City of Seattle

Duwamish Valley Sea Level Rise Adaptation VISION & STRATEGY REPORT

FINAL DRAFT January 2026

ACKNOWLEDGMENTS

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Support for this project was provided by the Robert Wood Johnson Foundation as part of the Cities Taking Action to Address Health, Equity and Climate Change Initiative. The views expressed here do not necessarily reflect the views of the Foundation.

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HOW TO USE THIS DOCUMENT

This report describes work undertaken over the past 3 years to advance holistic sea level rise (SLR) adaptation in the Duwamish Valley. The vision and strategies described here are a first step that provides a basis for more detailed planning and design in partnership with other agencies, residential and business communities, and property owners in the Duwamish Valley.

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This chapter presents the vision, design principles, and preferred approach to SLR adaptation in the Duwamish Valley. It includes potential infrastructure strategies and example illustrations of how adaptation strategies can integrate multiple benefits to meet the vision.

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This chapter outlines the near and long-term next steps to continue the work of SLR adaptation in the Duwamish Valley, including regulatory, funding, technical analysis, and partnership needs.

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This set of supplementary documents includes full summaries of community engagement events; research into relevant case studies for SLR adaptation; and comprehensive background research of existing conditions that informed the report.

"SOUTH PARK DESERVES NATURE, BEAUTY, HEALTH. WE LIVE HERE. THE RIVER DESERVES TO LIVE TOO. THE DUWAMISH VALLEY DESERVES SOMETHING BEAUTIFUL TO BE PROUD OF."

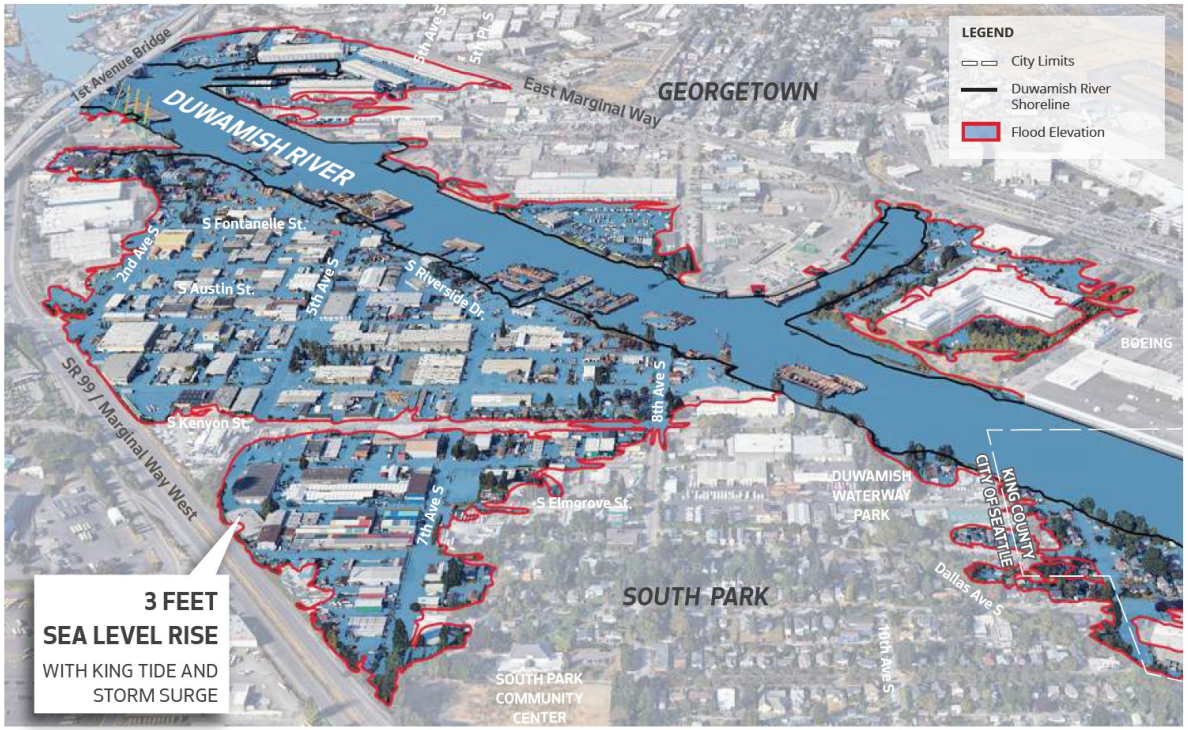
- DUWAMISH VALLEY RESIDENT

EXECUTIVE SUMMARY

The Duwamish Valley, including the South Park and Georgetown neighborhoods, is a close-knit and diverse environmental justice community bound together by intimate social and cultural ties. A mix of industrial and residential areas, it is centered around the Duwamish River, and it is the area most vulnerable to sea level rise-related coastal flooding in Seattle. With ongoing global climate change and sea level rise (SLR), existing flooding issues and other climate hazards in the Duwamish Valley will worsen.

The map below shows the projected future flood inundation areas resulting from combined impacts of SLR and storm surge flooding. SLR will increasingly impact critical local industries, jobs, and residents. Given the legacy of industrial contamination in this area, increased flooding can also contribute to recontamination of the Duwamish River, perpetuating health risks for people and wildlife. A coordinated vision and strategy to address SLR-related flooding is needed to ensure equitable outcomes for all.

This report is a roadmap for the City of Seattle to advance holistic SLR adaptation in the Duwamish Valley. It envisions equitable, community-driven investment in physical infrastructure that will provide multiple benefits, while protecting business and residential communities from increasing coastal flood risk. The report was developed with extensive engagement and input from the residential and business communities (henceforth referred as "community") of South Park and Georgetown. Based on this engagement and three years of research, information-sharing, development of ideas and strategies, and review and input by City leadership and partner agencies, this report presents a vision and preliminary strategies to approach SLR adaptation based on current understanding. It provides a starting point for continued analysis, reviews, consultations, and requests for funding.



Projected flood impacts to South Park and Georgetown with three feet of SLR projected to occur by 2100.

Design Principles

Flood management and SLR adaptation in the Duwamish Valley present an opportunity to equitably achieve multiple community and City priorities. The following Design Principles, developed in partnership with community members, provide direction for ongoing planning, design, and implementation of SLR adaptation infrastructure and associated multiple benefits.

- **Habitat & Ecology.** Improve habitat quantity and quality and restore tree canopy that supports improved ecological and public health.
- **Public Access & Co-Benefits.** Provide access to the river and green spaces to improve health and well-being.
- **Equity & Prosperity in Place.** Support anti-displacement and minimize harm to residents and businesses while providing local jobs.
- **Economic Impact.** Create direct and indirect economic benefits to local industrial and residential communities and ensure equitable distribution of costs.
- **Adaptability & Effectiveness.** Prioritize critical near-term investments to protect communities while maximizing long-term adaptability and resilience to other climate threats.
- **Feasibility.** Plan for investments in infrastructure that are feasible to build and maintain over the long term.
- **Participation & Transparent Process.** Continue meaningful community engagement and transparent processes.

Recommended Adaptation Approach

The City's infrastructure investments will start in the industrial area of South Park, where flooding from river over-topping impacts a large area. Projected impacts on the Georgetown side of the river are largely limited to individual properties, and property owners will determine the solutions that best fit their needs. Publicly-owned land, including streets and rights-of-way, parks and public facilities, present the most immediate opportunity for comprehensive protection infrastructure. By anchoring adaptation infrastructure close to the shoreline, the City can establish a continuous line of protection using public streets and existing publicly-owned sites. Street ends provide an early opportunity to raise the lowest existing areas along the shoreline.

Adaptation will be a collaborative effort between the City, Duwamish Valley communities, and local and regional partners. Private property owners along the shoreline whose sites are exposed to coastal flooding may choose to adapt to flooding using various strategies. The City and other public agencies will seek opportunities to collaborate with these owners to identify potential coordinated investments that achieve shared goals and make efficient use of resources.

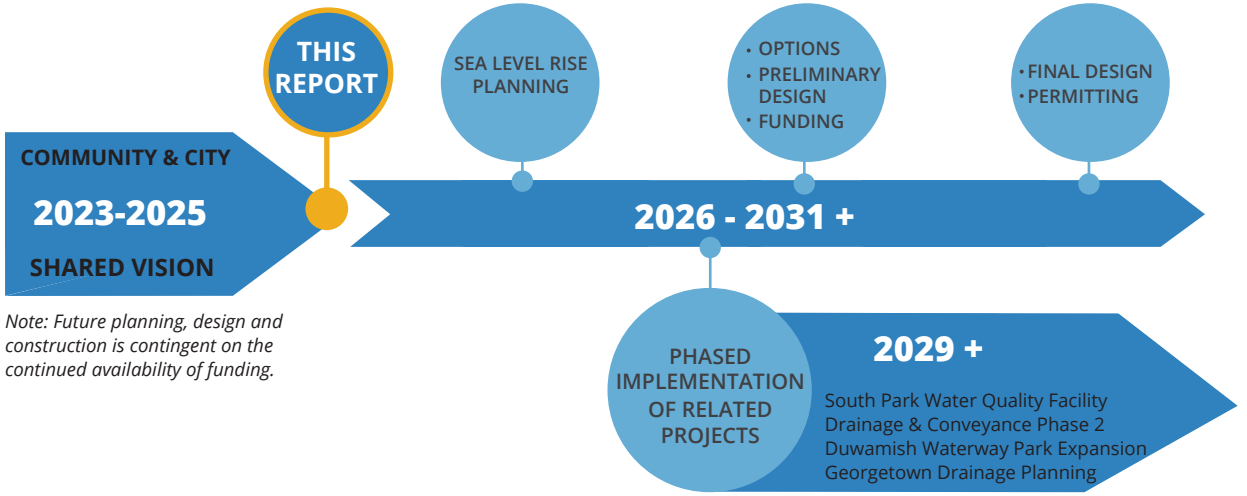
The City and partners will take an integrated and holistic approach to adaptation. In the short term, the City will continue to undertake preparedness and prevention. The City will also advance long-term solutions, leading with projects on public streets and sites while exploring adaptation solutions and partnerships with private property owners and agencies as opportunities arise. SLR adaptation in the Duwamish Valley will support long-term resilience of residents, industry, and ecology. Solutions will prioritize protection from flooding and may integrate accommodation of flooding and strategic and targeted repositioning of activities when appropriate.

Next Steps and Considerations Going Forward

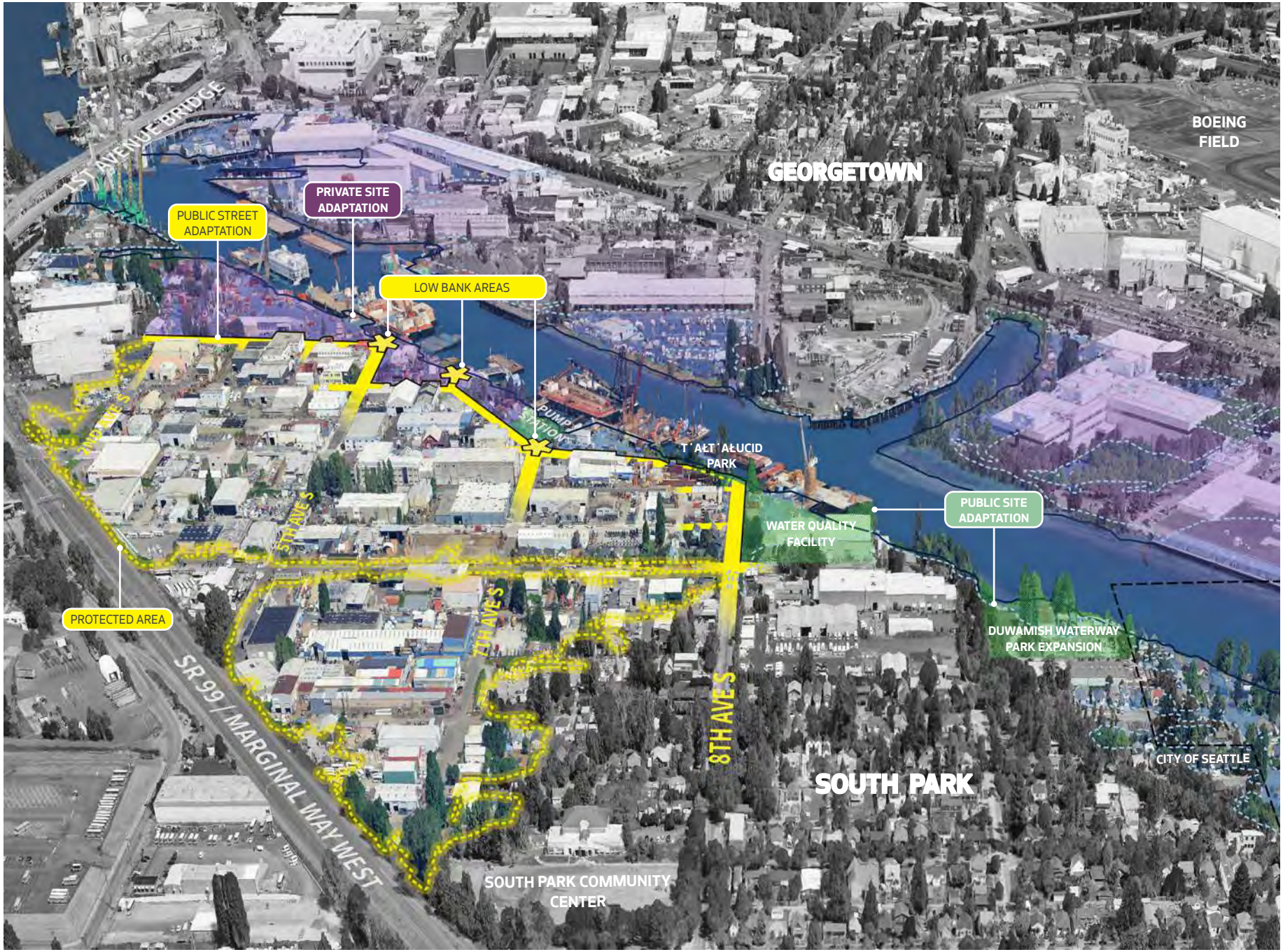
The City, led by Seattle Public Utilities (SPU), will coordinate the transition from annual flood preparedness and emergency response to long-term adaptation. In June 2025, the City created a new Duwamish Valley Water Resilience (DVWR) Section in the Drainage and Wastewater Line of Business (DWW LOB) within SPU's Planning & Program Management (PPM) Division. The DVWR team will focus on long-term flood management and water quality improvement projects in South Park and Georgetown, as well as the cleanup of four Superfund sites (Lower Duwamish Waterway, East Waterway, Terminal 108, and Gas Works Park).

The City will focus on the immediate coastal flood risk in the South Park industrial area and will continue to study and invest in flood management in Georgetown and the residential area of South Park. In the near term, Seattle Public Utilities is planning drainage improvements to address stormwater related flooding. Strategies to address coastal flooding, including SLR, can be integrated with these near-term investments.

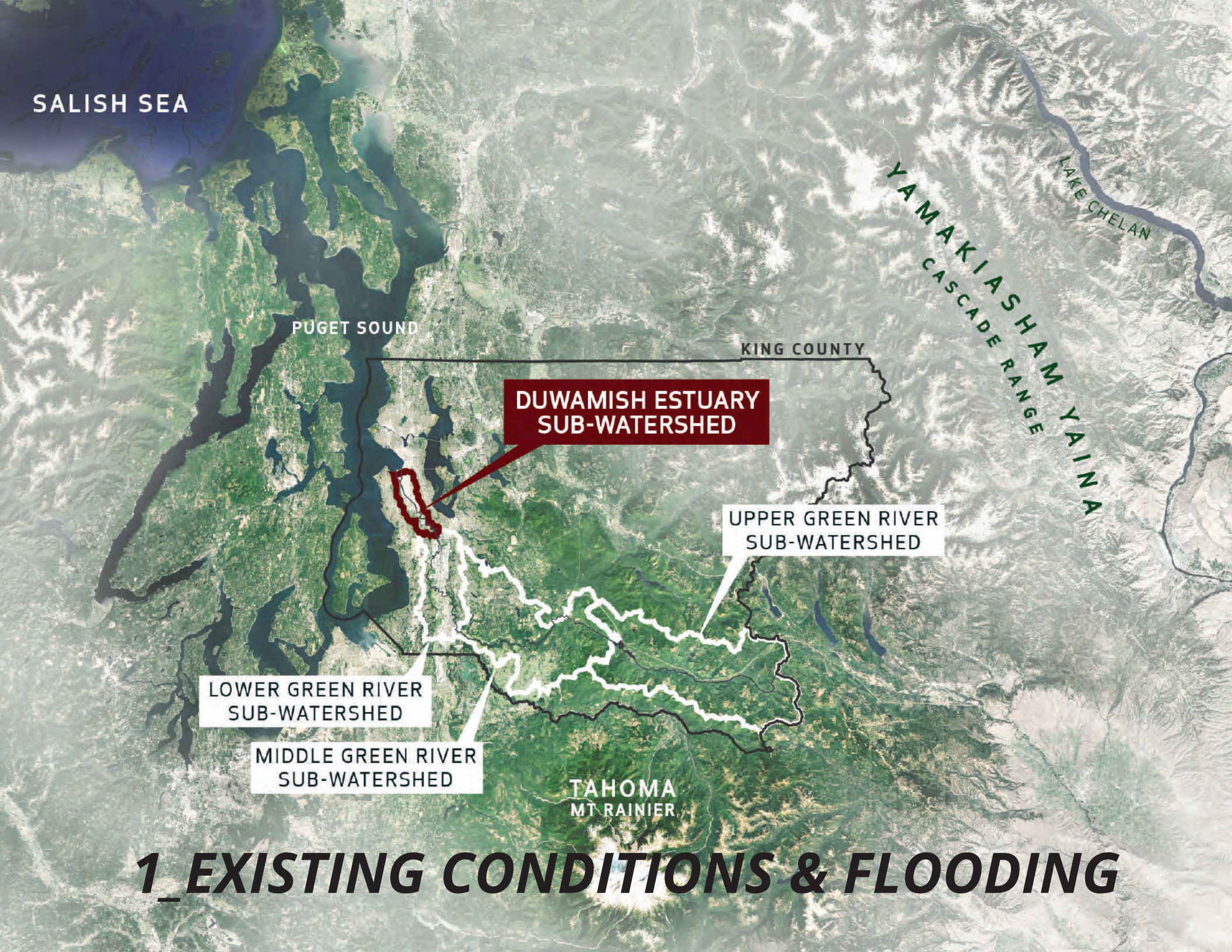
To inform long term and holistic investments in flood management and SLR adaptation for the Duwamish Valley, the City will continue to advance technical feasibility studies, create preliminary designs, and define potential regulatory and permitting pathways. The City has secured grant funding from the King County Flood Control District (KCFCD) and the Federal Emergency Management Agency (FEMA) to complete technical analysis and other early planning work. Beyond this, the City and partners will continue to pursue other funding from federal, state, and local sources. Through continued planning and into design, the City will adjust and update the vision for flood adaptation with ongoing community engagement, maintaining an inclusive process through future project phases. This includes exploring opportunities to increase the capacity of businesses and residents to engage as strong partners and leaders in creating community and climate resilience, as outlined in the Duwamish Valley Action Plan.



