4.0 Long-Term Impacts, Benefits, & Mitigation

This chapter describes the potential long-term (operational) impacts and mitigation measures for each element of the environment.

Long-term impacts are defined as impacts that would be present or persist after construction. They also include impacts that would occur as a result of long-term management actions. Future long-term management actions described throughout this chapter would be the responsibility of the governing body, which is being evaluated by the Funding and Governance Work Group to ensure that these actions are implemented.

The information presented in this chapter is summarized from the full analysis presented in the discipline reports prepared for each element of the environment. The EIS intentionally focuses on the most important elements and conclusions of the analysis and, in particular, the differences among the four project alternatives.

The magnitude of long-term impacts was identified as either less than significant or significant for each resource based on criteria described in the discipline reports. While the primary focus of a SEPA analysis is the identification of adverse impacts, the analysis also considered the potential for beneficial effects. Long-term beneficial effects were considered minor, moderate, or substantial. See the discipline reports in Attachments 5 through 18 for the full impact analysis, including additional tables, figures, and supporting discussion.

4.1 HYDRODYNAMICS & SEDIMENT TRANSPORT

This section describes the potential long-term hydrodynamics and sediment transport conditions of the Capitol Lake – Deschutes Estuary Long-Term Management Project. These conditions affect other disciplines addressed in the EIS. As such, the potential adverse impacts related to hydrodynamics and sediment transport conditions are incorporated into the evaluations of the other disciplines.

The information presented in this section is based on the results of a hydrodynamic and sediment transport numerical model and is summarized from the revised Hydrodynamics and Sediment Transport Discipline Report (Attachment 5). See the Final EIS Summary or within the Hydrodynamics and Sediment Transport Discipline Report for a summary of key changes between the Draft EIS and Final EIS. The discipline report includes complete details on the data used as inputs to the numerical model, model calibration and run scenarios, and model results. The EIS focuses on the most important differences in future water levels, flooding extents, and sediment deposition rates and patterns.

Key Findings: Long-Term Hydrodynamics and Sediment Transport Impacts

Water Levels and Flooding Extents: Based on numerical modeling results, the No Action and Managed Lake Alternatives would have similar long-term hydrodynamics and sediment transport conditions, and the Estuary and Hybrid Alternatives would have similar long-term conditions. All alternatives would experience high water levels and lowland flooding around the Capitol Lake Basin. For the No Action and Managed Lake Alternatives, the highest water levels would occur during extreme Deschutes River flood events. Under the Estuary and Hybrid Alternatives, the highest water levels would occur during extreme tides. Among all alternatives, the highest maximum water levels and greatest extent of flooding would occur for the Managed Lake Alternative during extreme river floods. The No Action Alternative would experience similar, although slightly lower, water levels during extreme river floods.

Sediment Deposition: In all alternatives, sediment would continue to accumulate within the Capitol Lake Basin and in West Bay. Under the Managed Lake Alternative, sediment deposition would be similar to the No Action Alternative. The removal of the 5th Avenue Dam under the Estuary and Hybrid Alternatives would allow more sediment to be transported farther downstream into Budd Inlet. This would result in less deposition in the basins and substantially more deposition in Budd Inlet during periods of high river flows. The reflecting pool wall in the Hybrid Alternative would force water to accelerate around the wall as it exits the North Basin, resulting in localized scour and increased transport of sediment to Budd Inlet. Sediment deposition in Budd Inlet would increase approximately 283% for the Estuary Alternative, and 366% for the Hybrid Alternative, on average. The increase in sediment deposition between Estuary and Hybrid Alternatives compared to the No Action Alternative would be higher in years with more extreme river flow. Under all alternatives, the majority of the sediment accumulation in Budd Inlet would occur in the eastern portion of West Bay.

4.1.1 What methods were used to assess hydrodynamic conditions?

Long-term hydrodynamic conditions were assessed using a 3D numerical model of the Capitol Lake – Deschutes Estuary system. Two hydrodynamic conditions were simulated for each project alternative to represent the extreme conditions: a +100-year river flood event and a 100-year tidal flood event. Both events were modeled with and without 2 feet (0.61 meters) of relative sea level rise (RSLR). Details on these flood conditions, which are described as Event #1 and Event #2, are provided in the Hydrodynamics and Sediment Transport Discipline Report (Attachment 5).

Sediment transport was predicted for each project alternative over a simulated period of 3 years. The 3-year period was modeled once using typical to low river flow conditions, and separately using extreme river flow conditions. Details on these hydrologic conditions, which are described as Event A and Event B, are provided in the Hydrodynamics and Sediment Transport Discipline Report (Attachment 5).

4.1.2 What are the long-term conditions under the No Action Alternative?

4.1.2.1 Hydrodynamics

Under the No Action Alternative, the 5th Avenue Dam would remain in its current configuration. The dam gates would continue to control water levels in Capitol Lake by limiting when, and at what rate, water can leave the lake and flow into Budd Inlet.

When major river floods occur (i.e., the **100-year flood** on the Deschutes River), water levels will rise in the lake and will cause lowland flooding throughout the Capitol Lake Basin, as has happened during previous flood events. Flooded areas will include Heritage Park, the Interpretive Center at the southwest end of the Middle Basin, parts of the Deschutes Parkway, Marathon Park, and Tumwater Historical Park, and portions of downtown Olympia. The modeled +100-year river flood event with 2 feet of RSLR will cause high water levels of up to 17.4 feet (5.3 meters) NAVD 88 in the North Basin, 17.7 feet (5.4 meters) NAVD 88 in the Middle Basin, and 21.0 feet (6.4 meters) NAVD 88 in the South Basin.

During extreme high tides (the 100-year tide) with 2 feet of RSLR, water levels in Budd Inlet will reach 16.4 feet (5.0 meters) NAVD 88

100-Year Flood Event

The 100-year event is a standard benchmark for assessment of risk associated with major flooding. A 100-year event would occur, on average, once in 100 years. In other words, there is a 1% probability that an event of this magnitude will occur in any given year.

The existing 100-year (15-minute average) flow rate for the Deschutes River is estimated to be 10,665 cubic feet per second (302 cubic meters per second) at USGS Station 12080100. With climate change, the 100-year flow rate is likely to increase. A +100-year (15-minute average) flow rate of 12,042 cubic feet per second (341 cubic meters per second) was used as the input for numerical simulations.

100-Year Tide

In a marine water body such as Budd Inlet, a 100-year tide can occur under certain astronomical and atmospheric conditions. The current 100-year tide elevation in Budd Inlet is 14.1 feet (4.3 meters) NAVD 88. With RSLR, this elevation will increase to 16.4 feet (5.0 meters) NAVD 88.

while water levels in Capitol Lake only reach a maximum of 12.5 feet (3.8 meters) NAVD 88. Flood waters from Budd Inlet will extend into parts of downtown Olympia and Heritage Park via overland flooding east of the 5th Avenue Dam along 4th Avenue W, Water Street NW, and Percival Landing. The existing low wall (Arc of Statehood) bordering the lake in Heritage Park prevents Budd Inlet flood waters from reaching Capitol Lake. No appreciable flooding will occur in low-lying areas of the Capitol Lake Basin as a result of the 100-year tide.

The dam gates prevent saltwater from traveling upstream during extreme (100-year return period) water levels and with relative sea level rise up to 0.5 feet. In the future, under alternatives that would retain the 5th Avenue Dam, if an extreme (100-year return period) water level occurs when sea level has risen more than 0.5 feet and less than 2 feet, saltwater would travel upstream into the North Basin for up to 3 hours during peak tides, before water begins to recede during that tidal cycle. This flow would be driven by a small hydraulic gradient (slope of water table) and therefore at a slow velocity.

Under the No Action Alternative (and the Managed Lake Alternative), additional **flood storage capacity** can be provided by preemptive draining, or drawdown, of the lake in anticipation of Deschutes River flooding, as is currently done. The ability to manage river flood waters and provide drawdown relies on operations at the 5th Avenue Dam. As this infrastructure ages, despite periodic repair and maintenance, the risk of operational failure at the 5th Avenue Dam increases. The risk of failure would be highest during back-to-back flood events, which are likely to occur with increasing frequency in the future given climate change projections. In this scenario, equipment malfunction or human error could result in extreme overland flooding. This risk is greater under the No Action Alternative because only minor repair and maintenance activities for the 5th Avenue Dam are anticipated.

Flood Storage Capacity

The ability of a system to temporarily retain flood waters is known as the system's flood storage capacity.

Flood Storage Capacity and Dam Operation

As described for the No Action Alternative, additional flood storage capacity can be provided by preemptive draining, or drawdown, of the lake in anticipation of storm events. While the risk of operational failure of the 5th Avenue Dam would be lower under the Managed Lake Alternative, risk would remain because providing enhanced flood storage capacity would still be reliant on the 5th Avenue Dam.

4.1.2.2 Sediment Transport

Under the No Action Alternative, the 5th Avenue Dam would remain in its current configuration. The dam would continue to capture most of the sediments transported into the basin and limit the amount of sediment that discharges into Budd Inlet. During high river flow events, sediment will continue to scour from the channel in the Middle Basin. Sediment will deposit in the South Basin, shallow (non-channel) areas of the Middle Basin, North Basin, and Budd Inlet.

Sediment has gradually been accumulating in all three basins since the construction of the 5th Avenue Dam. This long-term accumulation of sediment would continue under the No Action Alternative and would gradually reduce the depth of Capitol Lake. No sediment or depth management strategies would occur under the No Action Alternative.

4.1.3 What are the long-term conditions common to all action alternatives?

The hydrodynamics and sediment transport of each alternative vary; the Managed Lake Alternative would function differently than the Estuary Alternative, which would also change if a barrier wall were constructed in the North Basin per the Hybrid Alternative. There are no conditions common to all action alternatives.

4.1.4 What are the long-term conditions under the Managed Lake Alternative?

4.1.4.1 Hydrodynamics

The long-term hydrodynamic conditions of the Managed Lake Alternative are similar to the No Action Alternative. Like the No Action Alternative, the 5th Avenue Dam would continue to control water levels and flow velocities in the managed lake. Maximum water levels are determined by extreme river floods, and high water levels from extreme tides would be prevented from entering Capitol Lake.

During major river floods, water levels would be similar to the No Action Alternative. However, the Managed Lake Alternative includes construction of habitat areas in the Middle Basin, which would reduce the flood storage capacity within the basin; therefore, the modeled 100-year river flood event with 2 feet of RSLR would cause water levels of up to 0.7 feet (0.2 meters) higher than the No Action Alternative in the Middle and South Basins. Although the Managed Lake Alternative would include deepening of the North Basin, construction of habitat areas reduces the net peak volume of water that can be held in Capitol Lake without overland flooding.

Like the No Action Alternative, elevated water levels during extreme high tide events would be prevented from entering Capitol Lake by the 5th Avenue Dam, although flooding from Budd Inlet into downtown Olympia and Heritage Park would still occur via overland flooding east of the 5th Avenue Dam along 4th Avenue W,

Water Street NW, and Percival Landing. In the future, if an extreme (100-year return period) water level occurs when sea level has risen more than 0.5 feet and less than 2 feet, saltwater would travel upstream into the North Basin for up to 3 hours during peak tides, before water begins to recede during that tidal cycle. This flow would be driven by a small hydraulic gradient (slope of water table) and therefore at a slow velocity.

Olympia Sea Level Rise Response Plan

The Sea Level Rise Response Plan (2019) was developed by the City of Olympia, the Port of Olympia, and LOTT to minimize and prevent flooding to downtown Olympia. The plan outlines how downtown Olympia can adapt to rising seas, and includes various physical and operational strategies to address flood vulnerabilities. This includes construction of a berm at Heritage Park.

4.1.4.2 Sediment Transport

The Managed Lake Alternative would not change the operation or configuration of the 5th Avenue Dam, although the dam and gates would be overhauled to extend their serviceable life.

Overall, sediment deposition patterns would be largely the same under the No Action and Managed Lake Alternatives. However, the ongoing maintenance dredging in the North Basin would periodically remove sediments from the system, and as a result, water depth in the basin would remain deeper than under the No Action Alternative.

4.1.5 What are the long-term conditions under the Estuary Alternative?

4.1.5.1 Hydrodynamics

Under the Estuary Alternative, removal of the 5th Avenue Dam would restore natural hydrodynamic processes within the estuary. Direct connection with Budd Inlet would allow for tidal exchange in Capitol Lake. Much of the basin would experience two high tides and two low tides each day, although most of the North Basin would be submerged under the majority of tidal elevations.

With the Estuary Alternative, maximum water levels in most of the Capitol Lake Basin occur during major tidal flood events rather than river flood events. Water levels throughout the basin would be similar to those in Budd Inlet during an extreme tidal event.

The Estuary Alternative would reduce the exposure of the Capitol Lake Basin flooding from river floods and increase the exposure of the basin to flooding from tidal floods. However, planned construction of flood improvements in Heritage Park as part of the Olympia Sea Level Rise Response Plan would mitigate extreme tidal flood impacts in Heritage Park and downtown Olympia for the 100-year tide event and up to 2 feet (0.61 meters) of RSLR. Considering these planned improvements, the Estuary Alternative

would provide an overall reduction in flood risk from both river and tidal floods when compared to the No Action or Managed Lake Alternatives.

4.1.5.2 Sediment Transport

Removal of the 5th Avenue Dam would restore tidal flow to the Capitol Lake Basin and would reestablish natural sediment deposition patterns of the estuary. Restored sediment deposition patterns benefit natural marine food webs, and sufficient sediment input allows shorelines to dynamically adjust to rising sea levels. There would be long-term increased sediment deposition in West Bay. This alternative includes maintenance dredging in impacted areas of West Bay.

Sediments would be transported farther downstream within the Capitol Lake Basin due to the unobstructed river flow. During periods of high river flow, more sediment would deposit within Budd Inlet than under the No Action and Managed Lake Alternatives, and the sediment deposition would extend farther north into Budd Inlet. During periods of lower flow, this effect would be reduced. Deposition in Budd Inlet is predicted to occur primarily on the eastern shoreline of West Bay, due to the presence of a relatively shallow intertidal bench (sand bar) on the west side of the inlet.

On average, sediment deposition throughout lower Budd Inlet would increase by over 200% from the No Action Alternative under high flow periods. In some locations, there would be an increase of up to 283%. The Olympia Yacht Club and other private marinas would experience the greatest increases in deposition. Increased sedimentation can impact large vessels accessing berths at the Port of Olympia and smaller craft using marina slips in West Bay. However, the Estuary Alternative includes initial pre-dredging of the Capitol Lake Basin during construction to reduce the amount of sediment that could be mobilized following removal of the 5th Avenue Dam, as well as development of a sediment monitoring program to avoid and minimize the impacts related to sediment transport. Details on impacts of sediment transport on navigation are provided in Section 4.2, Navigation.

4.1.6 What are the long-term conditions under the Hybrid Alternative?

4.1.6.1 Hydrodynamics

The long-term hydrodynamic conditions for the estuary portion of the Hybrid Alternative would be similar to those of the Estuary Alternative. Removal of the 5th Avenue Dam would restore natural hydrodynamic processes within the estuary, with the exception of the reflecting pool. Water levels were not simulated in the hydraulic model for the reflecting pool. The freshwater reflecting pool would have a constant water level that could be maintained at or near the existing water levels in Capitol Lake.

With the Hybrid Alternative, maximum water levels in most of the basin would occur during extreme high tide events. Under the modeled 100-year high tide event, water levels and overland flood extents are approximately the same as those described for the Estuary Alternative. However, flooding in Heritage Park and along Powerhouse Road SW in the North Basin would be limited due to the wall that would define the westerly perimeter of the reflecting pool. In the South Basin, major river floods would determine maximum water levels for the Hybrid Alternative. Overland flood levels and extents would be approximately the same as the Estuary Alternative for major river floods.

The Hybrid Alternative would offer similar flood resilience benefits for river and marine floods as described for the Estuary Alternative.

4.1.6.2 Sediment Transport

As in the Estuary Alternative, the Hybrid Alternative includes the removal of the 5th Avenue Dam, initial dredging in portions of the basin during construction to remove excess sediment that would otherwise be mobilized, and maintenance dredging in impacted areas of West Bay. In the North Basin, a vertical wall would be constructed to create a 45-acre (18-hectare) reflecting pool along Heritage Park.

As in the Estuary Alternative, removal of the dam would immediately restore tidal flow to the Capitol Lake Basin and reestablish natural sediment deposition patterns in most of the estuary. Restored sediment deposition patterns benefit natural marine food webs, and sufficient sediment input allows shorelines to dynamically adjust to rising sea levels. Predicted changes to sediment patterns are similar

to those described for the Estuary Alternative. However, as water flows through the North Basin and out to Budd Inlet, it would accelerate along the reflecting pool wall. This increase in speed would scour sediment near the wall. Sediment eroded from the North Basin in this way would be transported into Budd Inlet, causing increased sedimentation. As a result, the Budd Inlet deposition for the Hybrid Alternative would be up to 23% greater than the predicted deposition for the Estuary Alternative, although the patterns of change would be similar.

With the freshwater reflecting pool, tidal water with a suspended sediment load would not enter the reflecting pool. The absence of tidal gates would avoid sediment transport into the reflecting pool.

4.1.7 How do the maximum water levels compare between all alternatives?

Numerical model results for maximum water levels at specific locations throughout the study area graphically illustrated in Figures 4.1.1 (for an extreme river flood event) and 4.1.2 (for an extreme high tide event), both with 2 feet (0.61 meters) of RSLR, and are listed in Tables 4.1.1 and 4.1.2. Maximum water levels in the reflecting pool for the Hybrid Alternative are not shown in Figures 4.1.1 and 4.1.2 because water levels inside the pool were not modeled.

Maximum water levels for the Estuary Alternative (during a +100-year river flow events) would be ≤1 foot (≤0.3 meter) lower than those of the No Action and Managed Lake Alternatives (during extreme river flooding). The spatial extent of flooding in the North Basin would be similar under all alternatives during both extreme events (extreme tide conditions and extreme river flooding). In the south end of the Middle Basin and in the South Basin, the spatial extent of flooding would be greater during an extreme flood event under the No Action and Managed Lake Alternatives.

Figure 4.1.1 Comparison of Maximum Water Levels for an Extreme River Flood Event with 2 Feet of RSLR by Alternative

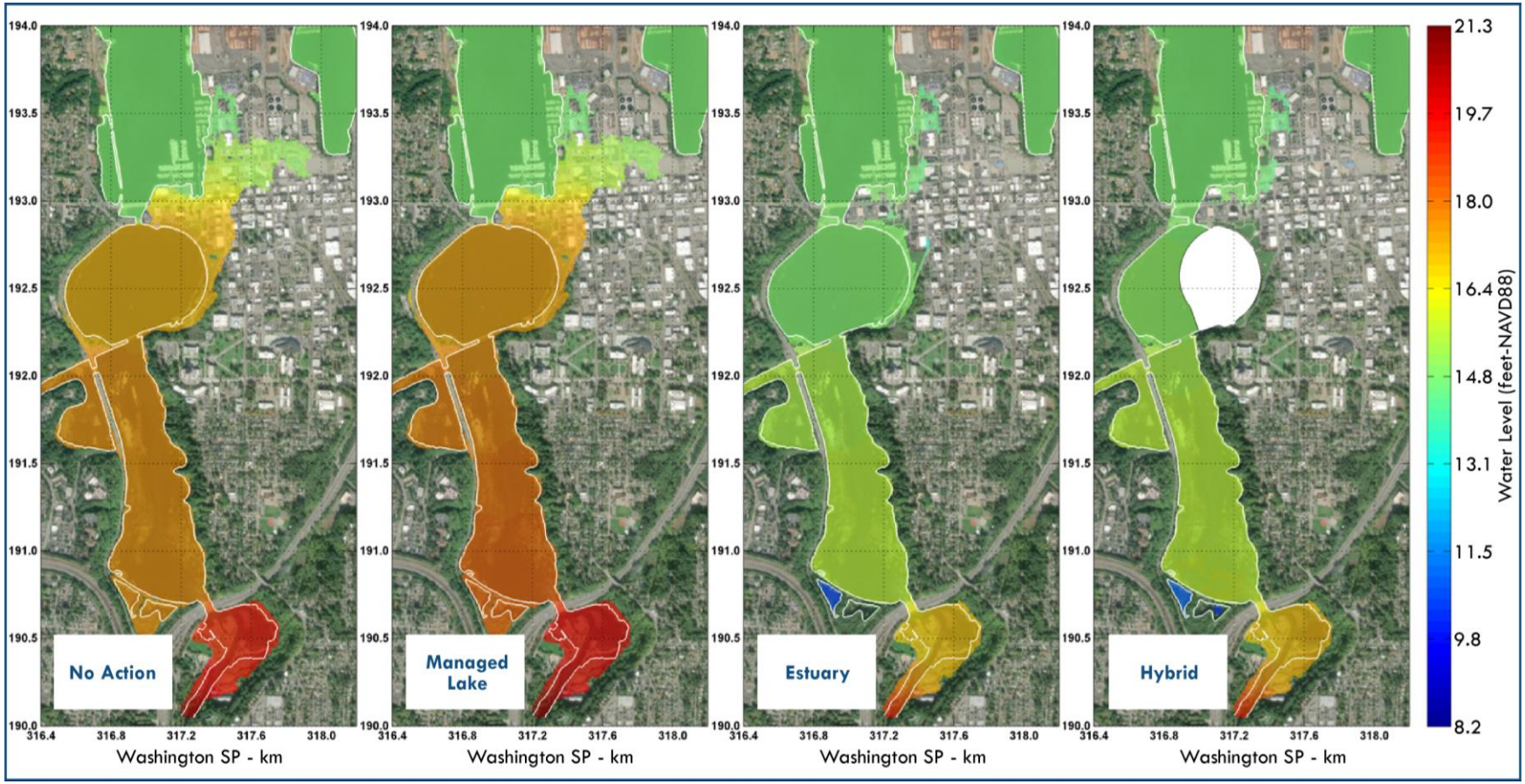


Figure 4.1.2 Comparison of Maximum Water Levels for an Extreme Tidal Flood Event with 2 feet of RSLR by Alternative

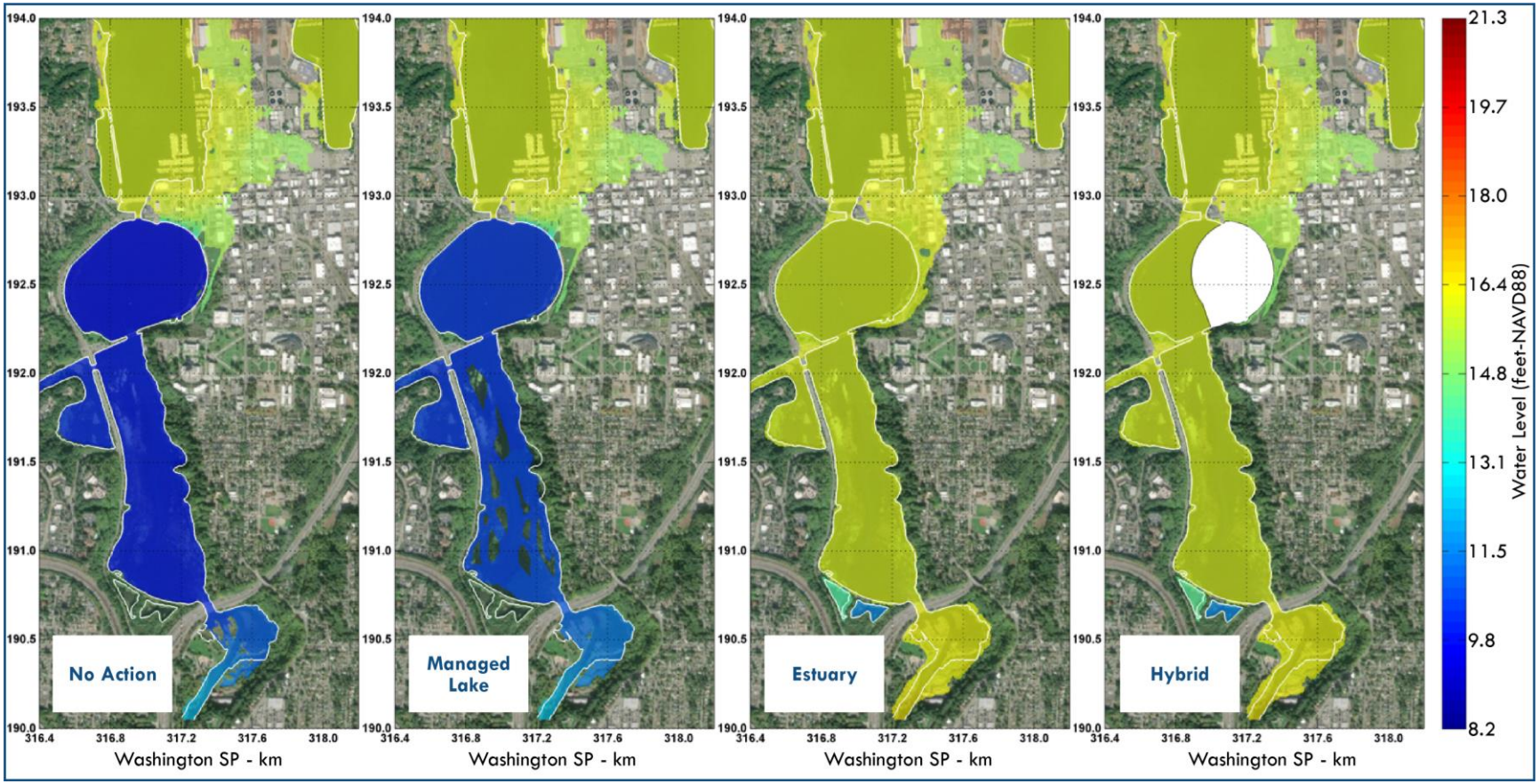


Table 4.1.1 Comparison of Maximum Water Levels for an Extreme River Flood Event with 2 feet of RSLR by Alternative

Location	No Action: Elevation (feet NAVD 88 *(meters NAVD 88)*)	Managed Lake: Elevation (feet NAVD 88 *(meters NAVD 88)*)	Estuary: Elevation (feet NAVD 88 *(meters NAVD 88)*)	Hybrid: Elevation (feet NAVD 88 *(meters NAVD 88)*)
5th Avenue Dam Gates (north side)	15.1 *(4.6)*	15.1 *(4.6)*	15.1 *(4.6)*	15.1 *(4.6)*
North Basin	17.4 *(5.3)*	17.7 *(5.4)*	15.1 *(4.6)*	15.4 *(4.7)*
Olympia & Belmore Railroad Inc., Railroad Trestle	17.7 *(5.4)*	17.7 *(5.4)*	15.4 *(4.7)*	15.4 *(4.7)*
Middle Basin	17.7 *(5.4)*	18.4 *(5.6)*	15.7 *(4.8)*	16.1 *(4.9)*
I-5 Bridge	18.0 *(5.5)*	18.7 *(5.7)*	16.1 *(4.9)*	16.4 *(5.0)*
South Basin	19.4 *(5.9)*	20.0 *(6.1)*	17.4 *(5.3)*	17.4 *(5.3)*

Table 4.1.2 Comparison of Maximum Water Levels for an Extreme High Tide Event with 2 feet of RSLR by Alternative

Location	No Action: Elevation (feet NAVD 88 *(meters NAVD 88)*)	Managed Lake: Elevation (feet NAVD 88 *(meters NAVD 88)*)	Estuary: Elevation (feet NAVD 88 *(meters NAVD 88)*)	Hybrid: Elevation (feet NAVD 88 *(meters NAVD 88)*)
5th Avenue Dam Gates (north side)	16.4 *(5.0)*	16.4 *(5.0)*	16.1 *(4.9)*	16.1 *(4.9)*
North Basin	9.8 *(3.0)*	10.2 *(3.1)*	16.1 *(4.9)*	16.1 *(4.9)*
Olympia & Belmore Railroad Inc., Railroad Trestle	9.8 *(3.0)*	10.5 *(3.2)*	16.1 *(4.9)*	16.1 *(4.9)*
Middle Basin	11.2 *(3.4)*	11.2 *(3.4)*	16.4 *(5.0)*	16.4 *(5.0)*
I-5 Bridge	10.2 *(3.1)*	10.8 *(3.3)*	16.4 *(5.0)*	16.4 *(5.0)*
South Basin	10.8 *(3.3)*	11.5 *(3.5)*	16.4 *(5.0)*	16.4 *(5.0)*

4.1.8 How does the sediment transport compare between all alternatives?

Numerical model results of annual deposition/erosion patterns for the four alternatives are presented in Figure 4.1.3, using the modeled high flow river event to represent worst-case deposition patterns, and are listed in Table 4.1.3 for the average annual sediment erosion/deposition.

What are the existing water levels in the Project Area (in feet NAVD 88)?

West Bay
Mean Higher High Water = +10.5
Mean Lower Low Water = -3.9

Lake Levels
Winter = +8.6
Summer = +9.6

Table 4.1.3 Comparison of Average Annual Sediment Deposition/Erosion (Without RSLR [1])

Location	No Action (in/year)	Managed Lake (in/year)	Estuary (in/year)	Hybrid (in/year)
South Basin	1.54	2.13	0.39	0.39
South Basin (% Change w.r.t. No Action)	--	(39%)	(-75%)	(-75%)
Middle Basin	-0.94	-0.67	-1.46	-1.34
Middle Basin (% Change w.r.t. No Action)	--	(-28%)	(54%)	(44%)
Percival Cove	0.16	0.16	0.24	0.24
Percival Cove (% Change w.r.t. No Action)	--	(-15%)	(43%)	(44%)
North Basin	1.73	1.77	0.63	-0.67
North Basin (% Change w.r.t. No Action)	--	(2%)	(-64%)	(-138%)
Olympia Yacht Club	1.65	1.69	6.18	7.64
Olympia Yacht Club (% Change w.r.t. No Action)	--	(1%)	(271%)	(358%)
Private Marinas	0.83	0.83	3.23	3.90
Private Marinas (% Change w.r.t. No Action)	--	(-1%)	(283%)	(366%)
Port of Olympia & Turning Basin	0.83	0.83	3.07	3.58
Port of Olympia & Turning Basin (% Change w.r.t. No Action)	--	(-2%)	(265%)	(328%)
Navigation Channel (excluding Turning Basin)	0.04	0.04	0.12	0.12
Navigation Channel (excluding Turning Basin) (% Change w.r.t. No Action)	--	(-4%)	(195%)	(234%)
Rest of Budd Inlet	0.04	0.04	0.16	0.16
Rest of Budd Inlet (% Change w.r.t. No Action)	--	(17%)	(236%)	(300%)

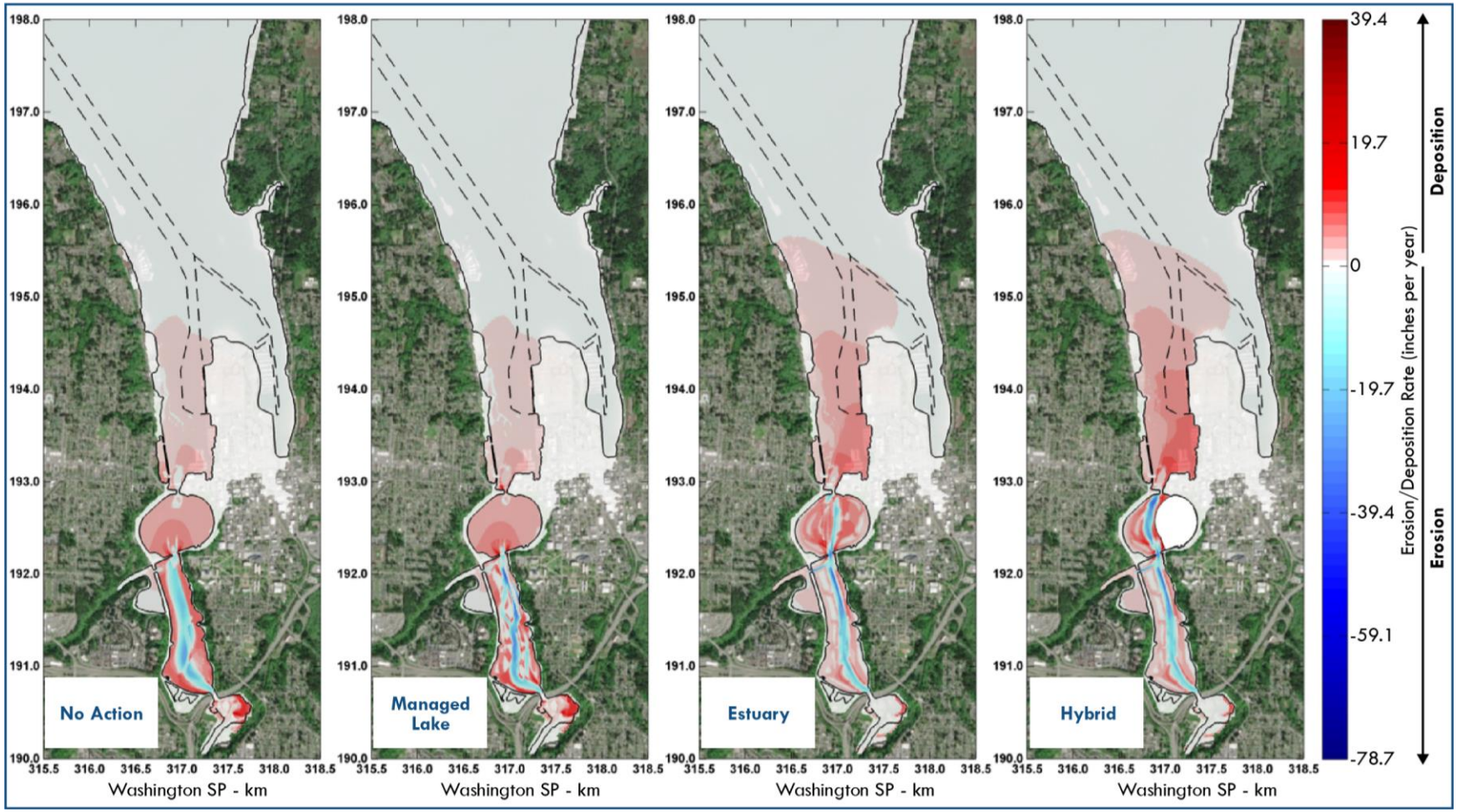
Note:

1. Numerical modeling was conducted for events that assumed RSLR and events that did not assume a rise in sea level. The analysis in the EIS presents the findings that assume no rise in sea level. This is because, based on the numerical modeling, these results are more conservative as they result in more sediment deposition.

Abbreviation:

w.r.t = With respect to

Figure 4.1.3 Annual Deposition/Erosion Patterns by Alternative



4.2 NAVIGATION

This section describes the potential long-term impacts and benefits of the Capitol Lake – Deschutes Estuary Long-Term Management Project on navigation in West Bay. The EIS focuses on the most important elements and conclusions of the analysis and, in particular, the differences among the four alternatives.

Information presented in this section is summarized from the full analysis in the revised Navigation Discipline Report (Attachment 6). See the Final EIS Summary or within the Navigation Discipline Report for a summary of key changes between the Draft EIS and Final EIS.

What is considered a significant impact to navigation?

Impacts to navigation would be considered significant if navigability would be so adversely affected by sediment deposition that large commercial vessels accessing the FNC and Port of Olympia were required to wait longer than 4 hours for channel access due to shallowed water depth and low tide conditions, or if over 10% of vessels at any single marina were unable to access leased moorage due to shallowed water depth caused by sediment deposition.

4.2.1 What methods of analysis were used to assess long-term impacts to navigation?

Operational impacts could be either adverse or beneficial. Operational impacts to vessel navigation were assessed both qualitatively and quantitatively, incorporating results from hydrodynamic and sediment transport modeling and data collected from the Port of Olympia, USACE, and private vessel moorage facilities in West Bay.

Key Findings: Long-Term Navigation Impacts

For the No Action Alternative, ongoing rates of sedimentation in West Bay would not change substantially as a result of the project. Maintenance dredging would still occur but a maintenance dredging plan would not be implemented. Operational impacts to navigation would be less than significant for this alternative, but over time could become significant if dredging is delayed again and causes navigational impacts, similar to existing conditions.

For the Managed Lake Alternative impacts to navigation in West Bay would be less than significant because there would be no meaningful change from existing conditions. Maintenance dredging would occur in the North Basin of Capitol Lake.

For the Estuary and Hybrid Alternatives, sediment deposition in West Bay would be four to five times the rate of sediment deposition under the No Action and Managed Lake Alternatives. Impacts to navigation are considered **significant**, but could be reduced to less than significant, if consistent funding is available for the maintenance dredging program, and with implementation of the recommended sediment monitoring. Maintenance dredging events would be coordinated (scheduled and phased) with the Port of Olympia and affected marinas to reduce the navigation-related disruption associated with these events to less than significant levels.

Under the Estuary and Hybrid Alternatives, there would be a coordinated effort for maintenance dredging and sediment monitoring, where one does not currently exist. This could provide a minor beneficial effect under the Estuary and Hybrid Alternatives because it would help to avoid or minimize impacts from chronically shallowed areas.

4.2.2 What are the long-term impacts to navigation under the No Action Alternative?

Under the No Action Alternative, sediment management strategies would not be implemented, and sedimentation would continue at existing rates from the Capitol Lake – Deschutes Estuary.

4.2.2.1 Sediment Deposition Rates

Annual sediment deposition/erosion rates in West Bay are highly dependent on river flow events with more extreme flow events depositing more sediments. Sediment deposition affects water depth, which in turn can affect navigation.

Table 4.2.1 includes sediment deposition rates for the No Action Alternative (and Managed Lake Alternative given the similarity).

Non-Project Dredging before 5th Avenue Dam Removal

The navigation analysis in the EIS includes a key assumption that non-project related dredging would occur in West Bay within the next 10 years, before the 5th Avenue Dam would be removed under the Estuary and Hybrid Alternatives. Between the Draft and Final EIS, this assumption was revisited and confirmed.

Outreach with the Port of Olympia, USACE, and existing West Bay marinas was used to evaluate existing maintenance dredging frequencies and known plans for future maintenance dredging by these different entities.

- The Port of Olympia has noted that present day cargo vessels are known to lighten their loads and sail on a rising tide when calling at the Port of Olympia, due to existing sediment accumulation in the FNC and Turning Basin. This impacts Port operations.
- Much of the accumulated sediments that are impacting Port of Olympia operations are contaminated. They must be removed (remediated) to restore the health of the marine environment and consumers of fish and shellfish.
- The Port of Olympia has taken recent action to support future dredging within the FNC and Turning Basin in addition to their own berths, to address sediment accumulation and contamination.
- The USACE has authority under the federal navigational servitude doctrine to maintain navigation in commercial waterways, including the Budd Inlet FNC, which is currently impacted by sedimentation in the FNC and Turning Basin. Dredging of the FNC is expected to occur as a separate, non-project action before sediment transport is reestablished in West Bay should the Estuary or Hybrid Alternative be constructed. This dredging is likely to be led by the Port of Olympia and is expected to include 2 feet of advance maintenance dredging depth and 1 foot of allowable overdredge; it is reasonable to assume that authorized depths would be reached in these areas concurrent with removal of the 5th Avenue Dam.
- West Bay marinas already experience sediment deposition to some extent and have either conducted maintenance dredging recently or plan to complete maintenance dredging within the next 10 years to maintain navigation and commercial viability, to comply with existing or new DNR lease requirements, and/or in parallel with dock upgrades and/or reconfiguration.

Table 4.2.1 Average Annual Sediment Deposition in West Bay for the No Action & Managed Lake Alternatives (inch each year *(cm each year)*)

Location	No Action Alternative	Managed Lake Alternative
Olympia Yacht Club	1.7 *(4.2)*	1.7 *(4.2)*
Other West Bay Private Marinas and Marina Access	0.83 *(2.1)*	0.83 *(2.1)*
Port of Olympia/ Turning Basin	0.83 *(2.1)*	0.83 *(2.1)*
FNC (excluding Turning Basin)	0.04 *(0.1)*	0.04 *(0.1)*

The highest sediment deposition rate would occur at the Olympia Yacht Club (closest to the 5th Avenue Dam), decreasing northward throughout the east side of West Bay past the other private marinas to the Port of Olympia and southern end of the FNC and turning basin (see Figure 4.2.1). Sediment deposition rates within West Bay are expected to increase slowly over time as the settling capacity of Capitol Lake decreases over time.

Numerical Modeling of Sediment Transport

Sediment transport was modeled for events that assumed RSLR and events that did not assume a rise in relative sea level.

The navigation analysis in the EIS presents the findings that assume **no rise in relative sea level**. This is because, based on the numerical modeling, these results are more conservative ("worst case") as they result in more sediment deposition.

For more detailed information on the full analysis, including additional tables and figures, see the Navigation Discipline Report (Attachment 6).

4.2.2.2 Existing Maintenance Dredging

Under the No Action Alternative, maintenance dredging would continue to be conducted by separate entities to maintain navigation in West Bay. Through outreach conducted by the EIS Project Team, it was confirmed that dredging is expected to occur along the eastern shore of West Bay within the next 10 years to maintain navigability, address known sediment contamination, and separately, as a requirement of marina lease renewals with DNR.

As such, the impact analysis assumes that operable and authorized depths are obtained within a 10-year period. Maintenance dredging thereafter is projected at the frequencies provided in Table 4.2.2 for the different locations shown in Figure 4.2.1. For example, the Olympia Yacht Club is likely to conduct maintenance dredging about once every 23 years or once within the 30-year project horizon, while the other private marinas, USACE, and the Port of Olympia may not need to conduct maintenance dredging at their facilities or within the channels and access areas to their facilities to avoid impacts during this time frame.

Table 4.2.2 No Action Alternative Maintenance Dredging in West Bay

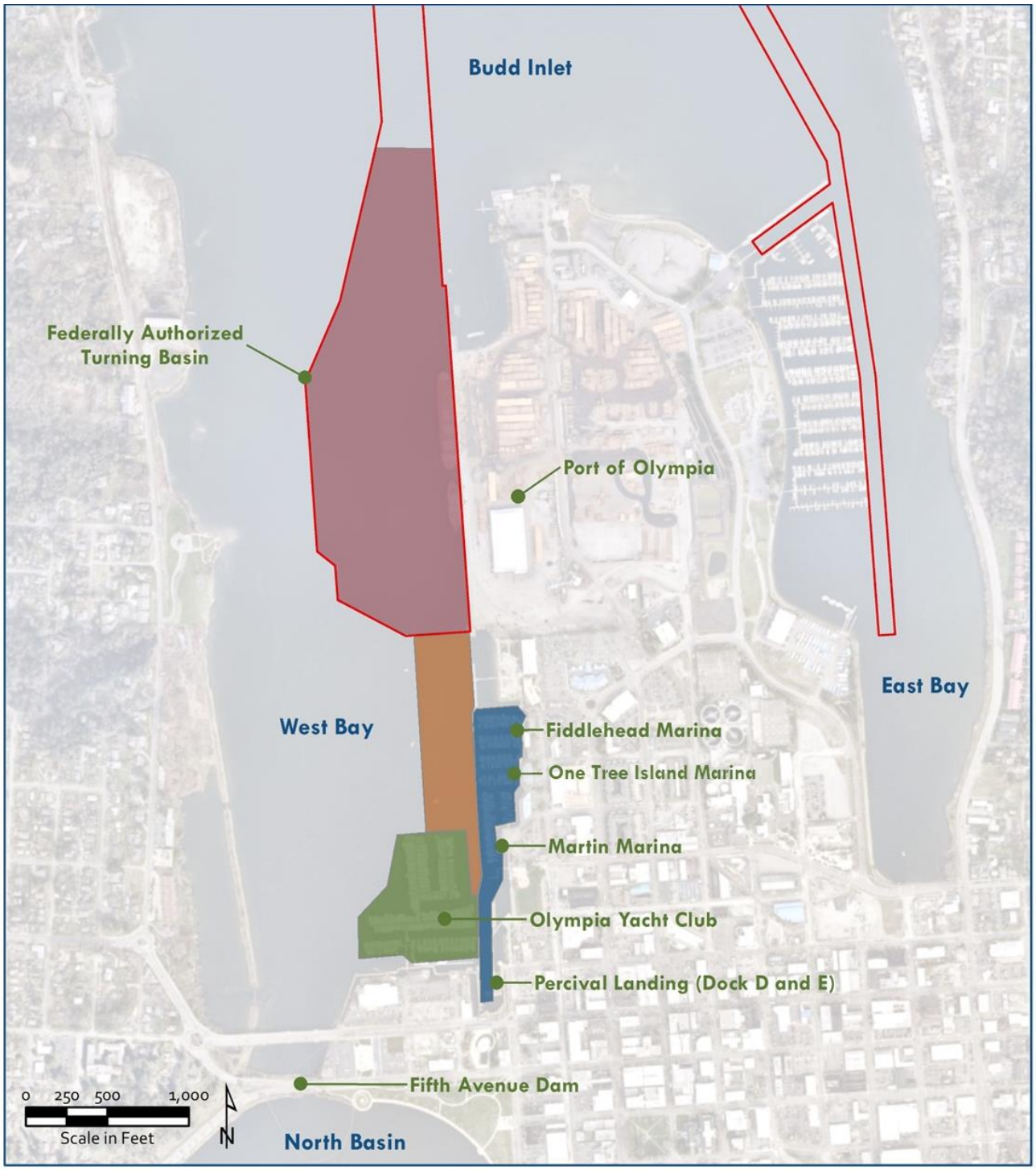
Estimated Dredge Frequency (years)	Location
23	Olympia Yacht Club
42	FNC/Turning Basin/Port
47	Other Lower West Bay Private Marinas

Maintenance dredging at the Olympia Yacht Club under the No Action Alternative is expected to be completed at frequencies similar to past maintenance dredging and would focus on key areas of shoaling and sediment deposition, not the entire marina. Maintenance dredging may require slip vacancies for temporary periods of time. In tight spaces, piles or floats may need to be removed and boathouses temporarily relocated prior to dredging (in some instances a small hydraulic dredge, rather than a clamshell dredge, can be used in tight spaces to minimize disturbances of existing structures). This could result in a temporary disruption to navigation if careful scheduling and phasing is not incorporated (i.e., dredging only impacted areas and phase dredging of different areas of the marina so that a smaller percentage of vessels and boathouses would need to be temporarily relocated at any one time). Marinas often include this type of scheduling and phasing as part of their maintenance activities and plan for temporary vessel/boathouse relocation to minimize disruptions and slip vacancies.

How were dredging frequencies determined for the No Action Alternative?

Anticipated existing maintenance dredging frequencies under the No Action Alternative were developed using records from past dredging events, average sediment accumulation rates, and amount of sediment deposition that could be accommodated by the different facilities before an impact occurred. The duration between dredge events is expected to decrease over time as Capitol Lake slowly fills up with sediment and more passes through the 5th Avenue Dam to West Bay.

Figure 4.2.1 Navigational Resources in West Bay & Areas of Maintenance Dredging



4.2.2.3 Impacts from Sediment Deposition

Under the No Action Alternative, the USACE, Port of Olympia, and private marinas would conduct maintenance dredging in West Bay to maintain navigation. Therefore, operational impacts on navigation under the No Action Alternative would be less than significant. However, sedimentation is currently impacting commercial navigation at the Port of Olympia, and coordination is underway to implement a needed maintenance dredge event. In the future, if dredging is delayed again, sediment deposition could result in a **significant impact** to navigation.

4.2.3 Are there long-term navigational impacts common to all action alternatives?

Potential impacts to navigation vary across the action alternatives. The location of sediment deposition and the approach to maintenance dredging differs depending on whether the 5th Avenue Dam is retained or removed.

The variability of sediment deposition and associated potential impacts to navigation are described below. Under the Estuary and Hybrid Alternatives, the Port of Olympia and private marinas in West Bay may also be temporarily impacted by the maintenance dredging proposed to reduce sediment accumulation.

4.2.4 What are the long-term impacts under the Managed Lake Alternative?

4.2.4.1 Sediment Deposition Rates

Under the Managed Lake Alternative, average annual sediment deposition rates for West Bay would be similar to those for the No Action Alternative, as shown in Table 4.2.1. Similar to the No Action Alternative, sediment that is suspended in the water column passes through the 5th Avenue Dam and results in limited deposition in West Bay. The highest sediment deposition rate would occur at the Olympia Yacht Club, with progressively lower deposition rates along the east side of West Bay.

Numerical modeling of sediment transport indicates that the Managed Lake Alternative would result in slightly reduced sediment deposition within West Bay compared to the No Action Alternative. This is likely due to deepening of the North Basin under the

Managed Lake Alternative, which would create a more effective settling basin for sediment.

Maintenance Dredging

Maintenance dredging under the Managed Lake Alternative would occur in the North Basin, and not in West Bay. Therefore, dredging in West Bay would continue to be completed by separate entities, including the USACE, Port of Olympia, and private marinas.

Impacts from Sediment Deposition

Similar to the No Action Alternative, under the Managed Lake Alternative, the USACE, Port of Olympia, and private marinas would conduct maintenance dredging in West Bay to maintain navigation. Therefore, operational impacts on navigation under the Managed Lake Alternative would be less than significant. However, notably, sedimentation is currently impacting commercial navigation at the Port of Olympia, and coordination is underway to implement a needed maintenance dredge event. In the future, if dredging is delayed again, sediment deposition could result in a **significant impact** to navigation.

4.2.5 What are the long-term impacts under the Estuary Alternative?

4.2.5.1 Sediment Deposition Rates

Under the Estuary Alternative, sediment deposition within West Bay would be up to three times higher than the No Action and Managed Lake Alternatives given the removal of the 5th Avenue Dam. Average annual sediment deposition rates for West Bay under the Estuary Alternative would range from approximately 6.18 inches (15.7 centimeters) each year at the Olympia Yacht Club at the southern tip of the study area to approximately 0.1 inches (0.3 centimeters) each year for the portion of the FNC at the northern-most boundary of the study area. The projected rates of sediment deposition are presented in Table 4.2.3 and are compared to the No Action Alternative.

Table 4.2.3 Average Annual Sediment Deposition in West Bay for the No Action & Estuary Alternatives (inch each year *(cm each year)*)

Location	No Action Alternative	Estuary Alternative
Olympia Yacht Club	1.7 *(4.2)*	6.18 *(15.7)*
Other West Bay Private Marinas and Marina Access	0.83 *(2.1)*	3.2 *(8.2)*
Port/Turning Basin	0.83 *(2.1)*	3.1 *(7.8)*
FNC (excluding Turning Basin)	0.04 *(0.1)*	0.1 *(0.3)*

The Estuary Alternative would increase sediment deposition in West Bay compared to the No Action Alternative because of the removal of the 5th Avenue Dam and transport of river-borne sediments into West Bay under high river flow events. Under low flow events, the river-borne sediments could settle within the North Basin and may not be transported into West Bay.

Sediment erosion/deposition patterns were assessed for two different flow events to provide a lower and upper bound:

1. Low-flow (Event A)—a 3-year simulation based on a 1-year river flow event occurring three times in a row.
1. High-flow (Event B)—a 3-year simulation based on a 115-year river flow event occurring three times in a row.

Table 4.2.4, Figure 4.2.2, and Figure 4.2.3 compare deposition and erosion patterns between the No Action, Managed Lake, Estuary, and Hybrid Alternatives for both events. The results indicate that annual erosion/deposition rates are generally higher for Event B than Event A because stronger flows will result in higher deposition and erosion rates. The removal of the 5th Avenue Dam increases sediment deposition to West Bay as sediments are transported farther downstream, as indicated by the deposition pattern shown for the Estuary and Hybrid Alternatives in Figure 4.2.3. Higher deposition rates would occur on the east side of West Bay due to a shallow intertidal habitat area on the west side of West Bay.

