scattered throughout all of the basins. Within the North Basin, emergent and scrub-shrub wetlands occur along Heritage Park on the east and Marathon Park in the southwest, and along Deschutes Parkway. Within the Middle Basin, the western shoreline is dominated by fringes of emergent and scrub-shrub wetlands with areas of forested wetland being common along the eastern shoreline. The wetlands of the South Basin are fed by the Deschutes River and side-slope seeps, forming a complex of emergent, scrub-shrub, and forested communities.

Vegetated Wetlands – Estuarine

These wetlands occur in the zone where freshwater and saltwater meet and are referred to as low marsh and high marsh. These wetlands have salinity levels greater than 0.5 ppt and are usually influenced by tides. Vegetated estuarine wetlands are characterized based on their elevation levels within the intertidal zone and dominant vegetation form. High marsh wetlands occur in the upper intertidal zone and are infrequently inundated with water. Typical vegetation species include tufted hair grass and arrow grass. Low marsh wetlands occur at lower elevations and are typically characterized by the presence of pickleweed, arrow grass, Lyngbye’s sedge, and saltgrass.

Very little (~3 acres) of this wetland type occurs in the study area, all in the form of high marsh along the southwest shoreline of West Bay.

Tideflats

These wetlands are broad, flat areas in the intertidal zone that are exposed at low tides and inundated at high tides. The substrate is mostly clay and silt-sized (i.e., very small) particles as well as organic material. They are either unvegetated or vegetated only by algal mats or annual plants such as sea lettuce. Eelgrass is not typically found in southern parts of Puget Sound, and no eelgrass is mapped within West Bay.



Exhibit 3.22 Vegetated freshwater wetlands (emergent and scrub-shrub) in the North Basin



Exhibit 3.23 Vegetated freshwater wetlands (emergent and scrub-shrub) in the South Basin

Intertidal Zone

The intertidal zone is the area along the shoreline that is either covered with water, or not, depending on the tidal cycle. It is within the area of tidal fluctuation.



Exhibit 3.24 Estuarine and tideflats along the western shoreline of West Bay

Although prevalent before the 5th Avenue Dam was constructed, very little (<1 acre) of this wetland type now occurs in the study area. Shallow water tideflats are found along the western shoreline of West Bay.

Deepwater Habitats – Freshwater and Estuarine

These include areas where surface water is permanent and deep, such that water is the principal medium within which the dominant organisms live. Deepwater habitats can be freshwater or estuarine. If present, vegetation is aquatic bed vegetation that is usually visible above the water surface. The boundary between wetlands and deepwater habitats in an estuarine system is the elevation of the extreme low water. The boundary between wetlands and deepwater habitat in the freshwater environment is a depth of 8.2 feet (2.5 meters) or the edge of emergent vegetation, shrubs, or trees.

Deepwater habitats make up the vast majority (~82%) of existing wetland types in the study area. The existing estuarine deepwater areas are all in West Bay, and the freshwater deepwater areas are in the North and Middle Basins. The estuarine and freshwater areas are divided by the 5th Avenue Dam.



Exhibit 3.25 Deepwater (freshwater) habitat in the North Basin

3.7 AIR QUALITY & ODOR

Air quality refers to the condition of the breathable air with respect to the presence of pollutants identified by the USEPA and Ecology as pervasive in urban environments, and for which state and federal health-based ambient air quality standards have been established. The air quality analysis addresses pollutants, which can have negative effects on human health and the environment. It also addresses greenhouse gases (GHGs), which can contribute to climate change.

Odor is a commonly experienced human sensation. The olfactory sense can detect and discriminate thousands of odors. The presence of an odor is the product of small quantities of certain chemicals, or mixtures of chemicals, in the air we breathe.

For assessing air quality and odor associated with the project, the study area is the Project Area and the surrounding ambient air that has the potential to be influenced by the project, based on the scope and nature of the construction and post-construction air emissions, as well as the nature of the topography and meteorological conditions in the area. Based on the nature and quantities of the air pollutant emissions and potential odors generated by the action alternatives, the impacted area is not expected to extend far from the Project Area.

Odor Characteristics

Important characteristics of odors at specific locations are described below.

- **Intensity.** Perceived strength of odor. It is subjective and important in characterizing the odor environment.
- **Duration.** The length of time an odor persists at a location.
- **Frequency.** How often an odor is present at a location.
- **Offensiveness (or Hedonic Tone).** Scientifically developed scale for the pleasantness or unpleasantness of the nature of the odor.

Methods for Studying Air Quality & Odor

Data sources used for the air quality and odor analysis include relevant USEPA reports and standard computer tools, as well as odor studies, particularly those concerning hydrogen sulfide (H₂S), an odorous gas that can be naturally produced from tideflats. Available literature on odor-producing emissions of tideflats was also reviewed.

For further information on data sources, see the Air Quality and Odor Discipline Report (Attachment 11).

3.7.1 What is the existing odor environment at Capitol Lake?

Existing potential sources of odor in the vicinity of the Project Area include the tideflats along the East and West Bay. Odors produced by tideflats have not been studied in depth, and the literature on associated quantitative odor-producing emissions is sparse. Most of the available literature focuses on sulfur compound emissions, which have been quantified per unit of tide-influenced area. These emissions are often driven by hydrogen sulfide (H₂S), a gas that has a characteristic odor of rotten eggs and an odor detection limit with a range that spans from 0.5 to 300 parts per billion depending on the studies considered. Ambient H₂S air concentrations in the Olympia area are not readily available to characterize existing odor conditions. However, the Olympic Region Clean Air Agency (ORCAA) logs odor complaints received from the public.

During a 5-year period (March 2015 through March 2020), the primary sources of odor complaints in the region were burning garbage, as well as smoke from woodstoves and burn piles, all of which accounted for approximately 86% of the total odor complaints. Other recurring sources of odor complaints received by ORCAA were from a hot-mix asphalt plant, a mushroom farm, and a packaging facility. A summary of odor complaints is provided in the Air Quality and Odor Discipline Report (Attachment 11). There were no odor complaints associated with tide fluctuations or associated natural odor-producing sources, and there were no odor complaints during a 2016 drawdown of Capitol Lake. However, the extreme heat event that occurred in 2021 led to some die-off of shellfish that may have caused decomposition odors. Such odors are generally a function of polysulfide compounds and are not driven by H₂S.

Did the historic estuary smell bad?

Historical anecdotal evidence of odors within the estuary is not reliable because it cannot be attributed to specific odor sources. There have been many changes in sewage management, industrial activities and related discharges, and other unknown contributors in the Project Area since that time.

3.7.2 What is the existing air quality environment in the Project Area?

Washington is subject to air quality regulations issued by USEPA, Ecology, and local air agencies such as ORCAA. These agencies have established National Ambient Air Quality Standards (NAAQS).

Concentration levels of the criteria pollutants must not exceed the NAAQS over specified time periods. Ecology and ORCAA monitor air quality in the region to compare the levels of criteria pollutants found in the atmosphere with the NAAQS. Areas that meet the limits set by the NAAQS 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 nonattainment, measures must be taken to bring the area back into compliance; after a nonattainment area achieves compliance, it becomes a “maintenance” area. This designation requires that Ecology, in coordination with ORCAA, develop an attainment plan to demonstrate how the area will come back into compliance with the standard.

Existing sources of air pollution in the vicinity of the project include industrial-zoned areas and transportation corridors, including marine diesel-fueled vessels and both diesel and gas vehicles on the nearby roadways.

Criteria air pollutants of primary concern are nitrogen dioxide, particulate matter of 10 micrometers or less (PM₁₀), and particulate matter of 2.5 micrometers or less (PM_{2.5}). Other pollutants include ozone precursors (i.e., hydrocarbons and nitrogen oxides), sulfur dioxide, ozone, and carbon monoxide. Given the setting, industrial and transportation sources likely comprise the largest contributors to ambient pollutant concentrations in the vicinity of the project. Smoke from residential wood combustion, one of the main sources of air pollution in Washington State, may also be a significant contributor to ambient particulate matter concentrations during winter months.

The area was designated as nonattainment during the period of 1992 to 1999 due to exceedances of the PM₁₀ 24-hour standard, primarily caused by smoke from woodstoves and fireplaces. In 2000, local monitoring indicated that the air quality had improved, and the area implemented a 20-year maintenance plan that concluded on December 4, 2020. The area continues to be in attainment for PM₁₀ and is no longer required to adhere to the maintenance plan.

National Ambient Air Quality Standards (NAAQS)

The Clean Air Act establishes emissions standards for criteria pollutants. These standards are known as NAAQS. The NAAQS set limits for criteria pollutants, including:

- Carbon monoxide
- Nitrogen dioxide
- Sulfur dioxide
- Particulate matter (two different sizes, 2.5 micrometers and less than 10 micrometers)
- Ozone

3.7.3 How are greenhouse gases assessed?

An executive order issued by Governor Christine Gregoire in February 2007 (Executive Order No. 07-02) established goals for Washington for reducing GHG emissions as follows:

- To reach 1990 levels of GHG emissions by 2020
- To reach 25% below 1990 emission levels by 2035
- To reach 50% below 1990 emission levels by 2050

On April 30, 2020, Ecology announced the beginning of the rulemaking process to create a new rule, Chapter 173-445 WAC, Greenhouse Gas Assessment for Projects, which will help address analysis and mitigation of GHG emissions for environmental assessments of certain projects. The new rule is slated to be completed sometime in 2023. As new rulemaking is under development, the EIS considers previous Ecology guidance as adopted in Chapter 173-441 WAC, Reporting of Emissions of Greenhouse Gases. This rule aligned the state's GHG reporting requirements with USEPA regulations, and required facilities that directly emit 10,000 metric tons of carbon dioxide (CO₂) equivalents (MTCO₂e) or more each year, as well as fuel suppliers that supply fuels in the state that would result in 10,000 MTCO₂e when combusted, to report their GHG emissions to Ecology.

Ecology estimated state-wide annual GHG emissions in 2015 at approximately 97 million MTCO₂e, and annual worldwide GHG emissions for 2010 were estimated by the World Resources Institute to be approximately 46 billion MTCO₂e.

In addition to GHG emissions created during construction and operation of the project, the EIS considers the carbon sequestration or emissions potential of the wetlands established under the project alternatives. Coastal wetland environments remove CO₂—a GHG—from the atmosphere and sequester the carbon as biomass, dead organic matter, and soil carbon. The environmental service of wetland carbon sequestration is often referred to as “blue carbon.”

While carbon is typically sequestered in wetland environments, methane (CH₄) emissions occur in marshes when anaerobic (i.e., oxygen-starved) conditions allow microbes to decompose organic matter and produce CH₄. The effect of wetlands on GHGs can vary widely from a net negative to a net positive, depending on the salinity and biomass in the system. The relative GHG sequestration or emissions expected under the alternatives are described in Chapter 4.0 (Section 4.7, Air Quality & Odor).

Which greenhouse gases are addressed in the EIS?

The following, most commonly emitted GHGs, are addressed in the EIS:

- Carbon Dioxide (CO₂)
- Nitrous Oxide (N₂O)
- Methane (CH₄)

MTCO₂e

MTCO₂e (metric tons of carbon dioxide equivalent) is the unit of measurement for GHGs. It is used to compare the emissions from different GHGs based on their global warming potential.

Carbon Sequestration

Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide.

In 2018, the Thurston Regional Planning Council adopted the Thurston Climate Adaptation Plan (TCAP) to guide Thurston County and the broad South Puget Sound region in developing strategies for adaptation and response to climate change. This 22-member intergovernmental board has a mission to provide visionary leadership on regional plans, policies, and issues. The TCAP includes a number of Guiding Principles, including a goal relating to GHG emissions.

The Guiding Principles support increased resiliency through achievable, flexible, and, where possible, measurable and replicable climate adaptation strategies. Relating to GHG emissions, the Guiding Principle states: "Identify and leverage climate change adaptation strategies and actions with mitigation co-benefits, such as reducing, capturing, and storing greenhouse gas emissions."

In 2020, collaborating jurisdictions adopted the Thurston Climate Mitigation Plan (TCMP) to address local contributions to the causes of climate change. The plan includes an emissions reduction target of reducing net communitywide GHG emissions 45% below 2015 levels by 2030 and 85% below 2015 levels by 2050. The TCAP and TCMP together form a comprehensive Climate Action Plan for the Thurston Region.

3.8 LAND USE, SHORELINES, & RECREATION

Land use refers to how land is developed and managed for various human uses. It also refers to the preservation or protection of land as a natural resource. Shorelines refers to land along a waterbody, which can also be developed for human purposes or preserved as a natural resource, subject to regulations specifically for shorelines. Recreation refers to opportunities for people to engage with and enjoy the natural and built environment. These three related resources are combined in this analysis.

The study area for land use, shorelines, and recreation includes the Capitol Lake Basin that Enterprise Services manages, and encompasses areas within 1,000 feet (300 meters) where shoreline use or recreation activities could change, or the alternatives could influence adjacent land uses. The study also includes areas within and adjacent to West Bay where shoreline uses such as recreational marinas or shipping could be affected by changes in sediment movement.

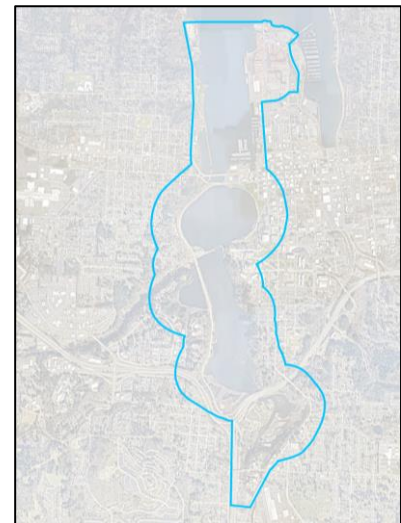


Exhibit 3.26 Land Use, Shorelines, and Recreation study area

Methods for Studying Land Use, Shorelines, & Recreation

Data sources used include relevant zoning and parcel information in GIS format, policy and planning documents, and land and shoreline use regulations applicable to the study area. The study also included input from the Community Sounding Board and Work Groups and data from a recreational user survey. Park users were surveyed at parks adjacent to Capitol Lake during high usage periods in the summer of 2019, including during Capital Lakefair.

The **Land Use, Shorelines, and Recreation Discipline Report (Attachment 12)** contains the full list of data sources used for the evaluation.

3.8.1 What is the existing land use, planning, and zoning in the study area?

The study area includes a range of uses, from open space used for wildlife habitat and recreation to intensively used commercial and industrial areas. Figure 3.8.1 shows the existing land uses in the study area.

Most land uses abutting Capitol Lake are various forms of open space. Capitol Lake is itself considered open space. Surrounding open space includes portions of the Capitol Campus, parks, habitat areas, and undeveloped portions of large single-family lots.

Transportation is also a notable land use surrounding Capitol Lake. The I-5 highway crosses between the South and Middle Basins. The BNSF Railway Trestle crosses between the Middle and North Basins. Deschutes Parkway extends the entire length of the west side of Capitol Lake, and 5th Avenue crosses the water between the North Basin and West Bay.

Around the North Basin, in addition to the open space described above, single-family development dominates the uses to the west, and a mixture of office, retail, and government uses are adjacent to the east.

Around the Middle Basin, in addition to the open space described above, uses are predominantly single-family residences and state capitol offices to the east. To the west, office and commercial uses front Lakeridge Way SW, including the Thurston County Courthouse. A steam plant (the Capitol Campus Powerhouse) occupies the shoreline at the northeast edge of the Middle Basin.

Figure 3.8.1 Map of Existing Land Uses



Legend

| | | | | |
|---------------|----------------------|--------------------------|---------------------------|------------------|
| City Boundary | Land Use Type | Parks and Open Space | Residential Single-Family | Transportation |
| Study Area | Cultural | Public Assembly | Retail | Undeveloped Land |
| | Hotel-Motel | Recreation | Service | Utilities |
| | Manufacturing | Residential Multi-Family | Other | Water |

Around the South Basin, single-family development is also predominant to the east. The South Basin abuts the New Market District and Brewery District in Tumwater, two commercial districts that surround and include the former Olympia Brewery.

West Bay is surrounded by parks, private recreational marinas, the Port of Olympia, commercial offices, a large sawmill, and a small number of townhouse residences.

The study area lies within the city limits of Olympia and Tumwater. The city limits and zoning designations within the study area are shown in Figure 3.8.2.

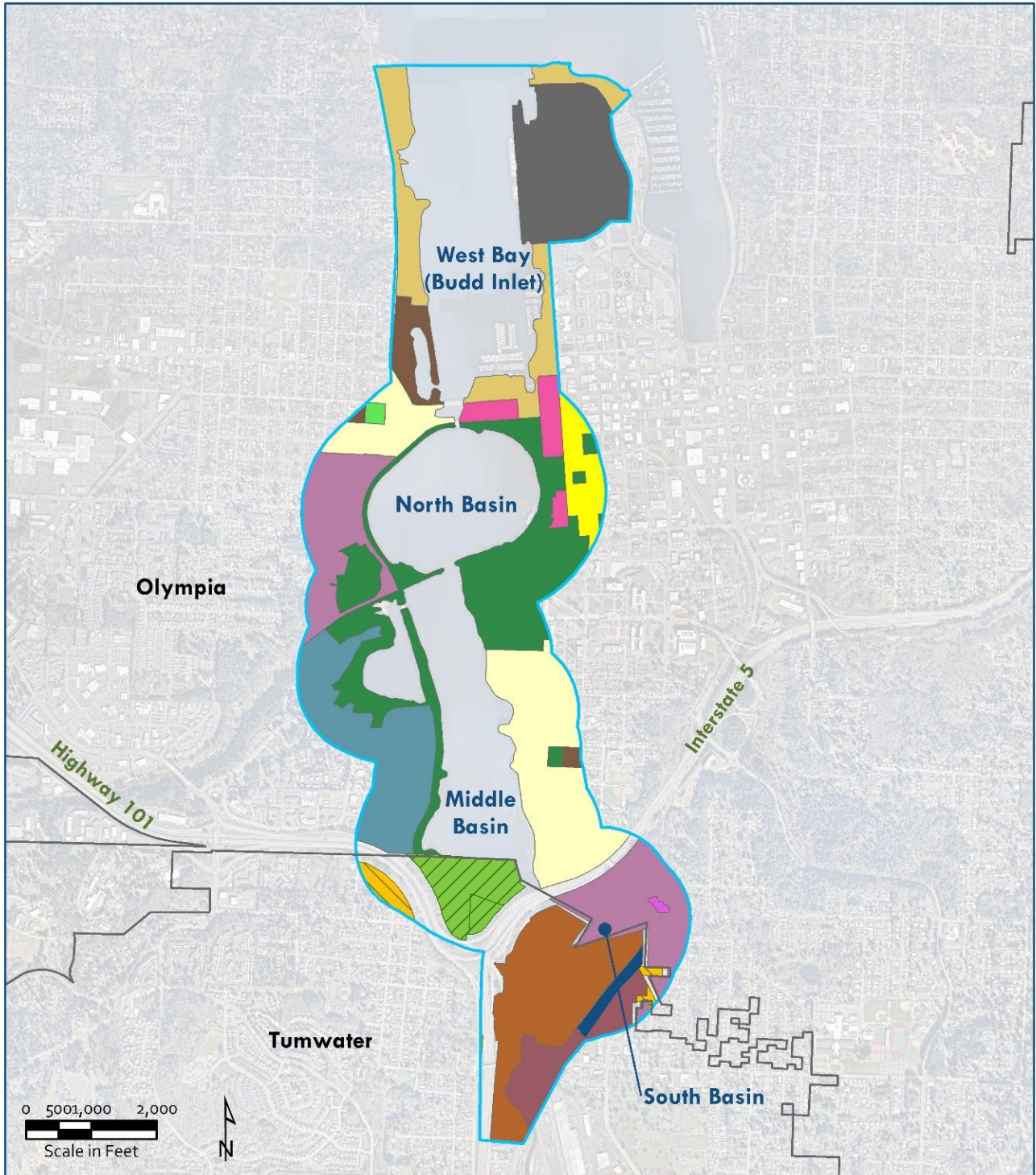
Residential zones comprise 33% of the study area, with the majority of that in single-family zoning. Green Belt and Open Space zoning comprises only 4% of the land within the study area, but much of the Capitol Campus could also be categorized as open space, especially areas adjacent to Capitol Lake.