Note: Future planning, design and construction is contingent on the continued availability of funding.



Recommended Adaptation Approach. Note: This image does not represent a final City of Seattle policy or proposal. It is intended to facilitate conversations with community, agencies and decision makers. This work will be refined over multiple phases including: further community engagement, technical and financial analysis; consultations with Tribes and agencies; permitting and environmental reviews; and City Mayoral and Council decisions.



1_EXISTING CONDITIONS & FLOODING

Project Area

The Green-Duwamish River runs from Blowout Mountain in the Cascade Range, through forests, fields, and urbanized areas, and finally into the Puget Sound. This region around present-day Seattle has been inhabited since the end of the last glacial period (around 8,000 BCE, or 10,000 years ago).

Within the broader regional context, this report focuses on the flood-impacted neighborhoods of South Park and Georgetown, located along the urbanized area of the Duwamish River within the City of Seattle. The study area is within the Duwamish Estuary Sub-Basin, the lowest region of the Duwamish River. It is the most densely developed area around the river and, because of its developed condition with armored shorelines, it has the highest need for salmon habitat restoration within the overall watershed.

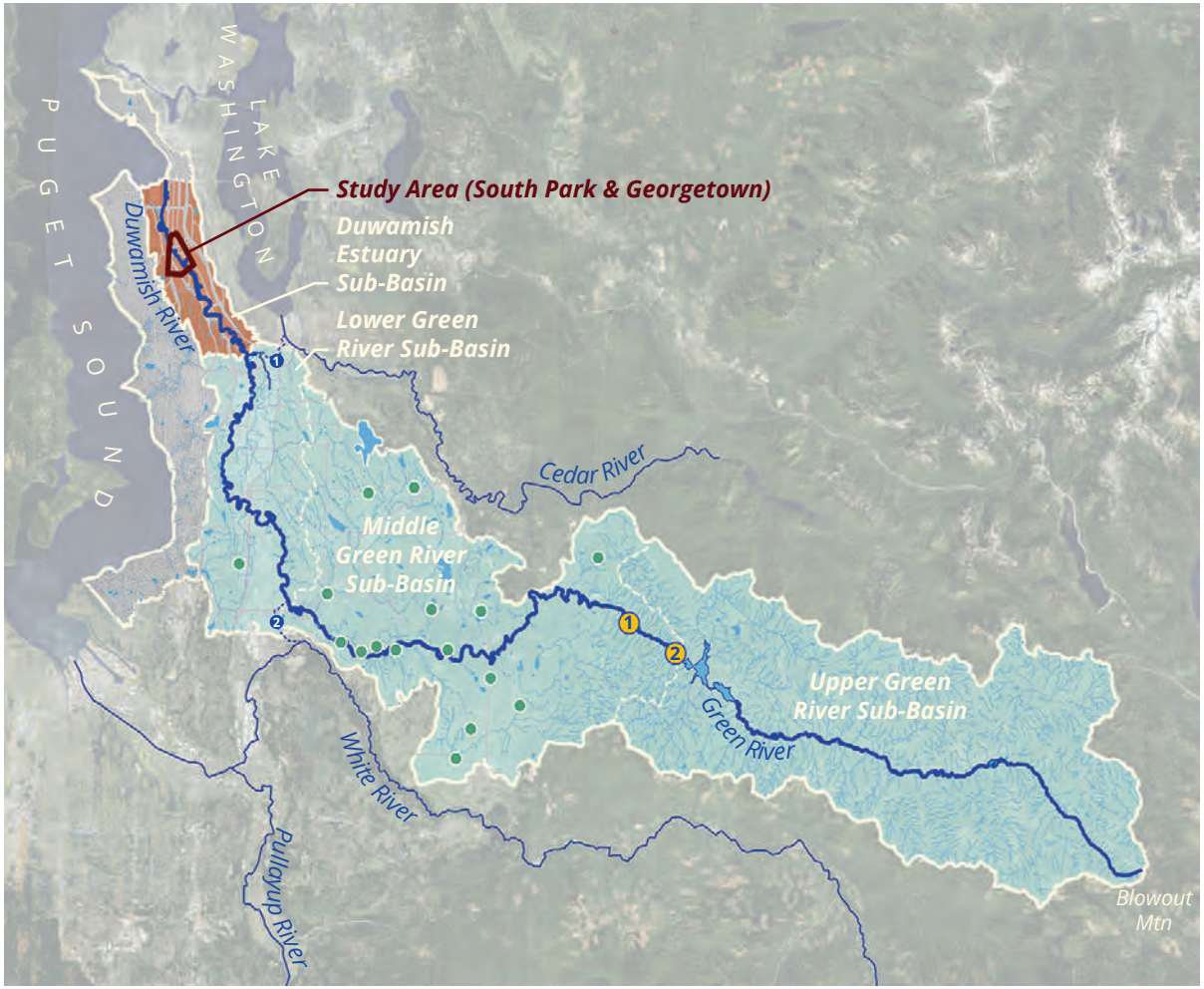


Figure 1. Green-Duwamish River Watershed. The Green-Duwamish River runs from Blowout Mountain in the Cascade Range, through forests, fields, and urbanized areas, and into the Puget Sound. This project's study area is located within the area with the highest need for salmon habitat.

History

The area known as the Duwamish Valley today is historically the homeland of the of Coast Salish tribes (including the Duwamish, Muckleshoot, and others), where the river meandered through a floodplain with mudflats and forest. The village of tohl-AHL-too ("herring house"), just north of this project's study area, was inhabited starting in the 6th century CE at the latest, as was the current industrial area at the mouth of the Duwamish River. That area was called hah-AH-poos, or "where there are horse clams". The Coast Salish ancestors occupied at least 17 villages in the mid-1850s. At least 93 permanent longhouses were located along the lower Duwamish River, Elliott Bay, Salmon Bay, Portage Bay, Lake Washington, Lake Washington, and Lake Sammamish.[1] Indigenous people still inhabit this place today.

With Euro-American immigrant settlement, the river's meandering floodplains were filled and the river straightened over time for use as an industrial waterway. The areas that were once wetlands are now low-lying areas that are susceptible to periodic flooding. The industrialization along the river has led to major loss of in-water and upland habitat while contributing to the contamination of soil and water. This legacy of contamination resulted in the river being designated a Superfund Site by the US Environmental Protection Agency (EPA) in 2001.

Figure 2 shows the historical path of the river and surrounding ecotones overlaid on its current channel. The areas most susceptible to flooding today are in former wetland and marsh areas.

1 Wikipedia contributors, "History of the Duwamish people," Wikipedia, The Free Encyclopedia (accessed September 9, 2025).

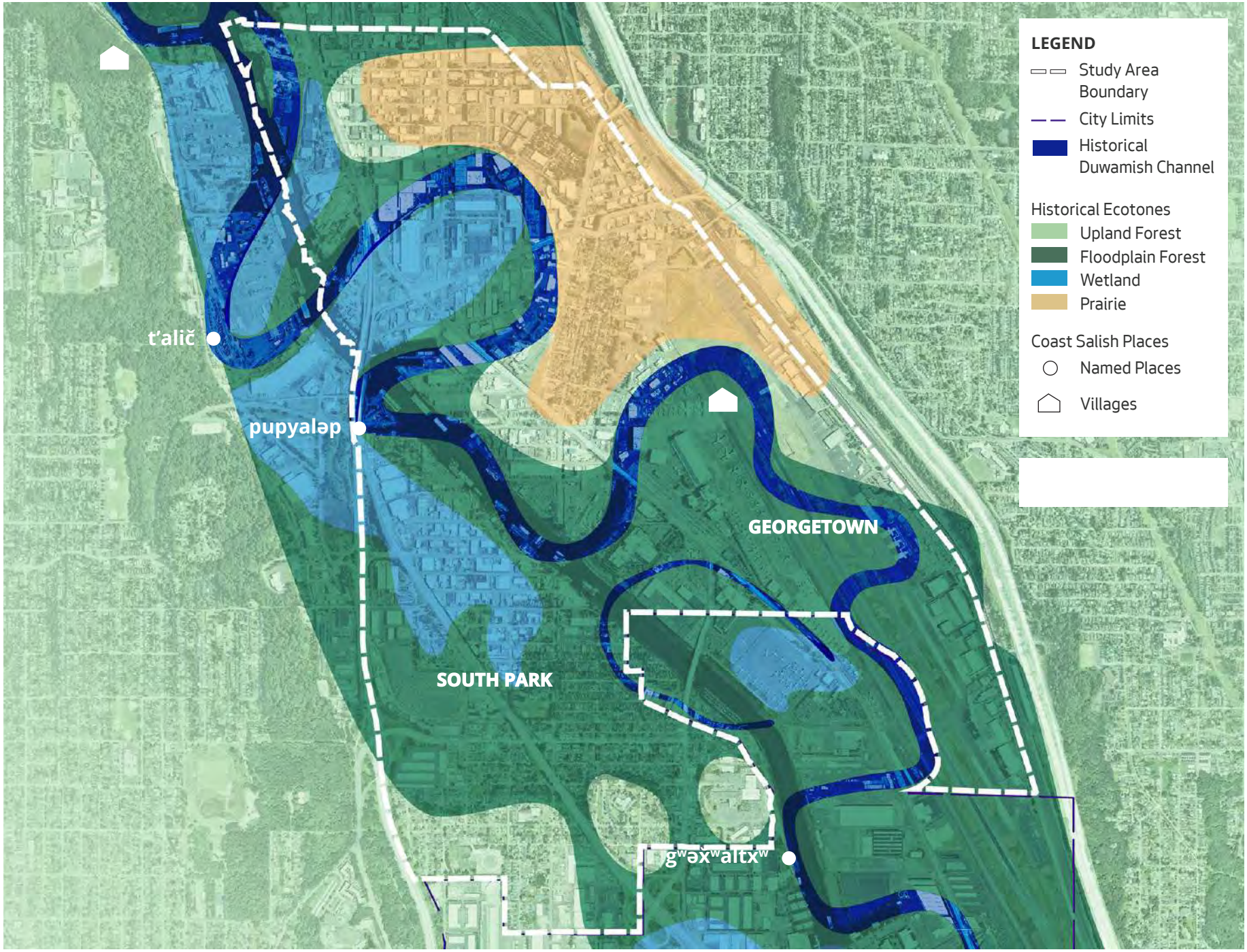


Figure 2. Study area for this report overlaid with the historical channel of the Duwamish River, historical ecotones from the ~1800s, and place-names of Coast Salish places (adapted from the Burke Museum Waterlines Project)

The Duwamish Valley Today

The South Park and Georgetown neighborhoods include resilient, close-knit communities. These neighborhoods are more racially diverse than the City of Seattle as a whole, and they are impacted by environmental environmental and health disparities. A 2013 Cumulative Health Impact Assessment, conducted with local communities, found that average life expectancy in South Park and Georgetown is eight years shorter than the county average. Health issues like heart disease, asthma, lung cancer, diabetes, and stroke are also more common in these neighborhoods than the county average. Though many of Seattle's most marginalized communities reside in this flood-impacted area, they have not seen significant investment in flood protection. The 2018 Duwamish Valley Action Plan directs the City of Seattle to identify and implement community resilience actions specific to the Duwamish Valley, including a strong focus on SLR and flooding.

Portions of the Duwamish Valley are part of the Duwamish Manufacturing Industrial Center (MIC), which is home to around 66,968 jobs[1]. This is one of the largest and most intensely developed manufacturing and industrial areas in the Pacific Northwest. The maritime access and availability of small and large sites, and supportive industrial policies in the Duwamish MIC, have allowed a unique mix of local businesses to remain and thrive in this area. Retaining maritime industrial businesses and local jobs is a strong priority for the City and local communities.

The project study area also includes significant residential and commercial areas. Figure 3 shows the study area and the industrial zones (Maritime Manufacturing and Logistics U/85) and residential zones within it.

1 Greater Duwamish Manufacturing and Industrial Center Plan, 2026

In South Park, some homes are located within the industrially zoned area, and these residences are particularly exposed to high tide flooding and impacts from industrial uses.

On the west side of the river, the report focuses on the northern portion of the South Park neighborhood, bounded by the First Avenue Bridge to the west, the Duwamish River and Seattle city limits to the east and West Marginal Way S to the south. This project area is about 200 acres and is largely developed. On the east side of the river, the focus is on the western portion of the Georgetown neighborhood, bounded by S Dawson Street to the north, East Marginal Way S to the east, and Seattle city limits to the south. This area is about 250 acres and is mostly developed. The riverbank is slightly lower in the South Park area, making this neighborhood more vulnerable to high tide flooding, but the overall land elevation in both neighborhoods is similar.

Duwamish Valley youth at the annual Duwamish River Festival

The Duwamish Valley is home to unique maritime industrial businesses.

Existing homes within the industrial zone are particularly exposed to high-tide flooding today.

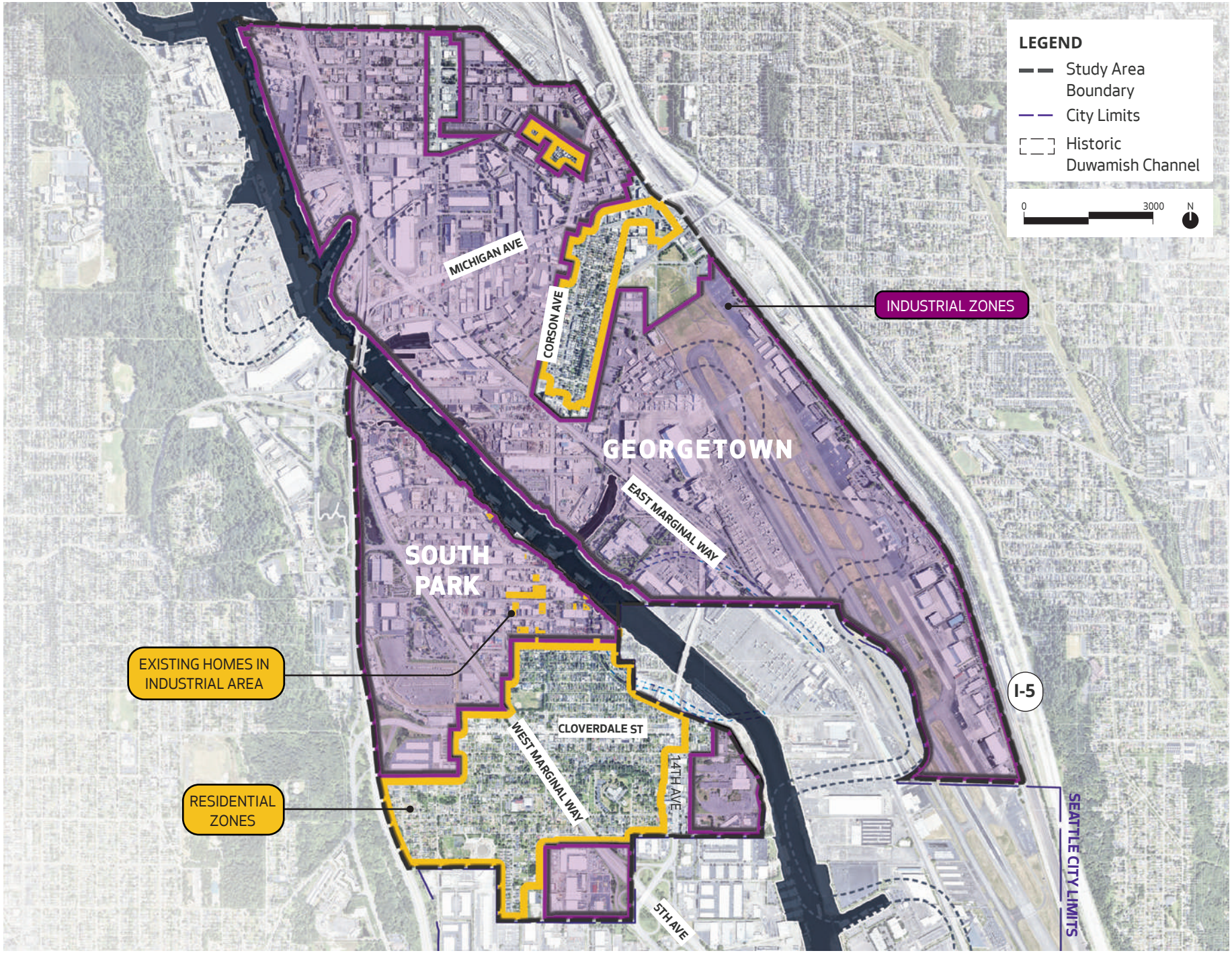


Figure 3. Study Area Industrial and Residential Zones

SEA LEVEL RISE AND FLOODING

The Duwamish Valley is Seattle's most vulnerable area to SLR-related **coastal flooding.** Flooding impacts the industrial and residential communities of South Park and Georgetown in slightly different ways. South Park is vulnerable to severe coastal flooding, and Georgetown is mostly impacted by stormwater-related **urban flooding.**

As sea levels rise, coastal flooding, storm surge, rainfall-driven stormwater flooding, and groundwater impacts are all likely to worsen. Therefore, the development of appropriate shoreline adaptation strategies must consider how SLR may exacerbate all future flooding conditions.