Table 4.2.4 Average Annual Sediment Erosion/Deposition for Modeling Events A & B without RSLR

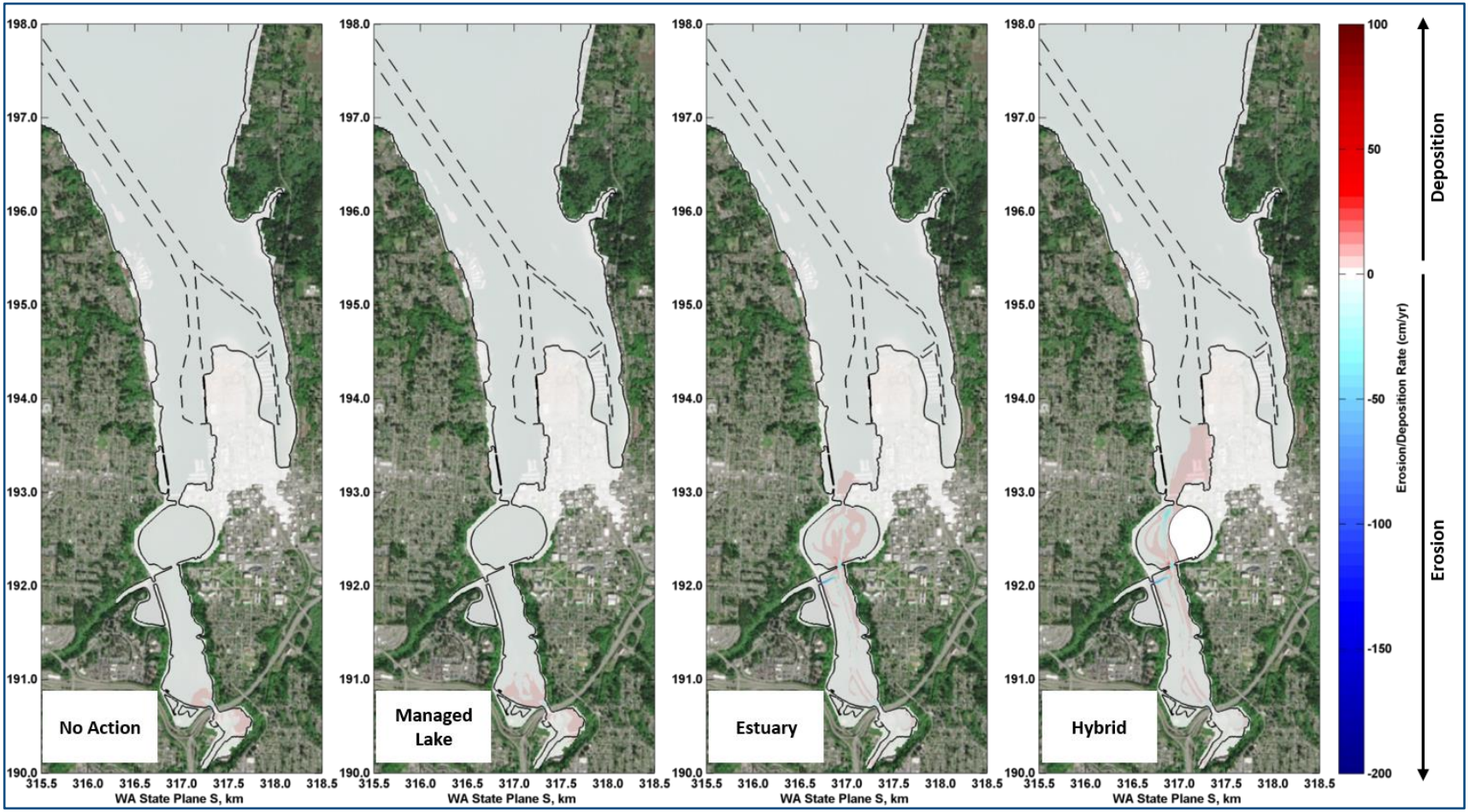
Location	No Action Alternative: A (low) in/yr *(cm/yr)*	No Action Alternative: B (high) in/yr *(cm/yr)*	Managed Lake: A (low) in/yr *(cm/yr)*	Managed Lake: B (high) in/yr *(cm/yr)*	Estuary Alternative: A (low) in/yr *(cm/yr)*	Estuary Alternative: B (high) in/yr *(cm/yr)*	Hybrid Alternative: A (low) in/yr *(cm/yr)*	Hybrid Alternative: B (high) in/yr *(cm/yr)*
Olympia Yacht Club	0.04 *(0.1)*	3.3 *(8.4)*	0.04 *(0.1)*	3.3 *(8.4)*	0.6 *(1.6)*	11.7 *(29.8)*	1.26 *(3.2)*	13.97 *(35.5)*
Other West Bay Private Marinas and Marina Access	0.0 *(0.0)*	1.7 *(4.2)*	0.0 *(0.0)*	1.7 *(4.2)*	0.2 *(0.5)*	6.2 *(15.8)*	0.433 *(1.1)*	7.4 *(18.8)*
Port of Olympia/ Turning Basin	0.0 *(0.0)*	1.7 *(4.2)*	0.0 *(0.0)*	1.6 *(4.1)*	0.08 *(0.2)*	6.1 *(15.4)*	0.16 *(0.4)*	7.05 *(17.9)*
FNC (excluding Turning Basin)	0.0 *(0.0)*	0.08 *(0.2)*	0.0 *(0.0)*	0.08 *(0.2)*	0.0 *(0.0)*	0.2 *(0.6)*	0.0 *(0.0)*	0.28 *(0.7)*

Notes:

Event A (low flow): a 3-year simulation based on the water year 2019 (10/01/2018 – 09/30/2019) repeating three times in a row. This is the lowest peak annual discharge in the last 10 years.

Event B (high flow): a 3-year simulation based on the water year 1996 (10/01/1995 – 09/30/1996) repeating three times in a row. This is the highest annual discharge on the record.

Figure 4.2.2 Erosion/Deposition Pattern (cm/yr) for Event A without RSLR

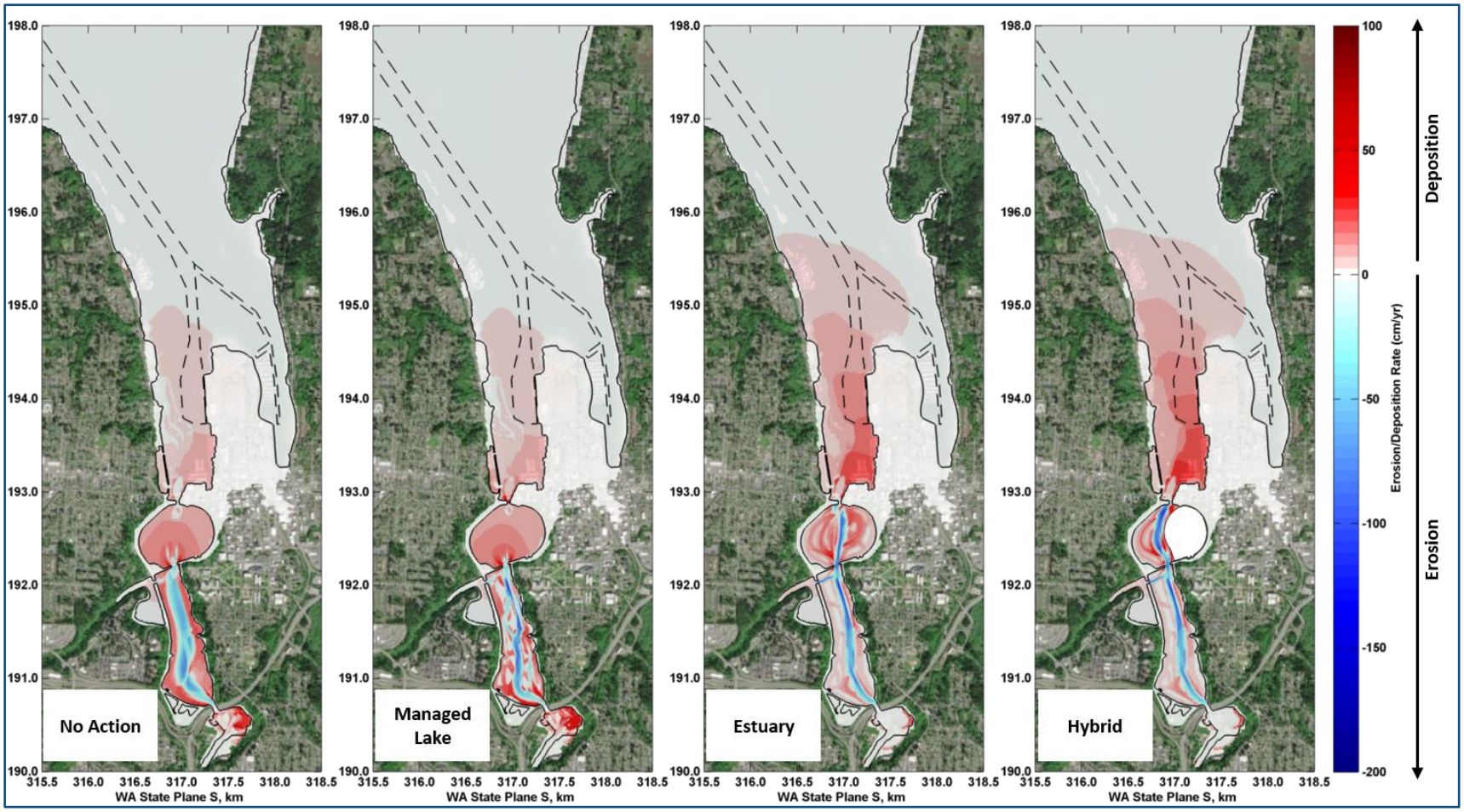


Notes:

Event A (low flow): a three-year simulation based on the water year 2019 (10/01/2018 – 09/30-2019) repeating three times in a row. This is the lowest peak annual discharge in the last 10 years.

The X and Y axes are showing coordinates (Easting, Northing) referenced to the Washington State Plane Horizontal Coordinate System. The Washington State Plane Horizontal Coordinate System is used to define and state the position or locations of points on the surface of the earth within the State of Washington.

Figure 4.2.3 Erosion/Deposition Pattern (cm/yr) for Event B without RSLR



Notes:

Event B (high flow): a three-year simulation based on the water year 1996 (10/01/1995 – 09/30/1996) repeating three times in a row. This is the highest annual discharge on the record.

The X and Y axes are showing coordinates (Easting, Northing) referenced to the Washington State Plane Horizontal Coordinate System. The Washington State Plane Horizontal Coordinate System is used to define and state the position or locations of points on the surface of the earth within the State of Washington.

4.2.5.2 Initial Dredging during Construction

A primary measure to reduce sediment transport into West Bay under the Estuary Alternative is to dredge the Capitol Lake Basin during construction, prior to removal of the 5th Avenue Dam. Initial construction dredging would remove approximately 526,000 cubic yards (400,000 cubic meters) of accumulated sediment from the North and Middle Basins during construction and beneficially reuse it to develop habitat areas. This would reduce sediment that would be available for transport into West Bay during high flow events after construction. Modeling shows that this initial dredging would result in a 49% reduction in impacts to anticipated sediment deposition at the Olympia Yacht Club.

4.2.5.3 Maintenance Dredging and Monitoring to Avoid Navigation Impacts after Construction

In addition to initial dredging, a maintenance dredging program is proposed to address sediment deposition in West Bay after construction of the Estuary Alternative. Maintenance dredging is proposed along the eastern shore of West Bay and is based on the sediment deposition patterns and rates that were projected by the numerical model, and from data collected from USACE, the Port of Olympia, and the private marinas. The anticipated dredge frequency and volume of material that would be dredged from West Bay under the Estuary Alternative is shown in Table 4.2.5. These frequencies assume that maintenance dredging would be conducted throughout West Bay within the next 10 years, and operable and authorized navigational depths are reestablished within West Bay before 5th Avenue Dam removal. Maintenance dredging is assumed and recommended at a frequency that would avoid significant impacts to navigation from sediment deposition.

Anticipated maintenance dredging frequencies and quantities under the Estuary Alternative were developed using sediment accumulation rates identified during numerical modeling and data gathered from past maintenance dredging events at West Bay facilities.

The rate of sediment accumulation is highly dependent on river flow conditions. Impacts to navigation would be significant if the dredging frequency is not adequate to address the actual rate of sediment accumulation based on environmental variables to avoid the

How were dredging frequencies determined for the Estuary Alternative?

The dredging frequencies presented in Table 4.2.5 are based on the following assumptions and projections:

- Before the 5th Avenue Dam is removed, authorized depths in West Bay would have been reestablished by dredging actions conducted by other entities. This removes accumulated sediment that is currently impacting navigation.
- The rate of sediment accumulation projected by the numerical model for the Estuary and Hybrid Alternatives was added to the surface left by the dredging actions conducted by others.
- Once the projected sediment deposition reached the amount of sediment deposition that triggers maintenance dredging as defined in the footnote on the following page and in the Navigation Discipline Report, a maintenance dredge event conducted by the project was assumed.

significance threshold established for this project.[1] Recognizing this, an annual sediment monitoring plan is included as mitigation to reduce impacts to navigation in West Bay to less than significant levels.

Table 4.2.5 Anticipated Maintenance Dredging in West Bay for the Estuary Alternative

Years after Construction	Location	Potential Duration of Dredging (1)	Estimated Amount (cubic yards *(cubic meters)*)
6	Olympia Yacht Club	2 months	21,600 *(16,500)*
12	Olympia Yacht Club	2 months	21,600 *(16,500)*
12	Other Lower West Bay Private Marinas	1 month	15,600 *(11,900)*
12	Port of Olympia/Turning Basin/FNC	9 months	247,800 *(189,500)*
18	Olympia Yacht Club	2 months	21,600 *(16,500)*
24	Olympia Yacht Club	2 months	21,600 *(16,500)*
24	Other Lower West Bay Private Marinas	1 month	15,600 *(11,900)*
24	Port of Olympia/Turning Basin/FNC	9 months	247,800 *(189,500)*
24	Marina Access	2 months	65,400 *(50,000)*
30	Olympia Yacht Club	2 months	21,600 *(16,500)*
		Total Dredged	**700,200 *(535,300)***

Note:

1. Maintenance dredging operations are assumed to be 10 hours a day, 5 days a week within the applicable in-water work window (July 16 through February 15 each year). Maintenance dredging could extend into more than one in-water work window if dredging were phased to minimize impacts to operations (e.g., many marinas avoid completing maintenance during busy summer months). This schedule assumes that only one dredge is used.

[1] As described above, impacts to navigation would be considered significant if navigability would be so adversely affected by sediment deposition that large commercial vessels accessing the FNC and Port of Olympia were required to wait longer than 4 hours for channel access due to shallowed water depth and low tide conditions caused by sediment deposition on more than one consecutive occasion, or if over 10% of vessels at any single marina were unable to access leased moorage due to shallowed water depth caused by sediment deposition.

Sediment monitoring, occurring at least annually, would allow the frequency of maintenance dredging to be reduced or increased within impacted areas of West Bay based on annual bathymetric data. For example, if sediment monitoring indicated heavy sediment deposition over a period of time as a result of high flow events, the frequency of maintenance dredging could be increased. Similarly, if a number of low flow events were observed for a period of time and low sediment deposition was observed, the time between maintenance dredging events could be extended.

When maintenance dredging occurs, it would require coordination with cargo vessel calls and/or call interruptions for months at a time during each dredge cycle. In tight spaces at marinas, piles or floats may need to be removed prior to dredging. Derrick barges, flat deck barges, and land equipment could be used to pull floats and piles from shoaled areas of the marinas if necessary. Boathouses located in shoaled areas requiring maintenance dredging may need to be temporarily relocated prior to maintenance dredging (a small hydraulic dredge can be used in tight spaces to minimize the need for infrastructure relocation). Any removed floats and piles would be reinstalled following dredging activities.

All dredged material would be sampled for chemical quality and for the presence of invasive species to ensure it is suitable for open-water disposal at an approved location in the Puget Sound. This is the assumed disposal scenario and would result in significant cost savings compared to upland disposal. If chemical quality does not meet state standards or if invasive species are present in the sediment, the dredged material would be transported to an upland disposal site.

Maintenance dredging would most likely be completed by mechanical means using water-based heavy marine equipment, such as derricks or excavators on flat barges, and dump scows. Maintenance dredging would be focused on areas of shoaling and sediment accumulation; maintenance dredging would likely not be needed across the entire FNC, vessel berth, or marina at any one time. With a coordinated maintenance dredging program, the dredge events could be planned in advance and phased in a way that would reduce impacts to the facilities. Dredging could be timed to avoid peak periods of recreational use (i.e., summer months for the marinas) and around vessel call schedules at the Port of Olympia.

Impacts on navigation in West Bay under the Estuary Alternative would be **significant,** but could be reduced to less than significant with implementation of the maintenance dredging program, and

What is the purpose of a monitoring plan?

The purpose of a monitoring plan is to identify sediment accumulation early so the frequency of maintenance dredging events can be adjusted and scheduled prior to reaching levels of significance.

A monitoring plan, in combination with the maintenance dredging program, allows for a flexible and responsive approach. This could reduce significant impacts to navigation from sediment deposition to less than significant levels.

Regular sediment monitoring, combined with scheduled, but adaptable maintenance dredging, provides for a consistent and coordinated management strategy that does not exist under the No Action Alternative.

annual (at a minimum) sediment monitoring that would support flexible and responsive dredging.

4.2.5.4 Impacts from Maintenance Dredging on Vessel Access and Berth or Slip Use

Under the Estuary Alternative, maintenance dredging in West Bay would occur at an assumed frequency of every 6 years. See Table 4.2.5 for the assumed maintenance dredging schedule, which shows that dredging would rotate across the facilities—not every facility would need to be dredged during each dredge event.

Early coordination with USACE, Port of Olympia, and West Bay private marinas would be required to schedule berth and slip use around the dredge events. For example, maintenance dredging at the Port of Olympia and in the FNC will require coordination of cargo vessel calls and/or call interruptions for up to 9 months during each dredge cycle (assumed to occur every 12 years in this location).

Maintenance dredging at West Bay private marinas could require slip vacancies for temporary periods of time (up to 2 months during each dredge cycle; assumed to occur every 6 years at Olympia Yacht Club and every 12 years at other private marinas). In tight spaces at the marinas, piles or floats may be required to be removed during dredging activities. Boathouses located in shoaled areas requiring maintenance dredging may need to be temporarily relocated prior to maintenance dredging. These required accommodations can be disruptive.

Although dredging is disruptive, it is common practice for operating water-dependent facilities that require minimum water depths to operate. Many ports and marinas in Puget Sound are able to remain operational during maintenance dredging activities. The number of active port berths can be temporarily reduced. Marinas can often move vessels to different slips to accommodate dredging in one location, and then move those vessels back to work at another dock or access area. Based on coordination with the marinas in 2022, it is understood that more than 10% of the slips in West Bay are vacant. The vacant slips could be used to temporarily moor vessels during maintenance dredge events.

Dredging would only occur within shoaled, isolated areas at the marinas, which would be limited to approximately 10% of the marina to ensure that impacts do not reach significant levels.

Are there potential beneficial effects under the Estuary and Hybrid Alternatives?

Under the Estuary Alternative, if consistent funding is available, maintenance dredging would be completed with regularity. Maintenance dredging would also occur as part of a coordinated program across facilities. Maintenance dredging is not coordinated or conducted with regularity in West Bay under existing conditions. The maintenance dredging is incorporated into the alternative itself and supplemented with a sediment monitoring plan that would support early identification of sediment accumulation conditions that could interrupt vessel access or berthing. Therefore, the recurring maintenance dredging and monitoring could provide a minor beneficial effect to navigation under the Estuary and Hybrid Alternatives. Coordination of the design and permitting, which is an extensive process, would also be a benefit compared to the current approach of each entity doing this work separately.

Potential Impacts if Maintenance Dredging is Delayed

If the maintenance dredging program proposed as part of the Estuary and Hybrid Alternatives was not carried out or was delayed (due to lapses in funding or for other reasons), **significant impacts** to the Port of Olympia and marinas would occur more quickly.

Within approximately 10 to 12 years post-construction, larger, heavier commercial vessels calling at the Port of Olympia could be required to wait up to 4 hours for channel access due to water depth and low tide conditions. Wait times could increase if maintenance dredging is delayed further than approximately 10 to 12 years and operations may require adjustment. However, within the project time horizon, the port vessel berths would not be fully precluded from use, but convenience and use of the south berth would be impacted, and this could increase Port of Olympia operation costs affiliated with this berth.

At the Olympia Yacht Club, if the proposed maintenance dredging does not occur, approximately 10% of slips could be impacted in approximately 5 to 6 years post-construction. The sediment accumulation pattern would likely look similar to present conditions, with shallower areas in the marina accumulating sediment first and deeper areas remaining accessible. Based on hydrodynamic and sediment transport modeling, the level of anticipated impact could increase under the Estuary Alternative to 20% of marina slips impacted in 12 years, 30% in 18 years, 40% in 24 years, and 50% in 30 years. Under the Hybrid Alternative, the level of anticipated impact could increase to 20% of leased moorage in 10 years, 30% in 15 years, 40% in 20 years, 50% in 25 years, and 60% in 30 years.

For the other West Bay marinas, all located north of the Olympia Yacht Club, it is estimated that 10% of slips could be impacted after 12 years. Sediment accumulation would also likely reflect present conditions, with shallower areas in the marinas accumulating sediment first and deeper areas remaining accessible. In 24 years under the Estuary Alternative, 20% of slips may be impacted, and about 25% of slips may be impacted after 30 years; whereas, this level of impact would occur in only 20 years under the Hybrid Alternative.

The Marina Access Area would be less constrained over the 30-year project time horizon given the deeper water in that area.

Lost leased moorage at the marinas as a result of potential delays in project-proposed maintenance dredging would be a **significant impact** and the severity would vary based on the duration of delay.

Please see Chapter 7.0 of the Final EIS for a description of the Funding and Governance Work Group proposal to fund maintenance dredging of the increased sediment that would be deposited in West Bay under the Estuary Alternative, consistent with the terms of an MOU and subsequent agreement that would extend through 2050.

Maintenance dredging at the Port of Olympia could be phased to avoid impacting more than one berth at a time, and care would be taken with scheduling to minimize the potential for cargo vessel call delays. Temporary relocation of vessels and boathouses to other open slips within West Bay private marinas would also minimize impacts. These measures would reduce the potential for significant impacts on vessel navigation from the maintenance dredging plan under the Estuary Alternative to less than significant.

4.2.6 What are the long-term impacts under the Hybrid Alternative?

4.2.6.1 Sediment Deposition Rates

With the Hybrid Alternative, sediment deposition within West Bay would be the highest of all alternatives. The projected rates of sediment deposition are presented in Table 4.2.6 and compared to the No Action and Estuary Alternatives. Average annual sediment deposition rates in West Bay under the Hybrid Alternative would range from approximately 7.64 inches (19.4 centimeters) each year at the Olympia Yacht Club at the southern tip of the study area to 0.1 inches (0.3 centimeters) within the portion of the FNC at the northern most boundary of the study area.

Table 4.2.6 Average Annual Sediment Deposition in West Bay for the No Action, Estuary, & Hybrid Alternatives

Location	No Action Alternative in/yr *(cm/yr)*	Estuary Alternative in/yr *(cm/yr)*	Hybrid Alternative in/yr *(cm/yr)*
Olympia Yacht Club	1.7 *(4.2)*	6.18 *(15.7)*	7.64 *(19.4)*
Other West Bay Private Marinas and Marina Access	0.83 *(2.1)*	3.2 *(8.2)*	3.9 *(9.9)*
Port of Olympia/ Turning Basin	0.87 *(2.1)*	3.1 *(7.8)*	3.6 *(9.1)*
FNC (excluding Turning Basin)	0.04 *(0.1)*	0.1 *(0.3)*	0.1 *(0.3)*

The increased sediment deposition under the Hybrid Alternative would most likely be due to acceleration of river flow within the North Basin as it is forced to bend around the barrier wall of the reflecting pool. This acceleration of the flow would result in increased erosion within the North Basin and increased deposition within West Bay compared to the Estuary Alternative.

Similar to the Estuary Alternative, sediment erosion/deposition patterns were also assessed for two different flow events: Event A, representing a low flow scenario; and Event B, representing a high flow scenario. Table 4.2.6 compares average annual sediment deposition in West Bay under the No Action, Estuary, and Hybrid Alternatives. Figure 4.2.2 and Figure 4.2.3 compare deposition and erosion patterns between the No Action, Managed Lake, Estuary,

and Hybrid Alternatives for both events. The results indicate that annual erosion/deposition rates are generally higher for Event B than Event A because stronger flows will result in higher deposition and erosion rates. Higher deposition rates would occur on the east side of West Bay due to a shallow intertidal habitat area on the west side of West Bay.

4.2.6.2 Initial Dredging during Construction

Similar to the Estuary Alternative, initial dredging would be conducted during construction to reduce a sediment source that would be available for transport into West Bay during high flow events after removal of the 5th Avenue Dam. Approximately 500,000 cubic yards (380,000 cubic meters) of sediment would be dredged from the North and Middle Basins during construction. Similar to the Estuary Alternative, numerical modeling shows that this initial dredging would result in a 49% reduction in impacts to sedimentation anticipated at the Olympia Yacht Club.

4.2.6.3 Maintenance Dredging

The approach to recurring maintenance dredging for the Hybrid Alternative would be similar to the Estuary Alternative but would vary based on the anticipated patterns and rates of accumulation. The frequency of maintenance dredging increases under the Hybrid Alternative (Table 4.2.7) compared to the Estuary Alternative.

Table 4.2.7 Anticipated Maintenance Dredging in West Bay for the Hybrid Alternative

Years after Construction	Location	Potential Duration of Dredging	Estimated Amount (cubic yards *(cubic meters)*)
5	Olympia Yacht Club	2 months	21,600 *(16,500)*
10	Olympia Yacht Club	2 months	21,600 *(16,500)*
10	Other Lower West Bay Private Marinas	1 month	15,600 *(11,900)*
10	Port of Olympia/Turning Basin	9 months	247,800 *(189,500)*
15	Olympia Yacht Club	2 months	21,600 *(16,500)*
20	Olympia Yacht Club	2 months	21,600 *(16,500)*

Years after Construction	Location	Potential Duration of Dredging	Estimated Amount (cubic yards *(cubic meters)*)
20	Other Lower West Bay Private Marinas	1 month	15,600 *(11,900)*
20	Port of Olympia /Turning Basin	9 months	247,800 *(189,500)*
20	Marina Access	2 months	65,400 *(50,000)*
25	Olympia Yacht Club	2 months	21,600 *(16,500)*
30	Olympia Yacht Club	2 months	21,600 *(16,500)*
30	Other Lower West Bay Private Marinas	1 month	15,600 *(11,900)*
30	Port of Olympia /Turning Basin	9 months	247,800 *(189,500)*
		Total Dredged	**985,200** ***(753,200)***

Note:

Maintenance dredging operations are assumed to be 10 hours a day, 5 days a week within the applicable in-water work window (July 16 through February 15 each year). Maintenance dredging could extend into more than one in-water work window if dredging were phased to minimize impacts to operations (e.g., many marinas avoid completing maintenance during busy summer months).

A sediment monitoring plan is also proposed for the Hybrid Alternative. Monitoring would reduce or increase the frequency of maintenance dredging within the identified resource areas in West Bay based on annual bathymetric data.

Maintenance dredging would be conducted according to the methods described for the Estuary Alternative. All dredged material is assumed to be suitable for open-water disposal, given the quality of the material moving downstream from the Deschutes River and because invasive species present in the lake are not expected to persist in the dredge areas.

Impacts on navigation in West Bay under the Hybrid Alternative would be **significant,** but could be reduced to less than significant with implementation of recurring maintenance dredging, and with sediment monitoring program that would support flexible and responsive dredging.

4.2.6.4 Impacts from Maintenance Dredging on Vessel Access and Slip or Berth Use

Under the Hybrid Alternative, maintenance dredging in West Bay would occur at an assumed frequency of every 5 years. See Table 4.2.5 for the assumed maintenance dredging schedule, which shows that dredging would rotate across the facilities—not every facility would need to be dredged during each dredge event. This would require the USACE, Port, and West Bay private marinas to schedule and coordinate berth and slip use around these events. The movement or relocation of marine infrastructure (piles, floats, boathouses, etc.) can be a substantial disruption to marine operations. However, as described for the No Action Alternative and Estuary Alternative, maintenance dredging is only carried out at impacted areas and often ports and marinas are able to remain operational during maintenance dredging activities. Early coordination and scheduling would be necessary to minimize impacts on navigation.

Sediment monitoring and regular implementation of an adaptable maintenance dredging program would facilitate proactive scheduling and planning. These measures would reduce the potential for significant impacts from the maintenance dredging program on vessel navigation under the Hybrid Alternative to less than significant.

4.2.7 What mitigation measures would be recommended or required for the three alternatives?

Enterprise Services would avoid and minimize potential impacts by complying with regulations, permits, plans, and authorizations. These anticipated measures, and other mitigation measures that were evaluated and eliminated are described below.

4.2.7.1 Managed Lake Alternative

Mitigation measures that avoid and minimize impacts to vessel navigation are not proposed under the Managed Lake Alternative because impacts to navigation in West Bay are not anticipated.

Project elements and mitigation measures

For the Estuary and Hybrid Alternatives, the following measures would avoid and minimize impacts to vessel navigation:

- Initial dredging of Capitol Lake would result in a 49% reduction in impacts to sedimentation at the Olympia Yacht Club.
- Implementation of a maintenance dredging program would ensure maintenance dredging occurs with regularity at the FNC, Port of Olympia, and marina facilities.
- Implementation of a sediment monitoring program would document conditions in West Bay and monitor sediment accumulation to identify when the FNC, turning basin, Port of Olympia, and marinas are nearing the threshold that triggers maintenance dredging.

4.2.7.2 Estuary Alternative

Two key project design features that avoid and minimize impacts to vessel navigation have been incorporated into the project under the Estuary Alternative:

- Initial dredging of Capitol Lake before the 5th Avenue Dam is removed was shown during numerical modeling to be effective in reducing sediment deposition in Budd Inlet. Sediment deposition at the Olympia Yacht Club, for example, reduces by approximately 49% when initial dredging is assumed.
- A maintenance dredging program would be implemented in impacted areas of West Bay. The purpose of this is to manage sediment accumulation in West Bay and minimize impacts to Port of Olympia and private marina facilities and access channels to less than significant levels.

In addition to the design features described above, the following mitigation measures are included in the project for the Estuary Alternative:

- A sediment monitoring plan would be developed and implemented to document initial conditions at the nearby southern portion of the FNC, the Port of Olympia, and West Bay private marinas and to observe when actual impacts occur. Sediment monitoring is especially important to document high flow events (i.e., storm surges), which influence sediment load. Monitoring would be conducted regularly and used to modify the maintenance dredging plan, as necessary. The use of sediment monitoring to implement the maintenance dredging plan allows for an adaptive, flexible, and responsive approach to avoiding significant impacts to navigation from sediment deposition.
- As part of the maintenance dredging program, scheduling and phasing would be developed in coordination with the USACE, Port of Olympia, and private marinas to minimize impacts to the FNC and turning basin, Port of Olympia berths, and private marinas. This would include early coordination and scheduling with marina managers and vessel slip and boathouse tenants to identify the need for, and provide, temporary moorage as required (i.e., space at another

marina or facility in West Bay, or the installation of a temporary dock to use during maintenance dredging).

A range of other mitigation measures were modeled to evaluate their ability to influence sediment deposition in Budd Inlet, and reduce impacts to navigation, including dredging of the shallow intertidal area, installation of a sediment control structure or trap, and dredging a deeper channel to connect the Capitol Lake Basin with West Bay. Following this evaluation, the sediment monitoring plan was determined to be the most effective measure to identify potentially impacted areas and ensure that impacts of sediment deposition do not reach significant levels. See the Navigation Discipline Report (Attachment 6) for more detail.

4.2.7.3 Hybrid Alternative

Mitigation measures that avoid and minimize impacts to vessel navigation for the Hybrid Alternative are the same as those described for the Estuary Alternative in Section 4.2.7.2.

4.2.8 What are the significant unavoidable adverse impacts to navigation?

The project would result in no significant long-term change to vessel navigation under the Managed Lake, Estuary, or Hybrid Alternatives so long as the recommended maintenance dredging program and sediment monitoring are conducted. See Chapter 7.0 of the Final EIS for additional information on the funding approach for the proposed maintenance dredging program. Project measures would be implemented to address sediment-related impacts in West Bay; therefore, significant impacts are avoidable and there would be no significant unavoidable adverse impacts on vessel navigation.

4.3 WATER QUALITY

This section describes the potential long-term impacts of the Capitol Lake – Deschutes Estuary Long-Term Management Project on water quality in the Project Area. Improving water quality is one of the primary project goals. Also described are measures that would be used to avoid, minimize, or mitigate adverse project effects, and the potential for significant unavoidable adverse impacts. In addition to adverse impacts that are the common focus of a SEPA EIS, anticipated beneficial effects on water quality are discussed for each project alternative. The information presented here is summarized from the full analysis in the revised Water Quality Discipline Report (Attachment 7).

See the Final EIS Summary or within the Water Quality Discipline Report for a summary of key changes between the Draft EIS and Final EIS.

This project is occurring during a period of change related to how the watershed and water resources in the Project Area and region are managed. Implementation of the recently approved Deschutes River TMDL should result in changes in watershed conditions that will be reflected in lake and estuary water quality. Also, the draft Budd Inlet TMDL has recently been released and a Puget Sound Nutrient Reduction Program is underway, both of which, if approved and implemented, would result in additional changes to water quality. These watershed-scale management efforts will be implemented regardless of which alternative is selected for implementation in the Capitol Lake Basin, and none of these activities are directly or indirectly impacted by the project alternatives. Therefore, while they are mentioned, they are not evaluated as part of the impact or benefits resulting from implementation of the project. However, the TMDLs establish a regulatory environment that reflect the existing (and anticipated future) condition; therefore, for each alternative an analysis has been included that addresses regulatory compliance in terms of water quality standards attainment and TMDL requirements, as they are currently viewed by Ecology.

Key Findings: Long-Term Effects on Water Quality

Under the No Action Alternative, current water quality conditions and trends would persist, reflecting the predominant influence from the Deschutes River. Eventually, there would be a **significant impact** on the lake from loss of open water habitat due to the transition from submerged aquatic plants to emergent plants along the shoreline. There would be no change to Budd Inlet because no substantive changes in water quality in the lake basin would be expected. Water quality standards for dissolved oxygen would continue to not be attained.

As described below, water quality conditions would improve in varying ways under all long-term management alternatives; however, exceedances of water quality standards would continue to occur under all long-term management alternatives.

Under the Managed Lake Alternative, the lake would experience no change in algae and **substantial benefits** from aquatic plant management. Capitol Lake is expected to continue to experience moderate summertime algal blooms consisting of non-toxic species. Seasonal exceedances of water quality standards in Capitol Lake (temperature, dissolved oxygen, total dissolved gas, and pH) are likely to continue, and there would be no change in impact to water quality in Budd Inlet where the water quality standards for dissolved oxygen would continue to not be attained and the habitat quality and quantity for cold water fish would not materially change.

The Estuary and Hybrid Alternatives would create an estuarine environment in the existing lake basin (or in the western portion of the lake basin under the Hybrid Alternative) that would have seasonally low dissolved oxygen, as is typical for South Puget Sound estuaries. This shift would be a **significant impact** when compared to existing conditions. However, estuarine water is inherently different than freshwater. Possible increases in algae blooms that might be expected due to the incoming tidal waters would be offset by Deschutes River flows; thus, the overall appearance of algal blooms may be similar to existing conditions in the Capitol Lake Basin. The elimination of freshwater aquatic plants would be a **substantial benefit**. Budd Inlet would experience no change to minor to moderate benefits associated with improved dissolved oxygen, and algal blooms are expected to be largely the same as current conditions. Ecology has determined that the Estuary Alternative would meet the applicable narrative water quality standard, and that it is the only alternative capable of meeting water quality standards for dissolved oxygen in Budd Inlet. Though, dissolved oxygen concentrations would continue to be low.

Under the Hybrid Alternative, the freshwater pool portion of the basin would require active management to offset the effects of a reduced flushing rate with higher concentrations of phosphorus compared to existing lake conditions. Even with active management the pool is not expected to consistently meet water quality standards. The proposed freshwater reflecting pool could produce more algae and have higher fluctuations in dissolved oxygen due to the increased residence time (reduced flushing rate) and the high phosphorus concentrations in stormwater and groundwater inflows to the pool when compared to existing conditions. However, it is assumed the pool would be actively managed to control these potential impacts and the pool would not experience more algae blooms than the existing Capitol Lake Basin.

Implementing BMPs required by water quality permits would result in less than significant water quality impacts from maintenance dredging under all action alternatives.

Climate change (under all project alternatives) will result in increased water temperature in all three water bodies: the Deschutes River, Capitol Lake, and Budd Inlet. The increase in temperature is likely to result in increased algal blooms, increased pH, and decreased dissolved oxygen and related impacts on nutrient dynamics. None of the project alternatives considered will affect the magnitude or extent of these impacts.

4.3.1 What methods were used to assess long-term impacts to water quality?

Potential long-term adverse impacts and beneficial effects to water quality conditions under each project alternative were evaluated using a combination of information on long-term trends, current conditions, and model predictions of environmental factors affecting water quality. (Comparisons to existing water quality conditions do not imply that the existing conditions define the natural or preferred condition.) Adverse impacts and beneficial effects were evaluated for both the lake basin area (currently Capitol Lake) and Budd Inlet.

The water quality impact assessment focused on dissolved oxygen and algal blooms, as well as changes in aquatic plants and habitat for cold water fish. Dissolved oxygen is critical because low dissolved oxygen concentrations have been a long-term problem in Budd Inlet and have been the focus of water quality improvement planning efforts for many years, including the recently released draft TMDL for Budd Inlet. Adequate dissolved oxygen concentrations are important to aquatic habitat, particularly for cold water fish. Algal blooms are important because they can directly impact dissolved oxygen concentrations and aesthetic qualities, and sometimes produce chemicals that are harmful to people, pets, and wildlife. Aquatic plants may also impact water quality, aesthetics, and recreation. Other water quality parameters (e.g., bacteria, pH, and temperature) are not addressed in the EIS because they are not helpful in differentiating between the long-term water quality effects of the project alternatives. Additional information on these parameters is included in the Water Quality Discipline Report (Attachment 7).

Evaluating the magnitude of beneficial effects and the significance of adverse impacts on water quality involved a qualitative evaluation of the attributes described above (e.g., algae blooms, dissolved oxygen, and aquatic plants) and the ability to meet regulatory requirements, specifically water quality standards for dissolved oxygen. The regulatory assessment includes Ecology's determination based on their model findings. Water quality standards in Washington State are set to protect designated beneficial uses, including both aquatic life and recreational uses. A predicted benefit or impact needs to consider the magnitude as well as the temporal and spatial extents of changes as they are experienced by a biological endpoint (e.g., salmon sensitive to low dissolved oxygen) or people (e.g., park visitors observing algal blooms or masses of floating aquatic plants). Consistent with SEPA requirements, this analysis acknowledges

What water quality long-term impacts were considered?

Long-term adverse impacts and beneficial effects to water quality are expected to occur from changes to how: (1) water, nutrients, and sediments would flow through and circulate in the Project Area under different project alternatives; and (2) aquatic plant and algae communities respond to altered conditions and maintenance. This water quality impact assessment focuses on dissolved oxygen, algal blooms, aquatic plants, habitat for cold water fish, and dissolved oxygen water quality standards attainment.

where there are gaps in relevant information associated with projected water quality changes, and areas of scientific uncertainty (WAC 197-11-080). As such, it considers a range of potential impacts, including a worst-case outcome, which results in a range in the levels of predicted water quality improvement from implementation of the long-term management alternatives.

4.3.2 What are the long-term impacts under the No Action Alternative?

Under the No Action Alternative, Enterprise Services would continue to implement limited nuisance and invasive species management activities. In the absence of a long-term management project, funding and approvals to manage sediment, control aquatic plants, implement water quality protection measures, improve ecological functions, or enhance community use cannot be obtained. As a result, the lake basin would continue to fill with sediment, ultimately with a loss of open-water habitat around the perimeter and more riverine conditions along the flow path of the Deschutes River. Submerged aquatic plants would continue to dominate the habitat and slowly transition (over decades) to emergent wetland plants. The lake basin currently has extensive aquatic plant growth, and further loss of open-water areas, in the absence of active lake management, is expected to result in a **significant impact** on water quality. Under the No Action Alternative, the lake's capacity to store sediments eventually would be lost and then the river's sediment load would pass directly to Budd Inlet. Within the 30-year planning horizon for this project, Capitol Lake is expected to continue functioning as a lake with dense aquatic plants, including decreasing sediment and nitrogen in waters discharged to Budd Inlet, and increasing phosphorus and TOC loads.

Dissolved oxygen concentrations in the lake basin would more closely reflect the dissolved oxygen in the Deschutes River as Capitol Lake gradually fills with river sediment. Minor to moderate benefits on dissolved oxygen and algae concentrations in the lake basin can be expected to result from implementation of the Deschutes River Total Maximum Daily Load (TMDL), and the natural establishment of emergent wetlands around the lake perimeter may provide further pollutant buffering.

The quality of the water entering Budd Inlet would become increasingly similar to that of the Deschutes River as the lake becomes more river-like. There would be no change in dissolved oxygen and algae concentrations expected in Budd Inlet from gradual

What is considered a significant impact to water quality?

Impacts to water quality are considered significant if there would be substantive spatial or temporal changes in dissolved oxygen concentrations that (1) decrease habitat quality or quantity for cold water fish, or (2) result in non-attainment of the numeric or narrative water quality standards for dissolved oxygen; a measurable increase in either the extent or frequency of algal blooms; or a measurable increase in the areal extent of aquatic plants. Substantial beneficial effects on water quality would be expected if (1) a substantive spatial or temporal improvement in dissolved oxygen would improve habitat quality or quantity for cold water fish, (2) a visually noticeable decrease in the extent or frequency of algal blooms and/or decrease in the areal extent of aquatic plants would occur, or (3) if improvements in dissolved oxygen are projected to result in attainment of water quality standards.

changes in the lake basin. Within the 30-year planning horizon, the No Action Alternative is not expected meet the recent TMDL requirements and, therefore, would result in continued exceedances of water quality standards in the Project Area, per Ecology determination.

Climate change will result in increased water temperature in all Project Area waterbodies. The increase in temperature will likely result in increased algal blooms, increased pH, decreased dissolved oxygen, and impacts on TOC and other nutrient dynamics. Summertime low flows will increase in severity, which could exacerbate the temperature effects. Peak (flood) flows in the Deschutes River are likely to increase over time, therefore increasing flood impacts in the Project Area. Also, since sediment is transported mostly during flood events, total sediment delivery could increase over time and accelerate lake filling. The No Action Alternative would not provide opportunities for adaptation to these effects of climate change.

4.3.3 What are the long-term impacts common to all action alternatives?

Long-term impacts common to all action alternatives are associated with recurring maintenance dredging to maintain target depths in the North Basin under the Managed Lake Alternative, or in impacted areas of West Bay under the Estuary and Hybrid Alternatives. The risk of water quality degradation from maintenance dredging is low because dredged sediment quality in both the lake basins and West Bay is expected to be uncontaminated (i.e., having concentrations of metals and organic contaminants below Sediment Management Standards (SMS) criteria following dredging completed as a separate action). Dredging BMPs would be implemented to reduce suspended sediments in the immediate dredge area and limit turbidity increases to within the temporary authorized mixing zone. Considering these factors, maintenance dredging for all action alternatives would have less than significant impacts on water quality.

Other long-term water quality impacts are expected from climate change. Climate change will result in increased water temperatures in the Deschutes River, Capitol Lake, and Budd Inlet. The increase in temperatures is likely to result in increased algal blooms, increased pH, decreased dissolved oxygen, and other water quality effects. Flood flows in the Deschutes River are likely to increase with climate change, resulting in greater flood impacts and sedimentation under any of the alternatives. Summertime low flows are also expected to

decrease, which could exacerbate the temperature effects described above. Differences may occur in the opportunities for adaptation to climate change, as described below.

4.3.4 What are the long-term impacts from the Managed Lake Alternative?

Under the Managed Lake Alternative, overall adverse impacts on water quality in Capitol Lake would be less than significant. Primarily through activities to control nuisance aquatic plant growth, minor to substantial water quality benefits are also anticipated, depending on the water quality parameter and location of effect (Table 4.3.1). The North Basin would be maintained as open-water habitat through periodic dredging, while the Middle and South Basins would gradually transition to a mix of vegetated wetlands and shallow water habitat. Within the lake basin, no substantive changes in dissolved oxygen concentrations would be expected. Management of Capitol Lake would have no change in impacts to water quality in Budd Inlet, and, as indicated by Ecology modeling, the lake would continue to be a major contributor to human-caused dissolved oxygen depletion in the inlet. There are also no changes expected from the Managed Lake Alternative on the general condition of habitat for cold water fish or the extent or frequency of algae blooms in Budd Inlet.

Specific effects on water quality under the Managed Lake Alternative would depend on management techniques implemented under an adaptive management approach that would integrate water quality, aquatic plant, algae, invasive species, and habitat management. Management objectives for the lake could include:

- Controlling nuisance or toxic algal blooms if they became problematic
- Controlling aquatic plants to improve aesthetics and boating access, and reduce fall and winter nutrient release to Budd Inlet
- Controlling invasive species
- Supporting beneficial uses (fish and wildlife habitat, fishing, small nonmotorized watercraft, aesthetics, reflecting pool, and other noncontact recreation uses)
- Supporting ongoing work to reduce nutrients and contaminants as identified in the existing Deschutes River TMDL and draft Budd Inlet TMDL
- Enhancing ecological value

Long-term impacts on water quality associated with the Managed Lake Alternative are listed and summarized in Table 4.3.1 and further described in this section.

Table 4.3.1 Summary of Long-Term Water Quality Impacts: Managed Lake Alternative

Impact	Impact Finding	Measures to Reduce or Mitigate Impacts	Significant & Unavoidable Impact
Cold water fish habitat in Capitol Lake Basin	No change in impact	N/A	No
Algae blooms in Capitol Lake Basin	No change in impact	N/A	No
Aquatic plants in Capitol Lake Basin	**Substantial benefit**	To be identified in Adaptive Management Plan	No
Short-term water quality effects from long-term management actions	Less than significant	BMPs and water quality permit conditions	No
Compliance with water quality standards	Continued non-compliance with dissolved oxygen standard	N/A	Yes
Cold water fish habitat in Budd Inlet	No change in impact	N/A	No
Algal blooms in Budd Inlet	No change in impact	N/A	No

4.3.4.1 Lake Basin

An adaptive lake management plan would be developed to achieve water quality objectives and enhance beneficial uses. These management actions would include development of an action threshold for the summer mean concentration of total phosphorus. This threshold would be used to identify when management actions are needed to reduce the frequency and extent of recreation impacts from algae, aquatic life impacts from high pH and dissolved gas in shallow waters, and low dissolved oxygen in deeper waters. An aquatic plant management plan would be developed to maintain an aquatic plant community that does not impair recreation or aquatic life uses. The adaptive lake management plan would specify water quality and aquatic plant monitoring procedures for evaluating whether the objectives are being met or need to be modified based on changes in water quality conditions or lake uses.

The adaptive lake management plan would include measures that are relatively modest (e.g., mechanical harvesting of aquatic plants), because of the following existing water quality conditions:

- The relatively low existing chlorophyll-*a* concentrations and lack of toxic algal blooms
- Dissolved oxygen conditions that support aquatic life and meet water quality criteria most of the time
- Reduced sediment phosphorus inputs by removing phosphorus-rich surface sediments from the North Basin
- Reduced watershed phosphorus inputs through implementation of the Deschutes TMDL and stormwater treatment
- Generally improving water quality trends that have been documented in recent years

As part of ongoing water quality management efforts throughout the basin, establishment of a lake-specific action threshold for phosphorus is expected to promote improvements in treatment of stormwater that enters the lake. These activities and continuing TMDL work in the Deschutes River Watershed would promote a continuing trend in water quality improvement. If the TMDL goal for total phosphorous in the Deschutes River is achieved, this would likely result in a substantive reduction in phosphorus loading to the lake and resulting total phosphorus concentrations, and may also reduce algae populations and moderate dissolved oxygen concentrations. However, implementation of the TMDL is a management activity that is not part of this project, and achieving the phosphorus reduction goal will be difficult and likely take time beyond the 30-year project planning horizon. For this analysis it is assumed that incoming nutrient concentrations would be similar to what exist currently. Therefore, potential improvements are not expected to decrease lake nutrient concentrations enough to shift from eutrophic (nutrient-rich) to mesotrophic (moderate levels of nutrients). The lake would continue to be productive (eutrophic) and support an aquatic plant community that would be controlled through aquatic plant management activities, such as mechanized harvesting. Reducing aquatic plants through these additional control activities would provide a **substantial benefit**.

Even with implementation of the adaptive management plan, Capitol Lake would continue to experience summertime algal blooms, occasional exceedances of state standards for dissolved

Managed Lake Alternative Impacts and Benefits to Water Quality

Dissolved Oxygen

- Capitol Lake Basin: no change
- Budd Inlet: no change

Cold Water Fish Habitat

- Capitol Lake Basin: no change
- Budd Inlet: no change

Algal Blooms

- Capitol Lake Basin: no change
- Budd Inlet: no change

Aquatic Plants

- Capitol Lake Basin: substantial benefit
- Budd Inlet: no change

Regulatory Compliance

- Ecology has determined Managed Lake Alternative is not likely to meet water quality standards.

oxygen, pH, and temperature, and frequent violations of total dissolved gas, as is typical of lake environments.

While there could be measurable decreases in the algae community and fewer occurrences of algal blooms due to decreased nutrients, the changes may not be noticeable to the public. This finding is supported by scenarios modeled by Ecology. Ecology evaluated potential impacts on lake quality from watershed improvements, dredging to 13 feet, and alum treatments; the modeling indicated that these measures would not have a meaningful effect on lake water quality.

Creation of habitat areas in the Middle Basin would impact hydrodynamics and create localized areas of more stagnant water associated with the change to wetland conditions. This change could promote more algae and/or plant growth in isolated areas. However, these impacts in small areas would result in less than significant impacts on the overall water quality of the Middle Basin.

Initial dredging of the North Basin would remove aquatic plants and upper layers of sediments that contain substantially higher concentrations of bioavailable phosphorus (phosphorus available for algae and plant growth). The lower concentrations of bioavailable phosphorus in the North Basin sediments that would be exposed after dredging may result in lower lake phosphorus concentrations and therefore a reduced nutrient supply for algal blooms. Less bioavailable phosphorus from the sediments could result in a minor benefit to water quality but based on river inputs alone the lake would continue to be eutrophic and support algal blooms.

Activities commonly used to control aquatic plants, algae, or invasive species, such as mechanical harvesting or application of approved aquatic herbicides, could have localized, short-term impacts. However, permit requirements (including BMPs) would minimize potential impacts. These lake management activities have been implemented on many other area lakes, and permit requirements are expected to result in less than significant impacts on water quality.