A major portion of the land abutting Capitol Lake is designated Capitol Campus on the City of Olympia zoning map. The Capitol Campus includes the main upper campus, Heritage Park, Deschutes Parkway, and the land surrounding Percival Cove in the Middle Basin, plus a few scattered parcels.



Exhibit 3.27 Port of Olympia facilities

Figure 3.8.2 Map of Existing Zoning



Legend

| | | | | |
|-------------------------------|---------------------------------|-----------------------------|--------------------------------|---|
| City of Olympia Zoning | Neighborhood Retail | Two Family Residential 6-12 | City of Tumwater Zoning | Single Family Low Density Residential 4-7 Units Per Acre |
| Capitol Campus | Planned Unit Development | Urban Residential | Brewery District | Single Family Medium Density Residential 6-9 Units Per Acre |
| Downtown Business | Professional Office/Residential | Urban Waterfront | Green Belt | |
| Industrial | Single Family Residential 4-8 | Urban Waterfront Housing | Historic Commercial | |
| Study Area | City Boundary | | Open Space | |

3.8.2 Which areas of the study area have shoreline environment designations?

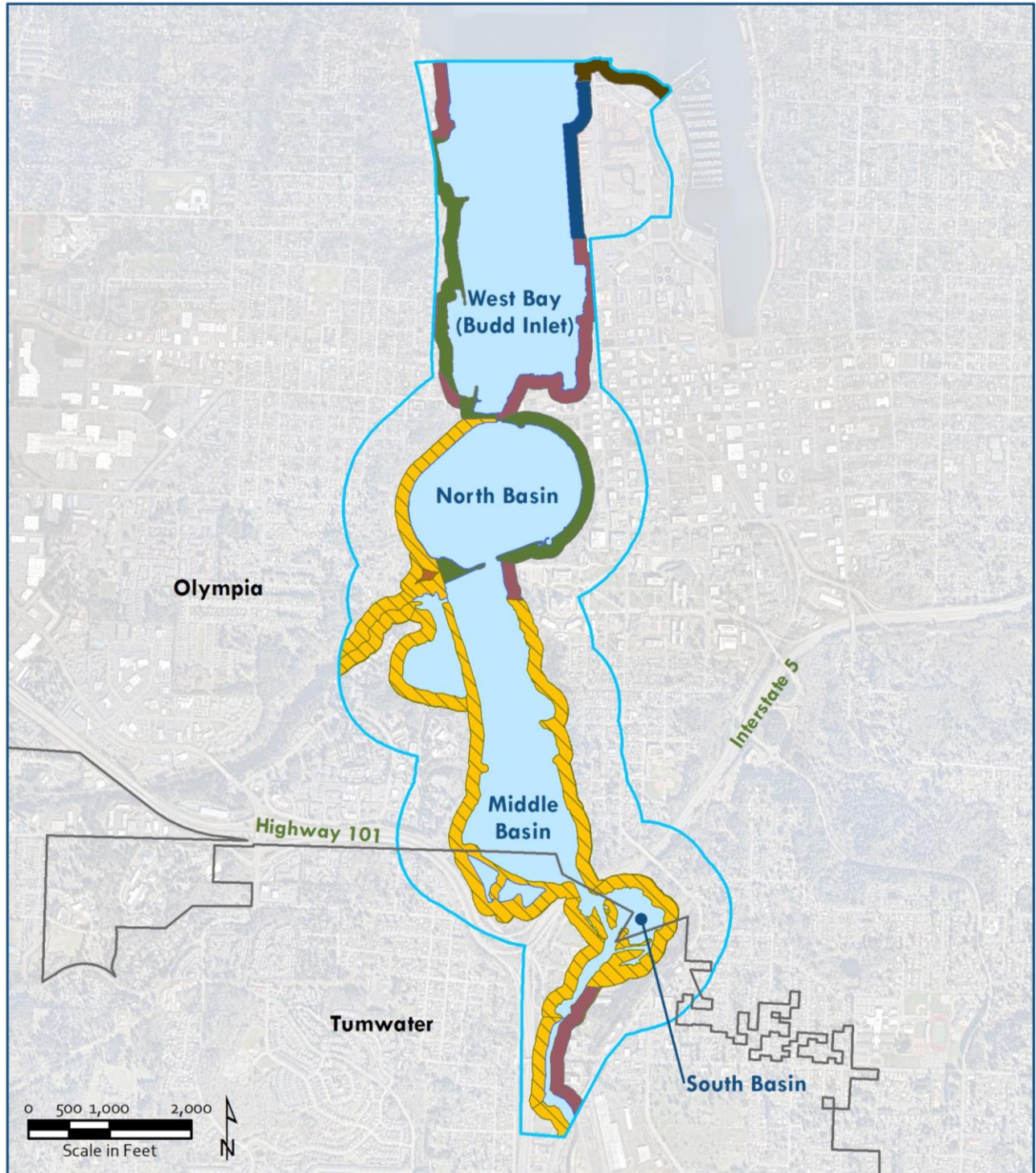
Shoreline designations are overlay zones authorized under the Shoreline Management Act and are shown on Figure 3.8.3. A large majority of the shoreline of Capitol Lake is designated Urban Conservancy, reflecting the goals of Olympia and Tumwater to support water-related and water-enjoyment uses while protecting and restoring ecological functions of these shorelines. The east side of the South Basin is designated Urban Intensity in recognition of the historic high-intensity uses associated with the brewery, and allowing commercial and recreational uses that are compatible with shoreline protection. The eastern and southern shores of the North Basin are designated Waterfront Recreation. This designation is applied to areas to be used for recreation or habitat conservation, and allows for low-intensity recreational use of the shorelines. A small portion of the Middle Basin is designated Urban Intensity in recognition of the historic Capitol Campus Powerhouse.

Along West Bay within Budd Inlet, designations of Waterfront Recreation and Urban Intensity predominate. A designation of Port Marine Industrial applies to the log shipping terminal in West Bay. This designation prioritizes and supports water-dependent industrial uses. Adjacent to and north of the shipping terminal, the shorelines are designated Marine Recreation, supporting public access and intensive recreational use such as the existing public dock and boat launch.

Shoreline Management Act

Under the state's Shoreline Management Act (SMA), each city and county that abuts a shoreline of statewide significance adopts a Shoreline Master Program (SMP) that applies to those waters and the adjacent land. Each SMP is based on SMA goals to protect the public trust by ensuring public access, protecting shoreline ecology, and accommodating water-dependent uses. This is accomplished through regulations in the SMP that establish shoreline environment designations, and corresponding use and development standards.

Figure 3.8.3 Map of Existing Shoreline Designations



Legend

| | | | |
|---------------|-----------------------|------------------------|-------------------|
| City Boundary | Aquatic | Port Marine Industrial | Urban Conservancy |
| Study Area | Marine Recreation | Shoreline Residential | Urban Intensity |
| | Waterfront Recreation | | |

3.8.3 What are current recreation sites and their uses?

Several parks provide both local and regional benefits. Brewery Park at Tumwater Falls and Tumwater Historical Park are tourist attractions on the shore of the South Basin, and provide facilities for picnicking, wildlife viewing, and other activities. Heritage Park, on the eastern shore of the North Basin, hosts major community gatherings and provides trails and other recreation facilities for the broader Olympia-Tumwater area and tourists visiting the capitol. Marathon Park, on the southwest shore of the North Basin, and Interpretive Center, on the southwest shore of the Middle Basin, both provide active recreation, wildlife viewing, and other recreational opportunities serving the broader Olympia-Tumwater area. All of these parks are linked by a series of trails extending around the North Basin and along the west shore of the Middle Basin and South Basin. Thurston Regional Planning Council plans linkages within the study area to regional trails along the Deschutes River, Percival Canyon, and West Bay. Figure 3.8.4 shows the recreation sites within the study area.

Recreation sites around Capitol Lake and West Bay attract hikers, runners, walkers, bicyclists, tourists, and other visitors to the Capitol Campus, downtown Tumwater, and downtown Olympia. Many community-supported events occur around the lake, including Capital Lakefair, Festival of the Steh-chass, Olympia Harbor Days, Olympia Wooden Boat Fair, and Capital City Marathon. Capital Lakefair, the largest recreational event that occurs in the Capitol Lake area, began in the 1950s, after construction of Capitol Lake and before the creation of Heritage Park. Capital Lakefair is an annual community festival at Heritage Park in the third week of July with an attendance of approximately 200,000. Despite current restrictions on water-oriented activities due to environmental conditions in Capitol Lake, shoreside activities remain as part of the current Capital Lakefair festival. For a list of events held in the Capitol Lake area, see Table 4.3 in the Land Use, Shorelines, and Recreation Discipline Report (Attachment 12).

History of Recreational Use in Capitol Lake Basin

Capitol Lake has been used formally for recreation since its creation in 1951. Prior to this time, there are anecdotal reports that fly fishing for salmon and trout was common in the estuary.

From 1964 to 1985, the City of Olympia operated a swimming area in the North Basin. Poor water quality forced the closure of the swimming area. Both recreational and organized boating took place on the lake from the early 1950s through 2009. In 2009, because of the presence of invasive New Zealand mudsnails, Capitol Lake was closed to all public water-oriented uses, including boating and fishing.

Figure 3.8.4 Map of Recreation Sites



Legend

- Public Trail
- Study Area
- Public Park

3.8.4 Does the EIS consider input from area recreationists?

Information on recreational use of the surrounding open space resources was gathered through surveys conducted during the summer of 2019 at locations around the Capitol Lake Basin, and at a Community Sounding Board meeting. The shorelines along Capitol Lake and nearby Budd Inlet are important places for many types of recreation, especially walking, attending events, and family time. Diverse activities continue around the lake despite restrictions on in-water uses. Many people indicated they would use the area more if uses like boating, fishing, swimming, and wading were restored. Enterprise Services considered this information during the decision-making process for this project. For additional information, see the Land Use, Shorelines, and Recreation Discipline Report (Attachment 12).

3.9 CULTURAL RESOURCES

Cultural resources include archaeological and historic built environment resources as well as traditional cultural properties.

In the EIS, cultural resources refers to archaeological resources, historic built environment resources, and traditional cultural properties.

Archaeological resources are places where past human activity has left physical traces. These traces include artifacts, deposits of debris, food remains (shells and bones), ruins of dwellings and other structures, and human remains and cemeteries. Historic built environment resources (historic resources) include buildings, structures, and landscape features built by people, and that remain in a functional state or operational readiness. Built environment resources typically must be at least 50 years old to be considered historic. Traditional cultural properties, sometimes referred to as areas of traditional cultural concern, are properties associated with cultural practices, beliefs, the sense of purpose, or existence of a living community that is rooted in that community's history or is important in maintaining its cultural identity and development as an ethnically distinctive people.

Certain cultural resources are protected under various federal, state, and local historic registers. These include districts, sites, buildings, structures, or objects that are already included in, or may be eligible for listing in the National Register of Historic Places (NRHP), Washington Heritage Register, City of Olympia Heritage Register, or City of Tumwater Register of Historic Places.

NRHP

The National Register of Historic Places (NRHP) is the official list of cultural resources that have been deemed worthy of preservation under the National Historic Preservation Act of 1966. Properties listed in the NRHP include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archaeology, engineering, and culture. NRHP properties are distinguished by having been documented and determined eligible according to uniform standards (Criteria A–D, known as the Criteria for Evaluation).

The Section 106 process under the National Historic Preservation Act (NHPA) is used to consider how cultural and historic resources would be affected by an undertaking. As part of this process, resources first are inventoried, then evaluated regarding their eligibility for listing in the NRHP. If they are eligible, then the process determines if the impacts are adverse or not, and whether mitigation is needed to offset adverse impacts. The USACE will be the lead agency for the Section 106 review for this project, and the review process is expected to include the Squaxin Island Tribe, Nisqually Indian Tribe, Confederated Tribes of the Chehalis Reservation, and the Washington State Department of Archaeology and Historic Preservation (DAHP).

In addition to the federal Section 106 process, Washington State Governor's Executive Order (EO) 21-02 requires state agencies implementing or assisting capital projects that are not otherwise subject to compliance with Section 106 of the NHPA, and are using funds appropriated in the state's biennial Capital Budget, to consider how projects may impact significant cultural and historic places. Similar to Section 106, the EO 21-02 process requires consultation with DAHP and affected tribes.

The Section 106 process and/or EO 21-02 will start once the SEPA EIS process concludes, an alternative is selected for implementation, and the design and permitting process begins. Additional information on the regulatory context for cultural resources is presented in the Cultural Resources Discipline Report (Attachment 13).

The study area for archaeological resources is defined as a 0.25-mile (0.40-kilometer) buffer east, south, and west of the Project Area; the northern boundary is the extent of anticipated sediment deposition and dredging that would occur within West Bay under the Estuary and Hybrid Alternatives. The study area for the historic built environment consists of areas that could be directly or indirectly impacted by construction or operation of the project and is larger than the Project Area. At the south end, the boundary extends to the top edge of the steep bluffs around the South Basin, I-5, and US Highway 101; the eastern boundary encompasses the South Capitol Neighborhood, West Capitol Campus, Downtown Olympia historic districts, and Capitol Way S; and the western boundary is the upland edge of the Project Area; finally, the northern boundary is defined by a direct line from the north end of the Port of Olympia harbor west to the shore.

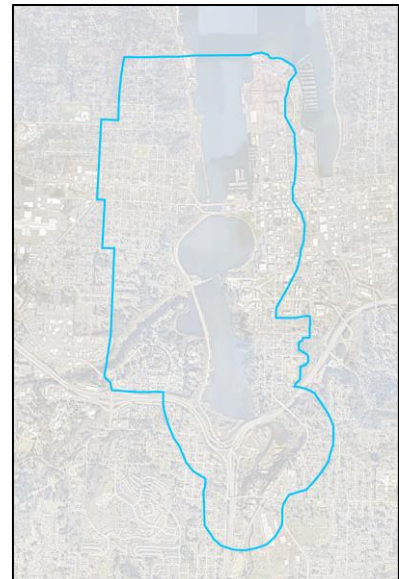


Exhibit 3.28 Cultural resources study area

Methods for Studying Cultural Resources

The review of archaeological and historic built environment resources included both desktop analysis and a field survey for historic resources. The desktop analysis of existing conditions and context for cultural resources was conducted using previous studies, database searches, historical maps, and historical registers. A field survey and completion of historic property inventory (HPI) forms were completed for historic resources that would be directly or indirectly impacted by one or more of the action alternatives. The completed HPI forms and survey information will help support future Section 106 and/or EO 21-02 consultation as part of permit evaluations for the selected alternative, and may be supplemented at that time with additional survey work.

The full list of studies, reports, and other data sources is presented in the revised Cultural Resources Discipline Report (Attachment 13). Given the large volume of publicly available information on historic development context and history of the Capitol Lake area, a larger volume of information was presented in the Draft EIS and in the Cultural Resources Discipline Report (Attachment 13) on the historic built environment relative to archaeological resources. However, given comments received on the Draft EIS, additional information has been included in both the Final EIS and the discipline report to describe the precontact era and Indigenous use context in the study area. Similarly, some of the information on the historic built environment presented in the EIS and the discipline report has been removed or summarized to present a more balanced level of information between historic built environment and cultural elements.

In addition, revisions were made to the Final EIS and revised discipline report based on comments received on the contents of the Draft EIS, as well as in response to DAHP's determinations of eligibility of resources after publication of the Draft EIS.

3.9.1 What cultural resources can be found in the study area?

3.9.1.1 Indigenous Context of the Study Area

The Capitol Lake – Deschutes Estuary is located within the ancestral lands of the Southern Coast Salish and Southwestern Coast Salish culture groups, which include, but are not limited, to the Squaxin *sq^w áksədabš* (people of the water), Nisqually *dx^wsq^waliʔabš* (people of the river, people of the grass), and Upper Chehalis *q^way'áyit=q'*. Descendants of these people are members of today's federally recognized Squaxin Island Tribe, Nisqually Indian Tribe, and Confederated Tribes of the Chehalis Reservation. Southern Coast Salish and Southwestern Coast Salish people have used the area since time immemorial for habitation and resource gathering. The Southern Coast Salish and Southwestern Coast Salish culture groups share similarities in language, subsistence patterns, structures, and other cultural practices. The area around Budd Inlet, and the people who lived there, are referred to as Steh-Chass *stəčásabš*. The proximity of the Deschutes Estuary to other inlets in South Puget Sound allowed other groups to make use of the waterways for travel, trade, and resource gathering.

Traditional use of the region has been organized around different resource environments, including marine, freshwater, and different terrestrial areas such as forests, prairies, and wetlands. Permanent and seasonal campsites were located at areas ideal for resource gathering, hunting, and travel access. Winter cedar plank house villages were often located in bays and inlets, at the mouths of rivers, river confluences, and terraces. Traditional Southern and Southwestern Coast Salish diet relies heavily upon salmon and shellfish. Salmon, caught at the mouths and from the banks of fish-bearing rivers, were smoked or dried for the winter, yielding the bulk of food consumed in winter season. Smoked or dried salmon was frequently shared among groups. Historically, the inlets surrounding the southernmost portion of Puget Sound provided abundant marine resources; these include Budd Inlet *Steh-Chass*, Eld Inlet *Squi'A'tl*, Hendersen Inlet *Noo-She-Chatl*, Totten Watershed *T'Peeksin*, Case Inlet *Squawksin*, and Little Skookum. Spring and summer months were frequently spent at upland seasonal camps where fishing, hunting, and gathering of roots, bulbs, berries, and other plants occurred. Shelters in camps were less permanent than in villages, usually consisting of reed mat shelters.

The natural waterways of the study area, including the Deschutes River and Percival Creek, along with other nearby rivers, lakes, and forests provided fishing and hunting opportunities for resources such as salmon, beaver, waterfowl, deer, elk, bear, and other animals. The ethnographic record and oral tradition speak to the importance of the land, its resources, and fishing among Indigenous groups throughout the region. This includes ceremonies and rites related to the resources and their procurement, including the First Salmon Ceremony. This ceremony celebrates the first catch of the season and ensures the fish return and remain an abundant resource for future seasons and generations. These ceremonies can include the use of traditional lands, preparation techniques, and distribution amongst Indigenous communities. Prior to the arrival of Euro-Americans, travel by canoe was the primary mode of transportation within Puget Sound, allowing groups to gather for trade, feasting, and ceremonial events. Cedar trees were fashioned into canoes, as well as yielding planks for houses and bark for fiber.