HIGH TIDE FLOODING

The Duwamish River's water levels are tidally-influenced. High tide flooding occurs when tides are high enough to overtop the riverbanks. The highest tides of the year, called "king tides," normally occur from November through March, when the earth is closest to the sun and moon's gravitational pulls.

STORM SURGE FLOODING

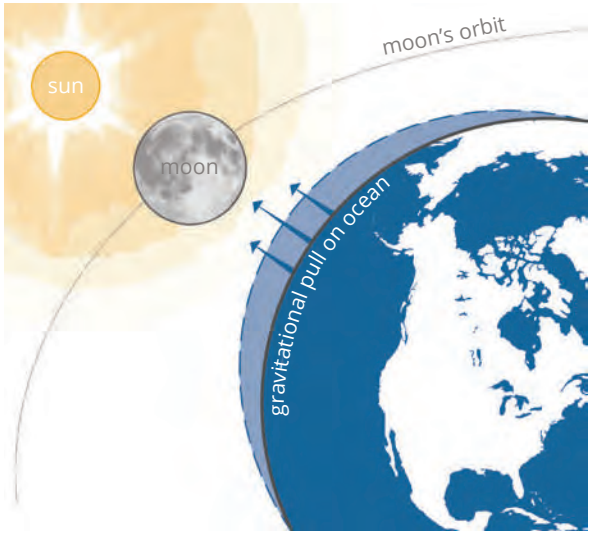
Storm surge happens when storm winds increase water levels in the Duwamish River. Low pressure storms can boost tides in Puget Sound by as much as three feet. This impact is muted somewhat further upland on the Duwamish River, but it still applies. The compound impacts of storm surge, high tides, and low pressure systems can create water levels that result in major flooding in South Park and Georgetown.

STORMWATER FLOODING (URBAN FLOODING)

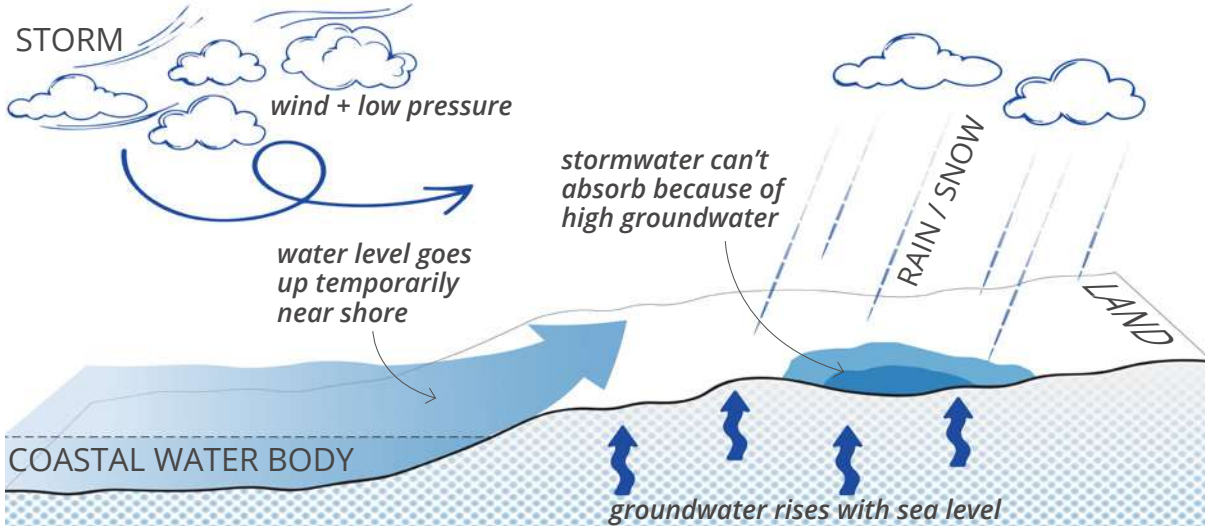
High-intensity rain events may result in runoff that exceeds the capacity of City and County stormwater drainage systems, causing flooding in areas with limited storm drainage infrastructure. Short duration, high intensity storms generate runoff volumes that can overwhelm the drainage system in minutes. Intermediate and long duration storms can also result in flooding depending on tidal conditions (SPU, 2020). This situation may be worsened if the stormwater and wastewater systems are combined. While the eastern and southern portions of the South Park neighborhood are served by a combined sewer system, the industrial area has a separated storm drainage system that is not linked to the combined system, and portions of the industrial area lack stormwater drainage.

GROUNDWATER & SOIL IMPACTS

Groundwater is water that exists in saturated zones in the ground, and tends to rise with the tide in areas close to the shore. The groundwater table is high in the Duwamish Valley, and SLR is expected to also cause groundwater to rise around the shoreline area. High groundwater makes it difficult for stormwater to absorb into the soil. The soils along the Duwamish River shoreline are highly compressible and are the result of artificial filling of wetlands. Liquefaction is a known risk factor in the neighborhood, which will increase in risk with a rising groundwater table.



High tides, or "astronomical tides," are caused by the gravitational pull on the ocean from the moon and sun.



Storm surge flooding is caused by low pressure and high winds. As sea levels rise, groundwater also rises, making it more difficult for the earth to absorb stormwater.

MEASUREMENT SYSTEM FOR FLOOD LEVELS

This report uses a system called NAVD88 to describe water levels. NAVD88 stands for the North American Vertical Datum of 1988. It is a standard system used by public agencies when measuring water levels, including high tides and storm surges. The "zero" point of NAVD88 sits between mean sea level and average daily lower tides. Figure 4 illustrates the NAVD88 measurement system and some relative typical tidal elevations.

In the NAVD88 system, mean sea level in Elliott Bay is at 4.32 feet (NOAA Station 9447130) and the mean higher high tidal elevation is 9.02 feet. Historical mean sea level change has added about 2 inches to the tidal elevations in the last two decades and 0.7 feet in the last century. Groundwater has been measured by SPU ranging from elevation 4 feet (close to mean sea level) to elevation 11 feet (which is above the ground surface of the lowest lying areas) depending on time of year and location. Riverbank elevations range from about 15.5 feet near S Holden St. and 8th Ave. S to 10.5 feet near S Fontanelle St. and 5th Ave. S. The average riverbank height is about 12 feet.

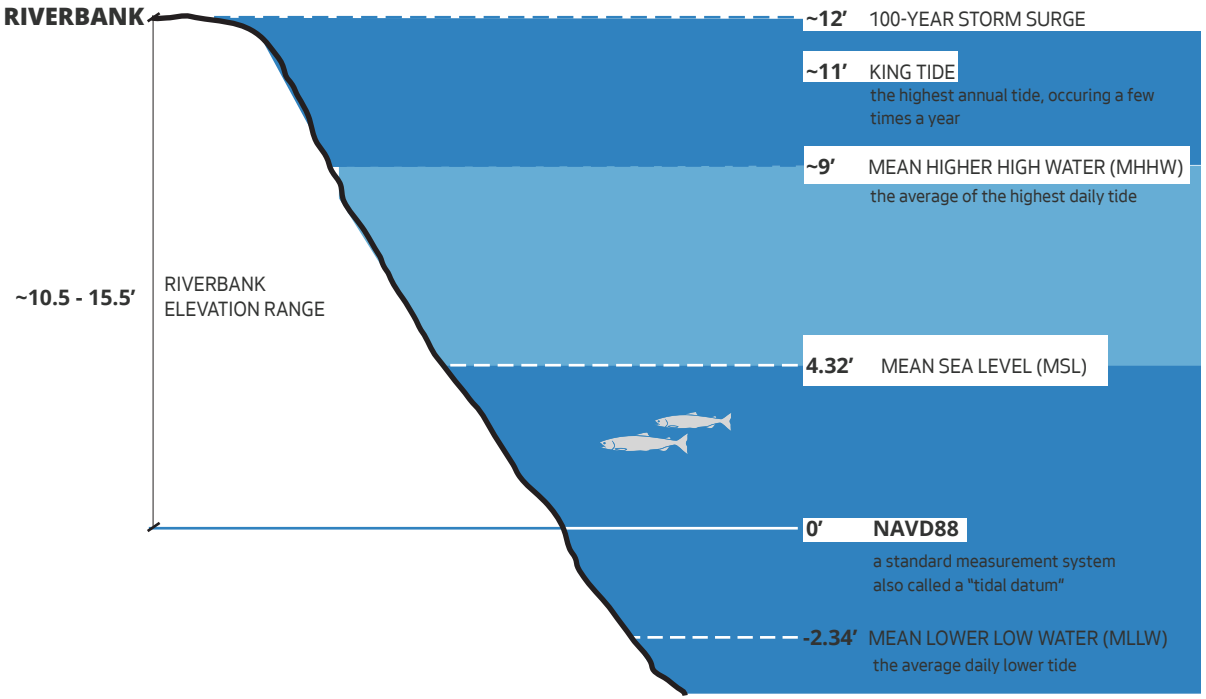


Figure 4. When describing the height of observed and projected flooding, this study uses a reference system called the North American Vertical Datum of 1988, or "NAVD88". The diagram shows other tidal elevations measured in NAVD88, including the typical amount of water rise attributed King Tide and Storm Surge.

Sea Level Rise Scenarios

Climate change presents uncertain futures, and scientific projections for SLR study different possible scenarios. To determine an appropriate level of future flooding to plan for, the City considered six SLR scenarios. All six scenarios assume that global greenhouse gas (GHG) emissions remain high. The six scenarios represent different levels of probability of exceeding a certain number of feet of SLR. The scenarios with a high probability of exceedance indicate a lower level of SLR, while the scenarios with a low probability of exceedance indicate a higher level of SLR. These scenarios are based on what scientists know about how quickly or slowly sea levels could rise if emissions remain high. The six scenarios are shown in the graph and table below (figures 5 and 6).

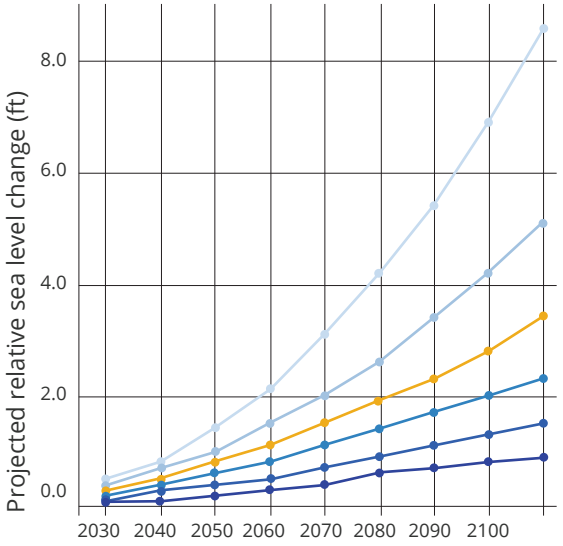


Figure 5. Projected relative SLR scenarios assuming high emissions (RCP 8.5).

The six SLR scenarios were evaluated based on a review of existing mapping, identification of shoreline overtopping locations, and alignment with other City efforts like SPU's 2017 Preliminary Flood Risk Management Study (with the US Army Corps of Engineers), SPU's Shape Our Water Integrated System Plan, and the process for redeveloping Seattle's Central Waterfront.

For the purposes of defining the potential inundation area and developing adaptation strategies, the City selected SLR projections in line with the Washington State Coastal Resilience Project guidance for an area containing critical assets. Projections were selected for two key planning time horizons: 2050 and 2100.

- 2050: 10% (Med-Low) probability of exceedance – MHHW + 1.10' SLR
- 2100: 10% (Med-Low) probability of exceedance – MHHW + 3.40' SLR

Planning for a Medium-Low probability of exceedance is a conservative approach since it reflects a higher level of SLR-related flooding. For mapping purposes, the projected feet of SLR were rounded down to the nearest number of feet.

It is important to note that existing SLR projections vary, particularly beyond 2050, when the rate of SLR will be determined by the global ability to reduce GHG emissions in the following decades. The projections used in this report assume little success at containing GHG emissions globally. If GHG emissions are curbed, the rate of SLR may be slower than projected in this report. However, the Duwamish Valley already experiences significant flooding today, and urgent action is needed.

Probability of Exceedance Mean Sea Level Rise						
	Very Low 0.1%	**Low 1%**	**Med-Low 10%**	**Med 50%**	**Med-High 90%**	**High 99%**
2050 (in feet)	2.2	1.5	1.1	0.8	0.5	0.3
2100 (in feet)	8.7	5.1	3.4	2.3	1.5	0.9
			Selected Scenario			

Figure 6. Relative SLR Projections for the Duwamish Valley, Seattle (47.533°N, 122.323°W)

Source for Figures 5 and 6: Lavin, P., Roop, H.A., Neff, P.D., Morgan, H., Cory, D., Correll, M., Kosara, R., and Norheim, R., 2019. Interactive Washington State Sea Level Rise Data Visualizations. Prepared by the Climate Impacts Group, University of Washington, Seattle. Updated 7/20.

The diagrams at right show existing and projected river elevations from coastal flooding king tides and storm surge, and SLR. The ground is shown at 12 feet, which is the average elevation of the riverbank in South Park today. Because the riverbank elevation varies from 10.5 feet at the lowest point to 15 feet at the highest, the river will flood the banks faster and more frequently in some places than others.

With one foot of SLR, a combined king tide and storm surge would reach about 13 feet NAVD88. This would create flooding about a foot deep in the low-lying areas of South Park. This amount of flooding can float a car off the ground and intrude into buildings. One foot of SLR is expected to occur by 2050, though water levels of nearly 13 feet NAVD88 have already been experienced.[1]

With three feet of SLR, daily high tides could cause flooding, and flood elevations of up to 15 feet could occur if there is a storm surge during a king tide. Three feet of SLR is expected to occur by 2100.

To protect the neighborhoods from the projected flood levels, SLR adaptation infrastructure needs to aim for an elevation of 14 to 16 feet NAVD88, about two to four feet above the existing riverbank. Flood protection infrastructure usually needs to be built higher than the elevation of the expected flood water level. The Federal Emergency Management Agency (FEMA), encourages communities to build at least one foot above expected flood elevation. This additional height is called "freeboard".

1 *December 27, 2022 highest observed tide was 12.87' NAVD88. NOAA Tides and Currents: https://tidesandcurrents.noaa.gov/datums.*

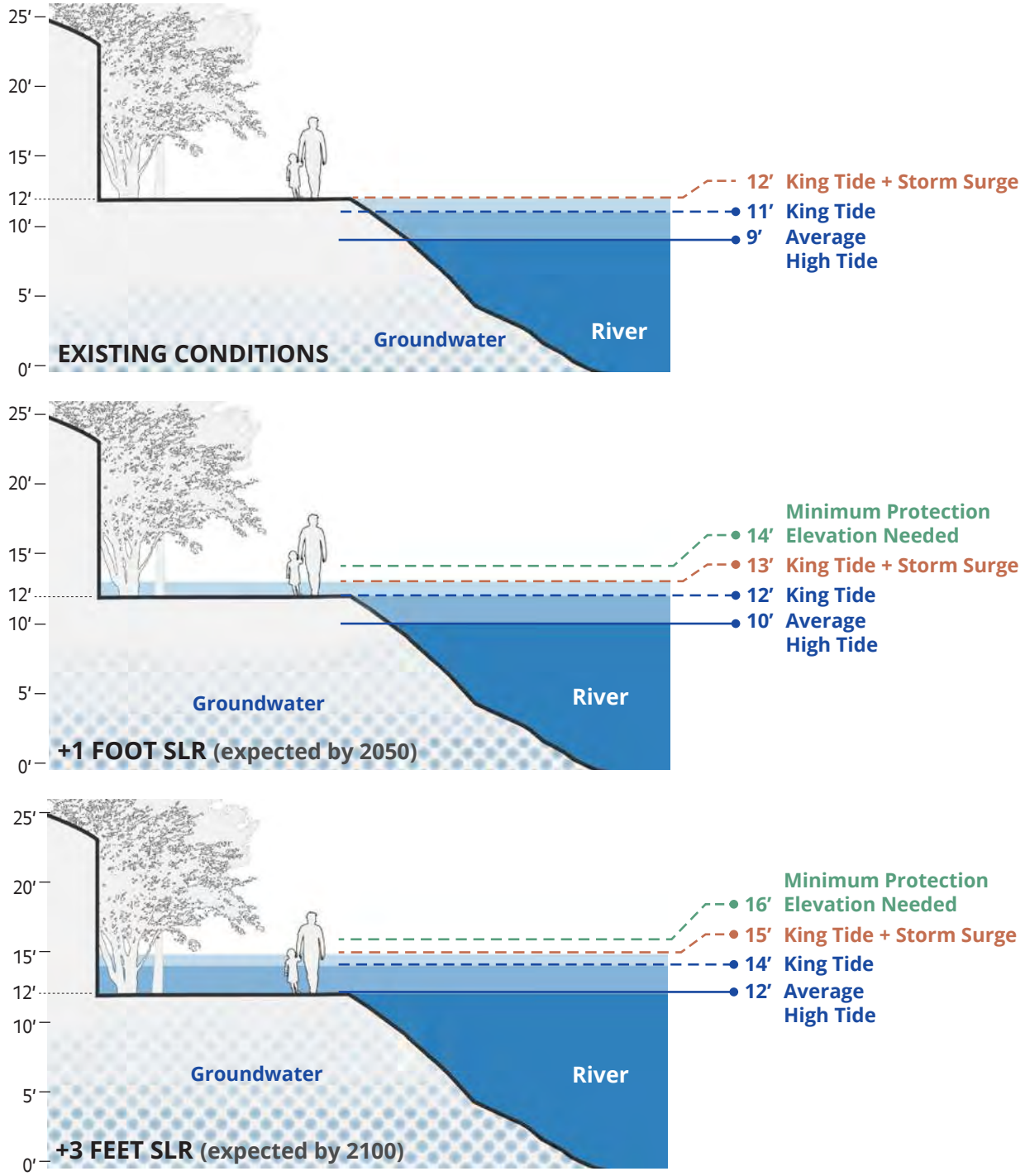


Figure 7: Flood water heights based on SLR projections for the City of Seattle. Source: Miller et al., 2018.
Notes: A "king tide" is an annual high tide that occurs a few times per year.
Average High Tide refers to Mean Higher High Water (MHHW). Elevations are shown in North American Vertical Datum of 1988 (NAVD88)

In addition to coastal flooding, groundwater tends to rise along with sea level. This could make stormwater flooding worse in low lying areas farther away from the bank.