4.3.4.2 Budd Inlet

Water quality conditions in lower Budd Inlet would generally remain the same as existing conditions under the Managed Lake Alternative. Lake and watershed management activities associated with management of the lake may reduce nutrient loading from these sources to the inlet, including possible decreases in summer/fall TOC

due to aquatic plant management activities. Ecology's modeling indicates that lake aquatic plants are an important contributor to Managed Lake depletion in Budd Inlet; therefore, it could be assumed that removal of the plants would benefit Managed Lake in Budd Inlet. However, as described previously, there is some uncertainty attributed to model findings, and a conservative approach has been taken in interpretation of impacts and benefits, and, therefore, it has been assumed that the portion of Managed Lake depletion attributed to Capitol Lake may decline due to these activities, but not substantially. The most nutrient loading to Budd Inlet is from Puget Sound tidal waters and inlet sediment flux, which would not be affected by the project. These existing nutrient sources from Puget Sound would continue to feed marine algal blooms and drive low dissolved oxygen conditions in the deeper waters, regardless of inputs from Capitol Lake. Sediment conditions and sediment dredging frequency in West Bay would remain the same as under existing conditions.

With implementation of the Deschutes River TMDL and partial implementation of the Budd Inlet TMDL (it can only be fully implemented through removal of the 5th Avenue Dam) there would be expected to be additional benefits to Budd Inlet in terms of habitat conditions for cold water fish and possibly the extent and frequency of algal blooms. TMDL implementation activities are not a project action and therefore not addressed in the evaluation of project impacts.

The Managed Lake Alternative would have no change to water quality in Budd Inlet compared to existing conditions because there would be no spatial or temporal changes in dissolved oxygen or other habitat conditions for cold water fish, and no change in the extent or frequency of algal blooms. Ecology's modeling has indicated that lake aquatic plants are an important contributor to dissolved oxygen depletion in Budd Inlet, and therefore, it could be assumed that their removal should increase dissolved oxygen in Budd Inlet; however, there is some uncertainty attributed to model findings. A conservative approach has been taken in interpretation of impacts and benefits, and it has been assumed that the portion of dissolved oxygen depletion attributed to Capitol Lake may decline under this alternative, but not substantially. Budd Inlet would continue to experience low summer dissolved oxygen concentrations that do not meet dissolved oxygen criteria, especially in the deeper waters. There would also be no change in the aquatic plants in Budd Inlet resulting from the Managed Lake Alternative.

4.3.4.3 How would the Managed Lake Alternative comply with water quality regulations?

Ecology has sole authority over the determination of water quality compliance; thus, evaluation of dissolved oxygen water quality standard attainment is based on Ecology's modeling and predictions. As provided in the Draft Budd Inlet TMDL, Ecology has stated that Enterprise Services may not deplete dissolved oxygen levels in Budd Inlet at any time or location beyond the impact of the natural estuary condition, and the TMDL provides a small oxygen depletion rate that would be allowed if Enterprise Services retained the lake, but overall **compliance with the TMDL would be very difficult and is not assumed**. Ecology does provide that if an alternative other than the Estuary Alternative is selected, Enterprise Services must show how water quality standards would be met through mechanistic water quality modeling. There is no known approach to meeting natural estuary conditions under a Managed Lake scenario, and no plans for mechanistic water quality modeling as part of the EIS.

Ecology has concluded that the Managed Lake Alternative would result in continued dissolved oxygen depletion in Budd Inlet so water quality standards in the Project Area would not be met with the current design. The Managed Lake Alternative would be unlikely to meet the recent Budd Inlet TMDL oxygen depletion limitations and therefore would result in continued exceedances of water quality standards in the Project Area, per Ecology interpretations.

4.3.5 What are the long-term impacts from the Estuary Alternative?

Long-term impacts or benefits from the Estuary Alternative include potential changes in the quality and nature of water in Budd Inlet and the existing lake basin, and recurring maintenance dredging of areas in West Bay (Table 4.3.2). The Estuary Alternative results in the greatest change from existing conditions, with effects that differ depending on their location. Therefore, the impacts on the lake basin and Budd Inlet are described separately in this section.

Table 4.3.2 Summary of Long-Term Water Quality Impacts: Estuary Alternative

Impact	Effect Finding	Measures to Reduce or Mitigate Significant Impacts	Significant & Unavoidable Impact
Cold water fish in Capitol Lake	**Significant impact** compared to existing lake water quality; estuary water quality inherently different	N/A	Yes
Algae in Capitol Lake	No change in impact	N/A	N/A
Aquatic plants in Capitol Lake	**Substantial benefit**	N/A	No
Short-term water quality effects from long-term management actions	Less than significant	Implementation of BMPs and environmental permit conditions	No
Compliance with water quality standards	Ecology has determined this alternative will meet the dissolved oxygen water quality standard	N/A	No
Cold water fish habitat in Budd Inlet	No change in impact to minor or moderate benefit	N/A	No
Algal blooms in Budd Inlet	No change in impact	N/A	No

4.3.5.1 Lake Basin

Under the Estuary Alternative, the existing lake basin would become part of the estuary, which by design would result in extensive changes in the water quality of the lake basin to conditions typical of an estuary. Compared to Capitol Lake where dissolved oxygen conditions are generally good throughout the basin, dissolved oxygen concentrations in this area would reach much lower levels under the Estuary Alternative.

The water quality in the lake basin area would be an extension of what currently exists in West Bay, but with less dissolved oxygen. Therefore, the dissolved oxygen concentrations in the lake basin area would be lower than West Bay and below the minimum water quality criterion, resulting in a **significant impact** when compared to existing conditions. Low dissolved oxygen concentrations are a common condition of narrow, shallow, tidal estuaries in the South Puget Sound; the continued influence of the Deschutes River would likely maintain

better dissolved oxygen conditions than in neighboring inlets. Such changes are not expected to significantly impact fish (see Section 4.5, Fish & Wildlife).

Algal blooms would continue to occur in what is the existing lake basin under this alternative. The blooms would be made up of marine algae communities that differ from the freshwater algae that currently exist in the basin. However, algal blooms would generally appear similar to existing conditions in the basin, and there would be no significant change in apparent water quality from algae. The elimination of freshwater aquatic plants from the transition to an estuarine habitat would provide a **substantial benefit** to water quality.

Creation of habitat areas and the formation of tideflats in the Middle and South Basins would impact water movement and may create small areas of more stagnant waters that promote algae, thereby causing localized areas of poorer water quality. Substantive spatial or temporal decreases in available dissolved oxygen are expected in the former Capitol Lake Basin area. Based on this, the Estuary Alternative would have **significant impacts** on habitat quality or quantity for cold water fish when compared to existing conditions. Although these impacts are characterized as significant because they represent a decline in dissolved oxygen concentrations from existing conditions, dissolved oxygen conditions would be similar to what is experienced in other inlets in South Puget Sound estuaries, and human-caused sources of oxygen depletion would be reduced to a level that meets the narrative water quality standard for dissolved oxygen, as determined by Ecology.

4.3.5.2 Budd Inlet

In evaluating potential long-term impacts and benefits of the Estuary Alternative, this section reviews model predictions for improvements in Budd Inlet dissolved oxygen in light of more recent water quality monitoring data from Capitol Lake and the Deschutes River. Ecology's modeling indicated that removal of the 5th Avenue Dam would result in improvements in Budd Inlet dissolved oxygen concentrations, predicting a dissolved oxygen gain of approximately 1 mg/L during the critical late-summer period in deeper waters throughout much of the inlet. Greater improvements were predicted for East Bay. Even with the projected improvements, the model predicted continued problematic excursions (levels) less than the 5 mg/L minimum water quality criterion in surface and bottom waters of East Bay after the 5th Avenue Dam is removed. Ecology's Draft TMDL for Budd Inlet has

Estuary Alternative Impacts and Benefits to Water Quality

Dissolved Oxygen

- Capitol Lake Basin: significant impact (when compared to existing lake water quality, but estuarine water would be inherently different)
- Budd Inlet: no change to moderate benefit and the only alternative that meets TMDL limits, as determined by Ecology

Cold Water Fish Habitat

- Capitol Lake Basin: significant impact compared to existing conditions
- Budd Inlet: no change to minor or moderate benefit

Algal Blooms

- Capitol Lake Basin: no change
- Budd Inlet: no change

Aquatic Plants

- Capitol Lake Basin: substantial benefit
- Budd Inlet: no change

Regulatory Compliance

- Ecology has determined the dissolved oxygen water quality standard will be met

determined that the Estuary Alternative would restore natural estuary conditions; thus, **compliance with the TMDL allocation is assumed.**

Field observations and trends in water quality monitoring data (as summarized in Chapter 3.0 [Section 3.3, Water Quality]) suggest uncertainties in these predicted dissolved oxygen improvements. Monitoring data indicate that dissolved oxygen changes could range from no improvement to the full improvement predicted by the model. However, the predicted improvements in dissolved oxygen are not based solely on changes in nutrient dynamics but also on expected changes in flow and circulation patterns in Budd Inlet after dam removal. 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.

Management scenarios, which had been identified and prioritized with stakeholders, were modeled by Ecology as potential management actions to address water quality concerns. All scenarios relied on establishing a "natural" condition as a baseline for comparing management scenarios, rather than comparing the scenarios to existing conditions. The "natural" condition was defined by assuming that nutrient concentrations and loadings from the rivers, tributaries, and Puget Sound are at background (pre-development) levels and that wastewater treatment plant (WWTP) discharges and other pollutant sources, such as stormwater, are at natural background river concentrations.

Ecology Modeling

Ecology performed modeling to evaluate the potential effectiveness of 15 different management scenarios for Budd Inlet, compared to "natural" conditions (not existing conditions) as a baseline for comparing management scenarios.

The scenario directly relevant to the Estuary Alternative was removal of the 5th Avenue Dam. Ecology modeling indicated that dissolved oxygen concentrations would gain approximately 1 mg/L during the critical late-summer period in deeper waters throughout much of Budd Inlet. Although dissolved oxygen is predicted to improve if the dam is removed, the numeric water quality criteria (i.e., 5 mg/L in inner Budd Inlet) would still not be met in either East Bay or West Bay, as stated by Ecology. The greater levels of dissolved oxygen depletion resulting from keeping the dam in place was attributed primarily to TOC loading from Capitol Lake, and the pulsed dam releases that alter Budd Inlet circulation were also identified as an important contributing factor.

Ecology predicted higher loads of dissolved inorganic nitrogen entering Budd Inlet during summer months without the dam, likely due to less freshwater algae and aquatic plant growth in the lake to

consume nutrients. The water that enters Budd Inlet from the Deschutes River would also have lower TOC concentrations due to the decrease in algae growth that occurs in the Capitol Lake Basin. Because the Ecology model predicts that dam removal would improve dissolved oxygen in Budd Inlet, the implication is that the decreased TOC (predicted to occur with dam removal) and changes in water circulation are more important to dissolved oxygen depletion in Budd Inlet than the increased dissolved inorganic nitrogen concentrations. Therefore, the TOC data and modeling results were examined closely.

Under the modeled 1997 conditions it was predicted that, without the dam, the TOC concentrations at the outflow would be substantively lower (2 mg/L) than conditions with the dam (5 mg/L) during the critical late summer/early fall time period when TOC peaks. However, recent field data (2019 and 2021) indicate that for most of the growing season the difference in TOC concentrations between the river and lake is approximately 0.5 to 1 mg/L. Evaluation of the critical time period when TOC concentration peaks is limited to only 2019 data; as described previously, 2004 data were impacted by the herbicide treatment and in 2021 no late-season peak was detected. The field data indicate that the TOC peak in 2019 was largely driven by loading from the Deschutes River and Percival Creek; TOC load from these rivers accounted for 77% of the TOC load increase. Therefore, although the lake contributed to the TOC load increase to Budd Inlet during that critical time period, it represented less than 25% of the increase.

Recent data also do not indicate a consistent link between TOC in the lake water and decreased dissolved oxygen in Budd Inlet. TOC concentrations were fairly consistently low throughout the summer in the lake, but in some years increased in late summer or fall. Recent data indicate that low dissolved oxygen concentrations in Budd Inlet started in July, well before the TOC concentration in the lake increased, and the dissolved oxygen concentrations continued to steadily decrease in Budd Inlet well past the time of the TOC peak in the river and lake.

Data available for Ecology's modeling included 2 years, 1997 and 2004, while data available for the current evaluation included only 2 additional years (2019 and 2021). Two to four years of data spread over a 20-year period does not comprise a comprehensive picture of interannual variability. In addition, one of those years represented an anomaly in TOC concentrations due to herbicide treatments that

impacted the magnitude and seasonal relationships for nutrient and TOC discharges to Budd Inlet. The lack of field data for this key predictive parameter and the lack of similarity between those years with data contributed to the level of uncertainty attributed to model predictions.

Comprehensive monitoring of the lake used by Ecology to make predictions under the TMDL was last completed over 15 years ago, and water quality has changed significantly over the past decades. The analysis of more recent data (i.e., 2005 to 2014, and 2019 and 2021) indicates significant improvement in both the lake and river during that time. This information implies that the background conditions on which the model was developed likely have changed.

Overall, the differences between model predictions and field observations, the general lack of TOC data, the lack of similarity between the few years of TOC data, and the apparent lack of a relationship between the seasonal trends in dissolved oxygen in Budd Inlet with TOC trends in the lake, contribute to uncertainty in interpretation of TOC results. This is exacerbated by changing river and lake conditions. These uncertainties led to a conclusion of more modest expectations for dissolved oxygen improvements that could be gained by removal of the 5th Avenue Dam compared to those predicted by modeling efforts.

Overall, any changes in dissolved oxygen concentrations are expected to be minor to moderate in Budd Inlet under the Estuary Alternative but not substantially change the general conditions for cold water fish or meet minimum numeric water quality criteria for dissolved oxygen. The low dissolved oxygen concentrations that occur in Budd Inlet naturally occur in tidal estuaries in Puget Sound and such levels are not expected to significantly impact fish (see Section 4.5, Fish & Wildlife).

With continued plentiful nutrient inflow from greater Puget Sound and the Deschutes River, Budd Inlet would continue to experience algal blooms of approximately the same extent and frequency as occur under existing conditions. In summary, the Estuary Alternative is expected to result in a no change to minor or moderate benefit to dissolved oxygen concentrations in Budd Inlet and no change in water quality conditions related to algal blooms and aquatic plants.

4.3.5.1 How would the Estuary Alternative comply with water quality regulations?

Ecology has sole authority over the determination of water quality compliance; thus, evaluation of dissolved oxygen water quality standard attainment is based on Ecology's modeling and predictions. Although there would be a reduction in dissolved oxygen in the former Capitol Lake Basin area, Ecology has determined that **only the Estuary Alternative will comply with requirements of the Draft TMDL for Budd Inlet** and therefore is the only alternative capable of meeting applicable water quality standards. This is because the water quality standards recognize that in some places dissolved oxygen is naturally low and, in those cases a narrative standard that limits human-caused sources of pollution takes effect. Because Ecology's model indicates that the 5th Avenue Dam is the largest source of human caused dissolved oxygen depletion, removing the dam removes that source and the water quality standard would be attained even with other human-caused sources of dissolved oxygen depletion remaining in place.

The recently released Budd Inlet TMDL, if fully implemented, would include a wide range of actions throughout Puget Sound and within the Deschutes River watershed and Budd Inlet in addition to removal of the 5th Avenue dam. Implementation of the Budd Inlet TMDL would further reduce nutrient and pollutant loads to Budd Inlet and result in further improvements to dissolved oxygen in Budd Inlet. The draft TMDL findings (Ecology 2022) state that dissolved oxygen numeric standards would be met if the TMDL is fully implemented. As previously noted, TMDL implementation activities are not a project action and therefore not addressed in the evaluation of project impacts.

4.3.6 What are the long-term impacts from the Hybrid Alternative?

Impacts or benefits from Hybrid Alternative operations would be essentially the same as described for the Estuary Alternative (see Section 4.3.5), except in the North Basin of the existing lake.

4.3.6.1 Lake Basin

In the North Basin, operational effects on water quality conditions within the smaller reflecting pool inside the barrier would be very different from the estuary outside the barrier wall. As with the Managed Lake Alternative, this alternative would require

development of a management plan for the reflecting pool to address water quality, aquatic plant, algae, and invasive species needs and to limit impacts to Budd Inlet. In general, it is expected that the freshwater reflecting pool would be managed to reduce the very high phosphorus concentration in the groundwater that would be used for flushing the lake, to concentrations reflective of a mesotrophic lake, to support all beneficial uses of the pool. Stormwater and groundwater nutrient inputs to Budd Inlet from the pool drainage basin would be reduced through activities such as nutrient inactivation of the inflow and enhanced stormwater treatment in the watershed to reduce development of algal blooms, including toxic algal blooms, in the freshwater reflecting pool. Algae and aquatic plants would still be present at quantities that would impact (increase) dissolved oxygen concentrations due to photosynthesis. Aquatic plants would be managed to support all beneficial uses of the pool and to minimize impacts to Budd Inlet.

The managed freshwater reflecting pool also would be expected to have somewhat higher summer surface water temperatures, lower summer bottom water dissolved oxygen concentrations, and higher fecal coliform bacteria concentrations than the existing lake basin because of the lower flushing rate.

Outside of the reflecting pool, water quality conditions would be similar to those described for the lake basin under the Estuary Alternative, but with greater influence from the river as it flows through a smaller area between the barrier and the western shoreline. Dissolved oxygen concentrations would be low but may be somewhat higher than described for the Estuary Alternative due to the increased influence of the river. Similar to the Estuary Alternative, the Hybrid Alternative would have **significant impacts** on water quality in the western portion of the existing lake basin compared to existing conditions. Although there would be a conversion from freshwater to marine algae, not much change is expected in terms of the overall areal extent or duration of algal blooms. Elimination of existing aquatic plants would be a **substantial benefit** to water quality.

4.3.6.2 Budd Inlet

Long-term water quality effects of the Hybrid Alternative in Budd Inlet would be essentially the same as those described for the Estuary Alternative. Because of the relatively small size of the reflecting pool and its drainage basin, the overall increase in nitrogen loading to Budd Inlet is not likely to be significantly higher than under

Hybrid Alternative Impacts and Benefits to Water Quality

Dissolved Oxygen

- Estuary Portion: significant impact (when a comparison is made to existing lake water quality, but estuarine water would be inherently different)
- Reflecting Pool: no change
- Budd Inlet: no change or minor to moderate benefit and no ability to meet water quality standards, as determined by Ecology

Cold Water Fish Habitat

- Estuary Portion: significant impact compared to existing conditions
- Reflecting Pool: significant impact
- Budd Inlet: no change in impact to minor or moderate benefit

Algal Blooms

- Estuary Portion: no change
- Reflecting Pool: no change
- Budd Inlet: no change

Aquatic Plants

- Estuary portion: substantial benefit
- Reflecting Pool: substantial benefit
- Budd Inlet: no change

Regulatory Compliance

- No change in impact (conservatively assuming dissolved oxygen standards would not be met

the Estuary Alternative. The decrease in TOC loading is not likely to be significantly lower than under the Estuary Alternative. Dissolved oxygen concentrations in pool waters discharged from the pool surface would likely be high due to plant and algae growth within the pool during the critical summer months when Budd Inlet water quality is impacted by low dissolved oxygen concentrations in its bottom waters. Removal of the dam and subsequent changes in hydrodynamics in Budd Inlet may contribute to minor or moderate improvement to dissolved oxygen in Budd Inlet, notably in East Bay. It is uncertain whether the Hybrid Alternative would meet the TMDL allocations, especially because it would retain a portion of the Project Area as a freshwater lake. Mechanistic modeling may be required to determine consistency with water quality standards.

4.3.6.3 How would the Hybrid Alternative comply with water quality regulations?

Ecology has sole authority over the determination of water quality compliance; thus, evaluation of dissolved oxygen water quality standard attainment is based on Ecology's modeling and predictions. As provided in the Draft TMDL allocation, Ecology has stated that Enterprise Services may not deplete dissolved oxygen levels in Budd Inlet at any time or location beyond the impact of the natural estuary condition. The Hybrid Alternative does not fully implement a natural estuary condition, and Ecology has not modeled this alternative; therefore, **compliance with the TMDL allocation is not assumed to be achievable**. Ecology does provide that if an alternative other than the Estuary Alternative is selected, Enterprise Services must show how water quality standards would be met through mechanistic water quality modeling. The approach to meeting natural estuary conditions as determined by Ecology under the Hybrid Alternative is unknown, and no plans for mechanistic water quality modeling has been conducted as part of the EIS.

4.3.7 What avoidance, minimization, and mitigation measures would be implemented?

Enterprise Services would avoid and minimize potential impacts by complying with regulations, permits, plans, and authorizations. These anticipated measures, and other mitigation measures that could be recommended or required, are described in this section.

4.3.7.1 Managed Lake Alternative

No significant impacts compared to existing conditions were identified for the Managed Lake Alternative because it would replicate the existing condition with the inclusion of management approaches. However, modeling has indicated that the 5th Avenue Dam is an important aspect of the dissolved oxygen problem in Budd Inlet due partially to the pulsed nature of the flow over the dam and its impact on circulation. This issue would need to be considered during design of the dam repairs to determine whether modifications could be made to limit the pulsed nature of the discharge.

When aquatic plants in Capitol Lake die back in the fall, total organic carbon from the plants enter Budd Inlet and contribute to oxygen depletion. Late-season removal of aquatic plants should be considered to reduce this impact. Aquatic plant removal through mechanical harvesting and other projects implemented under a lake management plan would require BMPs and other conditions in approved water quality permits.

4.3.7.2 Estuary and Hybrid Alternatives

Significant long-term adverse impacts have been identified for the lake basin under both the Estuary and Hybrid Alternatives because the freshwater lake basin would be converted from a well-oxygenated condition to one with very low oxygen conditions characteristic of inner Budd Inlet. However, these conditions are common in the shallow parts of inlets and embayments around South Puget Sound, and no measures are recommended to minimize or mitigate these impacts on aquatic habitat or other beneficial uses.

4.3.8 What are the significant unavoidable adverse impacts to water quality?

When the existing lake basin is opened to tidal waters under the Estuary or Hybrid Alternative, there would be a redistribution and transport of sediments. This activity would increase turbidity in both the lake basin and Budd Inlet until equilibrium is restored. This **significant unavoidable adverse impact** is addressed in more detail in Chapter 5.0 (Section 5.3, Water Quality), as it would occur during construction, and the impact could continue for 20 years before sediment distribution reaches a new equilibrium.

In the long-term, **significant unavoidable adverse impacts** to the lake basin would occur under the Estuary or Hybrid Alternative

because the lake basin would be converted from a well-oxygenated freshwater lake to an estuary with low oxygen conditions that would not meet numeric water quality criteria. While these low oxygen conditions can be potentially harmful to cold water fish, these concentrations are common in South Puget Sound inlets and embayments, and salmon and other cold water fish species are adapted to such conditions (see Section 4.5, Fish & Wildlife, for more information). As noted above, Ecology has determined that the Estuary Alternative would meet the narrative water quality standard for dissolved oxygen; it is not possible to determine if the Hybrid Alternative would meet this standard without mechanistic modeling.

4.4 AQUATIC INVASIVE SPECIES

This section describes the potential long-term impacts and benefits of the Capitol Lake – Deschutes Estuary Long-Term Management Project related to AIS in the Project Area. The EIS focuses on the most important elements and conclusions of the analysis and, in particular, the differences among the four alternatives.

Information presented in this section is summarized from the full analysis in the revised Aquatic Invasive Species Discipline Report (Attachment 8). See the Final EIS Summary or within the Aquatic Invasive Species Discipline Report for a summary of key changes between the Draft EIS and Final EIS.

What are the goals for AIS management?

The goal for AIS management under all action alternatives is to prevent the spread and further distribution of AIS.

Key Findings: Long-Term Aquatic Invasive Species Impacts

Under the No Action Alternative, Capitol Lake would remain closed to the public due to the New Zealand mudsnail, and invasive aquatic plant species would continue to be contained and managed using methods aimed at maintaining low population densities. The risk for AIS spreading from Capitol Lake under the No Action Alternative is expected to be less than significant.

Under all action alternatives, Capitol Lake would be treated before construction to significantly reduce AIS populations within the waterbody. Under the Estuary and Hybrid Alternatives, the reintroduction of saltwater to the basin could flush AIS into West Bay. Purple loosestrife seeds and New Zealand mudsnails are salt tolerant/adaptable to lower salinity levels and could settle in shallow areas near freshwater streams or river mouths. However, transport of AIS occurs under existing conditions when sediment and other debris are discharged during high river flow events; those populations have not become established in West Bay in over 10 years, and the Capitol Lake Basin would be treated before construction to further minimize the risk of spread. The abundance of AIS in Budd Inlet and the surrounding areas is not expected to be great enough to significantly impact native species, and there is no existing evidence of significant ecological harm from low density populations of New Zealand mudsnail that can exist in saline environments. Although there is some uncertainty, the Estuary and Hybrid Alternatives are expected to have less than significant impacts from AIS abundance and distribution. An AIS adaptive management plan would be prepared with measures to minimize potential impacts, including an approach to AIS monitoring.

The introduction of saltwater would have a minor beneficial effect in terms of reductions in freshwater AIS populations that are intolerant to higher salinities.

Under all action alternatives, boating and fishing in the Capitol Lake Basin would be reintroduced. Decontamination stations would be installed to prevent the spread of AIS by requiring recreationalists to decontaminate footwear, fishing gear, and nonmotorized vessels. Additionally, educational signs would be posted warning recreationalists of the presence of New Zealand mudsnails and other high-priority AIS, and their potential to spread. Effective use of education and decontamination stations is considered necessary to reduce impacts to less than significant levels for the spread of AIS.

4.4.1 What methods were used to assess long-term impacts to aquatic invasive species?

To determine the potential long-term impacts of the action alternatives related to AIS, the following primary operations were evaluated: dam removal and increased salinity, increased recreational use, and maintenance dredging.

Long-term adverse impacts and beneficial effects associated with AIS were evaluated using a combination of historical trends, current conditions, and future projections of environmental factors affecting AIS. Assessments of potential adverse and beneficial impacts were based on many factors, including:

- Anticipated changes in abundance and distribution for each species

- Relative potential for transport and establishment within and outside the study area
- Control priority, eradication potential, and potential management options of each species
- Relative effectiveness and nontarget species impacts of control measures
- Potential for short- and long-term recreational use restrictions

4.4.2 What are the long-term impacts under then No Action Alternative?

Under the No Action Alternative, Capitol Lake would remain closed to the public, and AIS would continue to be managed using containment and other methods aimed at maintaining low population densities. The New Zealand mudsnail population is not likely to substantially increase within the lake or move far outside the lake. Similarly, in the absence of intervention, the populations of other AIS invertebrates, fish, and mammals would be expected to continue to expand at current low rates. Based on this, under the No Action Alternative, the risk for AIS in Capitol Lake to spread to otherwise non-invaded water bodies is expected to be less than significant.

4.4.3 What are the long-term impacts common to all action alternatives?

The action alternatives have several long-term adverse impacts and beneficial effects in common. Active use of the Project Area would be restored under the action alternatives. The operation of the action alternatives has a greater potential to impact the distribution and abundance of aquatic invasive animals than the No Action Alternative due to active recreational use and maintenance dredging.

Potential impacts related to AIS that are common to all action alternatives during long-term operations include:

- Pedestrian use and fishing from boardwalks along the shoreline, and restored boating and fishing
- Habitat area maintenance
- Recurring maintenance dredging to maintain target depths

How were impacts to AIS assessed?

Operational impacts to AIS were assessed using an extensive review of available literature consisting of the following:

- Management plans (e.g., vegetation management, annual reports of aquatic weed treatments, New Zealand mudsnail management options, and recommendations for invasive species treatments
- Surveys that have been conducted to monitor the presence and distribution of AIS in Capitol Lake and Budd Inlet
- Relevant invasive species databases
- Research papers and studies that focused on detection, species biology, population fluctuations, transport and spread, and treatment options and effectiveness

What is the primary AIS of concern?

The New Zealand mudsnail is the primary AIS of concern. Eradication is not feasible under any of the project alternatives regardless of treatment, BMPs and mitigation measures implemented.

Mudsnails are resistant to extreme environmental factors and treatment, and they can reproduce and establish new populations from a single survivor, particularly in freshwater environments.

Operation of the action alternatives is not likely to affect the abundance or distribution of aquatic invasive plants and animals in Capitol Lake or other lakes in the study area, provided that the measures outlined in a project-specific AIS adaptive management plan and BMPs are implemented, including use of decontamination stations, educational signage, and ongoing monitoring of AIS. Enterprise Services would continue to manage aquatic invasive plant and animal species, limiting their expansion.

4.4.3.1 Recreational Use

Under all action alternatives, portions of the basin would be open to pedestrian traffic and fishing along the boardwalks and dock, and to nonmotorized boating activity limited to watercraft carried by hand. The risk for exportation of existing plant AIS from boating in the Capitol Lake Basin would be low because boating would predominately occur in deeper water areas of the North Basin where plant AIS do not exist. Boating is not expected along the natural shorelines in the Middle and South Basins where AIS plants (including fragment and seeds) largely exist. Boating would also be limited to hand-carried watercraft launched from designated locations, to control access.

The increase in traffic and activity on the shoreline and in the water would increase opportunity for the New Zealand mudsnail to spread outside Capitol Lake. New Zealand mudsnails can survive for long periods of time on hard material, such as watercraft, shoes and other recreational equipment.

To minimize the spread of AIS, decontamination stations would be installed, maintained, and operated at a boat launch in Marathon Park, Tumwater Historical Park, and at the Interpretive Center for decontaminating footwear, fishing gear, and nonmotorized vessels used in Capitol Lake. Decontamination stations could also be operated at existing boat launches in Budd Inlet, if needed, under the Estuary and Hybrid Alternatives. Initially, the decontamination stations would be attended by trained personnel to educate users and ensure compliance. It is anticipated that the stations would be attended during daylight hours every day of the week except holidays. Decontamination has been proven effective in avoiding the spread of AIS.

A similar approach has been implemented in Whatcom County, where boats and equipment are inspected at four checkpoints before entering Lake Whatcom and Lake Samish to ensure they are clean,

What is considered a significant impact from AIS?

Significant increases in AIS populations or distribution by an alternative are considered to be an adverse impact, whereas significant decreases in AIS populations or distribution are considered a beneficial effect of the alternative.

How are AIS transported during recreational use?

Plant AIS are primarily imported and exported to water bodies by plant fragments and seeds that collect in or on motorized watercraft and trailers. Hand-carried, nonmotorized watercraft can become contaminated by AIS through external contamination of watercraft or gear or by contaminated footwear while launching or retrieving watercraft.

Invertebrate AIS like New Zealand mudsnails, can survive for long periods of time on hard material, such as shoes, watercraft, and other recreational equipment.

The increase in boating, traffic, and activity on the shoreline and in the water would increase opportunities for plant and animal AIS to spread outside Capitol Lake.

drained, and dry and are not transporting AIS (Lake Whatcom Management Program 2022). Monitoring by WDFW has shown that this program has been effective in preventing the introduction of AIS of interest to Whatcom County as no species have been found in the lakes since the program began 10 years ago.

To further avoid and minimize the spread of AIS, the action alternatives would include educational signs that warn recreational lake users of the presence of New Zealand mudsnails and other high priority AIS. Signage would also notify recreationalists that water access is only permitted in areas where a decontamination station is provided. While the educational signs would not entirely prevent further spread of New Zealand mudsnails, they would inform the public of the importance and requirement of using the decontamination stations.

Exhibit 4.1 Example of educational sign alerting recreational lake users of New Zealand mudsnail presence decontamination requirements

Exhibit 4.2 Decontamination station at Bloedel Donovan Park at Lake Whatcom

Monitoring would also be conducted to confirm and track the use and effectiveness of attended stations. If monitoring indicates recreationalists are effectively using the stations and very few AIS are present on recreation equipment, then the stations may be converted to unattended stations in the future. Effective use of decontamination stations is considered necessary to reduce impacts to less than significant levels for the spread of AIS.

Hand-carried watercraft are not likely to transport a substantial amount of plant fragments and seeds, or invertebrate AIS like New Zealand mudsnail, especially with required inspection and decontamination. Also, any incidental motorboat access via West Bay under the Estuary or Hybrid Alternative would have limited contact with AIS present along the shoreline. As a result, operation of the action alternatives would have less than significant impacts on plant and invertebrate AIS because operations are not anticipated to substantially affect the abundance and distribution of invasive plant populations within or outside of the study area.

4.4.3.2 Habitat Areas

The constructed habitat areas would reduce the amount of open-water habitat and increase the amount of shallow-water habitat preferred by the New Zealand mudsnail and other invertebrates. The habitat areas would also increase the amount of forage and refuge habitat for nutria. However, the constructed habitat areas are small relative to the overall Project Area. As part of a habitat enhancement plan for the constructed habitat areas, aquatic invasive plants would

be removed and adaptive management actions taken, as necessary, to ensure native plant survivability.

Given the small amount of shallow water habitat for invertebrate AIS and forage/refuge habitat for mammal AIS, habitat areas would have a less than significant impact on AIS abundance and distribution.

4.4.3.3 Maintenance Dredging

The risk of export from maintenance dredging is considered low because, prior to construction, the Capitol Lake Basin would be chemically or physically treated to substantially reduce and/or eradicate plant and invertebrate AIS. BMPs would be implemented to minimize the potential for transport of invertebrate AIS outside the Project Area. The handling of sediment dredged during maintenance dredging varies by alternative and is discussed in more detail in the following sections.

4.4.4 What are the long-term impacts under the Managed Lake Alternative?

Long-term impacts of the Managed Lake Alternative related to AIS would generally be as described in Section 4.4.3. Compared to the Estuary and Hybrid Alternatives, there would be a larger population of AIS under the Managed Lake Alternative, particularly the New Zealand mudsnail.

Active use of the Project Area would be restored, with the following:

- Pedestrian use of boardwalks along the shoreline, and restored boating and fishing
- Recurring maintenance dredging in the North Basin to maintain target depths for recreation

The long-term impacts on aquatic invasive plants and animals under the Managed Lake Alternative would be as described in Section 4.4.3. As a result, operation of the Managed Lake Alternative would have less than significant impacts related to AIS because operations are not anticipated to substantially affect the abundance and distribution of invasive plant populations within or outside the study area.

4.4.4.1 Recreational Use

The impacts associated with increased recreational use would be as described for all action alternatives. Effective use of decontamination stations, educational signage, and monitoring would result in less

How will AIS be managed under the action alternatives?

- Decontamination stations would be installed to prevent the spread of AIS.
- Before and after recreational lake use, there would be mandatory inspection at the decontamination stations to reduce spread of AIS.
- Educational signage would be posted to warn recreational users of AIS presence and need for decontamination.
- Monitoring would be conducted to ensure effectiveness of decontamination.
- During maintenance dredging BMPs would be employed to minimize transport of AIS.
- Dredged sediment that would be placed at an upland disposal site would be treated to prevent transport of live New Zealand mudsnails.

than significant impacts on the spread of New Zealand mudsnails and other plant and invertebrate AIS to other freshwater bodies. Potential for new AIS to be introduced to Capitol Lake would be minimized by using decontamination stations upon both entry and exit from the lake.

The reintroduction of fishing within Capitol Lake would have minor beneficial effects by reducing invasive fish species. This management approach is effectively used in other systems for controlling AIS populations. There would be no impact on waterfowl or mammal AIS.

4.4.4.2 Maintenance Dredging

Under the Managed Lake Alternative, maintenance dredging would occur in the North Basin. The sediment that is exported after maintenance dredge events would be chemically or physically treated, as required by AIS transportation requirements that would be defined in project permits, to prevent the export of live New Zealand mudsnails. During transport, sediments would be covered and only disposed of at an approved upland site, and not near waterbodies. The upland placement site may be monitored to ensure no AIS become established at the placement site. Material dredged from the Managed Lake would not be suitable for placement at an open-water disposal site in Puget Sound because of the presence of the New Zealand mudsnail and purple loosestrife seed, which are not expected to be eradicated from the freshwater environment. Existing environmental regulations prohibit in-water disposal of sediment with these AIS; these regulations (or the environmental conditions) would have to change to allow for in-water disposal. BMPs and compliance with AIS transportation regulations would result in less than significant impacts related to changes in abundance and distribution of plant AIS, New Zealand mudsnails, and other invertebrate AIS. Maintenance dredging activities would have no impact on the distribution or population size of fish, or mammal AIS.

4.4.5 What are the long-term impacts under the Estuary Alternative?

Long-term impacts of the Estuary Alternative related to AIS would generally be as described in Section 4.4.3. The estuarine conditions would eliminate many of the AIS that currently exist in the Project Area and would continue to exist under the Managed Lake Alternative. Compared to the Managed Lake Alternative, there would

also be a smaller population of AIS, but the distribution would be wider.

Impacts related to AIS would be associated with the following:

- Removal of the 5th Avenue Dam, which would restore tidal influence to the entire Capitol Lake Basin
- Pedestrian use of boardwalks along the shoreline, and restored boating and fishing
- Recurring maintenance dredging in impacted areas of West Bay

4.4.5.1 Aquatic Invasive Plants

Restored Tidal Influence

Removal of the 5th Avenue Dam could increase the long-term movement of seeds and plant fragments into Budd Inlet downstream of the study area. However, transport of AIS occurs under existing conditions when sediment and other debris are discharged over the 5th Avenue Dam during high river flow (about once per year). Despite this transport, the population and distribution of AIS have not measurably increased outside of the Project Area. Comparatively, under the Estuary Alternative, there would be fewer freshwater plant AIS populations due to saltwater affecting their abundance. Therefore, the abundance and distribution of aquatic invasive plants in Budd Inlet and the surrounding areas would not likely significantly increase from restored tidal flow compared to existing conditions, resulting in no adverse impact to the distribution of freshwater plant AIS.

Purple loosestrife is the only freshwater plant AIS within Capitol Lake that has seeds that are salt-tolerant and could become plants if they settle near a freshwater stream or river mouth. Impacts may be avoided if the purple loosestrife population in Capitol Lake is dramatically reduced (or eradicated) during the early years of construction to eliminate viable seeds in sediments before dam removal (see mitigation measures described in Section 4.4.7).

The introduction of saline waters in the Estuary Alternative would likely have minor beneficial effects related to decreased distribution and abundance of freshwater plant AIS, primarily saltwater-intolerant species. The eradication of saltwater-intolerant plant AIS is described as a minor beneficial effect in the Final EIS rather than a substantial beneficial effect, as described in the Draft EIS, because

the populations are relatively low and these plants are commonly present in nearby lakes.

Recreational Use

The impact of recreational access on aquatic invasive plants under the Estuary Alternative would be as described in Section 4.4.3. The risk for importation of new plant AIS or exportation of existing plant AIS from reintroduced boating in the Capitol Lake Basin would be low because boat launching would be limited to hand-carried watercraft at designated boat access locations. Decontamination stations would be provided and staffed at these locations. Also, if incidental motorboat access was to occur, the vessels would have limited contact with plant fragments and seeds that exist along the shoreline in shallow water depths, which is not conducive to motorized vessels. Thus, recreational access would result in less than significant impacts to plant AIS.

Maintenance Dredging

Maintenance dredging would have no impact on plant AIS because none would be present in the sediment dredged from deeper waters in West Bay.

4.4.5.2 Aquatic Invasive Animals

Restored Tidal Influence

Following the removal of the dam, several freshwater aquatic invasive animals that are tolerant of brackish water would continue to be present near freshwater sources in the lake basin, although with much more limited distribution and abundance. Restored tidal flow would increase the potential for suspended New Zealand mudsnails, either individually or attached to floating debris, to be washed into Budd Inlet by high river flow. There would be an initial high mortality rate of New Zealand mudsnails as they reached the higher salinity in Budd Inlet. However, New Zealand mudsnails have become acclimatized to saline environments in other locations, such as the Columbia River estuary.

Due to treatment before construction and reduced freshwater habitat after construction, the New Zealand mudsnail population would be reduced to very low levels compared to the existing population. While the mudsnail population may increase over time as they become acclimatized to estuarine waters under the Estuary Alternative, it is likely that an estuarine population would remain

Would marine invasive species impact the estuary?

The restored estuary would be susceptible to invasion by nonnative marine species. These species of concern include two invasive crabs, the European green crab (*Carcinus maenas*) and Chinese mitten crab (*Eriocheir sinensis*). As of early 2022, European green crabs have not been detected within Puget Sound south of Admiralty Inlet, and Chinese mitten crabs have not been detected in Washington waters other than the Columbia River. Other high-priority invasive marine animal species for Washington state include the Asian marine clam (*Corbula amurensis*), tunicates (sea squirts), and Atlantic salmon (*Salmo salar*), per "Invasive Marine Species: Washington state priorities," published in the University of Washington's Encyclopedia of Puget Sound. The Asian marine clam has not been observed in Washington, and Atlantic salmon have never established a reproducing population in Puget Sound. Three invasive tunicate species are present in Puget Sound.

small due to the increased salinity and not have a significant impact on native estuarine species. They are not expected to spread vigorously given the impact of salinity. However, this cannot be easily studied, and uncertainty will remain.

The rate of transport to Budd Inlet may increase with dam removal due to sediment scour during low tide. However, given the apparent lack of downstream spread over the past 10 years and the significantly decreased abundance expected in the Estuary Alternative, the potential increase in transport and survival outside the study area by the dam removal is expected to have a less than significant impact on New Zealand mudsnail distribution and population. This is supported by a survey that was conducted in 2022 to evaluate the potential presence of New Zealand mudsnails in Budd Inlet; no New Zealand mudsnails were found despite their continued transport over the dam in high flow events for more than a decade. Based on input received from WDFW following the Draft EIS, it continues to be assumed that the resource agencies would consider this potential impact to be outweighed by the overall substantial improvements that the Estuary Alternative would otherwise provide. There are no known regulatory feasibility issues associated with this natural transport.

Nutria are found in brackish and saltwater environments and would tolerate the transition to an estuarine environment. Because their distribution is not limited by the 5th Avenue Dam, the dam removal would have no impact on nutria. For the impacts on other invertebrate, fish, and mammal AIS associated with the removal of the 5th Avenue Dam, see the Aquatic Invasive Species Discipline Report (Attachment 8).

Recreational Use

The impact of recreational access on aquatic invasive animals under the Estuary Alternative would be as described in Section 4.4.3. The increase in pedestrian and nonmotorized watercraft use would increase the potential for spread of invertebrate AIS outside the study area. Although the New Zealand mudsnail population would be substantially reduced by the conversion to a brackish environment, the increase in activity on and around the estuary would potentially increase spread of New Zealand mudsnails to other freshwater bodies by equipment (boots and boats) contacting estuary sediments. Incidental motorboat access from West Bay is not likely to import or export invertebrate AIS from the estuary because these vessels are not likely to contain invertebrate AIS upon entering the

estuary or to contact nearshore sediments where the AIS may continue to be present within the estuary. Decontamination stations and educational signs described in Section 4.4.3 would dramatically reduce the potential spread to a less than significant impact on invertebrate AIS.

Recreational use of the estuary would have no impact on any remaining fish, or mammal AIS populations.

Maintenance Dredging

Maintenance dredging under the Estuary Alternative would occur in impacted areas of West Bay only, not within the Capitol Lake Basin. The New Zealand mudsnail is not expected to be within the sediment that would be dredged under the Estuary Alternative because of the salinity levels within West Bay and because maintenance dredging would occur in deeper water used for navigation. Although New Zealand mudsnails are tolerant to higher salinity levels that can be found in West Bay, very few, if any, living New Zealand mudsnails would be expected in deep waters because they prefer shallow water habitat, especially areas with localized freshwater input.

Sediment dredged during the maintenance dredging events would be sampled for New Zealand mudsnail (and purple loosestrife seeds) to demonstrate suitability, and treated as necessary, for placement at an open-water disposal site in Puget Sound.

Maintenance dredging activities would have no impact on distribution or abundance of invertebrate, fish, or mammal AIS because no animal AIS would likely be present in the dredging area.

What are the benefits of placing dredged sediment at an open-water disposal site?

In-water placement of dredged sediment would result in a significant costs savings for the project compared to upland disposal; it also reduces truck trips from surface streets and the associated greenhouse gas emissions.

4.4.6 What are the long-term impacts under the Hybrid Alternative?

Long-term impacts of the Hybrid Alternative related to AIS would be as described for the Estuary Alternative in Section 4.4.5. Active use of the Project Area would be restored following construction with impacts related to AIS primarily associated with the following:

- Removal of the 5th Avenue Dam, which would restore tidal influence to the Capitol Lake Basin
- Pedestrian use of boardwalks along the shoreline, and restored boating and fishing
- Recurring maintenance dredging in impacted areas of West Bay

4.4.6.1 Aquatic Invasive Plants

The impacts to aquatic invasive plants associated with the operation of the Hybrid Alternative would be as described for the Estuary Alternative in Section 4.4.5.1. The introduction of saline waters in the Hybrid Alternative would likely have minor beneficial effects related to the distribution and abundance of freshwater plant AIS, same as the Estuary Alternative.

Implementation of decontamination stations and educational signage would dramatically reduce the potential spread to a less than significant impact from plant AIS.

Maintenance dredging and recreational access would result in less than significant impacts from plant AIS.

Under the Hybrid Alternative, operation of a freshwater reflecting pool would require ongoing maintenance to maintain water quality and manage plant AIS. AIS eradication is considered possible by chemical treatment of the pool because, unlike Capitol Lake, inflow and outflow could be regulated and the pool would not be naturally flushed by large volumes of river or tidal waters to dilute the added chemical and reduce chemical contact time. Also, potential refuge areas from treatment would be minimal due to the limited amount of shoreline habitat and structures in the constructed pool.

If AIS were not successfully eradicated from the reflecting pool, the implementation of educational signs and a decontamination station at the reflecting pool would dramatically reduce the potential spread to a less than significant impact related to plant AIS.

4.4.6.2 Aquatic Invasive Animals

The impacts associated with the operation of the Hybrid Alternative would be as described for the Estuary Alternative in Section 4.4.5.2. The potential increase in downstream transport of invertebrate AIS outside the study area from removal of the 5th Avenue Dam would have a less than significant impact in terms of New Zealand mudsnails population and distribution, though uncertainty remains. Dam removal would have less than significant impacts on fish AIS and no impact on nutria.

Decontamination stations and educational signs would dramatically reduce the potential spread to a less than significant impact on

invertebrate AIS. Recreational use of the estuary would have no impact on any remaining fish or mammal AIS populations.

Maintenance dredging activities would have no impact on distribution or abundance of invertebrate, fish, or mammal AIS because no animal AIS would likely be present in the dredging area.

Similar to management of plant AIS described in Section 4.4.6.1, operation of a freshwater reflecting pool would require ongoing maintenance to maintain water quality and manage animal AIS. Recreational use of the pool would have no impact on any remaining fish or mammal AIS populations.

4.4.7 What avoidance, minimization, and mitigation measures would be implemented?

Enterprise Services would avoid and minimize potential impacts by complying with regulations, permits, plans, and authorizations. These anticipated measures, and other mitigation measures that could be recommended or required, are described below.

4.4.7.1 Measures Common to All Action Alternatives

AIS Adaptive Management Plan

An AIS adaptive management plan, in consultation with affected jurisdictions, would be developed and implemented for the Preferred Alternative during the future phase and could include the following elements:

- Conduct monitoring of New Zealand mudsnails and purple loosestrife to identify their abundance within the study area.
- Determine which chemical treatment tests should be conducted and can be permitted and identify any treatment restrictions for reducing the New Zealand mudsnail population before construction to reduce its potential spread during construction.
- Design and conduct New Zealand mudsnail treatment tests with chemicals known to be effective.
- Obtain experimental use authorization to apply and test effectiveness of select chemicals that are not included in the Aquatic Invasive Species Management Permit.

- Prepare and implement a New Zealand mudsnail treatment plan using the preferred methodology.
- Prepare and implement a purple loosestrife treatment plan with a goal of eradication before construction begins to avoid or minimize downstream migration of seeds during operations.
- Specify BMPs for avoiding or minimizing the export of AIS through the dam during construction, such as the use of turbidity curtains and AIS monitoring.
- Conduct long-term monitoring of New Zealand mudsnails and purple loosestrife in the study area and adjacent waters to track changes in abundance for adaptive management.
- Research and design attended or unattended decontamination stations and establish a maintenance and monitoring plan to ensure their continued effectiveness.
- Design and install educational signs at strategic locations to inform citizens of the AIS threat and requirements for preventing spread.

Maintenance Dredging

Transportation of AIS outside of Capitol Lake is prohibited by state law. To avoid the risk for AIS transport outside of Capitol Lake, WDFW-approved BMPs would be implemented during maintenance dredging. Enterprise Services would follow all protocols established by WDFW before and after entering the lake and would ensure all vessels and equipment are decontaminated by removing visible plants, algae, and mud and rinsing with potable water.

4.4.7.2 Managed Lake Alternative

Potential treatment options outlined in the AIS adaptive management plan could be used to control New Zealand mudsnail abundance and distribution around Capitol Lake during long-term operations. Chemical treatments, including sodium chloride and Bayluscide, could be used, depending on New Zealand mudsnail distribution and density. However, chemical treatments can severely impact native species, and it may be difficult to permit their use. Therefore, the benefits and impacts of treatment would be carefully weighed during preparation of the AIS adaptive management plan.

While eradication is generally considered not to be feasible given the extent of the New Zealand mudsnail infestation and their resiliency, chemical treatment is a useful method for significantly reducing the population and limiting its spread outside the study area.

Chemical treatments may also target the high priority AIS plant species. Permitted aquatic herbicides could be used to control or eradicate purple loosestrife and Eurasian watermilfoil.

4.4.7.3 Estuary and Hybrid Alternatives

After the removal of the 5th Avenue Dam, the New Zealand mudsnail and other AIS populations would be controlled by the introduction of saltwater to the study area. However, due to the likely persistence of New Zealand mudsnails in upstream portions of the Estuary and Hybrid Alternatives, additional mitigation measures such as targeted chemical treatments may be needed to prevent potential significant impacts. Chemical treatments, including sodium chloride and Bayluscide, could be used, depending on New Zealand mudsnail distribution and density. However, chemical treatments can severely impact native species and it may be difficult to permit their use after native estuarine species become established. Therefore, the benefits and impacts of treatment would be carefully weighed in preparation of the AIS adaptive management plan.

4.4.8 What are the significant unavoidable adverse impacts to aquatic invasive species?

There would be no significant unavoidable adverse impacts related to AIS under any of the action alternatives.

4.5 FISH & WILDLIFE

This section describes the potential long-term impacts and benefits of the Capitol Lake – Deschutes Estuary Long-Term Management Project on fish and wildlife species and their habitat in the Project Area. The EIS focuses on the most important elements and conclusions of the analysis and, in particular, the differences among the four alternatives. Information presented in this section is summarized from the full analysis provided in the revised Fish and Wildlife Discipline Report (Attachment 9). See the Final EIS Summary or within the Fish and Wildlife Discipline Report for a summary of key changes between the Draft EIS and Final EIS.

4.5.1 What methods were used to assess long-term impacts to fish and wildlife?

Operational impacts were analyzed by considering the projected outcome of each alternative and the changes to habitat and the corresponding effects to fish and wildlife species. The analysis also considered the anticipated changes in abundance or distribution of aquatic invasive species. Both long-term adverse impacts and beneficial effects associated with fish and wildlife are evaluated based on expected changes in ecological functions and processes within the study area. Additional details on the significance criteria are presented in the Fish and Wildlife Discipline Report (Attachment 9).

4.5.2 What are the long-term impacts under the No Action Alternative?

In the long term, the 5th Avenue Dam would remain in-place and minimal aquatic vegetation removal would occur (consistent with current management practices). The lack of active lake management to remove sediment and aquatic vegetation could continue to affect habitat quality and habitat use by some fish or other aquatic species. In general, and compared to existing conditions, impacts would be less than significant because the changes would occur incrementally and use of the basin by these species would still persist.