The Steh-Chass village was located on the eastern shore of Budd Inlet in what is today downtown Olympia. Steh-Chass houses and canoes lined the beach, and different Coast Salish groups came to this area to trade. The Southern Coast Salish groups in this area were signatories of the 1854 Medicine Creek Treaty. However, after the outbreak of the Puget Sound War (1855 to 1856), the Steh-Chass and others were confined to Squaxin Island, which lacked drinking water, and a palisade was erected across the peninsula to exclude native people. After the

conclusion of the war, some Steh-Chass returned to the peninsula, but in 1859, Olympia passed an ordinance prohibiting native people from living on streets or vacant lots. Those employing native people were required to provide lodging.

When the Medicine Creek Treaty was ratified in 1859, lands in the South Puget Sound stretching from the Cascades to the Black Hills were officially ceded to the U.S. Government by the treaty signatories. This area includes the ancestral lands of the Squaxin Island Tribe, Nisqually Indian Tribe, and Confederated Tribes of the Chehalis Reservation. This treaty was the first negotiated between the U.S. Government and Indigenous groups in the Washington Territory and recognized certain rights, amongst them fishing rights in all “usual and accustomed grounds and stations.” This right was later upheld by the Boldt decision in 1974. The treaty led to the establishment of the Squaxin Island Reservation, Nisqually Reservation, and Puyallup Reservation.

3.9.1.2 Recorded Archaeological Resources

Only a small percentage of the Project Area has been subject to systematic archaeological investigation. However, given the shoreline setting of the Project Area and its proximity to water, much of the Project Area is classified as Very High to High Risk for the presence of precontact-era archaeological resources. Only in limited areas along the southern portion of the Middle Basin and west of the South Basin is archaeological risk classified as Moderate, Moderately Low, or Low Risk. Upland areas adjacent to the North and South Basins contain recorded precontact-era archaeological sites, and it is likely that further as-yet-undiscovered sites are buried in fill in the uplands adjacent to all three basins. It is also possible that some archaeological sites could extend downslope into the basins, again buried by fill or sediment.

Olympia’s waterfront and Downtown Historic District, as well as Tumwater, were developed largely by building on placed fill. Extensive filling along the shoreline of Capitol Lake created new landforms, such as Marathon Park, the Interpretive Center, and much of the shoreline of the North Basin. Archaeological studies along Capitol Lake and in the vicinity of the Olympia Downtown Historic District demonstrate that placed fill has capped cultural sites, often burying them by several feet and preserving archaeological materials.

Recorded and potential archaeological sites encompass a range of types and time periods. Such sites contain important information about the lives of Indigenous people, Chinese and Chinese-Americans, European Americans, and others who lived, worked, and frequented the

area, and have been reported in comments received on the Draft EIS to convey cultural and spiritual association with the Project Area. Precontact to ethnohistoric period occupation (camp and village) sites have been documented in upland areas, including within and adjacent to the Olympia Downtown Historic District, along the shores of Capitol Lake, and in the vicinity of Tumwater Falls. Given the extensive and long-term use of the tidelands and tideflats, areas within the Deschutes Estuary and Budd Inlet have a high potential to also contain archaeological sites with evidence for Indigenous hunting, gathering, and fishing, such as fish weirs and net weights.

Historic archaeological sites related to the area’s commercial and industrial development have also been documented. Landforms in the vicinity of 5th Avenue Dam are more notable for recorded historic-era archaeological sites rather than precontact-era sites. Recorded resources include “Heritage Park Bottle Dump” associated with the Olympia Brewing Company Bottle Works Plant Site in the North Basin, as well as refuse dumps and structural ruins. Also, the “Roadbed of the Olympia and Chehalis Valley Railroad” is situated along the western shoreline of the Middle Basin. In addition to these sites, the potential for archaeological sites related to Chinese and Chinese-Americans, and other ethnic and historically marginalized groups, is high in the former locations of communities like Chinatown and Little Hollywood. Table 3.9.1 lists the previously recorded archaeological sites in the study area and their register status.

Precontact/Historic Era

Archaeological resources are commonly classified by whether they date to the period before contact between Indigenous and non-Indigenous people (“precontact era”) or after contact (“historic era”).



Exhibit 3.29 Black and white aerial view of Capitol Buildings and Deschutes Estuary in Olympia facing north, circa 1927 (Source: unknown)

Table 3.9.1 Recorded Resources within the Cultural Resources Study Area

| Site Type | Proximity to Project Area | Site Number | Site Name | Description | Register Status |
|--|---------------------------|--------------------------|--|--------------------------------------|-----------------|
| Precontact Archaeological (North Basin) | Non-Adjacent | 45-TN-233 ⁽¹⁾ | Deschutes Park-Way Shell Midden | Shell midden, camp, lithic | Not evaluated |
| Precontact Archaeological (North Basin) | Adjacent | 45-TN-271 | Lower Deschutes Basin West Shell Midden | Shell midden | Not evaluated |
| Historic Archaeological (North Basin) | Within | 45-TN-242 | Heritage Park Bottle Dump, Olympia Brewing Company Bottle Works Plant Site | Debris scatter / concentration | Not evaluated |
| Multi-Component Archaeological (North Basin) | Adjacent | 45-TN-241 ⁽¹⁾ | Deschutes Parkway Beach Site / Steh-Chass / Squaxin Site | Shell midden, camp, historic objects | Not evaluated |

| Site Type | Proximity to Project Area | Site Number | Site Name | Description | Register Status |
|--|---------------------------|--------------------------|---|---|---------------------------------------|
| Precontact Archaeological (Middle Basin) | Adjacent | 45-TN-5 | -- | Shell midden "Shelly Point" | Not evaluated |
| Historic Archaeological (Middle Basin) | Within | 45-TN-232 | Roadbed of the Olympia and Chehalis Valley Railroad | Railroad grade 1878–1976 | Not evaluated |
| Historic Cemetery (Middle Basin) | Adjacent | 45-TN-480 ⁽²⁾ | Monroe Point Cemetery | Inactive. First use ca. 1848. | Not evaluated |
| Historic Cemetery (Middle Basin) | Non-Adjacent | 45-TN-424 | St. Johns Columbarium | Active. First use unknown. | Not evaluated |
| Historic Archaeological (South Basin) | Non-Adjacent | 45-TN-470 | 1 st and 2 nd Mill Addition Historic Debris Scatter | Debris scatter / concentration | Not evaluated |
| Historic Archaeological (South Basin) | Within | 45-TN-520 | Remains of Milling Facilities | Information unavailable | Information unavailable |
| Multi-Component Archaeological (South Basin) | Non-Adjacent | 45-TN-119 | Clanrick Crosby Property | Shell midden, feature, historic structures, historic debris | Not evaluated |
| Multi-Component Archaeological (South Basin) | Within | 45-TN-40 | Stehtsasamish and Tum Chuck | Shell midden, feature, lithics, historic objects | Not evaluated |
| Historic Cemetery (South Basin) | Non-Adjacent | 45-TN-372 | Masonic Memorial Park | Active. Earliest use ca. 1852/1859. | Not evaluated |
| Historic Cemetery (South Basin) | Non-Adjacent | 45-TN-374 | Schmidt Family Cemetery | Inactive. Earliest use ca. 1911. | Not evaluated |
| Precontact Archaeological (West Bay) | Within | 45-TN-380 | Garfield Creek Shell Midden | Shell midden | Not evaluated |
| Historic Archaeological (West Bay) | Non-Adjacent | 45-TN-201 | Percival's Dump | Debris scatter / concentration | Not evaluated |
| Historic Archaeological (West Bay) | Within (in water) | 45-TN-238 | Wooden structures and piling | Historic bridges | Determined National Register Eligible |
| Historic Archaeological (West Bay) | Within | 45-TN-239 | Historic Debris Scatter | Debris scatter / concentration | Not evaluated |
| Historic Archaeological (West Bay) | Within | 45-TN-381 | Tumwater Lumber Mill | Historic logging property | Not evaluated |

| Site Type | Proximity to Project Area | Site Number | Site Name | Description | Register Status |
|---|---------------------------|-------------|---|--|---------------------------------------|
| Historic Archaeological (West Bay) | Within | 45-TN-440 | West Bay Log Booming | Historic maritime property | Not evaluated |
| Historic Archaeological (West Bay) | Within (in water) | 45-TN-441 | Industrial Petroleum Piles | Historic industrial | Not evaluated |
| Historic Archaeological (West Bay) | Within (in water) | 45-TN-442 | Reliable Steel | Historic industrial | Not evaluated |
| Historic Archaeological (West Bay) | Non-adjacent | 45-TN-511 | Historic Bottle Dump | Debris scatter / concentration | Not evaluated |
| Historic Archaeological | Non-Adjacent | 45-TN-527 | 4 th Avenue East Trolley | Historic public works | Not evaluated |
| Multi-Component Archaeological (West Bay) | Adjacent | 45-TN-250 | 4 th Avenue Bridge Historic Dump | Shell midden and historic objects | Not evaluated |
| Multi-Component Archaeological (West Bay) | Non-Adjacent | 45-TN-519 | Second Street Midden, Olympia Dead Zone | Precontact shell midden, historic shell midden, historic debris scatter / concentration | Determined National Register Eligible |
| Multi-Component Archaeological (West Bay) | Non-Adjacent | 45-TN-522 | -- | Precontact and historic components, historic shell midden, historic debris scatter / concentration | Determined National Register Eligible |
| Multi-Component Archaeological (West Bay) | Non-Adjacent | 45-TN-526 | Franklin Street Shell Midden and Historics | Precontact shell midden, historic shell midden, historic objects | Not evaluated |
| Maritime (Historic) (West Bay) | Within | | Sandman tug | | Not evaluated |
| Maritime (Historic) (West Bay) | Within | | Percival's City Dock | | Not evaluated |

Notes:

Source: DAHP 2022

1. The Squaxin Island Tribe consider 45-TN-233 and 45-TN-241 to constitute a single archaeological site (Croes et al. 2000).
2. 45-TN-480 is recorded as both a cemetery and an archaeological site – this resource has been counted as a cemetery.

3.9.2 What historic built environment resources can be found in the study area?

3.9.2.1 Historic Setting of the Study Area

The Capitol Lake Basin began as a natural feature, part of the estuary transitioning between the freshwater Deschutes River and the saltwater tides of Budd Inlet. Over time, several events have changed the character of the Capitol Lake Basin: the establishment of Tumwater and Olympia; the growth of the west side of Olympia; the crossing of multiple railroad lines; and the evolution of the Capitol Campus, which includes the addition of the Des Chutes Basin Project (Capitol Lake).

In 1889, Washington became a state and Olympia the state capital. The state legislature selected New York architect Ernest Flagg to design the capitol building. Flagg's proposal oriented the capitol building to the south, and only the foundation was built. Twenty years later, the State Capitol Commission held a design competition for a master plan and design of a group of capitol buildings, and selected architects Wilder & White's submittal. In their design, Wilder & White identified the capitol building site's height above the surrounding water (Middle and North Basins) and the city as key to conveying its monumental significance. The State Capitol Commission hired the Olmsted Brothers to develop a preliminary plan for the general layout based on Wilder & White's capitol group design.

In 1912, the Olmsted Brothers worked with the State Capitol Commission and Wilder & White, showing reorganization of the land at the base of the bluff. Ultimately, Wilder & White opted for their layout of the capitol group, which was accepted by the State Capitol Commission and construction commenced. In 1927, the now State Capitol Committee (SCC) retained the Olmsted Brothers to design the campus landscape and approaches to the capitol group.

Much of the present-day configuration of the Capitol Lake Basin was established as part of the Des Chutes Basin Project, initiated by the State Legislature in 1937 through House Bill 530 authorizing work on the Des Chutes Basin Project in part "to be in keeping with and become a part of the capitol building and grounds; [...]." This work included clearing development from the shoreline of the Capitol Lake Basin, buying back tidelands, and developing the 5th Avenue Dam and Bridge, and Deschutes Parkway. The SCC retained James W. Carey & Associates to develop the overall design, which ultimately included selecting an earth fill dam for the 5th Avenue Dam, completed in 1951.



Exhibit 3.30 Deschutes Dam construction, April 8, 1950 (Source: The Susan Parish Collection of Photography, Washington State Archives)

For additional information on the historic setting, see the Cultural Resources Discipline Report (Attachment 13). This includes further information on the historic development context and themes applicable to the history of the Capitol Lake area, such as early European settlement, Chinese-American settlement, land development, State Capitol development and design, commercial development, transportation, and neighborhood development.

3.9.2.2 *Historic Built Environment Resources*

Historic built environment resources in the study area include historic districts and individually designated resources, both listed and those eligible for listing in the NRHP and other historic registers.

To determine potential impacts, the EIS analysis considered both listed historic resources and surveyed and evaluated for eligibility, historic resources that would be directly, or potentially indirectly impacted by one or more of the action alternatives for listing in the NRHP and other historic registers. During the Section 106 and/or EO 21-02 process, the lead federal agency will make a determination of eligibility for the identified resources, and forward that determination to DAHP in a letter with a request for concurrence on the determination(s).

The field survey results were combined with information from previous historic resources investigations to create a comprehensive inventory of the historic built environment of the study area. The comprehensive inventory includes both listed and eligible resources as well as those that have not been reviewed for eligibility. More than 100 historic resources were identified in the historic built environment study area, along with five existing historic districts. Figure 3.9.1 shows the location of the historic districts, as well as the individually listed and designated resources. For more information on the individual resources, see the Cultural Resources Discipline Report (Attachment 13).

Many of the individually eligible resources are within one of the five existing historic districts described below (and shown in Figure 3.9.1):

- **Tumwater Historic District (Listed).** The Tumwater Historic District, located within the Project Area in the South Basin, is listed on both the NRHP and the Washington Heritage Register. The historic district encompasses most features remaining from Tumwater's early development and includes the 1906 Brewery Building, Crosby house (built ca. 1860), and Henderson house (built ca. 1905). Tumwater Historical Park is also within the district.

- **Olympia Downtown Historic District (Listed).** The Olympia Downtown Historic District is listed in both the NRHP and the Washington Heritage Register. The district is adjacent to the Project Area in the North Basin and West Bay.
- **Downtown Olympia Historic District (Listed).** The Downtown Olympia Historic District is listed in the Olympia Heritage Register. The district is adjacent to the Project Area in the North Basin and West Bay.
- **Washington State Capitol Historic District (Listed).** The Washington State Capitol Historic District is listed in both the NRHP and Washington Heritage Register. The district is adjacent to the Project Area in the North and Middle Basins.
- **South Capitol Neighborhood Historic District (Listed).** The South Capitol Neighborhood Historic District is listed in both the NRHP and Washington Heritage Register. The district is adjacent to the Project Area in the Middle Basin.

Four historic resources identified during the EIS scoping period along with two additional resources identified during EIS preparation were surveyed at the intensive level. The initial four resources were the Capitol Lake – Deschutes Estuary, 5th Avenue Dam, 5th Avenue Bridge, and the Northern Pacific Railway Deschutes River Bridge. The two additional resources were Deschutes Parkway and the Olympic Street W Bridge. Three additional resources were surveyed at the reconnaissance level utilizing photographs taken during the initial site visit: the Percival Creek Bridge, Marathon Park, and a residence at 731 4th Avenue W.

Following release of the Draft EIS, DAHP reviewed the following historic resources (which included review of the Cultural Resources Discipline Report and associated HPI forms) and determined the following three historic resources are **eligible** for listing in the National Register (DAHP 2021):

- Olympic Street W Bridge
- 5th Avenue Dam
- 5th Avenue Bridge

As part of this review, DAHP determined the following five historic resources are **not eligible** for listing in the National Register (DAHP 2021):

- Capitol Lake – Deschutes Estuary
- Residence at 731 4th Avenue W
- Marathon Park

- Deschutes Parkway
- Des Chutes Basin Project relative to historic district eligibility

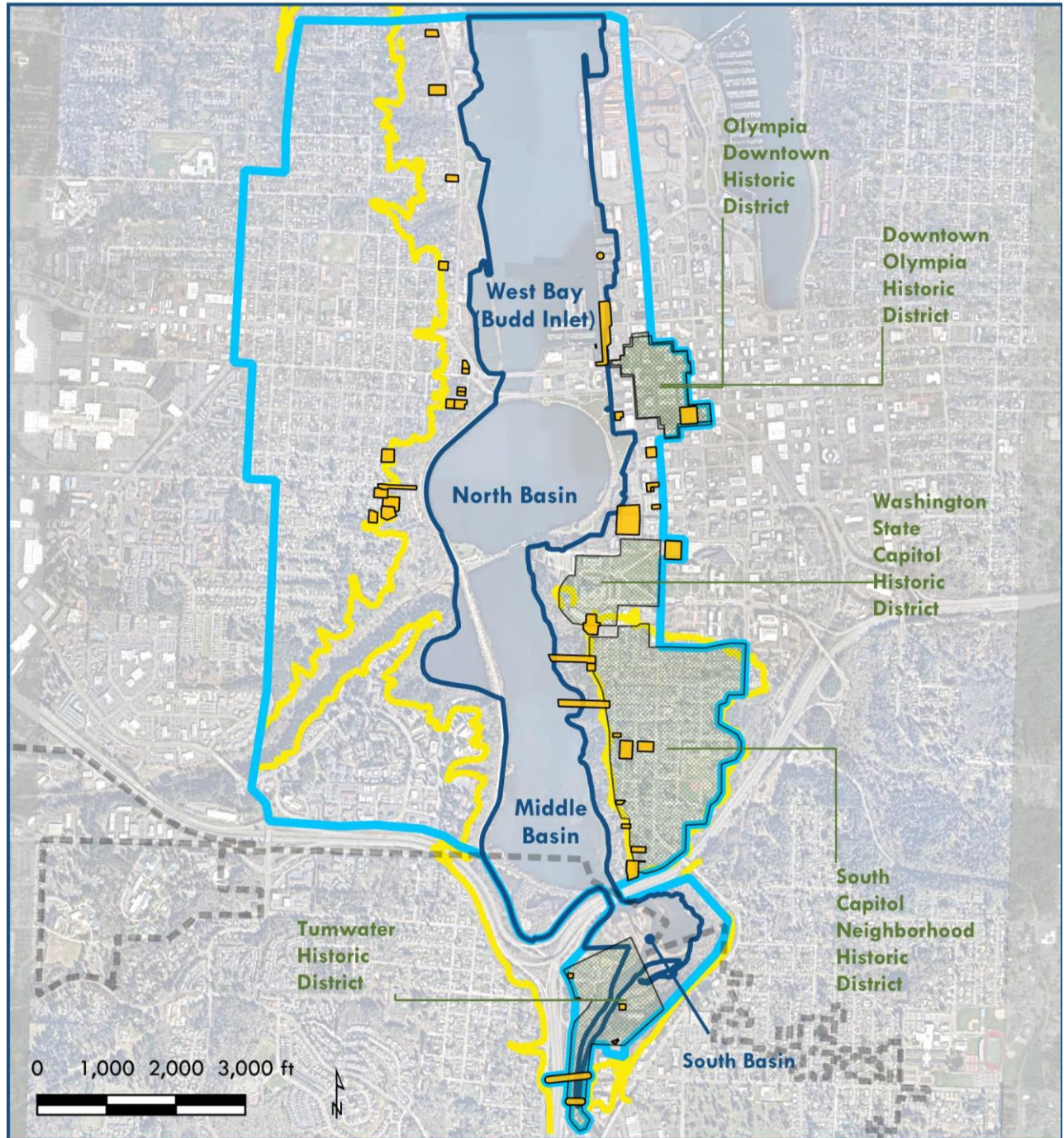
The information presented in the Final EIS has been updated accordingly based on DAHP's 2021 determination of both eligible and not eligible resources, as listed above. In particular, the Draft EIS included a recommendation of the Capitol Lake – Deschutes Estuary as an eligible resource, and had also recommended the designation of the Des Chutes Basin Project Historic District; analysis in the Draft EIS was based on these resources being potentially eligible. Results and conclusions in the Final EIS have been revised to reflect that these are not eligible resources, per DAHP (2021).