The map in Figure 8 shows the approximate areas that could be impacted during the highest flood elevation projected with SLR by 2050 and 2100. In South Park, coastal flooding overtops the shoreline on industrial sites and street-ends and flows through the streets, where it floods nearby residential areas. Most of the South Park industrial area is located in the FEMA 1% Annual Exceedance Flood Hazard Zone and or Seattle's designated flood-prone areas. Flooding also impacts a small area of unincorporated King County in the South Park neighborhood. Coastal flooding in Georgetown is limited to riverfront industrial sites, and does not extend to surrounding areas.

With 1 foot of SLR by 2050, the industrial areas of South Park can expect inundation of about 65 acres of the industrial area during king tide and storm surge events. Without SLR adaptation infrastructure, regular flood events are likely.

With a total of three feet of SLR by 2100, king tides combined with storm surge in this study area could lead to inundation of about 100 acres of the industrial area of South Park, 40 acres of the industrial area of Georgetown, and 6 acres of residential area at the southern edge of South Park within unincorporated King County.

In addition to coastal flooding, the low-lying areas shown in grey will be increasingly vulnerable to urban stormwater flooding as sea level and groundwater levels rise. Some of these areas, particularly in Georgetown, already experience urban flooding worsened by high tides.

Low-lying areas in the South Park industrial zone already experience high-tide flooding from the river.

Low-lying riverbank area on the South Park shoreline.

Low-lying industrial area in Georgetown (within a cluster of creative and working artist spaces) that has experienced urban flooding worsened by high tides.

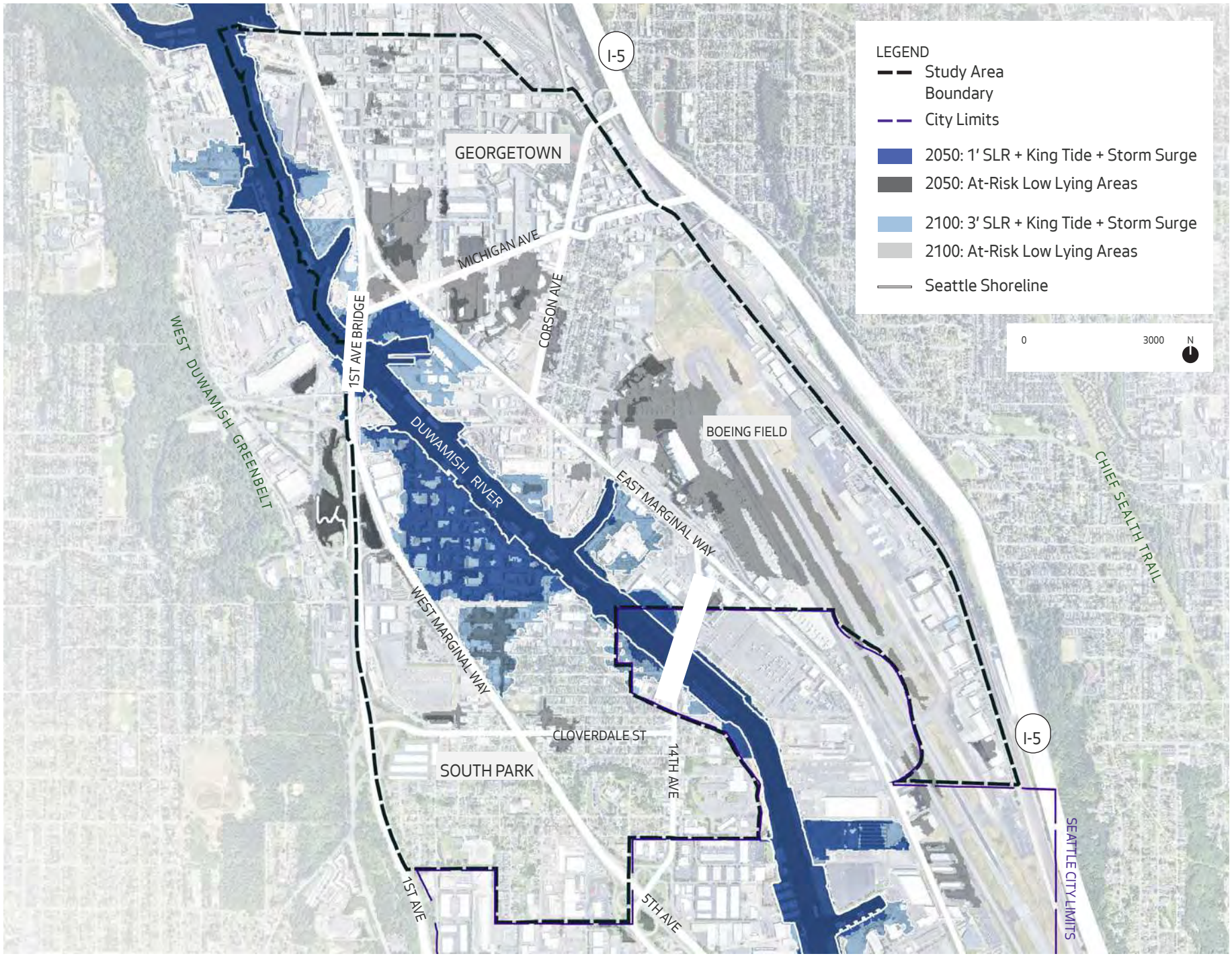


Figure 8: Flood impacts expected with king tide, storm surge, and SLR in 2050 and 2100. Based on SLR projections for the City of Seattle. Source: Miller et al., 2018.

Experiencing the Impacts of SLR

On December 27, 2022, a king tide combined with a low pressure system to create an historic flood event. At 8am, the water elevation reached 12 feet and 9 inches in Elliott Bay (NOAA, 2025). Water levels in South Park were recorded on a security camera to be even higher at around 12 feet and 11 inches (SPU, 2022).

Figure 9 shows an approximate map of the flood. Water overtopped the riverbanks first at the lowest points along the bank in South Park, including the intersections of 5th Ave. S and S Fontanelle St. and S Riverside St. and S Austin St. As the water rose, it flowed over higher elevation areas of the bank, including the intersection of S Riverside Dr. and S 7th Ave. and the intersection of S 8th Ave. and S Portland St. In addition to flooding coming over the riverbanks, people in South Park experienced sewer overflows inside homes and buildings as the high river water pushed backward into combined sewer and stormwater pipes. Community members also observed street flooding from stormwater in low-lying areas in Georgetown. The devastating flood displaced about 30 families living in South Park and impacted multiple industrial properties. Serious flooding events like these highlight the urgency of flood protection.

As part of the emergency response to king tide and storm surge flooding events, SPU constructed temporary solutions to around 15 feet NAVD88 as a precaution. This is approximately the expected flood elevation in a king tide and storm surge in 2100 with SLR. The temporary protection provides a visual example of the elevation of future floods, and therefore the elevation needed to protect the neighborhoods from future coastal flooding with the impacts expected from SLR.

Photo looking east on S. Holden St. of high tide and storm surge flooding on the morning of December 27, 2022.

Photo looking west on S. Chicago Street during the flood. Credit: Port of Seattle

The approximate height of this temporary sandbag berm (15 feet NAVD88) is the elevation of expected king tide and storm surge flooding in 2100 with SLR. Protection from flooding in 2100 would need to be about a foot higher than this to ensure full protection.

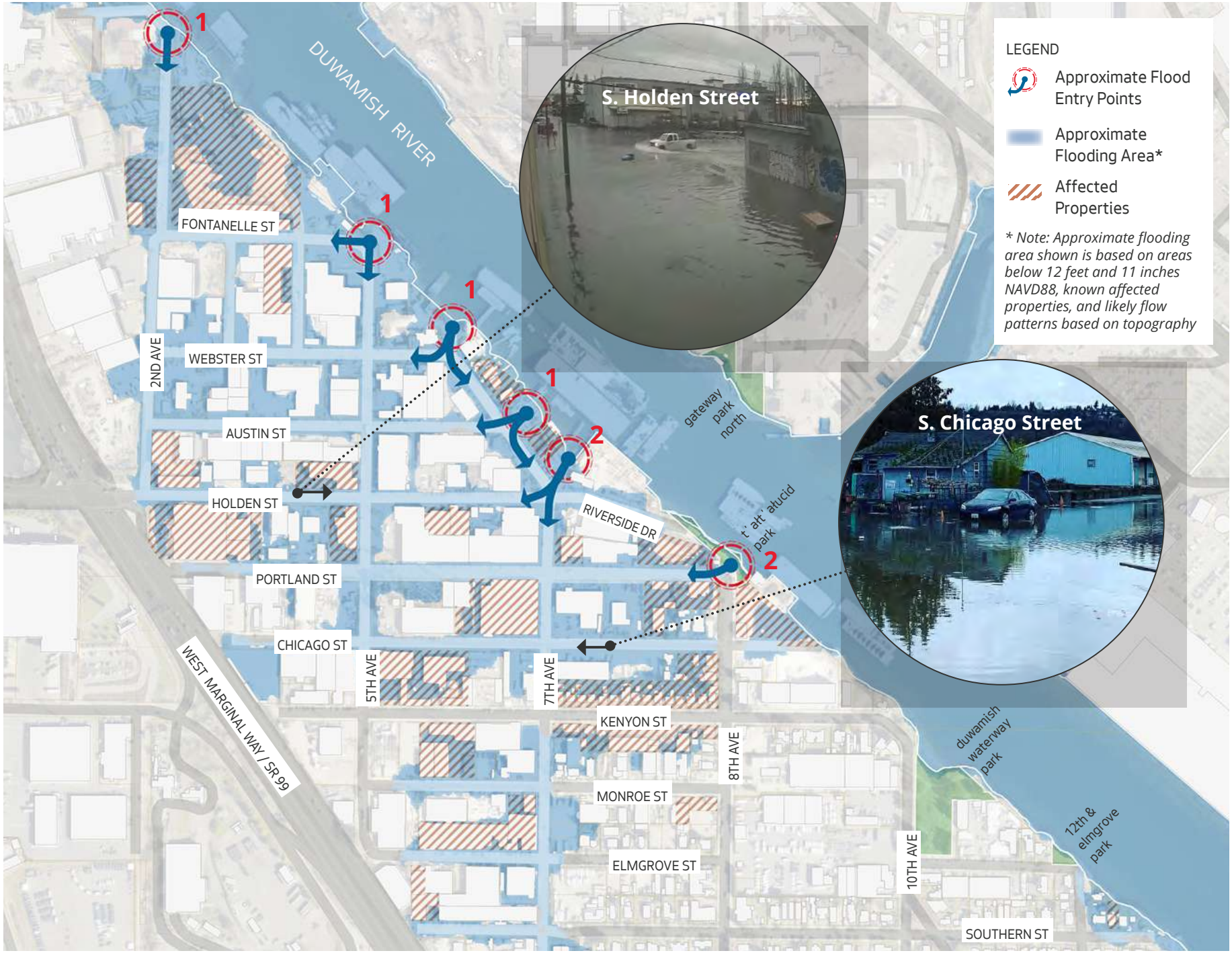


Figure 9. Approximate impacts of December 27th, 2022 flood event, with flood entry points numbered in the order that water overtopped the banks

Georgetown & Stormwater-Related Urban Flooding

While coastal inundation will flood some riverfront properties in Georgetown, stormwater-related urban flooding is a more widespread impact to the neighborhood. Urban flooding is caused by heavy rainfall or multiple short-duration storms in succession that overwhelm stormwater drainage system capacity. Climate change and SLR will likely make urban flooding issues worse over time. This situation may be worsened where the stormwater and wastewater systems are combined because of the combined volume of the two systems.

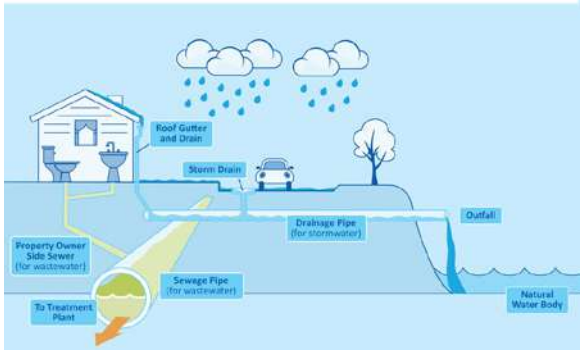
The flooding issues in Georgetown are a little more varied and complex than in the South Park neighborhood, because there are different types of drainage systems, shown at right, and mapped in Figure 10.

There are different types of flooding issues in Georgetown that SLR and climate change can impact. Firstly, the lack of drainage infrastructure results in localized flooding. Low spots that are missing catch basins and pipes to collect and convey the stormwater cause this type of flooding (for example, big puddles on the side of the road). Community members have observed this type of flooding in streets in the industrial area of Georgetown during high tides. SLR will not impact this type of flooding, but climate change is expected to increase the intensity of rainfall, which could result in more frequent localized flooding. Solutions typically involve installing the missing infrastructure, including catch basins, pipes, and green infrastructure to convey the water to drainage.

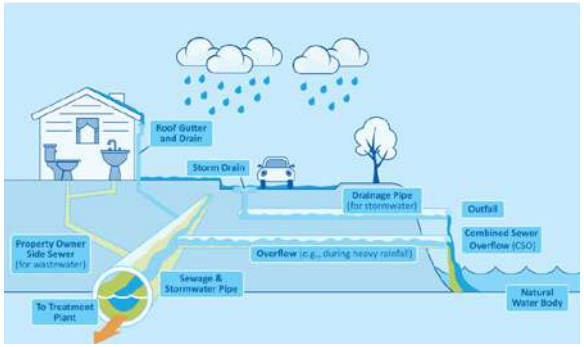
Additionally, Georgetown's drainage system lacks capacity and can be overwhelmed during heavy rain that coincides with a high tide or when a catch basin is clogged. This type of flooding results in stormwater (and/or combined sewage, depending on the type of drainage system) backing up onto the street or into homes and businesses. The frequency of this type of flooding depends on the type of drainage system as different areas of Georgetown have combined sewers, as well as separated and partially separated sewer systems (see Figure 10). In areas with combined sewers, it typically only occurs during large storms, but in separate or partially separated areas it could also happen during smaller storms if rain gets into the sanitary sewer or if a blockage occurs. SLR and climate change will increase the frequency and intensity of these types of flooding events. Solutions typically include installing backflow preventers on the ends of outfall pipes and side sewers, increasing pipe sizes, adding storage, or building pump stations.

COMBINED SEWER SYSTEM

SEPARATED SEWER SYSTEM



PARTIALLY SEPARATED SEWER SYSTEM



These diagrams show how combined, separated, and partially separated sewer systems work. Georgetown has all three types of sewer systems in place in different parts of the neighborhood - see Figure 10 for additional detail.
Diagram Source: SPU Shape Our Water

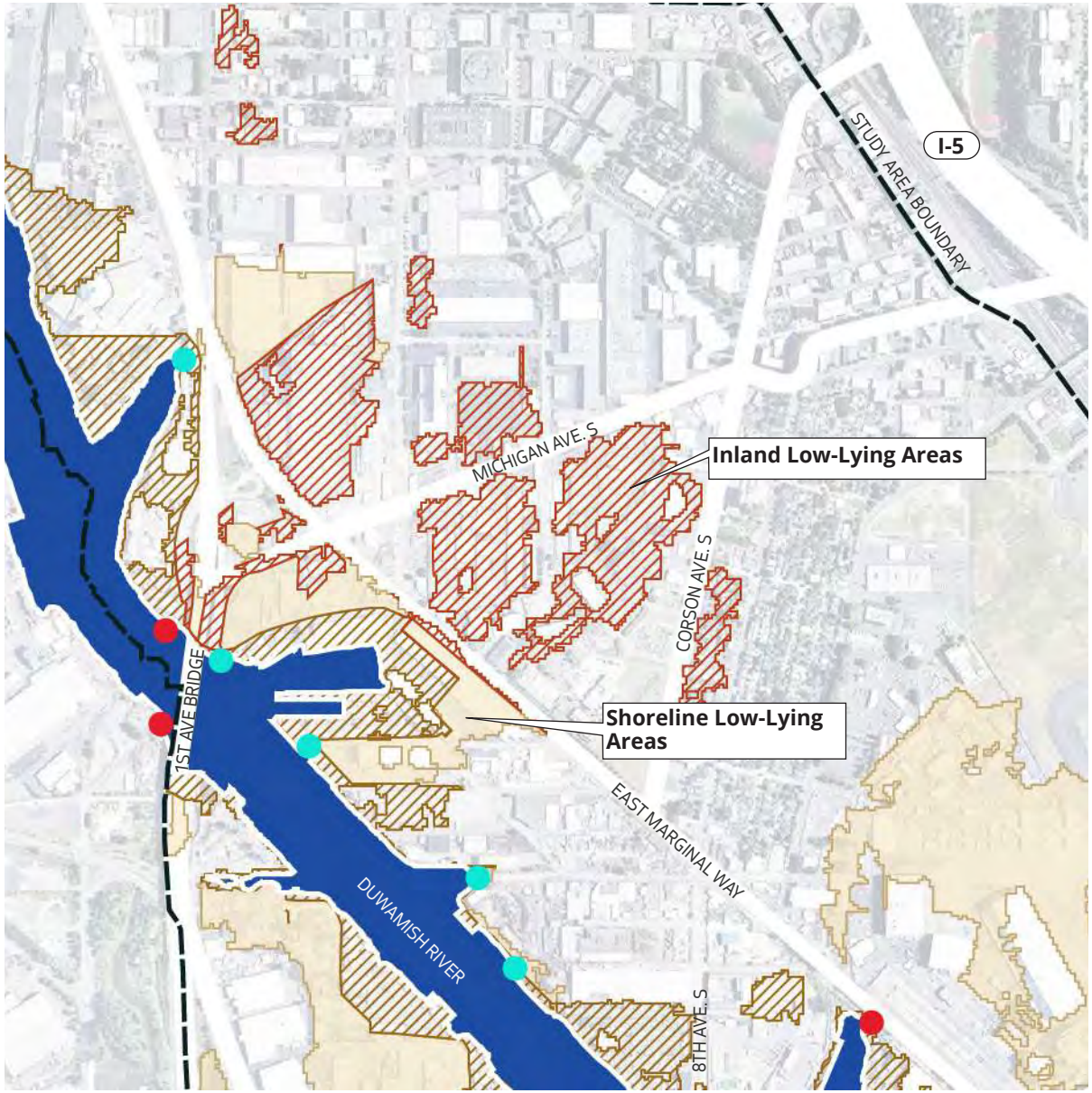


Figure 10: Three types of sewer basins within the low-lying areas of Georgetown and South Park. With SLR, low-lying areas will become increasingly vulnerable to flooding for different reasons depending on what kind of basin they are located in.