What fish and wildlife long-term impacts were considered?

Potential impacts were determined by evaluating known occurrences of species or species groups in the study area, life history requirements, and the potential changes in habitat condition, extent, and availability under each alternative. For fish, the analysis considered changes in wetted area, bathymetry, salinity, tidal inundation, freshwater inputs, water quality, and sediment distribution. For wildlife, changes in the availability of cover, food, predator-prey relationships, and breeding sites were also considered.

Key Findings: Long-Term Impacts on Fish and Wildlife

Under the No Action Alternative, habitat quality and habitat use by some fish and other aquatic species would continue to be affected by the presence of the dam and lack of active lake management. Under the Managed Lake Alternative, active lake management would have minor benefits to fish and other aquatic species, although fish and wildlife distribution and use patterns would remain similar to existing conditions.

The conversion of freshwater lake habitat to a tidally influenced brackish estuary would **substantially benefit** (Estuary Alternative) and moderately benefit (Hybrid Alternative) anadromous fish and marine fish, potentially including ESA-listed Chinook salmon and steelhead trout, as well as shellfish. The loss of freshwater habitat that supports a foraging base for bats from the Woodard Bay bat colony, however, would be a **significant unavoidable adverse impact**. Similarly, the elimination of habitat for native freshwater fish under the Estuary and Hybrid Alternatives from the conversion of freshwater deepwater habitat would be **a significant unavoidable adverse impact**. Other changes in habitat types under the action alternatives would provide minor to **substantial benefits** for other species, such as raptors, song birds, and shorebirds. All action alternatives would also create habitat areas with a mosaic of habitat types, a benefit to wildlife.

The goals associated with improving water quality, managing sediment accumulation and future deposition, and improving ecological functions in the study area would not be met under the No Action Alternative.

The No Action Alternative would perpetuate habitat conditions that were historically altered due to conversion of the Capitol Lake Basin from a natural estuary to a freshwater lake. These conditions, at least to some degree, affect the ability of the aquatic system to fully support populations of anadromous fish. Specifically, the lack of a brackish water transition zone and the abrupt transition between freshwater and saltwater created by the 5th Avenue Dam has altered natural salinity gradients, which in turn can affect the biological functions involved in smoltification. This can alter the fitness of outmigrating juvenile salmonids and could potentially result in delayed saltwater mortality of smolts. The lake also may increase the chance of predation on juvenile salmonids, as freshwater predators, such as bass, are present in the system. The lake may also not provide the full range of prey sources generally found in estuarine habitats.

Smoltification

Smoltification is a complex series of physiological changes where young salmonid fish (smolts) adapt from living in freshwater to living in saltwater.

For wildlife species, the alterations in habitat under the No Action Alternative would generally represent impacts that are less than significant for most species groups and indicator species, including fish, shellfish, birds, and water-dependent mammals. As described in Chapter 3.0 (Section 3.5), Yuma myotis and little brown bats from the Woodard Bay bat colony use Capitol Lake for foraging and/or drinking. The No Action Alternative would result in no substantive changes to existing conditions that are currently maintaining the constructed Capitol Lake and associated habitats. The transition of the lake to vegetated wetlands could reduce insect foraging opportunities for the bats, but most of those impacts would be realized beyond the 30-year time horizon of the project. Therefore, it is anticipated to result in a less than significant impact on the bats using the Woodard Bay trestle, as well as other bat species who reside in the area.

What is considered a significant impact or beneficial effect to fish and wildlife?

Large-scale "take" of protected fish and wildlife species or loss of habitat that could result in the elimination of a species group or species of regional importance, are considered to be significant impacts.

Substantial increases in the quality and/or quantity of suitable or key habitats for fish and wildlife are considered a beneficial effect of the alternative.

4.5.3 What are the long-term impacts common to all action alternatives?

With all action alternatives, the conversion of some areas of deepwater to wetland habitats would provide a minor beneficial effect for some species, such as raptors and songbirds.

Long-term adverse impacts on fish and wildlife from the action alternatives are mostly associated with the following:

- Recurring maintenance dredging to manage accumulated sediment, which can entrain aquatic organisms and increase turbidity levels
- The overwater and in-water structures associated with the boardwalks and dock, as well as the associated

artificial lighting, which can reduce the quality of aquatic habitat and increase predation

- Changes in the types and distribution of specific habitats, which will adversely affect some species while benefiting others

Potential adverse impacts of the new overwater and in-water structures (as well as the associated artificial lighting) include changes to fish distribution migration patterns and increased predation; these impacts, however, would be minor and less than significant for all action alternatives.

Other potential adverse impacts on fish and wildlife species would vary by alternative, as summarized below. Recurring maintenance dredging would have short-term effects similar to those caused by initial maintenance dredging, as described in Chapter 5.0 (Section 5.5.2).

4.5.4 What are the long-term impacts under the Managed Lake Alternative?

Under the Managed Alternative (compared to existing conditions), impacts on fish and wildlife would range from minor beneficial effects to less than significant impacts. The North Basin would be maintained as deepwater habitat through recurring maintenance dredging, while the Middle and South Basins would continue to progress to a mix of vegetated wetlands and shallow water habitat over time after initial establishment of habitat areas. In general, the distribution and use patterns of fish and wildlife would be similar to existing conditions. Marine fish distribution would continue to be limited to areas downstream of the dam.

Exhibit 4.3 View of North Basin and West Bay from the Capitol Campus

Reflecting the goals of the project to improve ecological functioning and water quality, the Managed Lake Alternative would benefit fish and wildlife in the study area, although not to the same extent as the Estuary and Hybrid Alternatives. Overall, there would be minor beneficial effects on fish, for both the anadromous and freshwater species groups due to changes in lake bathymetry and habitat conditions. Some coho and Chinook salmon may experience a slight benefit from increased water depths and the removal of aquatic vegetation in the North Basin and the development of complex edge habitat in conjunction with a more riverine-like main channel in the Middle and South Basins.

Despite some improvements to ecological functioning, the configuration as a lake would continue to limit the ability of the habitat to provide the suite of ecological functions required to fully sustain populations of salmon, as discussed under the No Action Alternative. The presence of the lake likely affects the fitness of outmigrating juvenile salmonids and could potentially result in delayed saltwater mortality of smolts. The lake also may increase the chance of predation on juvenile salmonids, as freshwater predators, such as bass, are present in the system. The lake may also not provide the full range of prey sources generally found in estuarine habitats.

In the Middle and South Basins, the habitat change to a mix of vegetated wetlands and shallow water habitat over time would have minor beneficial effects for some wildlife species such as raptors and songbirds because of increased foraging opportunities. The habitat changes would affect the habitat availability for use by other wildlife species, including waterfowl, shorebirds and wading birds, aerial feeders, and bats. Any adverse impacts on wildlife species would be less than significant, as similar habitats that would be lost are readily available in the region.

Similar to the No Action Alternative, the Managed Lake Alternative would result in no substantive changes to existing conditions that are currently maintaining the constructed Capitol Lake and associated habitats; therefore, it is anticipated to result in a less than significant impact on the bats using the Woodard Bay trestle, as well as other bat species who reside in the area.

The Managed Lake Alternative would involve the placement of a buttressing berm to improve stability of the earthen dam. This berm would be created by placing up to 25,000 cubic yards (19,115 cubic meters) of aggregate and riprap along approximately 0.5 acres (0.2 hectares) of the shoreline on the downstream (Budd Inlet) side of the earthen dam and adjacent to the dam along a portion of shoreline. The displacement of current native marine sediments by rock armoring would result in a reduction in the quality of the habitat and a minor reduction in habitat functions supporting the marine species groups. Specifically, the production of benthic macroinvertebrates would be affected where the rock material displaced native sediments; however, the affected area includes only a very small portion of Budd Inlet, and reducing the invertebrate population in this area would be, at most, limited to individual fish and would not negatively affect fish populations or result in measurable changes to species distributions or densities. Therefore,

impacts to marine fish species from the buttressing berm would be less than significant.

Long-term impacts on fish and wildlife associated with the Managed Lake Alternative are listed and summarized in Table 4.5.1.

Table 4.5.1 Summary of Long-Term Impacts: Managed Lake Alternative

Impact	Impact Finding	Measures to Reduce or Mitigate Significant Impacts	Significant & Unavoidable Impact
Fish – Impacts on fish species, species group, or aquatic habitat associated with additional permanent overwater and in-water structures and artificial lighting elements	Less than significant impact	BMPs and other measures to avoid and minimize impacts (see Section 4.5.8)	No
Fish – Alterations in lake bathymetry and water depths in the lake associated with dredging, for both the anadromous and freshwater species groups	Minor beneficial effect	Not applicable	Not applicable
Fish – Alterations in sediment function associated with dam overhaul repairs, including the buttressing berm in Budd Inlet (for the marine species group)	Less than significant impact	BMPs and other measures to avoid and minimize impacts (see Section 4.5.8)	No
Wildlife – Conversion of open-water habitat to wetland habitat areas for some species that utilize open-water habitat, such as waterfowl, bats, and aerial feeders	Less than significant impact	BMPs and other measures to avoid and minimize impacts (see Section 4.5.8)	No
Wildlife – Alterations in lake bathymetry and water depths in the lake associated with maintenance dredging	Less than significant impact	BMPs and other measures to avoid and minimize impacts (see Section 4.5.8)	No
Wildlife – Conversion of deepwater habitat to wetland habitat areas for some species that utilize wetland habitats for habitat or prey, such as raptors and songbirds	Minor beneficial effect	Not applicable	Not applicable

4.5.5 What are the long-term impacts under the Estuary Alternative?

Under the Estuary Alternative, some habitat zones would change, and some species would adapt to the altered habitat conditions while

others would not be able to persist in a saltwater environment. The long-term impacts on fish and wildlife would range from beneficial to less than significant to significant, depending on the species. Compared to the other action alternatives, reestablishing estuarine conditions would provide greater benefits to native species that would have historically used the Project Area, better reflecting the goals of the project to improve ecological functioning.

The estuary habitat conditions reestablished by dam removal would result in **substantial beneficial effects** for salmon, other anadromous species, and marine fish. Due to historical declines, estuary habitat is a scarce and valued habitat in the region as compared to freshwater ponds and lakes, which remain relatively abundant.

The transition from a lake to an estuary would result in changes in salinity, sediment deposition patterns, aquatic plants, invasive species distribution, water temperature, and water quality.

The removal of the dam would improve migration conditions for anadromous fish and aid in the transition between freshwater and saltwater. Although migration occurs under existing conditions and is not precluded, upstream passage of juvenile fish under existing conditions may be impeded. Removal of the dam would restore natural conditions, including a gradual transition from saltwater to freshwater, and vice versa, which would benefit anadromous salmon, particularly juvenile fish. For juvenile salmon originating in the Deschutes River or Percival Creek, as well as adult salmon returning to those systems, the Estuary Alternative would provide a natural freshwater to saltwater salinity gradient that is physiologically favorable. These changes would likely translate to increased fitness of juvenile outmigrants, potentially increasing early-marine survival. A wide body of literature shows the key role that estuaries in the Pacific Northwest play in supporting the growth and survival of juvenile salmonids, including Chinook salmon. Estuaries provide habitat conditions that support juvenile salmon in their physiological transitions, provide refugia from predators, and provide elevated prey resources relative to freshwater and marine systems. In addition to providing habitat for outmigrating fish from in-basin, estuaries have been shown to support non-natal Chinook salmon juveniles, both hatchery and wild origin fish. Although the abundance of juvenile fish from other basins that would utilize Capitol Lake under the Estuary Alternative is unknown, some number of both hatchery and wild non-natal juvenile Chinook salmon would be expected to

utilize the estuary habitats for feeding, growth, and avoidance of predators.

Dam removal would also eliminate a known compression point at the outlet of the 5th Avenue Dam. Under current conditions, anadromous fish must enter and exit the lake through a small fish ladder, exposing fish to predation from marine mammal, avian, and piscivorous fish predators that may congregate at the existing bottleneck created at the dam outlet. Anecdotal information indicates that harbor seals have been observed following salmon up and into the fish ladder. This constriction would be removed under the Estuary Alternative and allow outmigrating fish, including juvenile salmonids, to exit Capitol Lake through an outlet measuring up to 500 feet wide (at high tide) versus an outlet measuring only 9.5 feet wide under existing conditions. Existing levels of predation from marine mammals and avian species should decrease substantially with the removal of the dam/fish ladder compression point.

The estuarine habitat that would be fully exposed to tidal exchange would provide productive habitat for salmon, other anadromous species, and marine fish in the area. Estuaries provide key habitat for Chinook salmon. Shallow water habitats with salt marsh vegetation along the water's edge would provide preferred rearing habitat for juvenile salmon and productive epibenthic and terrestrial origin prey for juvenile salmon. Habitat quality would improve over time as macroinvertebrate populations and saltwater-tolerant aquatic vegetation became established in the intertidal zone and marsh habitat areas. Estuaries support key ecological processes such as freshwater input, sediment transport, erosion and accretion of sediments, tidal flow, tidal channel formation and maintenance, distributary channel migration, movement of aquatic organisms, and detritus import and export. Estuarine habitat in the South Sound has experienced severe reductions in both the quantity and quality of such key habitats for fish. Because of this, the transition in habitat type from freshwater lake to estuary would be highly valuable.

Due to the influence of water from Budd Inlet entering the Capitol Lake Basin, water quality in the basin would change with the transition from a freshwater system to a saltwater estuary. This could include a slight decrease in dissolved oxygen compared to existing freshwater dissolved oxygen conditions, and potential for (marine) algal blooms. The expected dissolved oxygen conditions are typical of South Puget Sound estuaries, and anadromous and marine fish species are adapted to such conditions. In addition, temperatures in

the estuary may increase slightly from existing conditions due to the influence of saltwater at high tide cycles, but any such changes would be well within the tolerances for fish.

Aquatic invasive species that are intolerant to saltwater (e.g., New Zealand mudsnail, Eurasian watermilfoil, curly pondweed) would be largely eradicated from the area with the transition from freshwater to saltwater. This would benefit anadromous and marine fish by creating room for the establishment of native salt-tolerant vegetation or naturally unvegetated tideflats, depending on elevations relative to the tides.

The removal of in-water fill associated with the 5th Avenue Dam would increase available habitat at the dam location and improve fish access to upstream habitats. Even when considering the effects of additional overwater and in-water structures from the new 5th Avenue Bridge and boardwalks, anadromous and marine fish in the study area would experience moderate beneficial effects from a net increase in available habitat. Reestablishment of a functional estuary would also increase habitat for a variety of marine shellfish (particularly the more mobile species such as crabs), a moderate beneficial effect. However, the habitat changes would negatively affect the survival of freshwater mussels in Capitol Lake (considered a species of "Least Concern" by the International Union for Conservation of Nature), a less than significant impact. By enhancing the salmon production of the basin (through additional refuge habitat for juvenile salmon and increasing the estuarine benthic organism prey for salmon), there would be a corresponding minor beneficial effect for orcas (an ESA-listed species) that may occasionally visit Budd Inlet.

Brackish water in the North and Middle Basins, and to a lesser degree in the South Basin, that would result from the Estuary Alternative would not be suitable for freshwater fish species. While none of the freshwater fish species present in the basin are listed as federal- or state-listed species, there would be indirect mortality and/or displacement to native freshwater fish species. The elimination of a large amount of available habitat would negatively affect local populations of these fish. This constitutes a **significant impact** on the native freshwater species, although in some cases (e.g., bass, carp, and bullhead) the affected species are non-native species that prey on native species, such as salmonids.

For wildlife species, the change to an estuarine environment would eliminate the freshwater lake. As described in Chapter 3.0 (Section 3.5),

Estuary Alternative: Aquatic Invasive Species

The introduction of saltwater would substantially reduce the presence of invasive plant species (except for purple loosestrife). The potential for downstream transport of invasive species outside the study area from removal of the 5th Avenue Dam is considered low due to the reduced population expected to survive in the estuarine waters.

bats from the Woodard Bay trestle colony forage at Capitol Lake. The effect on bats from the conversion of an artificial, lentic, open water habitat to natural riparian, wetland, and estuarine habitats is unknown. However, because of the lack of scientific information on this topic, it is possible that bats may be adversely impacted. For this reason, it has been determined that conversion of habitats from current conditions to those resulting from the Estuary Alternative would have **potentially significant impacts** on Yuma myotis and little brown bats at the Woodard Bay trestle colony, given their use of Capitol Lake for foraging and/or drinking. No impact is expected for any other bat species. Additional information on bat use of the study area and potential impacts has been included in the Fish and Wildlife Discipline Report (Attachment 9), as well as an annotated bibliograph of reviewed literature.

As with the Managed Lake Alternative, the conversion of deepwater habitat to wetland habitat areas would provide a minor beneficial effect for some wildlife species such as raptors and songbirds, by increasing hunting and foraging opportunities. Shorebirds and wading birds, such as heron, would experience a **substantial beneficial effect** from the conversion of freshwater to estuarine habitat, because of an increase in suitable habitat and changes in the types of prey available for this species group. Similarly, waterfowl would likely experience a moderate beneficial effect because of an increase in foraging opportunities. The habitat islands created under the Estuary Alternative would provide nesting sites that are not present under existing conditions, and would benefit species that breed in the area such as Canada geese and American coots, which are both common species.

There may be a minor reduction in the amount of insect prey for avian aerial feeders in the restored estuarine habitat; any reduction would result in a less than significant impact because of their ability to prey-switch and adjust to changes from the newly restored conditions.

Maintenance dredging under the Estuary Alternative could result in impacts on aquatic resources by causing physical or behavioral responses, or by affecting aquatic habitat, and potentially affecting access to fishing areas within West Bay during maintenance dredging cycles. For species associated with bottom habitats, including burrowing species, a greater magnitude of impacts is anticipated, due to the fishes' vulnerability to entrainment. However, no significant impacts are anticipated from dredging, based on the limited scope,

scale, and timing of the maintenance dredging. For additional information on the short-term impacts from dredging, see Chapter 5.0 (Section 5.5.2).

Long-term impacts on fish and wildlife associated with the Estuary Alternative are listed and summarized in Table 4.5.2.

Table 4.5.2 Summary of Long-Term Impacts: Estuary Alternative

Impact	Impact Finding	Measures to Reduce or Mitigate Significant Impacts	Significant & Unavoidable Impact
Fish – Aquatic habitat alterations related to dam removal (reduction in habitat for native freshwater fish due to transition from freshwater to brackish water in basin)	**Significant impact**	None	**Yes**
Fish – Conversion of freshwater lake habitat to a tidally influenced brackish estuary, specifically benefitting anadromous fish and marine fish, potentially including ESA-listed Chinook salmon and steelhead trout	**Substantial benefit**	Not applicable	Not applicable
Fish – Increase in available in-water habitat that would result from dam removal, specifically for anadromous fish and marine fish species, potentially including ESA-listed Chinook salmon and steelhead trout	Moderate beneficial effect	Not applicable	Not applicable
Wildlife – Habitat alteration (impacts on bats)	**Significant impact**	None	**Yes**
Wildlife – Habitat alteration (impacts on aerial feeders)	Less than significant	None	No
Wildlife – Increase in suitable habitat and changes in the types of prey available for shorebirds and wading birds from conversion to estuarine habitat	**Substantial benefit**	Not applicable	Not applicable
Wildlife – Large expansion of suitable habitat within the estuary for marine shellfish	Moderate beneficial effect	Not applicable	Not applicable
Wildlife – Increased system diversity and range of foraging opportunities for waterfowl	Moderate beneficial effect	Not applicable	Not applicable

Impact	Impact Finding	Measures to Reduce or Mitigate Significant Impacts	Significant & Unavoidable Impact
Wildlife – Increased habitat available for raptors and songbirds	Minor beneficial effect	Not applicable	Not applicable
Wildlife – Potential for increased salmon prey base for ESA-listed orcas	Minor beneficial effect	Not applicable	Not applicable

Note:

No naturally reproducing native populations of Chinook salmon or steelhead trout are present within the Deschutes River Basin or Percival Creek, although use of the study area by these species may occur. Chinook salmon from the Tumwater Falls Hatchery are not listed under the ESA.

4.5.6 What are the long-term impacts under the Hybrid Alternative?

Under the Hybrid Alternative, impacts on fish and wildlife would range from beneficial to less than significant to significant, with the nature and scale of impacts similar to those for the Estuary Alternative. The removal of the 5th Avenue Dam would allow saltwater from Budd Inlet to enter the former lake basins, transforming freshwater riverine and lacustrine aquatic habitats to estuarine habitat, except within the reflecting pool where freshwater conditions would be present, fed by groundwater.

Reflecting the goals of the project to improve ecological functions and water quality, many of the changes would be beneficial, although somewhat muted compared to the Estuary Alternative. Some habitat zones would change and species would adapt to the altered habitat conditions.

For salmon, other anadromous species, and marine fish, the estuary provided in the Hybrid Alternative would result in moderate beneficial effects relative to the Estuary Alternative, as the full range of estuarine functions would not be developed over the entire North Basin area. The Hybrid Alternative would establish a freshwater reflecting pool that does not support estuarine functions and would reduce the amount of habitat available to estuarine fish species in the North Basin. The approximately 45 acres of freshwater habitat in the reflecting pool would be isolated from the estuary portion of the North Basin. The reflecting pool would provide some (but not all) functions of a freshwater lake system for resident fish, but would not be utilized by anadromous fish. Conversely, the saline or brackish water in the estuary portion of the North Basin, the Middle Basin, and to a lesser degree in the South Basin, that would

result from the Hybrid Alternative would not be suitable for freshwater fish species. This would result in indirect mortality and/or displacement, same as the Estuary Alternative. This would be a **significant impact** for native species within the group, although in some cases (e.g., bass, carp, and bullhead) the affected species are non-native species that prey on native species, such as salmonids.

As with the Estuary Alternative, the loss of the freshwater lake, which supports emergent insects fed upon by bats and insectivorous birds, would result in a **potentially significant impact** on the Woodard Bay bat colony.

The 45 acres of deepwater, freshwater habitat behind the reflecting pool barrier wall would provide some limited habitat for existing freshwater mussels. Habitat would be extremely limited in the basin compared to existing conditions.

Under the Hybrid Alternative, the reflecting pool would offer some resting deepwater habitat for waterfowl when the estuary portion of the project is at low tide, a moderate beneficial effect. The pool would also provide production of insects preferred by aerial feeders. With the change from freshwater to estuarine habitat in other parts of the basin, impacts to aerial feeders would be less than significant overall.

As with the Estuary Alternative, the type of fish supported by the estuary would shift to estuarine species. Bald eagles and osprey are adept at feeding in both freshwater and estuarine environments. Fish production in the reflecting pool would likely be lower than that of the functional estuary portion of the project. Overall, there would be no impact on bald eagles and osprey.

Long-term impacts on fish and wildlife associated with the Hybrid Alternative are listed and summarized in Table 4.5.3.

Table 4.5.3 Summary of Long-Term Impacts: Hybrid Alternative

Impact	Impact Finding	Measures to Reduce or Mitigate Significant Impacts	Significant & Unavoidable Impact
Fish – Aquatic habitat alterations related to dam removal (reduction in habitat for native freshwater fish due to transition from freshwater to brackish water in basin)	**Significant impact**	None	**Yes**

Impact	Impact Finding	Measures to Reduce or Mitigate Significant Impacts	Significant & Unavoidable Impact
Fish – Conversion of freshwater lake habitat to a tidally influenced brackish estuary, benefitting anadromous fish and marine fish, potentially including ESA-listed Chinook salmon and steelhead trout	Moderate beneficial effects	Not applicable	Not applicable
Fish – Increase in available in-water habitat that would result from dam removal, specifically for anadromous fish and marine fish species	Moderate beneficial effects	Not applicable	Not applicable
Wildlife – Habitat alteration (impacts on bats)	**Significant impact**	None	**Yes**
Wildlife – Habitat alteration (impacts on aerial feeders)	Less than significant	None	No
Wildlife – Increase in suitable habitat and changes in the types of prey available for shorebirds and wading birds from conversion to estuarine habitat	Moderate beneficial effects	Not applicable	Not applicable
Wildlife – Large expansion of suitable habitat within the estuary for shellfish	Moderate beneficial effects	Not applicable	Not applicable
Wildlife – Increased system diversity and range of foraging opportunities for waterfowl	Moderate beneficial effects	Not applicable	Not applicable
Wildlife – Increased habitat available for raptors and songbirds	Minor beneficial effects	Not applicable	Not applicable
Wildlife – Potential for increased salmon prey base for ESA-listed orcas	Minor beneficial effects	Not applicable	Not applicable

4.5.7 What are the long-term impacts to tribal fishing resources?

Reintroducing tidal hydrology to the entire lake area would benefit many of the species of importance to local area tribes, specifically salmon and shellfish, and potentially other fish and wildlife, as well as plants. Maintenance dredging could also result in short-term and temporary impacts on tribal resources by causing physical or behavioral responses, or by affecting aquatic habitat, and potentially

affecting access to fishing areas within West Bay during maintenance dredging cycles.

Under the No Action Alternative, the continuation of current, limited management practices would not benefit species of importance to the tribes, specifically salmon and shellfish. Under the Managed Lake Alternative, maintaining a freshwater lake system would not substantially benefit species of importance to the tribes. Under both the No Action and Managed Lake Alternatives, impacts on salmon related to habitat changes from continued deposition of sediment in Capitol Lake would likely not measurably affect fish available for harvest.

Under the Estuary and Hybrid Alternatives, reintroducing tidal hydrology to the Capitol Lake Basin would benefit many of the species of importance to the tribes. Compared to the Estuary Alternative, the Hybrid Alternative would have less of an overall increase in habitat availability and access due to the freshwater reflecting pool.

Making a determination of significance related to treaty-reserved rights is not part of the EIS. However, potential impacts and benefits to tribal resources were considered in the decision-making process for identifying the Preferred Alternative, as outlined in Appendix 21 of the Final EIS. Mitigation associated with potential impacts on tribal resources would be addressed directly with the affected tribes during government-to-government consultations as part of the permitting, regulatory, and consultation processes for the selected alternative.

4.5.8 What avoidance, minimization, and mitigation measures would be implemented for the project?

4.5.8.1 Measures Common to All Action Alternatives

Enterprise Services would avoid and minimize potential impacts by complying with regulations, permits, plans, and authorizations. These anticipated measures, and other mitigation measures that could be recommended or required, are described below.

BMPs common to all action alternatives would include the following:

- During recurring dredging, use BMPs (for example, sediment curtains) to avoid unintentional impacts on habitat and water quality during dredging.

- To the extent practicable, minimize the width of pedestrian boardwalks and utilize fish-friendly designs, utilizing grated decking and a minimum number of support piles.

Following the SEPA review process, and as part of the design and permitting of the selected alternative, the USACE would conduct its own review of the project and would consult under Section 7 of the federal ESA with the U.S. Fish and Wildlife Service and NOAA Fisheries. WDFW would also review the project under state Hydraulic Project Approval requirements. Additional measures may be identified under one or both of these processes that could further reduce potential impacts on fish and wildlife resources.

Habitat Enhancement Plan

A Habitat Enhancement Plan would be developed and implemented for the selected alternative during the future design phase. The plan would be developed in coordination with and approved by Ecology, WDFW, City of Olympia, City of Tumwater, other applicable local, state, and federal agencies, and tribes.

Elements of the plan would generally include:

- Specific habitat creation, restoration, and design treatments for each habitat area (e.g., upland, riparian, wetland, and aquatic).
- Specific performance standards for the habitat areas to measure the success of these areas.
- Adaptive management and maintenance measures to ensure that the performance standards are met.
- Measures to address nuisance and invasive species within the Project Area.

4.5.8.2 Managed Lake Alternative

Lights on the new 5th Avenue Non-Vehicular Bridge would be positioned to illuminate only the walkways or use other methods, such as hoods that prevent excess light from reaching the water surface.

4.5.8.3 Estuary and Hybrid Alternatives

Additional measures for the Estuary and Hybrid Alternatives would include the following:

- Replacing trees removed to realign Deschutes Parkway based on City of Olympia's tree protection ordinances and critical areas regulations
- Positioning lights on the new 5th Avenue Bridge to illuminate only the walkways or use other methods, such as hoods that prevent excess light from reaching the water surface
- Coordination with wildlife experts during the design phase to identify opportunities to support bats

4.5.9 What are the significant unavoidable adverse impacts to fish and wildlife?

As described above, most potential impacts on fish or wildlife from any of the alternatives would not rise to the level of significant. The analysis did, however, identify some **significant unavoidable impacts**, as summarized below by alternative.

4.5.9.1 Managed Lake Alternative

No significant impacts on fish or wildlife.

4.5.9.2 Estuary and Hybrid Alternatives

- **Operational Impacts on Fish from Aquatic Habitat Alterations:** The saline or brackish water in the North and Middle Basins, and to a lesser degree in the South Basin, that would result from the Estuary and Hybrid Alternatives is not suitable for freshwater fish species, resulting in indirect mortality and/or displacement of these species in the Capitol Lake Basin; this would be a **significant unavoidable impact** to native freshwater species
- **Operational Impacts on Wildlife from Habitat Alterations:** Although difficult to assess because of data gaps in the understanding of current use of Capitol Lake, as well as how the restored habitats would support the existing assemblage, it is conservatively determined that there would be a potentially **significant unavoidable impact** on Yuma myotis and little brown bats at the Woodard Bay bat colony. This is because of the size of the colony and the change to an estuarine environment under the Estuary and Hybrid Alternatives.

4.6 WETLANDS

This section describes the potential long-term impacts and benefits of the Capitol Lake – Deschutes Estuary Long-Term Management Project on wetland resources in the study area. The EIS focuses on the most important elements and conclusions of the analysis and, in particular, the differences among the four alternatives. Information presented in this section is summarized from the full analysis provided in the revised Wetlands Discipline Report (Attachment 10). See the Final EIS Summary or within the Wetlands Discipline Report for a summary of key changes between the Draft EIS and Final EIS.

4.6.1 What methods were used to assess long-term impacts to wetlands?

Operational impacts are the long-term or permanent effects related to the operation of the project. These include the long-term or permanent loss of wetland habitat or functions. Depending on the alternative, the distribution and extent of estuarine and freshwater wetland types in the study area may be affected by changes in water depth, tidal fluctuations, circulation, velocity, salinity, installation of new structures, and maintenance dredging. Additional details on the significance criteria are presented in the Wetlands Discipline Report (Attachment 10).

As required by federal, state, and local laws, the project includes BMPs to avoid and minimize long-term wetland impacts (see Section 4.6.7). Potential impacts on wetland buffers were not considered in this analysis, as the size of the buffer varies and is

What is considered a significant impact or beneficial effect to wetlands?

Permanent net loss of more than 0.5 acres (0.2 hectares) of wetlands or the loss of wetland function that cannot be replaced through mitigation, are considered to be significant impacts.

A net gain in the quality and/or quantity of wetland area and/or function is considered a beneficial effect.

Key Findings: Long-Term Wetland Conditions

Reflecting the project goals of improving ecological functions and water quality in the basin, the Estuary and Hybrid Alternatives would reintroduce valuable estuarine wetland and tideflat habitats, now a relatively scarce resource in the Puget Sound region because of historical development patterns. The reestablishment of estuarine wetlands by reintroducing saltwater and tidal influences to the Capitol Lake Basin would provide a **substantial beneficial effect**.

Wetland habitat conditions under the Managed Lake Alternative would also improve with a transition from deepwater to vegetated freshwater wetlands and an increase in habitat complexity, providing a minor beneficial effect. Similar to the Managed Lake, wetlands habitat conditions under the No Action Alternative would improve as the system transitions to a more diverse complex of freshwater wetlands over time.

All action alternatives would create habitat areas with a mosaic of wetland habitats. With the habitat features included in the action alternatives and additional mitigation (if required by regulatory agencies), direct impacts from fill and indirect impacts from shade associated with the proposed rebuilt and new structures (e.g., dock and boardwalk) would be less than significant.

established following wetland delineation and rating. This work would be completed during final design and permitting of the selected alternative.

4.6.2 What are the long-term impacts under the No Action Alternative?

Under the No Action Alternative, sediment management strategies would not be implemented, and the Capitol Lake Basin would continue to accumulate sediment. Deepwater habitat areas would gradually transition to emergent, scrub-shrub, and forested wetlands—but the full transition to these vegetation wetland types would likely extend beyond the 30-year time horizon evaluated for the EIS. Overall, there would be a net gain in wetland functions (such as water quality and habitat) for these freshwater vegetated wetland areas, which would be a minor beneficial effect.

4.6.3 What are the long-term impacts common to all action alternatives?

Under all action alternatives, dredging, habitat creation, and construction of the boardwalks, dock, and boat launch would result in permanent changes to wetland types. Long-term impacts and changes to wetlands from operation of the project under the action alternatives are mostly associated with the following:

- **Permanent loss of wetlands** from the placement of fill for various project elements (e.g., boardwalks, dock, and boat launch)
- **Indirect impacts of shade** from new or rebuilt structures over wetland habitats (e.g., boardwalks and rebuilt dock)
- **Conversion of wetland area** from one wetland type to another wetland type (e.g., vegetated freshwater wetland to tideflat)
- **Periodic disturbance** related to maintenance dredging

All of the action alternatives would include boardwalks along the shorelines in the Middle and South Basins, a rebuilt dock at the Interpretive Center, and a new boat launch at Marathon Park. These overwater and in-water structures would result in similar areas of shade and fill within wetlands, across the action alternatives. Indirect impacts from shade would be primarily on freshwater deepwater habitats under the Managed Lake Alternative, and to estuarine

What wetland long-term impacts were considered?

Both long-term adverse impacts and beneficial effects were evaluated based on expected changes in ecological functions within the study area. Changes in wetland area and/or types would have associated effects on ecological functions related to water quality, hydrologic function, and habitat. The functions of wetland habitats lost and gained were compared for each alternative relative to existing conditions, using modeling and conceptual design information. Shading impacts and /or changes in wetland vegetation class due to overwater/over-wetland structures were also considered.

deepwater habitats or tideflats under the Estuary or Hybrid Alternatives.

Under all action alternatives, dredge spoils from initial dredging would be used to create areas of more complex habitat. This beneficial reuse of material avoids the cost and complexity of off-hauling dredge spoils, and the newly created habitat areas provide greater edge and structural heterogeneity within the Project Area. The habitat areas would include different elevations to support a diversity of wetland plant communities—emergent, scrub-shrub and forested—as well as some upland communities. The configuration of the habitat areas would be refined in the design phase for the selected alternative to maximize wetland habitat area and complexity.

The types of operational impacts vary by alternative (as described in The sections below) and could range from relatively minor impacts such as conversion of one wetland type to another, to more significant impacts such as the conversion of wetlands/waters of the U.S. or state to non-wetland non-water status. For the alternative selected, the design would be refined to minimize the wetland loss and maximize habitat benefits. With the habitat features included in the action alternatives and additional compensatory mitigation (if required by regulatory agencies; see Section 4.6.7), direct impacts from fill and indirect impacts from shade under all action alternatives would be less than significant.

4.6.4 What are the long-term impacts under the Managed Lake Alternative?

Under the Managed Lake Alternative, Capitol Lake would remain a freshwater system. The North Basin would be dredged to maintain the historic reflecting pool and would remain deepwater (freshwater) habitat. Habitat areas would be established in the Middle Basin, and the Middle and South Basins would transition over time from deepwater habitat to vegetated wetlands, similar to the No Action Alternative. There would be a net gain in wetland functions provided by the created emergent, scrub-shrub, and forested habitat areas and passive transition to vegetated wetlands. This effect would be similar to that described under the No Action Alternative and is a minor beneficial effect.

The area of wetlands or waters of the U.S. or state that would be filled under the Managed Lake Alternative is estimated at 23,800 square feet (0.55 acres), the vast majority of which (97%) is from the new dam

buttressing berm on the north side of the earthen dam in West Bay in estuarine habitat. This area of fill within the Capitol Lake Basin is small relative to the overall extent of wetlands in the basin; as a result, the decreases in wetland functions related to water quality improvement, hydrologic function, and fish and wildlife habitat would be small. Additionally, the habitat type that would be affected the most (deepwater habitat) is relatively common in the region.

Indirect impacts from shade are estimated at 56,600 square feet (1.3 acres), associated with the new 5th Avenue Non-Vehicular Bridge, boardwalks, and dock.

With habitat improvements included in the Managed Lake Alternative and additional compensatory wetland mitigation (if required by regulatory agencies), direct impacts from fill and indirect impacts from shade under the Managed Lake Alternative would be less than significant.

The creation of wetland habitat areas using dredge material and the gradual natural increase in vegetated wetland areas through ongoing sediment accumulation in the Middle Basin are expected to produce a net gain in wetland functions, providing a minor beneficial effect overall for this alternative.

Maintenance dredging in the North Basin would occur approximately 20 years after construction to maintain a lake-bed elevation similar to that produced by the initial dredging (initial dredging activities are described in Chapter 5.0 [Section 5.6.2]); the duration between dredge events would decrease over time. With maintenance dredging, most of the North Basin would remain freshwater deepwater habitat, and functions would remain similar to existing conditions; vegetated scrub-shrub and emergent wetlands would remain along the perimeter of the North Basin.

Long-term impacts on wetlands associated with the Managed Lake Alternative are listed and summarized in Table 4.6.1.

Table 4.6.1 Summary of Long-Term Impacts: Managed Lake Alternative

Impact	Impact Finding	Measures to Reduce or Mitigate Significant Impacts	Significant & Unavoidable Impact
Impacts on wetland area and/or function from direct fill and indirect shade impacts. No net loss of waters of the U.S. or state are anticipated from proposed structures.	Less than significant	BMPs and other measures to avoid and minimize impacts (see Section 4.6.7)	No
Improved hydrologic, water quality, and habitat functions with the creation of habitat areas and transition of the North and Middle Basins to a greater complexity of vegetated wetland types.	Minor beneficial effect	Not applicable	Not applicable

4.6.5 What are the long-term impacts under the Estuary Alternative?

Under the Estuary Alternative (as well as the Hybrid Alternative), the removal of the 5th Avenue Dam would restore saltwater and tidal influences to the Capitol Lake Basin, transforming it from a freshwater system to its historic condition as an estuarine system. Estuarine wetlands provide additional functions that are not available in freshwater deepwater habitats. Compared to freshwater wetlands, estuarine wetlands have been disproportionately affected by past development practices and are considered less common and more valuable in the Puget Sound region.

Under the Estuary Alternative, changes in wetland habitat would occur from the reintroduction of saltwater and tidal flow, creation of habitat areas, slope stabilization along Deschutes Parkway, new recreational structures, and recurring maintenance dredging in West Bay. Approximately 14 acres of currently forested freshwater wetlands would convert to estuarine or transitional wetlands, which would directly impact trees currently growing in these areas. However, the removal of the 5th Avenue Dam would reestablish estuarine wetland habitats throughout the basin, which is considered a **substantial beneficial effect**. The removal of the 5th Avenue Dam structure would restore approximately 3.3 acres (1.3 hectares) of a water of the U.S. The new area would primarily be estuarine deepwater habitat.

The new 5th Avenue Bridge, boardwalks, dock, and boat launch would fill an estimated 2,323 square feet (216 square meters) and indirectly

shade 2.3 acres (0.9 hectares) of wetlands. Overall, these impacts would be more than offset by the removal of approximately 3.3 acres of fill in waters of the U.S. or state due to the removal of the 5th Avenue Dam. Thus, direct impacts from fill and indirect impacts from shade under the Estuary Alternative would be less than significant.

Future accumulations of sediment in the southern portion of West Bay would be removed through recurring maintenance dredging, approximately every 6 years. The impact of these dredging activities on deepwater habitat in West Bay would be minor and similar to existing conditions. Impacts from dredging would be less than significant.

Long-term impacts on wetlands associated with the Estuary Alternative are summarized in Table 4.6.2.

Table 4.6.2 Summary of Long-Term Impacts: Estuary Alternative

Impact	Impact Finding	Measures to Reduce or Mitigate Significant Impacts	Significant & Unavoidable Impact
Impacts on wetland area and/or function from direct fill and indirect shade impacts. No net loss of waters of the U.S. or state are anticipated from proposed structures. Notably, several acres of fill would be removed from the Project Area as a result of dam demolition.	Less than significant	BMPs and other measures to avoid and minimize impacts (see Section 4.6.7)	No
Improved hydrologic, water quality, and habitat functions given the reestablishment of a high-value estuarine system (with a gain of tideflat, low marsh, high marsh, and deepwater estuarine habitat), and construction of habitat areas.	**Substantial beneficial effect**	Not applicable	Not applicable

4.6.6 What are the long-term impacts under the Hybrid Alternative?

Like the Estuary Alternative, removal of the 5th Avenue Dam with the Hybrid Alternative would restore saltwater and tidal influences to the Capitol Lake Basin, and the basin would convert to an estuarine system similar to historic, predevelopment conditions. Estuarine wetlands provide water quality, hydrologic, and fish and wildlife functions that are generally less common and more valuable in the Puget Sound region, and this conversion would be a **substantial beneficial effect**. The extent of beneficial effects, although still substantial, would be less than with the Estuary Alternative because

the reflecting pool in the eastern portion of the North Basin would be a constructed deepwater, freshwater habitat that would not provide as much benefit as an open estuarine system.

Changes to wetlands would occur under the Hybrid Alternative from the reintroduction of saltwater and tidal flow, creation of wetland habitat areas, slope stabilization along Deschutes Parkway, new structures, and recurring maintenance dredging in the groundwater-fed reflecting pool and West Bay.

The new 5th Avenue Bridge, boardwalks, dock, and boat launch would fill an area of approximately 2,323 square feet (216 square meters) and shade 2.2 acres (0.89 hectares) of some wetland types, the same as the Estuary Alternative. The barrier wall in the Hybrid Alternative would also fill approximately 1.2 acres (0.49 hectares) of estuarine deepwater habitat, resulting in more fill than the Estuary Alternative. As with the Estuary Alternative, however, these impacts are more than offset by the removal of the 5th Avenue Dam, which would restore approximately 145,000 square feet (3.3 acres) of a water of the U.S. or state. Overall, habitat complexity would be increased, and water quality and hydrologic functions would improve compared to the No Action Alternative. The habitat type that would be most affected (freshwater deepwater habitat) is relatively common in the region and would be replaced with a less common and more valuable habitat type (estuarine deepwater). Thus, direct impacts from fill and indirect impacts from shade under the Hybrid Alternative would be less than significant.

As with the Estuary Alternative, some of the freshwater forest and shrub-dominated wetland that has become established in the Middle and South Basins since the dam was constructed would be replaced with estuarine wetlands over time.

Accumulated sediment in the lower portion of West Bay would be managed through recurring maintenance about every 5 years. The impact of these maintenance dredging activities would be similar to existing conditions and would be less than significant.

Long-term impacts on wetlands associated with the Hybrid Alternative are listed and summarized in Table 4.6.3.

Table 4.6.3 Summary of Long-Term Impacts: Hybrid Alternative

Impact	Impact Finding	Measures to Reduce or Mitigate Significant Impacts	Significant & Unavoidable Impact
Impacts on wetland area and/or function from direct fill and indirect shade impacts. No net loss of waters of the U.S. or state are anticipated from proposed structures.	Less than significant	BMPs and other measures to avoid and minimize impacts (see Section 4.6.7)	No
Improved hydrologic, water quality, and habitat functions given the reestablishment of an estuarine system and construction of habitat areas.	**Substantial beneficial effect**	Not applicable	Not applicable

4.6.7 What avoidance, minimization, and mitigation measures would be implemented for the project?

The project has been designed to minimize both permanent and temporary impacts of the action alternatives. Compensatory mitigation for the loss of a water of the U.S. or state would be required if an action alternative had impacts that could not be fully avoided or offset through design of habitat features or implementation of the Habitat Enhancement Plan (described below). For the alternative selected, the design would be refined to minimize the wetland loss and maximize habitat benefits. With consideration of improved habitat functions and self-mitigating functions of the alternatives, the need for compensatory mitigation may be reduced to zero.

Required compensatory mitigation would be determined during the permitting phase. Enterprise Services would work with regulatory agencies to achieve no net loss of waters of the U.S. or state.

4.6.7.1 Measures Common to All Action Alternatives

Enterprise Services would avoid and minimize potential impacts by complying with regulations, permits, plans, and authorizations. These anticipated measures, and other mitigation measures that could be recommended or required, are described below.

BMPs common to all action alternatives would include the following:

- For boardwalks, pin piles may be used to minimize wetland fill under any alternative.

- During recurring dredging, contractors would use BMPs (for example, sediment curtains) to avoid unintentional impacts on habitat and water quality during dredging.

A Habitat Enhancement Plan would be developed and implemented for the selected alternative during the future design phase. The plan would be developed in coordination with and approved by Ecology; WDFW; City of Olympia; City of Tumwater; other applicable local, state, and federal agencies; and tribes. Elements of the plan would vary depending on the alternative, and generally include the following:

- Specific habitat creation, restoration, and design treatments for each habitat area (e.g., upland, riparian, wetland, and aquatic).
- Specific performance standards for the habitat areas to measure the success of these areas.
- Adaptive management and maintenance measures to ensure that the performance standards are met.
- Measures to address nuisance and invasive species within the Project Area.

4.6.7.2 Managed Lake Alternative

Direct and indirect impacts on wetlands from overwater structures would be compensated for at mitigation ratios determined by the permitting agencies, if it is determined that the Managed Lake Alternative is not self-mitigating.

4.6.7.3 Estuary and Hybrid Alternatives

The Estuary and Hybrid Alternatives would provide substantial ecological benefits through the conversion of freshwater wetland habitats to the less common and more valuable estuarine wetland system and a net reduction in fill. This ecological lift would be considered by agencies in determining compensatory mitigation requirements. If it is determined that the Estuary and Hybrid Alternatives are not self-mitigating, mitigation for the loss of waters of the U.S. or state would be compensated for using ratios similar to the Managed Lake Alternative.

4.6.8 What are the significant unavoidable adverse impacts to wetlands?

With compensatory mitigation (if required), there would no significant unavoidable adverse impacts on wetlands in the long term (i.e., during operation).

4.7 AIR QUALITY & ODOR

This section describes the potential long-term impacts and benefits of the Capitol Lake – Deschutes Estuary Long-Term Management Project on air quality and odor elements in the Project Area. The EIS focuses on the most important elements and conclusions of the analysis and, in particular, the differences among the four alternatives. Information presented in this section is summarized from the full analysis provided in the revised Air Quality and Odor Discipline Report (Attachment 11). See the Final EIS Summary or within the Air Quality and Odor Discipline Report for a summary of key changes between the Draft EIS and Final EIS.

What is considered a significant impact related to odor, air pollutant emissions, and GHG emissions?

Significant impacts to odor would be any odors generated by an alternative that would have a combination of high frequency, high intensity, long duration, offensive characteristic, and/or have these characteristics in locations with significant populations, such that malodor issues may arise.

Air quality impacts are considered significant if the total tons of each pollutant emitted per year are greater than the general conformity *de minimis* thresholds.

Impacts are considered significant for GHGs if the total annual GHG emissions are greater than the state-mandatory GHG reporting rule threshold (10,000 $MTCO_2e$).

Key Findings: Long-Term Air Quality and Odor Impacts

Odors: There is a potential for odors from the No Action Alternative as algae grows and then decays on the lake, which may create earthy, musty odors. However, odor impacts are expected to be less than significant given that these odor changes would be infrequent, short in duration, and with low intensity. The Managed Lake Alternative is expected to have less algae growth than the No Action Alternative, resulting in lower odor production potential. Any increase in odors under the Estuary and Hybrid Alternatives, even though naturally occurring from tideflats, may be considered a significant impact by a portion of the population with low tolerance to odor. For other portions of the population, naturally occurring odor from tideflats may not be objectionable. The variability in odor perception makes an impact determination subjective. In consideration of the variable frequency and duration, and low intensity, odor impacts from the Estuary and Hybrid Alternatives are expected to be less than significant.

Criteria Pollutants and GHG Emissions: Under all project alternatives, the annual emissions for criteria pollutants and GHGs would be less than the general conformity *de minimis* thresholds and the annual GHG emissions reporting thresholds. Both the air quality and GHG emission impacts for the No Action, Managed Lake, Estuary, and Hybrid Alternatives are expected to be less than significant.

Carbon Sequestration: While carbon dioxide (a GHG) is typically sequestered in wetland environments, methane (another GHG) is released from marshes during certain anaerobic conditions. Because of the increased salinities, methane releases under the Estuary and Hybrid Alternatives would be lower than the No Action or Managed Lake Alternatives. While the Estuary and Hybrid Alternatives would have the highest combined construction- and operation-related GHG emissions from equipment, the vegetated marshes established along the fringe of the estuary would sequester more soil carbon than would be expected in open-water habitats. This would provide better consistency with goals of the 2018 Thurston Climate Adaptation Plan.

4.7.1 What methods were used to assess long-term impacts to air quality and odor?

For assessing the long-term air quality and odor impacts associated with the project, the emissions sources of air pollutants, GHGs, and odor were considered within the bounds of the Project Area. The study area includes the surrounding ambient air that has the potential to be influenced by the project, based on the scope and nature of the post-construction air emissions, as well as the nature of the topography and meteorological conditions in the area. Due to the nature and quantities of the air pollutant emissions and potential odors generated by the project, the impacted area is not expected to extend far from the Project Area. The air quality impacts from recurring maintenance dredging were assessed by calculating the total project emissions of each criteria pollutant (i.e., nitrogen oxides [NO_x], sulfur dioxide [SO_2], carbon monoxide [CO], volatile organic compound [VOC], PM_{10}, $PM_{2.5}$) from equipment associated with maintenance dredging activities. Four categories of equipment were considered in estimating emissions: harbor craft, dredging vessels, construction equipment, and on-road trucks.

Odor Perception

Odor is a commonly experienced human sensation that virtually everyone understands. It is a human perception that results from small quantities of certain chemicals in the air we breathe. These chemicals cause nerve endings in the nose and mouth to send signals to the brain that is then interpreted as an odor. Most people understand that while the human olfactory system is very good, it is not perfect and a certain quantity of these chemicals must be present before we detect an odor; this quantity varies from person to person, with some people being more sensitive to odors than others.

Odors influence each person differently, but scientists broadly agree that consideration of five metrics is needed to assess the influence of odors: frequency, intensity, duration, offensiveness, and location. Within this study, these characteristics serve as the basis for assessing the significance of odors.

In contrast, impacts from air quality emissions were assessed by comparing estimated post-construction annual emission totals to the General Conformity *de minimis* thresholds, which are 100 tons each year for NO_x, SO_2, CO, VOC, PM_{10}, and $PM_{2.5}$. Additional details on the guidance documents and methods for determining emission totals are provided in the Air Quality and Odor Discipline Report (Attachment 11). Emissions totals below the *de minimis* thresholds are assumed to be less than significant.

Under SEPA, there is currently no guidance for how to determine the significance of GHG emissions. Equipment emissions totals can be compared against statewide and international GHG emissions, but such comparisons do not provide a bright line for determining significance. All GHG emissions contribute to the long-term impacts of climate change. Therefore, the GHGs produced from combined construction and post-construction activity were compared against the threshold used for Ecology's GHG reporting rule, 10,000 metric tons CO_2 equivalents. Notably, Ecology is currently undertaking rulemaking to provide future guidance on GHGs for SEPA analyses (see Chapter 3.0 [Section 3.7.3]).

What are general conformity *de minimis* thresholds?