Similarly, the EIS Project Team makes the following recommendations, based on the field survey findings. DAHP has yet to issue a determination on the National Register eligibility of these two resources.

- Percival Creek Bridge (recommended as **eligible** for National Register, Washington Heritage Register, or Olympia Heritage Register).
- Northern Pacific Railway – Deschutes River Bridge (recommended as **not eligible** for National Register, Washington Heritage Register, or Olympia Heritage Register).

For additional information, see the Cultural Resources Discipline Report (Attachment 13).

Figure 3.9.1 Historic Districts & Listed Historic Resources



Legend

- Individually Listed and Designated Resources
- Historic Districts
- Project Area
- Historic Built Environment Study Area
- 130 foot contour line
- City Limits

3.9.3 Are there traditional cultural properties in the study area?

As part of an earlier planning effort for the Capitol Lake Basin, a study was conducted in 2009 of cultural and spiritual values associated with future alternatives for the Capitol Lake Basin (*Study of Cultural & Spiritual Values Associated with Future Alternatives for Capitol Lake Basin*). The study was intended to identify the cultural and spiritual values associated with the Capitol Lake Basin held by a variety of stakeholders, and to assess potential impacts on those values from proposed alternatives for Capitol Lake Basin at that time.

Values were identified through document review and interviews with stakeholders, including representatives of:

- The Native American community (the Squaxin Island Tribe)
- The Olympia Chinese-American community

The 2009 report contains information regarding beliefs and experiences associated with the Capitol Lake Basin, which are summarized below. Stakeholder participants in the earlier study confirmed to the EIS Project Team that the 2009 report remains a valid representation; no new information on the communities' current ties to the area were identified.

In addition, Enterprise Services made written inquiries to the Squaxin Island Tribe and Nisqually Indian Tribe regarding the potential presence of traditional cultural properties and areas of concern. No specific information has been received from either tribe.

3.9.3.1 Squaxin Island Tribe

The Deschutes Estuary is the ancestral home to many of the Squaxin Island Tribe's members. The Deschutes Estuary was originally inhabited by the Steh-chass people who occupied the area around Budd Inlet. The Deschutes watershed continues to be used for ceremonial, subsistence, and commercial harvesting of natural resources, and is a place of strong cultural and spiritual value. The tribe sees value and significance of the Capitol Lake – Deschutes Estuary area as a provider, educator, connection to ancestors, and source of meditative tranquility. In addition, the natural condition of the original river and estuary is valued for the sake of itself. In its natural state, the basin provided water and mud for spiritual cleansing rituals; fish, shellfish, birds, and eggs; medicinal plants; and materials for basket-weaving such as sweetgrass. The tribe considers that a reintroduced estuary could be an educational resource to teach people about nature,

Traditional Cultural Properties

A desktop analysis of previously documented traditional cultural properties listed in the Washington Information System for Architectural and Archaeological Records Data (WISAARD) maintained by DAHP was conducted; none were identified within the study area.

Gwitsawdit

A prominent tribal value linked to the basin is **Gwitsawdit**, which are sacred "teachings of the land" that describe the balance of life and value of nature, and emphasize the interconnectedness of all aspects of the environment—an interconnectedness that was disrupted by construction of the 5th Avenue Dam.

land, and ancestors, as the area was once an important regional hub of Indigenous trade and transportation.

3.9.3.2 Chinese-American Community

The Chinese-American community is linked to the Deschutes Estuary through Olympia’s historic Chinatown.

Chinese immigrants first arrived in Olympia during the mid-19th century. Many found employment as construction laborers, in lumber camps, harvesting shellfish, commerce, and domestic work. From its roots on 4th Avenue W at Columbia Street and Capitol Way, Chinatown moved progressively south and west to 5th Avenue SW and Water Street SW, and the waterfront district known as Little Hollywood.

During the economic depression of 1882 to 1885, Chinese residents in Seattle and Tacoma were forcibly removed, but this did not happen in Olympia. However, anti-Chinese immigration laws and sentiment eventually led to the abandonment of Olympia’s Chinatown. In 1937, the SCC was authorized to develop and extend the State Capitol grounds, which involved purchasing or condemning basin and tidelands. Little Hollywood was razed in 1943, and remnants of Chinatown are now gone.

The Chinese-American community values the area as an embodiment of the American Dream. Capitol Lake Basin represents a first immigrant home in the U.S., and it was a starting point for establishing Olympia’s Chinese-American community. This experience is commemorated in a historic marker at Heritage Park Fountain, the site of the former Chinatown. The dedication of the Olympia Dragon Mural at the corner of 5th Avenue SW and Columbia Street SE in 2019 to commemorate the Chinese-American business community that was located along Columbia Street underscores the continued connection of this community with the area.

3.10 VISUAL RESOURCES

Visual resources are natural and human landscapes that are valued for their views. However, the importance of, sensitivity to, and impacts from changes to views can vary greatly from person to person. Public preferences for certain views are expressed in several planning policies and regulations.

The study area for visual resources extends beyond the Project Area to the areas where the project would be visible. This includes public viewpoints, scenic routes and highways, and views from private properties. The study area includes Deschutes Parkway and the parks



Exhibit 3.31 Black and white photograph of the City of Olympia (including Little Hollywood, Governor Hotel) from the west side of the Deschutes Estuary, looking east toward Mt. Rainier, 1942.

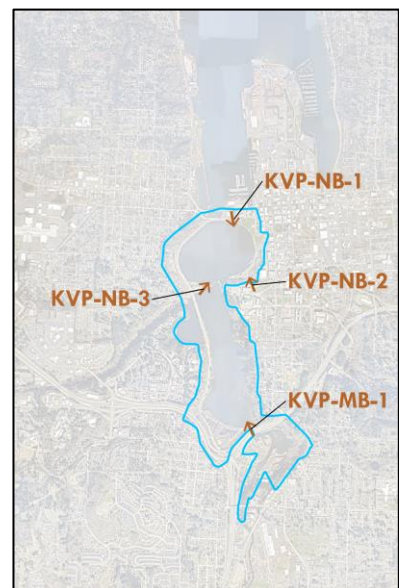


Exhibit 3.32 Visual Resources study area and key view points (KVPs) used for visual simulations

around the lake's north, west, and south shores; a portion of the Capitol Campus on the eastern shore; and the shorelines lining the southeast shore of the lake. Images in this section were taken from photo points, as shown on Figure 3.10.1.

Methods for Studying Visual Resources

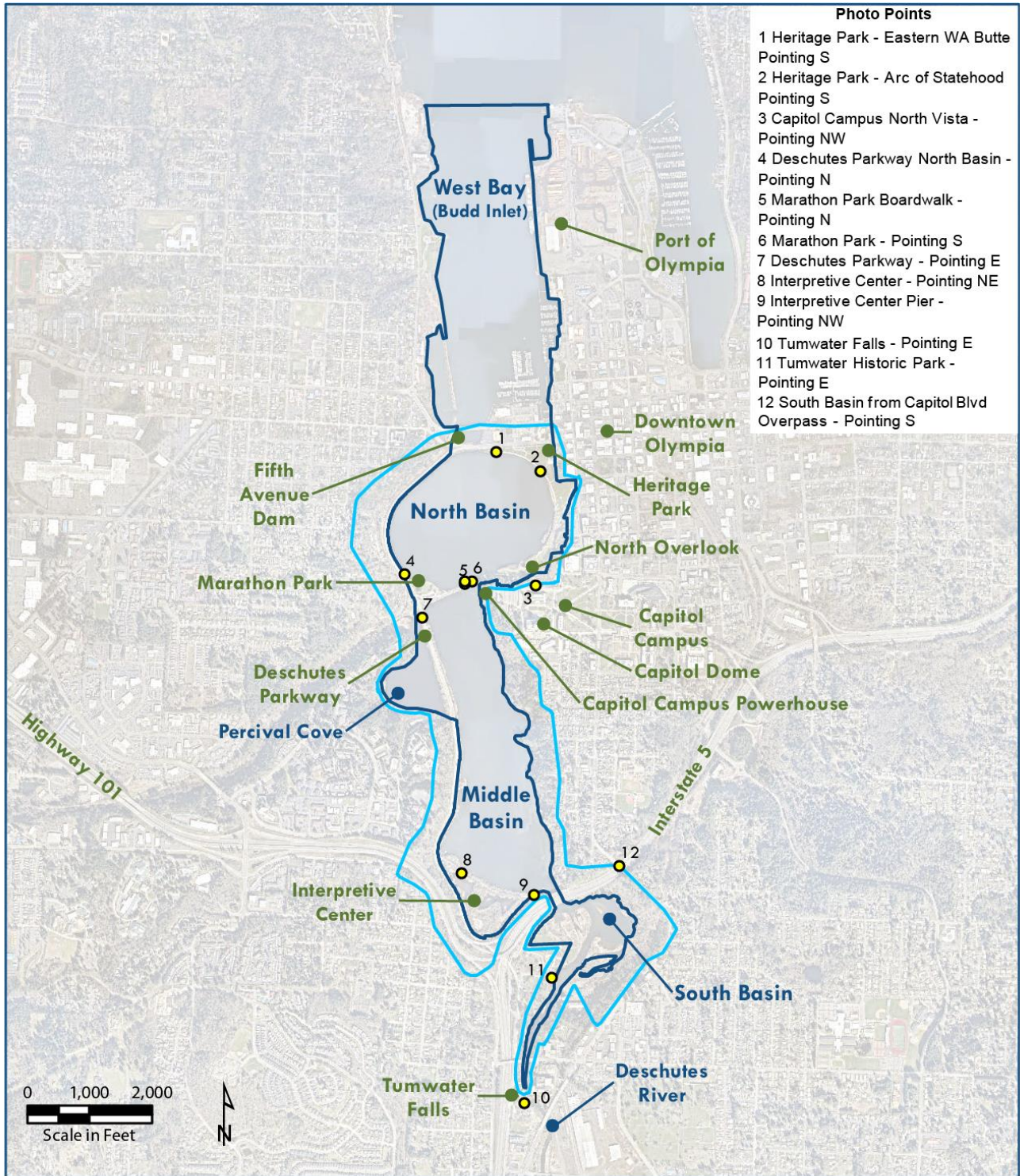
The affected environment was evaluated based on a review of the study area landscape and its uniqueness within the regional landscape, with reliance on agency policies to determine specific features that are valued. Data sources used for the analysis include aerial and terrestrial photography; GIS data including terrain, vegetative cover, and 3D modeling of structures and vegetation; relevant policy and planning documents; and land and shoreline use regulations applicable to the study area.

The full list of data sources is presented in the Visual Resources Discipline Report (Attachment 14).

3.10.1 What is the relevant context and regulatory landscape for this viewshed?

Capitol Lake is a large waterbody and a highly valued visual resource. Capitol Lake and the adjoining parks define edges of downtown Tumwater and Olympia, and contribute to the setting for the Washington State Capitol. The design of the Capitol Campus takes advantage of views of the water as a connection with the larger landscape setting that includes Puget Sound and the Olympic Mountains. While the state has adopted regulations regarding the use of Capitol Lake, no state regulation specifically directs the management of views or visual quality. Master Plans for the Capitol Campus do include goals relating to the views of the water and Olympic Mountains from the North Overlook. At a local level, the Cities of Tumwater and Olympia have policy guidance related to a general preference for protecting public views of the water, water's edge, and surrounding mountain views, and for naturalistic design treatments, but do not call out specific views that must be preserved (aside from views of the Capitol Dome).

Figure 3.10.1 Visual Resource Photo Locations



- Photo Points**
- 1 Heritage Park - Eastern WA Butte Pointing S
 - 2 Heritage Park - Arc of Statehood Pointing S
 - 3 Capitol Campus North Vista - Pointing NW
 - 4 Deschutes Parkway North Basin - Pointing N
 - 5 Marathon Park Boardwalk - Pointing N
 - 6 Marathon Park - Pointing S
 - 7 Deschutes Parkway - Pointing E
 - 8 Interpretive Center - Pointing NE
 - 9 Interpretive Center Pier - Pointing NW
 - 10 Tumwater Falls - Pointing E
 - 11 Tumwater Historic Park - Pointing E
 - 12 South Basin from Capitol Blvd Overpass - Pointing S

Legend

- Photo Point
- ▭ Project Area
- ▭ Study Area

3.10.2 What are the existing views within the North Basin?

The North Basin includes Heritage Park, Deschutes Parkway, and Marathon Park. The North Basin is noted for views of the Capitol Dome, which are available around much of the east, north, and west perimeter of Capitol Lake. The North Basin can also be seen from the Capitol Campus, particularly from the North Overlook. The North Basin is also a defining visual feature at the southwest edge of downtown Olympia. Views from taller buildings in downtown Olympia include the basin. The North Basin consists of four Landscape Similarity Zones, described in the following sections.

Landscape Similarity Zones

Landscape Similarity Zones are areas that have similar views and types of viewers within the basins.

3.10.2.1 Heritage Park

The area east of the 5th Avenue Dam is dominated by Heritage Park, a highly visited public park that is an extension of the Washington State Capitol Campus. The park comprises the east shoreline of the North Basin and is generally flat. At the northern edge of Heritage Park, a mound known as the Eastern Washington Butte offers views across the North Basin toward the Capitol (see Exhibit 3.33). The southeast portion of the North Basin also provides views of the Capitol Dome and large areas of water (see Exhibit 3.34).



Exhibit 3.33 Photo Point 1: Heritage Park Eastern Washington Butte looking south toward the Capitol Dome



Exhibit 3.34 Photo Point 2: Heritage Park Arc of Statehood shoreline looking south toward the Capitol Dome

The views from Heritage Park extend to Marathon Park and Deschutes Parkway. Views do not extend to the Middle Basin because of the BNSF Railway Trestle, which marks the division between the basins. The views looking south toward the Capitol Campus are highly unified, with the formal tree plantings along the shorelines leading to the

forested hillside topped by the Capitol Dome. There are some private views of Heritage Park from taller buildings downtown.

3.10.2.2 Capitol Campus North Overlook

The North Overlook, located on the Capitol Campus atop a steep hillside, offers views of Capitol Lake, downtown Olympia, Budd Inlet, Puget Sound, and the Olympic Mountains beyond (see Exhibit 3.35). Heritage Park stands in the foreground and the marinas and buildings of downtown Olympia form the middle ground of the view. The 5th Avenue Dam is visible on the far shore of Capitol Lake, but it is not prominent.

The view from the North Overlook provides a strong sense of place for viewers visiting the Capitol Campus.



Exhibit 3.35 Photo Point 3: Capitol Campus North Vista looking northwest

3.10.2.3 Deschutes Parkway

Deschutes Parkway extends west of the 5th Avenue Dam and continues south, along the west shore of the North Basin. Views from Deschutes Parkway are primarily open water (see Exhibit 3.36). The far shoreline is Heritage Park, which appears as a line of trees along the shore, with a low urban skyline behind it. The 5th Avenue Dam is visible but not prominent. Overall, the view is highly unified, like the view from Heritage Park. For a person traveling on the roadway, views of the water are intermittent, interrupted by parked vehicles as well as the street trees and in some areas, low shoreline vegetation. A few houses uphill and west of the parkway have views across the North Basin.



Exhibit 3.36 Photo Point 4: Deschutes Parkway looking east toward downtown Olympia

3.10.2.4 Marathon Park

Marathon Park is a large open space in the southwest portion of the North Basin. Views from this park are similar to those from Deschutes Parkway. Marathon Park has an east-west oriented boardwalk that crosses the channel between the North Basin and the Middle Basin. The views from this vantage point looking northeast across the North Basin afford the only experience of being over the water on the North Basin (see Exhibit 3.37). The views to the south from the Marathon Park boardwalk have a railroad bridge in the foreground (see Exhibit 3.38).



Exhibit 3.37 Photo Point 5: Marathon Park boardwalk looking northeast toward downtown Olympia



Exhibit 3.38 Photo Point 6: Marathon Park boardwalk looking south toward Middle Basin

3.10.3 What are the existing views within the Middle Basin?

The Middle Basin is bounded on the north by the BNSF Railway Trestle and on the south by the I-5 bridge. Viewed from a distance, both the eastern and western shores of the Middle Basin appear heavily vegetated and form a naturalistic frame for the open water of the basin. Except when standing near them, the built elements (the bridges and the Capitol Campus Powerhouse) are not dominant features in this landscape. Like the North Basin, the Middle Basin as a waterbody is predominantly open water. There are overwater views of the Capitol Dome from viewpoints on the south and west sides of the basin. Trails at Percival Cove and the Interpretive Center provide very different visual experiences where vegetation varies in height from very low to well overhead. The Middle Basin consists of three Landscape Similarity Zones described in the following sections.

3.10.3.1 Deschutes Parkway

The west shore of the Middle Basin is a continuation of Deschutes Parkway. The Middle Basin also includes Percival Cove, a largely natural area that is separated from the main basin by a causeway and bridge, which Deschutes Parkway traverses. Views are similar to those in the North Basin except that the roadway has open water on both sides. The Capitol Dome can also be seen along much of the corridor.

3.10.3.2 Interpretive Center

The Interpretive Center, at the southwest edge of the Middle Basin near the I-5 bridge, is made up of wetlands and paths, and has two small piers that provide close visual access to the water. The pathways afford views across the wetlands in the park as well as views north along the long sweep of the Middle Basin. From the shoreline path, open water and tree-lined shores dominate the view. In places, the Capitol Dome can be viewed (see Exhibit 3.39). Along other pathways, views are obscured by shrubby shoreline vegetation, but there are also openings where the entire basin can be observed.

This zone includes portions of I-5 and US Highway 101, as well as a small area upslope from US Highway 101. Only fleeting views of the Middle Basin are available from these highways.



Exhibit 3.39 Photo Point 8: Interpretive Center looking northeast toward the Capitol Dome

3.10.3.3 East Shore

There are no public view locations along the waterfront of the east shore. The area is mostly privately owned and has an extensive tree canopy on the steep slopes that line the shore and block views from the streets. The east shore of the Middle Basin is composed of steep slopes rising approximately 100 feet (30 meters) above the water level, forested with a mix of deciduous and coniferous trees (see Exhibit 3.40).

At the northeast end of the Middle Basin is the Capitol Campus Powerhouse, a historic industrial building nestled in the slope that provides steam heat to the Capitol Campus (see Exhibit 3.41). Viewed from Deschutes Parkway or the Interpretive Center, the eastern shore appears as a unified landscape of forest greenbelt, with the Capitol Dome and the I-5 bridge to the south being the only built features of any prominence.