Example of urban flooding that could be caused by drainage backups or inadequate local stormwater drainage infrastructure.

Ongoing Efforts to Address Urban Flooding

The City and partners are making infrastructure improvements to address urban flooding, including:

- **South Park Pump Station.** Completed in 2023, this facility pumps stormwater runoff into the river during high tide events when the river levels rise above outfalls, preventing the storm drain system from draining by gravity. The pump station will reduce flooding in the industrial and residential areas in the northern part of South Park.
- **Georgetown Wet Weather Treatment Facility (King County).** This new facility treats combined rain and wastewater that would otherwise discharge directly to the Duwamish River during heavy storms. Before the station was completed in 2022, heavy rains would fill up the area's sewer pipes, sending polluted runoff and sewage through a pipe into the river. Construction began in 2018 and was completed in 2023.
- **South Park Drainage and Roadway Partnership.** SPU and SDOT, supported by the King County Flood Control District. Pipe improvements from this project will collect and convey flows to the existing drainage system and lessen overall flooding. This work included adding pipes to improve drainage along S Holden St, S Chicago St, S Monroe St, & 5th Ave S.
- **South Park Water Quality Facility.** This is a new treatment facility on a 3-acre site along the river. It will remove a variety of pollutants from the stormwater from a 240-acre drainage basin before discharging it into the river.
- **South Park Drainage Improvements Project, Phase II (in design).** Phase II will continue to build out the formal piped drainage system on S Webster St, 5th Ave S, S Riverside Dr, and S Austin St. This project is estimated at $26 million and is expected to be completed in 2030.

SPU is assessing the feasibility to include sea level rise adaptation strategies into ongoing work (e.g., raising portions of the SPWQF site along the river and several street ends included in the Drainage Improvements Project, Phase II to function as berms).

Urban flooding in Georgetown and South Park will be influenced by rising sea levels and higher groundwater. Current infrastructure projects only address stormwater and drainage, and not SLR or other coastal flooding. The Duwamish Valley Water Resilience group expects to begin developing an Area Plan for Georgetown in the next few years to identify a comprehensive strategy for improving drainage and addressing impacts of climate change including SLR.

Temporary Flood Preparedness & Control Measures

Since the December 2022 flooding emergency, SPU has led preparedness and response activities in South Park to help the residents and businesses most at risk of flooding each wet weather season. In 2023, SPU drafted, and since has been implementing, the **South Park Readiness & Response Plan** (SPRRP), a document that outlines protocols for when and how to respond to flooding. Key components of this work include:

- **Floodwall & Bypass Pumps Design.** SPU designed a flood protection wall throughout the lowest lying areas along the Duwamish River to reduce impacts from river overtopping. The design is revisited every year to incorporate lessons learned from the previous season.
- **Logistics.** SPU crews build and maintain the floodwall.
- **Operations.** SPU crews can deploy six pumps and bypass systems to drain water away from roads.
- **Engagement & Communications.** SPU staff communicate with residents and businesses to support preparedness and response activities throughout the year. In 2025, this work included hosting a bilingual workshop for the Flood Community Advisory Group (in partnership with the Duwamish River Community Coalition, Villa Comunitaria, and Just Health Action); sending a mailer to those most at risk of flooding; door-to-door outreach; and sending text and email notifications.

In addition to these investments, SPU also works with a Near-Term Flooding Community Advisory Group of impacted residents to understand impacts and build awareness and engagement in preparedness and prevention.

While this temporary and emergency preparedness work can help to protect the community from coastal flooding in the near term, the City and private property owners will need to build permanent adaptation infrastructure and flooding adaption measures to protect the community from worsening coastal flooding from SLR.

Emergency preparedness efforts including temporary sandbag walls to protect from river flooding (SPU & King County)

South Park Pump Station (SPU)

Drainage and Roadway Improvements (SPU/SDOT)

South Park Water Quality Facility Site (SPU)

"HEAL THE DUWAMISH AND HELP PEOPLE LIVING IN THE DUWAMISH WATERSHED AREA AND THE LAND ITSELF!"

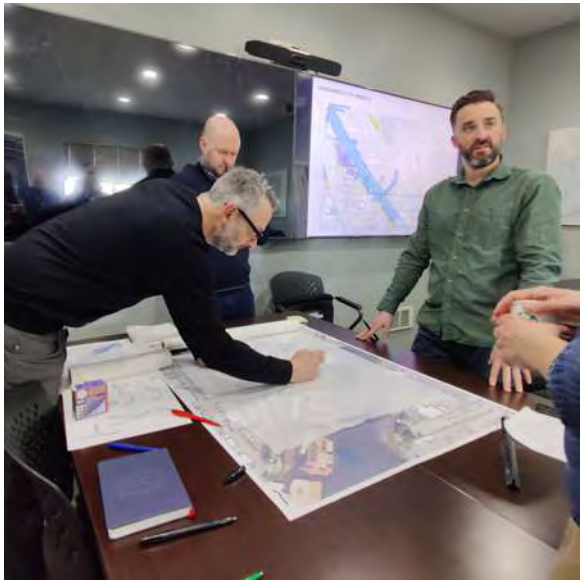
DUWAMISH VALLEY RESIDENT

2_COMMUNITY ENGAGEMENT

A key goal of this project was to summarize input and guidance from the community --both residents and businesses--toward a proposed approach for the development of SLR adaptation infrastructure. The project engaged broadly with local community, including existing community organizations. To guide and inform the work, the City convened a 17-member Community Advisory Group (CAG), including community members, representatives from community-based organizations, and industrial businesses in the Duwamish Valley. The CAG's purpose is to ensure those most affected by climate change--and those who currently tend to benefit the least from environmental and capital investments--guide the planning, design, and implementation of these programs and investments.

In addition to engagement conducted through this planning effort, the City coordinated with engagement efforts led by community-based organizations like the Duwamish River Community Coalition, the Duwamish Valley Sustainability Association, and others. This coordination with community-led efforts and expertise will continue to inform the City's work on climate adaptation.

Multilingual Open House, June 2024



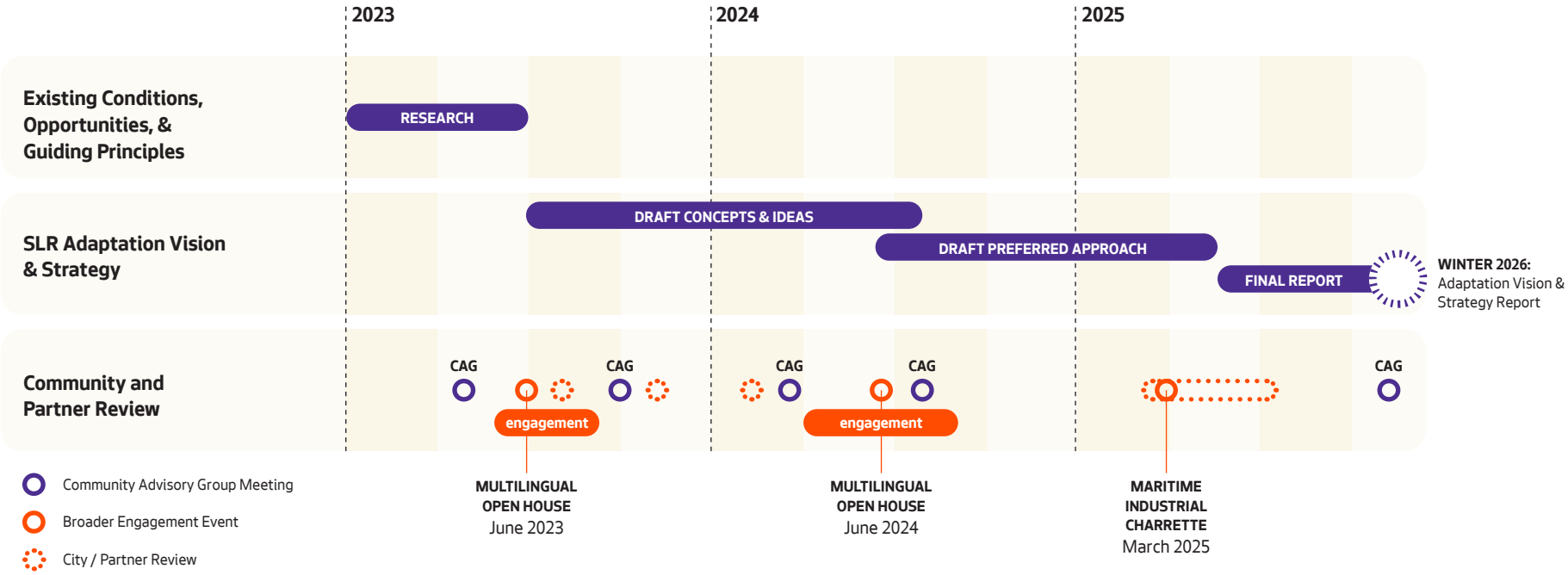
Maritime Industrial Charrette, March 2025

Process & Timeline

The City and consultant team conducted broad community engagement throughout the project, including multilingual open houses, workshops with the Duwamish Valley Youth Coalition and at the local Environmental Justice Forum, tabling at the Duwamish River Festival and meetings, a maritime industrial charrette for business owners and workers, and online surveys. Community engagement included both sharing information about flooding and existing community goals and asking for input on priorities for how to address increasing flooding. The CAG provided guidance on the broader community engagement strategy.

The CAG met periodically to review and provide input during the process. CAG meetings included review of flooding information, developing design principles for SLR adaptation infrastructure, and review and discussion of concepts and ideas to inform the overall vision and strategy for SLR adaptation. The City also conducted a workshop with maritime industrial businesses to understand operational needs of water-dependent industrial uses and explore the relationship between private and public strategies to address SLR.

In parallel with CAG and public input, the City conducted internal engagement with departments and leaders whose work overlaps with flood adaptation. The combination of City in-reach and community outreach directly informed the development and refinement of the vision and strategy.



Community Engagement Process & Timeline

Guiding Principles

Environmental justice and equitable development requires mechanisms for communication, transparency, and accountability. The engagement process enabled this work to reflect the priorities of those most affected by racial inequities and health disparities. To align climate adaptation and resilience efforts with these aims, the CAG developed the following Guiding Principles for achieving community resilience. Feedback from 213 community members who live, work, play, learn, and recreate in the Duwamish Valley directly informed these principles.

The Guiding Principles represent overarching values that form a vision for holistic climate resilience.

- **Support and uplift affected communities who are most impacted by climate change** through inclusive, community-centered decision-making that amplifies voices and promotes the interests of the Duwamish Valley.
- **Protect and accommodate with adaptive and creative infrastructure** that provides multiple benefits to the community.
- **Provide equitable benefits for residents and businesses.** Seek solutions that equitably promote local industry employment and support prosperity in place.
- **Promote racial equity and a thriving economy** by embedding a racial equity lens into all aspects of the work.
- **Prioritize feasible and nature-based solutions.** Aim to bring community and ecosystems back into relationship with the land, sky, river, and each other.

The Guiding Principles served as a broad direction to develop a more specific vision and Design Principles for SLR adaptation infrastructure.

Key Themes

Through engagement with Duwamish Valley communities, the following key themes informed the SLR adaptation vision and strategies:

- Flooding is an urgent issue that requires immediate investment, including support for families who have already been impacted by severe flooding.
- Community members want to see community-serving uses and public access as part of SLR adaptation infrastructure, including green space, ecology, and recreation.
- Infrastructure design should incorporate seating, views, tree canopy, cultural representation, and other public amenities.
- Waterfront property owners prefer to adapt to SLR independently.
- SLR adaptation strategies should focus on restoring the health of the community and the river, including cleaning up existing contamination and ensuring that current and future industrial uses do not pollute the river and the land.
- Adaptation strategies should seek to create balance and better relationship between industrial and residential areas, supporting the functional needs of industry while improving the well-being of residents and workers.
- It will be important to coordinate with King County on adaptation planning for areas of South Park that are outside City limits.
- Community members want to see holistic, creative, and large-scale solutions to the problems of SLR and climate change; but they also want to protect the community as soon as possible, even if that requires smaller-scale interventions to start.

Kayakers in the Duwamish River

Community participate in riparian planting

"I WANT TO MAKE SURE FUTURE DEVELOPMENTS REPRESENT THE COMMUNITIES AND CULTURES THAT HAVE CALLED THIS NEIGHBORHOOD HOME."

DUWAMISH VALLEY RESIDENT

3_SLR ADAPTATION VISION & STRATEGIES

VISION

Sea level rise adaptation and flood management in the Duwamish Valley present opportunities to achieve multiple community priorities and advance racial equity outcomes. These investments in the Duwamish Valley will support long-term resilience of the community, industry, and ecology.

Design Principles

The Community Advisory Group developed the following Design Principles to describe their vision for what SLR adaptation infrastructure projects should achieve. Each phase of work can prioritize providing multiple community benefits, including the following:

- **Habitat & Ecology.** Improve habitat quantity and quality and restore tree canopy that supports improved ecological and public health.
- **Public Access & Co-Benefits.** Provide access to the river and green spaces to improve health and well-being.
- **Equity & Prosperity in Place.** Support anti-displacement and minimize harm to residents and businesses while providing local jobs.
- **Economic Impact.** Create direct and indirect economic benefits to local industrial and residential communities and ensure equitable distribution of costs.
- **Adaptability & Effectiveness.** Prioritize critical near-term investments to protect communities while maximizing long-term adaptability and resilience to other climate threats.
- **Feasibility.** Plan for investments in infrastructure that are feasible to build and maintain over the long term.
- **Participation & Transparent Process.** Continue meaningful community engagement and transparent processes.

Adaptation infrastructure projects for SLR and flood management, including streets, utilities, and other public improvements, should provide multiple benefits that advance the overall vision as outlined in the Design Principles.

The City will continue to refine the vision and Design Principles through ongoing engagement with Duwamish Valley communities.

APPROACH TO SEA LEVEL RISE ADAPTATION

SLR impacts are expected to be broadest-reaching in South Park, where about 100 acres of land will be increasingly exposed to coastal flooding. This includes a large number of properties that are not located directly on the riverbank. In Georgetown, coastal flooding with SLR will mostly impact about 40 acres of privately owned shoreline properties. Figure 11 shows the areas expected to be exposed to frequent flooding with three feet of SLR, two feet of king tide, and one foot of storm surge.

Figure 12 shows the City's approach to SLR adaptation. In order to protect the large vulnerable area of South Park, a continuous line of infrastructure will be needed near the shoreline. This will create a higher elevation than the projected flooding levels and will stop high tides from overtopping the riverbanks and site. Publicly-owned streets and rights-of-way in South Park, and existing publicly-owned sites like the future South Park Water Quality Facility, present the most immediate opportunity for continuous, comprehensive protection infrastructure. Street ends provide early opportunities to raise the lowest existing areas along the shoreline.

The City and partners envision an integrated and holistic approach to adaptation, leading with projects on public properties, then exploring partnerships as opportunities arise. Adaptation will be a collaborative effort, continuing to work closely with the community, including property owners, on planning and design of adaptation infrastructure. Private property owners along the shoreline whose sites are exposed to coastal flooding may choose to adapt to flooding using various strategies. The City, and other public agencies can collaborate with these private owners to find opportunities for coordinated investments that provide maximum effectiveness, achieve shared goals, and make efficient use of resources.