General conformity *de minimis* thresholds are designed to be protective of airsheds that have a status of nonattainment or maintenance, and therefore have federal agency oversight. These serve as a point of reference for the annual emissions that may occur as a result of this project.

4.7.2 What are the long-term impacts under the No Action Alternative?

Odor impacts may arise with the No Action Alternative due to continued algae growth on the lake. In certain situations, algal blooms can release odor-causing compounds that may result in an unpleasant earthy and musty odor. Unlike an estuary, the existing Capitol Lake Basin does not have tidal fluctuations, which can vary the exposure of odor-producing materials. Because of this, odors—when present due to algae growth—would not generally fluctuate during the course of a day. However, the odors produced from the No Action Alternative would have little change from existing conditions where impacts are infrequent, short in duration, and with low intensity, resulting in a less than significant impact.

The No Action Alternative would not result in any additional impacts associated with air quality or GHG emissions from maintenance activities. Vehicle trips and equipment use associated with limited,

No Action Alternative: Carbon Sequestration Potential

Capitol Lake would remain a freshwater system under the No Action Alternative. The freshwater system under the No Action Alternative would likely have the highest net positive GHG emissions of any alternative because freshwater wetlands within the system would emit methane, have reduced capacity to sequester (store) soil carbon, and have low potential for biomass storage.

ongoing maintenance of the 5th Avenue Dam would produce negligible air emissions.

The No Action Alternative does not promote consistency with Guiding Principles in the 2018 Thurston Climate Adaptation Plan, which calls for identifying and leveraging climate change adaptation strategies and actions with mitigation co-benefits, such as reducing, capturing, and storing GHG emissions, along with enhancing resiliency for climate adaptation.

4.7.3 What are the long-term impacts common to all action alternatives?

Common air quality impacts associated with each action alternative following construction are related to maintenance dredging. Emissions would be from both the equipment used to perform the maintenance dredging (e.g., hydraulic or clamshell dredge) and the vehicles used to transport the dredged material to a disposal location (e.g., trucks, barge/tugs). Both upland and in-water disposal options, if feasible, were analyzed for each alternative. For upland disposal, the total miles traveled by haul trucks assumes a one-way trip distance of 250 miles (400 km), and total miles traveled for each on-road vehicle was scaled by the number of truck trips required. There are no permitted upland disposal locations within Thurston County that would take the dredged material, so a reasonable location farther from the Project Area was assumed. Emissions would differ by alternative and are addressed below for each alternative.

4.7.4 What are the long-term impacts under the Managed Lake Alternative?

4.7.4.1 Odor

Potential odors associated with the Managed Lake Alternative would be similar to the existing conditions. No complaints have been logged with ORCAA over the past 5 years regarding odor from the Project Area, and the Managed Lake Alternative would not increase the potential for odor generation. Algal blooms are expected to be less frequent under the Managed Lake Alternative than the No Action Alternative. As a result, there would be no increase in odors compared to the No Action Alternative and no new odor-related impacts.

4.7.4.2 Air Quality

Air quality impacts would primarily be associated with maintenance dredging and the disposal of dredged material. For the Managed Lake Alternative, maintenance dredging would be required 20 years after project construction (and occurring with increased frequency thereafter). During the evaluated time horizon of 30 years, a total estimated volume of sediment removed during maintenance dredging is estimated at 472,000 cubic yards (361,000 cubic meters).

Based on the type of equipment anticipated to be used and the duration of the dredging activity, total annual emissions are summarized in Table 4.7.1. Based on current regulations, in-water disposal is not feasible under the Managed Lake Alternative. Because an in-water disposal option is not feasible for the Managed Lake Alternative, the emissions are only tabulated for an upland disposal scenario. That could change in the future, and if in-water disposal were found to be feasible in the future, emissions associated with truck transport of dredged material would be reduced.

The close proximity of the Olympia & Belmore Railroad, Inc., railroad offers an opportunity for the dredged material to be hauled away from the Project Area by rail, either instead of or in combination with hauling by truck. The feasibility of using rail would depend on a number of factors to be determined by the project contractor prior to construction. These factors include whether or not destinations of hauled materials are adequately served by rail. If all or a portion of the dredged materials were hauled by rail, there would likely be a reduction in emissions compared to what is shown in Table 4.7.1, which assumes truck transport offsite. The total emissions are less than the general conformity *de minimis* values and, therefore, air quality impacts associated with operation of the project would be less than significant.

Table 4.7.1 Managed Lake Alternative's Long-Term Impacts – Upland Disposal

Pollutant	Project Emissions (tons each year)	General Conformity *De Minimis* Threshold (tons each year)	Greater Than *De Minimis*?
CO	8.0	100	No
NO_x	26.5	100	No
VOC	1.7	100	No
SO_2	0.06	100	No

Pollutant	Project Emissions (tons each year)	General Conformity *De Minimis* Threshold (tons each year)	Greater Than *De Minimis*?
PM_{10}	1.8	100	No
$PM_{2.5}$	1.0	100	No

4.7.4.3 Greenhouse Gases

The EIS considers the combined GHG emissions produced from equipment during construction and during operation of the project in order to determine long-term impacts. The combined emissions associated with construction activity and maintenance dredging were calculated on an annual basis over the 30-year time horizon evaluated for the EIS.

Equipment emissions associated with the Managed Lake Alternative are expected to produce about 32,308 $MTCO_2e$ (Table 4.7.2) over the 30-year project time horizon. Annually, this corresponds to about 1,077 $MTCO_2e$, well below Ecology's GHG reporting threshold of 10,000 $MTCO_2e$ or more each year. The annual GHG emissions represents less than 0.01% of estimated annual 2015 GHG emissions within Washington, and much smaller percentages of worldwide emissions. However, any project involving emissions contributes cumulatively to GHG emissions.

It is important to note that the scale of global climate change is so large that the impacts from one project, no matter the size, would almost certainly have no discernible effect on increasing or decreasing global climate change. In reality, any such effects can only be considered on a "cumulative" basis.

Table 4.7.2 Estimated GHG Emissions from Equipment ($MTCO_2e$) – Managed Lake Alternative

Project Emissions by Disposal Scenario	Life-span Emissions [1]	Annual Emissions [2]
Upland Disposal	32,308	1,077

Notes:

1. Estimated life-span emissions are based on an assumed average useful life of about 30 years.
2. Annual emissions estimates are based on dividing total emissions by assumed facility useful life span as indicated in note 1 above.

Managed Lake Alternative: Carbon Sequestration Potential

Increased biomass storage within habitat areas planned for the Managed Lake Alternative has not been quantitatively assessed relative to the reduction in methane emissions and increase in soil carbon anticipated for the Estuary and Hybrid Alternatives. However, the freshwater system under the Managed Lake Alternative would be expected to have slightly lower net positive GHG emissions than the No Action Alternative.

The GHG emissions from equipment associated with the Managed Lake Alternative would contribute to the cumulative carbon footprint of Thurston County, but the small contribution of GHG emissions from this alternative would be less than significant. Considering the cumulative contribution for this alternative, the Managed Lake Alternative generates the least construction- and operation-related GHG emissions from equipment of the action alternatives. Within the context of regional GHG emission goals described in the 2020 Thurston Climate Mitigation Plan to reduce GHG emissions 45% below 2015 levels by 2030 and 85% below 2015 levels by 2050, this alternative is the lowest long-term generator of GHG emissions from construction and operation activities.

The freshwater system under the Managed Lake Alternative is expected to capture and sequester slightly more carbon than the No Action Alternative, but would still have net positive GHG emissions due to methane emissions released from freshwater systems. The Managed Lake Alternative provides somewhat more consistency than the No Action Alternative with Guiding Principles in the 2018 Thurston Climate Adaptation Plan by improving the ability to reduce, capture, and store GHG emissions. However, any improvement would be minimal and the Managed Lake Alternative would also not promote consistency with Guiding Principles in the 2018 Thurston Climate Adaptation Plan, capturing and storing GHG emissions.

4.7.5 What are the long-term impacts under the Estuary Alternative?

4.7.5.1 Odor

Approximately 152 acres (61.5 hectares) of new tideflats would be created under the Estuary Alternative. Oxygen-starved organic material in tideflat sediments can produce low levels of hydrogen sulfide, which can create odors that smell like rotten eggs. Initially, following removal of the 5th Avenue Dam, reintroducing saltwater to the basin would cause hydrogen sulfide concentrations to increase as freshwater vegetation dies and the chemistry of the underlying soil changes. It is also anticipated that freshwater fish extirpated as a result of the transition to saltwater would decompose within the basin or be flushed from the basin by tidal action. During this phase of construction, visitors and adjacent landowners could notice odors that exceed those anticipated in the long term. Any odor impacts from this initial reintroduction of saltwater would be temporary, over a few weeks' duration. On a long-term basis, the potential frequency of these odors would be limited to times when the tidal areas are

South Sound Estuaries

The influence of tide-driven estuary odor environments is commonplace in the South Sound region. Within 15 miles (24 km) of the project, there are many estuaries varying in size and composition, such as Mud Bay, Kennedy Creek Natural Area Preserve, Ellis Cove, Woodard Bay Conservation Area, and Billy Frank Jr. Nisqually National Wildlife Refuge.

The closest nearby estuary, Mud Bay on the lower Eld Inlet, is roughly 5 miles (8 km) west of the project and has approximately 60 acres (24 hectares) of tideflats and salt marsh. The largest nearby estuary, at the Billy Frank Jr. Nisqually National Wildlife Refuge, is roughly 10 miles (16 km) away from the project and has approximately 1,000 acres (400 hectares) of combined tideflats and salt marshes. These estuaries provide some context for understanding potential odor levels and odor tolerances in the study area.

exposed (twice each day, though most of the North Basin would be submerged for the majority of the tidal cycle).

Based on ORCAA records, only one odor complaint has been lodged across its jurisdiction that includes the word "tide," and that complaint was not near a shoreline and occurred in 2007. While odor complaints are only one indication of possible odor issues, there is no other clear evidence that nearby estuaries promote deleterious odor conditions for the nearby communities. The presence of restaurants and other commercial activity along the waterfront further suggests that the naturally occurring odors are limited, or tolerated.

The average emissions rate of hydrogen sulfide per unit area of a tideflat is, at a minimum, 10 times less than the rate for salt marshes. Given that the Estuary Alternative would primarily add tideflat area with some salt marsh areas, and the estuary at the Billy Frank Jr. Nisqually National Wildlife Refuge has over six times the acreage of combined tideflat and salt marsh, the odor generation of the Estuary Alternative is expected to be comparatively low. Odor emission rates are not constant, and natural phenomena can occur that result in elevated hydrogen sulfide generation at times, but, on average, hydrogen sulfide-based odor generation from the tideflat is expected to be less than that of a combined tideflat and salt marsh of equal size, and considerably less than the odors produced by the Billy Frank Jr. Nisqually National Wildlife Refuge. Other variables such as geography and prevailing winds influence odor concentrations at these locations. However, regional stagnation events have not driven odor complaints associated with estuaries, based on odor complaints that have been filed with ORCAA.

The extreme heat event that occurred in 2021 led to some die-off of shellfish, which may have caused decomposition odors in the area. Such odors are generally a function of polysulfide compounds and are not driven by hydrogen sulfide. Similar to 2021, acute odor events due to extreme meteorological events may occur in the future, and may also result from shellfish and seaweed die-off in the re-established estuary. These odors would be indistinguishable from the odors that would also be produced in nearby Budd Inlet during such acute heat events.

The Capitol Lake Basin location is unique in that it is located in the downtown Olympia area where a larger population is present. While nearby estuaries, such as Mud Bay, include residential and commercial uses (e.g., waterfront restaurants), the areas adjacent to the estuaries do not have the same scale of urban and residential

interface that is found in the Project Area. Also, tolerances for estuary odors might be higher in locations where estuarine conditions have been present and, therefore, are not a new or changed condition. A tolerance for estuary odors in downtown Olympia or in nearby residential areas may be less than that of the nearby estuaries' communities.

In considering (1) the variable tides and tidal range of Puget Sound, which would result in inconsistent odor production frequency and durations; (2) the low intensity of odors expected to be routinely produced by the estuary, similar to estuaries elsewhere within Puget Sound; and (3) the naturally occurring character of the odor produced by estuaries, impacts would likely be less than significant. The odor perception of estuary odors is very subjective; some may find it objectionable, while others may find the odor of an estuary natural and pleasant. Even with the low and variable odor detection threshold of hydrogen sulfide, a portion of the population that perceives this odor may find it offensive and could consider any increase in estuary odors to be a significant impact.

Notably, historical anecdotal evidence of pre-dam odors is not reliable because they cannot be attributed to specific odor sources given the industrial activities, sewage management approaches, and other unknown contributors in the region at the time.

4.7.5.2 Air Quality

Long-term air quality impacts would primarily be associated with recurring maintenance dredging activities. For the Estuary Alternative, maintenance dredging would occur within areas of West Bay to avoid adverse impacts from sedimentation to navigation. Maintenance dredging would occur at the Olympia Yacht Club, the Port of Olympia/turning basin, private marinas, and access areas. For each maintenance dredging event, all areas were conservatively assumed to be dredged concurrently, condensing most of the activity to one calendar year, which increases the estimated annual emissions. Most of this dredging is expected be completed within one in-water work window (7 months).

Two disposal scenarios were considered for this alternative: (1) in-water disposal, and (2) upland disposal. Although the dredged material is assumed to be disposed of in-water, emissions were calculated for upland disposal to evaluate potential impacts to air quality and general conformity if the sediment was determined not suitable for in-water based on future sampling. These scenarios

would produce different air emissions due to the distinct equipment used for the disposal process (i.e., tugged barges and trucks). Emissions associated with the disposal scenarios are presented in Table 4.7.3 and represent the maximum annual emissions that could occur within a year.

Table 4.7.3 Estuary Alternative Maximum Annual Air Pollutant Emissions – Upland Disposal

Pollutant	Project Emissions (tons each year) – In-Water Disposal	Project Emissions (tons each year) – Upland Disposal	General Conformity *De Minimis* Thresholds (tons each year)	Greater Than *De Minimis*?
CO	14	22.9	100	No
NO_x	75	99.6	100	No
VOC	0.8	3.3	100	No
SO_2	0.04	0.12	100	No
PM_{10}	1.2	3.7	100	No
$PM_{2.5}$	1.2	2.4	100	No

While upland disposal would produce greater emissions, the maximum annual emissions for maintenance dredging with either the upland or in-water disposal scenarios would be less than the general conformity *de minimis* values. For the upland disposal scenario, however, emissions of NO_x would be just shy of this threshold value. In consideration of these emissions levels, air quality impacts associated with maintenance dredging and disposal are expected to be less than significant.

Estuary Alternative: Carbon Sequestration Potential

Because of the increased salinity levels, less methane would be released by the Estuary Alternative compared to the No Action or Managed Lake Alternative. Vegetated marshes along the fringe of the estuary would sequester more soil carbon through the biomass and in the soil than would be expected in open-water habitats.

4.7.5.3 Greenhouse Gases

Combined emissions from equipment during construction and operation were annualized over the 30-year time horizon to characterize the GHG footprint of the Estuary Alternative. The estimated GHG emissions from equipment are presented in Table 4.7.4 and indicate that emissions from the Estuary Alternative for either upland or in-water disposal would be less than Ecology's GHG reporting threshold and are therefore considered less than significant.

Unvegetated tidelands (the dominant habitat type under the Estuary Alternative) do not actively sequester carbon as much as vegetated marsh, which would be established along the shorelines. However, they are likely to maintain their current pool of carbon, and they release less methane than freshwater systems. The Estuary Alternative would naturally sequester carbon in vegetated marsh

areas, and has the least amount of long-term methane emissions. Carbon sequestration is one of the mitigation strategies included in the 2020 Thurston Climate Mitigation Plan. The Estuary Alternative also promotes the greatest level of consistency with the Guiding Principles in the 2018 Thurston Climate Adaptation Plan, which calls for identifying and leveraging climate change adaptation strategies and actions with mitigation co-benefits, such as reducing, capturing, and storing GHG emissions, along with enhancing resiliency for climate adaptation.

Table 4.7.4 Estimated GHG Emissions from Equipment ($MTCO_2e$) – Estuary Alternative

Project Emissions by Disposal Scenario	Life-span Emissions [1]	Annual Emissions [2]
Upland Disposal	49,998	1,667
In-Water Disposal	26,316	877

Notes:

1. Estimated life-span emissions are based on an assumed average useful life of about 30 years.
2. Annual emissions estimates are based on dividing total emissions by assumed facility useful life span as indicated in note 1 above.

4.7.6 What are the long-term impacts under the Hybrid Alternative?

4.7.6.1 Odor

The Hybrid Alternative would include approximately 119 acres (48.2 hectares) of tideflats, compared to 152 acres (61.5 hectares) under the Estuary Alternative. Based on the smaller acreage of tideflats, the Hybrid Alternative would have a lower potential to generate odor compared to the Estuary Alternative, but still an increase when compared to the Managed Lake Alternative.

As with the Estuary Alternative, the potential for long-term odor impacts from the Hybrid Alternative is considered less than significant.

4.7.6.2 Air Quality

Long-term air quality impacts would also primarily be associated with recurring maintenance dredging activities in West Bay. Similar to the Estuary Alternative, maintenance dredging would need to occur at

four different resource areas within West Bay to avoid sedimentation impacts on navigation.

The total emissions associated with maintenance dredging in West Bay using either in-water or upland disposal scenarios would be the same as the Estuary Alternative (see Table 4.7.3). The only difference in assumptions between the Estuary and Hybrid Alternatives is that the peak dredge event would occur sooner and more often under the Hybrid Alternative because dredging happens more frequently under the Hybrid Alternative. As described for the Estuary Alternative, the total emissions would be less than the general conformity *de minimis* values and, therefore, the air quality impacts associated with the Hybrid Alternative using upland or in-water disposal are expected to be less than significant.

4.7.6.3 Greenhouse Gases

Combined construction and operation emissions from equipment were annualized over the lifetime of the project (30 years) to characterize the GHG footprint of the Hybrid Alternative. The estimated GHG emissions from equipment are presented in Table 4.7.5. The emissions associated with the Hybrid Alternative are the highest of the three action alternatives and would contribute to the cumulative carbon footprint of Thurston County. However, the small contribution of GHG emissions from this alternative is expected to be less than significant.

Within the context of regional GHG emission goals described in the 2020 Thurston Climate Mitigation Plan to reduce GHG emissions 45% below 2015 levels by 2030 and 85% below 2015 levels by 2050, this alternative is the least consistent in terms of reducing long-term GHG emissions associated with construction and operation activities.

The Hybrid Alternative would naturally sequester carbon in vegetated marsh areas, and would have reduced levels of long-term methane emissions compared to the No Action Alternative. Carbon sequestration is one of the mitigation strategies included in the 2020 Thurston Climate Mitigation Plan. The Hybrid Alternative is also consistent with the Guiding Principles in the 2018 Thurston Climate Adaptation Plan by improving the ability to reduce, capture, and store GHG emissions, but less than the Estuary Alternative. The Hybrid Alternative would have slightly less net carbon sequestration when compared to the Estuary Alternative because of the decreased area of saline marsh along the fringe in the North Basin.

Hybrid Alternative: Carbon Sequestration Potential

The Hybrid Alternative would have slightly less net carbon sequestration compared to the Estuary Alternative because of the decreased area of saltwater marsh in the North Basin (due to the freshwater reflecting pool). The Hybrid Alternative is still expected to result in more carbon sequestration and less methane releases than the No Action and Managed Lake Alternatives.

Table 4.7.5 Estimated GHG Emissions from Equipment ($MTCO_2e$) – Hybrid Alternative

Project Emissions by Disposal Scenario	Life-span Emissions (1)	Annual Emissions (2)
Upland Disposal	64,806	2,160
In-Water Disposal	31,495	1,050

Notes:

1. Estimated life-span emissions are based on an assumed average useful life of about 30 years
2. Annual emissions estimates are based on dividing total emissions by assumed facility useful life span as indicated in note 1 above.

4.7.7 What mitigation measures would be implemented for the project?

The only activity under any of the action alternatives that would have the potential to impact air quality during operation of the project is recurring maintenance dredging. The mitigation methods for maintenance dredging would be the same as those listed in Chapter 5.0 (Section 5.7.6) for construction impacts. No mitigation is needed or proposed for impacts related to long-term air quality and odor impacts, all of which are less than significant.

4.7.8 What are the significant unavoidable adverse impacts to air quality and odors?

No significant unavoidable adverse impacts related to air quality or odor are expected during operation as a result of any of the action alternatives.

4.8 LAND USE, SHORELINES, & RECREATION

This section describes the potential long-term impacts and benefits of the Capitol Lake – Deschutes Estuary Long-Term Management Project on land use, shorelines, and recreation in the Project Area. The EIS focuses on the most important elements and conclusions of the analysis and, in particular, the differences among the four alternatives. The information presented in this section is summarized from the full analysis in the revised Land Use, Shorelines, and Recreation Discipline Report (Attachment 12). See the Final EIS Summary or within the Land Use, Shorelines, and Recreation Discipline Report for a summary of key changes between the Draft EIS and Final EIS.

Key Findings: Long-Term Land Use, Shorelines, and Recreation Impacts

The Estuary and Hybrid Alternative would increase sediment deposition in West Bay when compared to the No Action or Managed Lake Alternative. With maintenance dredging, this would not adversely affect land or shoreline uses. Impacts would be considered significant if maintenance dredging did not occur as planned. Under the Managed Lake Alternative, no substantial changes to land or shoreline uses would occur, and uses would be consistent with plans and policies for the affected areas; therefore, adverse impacts would be less than significant. The Managed Lake Alternative would retain the existing appearance of Capitol Lake more than the other action alternatives, and may be seen as more consistent with the guidelines contained in the Design Element of the Olympia's Downtown Strategy. Increased flooding is expected under all alternatives and could impact downtown land uses and low-lying parks. Flooding predicted in the Heritage Park area is expected to be mitigated for the Managed Lake and Estuary Alternatives by a berm and other improvements included in the Olympia Sea Level Rise Response Plan. The barrier wall included in the Hybrid Alternative would prevent flooding in the Heritage Park area. Under an extreme flood, the extent of inundation predicted at the Interpretive Center and Tumwater Historical Park would be slightly greater under the No Action Alternative and the Managed Lake Alternative, given the higher maximum flood elevations predicted for those alternatives.

For all action alternatives, improved water quality, sediment management, improved ecological functions, and increased opportunities for community use are expected to have **substantial beneficial effects** and would allow for the resumption of boating and fishing.

4.8.1 What methods were used to assess long-term impacts to land use, shorelines, and recreation?

The analysis of long-term land and shoreline use impacts included examining any direct changes to land use and potential indirect impacts due to effects on recreation (the predominant land use adjacent to the project). The analysis also incorporated results from the Economics Discipline Report (Attachment 18).

Recreational impacts were assessed by considering whether recreational opportunities would be improved, impeded, or remain unaffected by each alternative (for example, physical changes in the amount of open space, length of trails, etc.). This was compared to information gathered through the recreation user survey and other information on existing conditions. Additional details are presented in the Land Use, Shorelines, and Recreation Discipline Report (Attachment 12).

What land use, shorelines, and recreation long-term impacts were considered in the analysis?

The analysis considers if the alternatives could bring about major changes in the types or numbers of users and whether such changes would affect existing land use patterns. Expected or potential changes of use are compared for consistency with adopted land and shoreline use policies and plans.

4.8.2 What are the long-term impacts under the No Action Alternative?

Under the No Action Alternative, potential long-term impacts on land use, shorelines, and recreation would be related to the following:

- Limited ongoing maintenance of the 5th Avenue Dam

- Ongoing sedimentation of the Capitol Lake Basin (because no sediment management strategies would be implemented)
- The continued and increased extreme river flooding in the basin

4.8.2.1 Land Use and Shorelines

Under the No Action Alternative, Capitol Lake would be configured and operated largely as it is at present. Impacts of ongoing dam maintenance on land or shoreline use, if any, would be minimal.

As described in Section 4.1, Hydrodynamics & Sediment Transport, extreme river flooding is expected to increase under the No Action Alternative. In combination with RSLR, this would result in flood elevations in the downtown Olympia area that exceed the flood protection elevations included in the Olympia Sea Level Rise Response Plan for Heritage Park. However, the Olympia Sea Level Rise Response Plan recognizes that different alternatives could present subtle changes in how the shoreline is modified to address sea level rise. Given the adaptability built into the Olympia Sea Level Rise Response Plan to address future conditions, it is anticipated that future flooding predicted in the Heritage Park area would be addressed by the improvements under the Olympia Sea Level Rise Response Plan.

There would be a slight decrease in the sedimentation rate in the West Bay because of reduced scouring due to sea level rise. Therefore, no adverse effects on shoreline uses are expected as a result of sedimentation.

4.8.2.2 Recreation

Dam maintenance could periodically cause a temporary closure of the trail connection on 5th Avenue SW that crosses the dam, affecting trail users. Any impacts are expected to be of short duration, similar to past temporary closures.

Flooding of parks around the entire perimeter of Capitol Lake would increase as a result of extreme river floods and predicted RSLR. This would cause a gradual reduction in the number of days when these flooded portions of parks would be usable, and would increase maintenance costs because of flood damage.

What is considered a significant impact related to land use, shorelines, and recreation?

Impacts are considered significant if land and shoreline uses would be so adversely affected that an area would suffer from disinvestment and economic blight, or shoreline uses would be unable to operate.

Impacts are considered significant if recreational lands would be permanently lost without replacement with another resource of similar value.

No Action Alternative: Flood Elevations

Predicted water surface elevation of 17.5 feet NAVD 88 (5.3 meters NAVD 88) during extreme river flooding exceeds the elevation of 17.0 feet NAVD 88 (5.2 meters NAVD 88) included in the preliminary design for the Heritage Park berm, floodwall, and floodgate included in the Olympia Sea Level Rise Response Plan.

The current restrictions on swimming and boating are expected to remain. Other recreational activities and community events would continue much as they are at present. Continued sediment deposition and growth of emergent vegetation may affect the types of waterfowl and other wildlife that use the lake, but this would not likely affect the number or types of recreational users substantially. Capitol Lake would remain an urban respite for experiencing nature.

The No Action Alternative would not advance some of the community aspirations for improved recreational opportunities, as expressed in the user survey and through the Community Sounding Board. However, any changes in recreational activities under the No Action Alternative would be minor and, therefore, less than significant.

4.8.2.3 Consistency with Plans and Policies

The No Action Alternative would not change any land or shoreline uses, and the existing uses are generally consistent with current plans and policies. However, the No Action Alternative would not accomplish some of the goals in adopted plans applicable to the shoreline of Capitol Lake, including the 2018 Thurston Climate Adaptation Plan for enhancing resiliency to climate change.

4.8.3 What are the long-term impacts common to all action alternatives?

4.8.3.1 Land Use and Shorelines

The action alternatives would involve varying degrees of changes in the Capitol Lake Basin as a result of dredging, habitat area establishment, and, in the case of the Estuary and Hybrid Alternatives, reestablishing tidal flows into the basin. However, none of the action alternatives would result in long-term changes to land or shoreline use within the basin. The land use of the Capitol Lake Basin would remain open space.

All action alternatives would include recurring maintenance dredging to manage sediment, but at different locations and intervals. Maintenance dredging would maintain adequate water depth to keep areas accessible for boating. Maintenance dredging in the Project Area would be infrequent. It could inconvenience some uses while it is occurring, but would not have long-term adverse impacts under any alternative.

Improved water quality and sediment management that would occur under all action alternatives is expected to allow the resumption of boating and fishing, which were once common in the Capitol Lake Basin. Resuming boating and fishing would affect some adjacent land uses, by stimulating interest in businesses that support these activities. For these reasons, water quality and sediment management actions are expected to have **substantial beneficial effects** on land and shoreline use for all action alternatives.

4.8.3.2 Recreation

The recreational experience of the Capitol Lake Basin would change, mostly through improvements in sediment management, water quality, ecological functions, and increased opportunities for community use. The types of improvements vary among the action alternatives. For some recreational users, changes in the appearance of the Capitol Lake Basin would be viewed as adversely impacting their recreational experience, while other users would view the same changes as beneficially improving their experience. Aesthetic impacts vary among the alternatives and are described in Section 4.10, Visual Resources.

Resuming boating and fishing would likely increase use of the parks surrounding the basin, including more vehicles used to transport boats to the shore. Some recreational activities would disrupt others. For example, wildlife viewing or fishing could be disrupted by boaters entering an area. None of the action alternatives would add facilities for motorized boats.

The addition of boardwalks along the west shoreline of the South and Middle Basins under all action alternatives would promote walking, public gathering, wildlife viewing, and passive use, which are the most common existing uses of the Project Area. This could increase use of walkways at Tumwater Historical Park, the Interpretive Center, and Deschutes Parkway. Similarly, the new 5th Avenue Non-Vehicular Bridge (under the Managed Lake Alternative) and the new 5th Avenue Bridge (under the Estuary and Hybrid Alternatives) would improve the connection between the existing pathways at Heritage Park to existing pathways at Deschutes Parkway. They would better support the frequently used walking path around the North Basin. Because they would improve safety, particularly for bicycles, it could increase bicycle use around the North Basin, along West Bay and throughout the study area. All alternatives would maintain trail connectivity with existing and planned trails. Water-based recreation activities in West Bay would be similar to existing conditions.

Will water quality be improved to allow for boating and fishing?

All action alternatives would improve water quality sufficiently so that nonmotorized boating and fishing could be allowed throughout the Capitol Lake Basin. None of the action alternatives would add facilities for motorized boats.

Swimming

Hosting organized recreational activities, such as swimming facilities, is not within Enterprise Services' agency mission. Therefore, formal public swimming facilities are not included as part of the long-term management alternatives. Swimming facilities could be established within the North Basin, or elsewhere within the Project Area, in the future if water quality conditions allowed. As the property manager for the Capitol Lake Basin, a governmental or agency partner could negotiate a lease to operate formal swimming facilities in the Capitol Lake – Deschutes Estuary. The historic swimming beach within Capitol Lake was run by the City of Olympia Parks Department.

For these reasons, improvements to sediment management, water quality, ecological functions, and increased opportunities for community use would have **substantial beneficial effects** on recreation for all action alternatives.

4.8.3.3 Consistency with Plans and Policies

All action alternatives would, to varying degrees, promote the goals, policies, objectives, and priorities in adopted plans applicable to the shoreline of Capitol Lake that the No Action Alternative would not promote, including the following:

- Olympia Shoreline Master Plan (SMP) goals for restoring ecological functions and improving water quality (SMP Section 2.2 A through C)
- Olympia SMP Restoration Plan priorities pertinent to Capitol Lake – Deschutes Estuary, including improvements to water quality, sediment transport, and other ecological functions, including fish passage
- Tumwater Comprehensive Plan Conservation Element includes Priority Goal 4 and Environmental Goal E-4, protecting and improving water quality and aquatic habitat areas
- Tumwater SMP policies calling for preservation and enhancement of shoreline ecological functions, water quality, and public access (Goals 4.1.B 1 through 3 and 4.6.B 1 through 3; Use Policies 5.3.B.a and b, 5.4.A 4)

None of action alternatives would directly conflict with adopted strategies or actions in the Olympia Downtown Strategy. Planning for RSLR is ongoing and would be addressed in the design of all action alternatives. Planning for improvements to the Olympia Waterfront Trail, which incorporates a portion of the Heritage Park waterfront trail, are ongoing. The project would not adversely affect the trail, and would provide an improved connection to the Deschutes Parkway Trail via the proposed bridges under all action alternatives. None of the action alternatives would preclude the ability to link trails in the study area to regional trails, including trails planned along the Deschutes River, Percival Canyon, and West Bay.

Exhibit 4.4 View of Heritage Park with Capitol Buildings in the background.

Aesthetic preferences about the appearance of Capitol Lake are not described in the Olympia Downtown Strategy, but the Design Element of the strategy suggests developing guidelines that reinforce the "existing landscape along Capitol Lake." Aesthetic impacts of the

action alternatives on the waterfront area of downtown Olympia would vary by alternative.

4.8.4 What are the long-term impacts under the Managed Lake Alternative?

4.8.4.1 Land Use and Shorelines

The Managed Lake Alternative would retain the 5th Avenue Dam and 5th Avenue Bridge in their current configuration, consistent with existing conditions. However, the 5th Avenue Dam would be overhauled to significantly extend the serviceable life of the structure (i.e., through electrical system and structural upgrades). This alternative would also include construction of a new, approximately 14-foot-wide non-vehicular bridge south of the existing 5th Avenue Bridge to provide a dedicated trail connection.

As described in Section 4.8.3, the overall existing land use of the Capitol Lake Basin would remain open space. Recurring maintenance dredging could inconvenience some uses on the lake while it is occurring, but would be infrequent and temporary. The Managed Lake Alternative would result in no change or limited changes in land or shoreline uses, and any new uses would be consistent with planned uses for the affected areas; therefore, adverse impacts would be less than significant.

Flooding potential under the Managed Lake Alternative would be similar to the No Action Alternative, but slightly increased as described in the Hydrodynamics and Sediment Transport Discipline Report (Attachment 5). During extreme river floods, flooding of parks and other adjacent land uses would increase in extent and depth. The Olympia Sea Level Response Plan includes creating a raised berm, floodwall, and floodgate in Heritage Park, which would partially mitigate this impact, but would not fully mitigate the effects under the most extreme river floods modeled for this project. However, given the adaptability built into the Olympia Sea Level Rise Response Plan, it is anticipated that future flooding predicted in the Heritage Park area would be mitigated by the improvements under the Olympia Sea Level Rise Response Plan. With ongoing coordination and implementation of the Olympia Sea Level Rise Response Plan measures, impacts on land and shoreline use would be reduced to less than significant.

Exhibit 4.5 Sandbags in preparation of rising water levels in December 2019

Additional flood protection could be implemented, similar to those recommended in the Olympia Sea Level Response Plan to create a

higher elevation berm to account for extreme river floods. With this mitigation, impacts on land and shoreline use could be reduced to less than significant levels.

As with all action alternatives, sediment management, water quality, habitat improvements, and increased opportunities for community use are expected to have **substantial beneficial effects** on land and shoreline use by maintaining and/or enhancing the beneficial uses of the lake. The Managed Lake Alternative would preserve a larger area of permanent open water than the Estuary or Hybrid Alternatives, but this would not likely influence upland land use.

4.8.4.2 Recreation

Recreational activities and community events would continue much as they are at present, with the addition of boating and fishing opportunities. Boating and fishing opportunities would differ from the Estuary and Hybrid Alternatives because the basins would remain freshwater and would support a different group of fish species and would not be subject to daily tides. Without tidal influence, boating would be possible during all daytime park hours. For community events, the certainty of having open water at all times could be beneficial for planning water-based events.

The open-water area would be larger under the Managed Lake Alternative than under the other alternatives, but would not be connected to Puget Sound. Some recreational users, including some boaters and anglers, would view a freshwater system as positive, whereas others would prefer an estuarine recreational experience. There would be no access to the Project Area for motorized boats. Restricting motorized boat access to the Middle and South Basins would conflict with WAC 200-210-020, which currently permits motorized boat use in those basins. It is anticipated that the WAC would need to be updated.

Maintenance dredging would restrict recreational activities on Capitol Lake during dredging work. Maintenance dredging would require the temporary use of Marathon Park approximately every 20 years after construction (and increasing in frequency thereafter); however, no structures or equipment would be left there permanently, and the area would be restored to its previous condition upon completion of maintenance activities. Noise and dredging activities could detract from users' enjoyment of the parks and trails while dredging is occurring; however, these impacts would be temporary.

The extent and depth of flooding in parks around the entire perimeter of the lake would increase, due to extreme river flood events, similar to the No Action Alternative.

Under the Managed Lake Alternative, recreational uses would continue in the same manner as before the project, or continue with modifications that would have equivalent beneficial recreational value; therefore, adverse impacts would be less than significant.

As with all action alternatives, sediment management, water quality, ecological improvements, and increased opportunities for community use are expected have **substantial beneficial effects** on recreation.

Exhibit 4.6 View of dock at the southern point of the Interpretive Center, which would be reconstructed for fishing

4.8.4.3 Consistency with Plans and Policies

The Managed Lake Alternative would accomplish policy goals and objectives for ecological restoration and water quality improvement, as described in Section 4.8.3.3. However, it would have only minor benefits for fish and wildlife, and minor-to-moderate benefits for water quality (see Sections 4.5 and 4.3, respectively). The Managed Lake Alternative would not directly support the priorities of the Olympia SMP Restoration Plan for restoration of the Budd Inlet Estuary.

The Design Element of the City of Olympia's Downtown Strategy suggests developing guidelines that reinforce the "existing landscape along Capitol Lake." The Managed Lake Alternative would retain the existing appearance of the lake more than the other action alternatives, and may be seen as more consistent with this aspect of the Downtown Strategy. As described in Section 4.7, Air Quality & Odor, the Managed Lake Alternative would not accomplish some of the goals in the adopted 2020 Thurston Climate Action Plan related to enhancing resiliency to climate change.

4.8.5 What are the long-term impacts under the Estuary Alternative?

4.8.5.1 Land Use and Shorelines

No long-term change in land use would occur under the Estuary Alternative, with exception of a small area of land that would be needed for the new road connection between Deschutes Parkway and 4th Avenue W. This includes an undeveloped portion of two adjacent parcels zoned for single-family development. One parcel is

developed with a residence, but acquisition of this piece of land would likely occur as a lot line adjustment and would not affect the structure on that property and would not result in displacement or relocation. In addition, a portion of a railroad right-of-way would be acquired for placement of fill to support the road connection. This property, currently vacant, is no longer used for rail transportation. Enterprise Services would work with the owners of identified properties to provide compensation in accordance with Washington's Relocation Assistance law (RCW 8.26).

A group of single-family parcels along the east side of the Middle Basin extend into the lake. Only one of these parcels appears to have a dock on it. The land use on these parcels would not change, but the character of the submerged portions of these parcels would, due to the reintroduction of tidal influence in that portion of the estuary. The one dock and any other access improvements could be separated from the water at lower tide levels, which, while a minor impact, could be considered adverse by property owners with these amenities.

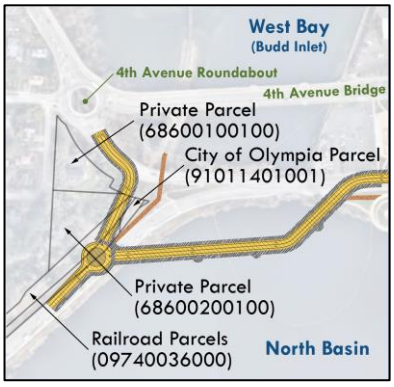


Exhibit 4.7 Parcels affected by the Estuary Alternative

Sediment deposition in West Bay would be greater than under the No Action or Managed Lake Alternatives. As such, this alternative would have the greatest potential to affect the private marinas, Port of Olympia, and FNC on West Bay by restricting access to or use of the marinas. These uses are designated as preferred and priority uses in the Olympia SMP.

Maintenance dredging within impacted areas of West Bay is included as part of the Estuary Alternative to avoid potential sediment deposition impacts to private marinas and the Port of Olympia. Impacts on these uses could affect the viability of their operations, depending on the severity of sediment deposition or during the recurring maintenance dredging operations. Impacts on land and shoreline use would be considered **significant** if maintenance dredging to avoid impacts to marinas, Port of Olympia shipping facilities, and the FNC does not occur as planned (e.g., because of funding lapse or other reason).

As described in Section 4.2, Navigation, sediment accumulation monitoring is proposed as mitigation to establish the proper dredging frequency and schedule. With sediment monitoring included as mitigation for this alternative, it would be feasible to mitigate adverse sediment accumulation at the private marinas, Port of Olympia, and FNC. Therefore, impacts on these priority land uses would be reduced

to less than significant, assuming monitoring and related maintenance dredging is implemented as proposed.

More frequent dredging in West Bay would mean that temporary measures to accommodate dredging activities would occur more often, requiring coordination with property owners to avoid impacts to shipping and to allow for temporary relocation of some vessels at marinas, similar to what has occurred during past dredging operations at these locations. This type of dredging has occurred in the past in these areas, and with proper coordination is not unusually disruptive to these operations. The increase in frequency is therefore not expected to endanger the viability of any of these priority uses.

Unlike the No Action and Managed Lake Alternatives, overland flooding under the Estuary Alternative is driven by extreme tide conditions (and RSLR) and not extreme river flooding. Under the Estuary Alternative, water levels within the Capitol Lake Basin would no longer be controlled by the 5th Avenue Dam and would rise and fall with the tides. Maximum water levels for the Estuary Alternative would be slightly (≤1 foot [≤0.3 meters]) lower than those of the No Action and Managed Lake Alternatives in consideration of both an extreme tide event and an extreme river flood event.

During extreme river floods (with 2 feet [0.61 meters] of RSLR), the Estuary Alternative would reduce the extent and intensity of flooding compared to the No Action and Managed Lake Alternatives. During extreme river flooding, maximum water levels for the Estuary Alternative would be around 2 feet (≤0.6 meter) lower than those of the No Action and Managed Lake Alternatives. Substantially less flooding is predicted in Heritage Park, downtown Olympia, and at the Interpretive Center. Lower elevation of flooding is also predicted in Tumwater Historical Park and in Marathon Park for the Estuary Alternative.

During extreme tides (with 2 feet [0.61 meters] of RSLR), maximum water levels would be around 4.5 feet (1.4 meters) higher for the Estuary Alternative than the No Action and Managed Lake Alternatives. Additional flooding is predicted in all parks and in the parking lots associated with the Capitol Campus Powerhouse and the Old Brewery during extreme tides. The extent of flooding in the Estuary Alternative would also increase in Heritage Park, downtown Olympia, and Powerhouse Road SW areas. Flood elevations are predicted to slightly exceed 16 feet (4.9 meters) NAVD 88 in this area. Note that under the Olympia Sea Level Rise Response Plan, a raised berm, floodwall, and floodgate would be constructed in Heritage

Maintenance Dredging Locations

The most frequent location for maintenance dredging would be the Olympia Yacht Club, where frequency of dredging would increase to once every 6 years, up from once every 23 years under the No Action Alternative. Dredging at Olympia Yacht Club could affect about 20% of the slips and take approximately 2 months. Some piles and boathouses may need to be temporarily removed in tight locations. In locations other than the Olympia Yacht Club, maintenance dredging would occur approximately every 12 years. The Port of Olympia vessel berths, turning basin, and navigational channel dredging would take the longest (9 months), unless multiple dredges are mobilized for the dredge event.

Would flood prevention measures be implemented in the Project Area?

Under the Olympia Sea Level Rise Response Plan, a raised berm, floodwall, and floodgate would be constructed in Heritage Park before 2 feet (0.61 meters) of RSLR is realized, which would prevent flooding via the existing lake for flood elevations up to 17 feet (5.2 meters) NAVD 88.

Park before 2 feet (0.61 meters) of RSLR is realized, which would prevent flooding via the existing lake for flood elevations up to 17 feet (5.2 meters) NAVD 88. Therefore, additional flooding predicted (beyond that in the No Action Alternative) in the Heritage Park area for the Estuary Alternative would be mitigated by the Sea Level Rise Response Plan actions. Ongoing coordination with the Olympia Sea Level Rise Response Plan team would ensure that modeled tidal-driven events continue to be mitigated by the planned improvements in the Heritage Park area.

4.8.5.2 Recreation

The Estuary Alternative would modify some recreational experiences but provide similar recreational value to existing land-based recreational resources. For example, estuarine habitat restoration would present opportunities for observing different wildlife species than at present. Trails in the South Basin would be relocated but provide equivalent or better experience for trail users.

Nonmotorized boating access would be restored in the Capitol Lake Basin, but the ability to boat in the basin would be dependent on tides. Portions of the Capitol Lake Basin, particularly in the Middle and South Basins, would become tideflats and would not be accessible by boats during low tides.

In the North Basin, the main channel of the river would remain inundated throughout the tide cycle, as would some areas in the eastern portion near Heritage Park, although not all inundated areas would be deep enough for boating.

Tides tend to be lower during the summer, when boating is most popular because the weather is warmer and days are longer. Lower tides would limit boat use during certain summer daytime hours. It is estimated that the side channels in the North and Middle Basins would be inundated at depths that would support shallow-draft boating, such as kayaking, for approximately 70% of the daylight hours during the months of May through September.

Tidal currents are a common consideration for boaters in Puget Sound. In West Bay, under higher river flow events the Estuary Alternative would increase currents; though, the increased current would make less than one knot difference in boating speed for most sailboats. An increase in current speed is not likely to impact use of the area by sailboats or powerboats, but could preclude some hand-powered vessels or inexperienced recreationalists.

During lower tides, boats with shallow draft and limited height above water would be able to move between West Bay of Budd Inlet and the North Basin, crossing under the 4th Avenue Bridge and the new 5th Avenue Bridge. Small sailboats with steppable masts (masts that can be easily lowered and raised) may also be able to pass into the basin at lower tides as well. However, conditions would be shallow in parts of the restored estuary during the lowest tides; the main channel would have the greatest depths but would also have the strongest current. The main channel currents would likely preclude some vessels or inexperienced recreationalists.

The boat launch at Marathon Park is conceptually designed to extend approximately 100 feet from the existing shoreline. This would improve access at all tidal cycles. The design of this boat launch would be progressed during the future design and permitting phase of the project.

Although the project goals are to support non-motorized boating access, additional recreational access from West Bay could result in occasional incidental use by motorized boats, although water depths in the former Capitol Lake Basin would not promote such use. In these instances, motorized boats could be more disruptive to other recreationists and wildlife, because of noise and wakes.

Exhibit 4.8 Boats at the Olympia Yacht Club in West Bay.

Low tides and decaying vegetation could result in sulfuric odor because of biological activity in the sediments that are not exposed along the shoreline of Capitol Lake today, which some people would find objectionable. As described in Section 4.5, Fish & Wildlife, given the intensity, variability, and duration of odors expected from the Estuary Alternative, odor impacts would be less than significant.

With measures proposed to mitigate navigation impacts, including at recreational marinas, recreational boaters would not be adversely impacted. As described above, dredging frequency would increase the most at Olympia Yacht Club, to every 6 years as compared to every 23 years under the No Action Alternative. Each dredging operation would take approximately 2 months and affect about 20% of the moorage slips. At other marinas, dredging would occur over 1 month every 12 years. Recreational boaters using the marinas are expected to be accommodated with other marina slips or at other facilities while dredging occurred. As a result, impacts on recreational boaters are expected to be less than significant. If dredging did not occur as planned, the number of slips available for moorage would be reduced. This would likely reduce recreational boating in West Bay as

a result, particularly for deeper draft vessels, resulting in **significant impacts.**

Under the Estuary Alternative, there would be qualitative differences in some recreational activities compared to the Managed Lake Alternative (e.g., nonmotorized boating). Most existing recreational activities in the study area would remain, while some would continue with modifications that would have equivalent beneficial recreational value. Therefore, adverse impacts would be less than significant.

As with all action alternatives, water quality improvements, sediment management, habitat improvements, and increased opportunities for community use are expected have **substantial beneficial effects** on recreation, especially compared to existing conditions where no water-based recreation (such as boating) exists today.

4.8.5.3 Consistency with Plans and Policies

The Estuary Alternative would accomplish policy goals and objectives for ecological restoration, as described in Section 4.8.3.3. This alternative would have **substantial benefits** to fish and wildlife compared to the No Action Alternative, and the greatest ecological benefits among the three action alternatives. In addition, the Estuary Alternative would accomplish Olympia SMP Restoration Plan priorities pertinent to the Budd Inlet Estuary.

The Olympia SMP Restoration Plan addresses the Budd Inlet Estuary in two of its Priority statements. Section 6.5 of the SMP, Priority 5 - Reconnect Fish Passage to Budd Inlet, and Restore Mouths of Tributary Streams, discusses the importance of fish passage, specifically noting the dam, fish ladder, and tide gate on the Deschutes River as well as other upstream and downstream tributaries to Budd Inlet. Section 6.9 of the SMP, Priority 9 - Restore Estuarine Transition Habitat and Intertidal Influence, discusses the importance of estuaries for a variety of ecological functions. These two sections of the Restoration Plan reflect the plan's overall vision for restoration of the Budd Inlet Estuary, which the Estuary Alternative would directly support, by creating a continuous estuary and improved fish passage.

As described in Section 4.7, Air Quality & Odor, the Estuary Alternative would also promote consistency with goals in the 2020 Thurston Climate Action Plan related to enhancing resiliency to climate change.

The Estuary Alternative would open the possibility of incidental use by motorized boats entering the North Basin from West Bay. This would conflict with the current prohibition on motorboats in the North Basin in WAC 200-210-020. The level of use by motorized boats would be limited by the low trestle design of the new 5th Avenue Bridge, which would be a barrier to larger motorized boats, especially at high tides. Relatedly, restricting motorized boat access to the Middle and South basins would also conflict with WAC 200-210-020, which permits motorized boat use in those basins. It is anticipated that the WAC would need to be updated to address the changed condition.

The Estuary Alternative would modify the appearance of the lake more than the Managed Lake Alternative, including changes in vegetation and inundation cycles along the Arc of Statehood, a component of the Olympia Waterfront Trail. These changes would be compatible with the existing landscape, however, and would not interfere with the Downtown Strategy. Some users may prefer the lake environment to an estuary environment, but others would prefer an estuary.

With maintenance dredging, including mitigation proposed to avoid impacts to navigation as described in Section 4.2, Navigation, potentially **significant impacts** on water-dependent land uses and recreation uses that are given priority in the City of Olympia SMP would be reduced to less than significant levels under the Estuary Alternative.

4.8.6 What are the long-term impacts under the Hybrid Alternative?

4.8.6.1 Land Use and Shorelines

Similar to the Estuary Alternative, downstream sediment deposition could affect priority water-dependent land uses in West Bay. Maintenance dredging within West Bay is also included as part of the Hybrid Alternative to avoid potential impacts to private marinas and the Port of Olympia. Impacts would be considered **significant** if project actions did not fully avoid impacts to private marinas, Port of Olympia shipping facilities, and the FNC (if maintenance dredging does not occur because of funding lapse or other reason). Impacts on these priority land uses would be reduced to less than significant, assuming monitoring and related maintenance dredging is implemented as proposed.

Exhibit 4.9 View of West Bay from Percival Landing Park.

The Hybrid Alternative would have the same effects on the submerged portions of the single-family parcels on the east side of the Middle Basin as the Estuary Alternative. Also, as with the Estuary Alternative, there would be minor acquisition of private property for the realignment of Deschutes Parkway. Otherwise, there would be no change or limited changes in land or shoreline uses, and any new uses would be consistent with planned uses for the affected areas. Adverse impacts would be less than significant.

Unlike the maximum water levels modeled for the Estuary Alternative, which are addressed by measures included in the Olympia Sea Level Rise Response Plan, the potential for flooding in the Heritage Park and Powerhouse Road SW area under the Hybrid Alternative would be addressed by the protective presence of the barrier wall for the hybrid freshwater reflecting pool.

4.8.6.2 Recreation

Effects on recreation would generally be as described for the Estuary Alternative, with the following differences.

Under the Hybrid Alternative, a pathway would be constructed atop the reflecting pool barrier wall. This pathway would accommodate both pedestrians and bicycles, with views of the water but no physical access into the water. When combined with the existing walking path along the Arc of Statehood, it would create an approximately 1-mile (1.6-km) loop around the smaller reflecting pool. The loop trail around the entire North Basin would remain. Therefore, this alternative would substantially expand public access as compared to the No Action Alternative or the other action alternatives.

Compared to the Estuary Alternative, there would be a reduced area of tideflats established in the North Basin due to the presence of the reflecting pool. As described in Section 4.7, Air Quality & Odor, the potential for odor generation would be slightly less than the Estuary Alternative.