Exhibit 3.40 Photo Point 9: Interpretive Center pier looking northwest



Exhibit 3.41 Photo Point 7: View from Deschutes Parkway looking east across Middle Basin to the Capitol Campus Powerhouse

3.10.4 What are the existing views within the South Basin?

The South Basin is bounded on the north by the I-5 bridge and on the south by Tumwater Falls. The falls form a natural and dramatic visual terminus (see Exhibit 3.42). The South Basin is the smallest of the basins and is dominated by views of riparian wetlands and forest, with the river channel and a small area of open water as a central spine. The South Basin is considered one Landscape Similarity Zone because views of it are similar from most angles, and views from within it, although varied, contain similar visual elements.

The features of the South Basin form a popular tourist attraction, and thousands of visitors come to the area each year to see the river, the fish hatchery, and the historic brewery and other buildings in the area. Most viewers see this zone from within one of the two parks that form the shorelines of this basin. Tumwater Historical Park has open areas with trails leading to the water's edge (see Exhibit 3.43). Brewery Park at Tumwater Falls also has trails and a pedestrian bridge over the river that allow users to see the river up close.

The visual character is largely unified, even in areas where built elements are close to the water. The main exception is the area near the I-5 bridge, where the massive overhead structure contrasts sharply with the rest of the basin.



Exhibit 3.42 Photo Point 10: Tumwater Falls looking east



Exhibit 3.43 Photo Point 11: Tumwater Historical Park looking south toward Brewery Park

3.11 ENVIRONMENTAL HEALTH

Environmental health addresses the physical, chemical, and biological factors that could affect human health. For this project, the chemical quality of sediment was evaluated as the primary potential change to environmental health. Additional information on sediment quality, including data collected for this project, is presented in the Sediment Quality Discipline Report (Attachment 15). Other aspects of environmental health that were evaluated in the EIS include the potential increase or decrease of mosquitos and toxic algae based on changing water quality conditions.

The study area for environmental health consists of areas that could be directly or indirectly affected by construction or operation of the action alternatives. This includes the North and Middle Basins within the Capitol Lake Basin, and West Bay, which could be affected by sediment transport from the Capitol Lake Basin, depending on the long-term management alternative. In this area, sediment quality could change as a result of the project.

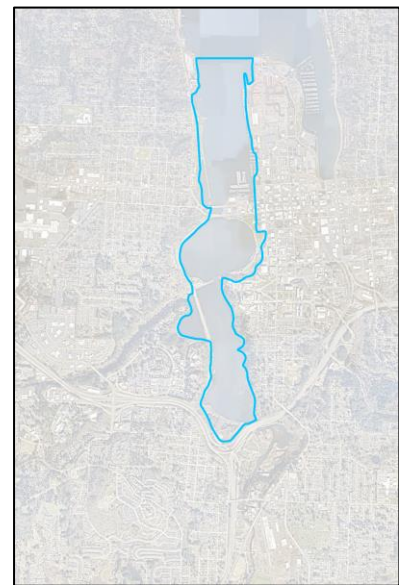


Exhibit 3.44 Environmental Health study area

Methods for Studying Environmental Health

Sediment quality data collected by the EIS Project Team in Capitol Lake, and those data publicly available in West Bay, are compared against regulatory criteria to determine if the sediment poses a risk to the environment. For this study, sediment quality data were compared to the following criteria:

Washington State Sediment Management Standards (SMS) freshwater and marine chemical criteria that are protective of the benthic community and human health in freshwater and marine sediment. SMS sediment cleanup standards chemical criteria include the Sediment Cleanup Objective (SCO) and CSL.

Dredged Material Management Program (DMMP) marine sediment screening levels (SLs) are applicable for any future dredging project in West Bay that would dispose of dredged sediments within the waters of the U.S.

Model Toxics Control Act (MTCA) Method B direct contact soil cleanup levels are used to evaluate options for the beneficial reuse of the sediments at a non-landfill upland location.

The Sediment Quality Discipline Report (Attachment 15) contains the full list of data sources used for the evaluation.

3.11.1 How was existing sediment quality evaluated?

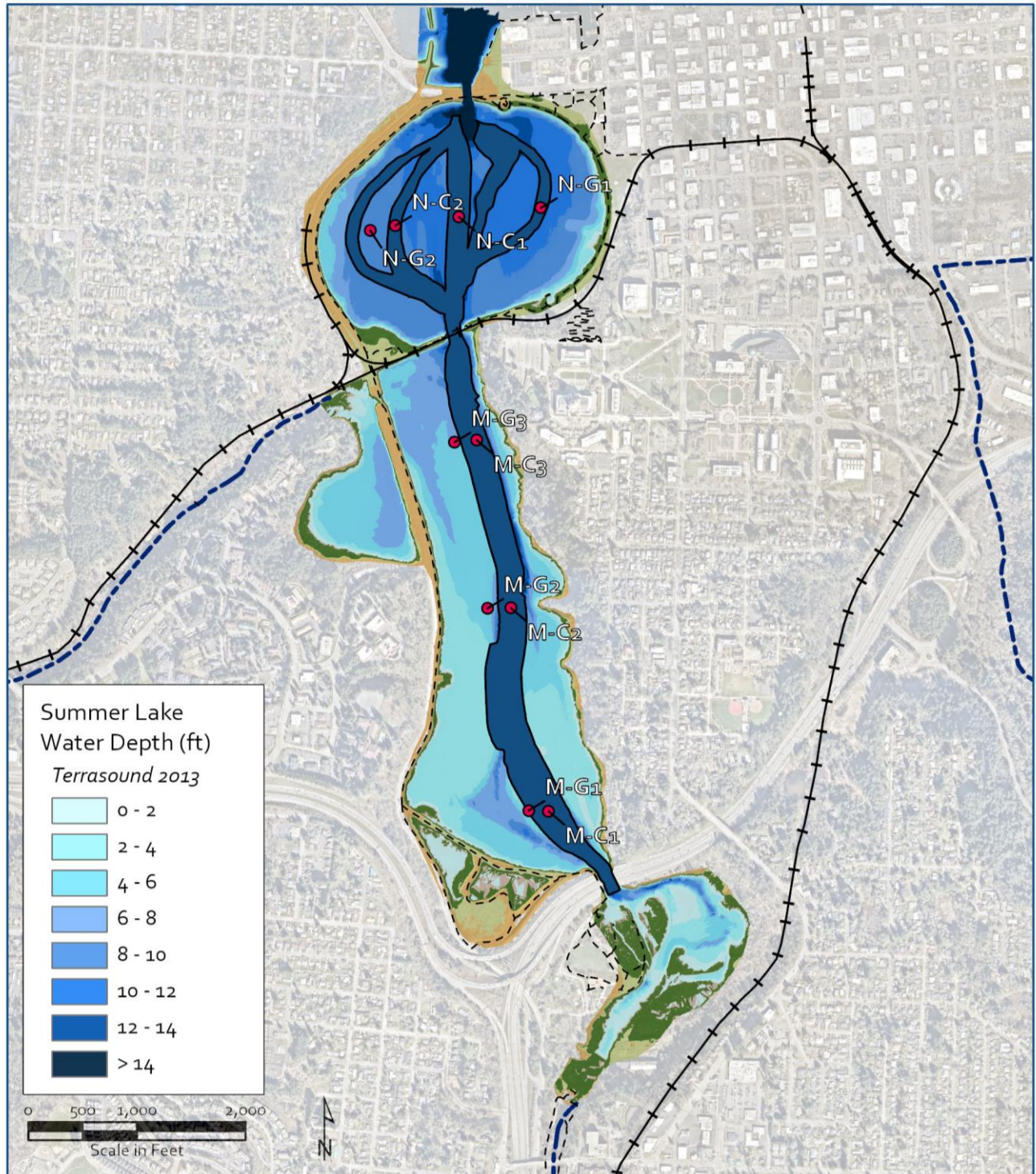
Information about the existing sediment quality conditions in Capitol Lake was obtained during a March 2020 sediment sampling event, as described in Section 3.11.2. Information about sediment quality for West Bay was evaluated using historical data available in Ecology's Environmental Information Management (EIM) online database and existing reports, as described in Section 3.11.3.

To evaluate sediment quality, chemical concentrations in surface sediments were compared to criteria for protecting benthic invertebrates (bottom-sediment dwelling organisms), wildlife, and human health in fresh and marine waters, as well as criteria for allowing potential disposal of sediments removed from the project site to an open-water disposal site in Puget Sound or an upland location.

3.11.2 What is the existing sediment quality in Capitol Lake?

In March 2020, a sediment sampling event was conducted in the North and Middle Basins to support the EIS analysis (Figure 3.11.1). The goal of this sediment sampling was to characterize the physical and chemical quality of sediments within the Capitol Lake Basin to evaluate existing conditions. This information was important for analyzing potential impacts to environmental health during construction and operation of each project alternative.

Figure 3.11.1 Sediment Sample Locations



Legend

- Sampling station
- Footpaths
- Rail
- Streams
- Estuary Channel Dredging Area

Surface, dredge layer, and Z layer sediment samples were collected in the North and Middle Basins in order to understand the quality of sediment that would be dredged and the sediment that would remain. Surface grab samples were collected from the top 3.9 inches (10 centimeters) of the sediment to characterize surface sediment quality. Subsurface sediment cores were collected to characterize the deeper layers. Samples were analyzed for the chemicals listed below. These chemicals were selected for analysis primarily because they are the chemicals that are regulated under SMS. Dioxins/furans do not have similar regulatory criteria under SMS, but have DMMP criteria to inform disposal options.

- Ammonia and sulfides
- Metals
- Butyltins
- Semivolatile organic compounds (SVOCs). For example, polycyclic aromatic hydrocarbons (PAHs), phthalates, and phenols.
- Polychlorinated biphenyls (PCBs)
- Organochlorine pesticides
- Total petroleum hydrocarbons (TPH)
- Dioxins/furans

The data indicated that, overall, Capitol Lake has sediment quality which meets nearly all applicable sediment criteria. See the Sediment Quality Discipline Report for detailed data table and analysis (Attachment 15). Sediment chemical concentrations were low in all three layers of both basins. The only criterion exceeded was the freshwater CSL for total sulfides protective of benthic invertebrates. High sulfide concentrations are common in lake sediments due to microbial decay of natural organic matter present in algae and aquatic plants.

Average concentrations of total sulfides exceeded the freshwater CSL in the surface and dredge layer in both basins, but not in the Z layer of either basin. This is because there is typically a low amount of organic matter in the deeper sediment. Organisms present in the surface layer are likely impacted by the high concentrations of total sulfides (and associated low dissolved oxygen), but not by anthropogenic chemicals.

Although there were detections of other chemicals, none of the observed metals or organic chemicals concentrations would trigger sediment cleanup, as the detected concentrations were less than the CSL and are common in urban areas. Concentrations of dioxins/furans

Three Layers of Sediment Evaluated

Surface layer sediments in many areas would be left undisturbed during and following construction. These are areas that would not be dredged.

Dredge layer sediments may be used to create habitat areas or be removed for off-site disposal or upland reuse (if treated for invasive species).

Z layer sediments are in dredge areas that would become exposed after dredging, but would remain.

Potential Toxic Effects of Total Sulfides

Risk to Benthic Organisms

Sulfides in sediment are naturally occurring. Elevated sulfide levels indicate the sediment may have low oxygen. Sometimes, the elevated sulfides in sediment can be toxic to benthic invertebrates or cause them to avoid the surrounding environment.

No Risks to Human Health

The sulfides that are present in Capitol Lake do not pose a health risk to humans during recreational activities such as boating or swimming.

would not trigger sediment cleanup but may not allow for open-water disposal, depending on the volume-weighted average concentration in all dredged sediments. However, in-water disposal of sediments dredged during construction is not anticipated. Based on the chemical quality, there would be no restrictions for reuse or placement of sediments dredged from Capitol Lake at an upland location based on chemical concentrations.

Overall, the data were consistent with past historical studies from Capitol Lake, which have always shown the sediment in Capitol Lake to be of good quality.

3.11.3 What is the existing sediment quality in West Bay?

Sediment quality in West Bay was evaluated for this project because of the potential for characteristics to change if the 5th Avenue Dam was removed and sediment was deposited in West Bay from the Capitol Lake Basin; and to evaluate the potential impacts to sediment quality if sediment was transported from West Bay into the Capitol Lake Basin during flooding/incoming tides.

Sediment quality has been evaluated in West Bay in four studies conducted between 2008 and 2019. Sediment sampling locations are shown on Figure 3.11.2. In general, sediment quality in West Bay has not met sediment quality criteria based on data provided in these historical studies. Contaminants of primary concern include carcinogenic PAHs and dioxins/furans, which affect human and ecological health, and are located throughout West Bay, while localized exceedances of benthic criteria, which protect biological organisms in the sediment, occur near stormwater outfalls. Results from the studies are summarized below, and the sediment data from all the studies are available in Ecology's EIM database.

Sediment chemical concentrations in West Bay only exceed SMS and DMMP criteria for select chemicals. The exceedances occur near the stormwater outfalls in the Fiddlehead Marina and the Port of Olympia along the eastern shoreline of West Bay. Chemicals that exceed SMS criteria included organic compounds (phthalates, benzoic acid, benzyl alcohol, acenaphthene [a PAH]) and mercury. In general, lower concentrations of chemicals were found in the central and southwest areas of West Bay.

Summary of Sediment Sampling in West Bay

- **2008:** A characterization study of existing sediment data was conducted by Ecology. As part of this study, all sediment data available in the EIM database for Budd Inlet were evaluated for exceedances of cleanup criteria.
- **2011 and 2018:** Sediment monitoring was conducted by Ecology's Marine Sediment Monitoring Team as part of the Puget Sound Sediment Monitoring Program.
- **2013:** Extensive sediment monitoring was conducted by the Port of Olympia in the vicinity of the Port of Olympia peninsula for developing a conceptual site model, sediment cleanup criteria, and remedial alternatives for the study area.
- **2019:** Historical data review and sediment sampling was conducted on behalf of the LOTT Budd Inlet Treatment Plant as part of evaluating compliance with their stormwater discharge permit.

See the Sediment Quality Discipline Report for detailed data tables and analysis (Attachment 15).

Average concentrations of dioxins/furans and carcinogenic PAHs in West Bay were calculated for comparison to their respective regional background concentrations that are protective of ecological and human health. The average dioxin/furan concentration for West Bay did not exceed regional background but did exceed the DMMP SL for disposal sites, indicating that these sediments, if dredged, cannot be disposed of in open water disposal sites. The average carcinogenic PAHs concentration for West Bay exceeded regional background, indicating potential impacts to ecological and human health. As Budd Inlet is currently an active site with on-going remedial activities, surface weighted average concentrations may be biased low when compared to results once site boundaries and SCUs are developed in the future.

Ecology has identified four sites around Budd Inlet that will require future cleanups based on existing chemical concentrations in sediments or in the uplands (soil and groundwater). These cleanup sites are presented in Figure 3.11.2 and described below.

- **Port of Olympia Peninsula Investigation.** The Port of Olympia has investigated contamination of the peninsula located between and including part of East Bay and West Bay and is currently evaluating possible cleanup actions for an interim cleanup action plan with Ecology. Ecology has not provided a timeline for that cleanup, but it is a foreseeable future action.
- **Reliable Steel.** A draft cleanup plan was prepared in 2014 but cleanup has not yet occurred. Contaminants found at concentrations greater than sediment cleanup levels include metals, PAHs, and phthalates.
- **Solid Wood Inc.** Initial investigations found levels of metals, TPH, and PAHs that exceeded MTCA criteria for soil or groundwater. An interim cleanup was conducted in 2009 for soil and groundwater contamination and a remedial investigation is currently underway.
- **Cascade Pole.** The Port of Olympia has been required by Ecology to conduct monitoring every 5 years to monitor conditions. The most recent sediment monitoring samples collected in 2017 are less than the project cleanup action levels and showed decreasing trends in PAH and dioxin concentrations compared to previous sediment monitoring events (2002, 2007, and 2012).

Regional Background

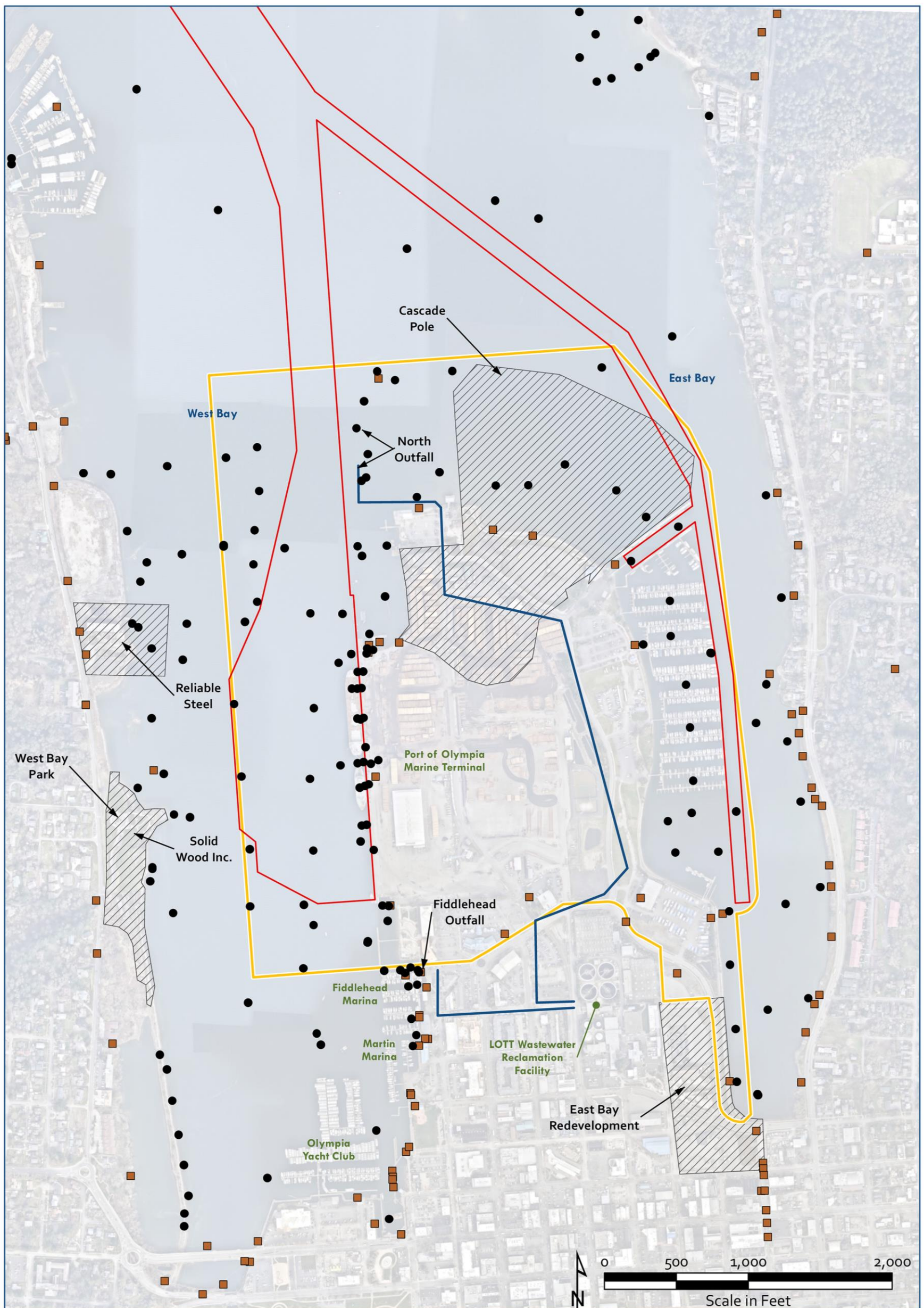
Regional background is the concentration of a chemical in the environment that exists from both natural sources and from man-made diffuse sources not associated with a specific cleanup site, such as traffic and other widespread impacts from urban environments.