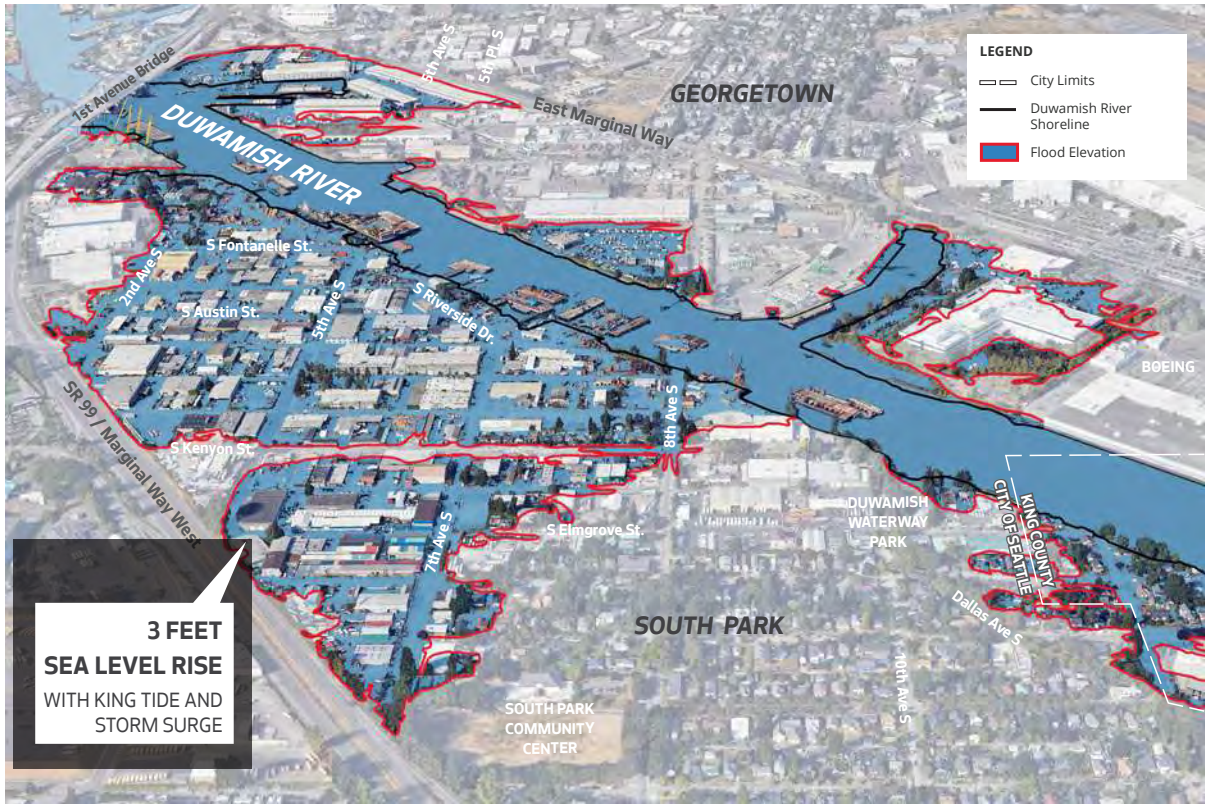


Figure 11. Flood level with three feet of SLR during a King Tide and storm surge. About 100 acres of South Park and 40 acres of Georgetown are exposed to flooding in this kind of flood event, which is expected to occur frequently by the year 2100.

King County will need to continue working with the City and have conversations with affected residents in the unincorporated "Sliver by the River" to identify specific adaptation strategies for this area.

Each phase of public investment in SLR and coastal flood adaptation will consider longer-term resilience. This means ensuring that early projects support, rather than preclude, a long-term strategy for complete flood protection that provides multiple community benefits.

Seattle's proposed approach reflects a shared vision of community and City based on current understanding, and developed through three years of research, information-sharing, development of ideas and strategies, community engagement, and review by City leadership and partner agencies. It is a starting point for continued analysis, reviews, requests for grant funding, and consultations.

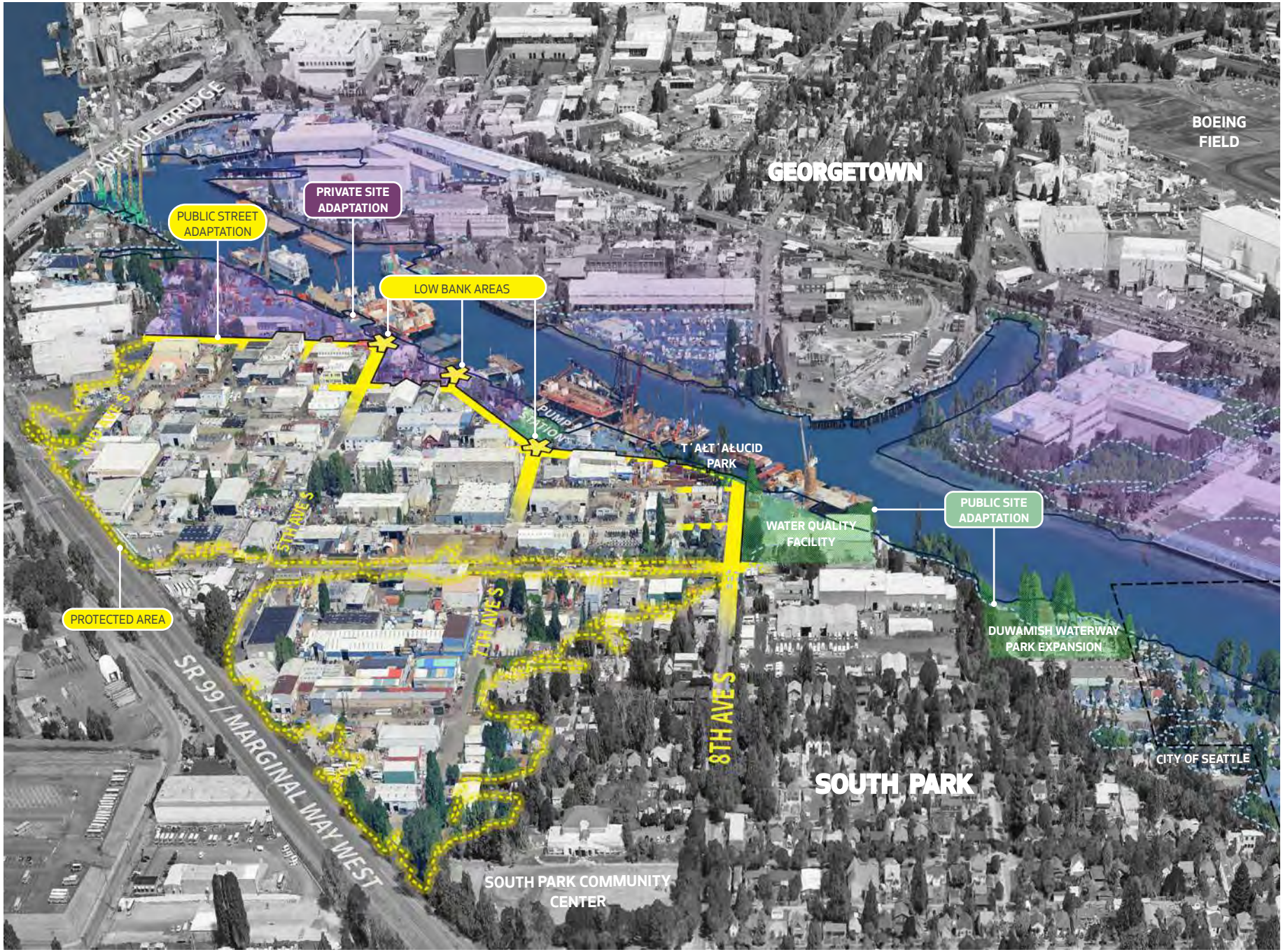


Figure 12. Recommended Adaptation Approach. Note: This image does not represent a final City of Seattle policy or proposal. It is intended to facilitate conversations with community, agencies and decision makers. This work will be refined over multiple phases including: further community engagement, technical and financial analysis; consultations with Tribes and agencies; permitting and environmental reviews; and City Mayoral and Council decisions.

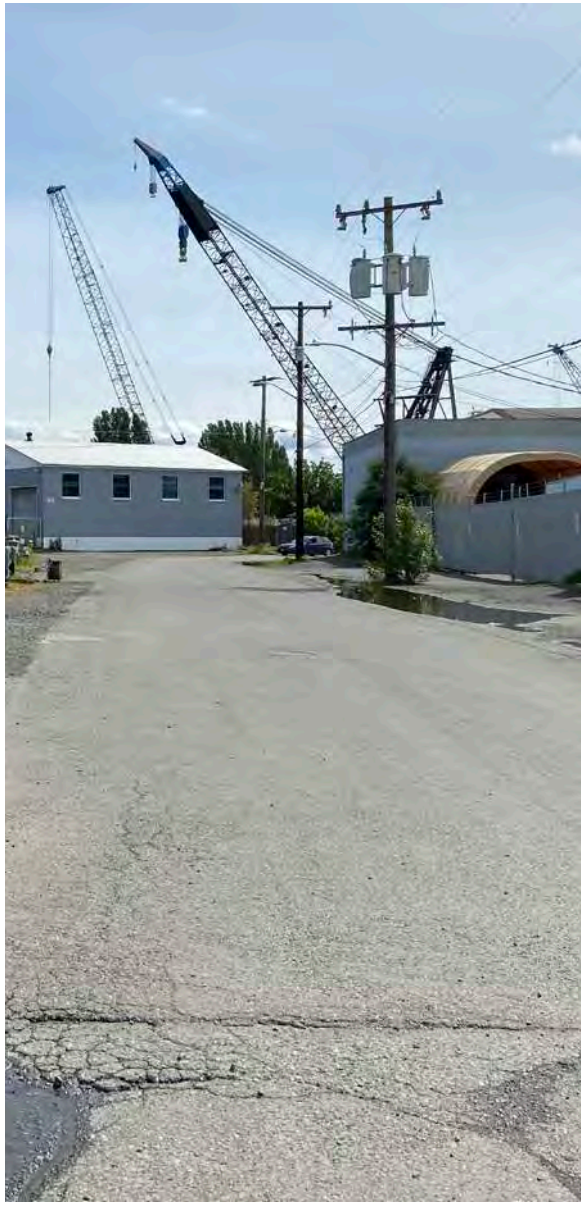
Part 1: Lead with Public Property

Adaptation will lead with a focus on public land to create a backbone of flood management infrastructure and to implement multiple benefits. Potential sites include public street right-of-ways, including street ends; and existing publicly-owned sites like the South Park Water Quality Facility. Early investments can focus on the lowest elevation areas along the shoreline.

Over time, the City can work with private properties to understand and address transportation and maritime access needs and explore partnerships to support private property owners to implement best practices that mitigate the impacts of flooding from SLR.

The benefits of leading with public property include the following:

- Ability to protect a significant area, including almost all businesses and residences in the South Park industrial area
- Opportunity to meet stormwater quality goals
- City owns and controls rights-of-way and SPU and park sites
- Potential to provide multiple benefits through flood adaptation investments that also provide needed improvements to utilities and transportation
- Several public projects are already underway, including the South Park Water Quality Facility, Unity Electric site, and SPU/SDOT drainage and roadway improvements
- Demonstrated positive benefit / cost ratio
- Opportunity for multiple benefits
- Allows the City to identify and pursue strategies that are appropriate for both private and public entities



Public Right-of-Way

Public street end where it meets the shoreline

South Park Water Quality Facility Site

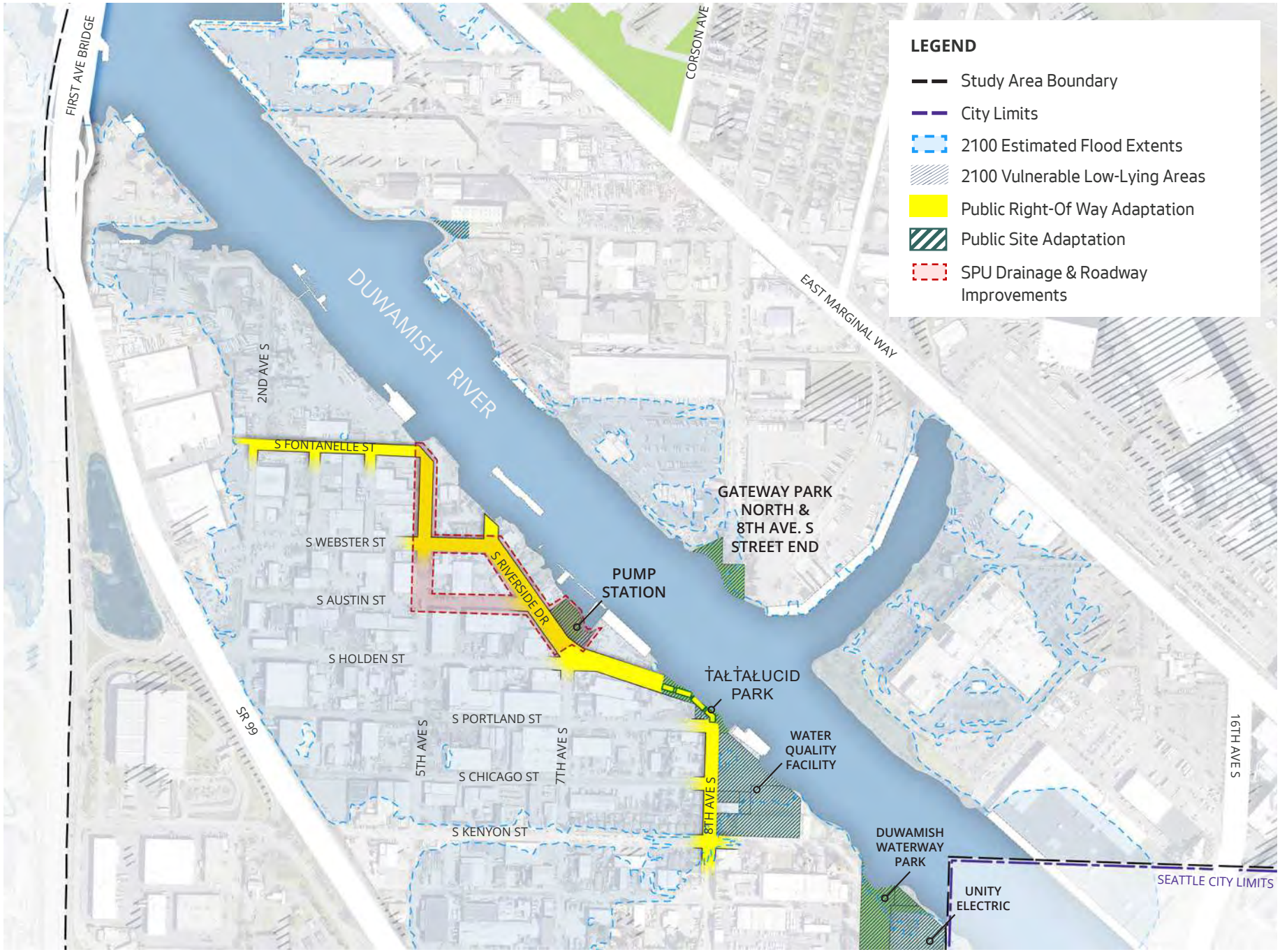


Figure 13. Leading with Public Property. Note: These examples and associated images do not represent City of Seattle policy or proposals. The descriptions and associated images are intended to facilitate conversations with community, agencies and decision makers. This work will be refined over multiple phases including: further community engagement, technical and financial analysis; consultations with Tribes and agencies; permitting and environmental reviews; and City Mayoral and Council decisions.

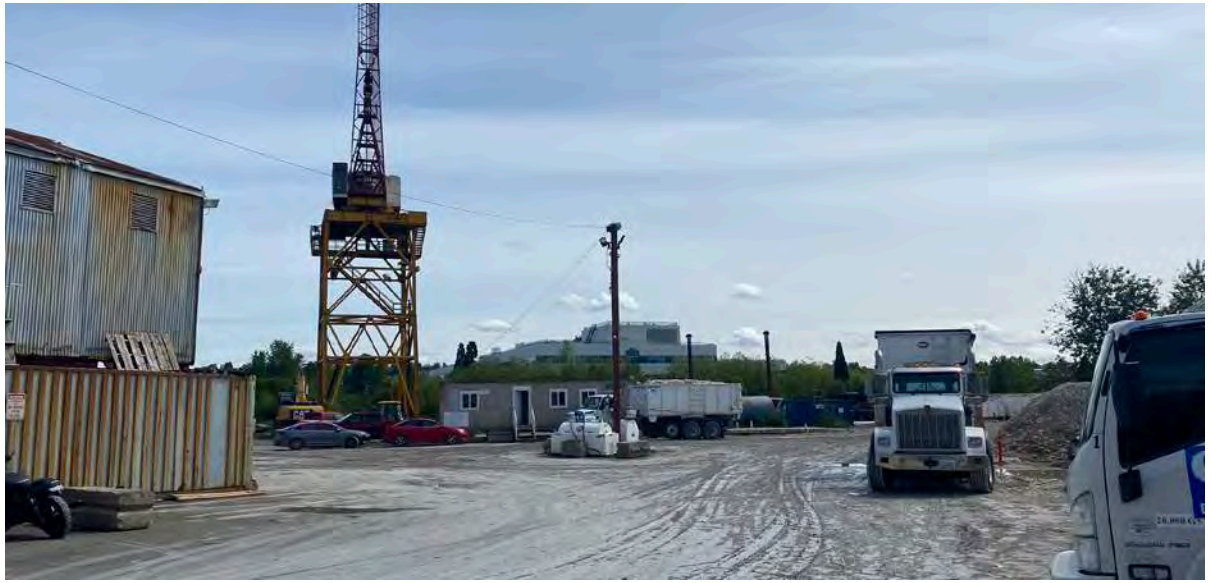
Part 2: Partnerships with Private Properties

Water-dependent industries and private property owners may adapt properties in ways that reflect their operational needs. There are opportunities to partner and collaborate along the shoreline, at street edges, and through permitting and environmental review, to achieve shared objectives and multiple benefits while increasing economies of scale. The benefits of this approach include:

- Most of the shoreline is in private ownership, creating significant opportunities for the City to partner with private landowners
- Support continued operation of primarily water-dependent, industrial properties
- Integrate public investments with private investments in flood adaptation and incorporate owner expertise on their site and access needs
- Potential for Port and Tribal partnerships in the Duwamish Waterway
- Allows the City to identify and pursue strategies that are appropriate for both private and public entities, with a focus on multiple benefits