As with the other action alternatives, with improved water quality and sediment management, boating access would be restored. At high tides, boats with shallow draft, including potential incidental use by motorized boats, would be able to move between West Bay and the North Basin. As with the Estuary Alternative, motorized boats could potentially enter the basin and could be more disruptive to other recreationists and wildlife. Boats would not be able to cross over the barrier wall to move between the reflecting pool and the

estuary. The reflecting pool would generally be maintained at a depth where boating with small, hand-launched craft would be possible. Launching could occur informally from the Arc of Statehood steps, or other future-established launch point.

Without adequate water quality management in the freshwater reflecting pool, both recreational access to the water and the quality of recreational experience could be adversely impacted. Severe algal blooms could become a public health hazard, placing portions of the shoreline temporarily off-limits to the public, and creating odors from rotting aquatic vegetation along the shoreline. Aquatic plants would also need to be managed to support boating and avoid such density that would interfere with recreational uses of the reflecting pool. With adequate water quality management, which can occur with relatively standard lake management practices, these impacts to recreational use of freshwater for the reflecting pool could be avoided.

Under the Hybrid Alternative, there would be qualitative differences in some recreational activities compared to the No Action and Managed Lake Alternatives. Most activities in the study area would remain the same, while some would continue with modifications that would have equivalent beneficial recreational value. Therefore, adverse impacts would be less than significant. As with all action alternatives, improvements to sediment management, water quality and ecological functions, and increased opportunities for community use would result in **substantial beneficial effects** on recreation.

4.8.6.3 Consistency with Plans and Policies

The Hybrid Alternative would accomplish policy goals and objectives for sediment management, water quality, ecological functions, and community use as described for the Estuary Alternative. This alternative would have moderate benefits to fish and wildlife, compared to the No Action Alternative, with some portions of the Capitol Lake Basin being adversely affected and some improving.

Impacts from this alternative would be similar to the Managed Lake Alternative with regard to the Arc of Statehood area, as this would remain an enclosed open-water area rather than being converted to an intertidal area as in the Estuary Alternative. It would result in a smaller enclosed water area, which may be perceived by some as less attractive than the larger waterbody that would be visible under the Managed Lake Alternative. These qualitative aesthetic differences

would not substantially influence the success of the Downtown Strategy.

As described in Section 4.7, Air Quality & Odor, the Hybrid Alternative would also promote consistency with goals in the 2018Thurston Climate Adaptation Plan related to enhancing resiliency to climate change, but to a slightly less extent than the Estuary Alternative.

4.8.7 What mitigation measures would be implemented for the project?

4.8.7.1 Managed Lake Alternative

Additional flooding predicted in the Heritage Park area could be mitigated in coordination with the Olympia Sea Level Rise Response Plan, through inclusion of design parameters for the flood protection design of the Heritage Park berm to account for extreme river flooding.

4.8.7.2 Estuary and Hybrid Alternatives

Section 4.2, Navigation, describes mitigation that would be necessary to avoid adverse impacts to navigation from the Estuary and Hybrid Alternatives; those measures are also listed here to mitigate adverse effects on priority shoreline uses. It is also assumed that a berm would be constructed in Heritage Park as included in the Olympia Sea Level Rise Response Plan to address flooding caused by higher tides due to RSLR. As noted for the Hybrid Alternative above, the reflecting pool barrier wall would effectively address flooding in the Heritage Park area due to extreme high tides and RSLR.

Additional measures to address potential adverse impacts are presented below:

- Work with owners of identified properties requiring acquisition and provide compensation in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended
- Implement monitoring to document initial conditions within West Bay and monitor sediment accumulation to identify when the FNC, turning basin, Port of Olympia, and private marinas are nearing the threshold that triggers maintenance dredging

- As part of the recurring maintenance dredging plan, implement scheduling and phasing to minimize impacts to existing Port of Olympia and private marina operations
- Continue to enforce restrictions on motorized boat use, including signage at the entry from West Bay to the North Basin
- If incidental motorized boat use occurs in the North Basin, establish a speed limit for motorized boat use to limit noise levels and promote safety among recreational users
- Establish rules such as no-wake, lower speed, or restricted access for motorized boats in areas frequented for wildlife viewing

4.8.8 What are the significant unavoidable adverse impacts to land use, shorelines, and recreation?

The project would result in no long-term change to land or shoreline uses, and existing uses are consistent with planned uses for the affected areas. With measures included in the project to address sediment-related impacts in West Bay, the viability of priority shoreline uses would not be adversely affected. If a monitoring plan and recurring maintenance dredging plan are implemented under the Estuary and Hybrid Alternatives, no significant unavoidable adverse impacts to recreation are anticipated.

4.9 CULTURAL RESOURCES

This section describes the potential long-term, operational impacts and benefits of the Capitol Lake – Deschutes Estuary Long-Term Management Project on cultural resources in the Project Area. The EIS focuses on the most important elements and conclusions of the analysis and, in particular, the differences among the four alternatives. The information presented in this section is summarized from the full analysis in the revised Cultural Resources Discipline Report (Attachment 13). See the Final EIS Summary or within the Cultural Resources Discipline Report for a summary of key changes between the Draft EIS and Final EIS.

Key Findings: Long-Term Impacts on Cultural Resources

For archaeological resources, long-term impacts resulting from operational activities and conditions (e.g., maintenance dredging, sedimentation, and flooding) are considered operational impacts. Most impacts to archaeological resources are associated with construction activities and are described in Chapter 5.0 (Section 5.9). Continued flooding could impact archaeological resources under the project alternatives. Under the Estuary and Hybrid Alternatives, currently submerged archaeological sites in Capitol Lake could become exposed as a result of reestablishment of estuary function, which could lead to discovery, erosion, looting, or destruction of those sites. Impacts on archaeological resources, if they were to occur from flooding or exposure, would be **potentially significant.**

For historic built environment resources, long-term changes from project actions (e.g., maintenance dredging, sedimentation, dam and bridge removal) are considered operational impacts. There are also a series of actions that would occur during construction to implement the long-term management alternatives; those are addressed in Chapter 5.0 (Section 5.9).

Because the 5th Avenue Dam, 5th Avenue Bridge, and Olympic Street W Bridge are determined eligible for historic register listing, their removal under the Estuary and Hybrid Alternatives would be a **significant impact.** Under the Managed Lake Alternative, repairs would not diminish the 5th Avenue Dam's essential physical features or their ability to convey their significance.

As with archaeological resources, impacts on historic resources from extreme tides and sea level rise would be **potentially significant** with the Estuary Alternative.

Cultural resources would be considered during the Section 106 and/or EO 21-02 process.

4.9.1 What methods were used to assess long-term impacts to cultural resources?

For the analysis of archaeological resources, most impacts are associated with construction activities and are described in Chapter 5.0 (Section 5.9, Cultural Resources). In many cases, these construction impacts result in long-term impacts on cultural resources. Section 4.9 of the EIS considers the long-term impacts associated with operational activities, such as maintenance dredging, ongoing sedimentation, and flooding.

Important factors in determining impacts on historic resources are whether or not there would be a permanent change to a property (such as demolition or physical alteration) and whether the property's historic context and setting would change. Additional details on the significance criteria are presented in the Cultural Resources Discipline Report (Attachment 13).

What cultural long-term impacts were considered in this analysis?

Recorded cultural resources, as well as potential unrecorded cultural resources, provided the basis for the evaluation of potential project impacts. An alternative would impact a cultural resource if it diminished the resource's essential features that qualify it for listing in the NRHP or Washington State Heritage Register, and/or designation to the Olympia Heritage Register or Tumwater Register of Historic Places.

4.9.2 What are the long-term impacts under the No Action Alternative?

As described in Chapter 3.0 (Section 3.9.3), there are no documented traditional cultural properties within the Project Area. Maintaining the status quo under the No Action Alternative would not benefit many of the species of importance to local area tribes, including salmon and shellfish (see Section 4.5.7 for more information). Tribal values would continue to be adversely impacted by the continued loss of connection to the natural environment and anthropogenic harm to the balance and functions from natural ecosystems.

The long-term impacts of the No Action Alternative on archaeological resources and historic built environment resources are described below.

4.9.2.1 Archaeological Resources

Under the No Action Alternative, ongoing maintenance of the 5th Avenue Dam would occur within the footprint of the existing structure or immediately adjacent in areas previously disturbed during original dam construction. No impacts on protected archaeological resources are anticipated.

Sedimentation within the Capitol Lake – Deschutes Estuary could eventually bury and obscure protected archaeological resources, making them more difficult to detect. Alternately, flooding within the Capitol Lake – Deschutes Estuary due to continued and increased extreme river flooding could impact protected archaeological resources if flooding results in erosion or inundation of areas containing such sites. If these sedimentation or flooding impacts did occur, there would be **potentially significant impacts** on archaeological resources.

4.9.2.2 Historic Built Environment Resources

The limited maintenance and repair activities for the 5th Avenue Dam would not diminish the integrity of the essential physical features in a way that would affect its eligibility for listing in a historic register. Impacts would be less than significant.

Sedimentation within the Capitol Lake Basin would reach a sediment equilibrium in the Middle and South Basins, with most of the sediment anticipated to accumulate in the North Basin. Sedimentation in the North Basin may diminish the 5th Avenue Dam's setting but would not

What is considered a significant impact related to archaeological and historic resources?

Archaeological resources are nonrenewable, and any impact on the integrity of a protected archaeological resource would be considered a significant impact. Because it is not known if any previously undiscovered archaeological sites would be disturbed, the term "potentially significant" is used.

Impacts are considered significant if they permanently diminish the ability for the resource to convey its significance.

diminish the integrity of the essential physical features for which the resource is eligible for listing in a historic register. Impacts would be less than significant.

Continued and increased extreme river flooding within the Capitol Lake Basin could result in the loss of integrity of materials, design, and workmanship from damage to individually listed and designated buildings and part of the Downtown Olympia Historic District. Flooding could also impact low-lying properties within the Tumwater Historic District, including the 1906 Brewery Building, resulting in the loss of integrity of materials, design, and workmanship. These would be **potentially significant impacts** on historic resources.

Exhibit 4.10 Undated black and white photo of the Brewery Building and powerhouse. (Source: State Library Photograph Collection, 1851-1990, Washington State Archives. Original images held at the Washington State Archives, Olympia, WA)

4.9.3 What are the long-term impacts common to all action alternatives?

In general, flooding is the long-term operational impact common to all action alternatives. Long-term changes to historic resources as a result of constructed facilities and changes to Capitol Lake would vary by alternative, as described below. As noted above, impacts on archaeological resources would primarily occur during construction activities, but would have permanent, long-term impacts (see Chapter 5.0 [Section 5.9]).

Flooding within the Capitol Lake Basin, due to continued and increased extreme river flooding (under the Managed Lake Alternative) and extreme tides and sea level rise (under the Estuary and Hybrid Alternatives) could have the same **potentially significant impacts** to historic resources described for the No Action Alternative.

4.9.4 What are the long-term impacts under the Managed Lake Alternative?

As described in Chapter 3.0 (Section 3.9.3), there are no documented traditional cultural properties within the Project Area. Maintaining a lake would not benefit many of the species of importance to local area tribes, including salmon and shellfish (see Section 4.5.7 for more information). The cultural value for tribes of the Managed Lake Alternative would be similar to conditions within the No Action Alternative. Tribal values would continue to be adversely impacted by the continued loss of connection to the natural environment and anthropogenic harm to the balance and functions from natural ecosystems.

The long-term impacts of the Managed Lake Alternative on archaeological resources and historic built environment resources are described below.

4.9.4.1 Archaeological Resources

Maintenance dredging would target recently accumulated sediments and is not expected to disturb intact native sediments that may be found at greater depths than the dredging limits. Therefore, no effects to pre-contact archaeological resources are expected during maintenance dredging. No other ground-disturbing activities would occur during operation.

Similar to the No Action Alternative, continued and increased flooding from extreme river flood elevations could impact archaeological resources under the Managed Lake Alternative. Impacts would be **potentially significant**.

4.9.4.2 Historic Built Environment Resources

Maintenance dredging would not result in long-term impacts on historic resources. DAHP determined that both the Capitol Lake – Deschutes Estuary and the Des Chutes Basin Project are not National Register eligible.

Establishing habitat areas in the Middle Basin would have no long-term impacts on historic resources such as the Washington State Capitol Historic District or the South Capitol Neighborhood Historic District, and would be set off from and below the National Register-eligible Percival Creek Bridge, retaining the visual character of the bridge.

The presence of the new boardwalks and the dock in the Middle and South Basins would not affect the Washington State Capitol Historic District. Boardwalks in the South Basin would be only partially within the Tumwater Historic District and would not impact the historic district.

The 5th Avenue Dam (eligible for listing in the National Register) would be overhauled to significantly extend the serviceable life of the structure (i.e., through electrical system and structural upgrades). The repairs would not diminish the dam's essential physical features or their ability to convey their significance.

Establishing the new 5th Avenue Non-Vehicular Bridge along the south side of the 5th Avenue Bridge and Dam would not diminish the

essential physical features or their ability to convey the significance of the 5th Avenue Dam or 5th Avenue Bridge.

4.9.5 What are the long-term impacts under the Estuary Alternative?

Impacts related to the establishment of habitat areas, boardwalks, and dock would be the same as described for the Managed Lake Alternative (less than significant). Other impacts related to stormwater outfall replacements, bridge scour protection, and slope stabilization along Deschutes Parkway would also be less than significant, as described in the Cultural Resources Discipline Report (Attachment 13).

Removal of the dam and conversion back to an estuary environment would have **substantial beneficial effects** for cultural, heritage, spiritual, and educational value for tribes. Reintroducing tidal hydrology to the Capitol Lake Basin would benefit many of the species of importance to local area tribes, including salmon and shellfish, and potentially other fish and wildlife, as well as plants (see Section 4.5.7 for more information).

The long-term impacts of the Estuary Alternative on archaeological resources and historic built environment resources are described below.

4.9.5.1 Archaeological Resources

Maintenance dredging in West Bay would occur in navigational areas that have authorized depths for commercial and recreational use and have been previously dredged. Dredging would target recently accumulated sediments and are not expected to disturb intact native sediments that may be found at greater depths than the dredging limits. As a result, it is unlikely that unrecorded, potentially protected sites would be disturbed. Therefore, no impacts on submerged archaeological resources are anticipated.

Flooding within the Capitol Lake – Deschutes Estuary due to extreme tides and sea level rise could impact recorded and unrecorded, potentially protected archaeological resources if flooding results in erosion or inundation of areas containing such sites. If the flooding impacts described above were to occur, there would be **potentially significant impacts** on archaeological resources.

Within the Capitol Lake Basin, currently submerged archaeological sites could become exposed as a result of reestablishment of estuary function, which could lead to discovery, erosion, looting, or destruction of those sites.

4.9.5.2 Historic Built Environment Resources

Because the 5th Avenue Dam, 5th Avenue Bridge, and Olympic Street W Bridge are determined eligible for historic register listing, their removal would be a **significant impact.**

Realignment of Deschutes Parkway at the north end would establish a roundabout connecting to the new 5th Avenue Bridge and would include a new connection to the existing Olympia Way/4th Avenue W roundabout. This work would be a **significant impact** on the Olympic Street W Bridge (eligible for listing in the National Register).

Maintenance dredging in West Bay would have no impacts on historic resources along the west side of West Bay.

Stormwater outfall replacements along Deschutes Parkway and along the Arc of Statehood would have no impact on historic resources.

Bridge scour protection, if required at the historic register-eligible Interstate 5 bridge, would be consistent with existing scour protection at the abutments and would not impact its eligibility.

Slope stabilization work along Deschutes Parkway would have no impact on historic resources.

Removal of the 5th Avenue Dan and Bridge would have no impacts on the following resources: Washington State Capitol Historic District, Olympia Downtown Historic District, Tumwater Historic District, and individually listed, designated, and unevaluated historic resources along the west side of the Project Area. The removal of the dam and bridge would not diminish the essential physical features of those historic districts and resources such that these districts and resources are no longer able to convey the significance for which they are listed to the National Register and the Washington Heritage Register. As described in Chapter 3.0 (Section 3.9), DAHP determined that both the Capitol Lake – Deschutes Estuary and the Des Chutes Basin Project are not National Register eligible.

For the Tumwater Historic District, removal of the 5th Avenue Dam would restore tidelands and estuary functions associated with historic

use patterns of the estuary. The estuary context and setting are more compatible with the historic waterfront character, particularly with regards to the setting and context for the historic brewery area. As such, there would an overall **substantial benefit**.

As with archaeological resources, impacts on historic resources from extreme tides and sea level rise would be **potentially significant** with the Estuary Alternative.

For further information on potential impacts on historic built environment resources, see Section 5.5.2.2 of the Cultural Resources Discipline Report (Attachment 13).

4.9.6 What are the long-term impacts under the Hybrid Alternative?

Under the Hybrid Alternative, long-term impacts would generally be the same as the Estuary Alternative.

Impacts related to maintenance dredging in West Bay, the established habitat areas, boardwalks and dock, 5th Avenue Dam and 5th Avenue Bridge removal, the new 5th Avenue Bridge, Deschutes Parkway realignment and Olympic Street W Bridge replacement, and slope stabilization along Deschutes Parkway would be the same as the Estuary Alternative, as described in Section 4.9.5.

Under the Hybrid Alternative, reintroducing tidal hydrology to a large portion of Capitol Lake Basin would benefit many of the species of importance to the tribes. Compared to the Estuary Alternative, the Hybrid Alternative would have less of an overall increase in habitat availability and access due to the reflecting pool (see Section 4.5.7 for more information).

As with the Estuary Alternative, impacts from extreme tides and sea level rise would be **potentially significant**.

4.9.6.1 Archaeological Resources

Under the Hybrid Alternative, operational impacts on archaeological sites would be the same as those described for the Estuary Alternative (see Section 4.9.5). Impacts on protected archaeological resources, if they were to occur, would be **potentially significant**.

4.9.6.2 Historic Built Environment Resources

All impacts would be the same as those described for the Estuary Alternative, including **potentially significant impacts** on the historic register eligible 5th Avenue Dam, 5th Avenue Bridge, and Olympic Street W Bridge. As with the Estuary Alternative, returning a more compatible estuary setting through removal of the 5th Avenue Dam would be a beneficial effect for the Tumwater Historic District.

4.9.7 What mitigation measures would be implemented for the project?

4.9.7.1 Measures Common to All Action Alternatives

The project would comply with Section 106 of the NHPA and/or EO 21-02. Mitigation for impacts on cultural resources, including "adverse effects" on historic resources, would be identified through consultation with the federal lead agency, affected tribes, DAHP, and other consulting parties. Mitigation measures for cultural resource impacts are designed to avoid, minimize, document, and/or interpret the impacted resource(s). Prior to implementing mitigation measures, impacted resources would be inventoried, surveyed, and studied.

Section 106 Process

Federal permits would be required from the USACE for all action alternatives. Therefore, future implementation of the selected alternative would be considered a federal undertaking subject to review and consultation under Section 106 of the NHPA. Based on the outcome of the Section 106 review and consultation process, the project would be required to comply with measures stipulated in a Memorandum of Agreement, if executed for the undertaking, to resolve potential adverse effects posed by the proposed project.

Archaeological Resources

Mitigation measures for archaeological resources would generally be the same as described in Chapter 5.0 (Section 5.9.6.1) for construction impacts. Before constructing any of the action alternatives, Enterprise Services would consult with DAHP, affected tribes, and the lead federal agency to determine the types and locations of archaeological studies that are needed. Any efforts to avoid, minimize, document, or interpret resources necessarily assume that inventories, surveys, and other properly designed studies occur as a precursor.

- DAHP may request and recommend archaeological survey, testing, recovery, and/or monitoring of all areas that would be impacted by construction. A variety of approaches, including terrestrial shovel probing, terrestrial auger probing, terrestrial geoprobing, and in-water geoprobing, deep mechanical trenching, and/or sonar, could be evaluated for use.
- Delineate recorded sites to determine if they can be avoided.

- Conduct archaeological monitoring during geotechnical and other ground-penetrating studies.
- Conduct archaeological review of all available geotechnical logs.
- Develop BMPs to minimize compaction of unpaved surfaces to the extent possible.
- Conduct all ground-disturbing construction work under the terms of an Archaeological Resources Inadvertent Discovery Plan and/or Archaeological Resources Monitoring Plan.
- Conduct archaeological monitoring during construction under the terms of an Archaeological Resources Monitoring Plan.

Historic Resources

For historic resources, measures are proposed as part of the EIS, and are expected to be consistent with the requirements/ recommendations that would come out of the Section 106 and/or EO 21-02 consultation process. The following measures would be proposed:

- Request an eligibility determination from DAHP for the Percival Creek Bridge, and the Northern Pacific Railway – Deschutes River Bridge.
- Complete the review process through the City of Olympia Heritage Commission (per City of Olympia Municipal Code, Chapter 18.12 Historic Preservation) and the City of Tumwater Historic Preservation Commission (per City of Tumwater Municipal Code, Chapter TMC 2.62 Historic Preservation) for any work that changes, alters, modifies, remodels, removes/demolishes, or significantly impacts historic resources designated to the Olympia Heritage Register and the Tumwater Register of Historic Places.
- Complete a project design review with the Capitol Campus Design Advisory Committee (CCDAC; per RCW 43.34.080).
- Develop an access plan for review by DAHP, the City of Olympia Heritage Commission, and the City of Tumwater Historic Preservation Commission relative to construction haul routes.

- Consult with DAHP, the City of Olympia Historic Preservation Officer, and the City of Tumwater Historic Preservation Officer on any changes in the approved design to determine if design review by DAHP, the Olympia Heritage Commission, and/or the City of Tumwater Historic Preservation Commission is required to ensure project compliance with the Secretary of the Interior's Standards for the Treatment of Historic Properties, the Secretary of the Interior's Standards with Guidelines for the Treatment of Cultural Landscapes, and the City of Olympia and City of Tumwater historic preservation ordinances.
- Potential mitigation could include pursuing a Cultural Landscape designation and/or developing an interpretive plan for the Capitol Lake – Deschutes Estuary in conjunction with the Interpretive Center that could be jointly led by the Olympia Heritage Commission and the Tumwater Historic Preservation Commission and undertaken in coordination with the Squaxin Island Tribe, the Nisqually Tribe, the Washington State Archives, the Washington State Historical Society, the Olympia Historical Society, and other stakeholders. This would address Indigenous use and traditional cultural knowledge, as well as the history and relationship between the Deschutes River and Percival Creek estuaries, the West Capitol Campus and associated landscape, Olympia, Westside of Olympia, and Tumwater to provide a more accurate and balanced level of information on historic periods and perspectives. This would support ongoing interpretive work at the Interpretive Center and existing parks and new work along the boardwalks within the South and Middle Basins.

4.9.7.2 Managed Lake Alternative

As described above, mitigation for adverse effects would be identified through the Section 106 and/or EO 21-02 process. In addition, mitigation measures that could help to maintain the character-defining features of affected historic resources are included in Section 5.7.2.1 of the Cultural Resources Discipline Report (Attachment 13).

4.9.7.3 Estuary Alternative

As described above, mitigation for adverse effects would be identified through the Section 106 and/or EO 21-02 process. In addition, several mitigation measures that could help to maintain the character-defining features of affected historic properties are included in Section 5.7.2.2 of the Cultural Resources Discipline Report (Attachment 13). These include, for example, preparing DAHP Level II Mitigation Documentation for the 5th Avenue Dam and 5th Avenue Bridge, and the Olympic Street W Bridge prior to undertaking construction. In addition, low-tide archaeological surveys and conditions monitoring could be conducted after construction to identify any archaeological sites that become exposed as a result of reestablishment of estuary function.

4.9.7.4 Hybrid Alternative

As described above, mitigation for adverse effects would be identified through the Section 106 and/or EO 21-02 process. In addition, several mitigation measures that could help to maintain the character-defining features of affected historic properties are included in Section 5.7.2.3 of the Cultural Resources Discipline Report (Attachment 13).

4.9.8 What are the significant unavoidable adverse impacts to cultural resources?

4.9.8.1 Archaeological Resources

There is no feasible mitigation to completely avoid the potential to impact unrecorded, protected archaeological sites. In addition to construction-related impacts, significant impacts could occur from flooding associated with extreme tides and sea level rise, as well as from site exposure as a result of reestablishment of estuary function (under the Estuary and Hybrid Alternatives).

4.9.8.2 Historic Built Environment Resources

Managed Lake Alternative

Under the Managed Lake Alternative, extreme river flooding would be a potentially significant unavoidable adverse impact on historic resources.

Estuary and Hybrid Alternatives

The **significant unavoidable adverse impacts** for the Estuary and Hybrid Alternatives would include the following:

- Loss of the individually eligible 5th Avenue Dam through removal
- Loss of the individually eligible 5th Avenue Bridge through removal
- Loss of the individually eligible Olympic Street W Bridge through removal
- Impacts to historic resources from extreme tides and sea level rise

4.10 VISUAL RESOURCES

This section describes the potential long-term impacts and benefits of the Capitol Lake – Deschutes Estuary Long-Term Management Project on visual resources. The EIS focuses on the most important elements and conclusions of the analysis and, in particular, the differences among the four alternatives. The information presented in this section is summarized from the full analysis in the revised Visual Resources Discipline Report (Attachment 14). See the Final EIS Summary or within the Visual Resources Discipline Report for a summary of key changes between the Draft EIS and Final EIS.

Key Findings: Long-Term Visual Resource Impacts

Additional view access provided by new boardwalks is expected to have **substantial beneficial effects** for all action alternatives. The Hybrid Alternative would also include a new walkway along the top of the reflecting pool barrier wall, adding nearly half a mile (0.8 km) of additional view access.

The Managed Lake Alternative would retain the existing appearance of Capitol Lake more than the other action alternatives, but would include new habitat areas. Compared to the No Action Alternative, the Managed Lake Alternative would have **substantial beneficial effects** related to the aesthetics associated with aquatic plant removal.

The Estuary Alternative would introduce tidal fluctuations in the water levels, a defined river channel, exposed tideflats, new habitat areas, and secondary channels between islands. This would change the appearance of the waterbody substantially, and also make it dynamic, with the basins filling and emptying twice each day. The landscape would remain unified and harmonious with the natural setting of the existing surroundings, resulting in less than significant impacts.

Under the Hybrid Alternative visual impacts of the barrier wall would be severe. Although mitigation for the appearance of the wall could be provided, its sheer scale would result in a **significant unavoidable impact**.

Because the lake is already affected by aquatic algae and aquatic plant populations, the impacts on visual quality from continued and worsening vegetative growth impacts under the No Action Alternative would be less than significant.

4.10.1 What methods were used to assess long-term impacts to visual resources?

To determine the potential long-term impacts of the action alternatives, key viewpoints (KVPs) were selected where the alternatives would be expected to have the highest potential for people to observe changes in visual character because of the project. The KVPs are in public places—parks, public rights-of-way, or the Capitol Campus. The locations were selected because they represent the following:

- Views experienced by a large number of viewers
- Locations where the changes caused by the project alternatives would be highly visible
- Locations that will also help the viewer understand the typical changes that would occur elsewhere in the Project Area as a result of the project alternatives

The analysis next evaluated how the alternatives would affect the Landscape Similarity Zones within each basin. As described in Chapter 3.0 (Section 3.10.2), Landscape Similarity Zones are areas that have similar views and types of viewers within the basins. The visual quality of each Landscape Similarity Zone in each basin is

What is considered a significant impact to visual resources?

For this analysis, visual resource impacts were considered significant if the visual effects would be severe, would be incompatible with the unity of the landscape setting, and would affect a large number of viewers from a public place.

described in terms of visual "unity." Unity refers to the degree to which the landscape is composed of elements that are compatible with the dominant character of the landscape.

Visual effects resulting from the project alternatives were identified in terms of spatial dominance, scale and contrast, and compatibility. As described in Chapter 3.0 (Section 3.10, Visual Resources), these are key factors in evaluating visual impacts. A visual element may change substantially as a result of the project but remain compatible with its surroundings. Additional details on the significance criteria are presented in the Visual Resources Discipline Report (Attachment 14).

This section includes visual simulation images that are examples of what the alternatives could look like from the selected KVPs. See Table 5.1 of the Visual Resources Discipline Report (Attachment 14) for additional viewpoints and summaries of expected changes by alternative.

Selecting Key Viewpoints

Potential KVPs for visual simulations of the alternatives were presented to the project's Community Sounding Board. Reflecting feedback from the Community Sounding Board, four KVPs were selected for visual simulation (KVP NB-1, KVP NB-2, KVP NB-3, and KVP-MB-1). The locations and direction of these KVPs are shown on Figure 3.10.1.

4.10.2 What are the long-term impacts under the No Action Alternative?

Under the No Action Alternative, there would be a gradual expansion of vegetated wetlands in areas of the lake as sediment accumulates, primarily occurring in the southeast portion of the North Basin. Any additional shoreline vegetation in the North Basin would likely be similar in character to existing vegetation and would not dominate views in any Landscape Similarity Zone, and would have minimal impact on visual character.

Spatial Dominance

Spatial dominance is the prevalent occupation of a space in a landscape by an object or landscape element.

Increased storm intensity due to climate change is expected to exacerbate flooding in the study area under the No Action Alternative. Flooding would primarily affect people's access to trails, which provide visual access, and would cause temporary changes to the visual environment. These visual effects would be temporary and would have negligible impacts on visual resources.

Scale and Contrast

Scale and contrast are the difference in absolute or relative scale in relation to other distinct objects or areas in a landscape.

There would likely be continued and worsening impacts to aesthetic values of the Capitol Lake Basin given the continued increase in algae and aquatic plant populations over time. The lake is already affected by floating algae and aquatic plant growth, and some people have expressed that this is aesthetically undesirable. The change under the No Action Alternative would be a minor increase over time; therefore, the visual impacts would be minor to moderate, depending on the degree of change that would occur. As a result, impacts on visual quality would be less than significant.

Compatibility

Compatibility is the degree to which landscape elements and characteristics are unified within their setting.

4.10.3 What are the long-term impacts common to all action alternatives?

Each action alternative would bring unique visual landscapes. There are no conditions common to all action alternatives.

4.10.4 What are the long-term impacts under the Managed Lake Alternative?

Views in the North Basin would remain very similar to those under the No Action Alternative. The 775-foot-long (236-meter-long) non-vehicular bridge would be a new structure along the north shoreline, and there would be minor changes to vegetation within the basin. Although the non-vehicular bridge would be a new structure along a shoreline that is dominated by open paths, trees, and other vegetation, it would be relatively low in scale and backed by the dam and the 5th Avenue and 4th Avenue Bridges. These changes would be minor in both scale and contrast and would be compatible with the landscape setting. The bridge can be seen in the photo simulation in Figure 4.10.1.

Views in the Middle Basin would change substantially, with some loss of views of open water where taller riparian vegetation would be introduced with the new habitat areas. As shown in the photo simulation in Figure 4.10.2, the habitat areas, while relatively large in scale and dominance, do not contrast with the surrounding shorelines, which are vegetated with similar species. These changes are considered compatible and harmonious with the setting. The South Basin would change least of all, with the only change being the addition of boardwalks that would improve access to views and would be a **substantial beneficial effect**.

Reductions in aquatic plant growth in the lake would be a **substantial beneficial effect** on visual resources. New boardwalks would improve access to views within the habitat areas and would be a **substantial beneficial effect**.

Figure 4.10.1 North Overlook Visual Simulation (KVP NB-2) – Managed Lake Alternative

Figure 4.10.2 Interpretive Center Visual Simulation (KVP MB-1) – Managed Lake Alternative

4.10.5 What are the long-term impacts under the Estuary Alternative?

The Estuary Alternative would affect visual resources primarily by replacing the lake with an estuary subject to daily tidal action.

Some viewers prefer the view of open water to that of an estuary that dynamically changes with the tides; and the reverse is true for other viewers. This analysis does not attempt to determine which of these groups of viewers is larger. Open water provides a more uniform surface than an intertidal area that is only partially filled with water. A uniform surface means more uniform light reflectance, including both the color of the sky and of shoreline features. When the wind is low, the mirror effect of open water can enhance views, such as those of the Capitol Dome. An intertidal area is preferred by other viewers because it changes. The cycles of the tide produce varied visual effects, at times exposing the channels that lie beneath the water and at other times filling those channels like a lake. For most of the day, the estuary would be partially submerged. When not submerged, tideflats would be exposed in the intertidal areas. Intertidal areas also accumulate marine debris that is deposited at low tide and then may or may not be removed by the next tide.

Tideflats

Tideflats, also known as **mudflats,** are intertidal coastal wetlands that form where tides or rivers have deposited sediments. Tideflats consist of exposed layers of bay mud, resulting from the deposition of estuarine silts, clays, and marine detritus. Most of the sediment within a tideflat is within the intertidal zone, and thus the tideflat is submerged and exposed approximately twice daily.

Policies support the preservation and enhancement of shoreline views, especially of natural shorelines, but do not express a preference for one or the other of these types of shoreline views. Therefore, this analysis does not place a higher value on one or the other of these shoreline types, but rather, considers the dominance, scale and contrast, and compatibility of the Estuary Alternative.

Views in the North Basin would change substantially from those under the No Action Alternative, due the conversion of the basin to an estuary with a twice daily tidal exchange. See Figures 4.10.3 through 4.10.5 for visual simulations of future conditions from the Eastern Washington Butte at various tides. See Figures 4.10.6 through 4.10.8 for similar visual simulations from the North Overlook at various tides. The new 5th Avenue Bridge with bicycle paths and sidewalks would cross the North Basin to the south of the existing 5th Avenue Bridge. This would replace the existing 5th Avenue Dam and Bridge, which would be demolished. As with the Managed Lake Alternative, the Estuary Alternative includes the creation of habitat areas (as indicated in Figures 4.10.6 through 4.10.8). The most notable change in the North Basin would be the tidal fluctuations,

with high tides filling the basin near to its current depth as a lake, and low tides leaving intertidal tideflats exposed. The scale of this change is large enough to be dominant, and it would be noticeably different from existing conditions at lower tide levels. In summer months, both low tides and high tides tend to be lower than average, with the result that more tideflat would be exposed during summer months (and during the summer daytime hours) than during winter months. Water levels would be at mean tide or higher approximately 43% of daytime hours in the period between May and September, covering 80 % or more of the North Basin.

With the tidal opening, there would be unrestricted movement between West Bay and the basin. This could bring in marine debris or other aquatic features, commonly found across tideflats that may or may not be removed by the next high tide.

While the basin would be visually different, the estuary would not contrast visually with its surroundings. Despite the scale of these changes, the landscape would remain natural in character and be visually compatible, unified, and harmonious with its setting among parks and a scenic drive.

Views in the Middle Basin would also change substantially, with the introduction of tidal fluctuation and habitat areas. See Figures 4.10.9through 4.10.11 for visual simulations from the Interpretive Center at various tides. Due to the introduction of saltwater, the plant species that would occupy the new habitat areas would not include the taller trees that could grow on the habitat areas in the Managed Lake Alternative. The lower vegetation is not expected to block views of the basin from Deschutes Parkway. As with the Managed Lake Alternative, boardwalks would improve access to views within the habitat areas.

In the South Basin, tidal fluctuation would result in changes in vegetation due to the mixing of saltwater with freshwater. Because of its location at the upper end of the estuary, the South Basin would appear as a river environment most of the time and would only fill to water levels that create open water during daily high tides. The addition of boardwalks to the South Basin would also improve access to views.

In all three basins, the views would continue to be of a unified and naturalistic waterbody and shoreline that is compatible with its surroundings. The natural landscape would remain visually unified

and harmonious with its setting among parks and a scenic drive. Therefore, the impacts of the Estuary Alternative on visual quality would be less than significant.

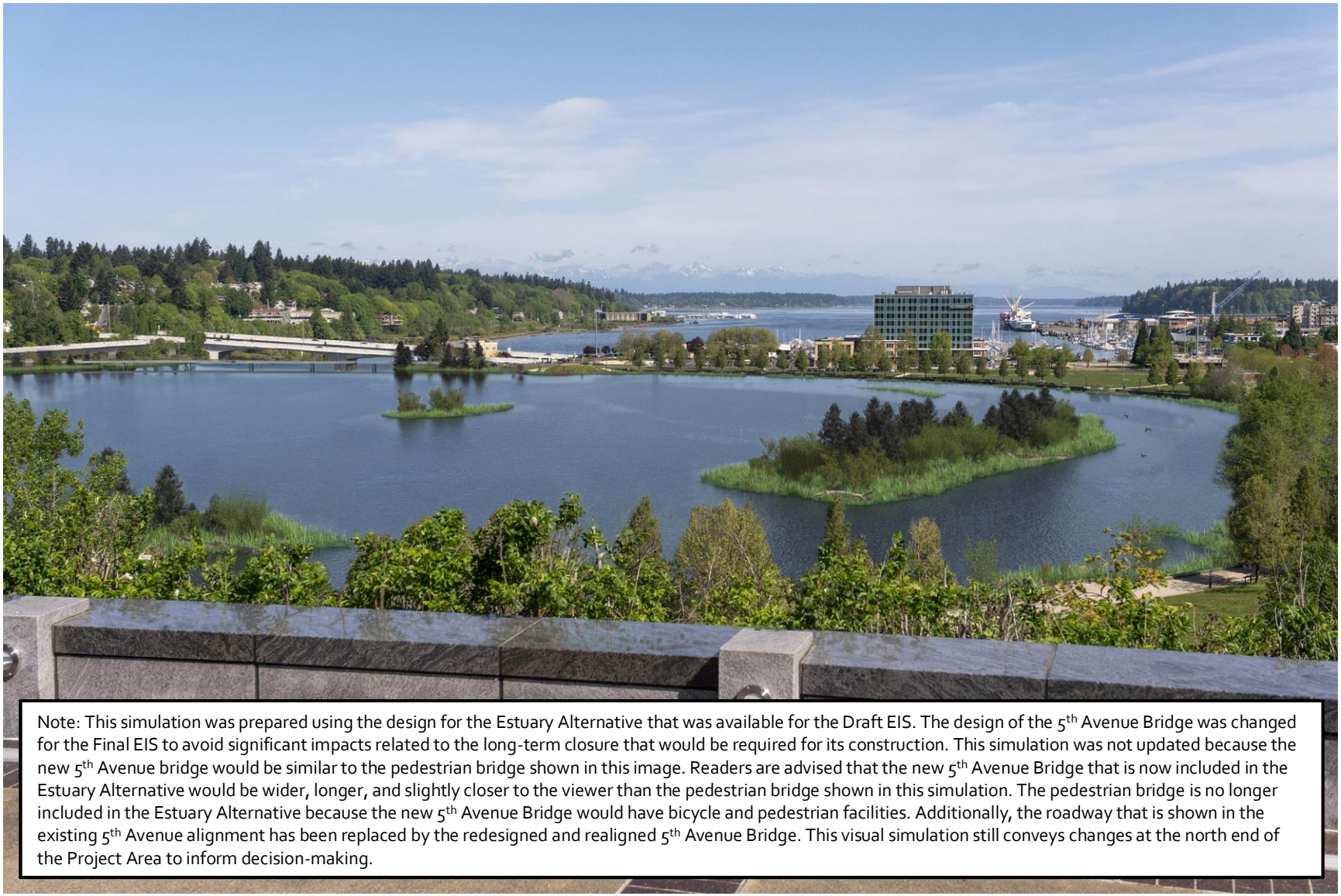
New boardwalks would improve access to views within the habitat areas and would be a **substantial beneficial effect**.

Figure 4.10.3 Eastern Washington Butte at High Tide Visual Simulation (KVP NB-1) – Estuary Alternative

Figure 4.10.4 Eastern Washington Butte at Mean Tide Visual Simulation (KVP NB-1) – Estuary Alternative

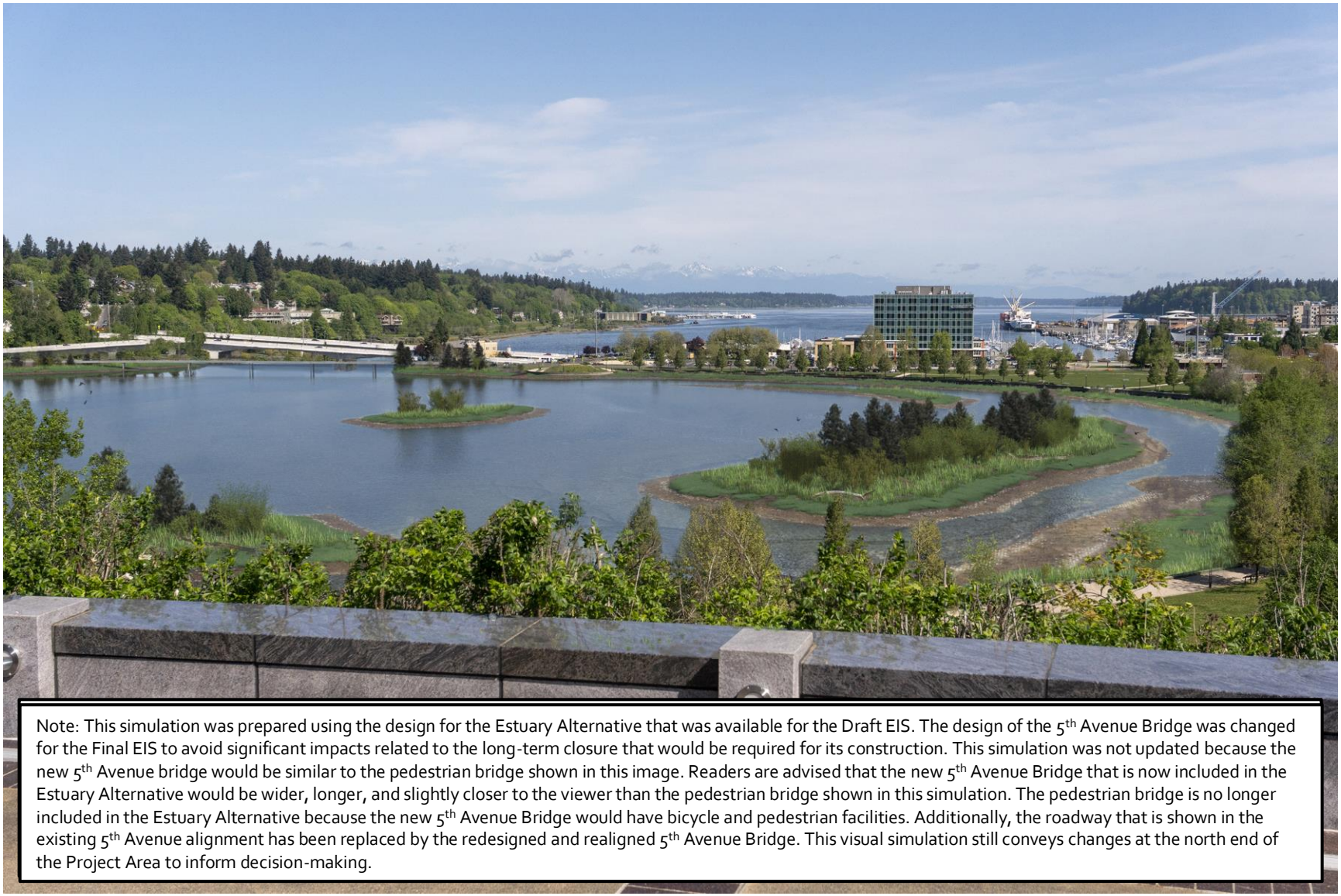
Figure 4.10.5 Eastern Washington Butte at Low Tide Visual Simulation (KVP NB-1) – Estuary Alternative

Figure 4.10.6 North Overlook at High Tide Visual Simulation (KVP NB-2) – Estuary Alternative



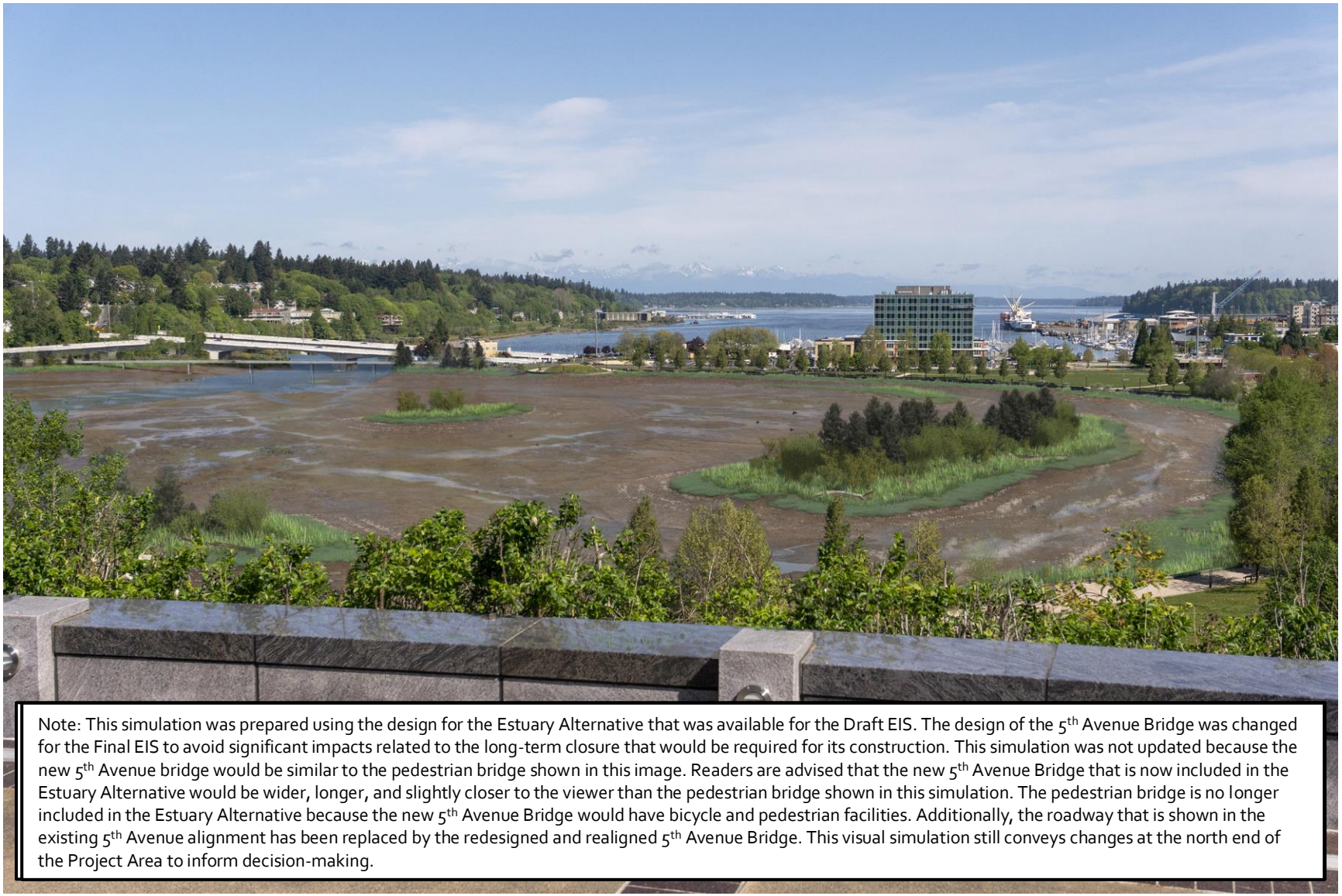
Note: This simulation was prepared using the design for the Estuary Alternative that was available for the Draft EIS. The design of the 5th Avenue Bridge was changed for the Final EIS to avoid significant impacts related to the long-term closure that would be required for its construction. This simulation was not updated because the new 5th Avenue bridge would be similar to the pedestrian bridge shown in this image. Readers are advised that the new 5th Avenue Bridge that is now included in the Estuary Alternative would be wider, longer, and slightly closer to the viewer than the pedestrian bridge shown in this simulation. The pedestrian bridge is no longer included in the Estuary Alternative because the new 5th Avenue Bridge would have bicycle and pedestrian facilities. Additionally, the roadway that is shown in the existing 5th Avenue alignment has been replaced by the redesigned and realigned 5th Avenue Bridge. This visual simulation still conveys changes at the north end of the Project Area to inform decision-making.

Figure 4.10.7 North Overlook at Mean Tide Visual Simulation (KVP NB-2) – Estuary Alternative



Note: This simulation was prepared using the design for the Estuary Alternative that was available for the Draft EIS. The design of the 5th Avenue Bridge was changed for the Final EIS to avoid significant impacts related to the long-term closure that would be required for its construction. This simulation was not updated because the new 5th Avenue bridge would be similar to the pedestrian bridge shown in this image. Readers are advised that the new 5th Avenue Bridge that is now included in the Estuary Alternative would be wider, longer, and slightly closer to the viewer than the pedestrian bridge shown in this simulation. The pedestrian bridge is no longer included in the Estuary Alternative because the new 5th Avenue Bridge would have bicycle and pedestrian facilities. Additionally, the roadway that is shown in the existing 5th Avenue alignment has been replaced by the redesigned and realigned 5th Avenue Bridge. This visual simulation still conveys changes at the north end of the Project Area to inform decision-making.

Figure 4.10.8 North Overlook at Low Tide Visual Simulation (KVP NB-2) – Estuary Alternative



Note: This simulation was prepared using the design for the Estuary Alternative that was available for the Draft EIS. The design of the 5th Avenue Bridge was changed for the Final EIS to avoid significant impacts related to the long-term closure that would be required for its construction. This simulation was not updated because the new 5th Avenue bridge would be similar to the pedestrian bridge shown in this image. Readers are advised that the new 5th Avenue Bridge that is now included in the Estuary Alternative would be wider, longer, and slightly closer to the viewer than the pedestrian bridge shown in this simulation. The pedestrian bridge is no longer included in the Estuary Alternative because the new 5th Avenue Bridge would have bicycle and pedestrian facilities. Additionally, the roadway that is shown in the existing 5th Avenue alignment has been replaced by the redesigned and realigned 5th Avenue Bridge. This visual simulation still conveys changes at the north end of the Project Area to inform decision-making.

Figure 4.10.9 Interpretive Center at High Tide Visual Simulation (KVP MB-1) – Estuary Alternative

Figure 4.10.10 Interpretive Center at Mean Tide Visual Simulation (KVP MB-1) – Estuary Alternative

Figure 4.10.11 Interpretive Center at Low Tide Visual Simulation (KVP MB-1) – Estuary Alternative

4.10.6 What are the long-term impacts under the Hybrid Alternative?

The Hybrid Alternative would impact visual resources by replacing most of the lake with an estuary, and by adding a 2,600-foot-long (790-meter-long) barrier wall to retain a reflecting pool in the eastern portion of the North Basin. Other visual elements of the Hybrid Alternative would be the same as described in Section 4.10.5 for the Estuary Alternative.

Views in the North Basin would change substantially from those under the No Action Alternative, due to the addition of the barrier wall and tidal fluctuation in water levels that would expose tideflats. The reflecting pool barrier would be constructed across the North Basin in an arced fashion and would be filled with groundwater-fed freshwater. The barrier wall in the middle of the North Basin, bisecting two different water features, would be a large scale, visually dominant feature that would contrast with its surroundings, particularly as viewed from the west side. It would not be harmonious with or contribute to a unified landscape, particularly as viewed from Deschutes Parkway and Marathon Park. See Figure 4.10.12 for a visual simulation of future conditions from Eastern Washington Butte. See Figures 4.10.13 and 4.10.14 for visual simulations of future conditions from Marathon Park at high tide and low tide.