For chemical concentrations less than regional background concentrations, cleanup is not required.

What is the sediment quality in the Project Area?

The sediment in Capitol Lake meets nearly all applicable sediment quality standards. The sediments in West Bay are impacted by carcinogenic polycyclic aromatic hydrocarbons (cPAHs) and dioxins/furans and future cleanups are planned to address the contamination.

Figure 3.11.2 Surface Sediment Sample, Outfall, & Cleanup Site Locations in West Bay



Legend

- Cleanup Site
- Federal Navigation Channel
- Port of Olympia Peninsula Investigation
- LOTT Outfall
- Stormwater Outfall
- Historical Surface Sediment Sample Location

3.11.4 How are mosquitoes relevant to environmental health?

Within the state of Washington there are 52 species of mosquitoes, of which 26 have been identified in Thurston County. Mosquitoes are known vectors capable of spreading disease-causing agents to humans. In 2008 the Washington State Department of Health (WDOH) reported that 12 species of mosquitos found in Thurston County were West Nile Virus (WNV) positive. However, detection or isolation of WNV viral RNA in a species of mosquito does not indicate that the species is a competent vector for the disease, but is an indication that the species has come into contact with the WNV transmission cycle. Two species of mosquito, *Culex pipiens* and *Culex tarsalis*, are considered the state's primary vectors of WNV, both of which are known to occur within Thurston County. Other mosquito-borne illnesses include Western Equine Encephalitis and St. Louis Encephalitis. The Centers for Disease Control reported that in 2018 there were a total of 56 mosquito-borne disease cases within Washington State.

Mosquitoes lay their eggs in standing water and moist soil and have adapted to a wide variety of habitats including ponds and marshes. Larvae are rarely found in deep water lakes and ponds or in flowing water such as streams or rivers.

A study conducted on the salinity tolerance of six different species of mosquitoes found that 100% mortality occurred with salinity levels between 10.2 and 17 ppt (30% to 50% saltwater). Of the six species *C. pipiens* was found to be the least salinity-tolerant species. A different study found that *C. tarsalis* had a higher salinity tolerance, up to 70% saltwater. These findings are applied to the analysis of potential changes in mosquito presence under the project alternatives.

3.11.5 Why is toxic algae considered as part of the environmental health analysis?

Capitol Lake experiences summer-time algal blooms. The algae community within the lake is primarily dominated by diatoms and cyanobacteria (blue-green algae). As described in Section 3.3, Water Quality, the lake experienced one blue-green algal bloom, which occurred in August 2004. People are typically exposed to toxic algae through contact with skin, inhalation of aerosols, or by consuming toxins via contaminated shellfish or water. Exposure can be linked to recreational activities associated with swimming, boating, and fishing. Symptoms of exposure to a toxic algae generally depend on the length

Cyanobacteria

Cyanobacteria, also called blue-green algae, are a group of algae primarily found in inland waters that can have major effects on water quality.

and type of exposure, but include irritation to the skin, eyes, nose, throat, and respiratory system. Some forms of cyanobacteria create toxins called cyanotoxins, which can impact the nervous system, liver, skin, stomach, and intestines.

In the past, Budd Inlet has been closed to shellfishing due to the presence of Diarrhetic Shellfish Poison (DSP). DSP is a biotoxin produced by a microscopic algae, *Dinophysis*, which is dinoflagellate. If ingested, symptoms of DSP include abdominal pain, vomiting, nausea, and diarrhea. Domoic acid is another biotoxin produced by a microscopic diatom belonging to the genus *Pseudo-nitzschia* that can accumulate in shellfish and cause Amnesic Shellfish Poisoning. Symptoms of Amnesic Shellfish Poisoning include gastrointestinal and neurological disorders and can be life-threatening. In 2008 domoic acid was detected in blue mussels in Budd Inlet.

Dinoflagellate

Dinoflagellates are a widespread group of primarily marine algae known for toxic algal blooms.

Diatom

Diatoms are a major group of algae found in marine water, freshwater, and soil.

Reference Materials for Section 3.11 (beyond those used in the sediment quality analysis)

CDC. 2017. [Harmful Algal Bloom \(HAB\)-Associated Illness](#).

CDC. 2020. [Washington: Vector-borne diseases Profile \(2004-2018\)](#).

Essington, T., et al. [The Biophysical Condition of the Puget Sound: Chemistry, Section 3. Harmful Algal Blooms. Encyclopedia of Puget Sound](#).

WDOH (Washington State Department of Health). 2008. [Guidance for Surveillance, Prevention, and Control of Mosquito-borne Disease, 2008 edition](#).

WDOH. 2019. [Distribution of Mosquitoes in Washington State, Western Washington Mosquito Species by County](#).

WDOH. 2020. [Diarrhetic Shellfish Poisoning \(DSP\)](#).

Kengne, P., et al. 2019. "Tolerance of disease-vector mosquitoes to brackish water and their osmoregulatory ability." *Ecosphere*, 10(10):e02783. 10.1002/ecs2.2783

Bradley, T. and Majorie P. 2000. "The Physiology of Salinity Tolerance in Larvae of two Species of Culex Mosquitoes: The Role of Compatible Solutes." *The Journal of Experimental Biology*, 203 821-830 (2000).

3.12 TRANSPORTATION

The transportation analysis includes the following elements: vehicle traffic on the street system, transit, nonmotorized travel (walking, bicycling), freight service (by rail and truck), and parking.

The study area for transportation includes all roadways, nonmotorized facilities, transit, and rail facilities located within and adjacent to the Project Area, streets that could carry truck trips hauling materials to and from the site during construction, and streets that could experience additional traffic generated by construction of the action alternatives. The study area is adjacent to and just north of the intersection of I-5 and US Highway 101. Deschutes Parkway is a major collector running along the western shore of the Capitol Lake Basin. Both 4th Avenue W and 5th Avenue SW are roadways and bridges that cross the basin between West Bay and the North Basin. The information presented in this section is summarized from the Transportation Discipline Report (Attachment 16).

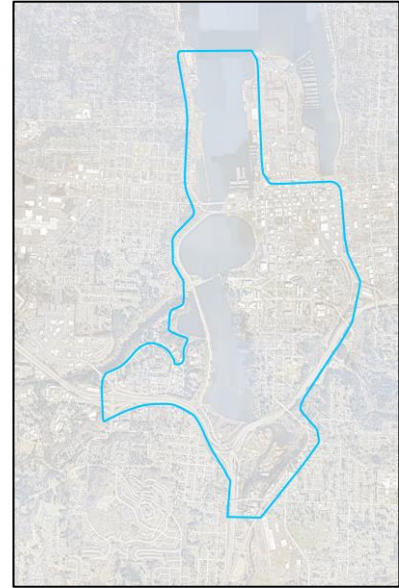


Exhibit 3.45 Transportation study area

Methods for Studying Affected Environment

Data sources used for studying the affected environment for the transportation analysis include inventories of street, sidewalk, bicycle, and rail facilities in GIS format, as well as transportation planning and policy documents for the jurisdictions in which the facilities are located. Adherence to applicable engineering design and construction standards adopted at the federal, state, and local levels were also taken into account. Sources used in the transportation analysis include (among others) the City of Olympia Comprehensive Plan and Engineering Design and Development Standards; the City of Tumwater Transportation Master Plan; Thurston County GIS data; and the Washington State Department of Transportation (WSDOT) Design Manual and Standard Specifications for Road, Bridge, and Municipal Construction.

The full list of data sources is presented in the Transportation Discipline Report (Attachment 16).

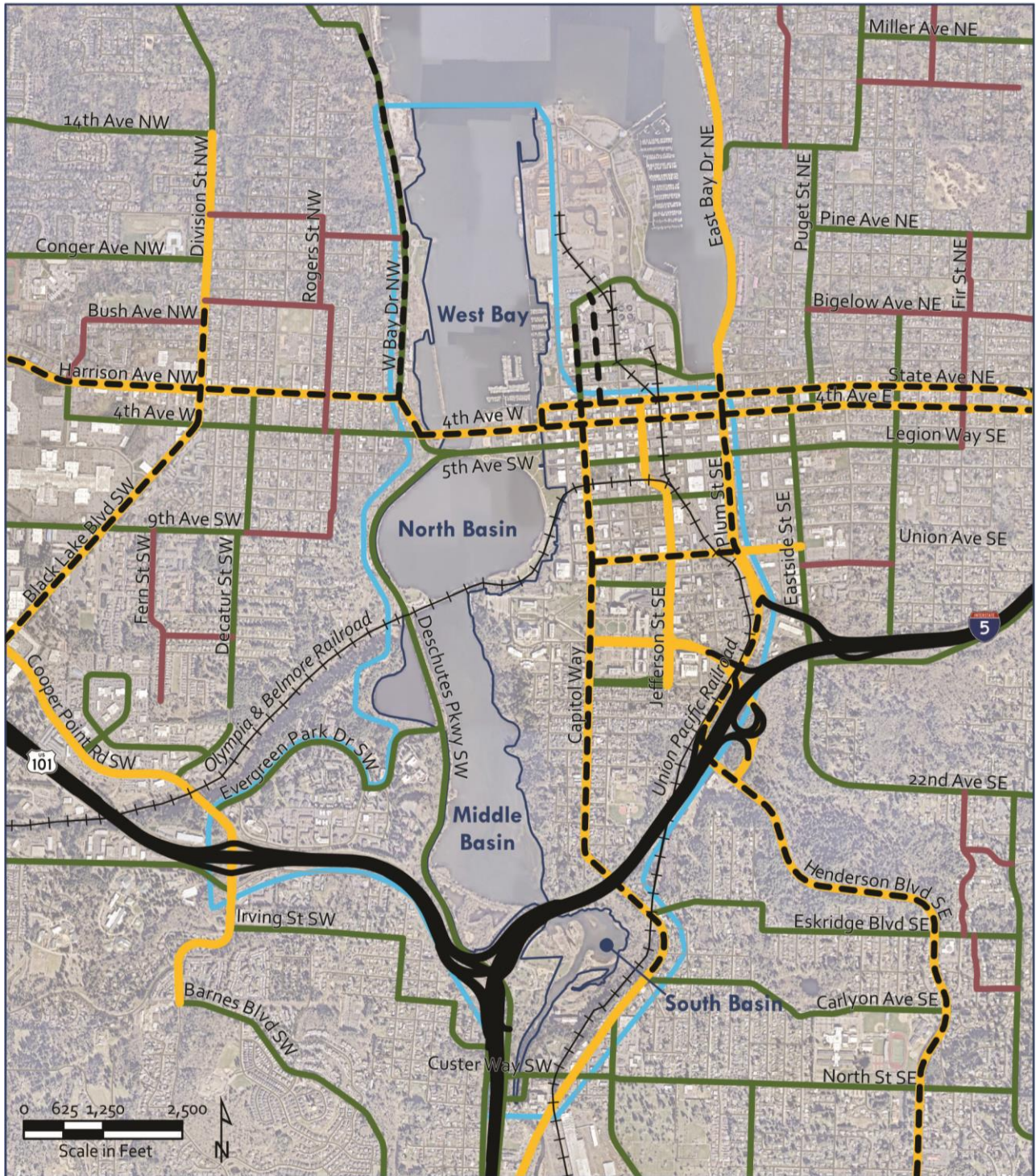
3.12.1 What is the existing street network in the study area?

Figure 3.12.1 shows the street network in the Project Area and study area. Average pre-COVID-19 pandemic daily traffic volumes are listed in Table 3.12.1.

Table 3.12.1 Streets & Corresponding Average Daily Trips in the Transportation Study Area

| Street | Average Daily Traffic (vehicles each day) |
|---|---|
| 4 th Avenue W (across bridge) | 22,000 |
| 5 th Avenue SW (across bridge) | 17,000 |
| Deschutes Parkway | 5,000 – 7,000 |
| Capitol Way S / Capitol Boulevard SE | 7,000 – 12,000 |
| State Avenue NE | 12,000 |

Figure 3.12.1 Street & Freight Network



Legend

- Interstate/Freeway
- Arterial
- Major Collector
- Neighborhood Collector
- Local Access
- Designated Truck Route
- Project Area
- Study Area

3.12.2 What are the existing traffic operations in the study area?

Traffic operations were evaluated based on level-of-service (LOS). The transportation analysis examined existing pre-COVID-19 pandemic peak hour LOS at key intersections within the transportation study area, based on the most recent available information from the Cities of Olympia and Tumwater. For most intersections within the study area, LOS E is the locally adopted standard that applies. All study area intersections within Olympia are operating at LOS C or better during all times of day, with most operating at LOS A or B, and the study area intersections within Tumwater are operating at LOS D or better. These operations are well within the cities' adopted standard of LOS E for these intersections.

3.12.3 What is the existing parking available in the study area?

On-street parking in the transportation study area includes both unrestricted and time-restricted parking facilities. Most of the streets in Downtown Olympia have time-limited parking restrictions, many with parking meters. Unrestricted on-street parking is available on Deschutes Parkway and also along West Bay Drive NW and in the residential neighborhoods to the west of the Project Area. Parking is also available in the public parks in the study area, including Marathon Park and Heritage Park.

3.12.4 What is the existing transit network in the study area?

Bus service is provided in the study area by Intercity Transit. The Olympia Transit Center is located at State Avenue NE/ Washington Street NE in downtown Olympia, and serves as the start and end point for all bus routes that travel through the transportation study area. Before the COVID-19 pandemic, bus routes that serve the transportation study area, either via 4th Avenue W or 5th Avenue SW, include routes 41, 45, 47, and 48 (4th Avenue routes) and 12 and 42 (Deschutes Parkway and 5th Avenue SW routes); most routes provide either daily or weekday service about every 30 minutes. Two Intercity Transit routes (12 and 42) also use Deschutes Parkway.

Level of Service (LOS)

LOS is a qualitative measure used to characterize intersection operating conditions. Six letter designations, "A" through "F," are used to define LOS. LOS A is the best and represents good traffic operations with little or no delay to motorists. LOS F is the worst and indicates poor traffic operations with long delays. The Cities of Olympia and Tumwater have adopted LOS standards that are applicable to streets within the study area.

3.12.5 What is the existing freight network in the study area?

Freight movement within the transportation study area includes truck and rail movement to and from the Port of Olympia, located in West Bay at the south end of Budd Inlet, and also local truck deliveries. The City of Olympia has designated certain streets as truck routes (as shown on Figure 3.12.1). Trucks are restricted to these streets for all freight movement, except for local deliveries. The route between the Project Area and the regional highway system using designated streets would utilize 4th Avenue E, State Avenue NE, and Plum Street SE.

One railroad mainline crosses the Project Area, shown on Figure 3.12.1. These tracks are part of the Olympia & Belmore Railroad, Inc., owned and operated by Genesee & Wyoming. The Olympia & Belmore Railroad, Inc., also provides a link between the Port of Olympia and the national rail freight network (BNSF Railway and Union Pacific Railroad lines). This line serves about three trains each week.

3.12.6 What is the existing pedestrian and bicycle network in the study area?

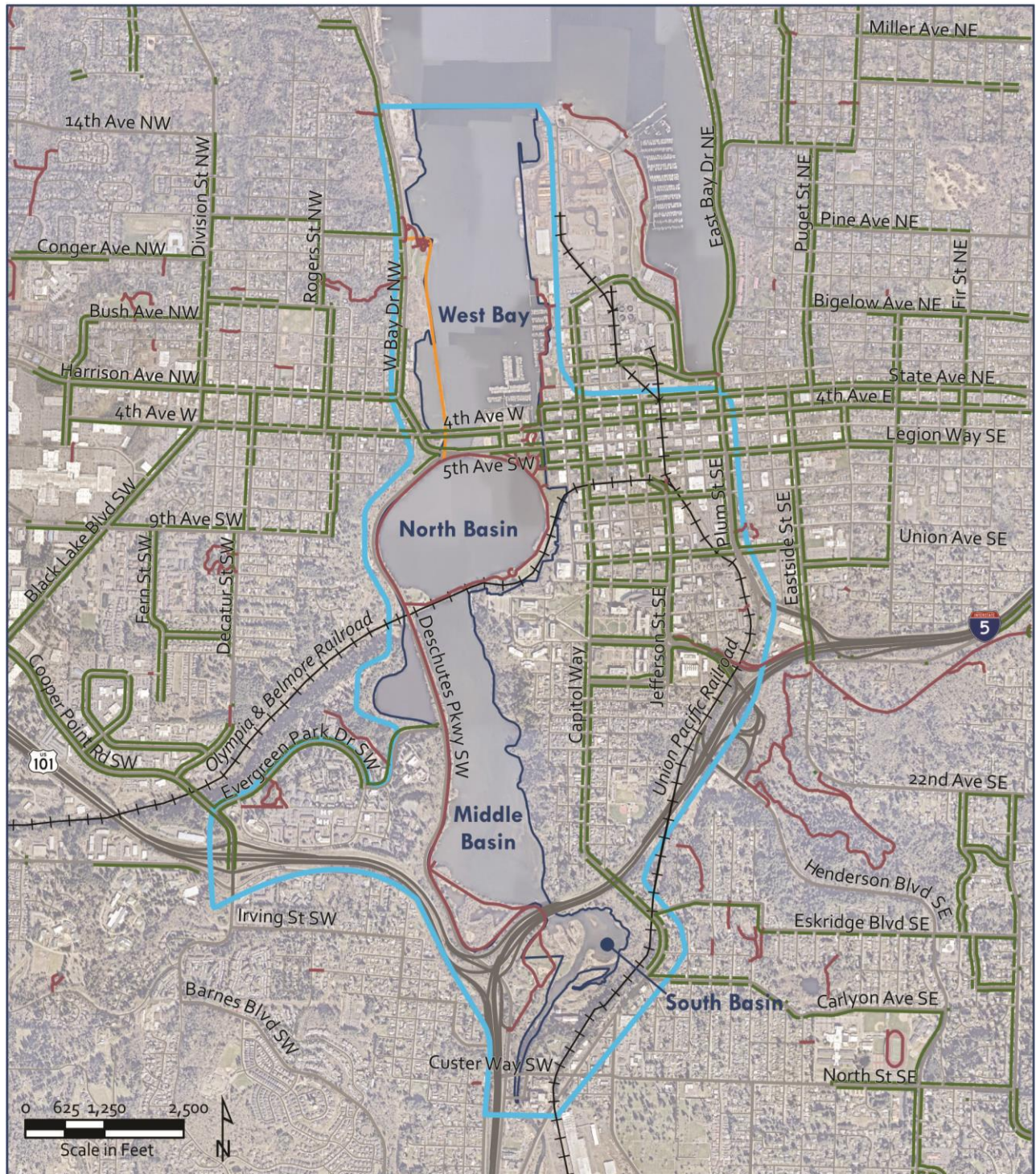
The City of Olympia's walking and bicycling infrastructure supports nonmotorized travel to employment centers, commercial districts, transit stops, schools and major institutions, and recreational destinations. There are several trails near the Project Area, many traversing the parks along the water. Deschutes Parkway, West Bay Drive NW, 4th Avenue W, and 5th Avenue SW are all part of the pedestrian and bicycle network within the study area (see Figures 3.12.2 and 3.12.3). The City of Olympia has evaluated options to upgrade the trail connection to West Bay Park, which is located immediately north of Capitol Lake along the west edge of Budd Inlet. The trail utilizes portions of the former rail corridor that connects to Deschutes Parkway just south of 5th Avenue SW.