Maritime Access and Use

Working Yards



Cranes and Loading Access

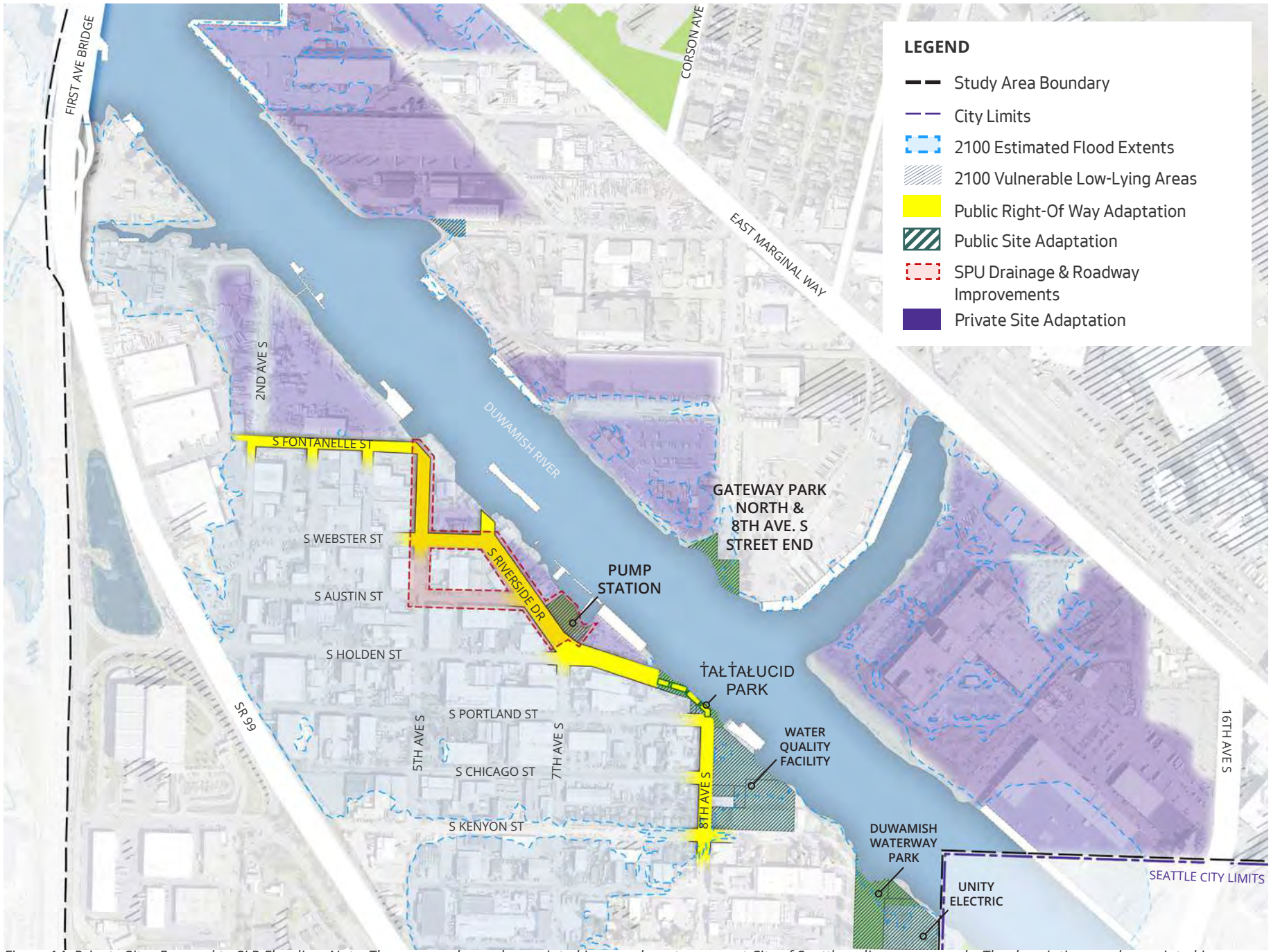


Figure 14. Private Sites Exposed to SLR Flooding. Note: These examples and associated images do not represent City of Seattle policy or proposals. The descriptions and associated images are intended to facilitate conversations with community, agencies and decision makers. This work will be refined over multiple phases including: further community engagement, technical and financial analysis; consultations with Tribes and agencies; permitting and environmental reviews; and City Mayoral and Council decisions.

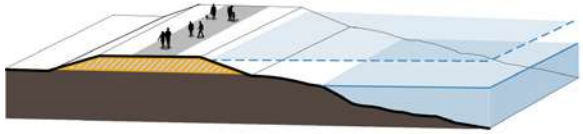
SLR ADAPTATION INFRASTRUCTURE STRATEGIES

The following examples of SLR adaptation infrastructure are early ideas that could be beneficial for publicly or privately owned sites. Infrastructure strategies can be customized or combined to incorporate multiple community benefits as outlined in the Design Principles.

The next phase of technical analysis and 2-5% design will identify a preliminary preferred design concept with potential locations to apply these strategies. These early ideas can inform the next phase of collaborating with private owners to define adaptation projects and explore feasibility.

LEVEE

A levee is an engineered structure, usually made of earth, with sloped sides and a flat top. A levee would act as a barrier to prevent the river from overtopping its banks during the highest tides. Bicycle and pedestrian walkways can be included along the flat top of a levee. To save space while providing additional height, a flood wall can be added to the top of a levee. When a levee is built along a shoreline, it can be designed to include riparian and in-water habitat on its wet side. If needed, levees can be designed for certification by FEMA so that properties behind the levee may be eligible for discounted flood insurance.

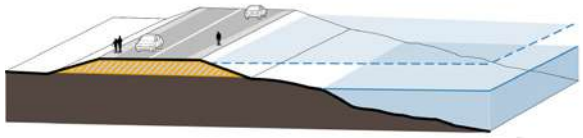


Levee with Multi-Use Path

Example: The Moonwalk Riverfront Park, New Orleans, LA

RAISED ROAD

A raised road is similar to a levee. It is a roadway that is elevated on top of a levee or earthen berm with sloped sides. Raised roads allow ongoing access to and through flood-prone areas while protecting areas behind them. Other cities, like Miami, FL and Honolulu, HI are pursuing raised roads as a strategy to adapt to rising tides. A key issue with raised roads is the potential impact to surrounding sites. A raised road takes up additional space for its side slopes; and it requires surrounding properties to reconfigure their access to slope up to the new height of the road or access their site from another location.



Raised Road

Example: Peirce Island Road, Portsmouth, NH

Riverwalk levee that includes a flood wall on top, providing additional protection height. Mt. Vernon, WA

"Living Levee" with salt marsh habitat in Alviso, CA

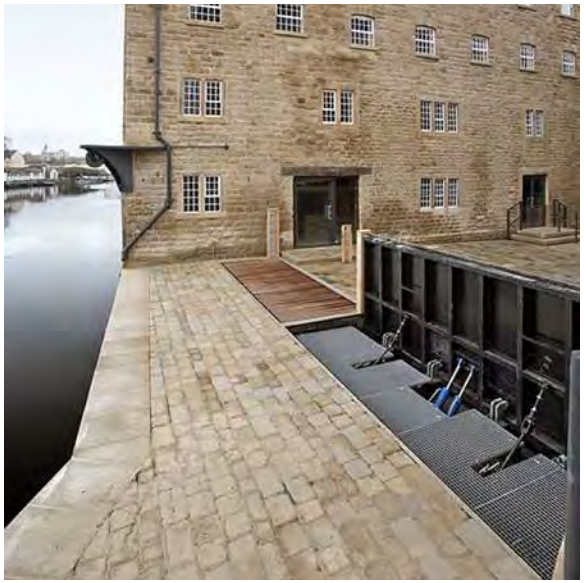
Access to a raised road in Miami Beach, FL

Marine Drive raised road along Columbia River, Portland, OR

DEPLOYABLE FLOOD WALL

A deployable flood wall is a flood barrier that can be raised when it is needed and removed or stowed away when it is not needed. The potential benefit of this strategy is that it allows access to the shoreline during dry times and only blocks off the shoreline during the most extreme high tide or storm surge events. Deployable flood walls that are truly temporary, like Hesco barriers, can be flexible in their location based on operational needs. Deployable walls can also be permanent features installed in a specific location, like automatic flood gates that pop up during flooding events.

Deployable Flood Wall

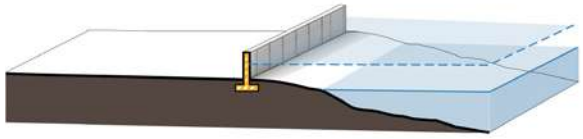


Example: Deployable flood wall

FLOOD WALL

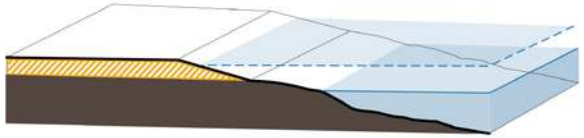
A flood wall is a permanent vertical structure made from man-made materials like concrete or steel. It acts as a barrier that keeps river water from flooding the land behind it. A flood wall made of "sheet piles", or interlocking steel segments, may be relatively simple to implement. However, sheet pile walls may perform poorly with repeated and increasing exposure to flooding over time. A wall with a deeper foundation, such as a diaphragm slurry wall, can be more resilient to water exposure while also helping to prevent underground contamination from moving into the river.

Flood walls, including deployable and permanent flood walls, can be beneficial on private sites where space is valuable and protection needs to fit within a narrow area. However, this strategy provides limited co-benefits beyond flood protection. Opportunities for habitat creation and nature-based solutions are limited.

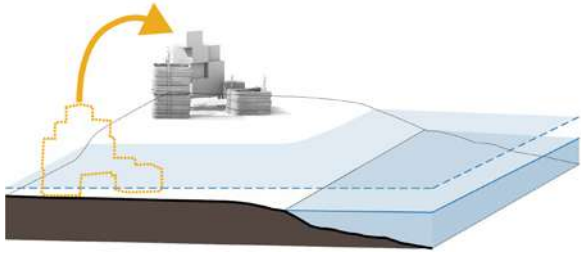


Flood Wall

Example: Transparent flood wall with gate at access point



Raised Site



Repositioning/Floodproofing

RAISED SITE

Public or private property owners may consider selectively raising portions of sites that need to remain dry during flood events. Adding fill to areas that are currently designated as flood-prone under city floodplain regulations may trigger additional requirements such as detailed engineering studies showing how the fill will affect surrounding flood-prone areas. For more information on floodplain regulations, see p. 57.

REPOSITIONING / FLOODPROOFING

Uses can be repositioned to higher ground within an existing site. Repositioning operations as needed to higher portions of the site might allow for lower portions of a site to safely flood if this does not disrupt site operations or public health and safety. If areas of a site are allowed to flood periodically, there is a risk of existing site contamination leaching back into the river when flooding recedes. Regulators can explore incentives for green buffers along the shoreline and other strategies to prevent any existing contamination from spreading through the movement of flood water.

If buildings are located in flood-prone areas of private sites, private owners could "floodproof" existing buildings, or redesign them so that flooding does not damage the structure and its contents. This could mean making a building watertight ("dry floodproofing"); or making the lower parts of the building out of materials that can withstand flooding and allowing the building to flood.

If private owners choose to reposition and/or floodproof instead of fully protecting from flooding, other flood protection may be needed to ensure that river water does not flood across shoreline sites and impact other properties behind them.

EXAMPLE ILLUSTRATIONS

Each example illustration shows how a **prototypical shoreline site** could be redesigned to adapt to rising tides. These examples demonstrate how various SLR adaptation strategies can be incorporated into adaptation projects to meet the vision and Design Principles. These illustrations were used as a basis for conversations with community members to better understand their priorities for how the design of SLR protection should provide **multiple community benefits**.

Each example illustration includes a summary of community feedback from the multilingual open house, online survey, CAG meetings, and other engagement with community members. Each example also lists key community priorities for multiple benefits that would allow the example project to meet the Design Principles.

The purpose of these illustrations is to foreground community priorities for multiple benefits with SLR adaptation. They can be used to support grant and other funding requests to inform more detailed planning and design for SLR adaptation on a site-by-site basis.

examples of community comments:

" PUBLIC ACCESS "

" PRESERVATION OF NATURE "

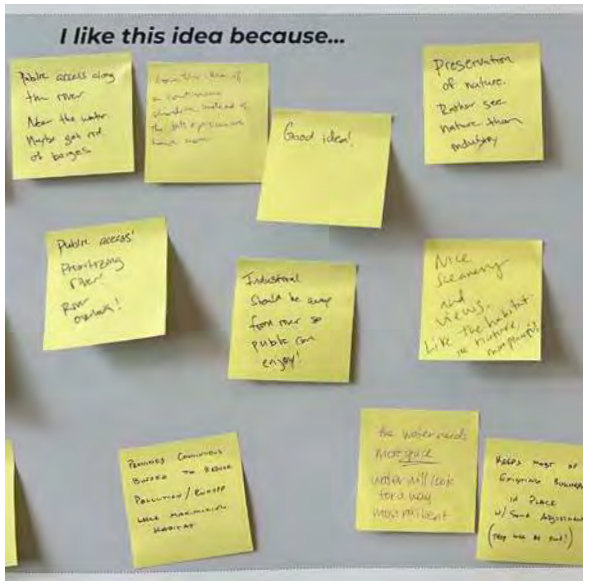
" SAFETY AND ACCESSIBILITY "

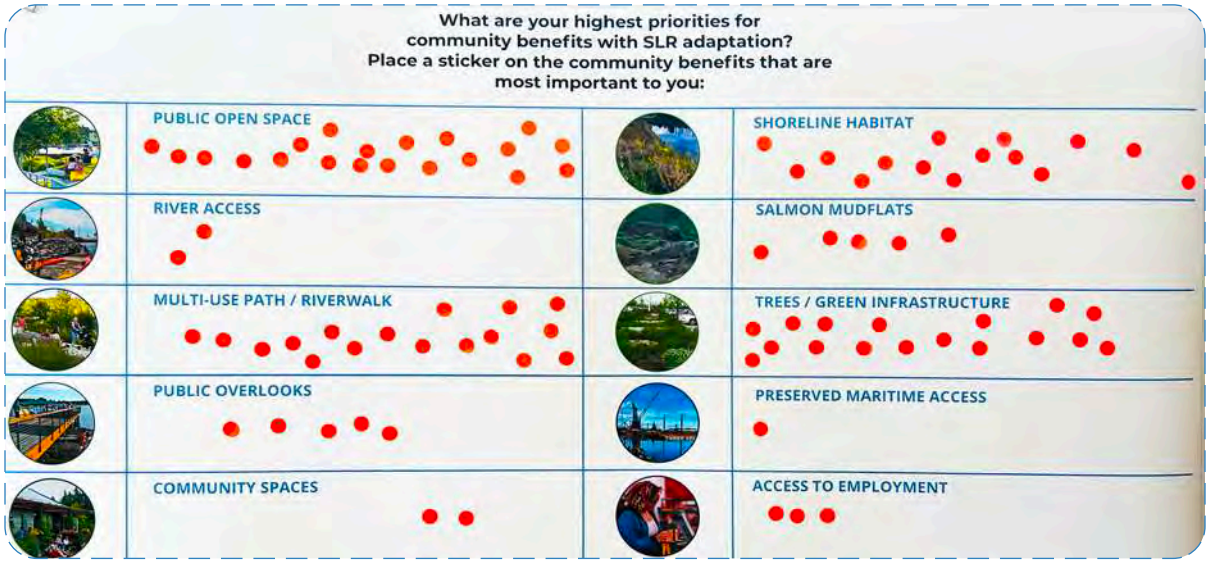
" WATER RECREATION "

" COMMUNITY AMENITIES "

" SCENERY AND VIEWS "

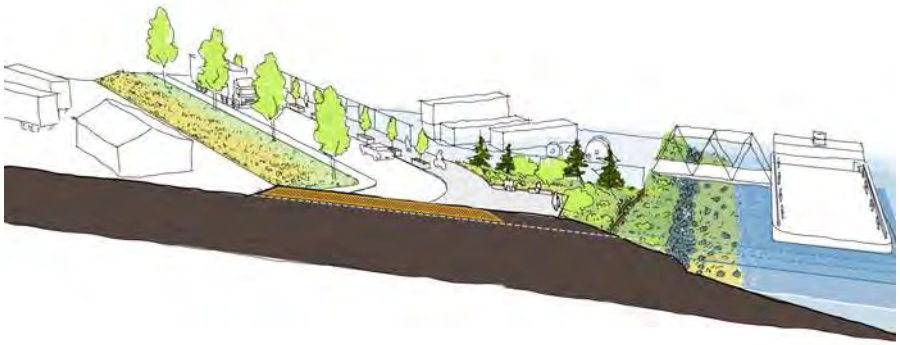
" REDUCE POLLUTION "





RAISED ROAD & STREET END

Roads and public sites could be raised to provide a continuous "backbone" of protection from increased river flooding.



LEVEE WITH HABITAT, PUBLIC ACCESS, AND COMMUNITY FACILITIES

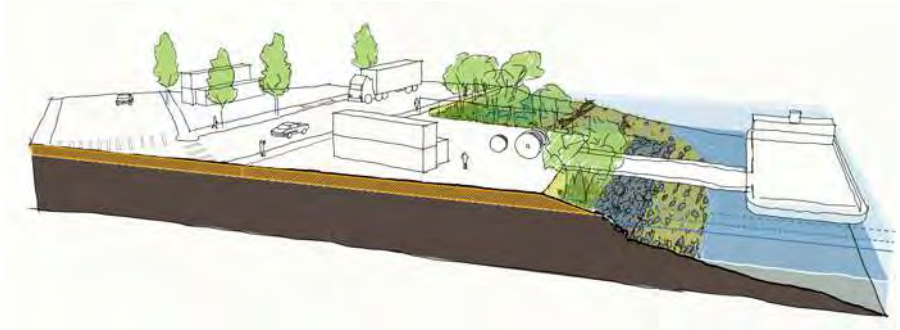
Community amenities could be integrated on public properties.