When viewed from the North Overlook, the North Basin would appear similar to existing conditions (see Figure 4.10.14), since most of what would be visible is the reflecting pool. The reflecting pool would have a similar appearance to the existing lake; the water level would typically be maintained at approximately the same high water level as the lake is now. The barrier wall would be a conspicuous element but subordinate. The wall would be somewhat more prominent at low tides than at high tides, as shown on Figure 4.10.13.

Views within the Middle and South Basins would be affected in the same manner as described in Section 4.10.5 for the Estuary Alternative.

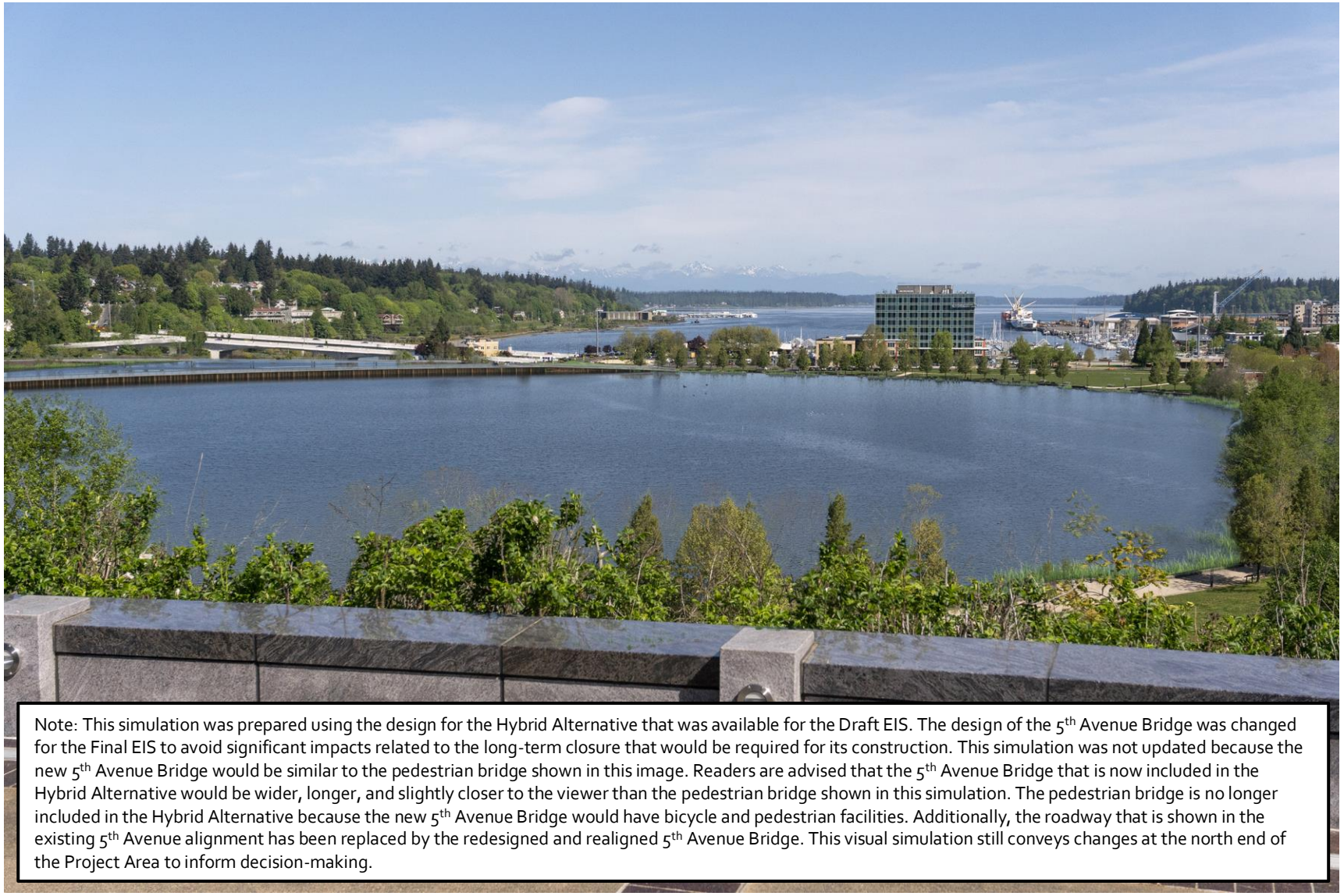
New boardwalks and the trail atop the barrier wall would improve access to views, and would be a **substantial beneficial effect**.

The adverse impacts on views in the North Basin, described above, could be reduced with mitigation described in Section 4.10.7.4, but would remain **significant** due to the presence of the barrier wall, which would not be harmonious with or contribute to a unified landscape.

Figure 4.10.12 Marathon Park at High Tide (KVP NB-3) – Hybrid Alternative

Figure 4.10.13 Marathon Park at Low Tide Visual Simulation (KVP NB-3) – Hybrid Alternative

Figure 4.10.14 North Overlook Visual Simulation (KVP NB-2) – Hybrid Alternative



Note: This simulation was prepared using the design for the Hybrid Alternative that was available for the Draft EIS. The design of the 5th Avenue Bridge was changed for the Final EIS to avoid significant impacts related to the long-term closure that would be required for its construction. This simulation was not updated because the new 5th Avenue Bridge would be similar to the pedestrian bridge shown in this image. Readers are advised that the 5th Avenue Bridge that is now included in the Hybrid Alternative would be wider, longer, and slightly closer to the viewer than the pedestrian bridge shown in this simulation. The pedestrian bridge is no longer included in the Hybrid Alternative because the new 5th Avenue Bridge would have bicycle and pedestrian facilities. Additionally, the roadway that is shown in the existing 5th Avenue alignment has been replaced by the redesigned and realigned 5th Avenue Bridge. This visual simulation still conveys changes at the north end of the Project Area to inform decision-making.

4.10.7 What mitigation measures would be implemented for the project?

4.10.7.1 Measures Common to All Action Alternatives

A number of project design features that minimize visual impacts have been incorporated into the project, including the following:

- Native plants would be used to vegetate new habitat areas and disturbed areas and would be compatible with existing native vegetation.
- New boardwalks would enhance viewer access to the Capitol Lake – Deschutes Estuary.
- Design of park modifications/improvements and of the new 5th Avenue Bridge could be developed with input from user groups, like the Community Sounding Board and representatives from the local jurisdictions, to ensure design compatibility and maximize user enjoyment of views.
- Final design and location of the habitat areas would consider aesthetics and views.
- Design of habitat areas and shoreline plantings could include the establishment of view corridors where the height of trees is limited so that they would remain open for long vistas.
- Lighting on the walkways could be placed as low as possible and directed onto the walkway surface only, to minimize the contrast that a lighted structure would have with the surrounding water.

4.10.7.2 Managed Lake Alternative

- Habitat areas in the Middle Basin could be designed with view corridors where tall tree species would not be planted, to permit more open views from key locations, such as along Deschutes Parkway.
- Maintenance dredging could be scheduled to minimize impacts on views from Marathon Park during the summer season.

4.10.7.3 Estuary Alternative

- View corridors could be established at locations along Deschutes Parkway where lower height vegetation could be used to facilitate views toward the water.

4.10.7.4 Hybrid Alternative

- The barrier wall could have a textured concrete surface to improve the appearance of the structure, especially from the estuary side of the wall where more of the wall would be exposed during low tides.
- The bicycle path and sidewalk from the new 5th Avenue Bridge and pathway from the barrier wall could be designed to better integrate with the long-term plans for the Eastern Washington Butte. They could meet the shore farther from the butte to reduce visual and spatial conflicts, or the height of the butte could be increased to take advantage of the higher elevation of the walkway approaches needed to connect to the barrier wall walkway.
- Guardrails on the barrier wall walkway could be designed to be as transparent as possible, to reduce the apparent height of the wall.

4.10.8 What are the significant unavoidable adverse impacts to visual resources?

There would be **significant unavoidable impacts** under the Hybrid Alternative because of the scale and contrast imposed by the reflecting pool barrier wall. Even with design treatments, such as a mostly transparent guardrail and textured concrete surface treatment, this alternative would significantly disrupt the visual unity of the North Basin.

4.11 ENVIRONMENTAL HEALTH

This section describes the potential long-term impacts and benefits of the Capitol Lake – Deschutes Estuary Long-Term Management Project on environmental health in the study area. The EIS focuses on the most important elements and conclusions of the analysis and, in particular, the differences among the four alternatives.

Information presented in this section is summarized from the full analysis in the revised Sediment Quality Discipline Report (Attachment 15). See the Final EIS Summary or within the Sediment Quality Discipline Report for a summary of key changes between the Draft EIS and Final EIS.

The primary focus of the environmental health analysis was on sediment quality because the EIS focuses on the most important elements and conclusions of the discipline-specific analyses. The analysis concluded that the sediment quality of Capitol Lake is generally good with the exception that high sulfides are present in surface and dredge layer sediments. As described in Chapter 3.0 (Section 3.0, Existing Conditions & Affected Environment), sulfides may be toxic to benthic organisms but do not pose a health risk to humans during recreational activities. Therefore, the long-term impacts associated with the alternatives are focused on impacts to sediment quality and effects on benthic organisms, not risks to humans. This section focuses on the potential operational impacts from the project, as well as the necessary context to interpret the conclusions.

This section also presents other environmental health considerations that were considered in the analysis. Section 4.11.10 summarizes potential changes in mosquito presence and toxic algae that could occur in the Project Area, and potential increased environmental health hazards from tideflats.

Key Findings: Long-Term Sediment Quality Impacts

Under the No Action Alternative, there would be no construction- or operation-related impacts. There would be no changes to sediment quality. It is expected that the sediment inputs to the Capitol Lake Basin would remain as they are now, so the risk of reduced sediment quality is expected to be less than significant. Benthic organisms would continue to be affected by high sulfide concentrations.

For all action alternatives, the primary long-term sediment quality impact would result from recurring maintenance dredging to maintain target depths. The risk of sediment quality degradation from maintenance dredging is considered low because dredged sediment quality in both the lake basins and West Bay is expected to be similar to sediment quality currently present in Capitol Lake surface sediments. Therefore, maintenance dredging for all action alternatives would have no adverse impacts on sediment quality because operations are not anticipated to substantially affect sediment quality within or outside the Project Area.

For the Estuary and Hybrid Alternatives, the export of sediment into West Bay would result in a decrease in sediment chemical and organic carbon concentrations in West Bay. This would provide natural recovery to most impacted areas within West Bay. Therefore, **minor to substantial beneficial** effects on sediment quality are expected in West Bay depending on the location, deposition rates, and chemical parameter.

Moderate beneficial effects on sediment quality would be expected for both the Estuary and Hybrid Alternatives, particularly where moderate to high deposition rates would cover existing high concentrations of sediment contamination for dioxins/furans and carcinogenic PAHs in areas of West Bay.

4.11.1 How does sediment quality change under the project alternatives?

The analysis examined the following sediment quality impacts: sediment transport, deposition of suspended sediment, and maintenance dredging.

4.11.2 What methods were used to assess long-term impacts to environmental health?

Long-term adverse impacts and beneficial effects associated with sediment quality for each of the four project alternatives were evaluated using a combination of current conditions, predicted rates and patterns of sediment transport, and future projections of environmental factors.

The long-term impacts of each alternative were assessed based on the potential of project alternatives to result in changes in sediment quality within or outside the Project Area a from erosion/deposition or removal of sediment into or out of the Project Area. Impacts were considered less than significant if predicted increases in chemical concentrations would not increase the frequency of sediment cleanup criteria exceedance in the water body. Impacts were

How was sediment quality evaluated?

As described in Chapter 3.0 (Section 3.1), sediment quality was evaluated by comparing existing and expected future chemical concentrations in surface sediments to criteria promulgated by Washington State regulations for protecting benthic invertebrates and human health in fresh and marine waters, as well as for allowing potential disposal of sediments removed from the project site to an open-water disposal site in Puget Sound or an upland location.

considered significant if there would be a substantial increased risk, relative to existing conditions, of exceeding sediment cleanup criteria.

4.11.3 What are the long-term impacts under the No Action Alternative?

Under the No Action Alternative, the lake would remain closed to the public for recreational use, there would be no changes to sediment quality, and sediment quality would remain consistent with current conditions. As described in Chapter 3.0 (Section 3.0, Existing Conditions & Affected Environment), data indicate that, overall, Capitol Lake has sediment that meets nearly all applicable sediment criteria; therefore, there are no potential environmental health impacts to humans.

It is expected that the sediment inputs to the Capitol Lake Basin would remain consistent with existing conditions, so a change in sediment quality is expected to be unlikely, and impacts would be less than significant. There are no reasonably foreseeable future conditions that are expected to affect the sediment quality of Capitol Lake.

4.11.4 What are the long-term impacts common to all action alternatives?

With all action alternatives, long-term impacts are associated with recurring maintenance dredging to maintain target depths in the North Basin or West Bay. The risk of sediment quality degradation from maintenance dredging is considered low because the quality of dredged sediment in both the lake basins and West Bay is expected to be similar to the sediment quality currently present in Capitol Lake surface sediments, which meets nearly all applicable sediment criteria. The sediments dredged from West Bay as part of the project would be the sediment that has recently deposited from the Deschutes River or lake basin, not the existing sediment in West Bay that is known to be contaminated. Maintenance dredging of a portion of West Bay (along the shoreline in areas used for navigation) would be performed for the Estuary and Hybrid Alternatives only and would consist of removing those sediments transported to West Bay from the Deschutes River and lake basins. Chemical concentrations in those dredged sediments are expected to be similar to the existing lake sediments, which are characterized as generally good. In addition, dredging BMPs would be implemented to reduce off-site transport of sediments.

As a result, maintenance dredging for all action alternatives would have no adverse impacts on sediment quality because operations are not anticipated to substantially affect sediment quality within or outside the Project Area.

For all alternatives, sediment from maintenance dredging would be transported for disposal outside of the Project Area (or beneficially reused, if feasible). For the Estuary and Hybrid Alternatives, the ability to dispose of dredged sediments in-water is partially related to the quality of the sediment. It is expected that the sediment would be chemically suitable for in-water disposal based on the known quality of sediment that is representative of the sediment that would be dredged during maintenance dredging. For the Managed Lake Alternative, in-water disposal is not feasible (due to the presence of invasive species), and sediment must be disposed upland.

4.11.5 What are the long-term impacts under the Managed Lake Alternative?

As described in Section 4.11.4, the primary long-term sediment quality impact for the Managed Lake Alternative would result from maintenance dredging. Long-term impacts of the Managed Lake Alternative on sediment quality would be associated with maintenance dredging in the North Basin that would occur once in the 30-year time horizon of the project—20 years after construction completion—to maintain target depths. Maintenance dredging would have no adverse impacts on sediment quality because those operations are not anticipated to substantially affect sediment quality within or outside the Project Area, as described below.

Sediment that does not require cleanup relative to applicable standards is present throughout the lake within and below the planned dredge layer areas, except for elevated sulfides in the dredge layer, as described in Chapter 3.0 (Section 3.11.2). During maintenance dredging, only minor amounts of sediments would be suspended, and those sediments would settle within the lake upon completion of dredging. The settled sediment would be of the same quality as other sediment present in the lake.

The sediment removed during dredging would be placed on a barge and allowed to settle to remove water prior to transport to an upland reuse or disposal site. Water returned to the lake would contain very little suspended sediment because BMPs would be employed to reduce turbidity and ensure water quality permit compliance for the

return water discharge. Sediment quality in the lake would not be changed. In addition, settling of minor amounts of suspended sediment in the return water discharge would not change sediment quality in the lake bed because it would be the same as that in the dredged sediments.

4.11.6 What are the long-term impacts under the Estuary Alternative?

The primary long-term change in sediment quality from the Estuary Alternative would be the deposition of Deschutes River sediment in West Bay. Additionally, as described in Section 4.11.4, sediment quality under the Estuary Alternative would also be affected by recurring maintenance dredging.

Under the Estuary Alternative, sediments in the Deschutes River and lake basin would be naturally transported into West Bay after removal of the 5th Avenue Dam. Table 4.11.1 presents average annual sediment deposition rates in areas of Budd Inlet for the Estuary and Hybrid Alternatives.

Table 4.11.1 Average Annual Sediment Deposition in Budd Inlet for Modeling without Relative Sea Level Rise (inches per year *(cm per year)*)

Location	No Action	Managed Lake	Estuary	Hybrid
Olympia Yacht Club	1.7 *(4.3)*	1.7 *(4.3)*	6.2 *(15.7)*	7.3 *(19.4)*
Other West Bay Marinas	0.83 *(2.1)*	0.83 *(2.1)*	3.2 *(8.2)*	3.9 *(9.9)*
Port of Olympia Terminal & Turning Basin	0.87 *(2.2)*	0.83 *(2.1)*	3.1 *(7.8)*	3.6 *(9.1)*
FNC (excluding Turning Basin)	0.04 *(0.1)*	0.04 *(0.1)*	0.12 *(0.3)*	0.12 *(0.3)*
Rest of West Bay	0.04 *(0.1)*	0.08 *(0.2)*	0.16 *(0.4)*	0.2 *(0.5)*

Sediment deposition throughout West Bay under the Estuary Alternative would increase up to three times compared to existing conditions.

As shown on Figure 4.11.1, most of West Bay is expected to receive 0.16 inches (0.4 centimeters) of sediment deposition each year, with greater accumulation (up to 6.2 inches each year [16 centimeters each year]) occurring at Olympia Yacht Club in the southeast portion of West Bay. Minimal sediment deposition (less than 0.1 inches each year [0.3 centimeters each year]) would occur along the western

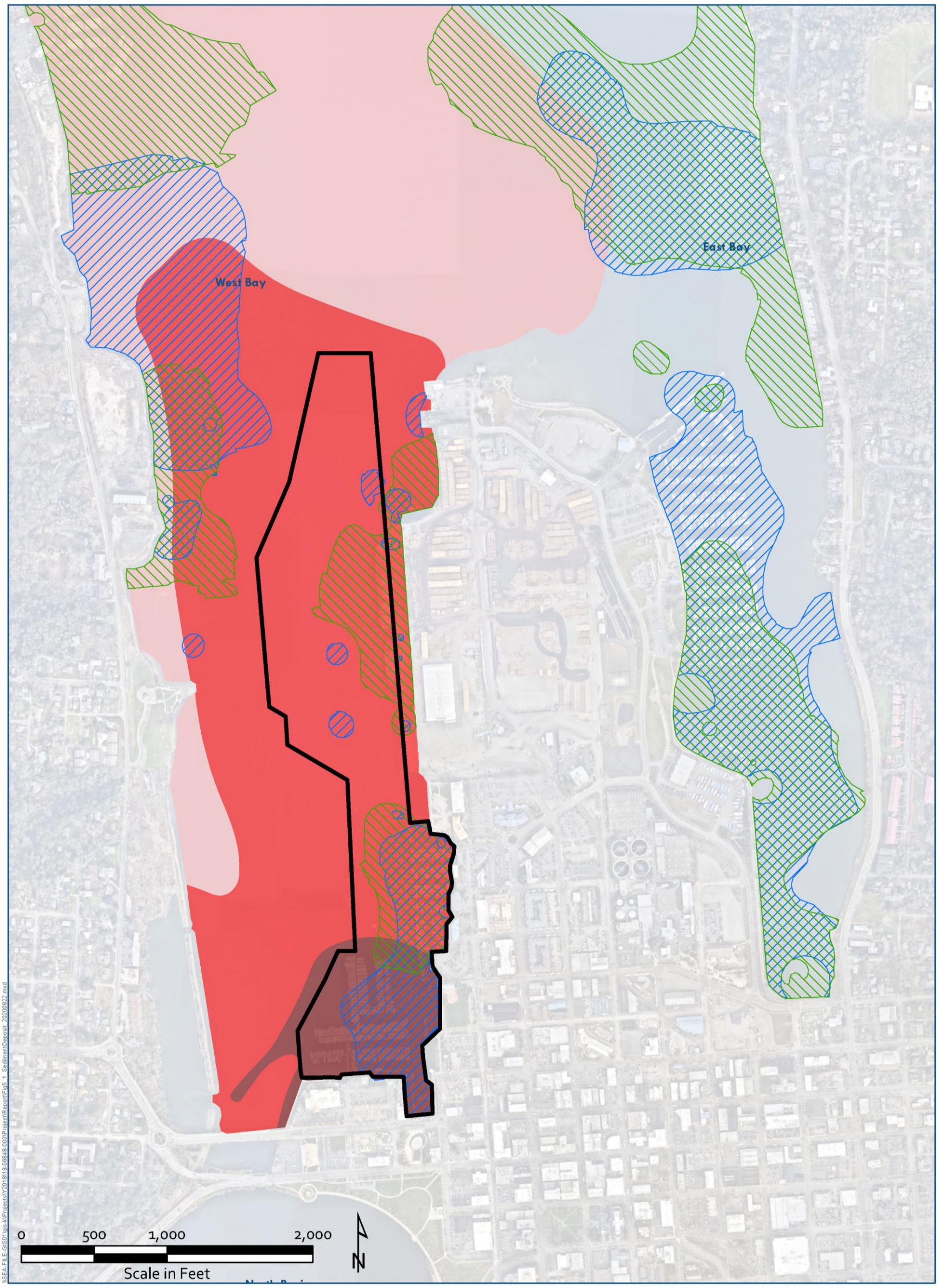
shoreline and north West Bay, with minimal to no sediment deposition in East Bay. As shown in Figure 4.11.1, deposition is anticipated to occur in areas where sediment contamination is currently present, although this sediment contamination is expected to be addressed through a separate regulatory process before removal of the 5th Avenue Dam under the Estuary Alternative. The Port of Olympia is currently designing the approach and extent of the sediment cleanup, but the remedial action is expected include some combination of sediment removal through dredging and natural recovery where clean sediments, like those that would be deposited from the Deschutes River, slowly cover areas of known contamination.

What is natural recovery & could it be implemented in West Bay?

Natural recovery is the process in which newly deposited clean sediment naturally settles on and is naturally mixed with existing contaminated sediment, diluting the overall sediment contamination in an area and lowering surface contamination. This is a common methodology in remediation design and could be used in portions of West Bay, especially in shallower areas of intertidal habitat found on the west side of West Bay where shallow conditions provide valuable habitat and do not conflict with navigational uses. Sediment that would be deposited by the Deschutes River into West Bay under the Estuary and Hybrid Alternatives was sampled and meets nearly all applicable sediment standards. This sediment, therefore, could support natural recovery in West Bay.

It is assumed that dredging (removal), capping, or a combination of the two would be required for areas with greater levels of contamination, and in the deeper navigational areas of West Bay.

Figure 4.11.1 Modeled Future Sediment Deposition without Sea Level Rise for Estuary and Hybrid Alternatives and Existing Surface Contamination in Budd Inlet



As described in Chapter 3.0 (Section 3.11.2), sediment quality is better in the Capitol Lake Basin (sediment accumulated in the basin originated from the Deschutes River) than in West Bay, and if natural recovery is used in areas of West Bay, the downstream deposition of sediment in the Estuary Alternative would improve sediment quality in West Bay. This sediment would decrease existing surface sediment concentrations for some contaminants (i.e., dioxins/furans and cPAHs) and organic carbon compared to existing conditions, or that may remain after a separate cleanup process. The change in chemical concentration is explained in more detail in the Sediment Quality Discipline Report (Attachment 15). Within 1 year, the top 4 inches (10 centimeters) of sediment in most of West Bay would consist of clean sediment deposited from the Deschutes River and restored estuary.

A decrease in existing sediment chemical and organic carbon concentrations would provide natural recovery to most impacted areas within West Bay. Therefore, the export of sediment into West Bay would have minor to moderate beneficial effects on sediment quality in West Bay depending on the location, deposition rates, and chemical parameter. Moderate beneficial effects on sediment quality would be expected, particularly where moderate to high deposition rates could cover high concentrations of sediment contamination in areas of West Bay.

The EIS assumes that existing sediment contamination in West Bay would be remediated by the Port of Olympia within the next 10 years, before removal of the 5th Avenue Dam under the Estuary Alternative, given coordination with the Port of Olympia regarding this effort. If this occurs, it increases the likelihood that the sediment removed during project maintenance dredging would be suitable for in-water disposal.

As presented in the Hydrodynamics and Sediment Transport Discipline Report (Attachment 5), sediments would predominately erode from the estuary toward West Bay. Numerical modeling of hydrodynamics and sediment transport does show that a small amount of sediment may move upstream during incoming (flood) tides. However, the sediment that is moved upstream during those tides would be the surface layer sediment that had been transported downstream from the Deschutes River. Numerical modeling shows that there would not be an upstream movement of sediments from Budd Inlet that would significantly change sediment quality in the Capitol Lake Basin following dam removal. Therefore, no adverse impacts on sediment

Contaminants of Concern in West Bay

Dioxins/furans and carcinogenic PAHs are chemicals that are widespread in urban environments and accumulate in the tissues of humans and wildlife.

Dioxins/furans tend to be associated with historical industrial operations including wood treatment facilities and hog fuel burners. They are also formed naturally by forest fires and volcanoes.

Carcinogenic PAHs are primarily formed during burning of fossil fuels, wood, or other organic substances. One of the most common sources for carcinogenic PAHs in the environment is exhaust from vehicles.

quality would be expected from minor amounts of West Bay sediments deposited in the restored estuary during flood tides.

Maintenance dredging of West Bay would have no adverse impacts on sediment quality because those operations are not anticipated to substantially affect sediment quality within or outside the study area. The risk of sediment quality degradation from maintenance dredging is considered low because dredged sediment quality in West Bay is expected to be similar to the quality currently present in Capitol Lake surface sediments since dredged sediments would be the accumulated sediment that originated from the Deschutes River or lake basin. In addition, dredging BMPs would be implemented to reduce off-site transport of sediments (from turbidity) during dredging.

For the Estuary Alternative, all sediments dredged during maintenance dredging would be transported and disposed of outside of the Project Area under long-term management. Sediment disposal options could include either open-water disposal in Puget Sound or unrestricted upland reuse based on the anticipated sediment quality of the removed materials expected from the lake sediment characterization that does not require cleanup relative to applicable standards. Based on the expected sediment quality of the dredged sediment, it is likely that all sediments dredged during maintenance dredging could be disposed in-water, so long as the material was also free of the priority invasive species, New Zealand mudsnail and purple loosestrife. This would be confirmed by sediment sampling prior to maintenance dredging.

Operational Impacts to Sediment Quality in West Bay

Concentrations of TOC, metals, organics (cPAHs), and dioxins/furans in West Bay would **decrease** with sediment deposition from operation of the **Estuary and Hybrid Alternatives.**

This decrease in contaminants would occur within 1 year and would provide natural recovery to most areas of West Bay.

4.11.7 What are the long-term impacts under the Hybrid Alternative?

As with the Estuary Alternative, the primary long-term change in sediment quality from the Hybrid Alternative would be the deposition of Deschutes River sediment in West Bay. Additionally, as described in Section 4.11.4, sediment quality under the Hybrid Alternative would also be affected by recurring maintenance dredging.

Maintenance dredging of West Bay would have no adverse impacts on sediment quality because those operations are not anticipated to substantially affect sediment quality within or outside the study area, as described above in Section 4.11.6.

As described above for the Estuary Alternative (Section 4.11.6), lake sediment would be transported into West Bay after removal of the

5th Avenue Dam. As shown in Table 4.11.1, downstream deposition of both river sediment and sediment from the restored estuary is expected to occur at rates up to 7.3 inches each year (19 centimeters each year). As described for the Estuary Alternative, sediment quality is better in the lake (sediment accumulated in the basin originated from the Deschutes River) than in Budd Inlet, and it is expected that downstream deposition of both river sediment and eroded estuary sediment would improve sediment quality where it deposits in West Bay.

Similar to the Estuary Alternative, a decrease in surface sediment concentrations of dioxins/furans and cPAHs in West Bay would be expected based on sediment deposition from the estuary. This decrease in concentrations would provide natural recovery to areas within West Bay. Therefore, the export of sediment into West Bay would have minor to moderate beneficial effects on sediment quality in West Bay depending on the location, deposition rates, and chemical parameter. Moderate beneficial effects on sediment quality would be expected particularly where high deposition rates would cover high concentrations of contaminants and organic carbon concentrations, as described for the Estuary Alternative and shown in Figure 4.11.1. The decrease in chemical concentrations would occur within 1 year for most of West Bay.

4.11.8 What mitigation measures would be implemented for the project?

Enterprise Services would avoid and minimize potential impacts by complying with regulations, permits, plans, and authorizations. These anticipated measures, and other mitigation measures that could be recommended or required, are described below.

4.11.8.1 Measures Common to All Alternatives

In accordance with the environmental permits that would be obtained prior to maintenance dredging, BMPs for turbidity management and spill prevention would be implemented during construction and operational dredging activities to minimize and avoid impacts. The BMPs are nondiscretionary actions that are needed to maintain water quality standards throughout the work. They often include the following measures.

- Hydraulic dredging
- Closed dredge bucket
- Limiting barge overflow

Summary of Long-Term Impacts and Mitigation Measures

For all action alternatives, sediment dredging and placement of dredged sediment in constructed habitat areas would have no adverse impacts.

Mitigation measures common to all action alternatives that would be employed could include BMPs for turbidity management and spill prevention.

These measures would avoid and minimize impacts.

- Slowing dredge rate
- Seasonal/migratory windows
- Tidal dredging
- Silt curtain

A water quality monitoring and protection plan (WQMPP) would also be prepared, approved by the regulatory agencies, and implemented throughout construction. This plan is intended to measure the performance of the BMPs implemented to maintain water quality standards, identify potential violations, and outline contingency measures that would be implemented if water quality standards were violated. The plan would include turbidity monitoring, inspection of spill control equipment, and actions required by the certification. Therefore, no specific sediment quality mitigation plans would be necessary for the project.

4.11.8.2 Managed Lake Alternative

No additional mitigation would be needed to address long-term sediment quality impacts of the Managed Lake Alternative.

4.11.8.3 Estuary Alternative

No additional mitigation would be needed to address long-term sediment quality impacts of the Estuary Lake Alternative.

4.11.8.4 Hybrid Alternative

No additional mitigation would be needed to address long-term sediment quality impacts of the Hybrid Alternative.

4.11.9 What are the significant unavoidable adverse impacts to sediment quality and environmental health?

There would be no significant unavoidable adverse impacts related to sediment quality or environmental health under any of the action alternatives.

4.11.9.1 What other environmental health considerations were evaluated for potential changes under long-term management?

The analysis also examined potential changes in mosquitoes and toxic algae in the Project Area, and potential increased environmental health hazards from tideflats.

4.11.9.2 Long-Term Impacts: No Action Alternative

Under the No Action Alternative, potential breeding habitat for mosquitoes would continue to include any stagnant freshwater present within Capitol Lake. The potential for freshwater mosquito habitat could increase under the No Action Alternative as continued sediment accumulation would result in shallower wetland conditions around the perimeter of the lake basins. This could promote stagnant freshwater conditions needed for breeding. Any changes in the availability of habitat conducive to mosquito breeding is expected to result in little to no change in exposure to mosquito or vector populations, or the spread of mosquito- or vector-borne illnesses within the study area, resulting in a less than significant impact.

Under the No Action Alternative, water quality in the Capitol Lake Basin would become increasingly similar to that found in the Deschutes River, resulting in fewer algae found throughout the basin. Therefore, algal blooms are not expected to result in impacts to human or environmental health (see Water Quality Discipline Report [Attachment 7]). As discussed in the Land Use, Shorelines, and Recreation Discipline Report (Attachment 12), recreational activities have not taken place on the lake since 2009. The continued absence of recreation on the lake under the No Action Alternative would reduce human exposure if toxic algae were to develop in the basin. As a result, no impacts are anticipated.

4.11.9.3 Long-Term Impacts: Managed Lake Alternative

In the Middle and South Basins, the Managed Lake Alternative would include conditions similar to those that would occur under the No Action Alternative, and may include additional areas around established habitat areas that could be conducive to mosquito habitat. However, the open-water conditions that would be maintained in the North Basin through initial and maintenance dredging would be less likely to support stagnant conditions that support mosquito breeding. Mosquito breeding opportunities in urban areas are ubiquitous. Any changes in the availability of habitat

conducive to mosquito breeding from the Managed Lake Alternative is expected to result in little to no change in exposure to mosquito or vector populations, or the spread of mosquito- or vector-borne illnesses within the study area, resulting in a less than significant impact.

With the implementation of the adaptive management plan it is unlikely that toxic algae would develop and create water quality problems that threaten human health and safety. As a result, no impacts associated with toxic algal blooms are anticipated.

4.11.9.4 Long-Term Impacts: Estuary Alternative

The Estuary Alternative would convert substantial portions of the North and Middle Basins to tideflats, which would be submerged during high tides and exposed during low tides. The South Basin would only have a limited area of exposed tideflat at low tide. Tideflats can pose a hazard when people venture on to them, as there is the risk of becoming stuck and unable to return to shore. Signs cautioning the public of the dangers of traveling out on tideflats are currently found at several recreation areas in the South Sound. In 2017, the Olympia Fire Department Deputy Fire Chief reported to KOMO News that people get stuck in tideflats several times a year, requiring rescue. To address this potential hazard, signs would be posted at recreation areas around the basin warning the public of the dangers of tideflats if the Estuary Alternative is selected and implemented. With signs posted at recreation areas around the basin, this hazard would be reduced and potential impacts would be less than significant.

The mosquito species found in Thurston County with higher salinity tolerance, such as *Ochlerotatus dorsalis*, could establish breeding sites within higher salinity areas of the North and Middle Basins. Less saline conditions in the South Basin could result in the continued presence of mosquito populations that require primarily freshwater conditions. Mosquito breeding opportunities in urban areas are ubiquitous. Any changes from the estuary alternative in the availability of habitat conducive to mosquito breeding is expected to result in little to no change in exposure to mosquito or vector populations, or the spread of mosquito- or vector-borne illnesses within the study area, resulting in a less than significant impact.

WDOH has issued a permanent shellfish harvest closure in inner Budd Inlet (including West Bay) due to the location of the Budd Inlet Treatment Plant outfall. There is also a permanent swimming advisory

in areas of West Bay because of public safety risks associated with the treatment plant outfall, stormwater outfalls, and marinas. In previous years, WDOH has closed outer Budd Inlet to shellfish harvesting due to diarrhetic shellfish poison and domoic acid, as reported by Thurston County in 2015 and King 5 News in 2019. Under the Estuary Alternative, the presence of diarrhetic shellfish poison and domoic acid may spread to the North and Middle Basins as these areas become an extension of West Bay. The most common route of human exposure to these toxins is through consumption of contaminated shellfish. While the reintroduction of boating in the Capitol Lake – Deschutes Estuary would bring more people in contact with water that occasionally experiences toxic algal blooms, direct exposure would be limited due to extension of shellfish closures. As a result, impacts are anticipated to be less than significant.

4.11.9.5 Long-Term Impacts: Hybrid Alternative

Under the Hybrid Alternative, less of the North Basin would be converted to intertidal tideflats, compared to the Estuary Alternative, given inclusion of the reflecting pool. Potential hazards associated with exposed tideflats would be the same as described for the Estuary Alternative.

Lake management practices would be implemented in the freshwater pool to manage and reduce toxic algal blooms. If unmanaged, the potential for toxic algal blooms would increase.

Reference Materials for Section 4.11 (beyond those used in the sediment quality analysis)

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

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WDOH. 2020. Diarrhetic Shellfish Poisoning (DSP).

4.12 TRANSPORTATION

This section describes the potential long-term impacts and benefits of the Capitol Lake – Deschutes Estuary Long-Term Management Project on surface transportation elements in the Project Area. The EIS focuses on the most important elements and conclusions of the analysis and, in particular, the differences among the four alternatives. The information presented in this section is summarized from the full analysis in the revised Transportation Discipline Report (Attachment 16). See the Final EIS Summary or within the Transportation Discipline Report for a summary of key changes between the Draft EIS and Final EIS.

Key Findings: Long-Term Transportation Impacts

For all action alternatives, the primary long-term transportation impact would result from hauling dredged material associated with recurring maintenance dredging, with a frequency ranging from about 5 to 20 years depending on the alternative (with truck transport occurring for up to 6 or 7 months during the dredging cycles). If all dredged materials were transported by truck or rail, or a combination of both, it is likely that traffic operations at some intersections would degrade to LOS F during some times of the day. In this case, the impact on traffic operations is expected to be **significant**. For the Managed Lake Alternative, this is considered a **significant unavoidable impact**. If in-water disposal is possible for the Managed Lake Alternative, dredged material would need to be trucked to a near-site loading facility. Although the distance travelled for disposal of dredge material would be less than that required for upland disposal, the volume of truck traffic on local streets would still have a significant unavoidable impact to the local roadway network. For the Estuary and Hybrid Alternatives, this is also considered a **significant** but potentially avoidable impact if the dredged material is transported from the site by barge. In this latter disposal scenario, impacts on surface transportation could be eliminated or reduced to less than significant levels because the barge would be loaded directly, avoiding use of the local roadway network.

All action alternatives would support and improve pedestrian and bicycle travel, providing a **substantial transportation benefit**. The Estuary and Hybrid Alternatives, with the new 5th Avenue Bridge, would provide other **substantial transportation benefits** by extending the design life of a major element of the City of Olympia's transportation network and reducing overall maintenance needs related to the bridge.

For all action alternatives, any vehicle trips generated by recreational amenities provided by the project, or ongoing maintenance activities, would have a negligible effect on traffic operations or parking and are considered less than significant.

4.12.1 What methods were used to assess long-term impacts to transportation?

To determine the potential long-term impacts of the project alternatives on transportation, the characteristics of the transportation facilities within the study area were first identified. Potential disruptions of the vehicular, transit, pedestrian, or bicycle network after project completion (long-term) were determined by reviewing the overlap of each alternative footprint with the streets, pedestrian and bicycle facilities, transit routes, and rail facilities within the transportation study area. The effect of traffic and parking demand generated by each of the action alternatives was also evaluated.

As described in detail in the Transportation Discipline Report (Attachment 16), different criteria for determining significant impacts were established for vehicle operations, parking, transit, railroad operations, and pedestrian/bicycle use. The same criteria were considered both for construction (Chapter 5.0 [Section 5.12, Transportation]) and for the recurring maintenance dredging that

What is considered a significant transportation impact?

In general, significant impacts would occur if construction and maintenance dredging activities substantially affected the function of the transportation system, disrupted rail operations, or removed a pedestrian/bicycle connection in a way that would either violate local regulatory standards or would substantially disrupt these activities.

would occur under long-term operation. Details on the specific criteria are presented in the Discipline Report.

4.12.2 What are the long-term impacts under the No Action Alternative?

Under the No Action Alternative, the 5th Avenue Dam and 5th Avenue Bridge would be retained in their current configuration with limited repair and maintenance activities. In the last 30 years, the repair and maintenance activities have been limited to emergency or high-priority actions.

The No Action Alternative would not include new facilities considered to be beneficial to the transportation network, such as a new 5th Avenue Non-Vehicular Bridge, replacement of the 5th Avenue Bridge, or boardwalks, but it would maintain the existing transportation network. Potential long-term impacts would be related to limited ongoing maintenance of the 5th Avenue Dam. These activities could infrequently generate a small number of vehicle trips that are expected to primarily occur during off-peak times of the day and would be consistent with the types of maintenance trips that currently occur. Vehicle trips associated with ongoing maintenance would have a negligible effect on traffic operations and are considered less than significant.

4.12.3 What are the long-term impacts common to all action alternatives?

With all action alternatives, the transportation system would be fully restored after construction, and no adverse long-term impacts on the multimodal transportation network would result. Provision of the new 5th Avenue Non-Vehicular Bridge under the Managed Lake Alternative and the new 5th Avenue Bridge under the Estuary and Hybrid Alternatives would improve the vehicular, bicycle, and pedestrian connection between Deschutes Parkway and downtown Olympia. The proposed transportation improvements would also provide connectivity between Olympic Way and Deschutes Parkway that do not exist today, and would support many policies established by the City of Olympia that seek to support and improve pedestrian and bicycle travel throughout the city and is considered a **substantial transportation benefit**. Likewise, the presence of the new boardwalks in the South and Middle Basins would enhance the pedestrian environment, supporting the City of Olympia's policies encouraging nonmotorized travel, and is considered a moderate transportation benefit.

What transportation long-term impacts were considered in this analysis?

Most project-related impacts on transportation would be associated with construction of the alternatives; these construction impacts are described in Chapter 5.0 (Section 5.12, Transportation). Impacts on surface transportation from long-term operation of the project are primarily associated with infrequent but recurring maintenance dredging.

Parking demand would continue to be supported by the existing parking supply at Marathon Park and on Deschutes Parkway. Any trips generated by new recreational amenities (e.g., the rebuilt dock and hand-carried boat launch) and ongoing maintenance activities would have a negligible effect on traffic operations or parking and are considered less than significant.

The primary long-term transportation impact for each of the three action alternatives would result from recurring maintenance dredging, ranging from about a 5- to 20-year frequency depending on the alternative, with truck transport occurring for up to 6 or 7 months during the dredging cycles. The quantity and duration of dredging activity, as well as the transportation modes available to haul dredged materials, would also vary among the three alternatives. More detail is provided for each alternative below.

No long-term transportation mitigation measures would be needed for any of the alternatives, except to address traffic impacts resulting from recurring maintenance dredging. Prior to maintenance dredging, Enterprise Services would develop a Construction Traffic Management Plan (CTMP) that describes the mode of transport selected to move dredged material. For additional details on the CTMP, see Chapter 5.0 (Section 5.12.6).

4.12.4 What are the long-term impacts under the Managed Lake Alternative?

The Managed Lake Alternative would retain the 5th Avenue Dam and Bridge in their current configuration, consistent with existing conditions. However, the 5th Avenue Bridge would be overhauled to significantly extend the serviceable life of the structure (i.e., through electrical system and structural upgrades).

As described above under *Long-term Impacts Common to All Action Alternatives*, the primary long-term transportation impact for the Managed Lake Alternative would result from recurring maintenance dredging, at an estimated 20-year frequency (see Table 4.12.1). If all dredged material were transported by truck, rail, or a combination of both, it is likely that traffic operations at some intersections would degrade to LOS F during some times of the day. Based on the volume of dredged material and the feasible transportation modes to export the material (see Table 4.12.1), this is a **significant unavoidable impact** on traffic operations.

Existing environmental conditions in Capitol Lake and existing environmental regulations prohibit in-water disposal of dredged material with known invasive species. Given this, hauling of dredged material by barge is not likely to be feasible because dredged materials are expected to require upland disposal. However, if environmental or regulatory conditions change in the future, dredged material could potentially be disposed of in-water. To do this, the dredged material would be loaded into trucks and taken to an off-site facility, likely the Port of Olympia, for transload onto a barge. The same number of truck trips generated for maintenance dredging, provided in Table 4.12.1 would be needed in this scenario, and their impact to the local roadway network would still be considered significant.

Table 4.12.1 Export Dredge Volume & Truck Trips Generated by Maintenance Dredging for the Managed Lake Alternative

Transportation-Related Elements of Maintenance Dredging	Maintenance Dredging Every 20 Years Assumed
Export Volume	472,000 cubic yards (361,000 cubic meters)
Estimated Total Truck Loads	29,500 truck loads
Estimated Duration of Activity	18 months
Estimated Average Truck Trips each week	800 trips
Estimated Average Truck Trips each day	160 trips
Estimated Average Truck Trips each hour	20 trips
Feasibility of Hauling by Rail	Feasible
Feasibility of Hauling by Barge	Not likely to be feasible, based on existing data and environmental regulations

Long-term impacts on transportation associated with the Managed Lake Alternative are listed and summarized in Table 4.12.2.

Table 4.12.2 Summary of Long-Term Impacts: Managed Lake Alternative

Transportation-Related Elements of the Managed Lake Alternative	Impact Finding	Measures to Reduce or Mitigate Significant Impacts	Significant & Unavoidable Impact
New 5th Avenue Non-Vehicular Bridge	**Substantial transportation benefit**	Not applicable	Not applicable
New Boardwalks	Moderate transportation benefit	Not applicable	Not applicable

Transportation-Related Elements of the Managed Lake Alternative	Impact Finding	Measures to Reduce or Mitigate Significant Impacts	Significant & Unavoidable Impact
Traffic Generated by New Recreational Elements	Less than significant impact	None	No
Traffic Generated by Ongoing Minor Maintenance	Less than significant impact	None	No
Truck/Rail Trips Generated by Maintenance Dredging	**Significant impact** (estimated 20-year frequency)	Implement a CTMP; see Chapter 5.0 (Section 5.12.6)	**Yes**

4.12.5 What are the long-term impacts under the Estuary Alternative?

Under the Estuary Alternative, the existing 5th Avenue Bridge would be removed and a new bridge would be built south of the existing 5th Avenue Dam and Bridge (whereas the No Action and Managed Lake Alternatives would retain the existing bridge).

The new bridge would include a vehicle lane, bicycle lane, and sidewalk in each direction, with the sidewalk on the south side providing a dedicated recreational trail connection. This bridge would be constructed and connected to the transportation system before the existing 5th Avenue Dam and Bridge are removed to avoid a long-term closure of the roadway. A new Olympic Way connection would be constructed between Deschutes Parkway and the roundabout at 4th Avenue W, and a new roundabout would control the intersection of 5th Avenue SW/ Deschutes Parkway / Olympic Way on the west side of the estuary. The new roundabout would provide vehicular connectivity between Olympic Way and Deschutes Parkway that does not exist today.

The new bridge would be at approximately the same grade as the existing 5th Avenue SW and Deschutes Parkway. On the east end of the bridge, the two-lane roadway would transition to three lanes west of Simmons Street NW. The three-lane section is consistent with the City of Olympia's long-term plan for 5th Avenue SW, which include lane modifications and bicycle lanes.

Replacement of the bridge would provide a **substantial transportation benefit** because it would improve connectivity for all travel modes, extend the design life of a major element of Olympia's transportation network, and reduce overall maintenance needs related to the bridge within the time horizon of this project.

As described above in Section 4.12.3, the primary long-term transportation impact for the Estuary Alternative would result from recurring maintenance dredging, with an estimated 6-year frequency for this alternative. The quantity and duration of dredging activity would vary between the dredge events; depending on the dredge cycle, the number of truck trips needed could be either higher or lower than those of the Managed Lake Alternative If all dredged material were transported by truck, rail, or a combination of both, it is likely that traffic operations at some intersections would degrade to LOS F during some times of the day. In this case, the impact on traffic operations is expected to be **significant**. Export dredge volume and the associated estimated truck trips generated by maintenance dredging for the Estuary Alternative are summarized in Table 4.12.3.

Table 4.12.3 Export Dredge Volume & Truck Trips Generated by Maintenance Dredging for the Estuary Alternative

Transportation-Related Elements of the Managed Lake Alternative	Maintenance Dredging Year 6, 18, 30	Maintenance Dredging Year 12	Maintenance Dredging Year 24
Export Volume	21,600 cubic yards (16,500 cubic meters)	285,000 cubic yards (218,000 cubic meters)	350,400 cubic yards (267,900 cubic meters)
Estimated Duration of Activity	2 months	9 to 12 months	9 to 14 months
Estimated Total Truck Loads	1,350 truck loads	17,820 truck loads	21,910 truck loads
Estimated Average Truck Trips each week	550 trips	550 to 2,000 trips	550 to 3,350 trips
Estimated Average Truck Trips each day	110 trips	110 to 400 trips	110 to 670 trips
Estimated Average Truck Trips each hour	14 trips	14 to 50 trips	14 to 84 trips
Feasibility of Hauling by Rail	Feasible	Feasible for portion of material	Feasible for portion of material
Feasibility of Hauling by Barge	Feasible	Feasible	Feasible

With the Estuary Alternative, the location of maintenance dredging in West Bay offers the opportunity for the dredged material to be transported from the site by barge to an in-water disposal location, either entirely or in combination with some upland disposal, which would occur by truck and/or rail. Disposal at an in-water location would occur if the dredged material was determined suitable following sampling for chemical quality and invasive species; this

disposal approach is expected to generate one to three barge trips from the site each day.

Impacts on surface transportation would be **significant,** but could be eliminated or reduced to less than significant levels if some or all dredged material is transported by barge. Therefore, for the Estuary Alternative, this impact would only be significant and unavoidable if open-water disposal (i.e., transport by barge) is found to be infeasible when the dredging is needed.

No additional mitigation beyond implementation of a CTMP during maintenance dredging would be needed to address long-term transportation impacts of the Estuary Alternative.

Long-term impacts on transportation associated with the Estuary Alternative are listed and summarized in Table 4.12.4.

Table 4.12.4 Summary of Long-Term Impacts: Estuary Alternative

Transportation-Related Elements of the Estuary Alternative	Impact Finding	Measures to Reduce or Mitigate Significant Impacts	Significant Unavoidable Impact
New 5th Avenue Bridge	**Substantial transportation benefit**	Not applicable	Not applicable
New Boardwalks	Moderate transportation benefit	None	No
Traffic Generated by New Recreational Elements	Less than significant impact	None	No
Traffic Generated by Ongoing Minor Maintenance	Less than significant impact	None	No
Truck/Rail Trips Generated by Maintenance Dredging Activity	**Significant impact** (estimated 6-year frequency)	Implementation of a CTMP. Use of barges to haul dredged material, if suitable.	No, *if use of barge (for open-water disposal) is feasible.* **Yes,** *if use of barge (and in-water disposal) is not feasible.*

4.12.6 What are the long-term impacts under the Hybrid Alternative?

As with the Estuary Alternative, replacement of the 5th Avenue Bridge would provide a **substantial transportation benefit** because it would

improve connectivity for all travel modes, extend the design life of a major element of the City of Olympia's transportation network and reduce overall maintenance needs related to the bridge within the time horizon of this project.

As described in Section 4.12.3, the primary long-term transportation impact for the Hybrid Alternative would result from recurring maintenance dredging in West Bay, at an estimated 5-year frequency for this alternative. The quantity and duration of dredging activity would vary between the dredge events. If all dredged material were transported by truck, rail, or a combination of both, it is likely that traffic operations at some intersections would degrade to LOS F during some times of the day. In this case, the impact on traffic operations is expected to be **significant**. Export dredge volume and the associated estimated truck trips generated by maintenance dredging for the Hybrid Alternative are summarized in Table 4.12.5.

Table 4.12.5 Export Dredge Volume & Truck Trips Generated by Maintenance Dredging for the Hybrid Alternative

Transportation-Related Elements of the Estuary Alternative	Maintenance Dredging Year 5, 15, 25	Maintenance Dredging Year 10, 30	Maintenance Dredging Year 20
Export Volume	21,600 cubic yards (16,500 cubic meters)	285,000 cubic yards (218,000 cubic meters)	350,400 cubic yards (267,900 cubic meters)
Estimated Duration of Activity	2 months	9 to 12 months	9 to 14 months
Estimated Total Truck Loads	1,350 truck loads	17,820 truck loads	21,910 truck loads
Estimated Average Truck Trips each week	550 trips	550 to 2,000 trips	550 to 3,350 trips
Estimated Average Truck Trips each day	110 trips	110 to 400 trips	110 to 670 trips
Estimated Average Truck Trips each hour	14 trips	14 to 50 trips	14 to 84 trips
Feasibility of Hauling by Rail	Feasible	Feasible for portion of material	Feasible for portion of material
Feasibility of Hauling by Barge	Feasible	Feasible	Feasible

As with the Estuary Alternative, the location of maintenance dredging in West Bay offers an opportunity for the dredged material to be transported from the site by barge to an in-water disposal location, either instead of or in combination with hauling by truck and/or rail. Impacts on surface transportation could be eliminated or

reduced to less than significant tlevels if some or all dredged material is transported by barge. Therefore, for the Hybrid Alternative, this impact would only be significant and unavoidable if use of barge transport is found to be infeasible when the dredging is needed.