The bicycle network includes facilities that are designated by the Thurston Regional Planning Council (TRPC) as Multi-Use Paths, Bike Lanes, and Bike Streets. These designations are consistent with the City of Olympia's designations of Class I Bike Path, Class II Bike Lane, and Class III Bike Route, respectively.



Exhibit 3.46 View of trail linking Marathon Park to east side of Capitol Lake near the Olympia & Belmore Railroad, Inc., railway

Figure 3.12.2 Pedestrian Network



Legend

- Sidewalk
- Public Trail
- Project Area
- Study Area

Figure 3.12.3 Bike Network



Legend

- Multi-Use Path
- Bike Lane
- Bike Street
- Project Area
- Study Area

3.13 PUBLIC SERVICES & UTILITIES

The public services and utilities considered in this analysis include the following:

- Fire and emergency response services
- Water, sewer, and stormwater utilities
- Electricity, natural gas, and telecommunications

The study area for the analysis includes the Project Area and adjacent areas where these services could be affected by either construction or operation of the project.

Information in the EIS is summarized from the Public Services & Utilities Discipline Report (Attachment 17), which includes more detailed information on public services and utilities in the study area, as well as information on the regulatory context.

Methods for Studying Public Services and Utilities

Data and information sources used for the public services and utilities analysis include inventories of sewer and water lines, storm drains, underground gas lines, fiber-optic conduit, electrical transmission lines, and emergency services from local planning documents, as well as interviews with local jurisdictions.

Additional information is presented in the Public Services & Utilities Discipline Report (Attachment 17).

3.13.1 What fire and emergency response services are currently available in the study area?

The Olympia Fire Department and Tumwater Fire Department provide emergency fire and medical services to the study area. Most of the study area is located within Olympia Fire Districts 1 and 2, with a very small portion within District 3. Each district is served by a fire station. The southern portion of the study area is located within the service area of the City of Tumwater Fire Department. No fire stations are located within the study area; however, multiple stations are within 1 mile (1.6 km) of the study area, which ensures a timely response to incidents in the area. Average response times are about 7 minutes for Olympia Fire Districts and about 6 minutes for Tumwater Stations.

Four law enforcement agencies have jurisdictions that overlap the study area: the Olympia Police Department, Tumwater Police Department, Thurston County Sheriff, and Washington State Patrol. All stations and other facilities are located outside of the study area.

County sheriffs are responsible for maintaining the peace within their respective counties and filing complaints within their jurisdictions. Washington State Patrol has jurisdiction over state roadways (I-5 and US Highway 101) and the Capitol Campus.

No hospitals are located within the study area. The nearest hospital is Capital Medical Center, about 1.5 miles (2.4 km) west of the study area.

3.13.2 What water, sewer, and stormwater utilities are currently in the study area?

The water systems for both the Cities of Olympia and Tumwater include wells, reservoirs, pumps, and distribution lines to supply residents with water. Water lines within the study area include a potable water line that is routed across the 5th Avenue Bridge, an 8-inch-diameter (20-centimeter-diameter) line routed along Deschutes Parkway, and a 16-inch-diameter (41-centimeter-diameter) line that is routed under Marathon Park and suspended from the pedestrian bridge adjacent to the Olympia & Belmore Railroad, Inc., railroad.



Exhibit 3.47 Utilities line routed along Deschutes Parkway. View from parkway of Percival Cove

The wastewater systems for both the Cities of Olympia and Tumwater include gravity pipes, pressure pipes, and pump stations. The Olympia Wastewater Utility and Tumwater Water Resources Divisions are responsible for collecting and conveying wastewater flows to regional treatment facilities operated by LOTT. The main treatment facility for LOTT is the Budd Inlet Treatment Plant, which processes approximately 14 million gallons of wastewater on an average day. The Budd Inlet Treatment Plant, located between downtown Olympia and the Port of Olympia, discharges treated water through an outfall in West Bay, and also provides reclaimed water.

A LOTT reclaimed water force main is routed on the western side of the Middle Basin and around the North Basin crossing at the 5th Avenue Bridge and between the North and Middle Basins near Heritage Park. LOTT also owns and maintains a 12- to 18-inch -diameter (30- to 46-centimeter-diameter) reclaimed water distribution line that is routed along the eastern shoreline of the North Basin, crossing between the North and Middle Basins near Heritage Park along the pedestrian walkway bridge, and running along the western shoreline of the Middle Basin into the City of Tumwater.

The City of Olympia's sewer gravity mains range from 6 inches to 24 inches in diameter, with most pipelines located in the outer portions of the study area. Flow from West Olympia is conveyed across the 4th Avenue Bridge via an 18-inch-diameter sewer gravity main.

Two pump stations are located adjacent to the North and Middle Basins: one at the south end of Budd Inlet east of the 4th Avenue Bridge and the other (Percival Pump Station) near the southwestern portion of the North Basin. Sanitary sewer infrastructure within the study area includes a 22-inch-diameter high-density polypropylene gravity line to the west of the Middle Basin, a 20- to 24-inch-diameter force main routed to the west of the North Basin and across the 5th Avenue Dam, and a 24-inch-diameter ductile iron pipe under the pedestrian bridge adjacent to the BNSF Railway Trestle. In the City of Tumwater portion of the study area, a water treatment structure is located just south of the junction between I-5 and US Highway 101, adjacent to the east side of I-5. There are three wastewater lift stations (also referred to as pump stations) located in the vicinity of the South Basin. Most of the water lines and sewer lines within the study area are made of ductile iron. The storm system for each city includes a system of catch basins, conveyance lines, and outfalls. Figure 3.13.1 shows the wastewater, water, and stormwater lines and structures located in the study area.

Within the study area, there are approximately 74 corrugated metal (steel) pipe (CMP) stormwater outfall sites, of which 63 are located within the shoreline of Capitol Lake. In addition to outfalls within the City Olympia and City of Tumwater storm systems, state-owned and privately owned outfalls discharge to the lake. Figure 3.13.2 shows the type and location of each outfall.

Increased flooding from both extreme river flows and/or sea-level rise can damage utility infrastructure. A major concern in downtown Olympia is the impact of floodwaters on stormwater infrastructure. The City of Olympia has a combined sanitary sewer and stormwater system, which means that when floodwaters enter storm drains, generally the water is routed to the Budd Inlet Treatment Plant on the East Bay of Budd Inlet. Increased groundwater elevations due to sea level rise can also cause excess infiltration into sanitary sewer mains.

Contributions of floodwater to the stormwater system impact the processing capacity of the Budd Inlet Treatment Plant and increase the likelihood of bypassing events, where untreated or partially treated wastewater is discharged directly to Budd Inlet. The overwhelmed sanitary-stormwater system can also back up sewer mains and potentially flood buildings and street drains with untreated sewage. This problem will become more frequent with sea level rise.

Olympia Sea Level Rise Response Plan

To address flooding vulnerabilities of downtown and the combined sewer system, the City of Olympia, LOTT, and the Port of Olympia prepared an Olympia Sea Level Response Plan. In the near term, flooding is managed through emergency response activities, installing backflow prevention on key stormwater outfalls and pipes, and landscaping of low spots to reduce flood impacts. Even with these actions, however, low-lying areas within and adjacent to Heritage Park will be vulnerable to flooding during infrequent, high-discharge flood events in the Deschutes Watershed.

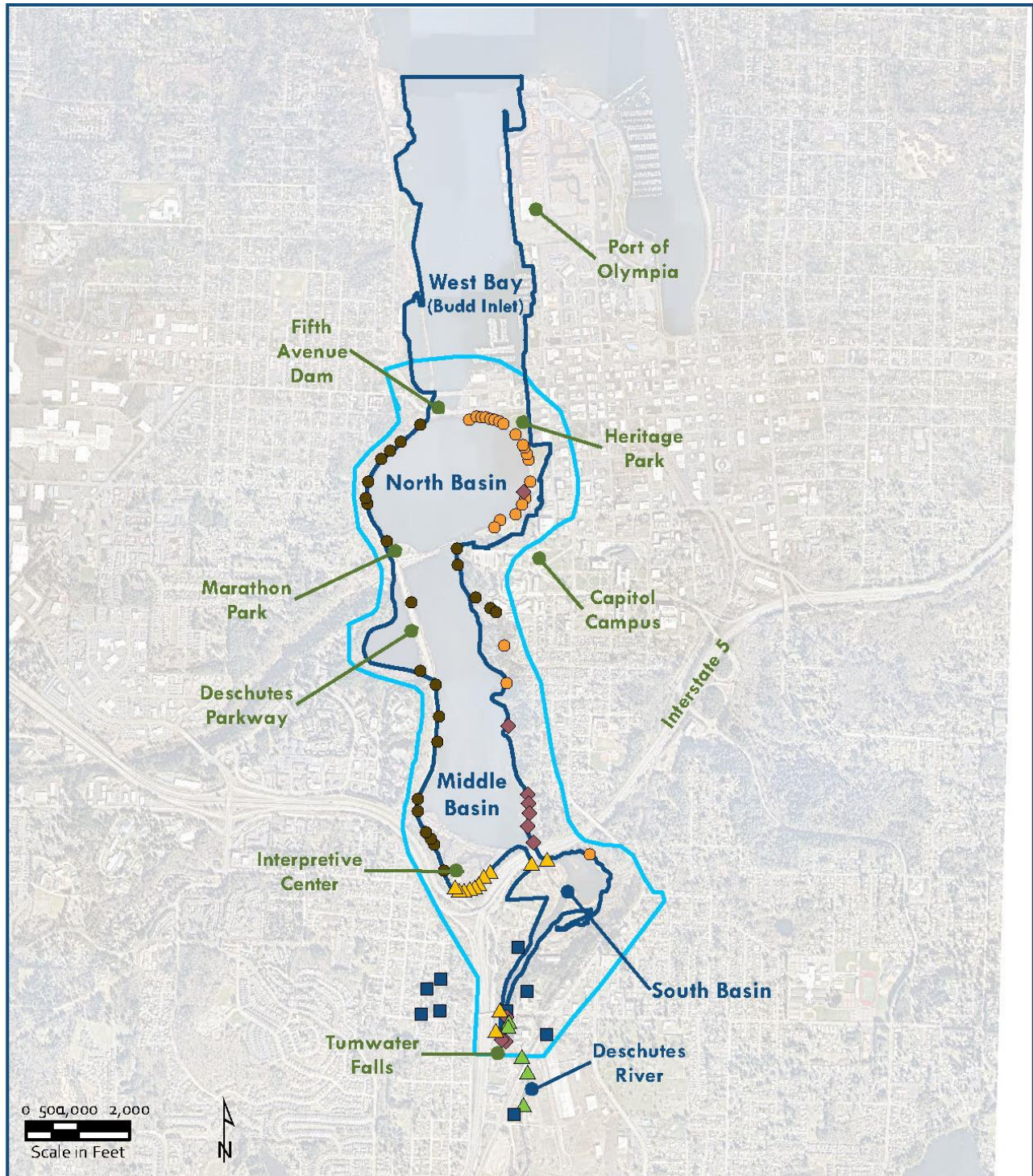
Figure 3.13.1 Capitol Lake Utility Lines and Pump Stations



Legend

- | | | | | |
|--------------|--------------|---------------|--------------------|--------------------|
| Project Area | Pump Station | Service | Lateral Line | Force Main |
| Study Area | Pipe | Pressure Main | Sewer Gravity Main | Storm Gravity Main |

Figure 3.13.2 Capitol Lake Stormwater Outfall Locations



Legend

- | | | |
|--------------|----------------------------------|-------------------------------|
| Project Area | SiteType | City of Olympia Outfall Site |
| Study Area | Enterprise Services Outfall Site | Seep or Other Outfall |
| | Brewery Outfall Site | City of Tumwater Outfall Site |
| | | WSDOT Outfall Site |

Water quality is also an issue of concern for utility services in the study area. As described in Section 3.3.8, Ecology has identified Capitol Lake and the 5th Avenue Dam as the primary cause of human-induced depletion of dissolved oxygen in Budd Inlet (due to altered circulation caused by the 5th Avenue Dam, but more so due to loading of nutrients [carbon] from Capitol Lake. Other anthropogenic sources of nutrients identified include wastewater treatment plants (WWTP) that discharge directly to Budd Inlet (such as LOTT), WWTPs that discharge in Puget Sound north of Budd Inlet, and other non-point pollution sources.

3.13.3 What electricity, natural gas, and telecommunications services are currently in the study area?

Puget Sound Energy (PSE) is the primary electricity and natural gas service provider to the Cities of Olympia and Tumwater, and both electric lines and natural gas lines are located within the study area. Most of the electrical lines are located aboveground. PSE power lines cross the 5th Avenue Bridge and the southeastern portion of the South Basin. In the 5th Avenue Bridge vicinity, east-west aligned overhead powerlines cross over the 4th Avenue W Bridge and the southerly end of West Bay before splitting to the northwest and southwest, just east of the Olympic Street W and Deschutes Parkway fork. Within the study area, natural gas lines are buried and strung under the 5th Avenue Bridge.

A steam plant occupies the shoreline at the northeast edge of the Middle Basin. Known as the Capitol Campus Powerhouse, the plant has produced steam since the 1920s serving east and west Capitol Campus with nearly 3 miles (4.8 km) of steam and condensation piping, providing steam to 12 of the 19 campus buildings.

The primary provider of telecommunication services in the study area is Qwest Corporation, which does business as CenturyLink QC. A number of other private companies (e.g., AT&T, Verizon, Comcast, and Ziply) also maintain fiber optic cables and provide service throughout the area.



Exhibit 3.48 Steam plant on the northeast shore of the Middle Basin

3.14 ECONOMICS

SEPA does not require the economic analysis of a proposed action. As such, the statutes and regulations governing SEPA do not provide specific guidance for what methods to use to analyze economic effects in an EIS. For the Capitol Lake – Deschutes Estuary Long-Term Management Project, however, the Washington State Legislature and project stakeholders have stressed that an economic analysis is a critical component of the EIS and is needed to support the overall decision-making process. According to the Washington State Legislature in Engrossed Substitute Senate Bill 6095 (2018):

"The appropriation in this section is subject to the following conditions and limitations: ... The environmental impact statement must also consider an expanded area around Capitol Lake and Budd Inlet including the Port of Olympia for the economic analysis. The environmental impact statement must consider the use of equal funding from nonstate entities including, but not limited to, local governments, special purpose districts, tribes, and not-for-profit organizations."

The Funding and Governance Work Group is coordinating the approach to future funding and management of the resources associated with the Capitol Lake – Deschutes Estuary. The Funding and Governance Work Group includes representatives from Enterprise Services, Department of Natural Resources, the Squaxin Island Tribe, the Cities of Olympia and Tumwater, Thurston County, the Port of Olympia, and LOTT. The economic analysis presented in the EIS helps to inform decision-making.

In the absence of relevant laws, plans, and policies governing economic resources, the methodology followed for the EIS is consistent with professional standards of economic analysis, in the context of environmental impact review. It reflects federal guidance for using economic analysis in regulatory decision-making, water resource planning, and socioeconomic analysis under NEPA.

Based on scoping and early project coordination among the EIS Project Team, Enterprise Services, and stakeholders in the region, it was determined that the economic analysis for the EIS would focus on the following key topics:

- Downstream economic activity
- Development in downtown Olympia (both commercial and residential)
- Demand for and value of recreation
- Demand for and value of ecosystem services

Economics also relates to equity and social justice, topics that are considered in this economic analysis. The subject of economics is interrelated with and linked to other resource topics addressed throughout the EIS, and the affected environments for the latter two topics (recreation and ecosystem services) are described in other sections of the EIS (in particular, Section 3.3, Water Quality, Section 3.6, Wetlands, Section 3.5, Fish & Wildlife, Section 3.7, Air Quality & Odor, Section 3.8, Land Use, Shorelines, & Recreation, and Section 3.9, Cultural Resources). The key factors of the affected environment that influence economic activity and development in the downtown area are summarized in this section, focusing on population, employment, income, and economic activity. The information presented in the EIS summarizes the baseline conditions that inform the analysis of potential long-term and short-term impacts. More details on the affected environment for economics, as well as broader information that provides valuable context, is presented in the Economics Discipline Report (Attachment 18).

Downstream Economic Activity

For this analysis, the term “downstream economic activity” is used to describe directly or indirectly affected economic activity surrounding Budd Inlet, within or near the Project Area—for example, impacts that primarily could affect businesses that are physically downstream of the project (at the Port of Olympia, marinas, and in downtown Olympia), but also throughout the county-wide study area.

Equity & Social Justice

The distribution of economic resources has implications for equity and social justice. By examining who benefits, who experiences costs, and where, when, and how economic impacts materialize across different groups of people, the economic analysis brings into focus issues of fairness and consideration of people’s different needs and values. For this project, key equity and social justice issues are related to tribal values for, and use of, natural resources.

Methods for Studying the Affected Environment for Economics

The affected environment was evaluated based primarily on a literature review of publicly available demographic and economic data, data reported in past assessments of Capitol Lake – Deschutes Estuary long-term management planning, coordination with the Port of Olympia as a primary downstream resource, proprietary data from data service providers, and information generated from interviews and email correspondence conducted specifically for this project. The interviews were conducted by telephone with two groups: (1) planners and economic development officials (to capture the public sector perspective), and (2) private developers and real estate experts (to capture the private sector perspective). The EIS Project Team also conducted an on-site park user survey in the summer of 2019 to gather information about recreational use.

For more information on the data sources and how they were used, see the Economics Discipline Report (Attachment 18).

3.14.1 What are the regional population and economic conditions?

The economy in the study area is influenced by the current and expected future conditions related to population and economic resources in Thurston County and the Cities of Olympia and Tumwater. Background information on population, employment, and income for the study area is summarized in this section. It should be noted that the onset of the COVID-19 pandemic in early 2020 affected economic conditions, resulting in uncertainties regarding future conditions. Existing conditions are described according to available information (most of which is pre-pandemic), and projections based on pre-pandemic conditions are subject to some level of uncertainty. For those conditions that have been described as affected by the COVID-19 pandemic, the data reflect conditions as recent as summer 2020 when the economic analysis was underway.

3.14.1.1 Population

Similar to overall population increases throughout the Puget Sound region, the population in Thurston County increased by 9% between 2010 and 2018 (see Table 3.14.1). Much of that growth occurred in Lacey, which is adjacent to nearby military installations (e.g., Joint Base Lewis-McChord). Within Thurston County, the City of Tumwater has seen the largest rate of growth (30%) as the State of Washington recently opened new campuses to accommodate the state's public-sector workforce and housing remains relatively affordable.