No additional mitigation beyond implementation of a CTMP during maintenance dredging would be needed to address long-term transportation impacts of the Hybrid Alternative.

Long-term impacts on transportation associated with the Hybrid Alternative are listed and summarized in Table 4.12.6.

Table 4.12.6 Summary of Long-Term Impacts: Hybrid Alternative

Transportation-related Elements of the Hybrid Alternative	Impact Finding	Measures to Reduce or Mitigate Significant Impacts	Significant Unavoidable Impact
New 5th Avenue Bridge	**Substantial transportation benefit**	Not applicable	Not applicable
New Boardwalks	Moderate transportation benefit	None	No
Traffic Generated by New Recreational Elements	Less than significant impact	None	No
Traffic Generated by Ongoing Minor Maintenance	Less than significant impact	None	No
Truck/Rail Trips Generated by Maintenance Dredging Activity	**Significant impact** (estimated 5-year frequency)	Implementation of a CTMP. Use of barge to haul dredged material, if suitable.	No, *if use of barge (for open-water disposal) is feasible* **Yes**, *if use of barge (and in-water disposal) is not feasible*

4.12.7 What mitigation measures would be implemented for the project?

4.12.7.1 Measures Common to All Alternatives

No long-term transportation mitigation measures would be needed for any of the alternatives, except to address traffic impacts resulting from recurring maintenance dredging. The following measure would reduce traffic impacts during maintenance dredging, if dredged material were transported by truck or rail:

- **CTMP for Maintenance Dredging.** Prior to maintenance dredging, Enterprise Services would develop a CTMP that

describes the mode of transport selected to move dredged material. For additional details on the CTMP, see Chapter 5.0 (Section 5.12.6).

4.12.7.2 Managed Lake Alternative

No additional mitigation would be needed to address long-term transportation impacts of the Managed Lake Alternative.

4.12.7.3 Estuary Alternative

No additional mitigation would be needed to address long-term transportation impacts of the Estuary Alternative. If the dredged material is determined suitable for open-water disposal, barges would be used to transport material from the site and impacts on surface transportation would be minimized or avoided.

4.12.7.4 Hybrid Alternative

As under the Estuary Alternative, no additional mitigation would be needed to address long-term transportation impacts of the Hybrid Alternative. If the dredged material is determined suitable for open-water disposal, barges would be used to transport material from the site and impacts on surface transportation would be minimized or avoided.

4.12.8 What are the significant unavoidable adverse impacts to transportation?

During the periods of future maintenance dredging for the three action alternatives, hauling dredged material by truck, rail, a combination of truck and rail, or barge (if feasible) could result in congested operations during some periods of peak traffic demand, resulting in a **significant unavoidable impact**. For the Estuary or Hybrid Alternatives, this impact could be avoided through the use of barges that could be loaded directly to haul dredged material. This impact would only be significant and unavoidable if open-water disposal (and use of barges) were found to be infeasible.

4.13 PUBLIC SERVICES & UTILITIES

This section describes the potential long-term impacts and benefits of the Capitol Lake – Deschutes Estuary Long-Term Management Project on public services and utilities in the Project Area. The EIS focuses on the most important elements and conclusions of the analysis and, in particular, the differences among the four

alternatives. The information presented in this section is summarized from the full analysis in the revised Public Services and Utilities Discipline Report (Attachment 17). See the Final EIS Summary or within the Public Services and Utilities Discipline Report for a summary of key changes between the Draft EIS and Final EIS.

Key Findings: Long-Term Impacts on Public Services and Utilities

Under all of the action alternatives, any increases in demand for emergency response services because of visitation from the new recreational opportunities (e.g., the boardwalk, nonmotorized boating) would be minor. Impacts on utility infrastructure from saltwater exposure under the Estuary and Hybrid Alternatives would be **significant** but could be addressed through mitigation measures. Under the No Action and Managed Lake Alternatives, impacts on utility infrastructure from extreme river flooding would be **significant** but could also be addressed through mitigation measures.

Based on Ecology's draft TMDL allocations, if other sources do not meet their load allocations and water quality standards are not being met in the watershed, LOTT and other utility dischargers could be required to implement additional treatment. LOTT and other utility dischargers would almost certainly need to implement additional treatment sooner under the No Action and Managed Lake Alternatives because they retain Capitol Lake, and Capitol Lake is the primary and largest source of nutrient loading to Budd Inlet, according to Ecology modeling, and this would be a **significant impact**. There would be no impact to LOTT under the Estuary Alternative and a less than significant impact under the Hybrid Alternative, given uncertainty.

4.13.1 What methods were used to assess long-term impacts to public services and utilities?

The analysis of operational impacts considered the potential for project activities to result in long-term or permanent service disruptions. Impacts on response times of emergency services and other public services in the long term were also considered. The analysis also addressed how project alternatives could change how climate change and RSLR affect public services and utilities in the study area. RSLR projections were incorporated into the hydrodynamic numerical modeling as part of future conditions (see Section 4. 1, Hydrodynamics & Sediment Transport).

The analysis also considered if the alternatives would require substantial changes to utilities to fulfill service requirements.

What public services and utilities long-term impacts were considered in this analysis?

This section focuses on activities or conditions that could create permanent or long-term interruptions to utilities, require changes to utilities to fulfill service requirements, or create longer response times for public services in the area.

4.13.2 What are the long-term impacts under the No Action Alternative?

4.13.2.1 Public Services

The No Action Alternative would not result in any operational impacts on public services. This alternative would not create additional recreation facilities or uses in the study area and would not attract additional visitors to the study area. As a result, it would not increase the demand for police services or other emergency responses, and there would be no impacts.

4.13.2.2 Utilities

Ongoing maintenance of the 5th Avenue Dam would not require any utility replacements or relocations. There would be no impacts on existing underground or overhead utilities as no relocations would be required.

As described in Chapter 3.0 (Section 3.3, Water Quality), Ecology issued a Budd Inlet TMDL for Dissolved Oxygen (Water Quality Improvement Report and Implementation Plan). The TMDL identifies several specific sources of pollution that result in low dissolved oxygen levels in Budd Inlet, the largest of which is Capitol Lake. There are four WWTPs that discharge directly into Budd Inlet and also contribute to low dissolved oxygen conditions. Their permits require them to remove organic compounds from wastewater before discharging it. LOTT, the largest WWTP within the watershed, has additional treatment processes in place that remove nitrogen from its effluent, though WWTPs are unable to remove all nutrients from the water before discharge.

The waste load allocations for LOTT and other dischargers, are set by Ecology based on the assumption that Enterprise Services ensures that Capitol Lake meets the "natural estuary condition."

Because the No Action Alternative would not meet the waste load allocation, Ecology would likely need to enforce a reduction in pollutant loading from other point and nonpoint sources that discharge to Budd Inlet. LOTT and other nutrient sources within the Capitol Lake Basin, including other utility dischargers, would likely have to improve water quality of their discharge sooner under a No Action Alternative. LOTT would likely need to remove additional nutrients from its wastewater discharge by investing in additional water treatment capacity. Because the No Action Alternative would

What is considered a significant impact related to utilities and public services?

Impacts on utilities are considered significant if the project has the potential to damage existing utilities or interrupt utility service creating permanent or long-term interruptions to services.

Impacts are also considered significant if the project would require substantial changes to utilities to fulfill service requirements.

Impacts on public services are considered significant if the project would create a demand for public services that substantially exceeds the capacity of public service agencies.

TMDL

A TMDL is the maximum amount of a pollutant allowed to enter a waterbody in order for the waterbody to continue to meet water quality standards for that pollutant. A TMDL for a pollutant in a waterbody can be used to allocate load reductions among pollutant sources, such as contaminated sediment migration, stormwater, or transportation activities.

likely require this additional treatment sooner than the other project alternatives, LOTT would have less time to plan and save for this investment, resulting in an increased cost to ratepayers sooner. The increased likelihood of additional treatment being needed sooner, and associated additional costs, would result in a **significant impact** to LOTT under the No Action Alternative.

Overland flooding can damage vulnerable aboveground utilities or create service interruptions. Under the No Action Alternative (as well as all action alternatives), numerical modeling show that extreme river flooding in the Capitol Lake Basin would not only continue but increase, placing some utility infrastructure at risk. Although this flooding would occur in low-lying areas along the entire perimeter of the Capitol Lake Basin, most of the utilities that could be affected are on the eastern shore of the North Basin, in the vicinity of Heritage Park and Powerhouse Road SW. Similarly, floodwaters in downtown Olympia can overflow stormwater infrastructure, discharging untreated wastewater directly to Budd Inlet. The City of Olympia, LOTT, and Port of Olympia have outlined measures that would be implemented at different RSLR projections as part of the City of Olympia Sea Level Rise Response Plan. However, overland flooding from Capitol Lake Basin for the extreme river flood event under the No Action Alternative would result in water surface elevations in the downtown area that exceed the current flood protection elevations set in the Olympia Sea Level Response Plan. Impacts would be **potentially significant** on stormwater and other utilities that could be physically or operationally affected during extreme river flood events. It is recognized that the Olympia Sea Level Rise Response Plan is adaptable to future decisions made about the long-term management of Capitol Lake. Regardless of the future of Capitol Lake, the Olympia Sea Level Rise Response Plan describes that the eastern shoreline along Heritage Park will need to be modified in order to prevent future downtown flooding. The plan recognizes that different alternatives could present subtle changes in how the shoreline is modified to address sea level rise. Given the adaptability built into the Olympia Sea Level Rise Response Plan, it is anticipated that future flooding predicted in the Heritage Park area would be mitigated by the improvements under the plan. This assumes ongoing coordination between Enterprise Services and the City of Olympia to assist the City of Olympia with updated design parameters for the floodproofing design of the Heritage Park berm in consideration of hydrologic modeling completed for this project.

Exhibit 4.11 Flooding at Capitol Lake in December 2019

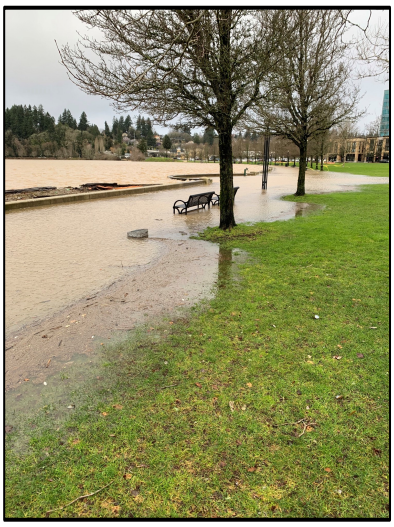

Exhibit 4.12 January 2022 flooding in Heritage Park

4.13.3 What are the long-term impacts common to all action alternatives?

Under all action alternatives, additional visitors could be attracted to the area as a result of enhanced recreational facilities and opportunities. Any increase in the demand for emergency response services as a result of increased use would be relatively minor, and impacts would be less than significant.

All action alternatives would include recurring maintenance dredging. Recurring maintenance dredging could require the use of temporary power, such as on-site generators or use of existing electricity. Decontamination stations would also require the extension of buried electric lines and water lines to the station locations, but would require only minor amounts of electricity and water to operate. None of these activities would damage utilities or create service interruptions. As a result, no impacts on utilities are anticipated.

The action alternatives are generally compatible with and do not conflict with any of the proposed design measures included in the Olympia Sea Level Rise Response Plan. Those measures could be implemented as part of any alternative.

Other potential long-term impacts on public services and utilities would vary by alternative, as described below.

4.13.4 What are the long-term impacts under the Managed Lake Alternative?

In addition to minor electricity requirements at decontamination stations, permanent lighting would be needed along the new 5th Avenue Non-Vehicular Bridge. At the current level of design, the lighting system has not been specified. The final design of the alternative would include a low-energy lighting system and low wattage lights such as light emitting diode (LED) lamps and, if feasible, would be solar powered.

As described above for the No Action Alternative, the Budd Inlet TMDL states that Enterprise Services may not deplete dissolved oxygen levels in Budd Inlet at any time or location beyond the impact of the natural estuary condition. The waste load allocations for other dischargers, including LOTT, are based on the assumption that Enterprise Services would meet the natural estuary conditions. Because the Managed Lake Alternative would not meet the waste load allocation, Ecology would likely need to enforce a reduction in

pollutant loading from other point and nonpoint sources that discharge to Budd Inlet. LOTT would likely need to remove additional nutrients from its wastewater discharge by investing in additional water treatment capacity. The increased likelihood of additional treatment being needed sooner and resulting additional costs would result in a **significant impact** to LOTT under the Managed Lake Alternative.

As also described for the No Action Alternative, overland flooding of low-lying areas around the Capitol Lake Basin could damage vulnerable, aboveground utilities or interrupt service, especially in the vicinity of Heritage Park and Powerhouse Road SW. Based on results of the numerical model, maximum flood levels during extreme floods would be the highest under the Managed Lake Alternative, compared to all alternatives. This is most likely due to a net reduction in flood storage capacity for the Managed Lake Alternative due to the creation of habitat areas in the Middle Basin, despite the North Basin dredging.

As with the No Action Alternative, the predicted maximum water levels under the Managed Lake Alternative exceed the flood protection elevations set in the Olympia Sea Level Rise Response Plan. Therefore, flooding from extreme river flood events is also not mitigated by the current Olympia Sea Level Rise Response Plan under the Managed Lake Alternative. Impacts would be **potentially significant** on stormwater and other utilities that could be physically or operationally affected during extreme river flood events. As in the No Action Alternative, it is anticipated that future flooding predicted in the Heritage Park area would be mitigated by the improvements under the Olympia Sea Level Response Plan. This assumes ongoing coordination between Enterprise Services and the City of Olympia to assist the City of Olympia with updated design parameters for the floodproofing design of the Heritage Park berm in consideration of hydrologic modeling completed for this project.

4.13.5 What are the long-term impacts under the Estuary Alternative?

In addition to minor electricity requirements at decontamination stations, the new 5th Avenue Bridge would require additional electricity to power permanent lighting along the bridge. At the current level of design, the lighting system has not been specified. Conventional street lighting systems can draw up to 500 to 1,000 watts per hour. The final design would include a low-energy lighting system and include

low wattage lights such as LED lamps and, if feasible, would be solar powered.

Under the Estuary Alternative, long-term impacts on public services and utilities would mostly be associated with restoring tidal hydrology to the Capitol Lake Basin, which would introduce saltwater into locations where existing utility infrastructure is vulnerable to saline conditions. Corrosion of metal utility lines is a risk when these objects are exposed to saltwater. Potentially vulnerable utilities include suspended utilities on the Olympia & Belmore Railroad, Inc., railroad crossing and buried ductile iron utility lines present in the area, including under Marathon Park. If exposed to groundwater with low levels of salinity, the life expectancy of the lines could be reduced. Corrugated metal (steel) pipe outfalls located within the Capitol Lake Basin would also likely deteriorate quickly in saltwater. Design measures are included to replace those existing metal outfalls. Other low-lying utility lines would remain vulnerable. Given the potential for damage, impacts are considered **significant**. Coordination with local utility providers during their scheduled systemwide conditions assessments would help to ensure corrosion risks are identified and appropriate measures are in place to monitor, protect (e.g., through sliplining pipes), or replace utilities at risk of corrosion. With this mitigation, impacts from saltwater exposure could be reduced to less than significant levels.

Ecology has stated in the Budd Inlet TMDL that the Estuary Alternative is the only alternative that can meet the waste load allocation because it would constitute a "natural estuary" condition. This means that under the existing TMDL, if all other discharges are meeting their waste load allocations, Ecology should not need to increase discharge requirements for LOTT and other utility dischargers. LOTT and the other dischargers must continue to meet existing discharge benchmarks and these may become increasingly stringent in the future and may still result in additional treatment requirements; but these changes would be unrelated to the project under an Estuary Alternative. As a result, no impacts to LOTT and other utility dischargers are anticipated under the Estuary Alternative.

Unlike the No Action and Managed Lake Alternatives, overland flooding under the Estuary Alternative is driven by extreme tide conditions (with RSLR) and not extreme river flooding. Under the Estuary Alternative, water levels within the Capitol Lake Basin would no longer be controlled by the 5th Avenue Dam and would rise and fall

with the tides. Maximum water levels for the Estuary Alternative would be slightly (≤1 foot [≤0.3 meters]) lower than those of the No Action and Managed Lake Alternatives. Under the Estuary Alternative, the modeled flood elevations predicted in the Heritage Park area would be mitigated by the improvements currently planned under the Olympia Sea Level Rise Response Plan.

4.13.6 What are the long-term impacts under the Hybrid Alternative?

In addition to electricity requirements along the new 5th Avenue Bridge and at decontamination stations, the Hybrid Alternative requires some additional electricity to power permanent lighting along the barrier wall. At the current level of design, the lighting system has not been specified. The final design of the alternative would include a low-energy lighting system and low wattage lights such as LED lamps and, if feasible, would be solar powered.

For the Hybrid Alternative, the long-term impacts on public services and utilities would be similar to those described above for the Estuary Alternative. This includes **potentially significant impacts** on utility lines from saltwater exposure related to the restoration of tidal hydrology in the basin. With implementation of mitigation measures, impacts would be less than significant. With the freshwater pool in the North Basin, corrosion impacts on outfalls along the Arc of Statehood would be avoided and no replacements would be necessary.

Unlike the maximum water levels modeled for the Estuary Alternative, which are addressed by measures included in the Olympia Sea Level Rise Response Plan, the potential for flooding in the Heritage Park and Powerhouse Road SW area under the Hybrid Alternative would be addressed by the protective presence of the barrier wall for the hybrid reflecting pool.

The Hybrid Alternative has not been modeled by Ecology so there is uncertainty related to how this alternative would change waste load allocations. Because it is not a "natural estuary" condition, it is possible that Ecology may further regulate other point and non-point discharges into Budd Inlet in order to meet water quality standards. Therefore, the Hybrid Alternative could require LOTT to construct additional treatment sooner than under the Estuary Alternative. However, it is likely that requirements for LOTT and other utility dischargers would be substantially less stringent than would occur under the No Action and Managed Lake Alternatives, and therefore,

additional treatment could be constructed later. Given this, the impacts are considered less than significant.

4.13.7 What avoidance, minimization, and mitigation measures would be implemented for the project?

Project design features have been incorporated into the Estuary and Hybrid Alternatives to minimize long-term impacts on public services and utilities, such as replacing outfalls and other infrastructure vulnerable to saltwater exposure. Additional measures to address adverse impacts are listed below, by alternative.

4.13.7.1 Managed Lake Alternative

- In coordination with the Olympia Sea Level Rise Response Plan, include design parameters for the flood protection design of the Heritage Park berm to account for extreme river flooding.

4.13.7.2 Estuary and Hybrid Alternatives

- During design, complete an evaluation of utilities within low-lying areas potentially vulnerable to flooding under future conditions with RSLR, and coordinate with public and private utility owners in developing a protection or replacement schedule.
- Coordinate with local utility providers during their scheduled systemwide conditions assessments to ensure corrosion risks are identified and appropriate measures are in place to monitor, protect, or replace utilities at risk of corrosion.

4.13.8 What are the significant unavoidable adverse impacts to public services and utilities?

For the Managed Lake Alternative, if Ecology requires LOTT and other utility dischargers to implement additional measures to improve water quality in the basin, this would be a **significant unavoidable impact**.

With the mitigation measures identified above, there would be no significant unavoidable adverse impacts on public services or utilities under either the Estuary or Hybrid Alternative.

4.14 ECONOMICS

This section describes the potential long-term impacts and benefits of the Capitol Lake – Deschutes Estuary Long-Term Management Project on economic value and economic activity in the study area for the project, as well as potential benefits. The EIS focuses on the most important elements and conclusions of the analysis and, in particular, the differences among the four alternatives.

Information presented in this section is summarized from the full analysis in the revised Economics Discipline Report (provided as Attachment 18). See the Final EIS Summary or within the Economics Discipline Report for a summary of key changes between the Draft EIS and Final EIS.

Key Findings: Long-Term Impacts on Economic Value and Activity

Downstream Economic Activity and Downtown Development: The long-term impacts on economic activity and changes in economic value would be similar in type among the action alternatives.

Maintenance dredging would increase spending in the study area, and navigability would be maintained for marina and Port of Olympia activities. While the Managed Lake Alternative would cost the most, the higher cost is due to a higher per-unit disposal cost for upland disposal, which is assumed because of the invasive New Zealand mudsnail that would persist in Capitol Lake. Thus, the higher cost may not support a similarly higher level of economic activity compared to the Estuary and Hybrid Alternatives.

Effects on development in downtown Olympia would be beneficial, as long as the action alternatives are implemented in a way that is both attractive and accessible. Overall, other economic factors have more influence on market conditions for development.

Demand for and Value of Recreation and Ecosystem Services: The Estuary and Hybrid Alternatives may result in Ecology assigning less stringent discharge reduction requirements for LOTT and stormwater dischargers, likely resulting in reduced or avoided regulatory compliance costs compared to the No Action and Managed Lake Alternatives. The enhancements to trails, habitat areas, and restored water-based recreation would increase the value of recreation in the basin across all action alternatives. For ecosystem services, the action alternatives would improve habitats, visual aesthetics, and cultural, heritage, spiritual, and educational values, with the benefits—especially to tribes and people who value natural ecosystems—more pronounced for the Estuary and Hybrid Alternatives. The Managed Lake and No Action Alternatives would adversely impact tribal values by the continued loss of connection to the natural environment and anthropogenic harm to the balance and functions from natural ecosystems. In some cases, changes in the environmental setting represent trade-offs in how an impact or effect is perceived. For example, the aesthetic impacts would vary based on individual preferences. In such cases, the distribution of benefits and costs would differ across different populations and groups of people and could be considered either a beneficial effect or an adverse impact.

Project benefits would not be realized under the No Action Alternative, which would be characterized by increased flood risk, increased costs for addressing water quality issues, lack of water access for recreation, and ongoing equity and social justice issues.

4.14.1 What methods were used to analyze long-term economic impacts?

As described in Chapter 3.0 (Section 3.14, Economics), SEPA does not require economic analysis of a proposed action, and its rules and statues do not provide specific guidance for what methods to use to analyze economic effects in an EIS. For this project, potential long-term economic impacts were assessed based on the potential for the action alternatives to result in changes in economic activity or economic value in the region. This assessment evaluated the long-term economic impacts (and potential beneficial effects) related to the four primary categories or topics: downstream economic activity, downtown development, demand for and value of recreation, and demand for and value of ecosystem services.

The assessment of long-term impacts related to these four topics required different methods, each considering the geographic extent, data sources, and analytical approach for assessing impacts. The analysis of changes in economic values and economic activity was based primarily on available data sources. Where possible, and when data were available, the analysis provided quantitative results. Where quantitative data were unavailable, the direction, magnitude, timing, and duration of the impacts were identified and described qualitatively. The assessment of economic impacts is also an exercise in identifying the trade-offs associated with the alternatives being considered, and describing both the potential beneficial effects and adverse impacts.

To calculate the economic contribution of the alternatives, the analysis used the 2018 version of IMPLAN, an input-output model that calculates the change in jobs, labor income, and economic output that may arise from changes in construction spending related to the action alternatives. The quantitative results for costs and values represent planning-level estimates based on information available at this stage of the project for the conceptual action alternatives. However, the effects of spending and the resulting changes in economic activity are not economic benefits, costs, or measures of economic value because they do not evaluate changes in social welfare. Most data presented reflect pre-COVID conditions, and the pandemic has since disrupted typical economic conditions and patterns; projections of future conditions include a certain level of uncertainty associated with this disruption. These evolving trends do not change the ability of this analysis to differentiate impacts and benefits across the alternatives.

What criteria for long-term economic impacts were considered?

For the other environmental elements, the EIS presents clearly defined criteria to assess the significance of potential adverse impacts (e.g., significant vs. less than significant). As SEPA does not provide guidance for how to conduct economic analyses (or require them for an EIS), this Economics section instead uses potential impact indicators to identify how the action alternatives would produce impacts. Impacts are qualitatively described as minor adverse impacts, adverse impacts, or substantial adverse impacts. Beneficial effects are also identified. The section is organized to reflect this approach.

More details on the methodology for each component (including the study area for each topic) are presented in the Economics Discipline Report (Attachment 18).

4.14.2 What are the long-term conditions under the No Action Alternative?

Under the No Action Alternative, the limited actions to control invasive aquatic plants and other ongoing projects adjacent to the Capitol Lake Basin would continue, but a long-term management project would not be implemented. In the absence of a long-term management project, it is unlikely that Enterprise Services would be able to procure funding and approvals to manage sediment, manage or enhance water quality and related habitat and ecological functions, or enhance community use. Current conditions would continue, and in some cases would worsen over the long term. Over the long term, the lack of a lake management program could contribute to reduced amenity-related value of the Capitol Lake Basin and potentially lead to a less robust investment climate in downtown Olympia. It could also lead to lost or reduced opportunities to capitalize on restored recreation activity, and lost recreation-related value to both residents and visitors to the region. The long-term economic impacts from the No Action Alternative are summarized in Table 4.14.1.

Table 4.14.1 Summary of Long-Term Impacts: No Action Alternative

Long-Term Impact	Impact Summary
Downstream Economic Activity (e.g., economic activity surrounding Budd Inlet, downstream of of the Project Area)	**No discernable economic effect** on jobs, labor income, or economic output. **Adverse Impact –** Increased risk and potential cost from disruptions to economic activity in downtown Olympia and areas downstream during high-flow flood events. Nominally increased rates of sedimentation impacting the Olympia Yacht Club and the private marinas in West Bay compared to past conditions as Capitol Lake's capacity to hold sediment declines; costs related to increased maintenance dredging borne by Olympia Yacht Club and the private marinas in West Bay could nominally increase. Employment opportunities created by increased maintenance dredging would largely support in-water construction businesses in Tacoma or other areas in the State of Washington, where these businesses are more prevalently located, therefore limiting employment revenues in the study region. Costs related to disrupted economic activity could also materialize from increased frequency and magnitude of flooding. Increased flooding could increase maintenance costs associated with aging infrastructure, potentially increasing costs to taxpayers and utility ratepayers.

Long-Term Impact	Impact Summary
Downtown Development	**Minor Adverse Impact –** The impacts of not taking action could result in potential deferred or displaced investment decisions for some developers, arising from uncertainty around future conditions of the Capitol Lake Basin. Larger market and economic trends are likely to be more influential in shaping the future of downtown development in Olympia.
Demand for and Value of Recreation	**Adverse Impact –** People who want to access the water by boat in or from downtown Olympia would continue to access the water elsewhere, potentially at higher cost or lower value of the experience. Recreational value for trail, path, and park use would be impacted by potential temporary closures from flooding in future sea level rise scenarios. Repeat flood events could result in loss of investment in recreation infrastructure and reduced access or quality of recreation in the long run.
Demand for and Value of Ecosystem Services	**Adverse Impact –** Potential utility and ratepayer costs associated with water quality regulation, as new TMDL allocations would shift additional nutrient reduction responsibilities to wastewater and stormwater dischargers. Potential small increased risk and cost of flooding associated with the diminished capacity to regulate floods of Deschutes River flows. **Substantial Adverse Impact –** Sustained equity and social justice issues related to ongoing diminished ecosystem services that produce commercial, subsistence, cultural, heritage, spiritual, and educational value for tribal populations.

4.14.3 What are the long-term impacts common to all action alternatives?

Long-term changes in economic conditions from operation of the project under the action alternatives are described for the following:

- Downstream economic activity
- Development in downtown Olympia
- Demand for and value of recreation
- Value of ecosystem services

4.14.3.1 Downstream Economic Activity

Long-term operation of the project would involve maintenance dredging, which would produce spending in the regional economy, spread out over 30 years. Capital expenditures on dredging sediment and other in-water work for maintenance could support regional economic activity (jobs and income) through the purchase of goods and services and labor in the study area. The Managed Lake Alternative would produce the most direct spending and largest effect on jobs and incomes in the study region because it is projected

to have the highest costs associated with maintenance dredging (see Table 4.14.2). The Estuary Alternative would produce the least, for the opposite reason.

Most of the operational costs would be spent on goods and services acquired from outside the region. Thus, this spending would not meaningfully change aggregate spending levels or economic activities within the study region under any alternative. However, the spending could produce beneficial effects to those individuals, businesses, and industries that work on the project. Planning-level cost estimates for maintenance dredging are summarized in Table 4.14.2. The construction costs (which are described in Chapter 5.0 [Section 5.14, Economics]) are included for context, as they factor into the total long-term costs. See Chapter 7.0, Planning-Level Costs, Funding Approach, & Other Considerations, for a more detailed description of the planning-level costs and primary assumptions.

Table 4.14.2 Planning-Level Cost Estimates by Alternative

Project Alternative	Construction Costs ($M)	Maintenance Dredging ($M) over 30 Years	Total Costs ($M): Construction + Maint. Dredging over 30 Years
No Action	$0	$11–$19	$11–$19
Managed Lake	$76–$136	$141–$254	$217–$390
Estuary	$137–$247	$40–$71	$177–$318
Hybrid	$178–$320	$54–$97	$232–$417

Through the Funding and Governance Work Group process, the members recommended that Enterprise Services take responsibility for construction costs for any alternative. Enterprise Services is exploring potential funding strategies, which would likely include a combination of state and federal grants and appropriations of taxpayer dollars. The ultimate funding mechanism has not yet been determined.

The Funding and Governance Work Group members recommended the following responsibility for funding of long-term maintenance under each of the alternatives.

- Estuary Alternative: shared funding and governance for long-term maintenance
- Managed Lake Alternative: state responsibility for long-term maintenance
- Hybrid Alternative: unknown

The cost distributions for long-term maintenance are described in more detail in the Funding and Governance Work Group MOU provided as Attachment 23. See Chapter 7.0 for additional information on Planning-Level Costs, Funding Approach, and Other Considerations.

4.14.3.2 Development in Downtown Olympia

Across all action alternatives, resolving long-term management uncertainties in the Capitol Lake Basin will likely increase the certainty that the area will continue to be a valuable amenity with benefits for current and future development in downtown Olympia, compared to the No Action Alternative. From the research conducted for this evaluation, there is no clear signal that implementing any action alternative, including the Estuary or Hybrid Alternative, would reduce demand for residential or commercial development in downtown Olympia. The City of Olympia's plans for the redevelopment of downtown are long-range, and investment in residential and commercial development is projected to increase in intensity over the next decade.

The Estuary Alternative represents the most visual and environmental changes in the downtown area. These changes have the potential to create uncertainty, at least initially, among investors, developers, and residents in downtown Olympia. As designs are further developed and project elements associated with well-planned, thoughtful, and functional estuary design are further identified, this alternative would be unlikely to produce a negative impact on downtown development compared to the other alternatives. The Hybrid Alternative would likely have a similar effect, although with less upfront risk because it would retain the reflecting pool as a familiar feature. The Managed Lake Alternative would represent the least amount of visual change compared to current conditions and is unlikely to increase uncertainty among potential investors about future conditions. In summary, all action alternatives are likely to produce benefits for downtown development, assuming they are implemented in a way that is well-planned, thoughtfully designed, and accessible.

4.14.3.3 Demand for and Value of Recreation

All action alternatives would produce beneficial effects to recreation compared to the No Action Alternative by improving trails (e.g., adding boardwalks), increasing the diversity of vegetation and habitat areas, and restoring water-based recreation and access.

Why are costs reported in 2022 dollars in the Final EIS?

In the Draft EIS, the planning-level cost estimates assumed 3.5% annual escalation with construction beginning in 2028. Escalation has been removed from the planning-level cost estimates included in the Final EIS given the impact that the response to the COVID-19 pandemic has had on inflation and the associated uncertainty in escalating costs into the future. The Funding and Governance Work Group also requested that planning-level cost estimates were reported in 2022 dollars.

Some people may experience losses in value if their preferred environmental setting (e.g., managed versus unmanaged or natural) is not implemented. Because of the status quo bias and the endowment effect, these losses would likely be felt more strongly by people in favor of a Managed Lake Alternative, should the Estuary Alternative be selected. Such perceived losses would likely diminish over time as people adjust to the new conditions. The overall economic value associated with recreation in the Hybrid Alternative could be higher than the Managed Lake and Estuary Alternatives, because it shares both predominant features, although data are unavailable to confirm this outcome.

Restored access within the Capitol Lake Basin for water-related recreation would expand the amenities offered to downtown residents and visitors, a beneficial effect of all action alternatives. Water access in the Capitol Lake Basin has been restricted since 2009. Despite being surrounded by water, direct opportunities for water-based interaction in the Project Area are limited, making new ones more valuable. Other than the public and private marinas in downtown Olympia, there are no nonmotorized boat access points or beaches in the immediate vicinity of downtown that offer a full range of nonmotorized water-based recreation. Restoring access would create new opportunities for enjoying different types of water-based recreation in a central location. While the types of boating available would differ among alternatives and the duration of boating access would be shorter under the Estuary and Hybrid Alternatives because of tidal influence, the differences would be minor, especially because water depth in the North Basin would be sufficient for water-based recreation during most of the tidal cycle. By restoring access to water-based recreation and enhancing vegetation throughout the Capitol Lake Basin, the value of the amenities it provides to people would increase. These amenities benefit both downtown development economic value as well as the value of recreational experiences. All recreation enhancements would increase in value over time as the downtown residential market continues to grow.

The distributional implications of choosing one alternative over another are potentially important, especially from an equity and social justice perspective. Status quo bias may favor the Managed Lake Alternative. To the extent that the Managed Lake Alternative would sustain a managed environment for recreation and preclude expansion of a more natural recreational setting, it would produce both beneficial effects and adverse impacts for future recreational users, depending on individual preference.

Status Quo Bias and the Endowment Effect

For economic value, there is often bias toward preserving the status quo. This phenomenon is referred to as the "endowment effect," and it is related to loss aversion. It happens when a person experiences a greater loss from giving up something they already have than the amount they would pay to acquire it. More simply, people tend to prefer the status quo and resist change for various reasons, such as attachment to place and identity. Because of the endowment effect, the value that people place on maintaining the status quo is often or typically higher than the value people place on moving to a new state of the environment.

4.14.3.4 Value of Ecosystem Services

Differences among the action alternatives over the long term arise from changes in habitat that provide ecosystem services related to water quality, habitat, flood regulation, visual aesthetics, and cultural, heritage, spiritual, and educational services. The differences are in the costs/avoided costs for ratepayers and distributional and equity concerns arising from changes in habitat provision, visual aesthetics, and cultural services, especially for tribal populations. The action alternatives would create long-term changes in habitat quality and distribution, with a greater diversity of habitat types, including tideflats and estuarine wetlands under the Estuary and Hybrid Alternatives compared to the Managed Lake Alternative, which would have primarily freshwater wetlands and deep freshwater habitat types.

The Managed Lake Alternative would be similar to the No Action Alternative in terms of water quality and regulatory compliance (as described in more detail in Section 4.3, Water Quality). As Ecology moves toward finalization of its TMDL for Budd Inlet, it may modify allocations for major dischargers, which could result in more stringent permit requirements for LOTT and other dischargers. The issue of discharge allocations is complicated, and there will always be some uncertainty as to how Ecology would regulate dischargers in the future. However, if LOTT and other dischargers were required to implement additional measures as a result of Enterprise Services not meeting its future waste load allocations (equivalent to a natural estuary condition) the most stringent targets would occur under the No Action and Managed Lake Alternatives. This would be an adverse impact.

Ecology modeling suggests that the Estuary and Hybrid Alternatives would improve dissolved oxygen conditions in Budd Inlet. This may result in Ecology assigning less stringent discharge reduction requirements for LOTT and stormwater dischargers, likely reducing, deferred, or avoiding the costs of regulatory compliance compared to the No Action and Managed Lake Alternatives. This would be a beneficial effect for utilities and their ratepayers compared to the No Action and Managed Lake Alternatives.

The increased diversity of habitat would be a beneficial effect under all action alternatives, as well as the water quality improvements that would benefit native species. The overall economic value of increased habitat and diversity would likely be higher for the Estuary and Hybrid Alternatives, which would provide better habitat quality for

species of commercial, recreational, and cultural value, especially salmon. These effects would specifically benefit local tribes, which rely on salmon for subsistence, commercial, and cultural value. Not all species would benefit under the Estuary and Hybrid Alternatives; some freshwater fish and freshwater vegetation communities would not survive in the saltwater-dominant Estuary and Hybrid Alternatives, resulting in adverse impacts for people who derive value from these ecosystems and resources.

The Estuary and Hybrid Alternatives would enhance cultural values (including heritage and spiritual value) for populations that prefer the restoration of naturally functioning ecosystems, including tribes. Restoration would enhance opportunities for local tribes to exercise culturally important traditions, and for all people to learn. The No Action and Managed Lake Alternatives would preserve values for some people who prefer maintaining the recent historical conditions. All action alternatives would maintain the educational use value of Capitol Lake – Deschutes Estuary, but the Estuary and Hybrid Alternatives would substantially expand opportunities for research and discovery, with potential beneficial applications to increase the success and cost-effectiveness of future restoration projects.

There are distributional and social justice implications associated with maintaining the status quo conditions of a freshwater lake ecosystem under the No Action and Managed Lake Alternatives. The status quo conditions perpetuate historic inequities, particularly for tribal populations that have experienced ongoing adverse impacts from changes to the ecosystem since nonindigenous settlement of the region occurred. Improvements to culturally and economically important species and habitat functions in the Estuary and Hybrid Alternatives, particularly from the removal of the 5th Avenue Dam, have the potential to result in **substantial beneficial effects** for tribes.

The Estuary and Hybrid Alternatives would reduce the risk of riverine flood impacts in the Capitol Lake Basin, through improved flood regulation capacity in these events. This would produce a beneficial effect by slightly lowering flood risk and associated disruption and damage to property and infrastructure, compared to the No Action and Managed Lake Alternatives.

Changes in the value of visual aesthetics would depend on individual preferences for the different conditions created by the action alternatives. Some people may prefer the status quo visual conditions, while others may prefer the estuarine environment (for

more information see Section 4.10, Visual Resources). Because of this trade-off, the result could either be a beneficial effect or an adverse impact, depending on viewer preference.

The action alternatives also have differences in GHG emissions and carbon sequestration potential over the long term. The Managed Lake Alternative would reduce GHG emissions slightly compared to the No Action Alternative, but overall the freshwater system does not provide much opportunity for reducing, capturing, or storing GHG emissions. The Estuary and Hybrid Alternatives would provide more opportunity for carbon sequestration and less methane emissions than the Managed Lake Alternative, with the Estuary Alternative providing slightly more storage capacity than the Hybrid Alternative. Both the Estuary and Hybrid Alternatives would have a beneficial effect because they are better aligned with local climate adaptation goals compared to the Managed Lake Alternative. For more information on greenhouse and carbon sequestration, see Section 4.7, Air Quality & Odor.

4.14.4 What are the long-term impacts under the Managed Lake Alternative?

Like the No Action Alternative, the Managed Lake Alternative would retain the Capitol Lake Basin in its current configuration, although the Managed Lake Alternative would include some additional management actions. The long-term impacts are described in Section 4.14.3 as part of the comparison of all action alternatives. The long-term impacts on economics associated with the Managed Lake Alternative are listed and summarized in Table 4.14.3.

Table 4.14.3 Summary of Long-Term Economic Impacts: Managed Lake Alternative

Long-Term Impact	Impact Summary
Downstream Economic Activity	**Minor Beneficial Effect –** Recurring maintenance dredging in the North Basin would support economic activity in the study region. State-led responsibility for operation means dredging funding would likely come from appropriations of taxpayer dollars supporting economic activity in the region that may not otherwise occur. **No Effect –** Ongoing dredging by other entities is expected to maintain navigability downstream, preserving the economic value of marina and Port of Olympia activities. A lapse in dredging is unlikely to affect marina and Port of Olympia activities during the 30-year operation window.

Long-Term Impact	Impact Summary
Downtown Development	**Minor Beneficial Effect –** Long-term impacts on downtown development would likely be positive under the Managed Lake Alternative (as with all action alternatives), as long as they are implemented in a way that is well-planned, thoughtfully designed, and accessible. Uncertainty is lowest under the Managed Lake Alternative because it most closely resembles current conditions. Overall, other economic factors likely have more influence on market conditions for development in downtown Olympia than changes in the Capitol Lake Basin.
Demand for and Value of Recreation	**Beneficial Effect –** Enhancements to trails, habitat areas, and restored water-based recreation would increase the value of recreation in the Capitol Lake Basin. Economic opportunities may arise to capture some increased value as revenue through new business ventures. While swimming infrastructure is not currently planned, the Managed Lake Alternative would preserve option value associated with the potential to develop swimming opportunities in the future. The aesthetic impacts on the recreational experience for visitors would vary based on individual preferences. People who prefer the status quo will likely prefer the Managed Lake Alternative relative to the other action alternatives. The Managed Lake Alternative offers boating opportunities that are more consistent and more easily accessible compared to the Estuary and Hybrid Alternatives.
Demand for and Value of Ecosystem Services	**Beneficial Effect –** Improvements in habitat for some species, visual aesthetics, and cultural, heritage, spiritual, and educational value arising from enhanced habitat areas would all be beneficial effects under the Managed Lake Alternative. Expanded recreation infrastructure and restored in-water use would also be benefits. **Adverse Impact –** As with the No Action Alternative, there is a high likelihood that new TMDL allocations could shift additional responsibilities for nutrient reduction to wastewater and stormwater dischargers. LOTT would almost certainly need to invest in treatment capacity, with increased costs for ratepayers. There is also a potential small increased risk and cost associated with reduced capacity to regulate floods for Deschutes River flows.
Equity and Distributional Impacts	**Disproportionate Adverse Impacts on Tribal Populations –** The cultural value for tribes of the Managed Lake Alternative would be similar to conditions under the No Action Alternative. Tribal values would continue to be adversely impacted by the loss of connection to the natural environment and anthropogenic harm to natural ecosystems. The lack of access to water resources, presence of the 5th Avenue Dam, and impacts on species and natural functions have created costs in the form of reduced value to tribes, which would continue under the Managed Lake Alternative. An equitable consideration of cultural value would need to consider the past inequities associated with management of the Capitol Lake Basin. Many, if not all, cultural services for tribes are defined by place, tradition, and continuity of use and practice.

4.14.5 What are the long-term impacts under the Estuary Alternative?

Under the Estuary Alternative, long-term impacts on economics would mostly be associated with restoring tidal hydrology to the Capitol Lake Basin. The long-term impacts are described in Section 4.14.3 as part of the comparison of all action alternatives. Long-term impacts on economics associated with the Estuary Alternative are listed and summarized in Table 4.14.4.

Table 4.14.4 Summary of Long-Term Impacts: Estuary Alternative

Long-Term Impact	Impact Summary
Downstream Economic Activity	**Minor Beneficial Effect –** Recurring maintenance dredging in West Bay would support economic activity in the region. A mix of local, state, federal, and private funding sources would likely support dredging; federal and state dollars may support economic activity that would not otherwise materialize in the region. **No Effect –** Ongoing dredging would maintain navigability downstream, preserving the economic value of marina and Port of Olympia activities. A lapse in dredging could limit moorage accessibility and Port of Olympia navigability, reducing revenues to businesses and organizations and potentially reducing regional economic activity related to boating and trade.
Downtown Development	**Minor Beneficial Effect –** Long-term impacts on downtown development would be positive under the Estuary Alternative (as under all action alternatives), as long as they are implemented in a way that is well-planned, thoughtfully designed, and accessible. Uncertainty associated with environmental conditions and implementation risks may materialize, and is highest under the Estuary Alternative, but is likely to resolve once construction begins. Overall, other economic factors likely have more influence on market conditions for development in downtown Olympia than changes in the Capitol Lake Basin.

Long-Term Impact	Impact Summary
Demand for and Value of Recreation	**Beneficial Effect –** Enhancements to trails, habitat areas, and restored water-based recreation would increase the value of recreation in the Capitol Lake Basin. Economic opportunities may arise to capture some increased value as revenue through new business ventures. The aesthetic impacts on the recreational experience for visitors would vary based on the individual's preferences. The more dramatic visual change in the Estuary Alternative could reduce value for some recreational users. However, other recreational users who prefer a more natural environment setting may experience an increased value. Relative to the Managed Lake Alternative, the Estuary Alternative offers potentially more challenging and dynamic boating conditions, which may have higher value for some boaters, but likely appeal to a more limited population. **Minor Adverse Effect –** While all upland facilities would remain to support established events associated with Capitol Lake, the cultural and symbolic orientation toward the lake may influence how quickly and efficiently organizers are able to adapt to new conditions. Long-term demand for public celebrations and events will likely ensure that people continue to use the facilities in Heritage Park to create social value, although organizational costs may rise temporarily and the distribution of benefits across participants may shift.
Demand for and Value of Ecosystem Services	**Beneficial Effect –** Improvements in habitat, visual aesthetics, and cultural value from the enhanced habitat areas and habitat provision for native and commercially important species including salmonids, expanded recreation infrastructure, and restored in-water use would all be beneficial effects. Regulatory compliance costs for LOTT and its ratepayers could potentially be avoided or minimized (compared to the No Action and Managed Lake Alternatives), associated with improved water quality in Budd Inlet. There would also be a potentially reduced risk of flooding and avoided cost from improved capacity for flood regulation. Increased educational value would arise from opportunities for research and observation of ecosystem restoration, with the potential to improve the success and reduce costs of future estuary restoration projects throughout Puget Sound. **Substantial Beneficial Effect –** The Estuary Alternative would enhance economic, cultural heritage, spiritual, and educational values associated with ecosystem restoration for tribal populations, incorporating consideration of equity and social justice impacts of existing conditions. **Adverse Impact –** The Estuary Alternative would create a potential loss in habitat for freshwater species, visual aesthetics, and cultural, heritage, spiritual, and educational values for people who prefer freshwater ecosystems and the reflecting pool.

Long-Term Impact	Impact Summary
Equity and Distributional Impacts	**Beneficial Effect for Tribal Populations –** Tribal populations would experience the beneficial effects of restoring the Capitol Lake Basin to an estuarine system. This has social justice dimensions as tribes have been historically disadvantaged, not just from the management of Capitol Lake over the last 70 years, but since nonindigenous settlement of the region occurred. The 5th Avenue Dam has altered the natural system and resulted in water quality changes that have harmed species, specifically salmon, as well as plants and other animals that tribes depend on for economic, subsistence, and cultural purposes.

4.14.6 What are the long-term impacts under the Hybrid Alternative?

For the Hybrid Alternative, the long-term impacts on public services and utilities would be similar to that described above for the Estuary Alternative. Long-term impacts on economics associated with the Hybrid Alternative are listed and summarized in Table 4.14.5.

Table 4.14.5 Summary of Long-Term Impacts: Hybrid Alternative

Long-Term Impact	Impact Summary
Downstream Economic Activity	**Minor Beneficial Effect –** Recurring maintenance dredging in West Bay would support jobs, labor income, and economic output in the region. A mix of local, state, and federal funding sources would likely support dredging; federal and state dollars may not otherwise support economic activity in the region. **No Effect –** Ongoing dredging would maintain navigability downstream, preserving the economic value of marina and Port of Olympia activities. A lapse in dredging could limit moorage accessibility and Port of Olympia navigability, reducing revenues to businesses and organizations and potentially reducing regional economic activity related to boating and trade.
Downtown Development	**Minor Beneficial Effect –** Long-term impacts on downtown development would be positive under the Hybrid Alternative (as with all action alternatives), as long as they are implemented in a way that is well-planned, thoughtfully designed, and accessible. Uncertainty associated with environmental conditions and implementation risks may materialize but is likely to resolve once construction begins. Overall, other economic factors likely have more influence on market conditions for development in downtown Olympia than changes in the Capitol Lake Basin.

Long-Term Impact	Impact Summary
Demand for and Value of Recreation	**Beneficial Effect –** Enhancements to trails, habitat, and restored water-based recreation would increase the value of recreation in the Capitol Lake Basin. Economic opportunities may arise to capture some increased value as revenue through new business ventures. While swimming infrastructure is not currently planned, the Hybrid Alternative would preserve option value associated with the potential to develop swimming opportunities in the future. The aesthetic impacts on the recreational experience for visitors would vary based on an individual's preferences. The barrier wall would provide an additional pathway for pedestrians and bicyclists, which would provide a new perspective on the basin compared to other paths in the study area. This may attract new visitors to the area and potentially generate somewhat higher levels of economic value compared to the Estuary and Managed Lake Alternatives.
Demand for and Value of Ecosystem Services	**Beneficial Effect –** Improvements in habitat, visual aesthetics, and cultural value from the enhanced habitat areas and habitat provision for native and commercially important species including salmonids, expanded recreation infrastructure, and restored in-water use would be similar to those described for the Estuary Alternative and would have beneficial effects. There would be potential avoided or delayed regulatory compliance costs for LOTT and its ratepayers compared to the No Action and Managed Lake Alternatives—but higher risk than the Estuary Alternative due to uncertainty from the reflecting pool—resulting from improved water quality in Budd Inlet. There would also be a potentially reduced risk of flooding and avoided cost from improved ecosystem flood regulation capacity. compared to the No Action and Managed Lake Alternatives. **Substantial Beneficial Effect –** The Hybrid Alternative would enhance commercial, subsistence, cultural, heritage, spiritual, and educational values associated with ecosystem restoration for tribal populations, addressing equity and social justice impacts of existing conditions. **Minor Adverse Impact –** The Hybrid Alternative would create a potential loss in aesthetic value associated with the reflecting pool wall, especially for those experiencing the estuary environment at water-level. The alternative could also diminish cultural, heritage, spiritual, and educational values for people who prefer a different setting.
Equity and Distributional Impacts	**Beneficial Effect for Tribal Populations –** Tribal populations would experience the beneficial effects of restoring the Capitol Lake Basin to an estuarine system, but to a lesser degree than under the Estuary Alternative. The presence of the reflecting pool and barrier wall would not fully restore the North Basin to estuarine conditions.

4.14.7 What mitigation measures would be recommended or required for the three alternatives?

The impacts on economic resources from the action alternatives would likely be largely positive and not require avoidance, minimization, and mitigation measures beyond those described for other resources (Sections 4.1 through 4.13). In addition, this economic analysis does not identify significant impacts that would require mitigation.

Under the Estuary and Hybrid Alternatives in particular, there is the potential to increase levels of uncertainty in future conditions compared to the Managed Lake Alternative, because they represent a dramatic change from current conditions. Transitioning from a managed lake to an estuary, if implemented without sufficient attention to appearance, could result in minor adverse impacts on the market for development in downtown Olympia. This risk can be minimized by:

- Recognizing the importance of incorporating aesthetically pleasing and functional elements into project design and effectively implementing them, with input and feedback from local residents and developers.
- Pursuing adequate funding to fully implement all project elements successfully and timely, with a priority on those elements that engage people in the environment and provide access to the water. Enterprise Services would lead the effort to secure funding for upfront construction, with funds likely to come from a combination of state and federal grants, appropriations of taxpayer dollars, and funds from other private and non-profit granting programs.
- Developing a plan for functional governance, funding, and adaptive management to quickly and productively address potential issues that may arise that compromise the amenity value of the resource. As noted throughout, the Funding and Governance Work Group process has resulted in a MOU outlining long-term management responsibilities and a funding allocation amongst its members. This agreement sets forth a process where Funding and Governance Work Group members will agree to management responsibilities and funding for sediment management in a binding Interlocal Agreement. This agreement is specific to the Estuary Alternative.

The ongoing evaluation of public preferences about perceived and real changes in value will also help ensure that future design and implementation plans maximize economic outcomes. The distribution of benefits and costs across different populations and groups of people will also be considered in the long term, to identify and address potential equity and social justice concerns.