Table 3.14.1 Current Population & Population Change between 2010 and 2018

| Geographic Area | 2010 | 2018 | Percentage Change |
|------------------|---------|---------|-------------------|
| Thurston County | 252,264 | 274,684 | 9% |
| City of Olympia | 46,478 | 50,836 | 9% |
| City of Tumwater | 17,371 | 22,500 | 30% |

As it grows, Thurston County is becoming more ethnically and racially diverse. A quarter of Thurston County residents identify as non-white, followed by 23% of Olympia residents, and 18% of residents in the City of Tumwater. Those who identified as either Hispanic/Latino or Asian alone made up the largest share of non-white residents in the study area. Native American/Alaska Native populations comprised about 1% of the population in the study area.

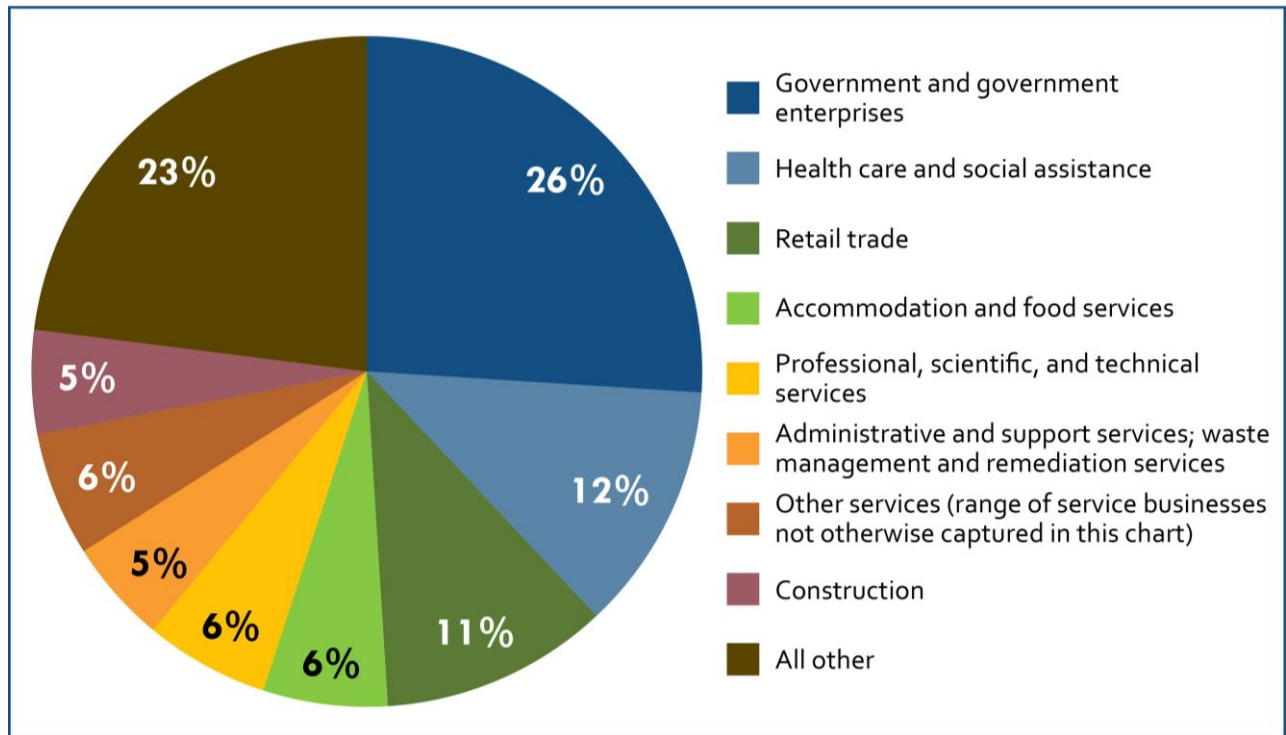
Looking ahead, the Washington State Office of Financial Management estimates that the population in Thurston County will continue to grow, increasing by 26% between 2020 and 2040, with an average annual growth rate of 1%.

3.14.1.2 Employment

Historically, natural resources played an important role in the local economy, with mining and lumber as the main industries in Thurston County through the 1920s. When Olympia was established as the state capitol in 1927, employment in the government sector grew, eventually outpacing the lumber industry in the 1950s. Decades later, the area's accommodation sectors and food services, as well as arts, entertainment, and recreation sectors grew with the passage of the Indian Gaming Regulatory Act (IGRA). Tribal casinos are now among Thurston County's top five employers.

Today, government at the local, state, and federal levels continues to be the county's largest employer. In 2018, about 154,500 people were employed (part-time and full-time) in Thurston County, with most employees (39,855) working in the government sector. The county's five largest private employers that year were Providence St. Peter Hospital, Safeway, Walmart, Nisqually Red Wind Casino, and Lucky Eagle Casino & Hotel. Figure 3.14.1 shows the major employment sectors in Thurston County. Aside from government, employment is heavily concentrated in health care and social assistance, retail, and accommodation and food services.

Figure 3.14.1 Employment by Sector in Thurston County



The employment forecast for Thurston County through 2045 suggests that government will remain the largest employment sector, followed by healthcare and social assistance, professional services, and retail trade (similar to today’s conditions). The sector expected to grow the most between 2017 and 2045 is arts, entertainment, and recreation, which may more than double. Despite this expected growth, it will remain a small proportion of overall county employment. “Other services,” which is a catch-all category that covers a wide range of service businesses, is also expected to grow substantially, likely in part driven by expected steady growth in residential populations and household income.

3.14.1.3 Income

Median household income (MHI) is calculated as the midpoint between the incomes for all households within a defined study area. The City of Tumwater and Thurston County have a higher MHI than Olympia, but the gap has narrowed in recent years. As Table 3.14.2 shows, MHI in both the City of Tumwater and Thurston County has decreased since 2010, while the City of Olympia’s MHI has increased by 3% over the last decade.

Table 3.14.2 Real Median Household Income (2018 Inflation-Adjusted Dollars)

| Geographic Area | 2010 | 2018 | Percentage Change |
|------------------|----------|----------|-------------------|
| Thurston County | \$70,165 | \$69,592 | -1% |
| City of Olympia | \$56,958 | \$58,606 | 3% |
| City of Tumwater | \$69,768 | \$65,167 | -7% |

3.14.2 What is economic activity and development like downstream of the 5th Avenue Dam?

The Port of Olympia has been an economic development resource for the surrounding local and regional economy for over 100 years, even before the 5th Avenue Dam was constructed. Funding for the Port of Olympia is mostly derived from operating revenue (e.g., cargo handling, leases). The Port of Olympia also receives financial support through a tax levy, which in recent years has generated over \$6 million per year. In 2014, the Port of Olympia’s marine terminal, marina, general aviation activity, and real estate tenants supported \$106.1 million in direct wages and 2,400 jobs, with an average salary of \$44,204. Approximately 89% of the direct jobs were held by Thurston County residents. The Port of Olympia was also responsible for almost 1,200 induced jobs and \$90.3 million in purchases of local supplies and services from firms providing direct services to the Port of Olympia.

In addition to the Port of Olympia, economic development adjacent to West Bay includes:

- **NorthPoint**, an area of restaurants and views of Puget Sound. Formerly an industrial site, the area was restored by the Port of Olympia and Ecology in 2006.
- **The Market District**, retail and commercial establishments, the centerpiece of which is the popular year-round Olympia Farmers Market.
- **Private Marinas**, a group of three privately owned marinas (Martin Marina, One Tree Island Marina, and Fiddlehead Marina) adjacent to Percival Landing Park. They consist of 215 boat slips and host family-owned and operated offices and docks. The Port Plaza dock, located north of Fiddlehead Marina and managed by Swantown Marina (Port of Olympia) also generates revenue through temporary moorage fees.



Exhibit 3.49 Port of Olympia



Exhibit 3.50 NorthPoint on the Port Peninsula



Exhibit 3.51 Market District on the Port Peninsula

- **The Olympia Yacht Club**, a private organization offering moorage opportunities to members, sailing education programs in partnership with Olympia Parks, Arts and Recreation, and other activities.
- **West Bay Tidelands**, the western shoreline of West Bay, which is undeveloped and has been the subject of habitat restoration and recreational planning efforts over the past several years. The objective of the restoration is to improve the ecological functioning of West Bay by connecting restoration sites that promote natural coastal processes, while the recreational opportunities would support public use of the shoreline. Ongoing restoration and recreation development activities have the potential to generate employment opportunities and enhance recreational use and spending in the local area. See Figure 3.14.2.



Exhibit 3.52 West Bay Tidelands

Figure 3.14.2 Properties North of 5th Avenue Dam Considered in Downstream Economic Activity Analysis



3.14.3 What are the economic conditions in Downtown Olympia?

Downtown Olympia covers about a half of a square mile (1.3 square kilometers) to the east of the northernmost portion of Capitol Lake, and to West Bay, and is home to more than 450 local businesses and about 1,900 residents. Its main attractions include waterfront activities, a farmers market near the waterfront, various dining and retail establishments, a children’s museum, multiple theaters, and a Creative District that supports artists and cultural venues. City planning efforts support future development in the downtown area. The 2017 Downtown Strategy calls for downtown to absorb 25%, or about 5,000 residents, of the City of Olympia’s population growth over the next 20 years. The City of Olympia plans for a walkable, family-friendly neighborhood with a mix of urban housing options. In recent years, more than \$180 million of public and private money has been invested in development and redevelopment in downtown Olympia.

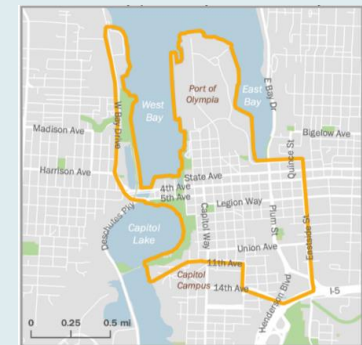
Based on a synthesis of findings from the sources used to study the affected environment (key-informant interviews, market assessment, and literature review), the following conclusions are the most relevant for assessing the potential impact of the action alternatives on development in downtown Olympia:

- The appropriate study area for impacts to development in downtown Olympia is the Downtown Olympia Community Renewal Area, the relevant area defining downtown development in the City of Olympia.
- Population growth in the region is the primary driver of demand for development in downtown Olympia.
- A segment of the growing population is attracted to development similar to what is currently being developed in downtown Olympia: primarily smaller households, which are most often made up of younger and older people.
- Retail demand is currently driven by visitors, workers, and tourists, as well as a growing base of downtown residents. Increasing residential demand will drive new retail growth, which in turn attracts more residential development.
- Downtown Olympia will successfully attract demand for residential development based on two main factors: competitive rents compared to other locations, and the portfolio of amenities (including environmental amenities) that downtown has to offer.

Downtown Olympia and Community Renewal Area

The Downtown Olympia Community Renewal Area boundary is the product of a recent community process to address blight, remove barriers to redevelopment, and initiate development partnerships with the Port of Olympia in downtown Olympia.

Capitol Lake is listed as a potential amenity in the feasibility study for the Community Renewal Area, which supports the use of this boundary to investigate the potential impacts of changes in the amenity on downtown development.



- The downtown area has many amenities that differentiate it from other areas. These include the waterfront facing both sides of Budd Inlet, the Capitol Campus grounds, public attractions (museums and the farmers market), and Percival Landing.
- For Capitol Lake specifically, interviewees most frequently cited the surrounding walking trails as one of its most compelling features for downtown residents, followed by the views it provides. These features would continue to contribute to attracting residential demand to downtown to the extent they are maintained in future management alternatives.

Growth in downtown Olympia is driven in part by its amenities, including Capitol Lake. Existing and potential new residents will assess quality-of-life factors in their decision to live downtown. Visitors will come for work or to visit the capitol grounds and will return (or not) based on the quality of their experience. Retailers, restaurant owners, and service providers will respond to demand from residents and visitors and locate and invest accordingly. However, the largest influence on new development continues to be overall regional demand for housing among demographic segments that are more likely to prefer high amenity, urban environments.

3.14.4 What is the demand for and value of recreation?

Recreation resources, facilities, and opportunities in the Project Area include local parks, trails and paths, events, and water-based opportunities (as described in Section 3.8, Land Use, Shorelines, & Recreation). Heritage Park, Marathon Park, Tumwater Historical Park, the Interpretive Center, and Percival Landing Park are all particularly important recreation sites in the basin, and recreational use is popular with local residents and visitors. Throughout the county, there are a variety of publicly and privately owned and operated parks and natural areas. Recreational resources throughout the county provide opportunities similar to the features offered by recreational resources within the basin, meaning that opportunities are not limited to those within the Project Area. People who recreate within the basin may also visit these other areas throughout the county, or may choose to visit Capitol Lake.

Based on a synthesis of findings from the economic analysis in the Economics Discipline Report (Attachment 18), the following are key

conclusions relevant to the demand for and value of recreation in the Capitol Lake – Deschutes Estuary:

- Demand for the types of recreation provided by the Capitol Lake Basin is strong. Demand will likely increase in the future with regional population growth, local population growth supported by residential development in downtown Olympia, and increasing participation rates in many types of outdoor recreation supported by the Capitol Lake – Deschutes Estuary.
- The Capitol Lake Basin provides the types of recreation opportunities that Washington state and Thurston County residents demand the most: urban trails and paths for walking and biking; exploring waterways, coastlines, and natural spaces; and participating in outdoor events.
- Annual use of the parks and facilities surrounding Capitol Lake during formal events likely exceeds 200,000 people. Monthly use of Heritage Park during peak summer season likely exceeds 30,000 people. Recorded pedestrian use of paths throughout the Capitol Lake Basin varies from thousands of trips in some parts of the North Basin to hundreds of thousands of trips in parts of the South Basin per year. The path circumnavigating Capitol Lake is most popularly used by pedestrians. Recorded bicycle use is more concentrated along Deschutes Parkway, with an average of over 60,000 trips per year (primarily reflecting trips for commuting).
- Other similar opportunities for trail- and park-based recreation are available in the region, which can offset direct losses of economic value when recreation closures occur in the study area.
- Demand for some activities not currently available in the Capitol Lake Basin (such as nonmotorized boating, paddling, and fishing) is present and growing. Availability of substitutes for paddling opportunities in the downtown area is limited. The nearest access for small, hand-launched watercraft, such as canoes and kayaks, is in West Bay Park and the northern part of Budd Inlet.
- Recreation activity is economically important because it is something people value. Enhancements to recreation improve people's overall economic well-being, and may

- lead to more people moving to the region in part because they value recreation amenities.
- Recreation activity is also important economically in the region because visitors coming into the study area to participate in recreation activities spend money that would not likely otherwise be spent in the region. Spending ranges from \$8 per participant per day for local park use to over \$80 per day for nonmotorized boat use. (Residents spend money on recreation too, but it is likely this money would have been spent locally whether they were recreating or doing something else.)
 - The economic value people place on recreation experiences is influenced by the quality of the environmental setting where recreation takes place, and on their understanding of the cultural and symbolic meaning attached to place. People place higher values on visually interesting sites. Symbolic and cultural meaning cannot be quantified but is highly influential and varies from person to person.
 - The alignment of preferences and economic value may bias toward maintaining status quo because people tend to value more highly what they know; and people who perceive they are giving something up that they care about may value the loss more highly than the value someone may place on gaining something new, a manifestation of the endowment effect.

In short, recreation in the Capitol Lake Basin is economically important, and changes in development patterns in downtown Olympia will likely increase the value of recreation opportunities in the future. Rising demand may also lead to more crowded recreation sites, further increasing the value of expanding recreation opportunities.

3.14.5 What is the demand for and value of ecosystem services?

Ecosystem services describe the capacity of an ecosystem to provide goods and services that people value. Increases in an ecosystem's ability to provide goods and services produce economic benefits, as they increase the value people derive from the ecosystem. Conversely, decreases in an ecosystem's ability to provide goods and services produce economic costs. These values may accrue as factors of production to industries and tribes (e.g., commercial fishing), recreational use values of the broader ecosystem (e.g., fishing or

birdwatching), or nonuse values related to the health and function of the ecosystem. Ecosystem goods and services typically are not traded in markets, so their value is inferred from nonmarket valuation techniques to assess changes in value. Ecosystem services addressed in this economic analysis include the following:

- **Habitat Provision:** Ecosystem services are largely determined by the type and quality of habitat available. The habitat types currently present in the Project Area include submerged/open water, river channel, freshwater wetlands, tidelflat, low marsh, high marsh, transitional, and upland areas. These habitats provide benefits and functions for fish, wildlife, and plant species, which people value. The affected environment for the habitats that make up ecosystem services are described in detail in other sections this chapter (see Section 3.5, Fish & Wildlife, and Section 3.6, Wetlands).
- **Water Regulation:** Water regulation includes maintenance of water quality and flood regulation. Clean water—at the right place and right time—contributes to a variety of goods and services that people rely on. Clean water supports commercial livelihoods, subsistence, recreation, cultural meaning, and individual well-being, in part by supporting aquatic ecosystems that humans depend on and value (see Section 3.3, Water Quality). Flood regulation and management of wastewater and stormwater are crucial for maintaining infrastructure in the region (see Section 3.13, Public Services & Utilities).
- **Climate Regulation:** Another ecosystem service provided by the natural capital in the Capitol Lake – Deschutes Estuary is the ability to regulate climate through sequestering GHGs. GHGs in the basin are primarily sequestered in the vegetation and soil in and around the water. In contrast to sequestration, GHGs are released by decomposing organic matter, such as vegetation (see Section 3.7, Air Quality & Odor). The threats from climate change in Washington state include sea level rise, increased flooding, reduced snowpack, droughts, increased fire risk, ocean acidification, and others. Sea level rise is especially relevant for this project because downtown Olympia is vulnerable to flooding given the extensive shorelines, including Capitol Lake – Deschutes Estuary and West Bay, and it is only 12 inches (30 centimeters) above sea level. All of these influence economic value in the study area.

- **Cultural, Heritage, Spiritual, Historical, and Education Values:** Cultural, heritage, spiritual, historical, and education values are a component of cultural services that represent the nonmaterial benefits that people obtain from ecosystems and environments. Three primary components to these values are associated with Capitol Lake – Deschutes Estuary. The first is the cultural, heritage, and spiritual values associated with the environment and natural resources used for ceremonial and subsistence purposes by tribes since time immemorial. The second is the historic value of Capitol Lake as a component of the Capitol Campus and the City of Olympia. The third is the potential for the ecosystem and ecosystem management activities to offer educational opportunities to the public, resource managers, and researchers. Studies of the area’s ecology add to scientific knowledge of the region’s ecosystems and how natural and human-influenced processes are affected by various management strategies. This research is ongoing and has the potential to evolve in different ways depending on future conditions.
- **Visual Aesthetics:** The visual aesthetic of the Capitol Lake – Deschutes Estuary creates value in two ways: by defining and enhancing public areas, such as parks, trails, and roads that are available to all; and by serving as a more distant backdrop to private properties with restricted access. Public views include all those around Capitol Lake – Deschutes Estuary, such as the view of the Capitol Dome from the reflecting pool in the North Basin, mountain views and views of downtown from the North Overlook, the waterfront views throughout the trails on the shoreline, and secluded views of vegetation that provide an immersive experience in the South Basin. Although the exact value of these public visual amenities is unknown, these visual amenities likely increase tourism, recreational use, and overall visitation to the area. Some private views of the water features in the basin are from residential properties in the sloped area above Deschutes Parkway and from taller buildings in downtown, particularly to the east and north of the lake. For more information on the affected environment for visual aesthetics, including public and private views, see Section 3.10, Visual Resources.