LEVEE OR RAISED ROAD WITH SIGNIFICANT SALMON HABITAT

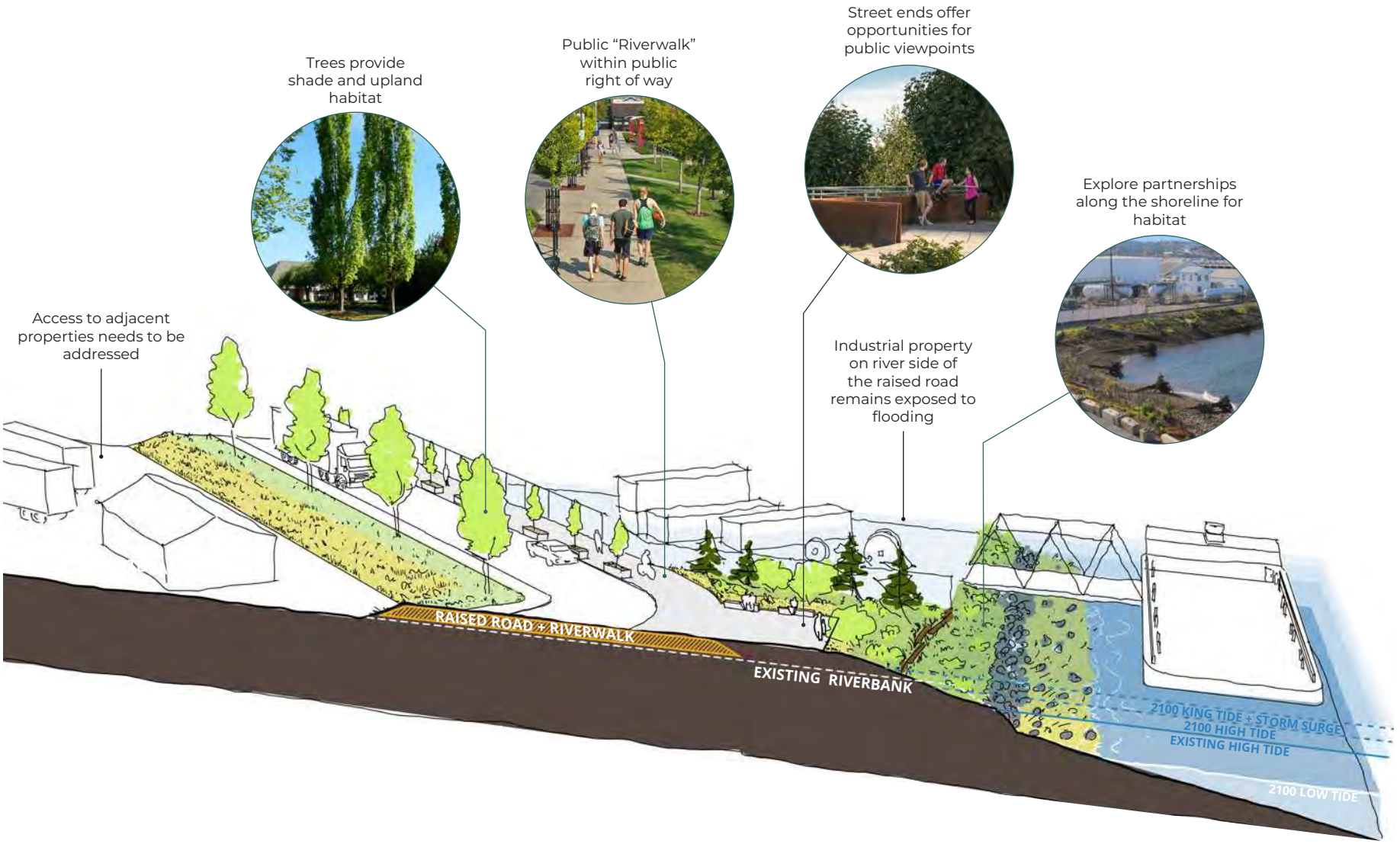
Significant habitat for salmon and other species could be integrated on public properties.

RAISED ROAD AND RAISED SITE PARTNERSHIP

Partnerships between private property adaptation and public investments could create habitat along the shoreline while achieving shared goals.



EXAMPLE: RAISED ROAD & STREET END



Raised Road & Street End

Roads and public sites could be raised to provide a continuous "backbone" of protection from increased river flooding. Raised roads would maintain access to businesses, and could provide improved walking and biking pathways to create a "Riverwalk" with periodic public viewpoints overlooking the river at public street ends. In addition to trees and greenery along the raised road, street ends could include riparian and other habitat restoration at the river's edge.

The City would need to work with private property owners on either side of the raised road to ensure they can access the street at its new elevation. Private properties on the river side of a raised road would remain exposed to increased river flooding in addition to reconfiguring access to connect to the raised road.

Community Feedback

Below are key themes from feedback shared by community members who reviewed this example.

Benefits

- May be easier and faster to protect the community as a first phase because the streets are publicly-owned
- Could be phased in order to meet changing needs
- Opportunity for public walking path and view and access points
- Creates healthier and greener environment for community members to walk and bike

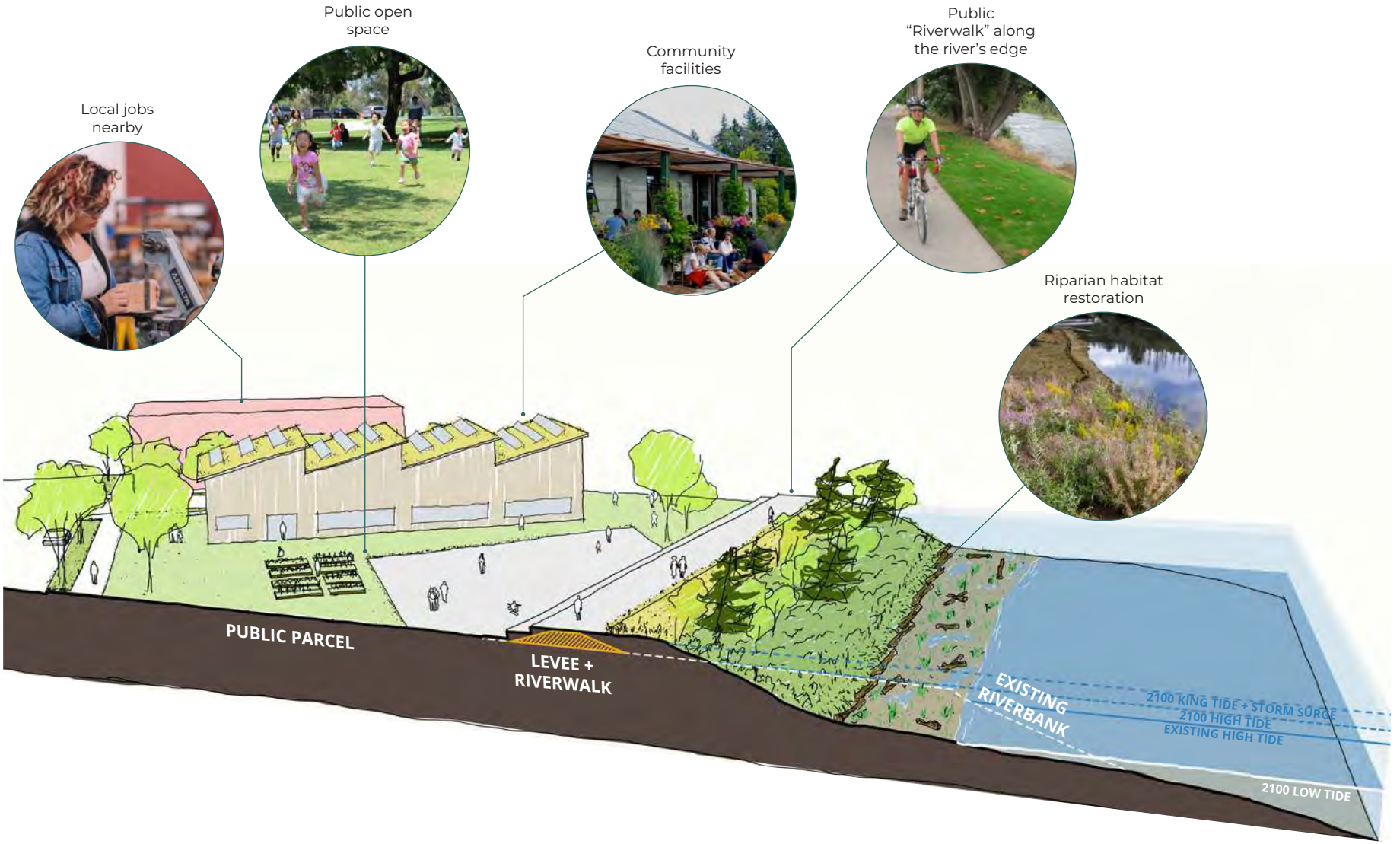
Concerns

- Complex coordination with private properties
- Limited opportunities for habitat restoration and other co-benefits to the community
- Uncertainty about flood protection for remaining areas, including industrial sites on the riverward side of the raised road
- Limits public access to the water
- Feels too small of an intervention for the scale of the problem

Community Priorities

Design Principle	Community Priorities
PUBLIC ACCESS & CO-BENEFITS	Ensure the raised road provides multiple co-benefits, such as safe walking & biking routes, trees, and street end overlooks
HABITAT & ECOLOGY	Create riparian habitat at street-ends, pollinator pathways, and green infrastructure; explore opportunities to partner with waterfront businesses and agencies to address needs of water-dependent uses and improve habitat
ADAPTABILITY, EFFECTIVENESS, & FEASIBILITY	Ensure opportunity to increase protection elevation over time
EQUITY & PROSPERITY IN PLACE	Provide protection to residential areas and mitigate displacement; preserve land for jobs and businesses.
ECONOMIC IMPACT	Work with private properties to address access needs
PARTICIPATION & TRANSPARENT PROCESS	Coordinate closely and partner with industrial businesses to meet their needs; and ensure clear communication and robust engagement with community on public infrastructure elements

EXAMPLE: LEVEE WITH HABITAT, PUBLIC ACCESS, AND COMMUNITY FACILITIES



Community Facilities, Levee, and Path with Habitat

This example shows how community amenities could be integrated on public properties including parks, street ends, and other City-owned properties. If protection like a levee is placed closer to the river shoreline, this could provide space for community facilities and public open space with recreation and shade. Open spaces can include active gathering spaces, like a plaza, or more passive green space with plants and habitat.

A levee at the shoreline could include a multi-use path or "Riverwalk" along its top. On the river side of the levee, riparian habitat on the slope of the riverbank can provide shade and refuge for birds, insects, and fish in the water below. There may be opportunities for in-water habitat by placing logs near the waterline or planting intertidal plants in the intertidal zone if the slopes are gentle enough to create a marsh bed. These kinds of habitat improvements can support fish and wildlife, improve water quality, and control erosion, among other benefits.

Community Feedback

Below are key themes from feedback on this example shared by community members.

Benefits

- Focuses on multiple community benefits
- Enhances "community by the river" feel
- Balances community and industry uses along the river

Concerns

- Complex coordination and permitting
- Contamination may exist on public sites and would need to be cleaned up
- Needs to be integrated with other strategies to provide continuous flood protection.

Community Priorities

Design Principle	Community Priorities
PUBLIC ACCESS & CO-BENEFITS	Include community facilities, open space, and river access including views
HABITAT & ECOLOGY	Provide riparian habitat along riverbank, tree canopy, and green infrastructure; maximize riparian habitat area on the river side of the levee
ADAPTABILITY, EFFECTIVENESS, & FEASIBILITY	Ensure opportunity to increase protection elevation over time
EQUITY & PROSPERITY IN PLACE	Provide community amenities for residents and workers
ECONOMIC IMPACT	Prioritize local hiring for construction, restoration, and maintenance
PARTICIPATION & TRANSPARENT PROCESS	Conduct clear communication & robust engagement to co-create community-supported site design

EXAMPLE: LEVEE OR RAISED ROAD WITH SIGNIFICANT SALMON HABITAT

Levee or Raised Road with Significant Salmon Habitat

This example shows how significant habitat for salmon and other species could be integrated on public properties, including parks and utility sites. It illustrates how Nature-Based Solutions could be integrated and maximized with SLR protection on a publicly-owned parcel along the shoreline. In this example, the shoreline is carved back as far as possible, creating shallow, gently sloping mudflat areas to support fish, including juvenile salmon. This could include critical off-channel habitat that allows juvenile salmon to rest during their transition from freshwater to saltwater fish. Additionally, the shoreline in this example includes riparian forest and vegetation, providing shade and refuge for fish, birds, and insects, while providing cooling benefits for wildlife and people. The Green Duwamish and Central Puget Sound Watershed (WRIA 9) Salmon Habitat Plan notes a need for these habitat types between River Mile 1 and 10 of the Duwamish River, noting a 10-year target for 40 acres of shallow water habitat and 170 acres of riparian forest restoration along the shoreline.

In this example, flood protection could be provided by a raised road behind the site; or by a levee that runs through the site with a public Riverwalk along its top. This would offer opportunities for public viewpoints, seating, and access to nature. Other community uses can also be integrated, such as space for community programs and access for hand-launch boats.

Community Feedback

Below are key themes from feedback on this example shared by community members.

Benefits

- Prioritizes public access and open space, river health, and allows community connection to the river
- Green buffer reduces pollution/runoff while maximizing habitat
- Provides connected habitat spaces that benefit salmon
- Provides the river with more space, increasing resilience from flooding
- Creates shade, cooling, and other resilience benefits

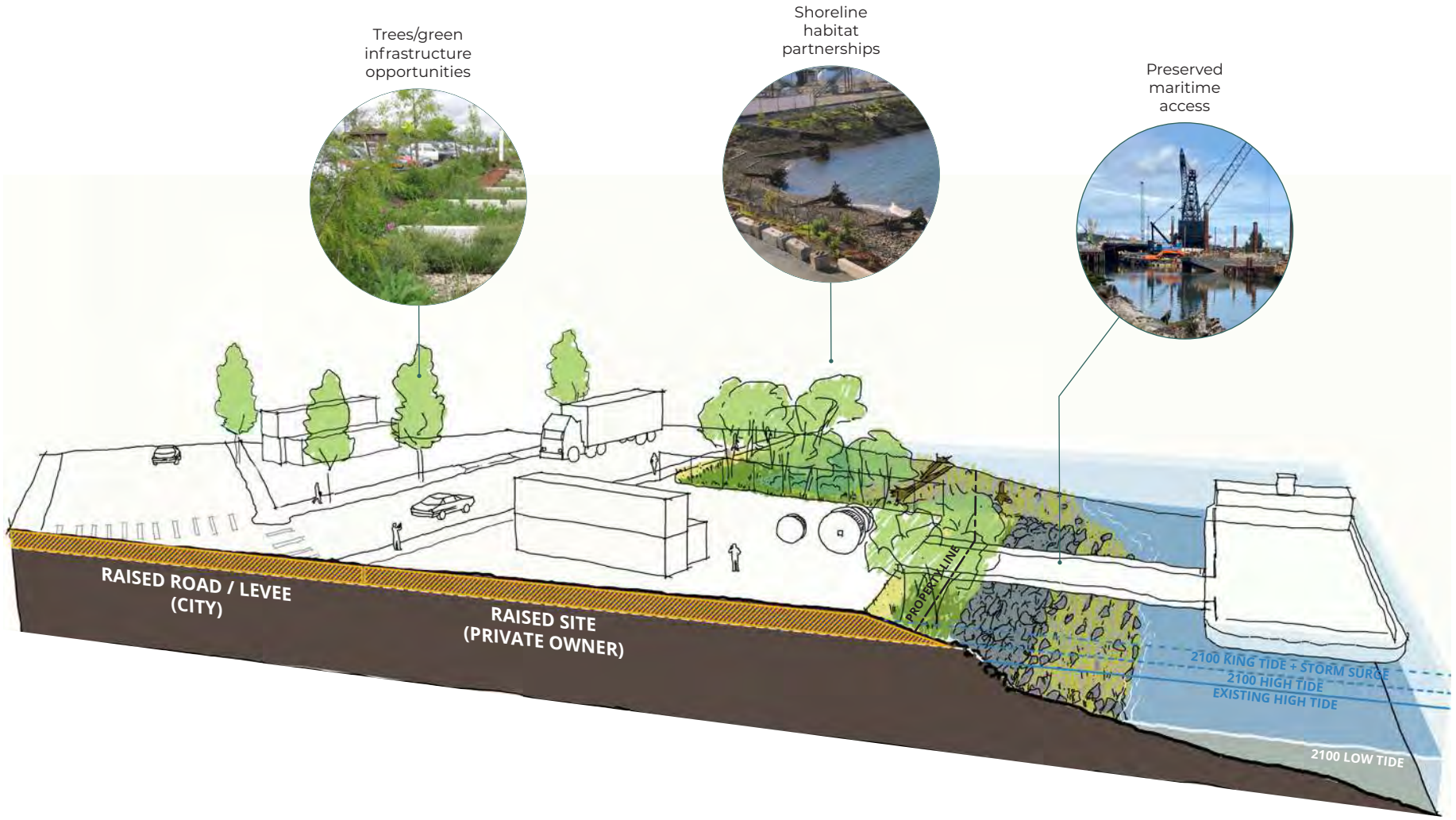
Concerns

- May be difficult and take a long time to build due to complexity, contamination, cost, and other factors
- Nearby industrial uses could negatively impact habitat
- Want to ensure that maritime industrial businesses also benefit from this approach

Community Priorities

Design Principle	Community Priorities
PUBLIC ACCESS & CO-BENEFITS	Include riverwalk, overlooks, and green space along the restored riverbank
HABITAT & ECOLOGY	Create mudflats and side channels for juvenile salmon; restore riparian habitat at riverbank
ADAPTABILITY, EFFECTIVENESS, & FEASIBILITY	Maximize resilience by setting protection infrastructure back from the water
EQUITY & PROSPERITY IN PLACE	Provide access to nature and open space for local residents and workers
ECONOMIC IMPACT	Prioritize local hiring for significant habitat restoration, maintenance, and monitoring
PARTICIPATION & TRANSPARENT PROCESS	Conduct clear communication & robust engagement to co-create community-supported site design; and integrate environmental education opportunities

EXAMPLE: RAISED ROAD AND RAISED SITE PARTNERSHIP



Raised Road & Raised Site Partnership

Private properties may choose to raise portions of their sites to support ongoing operations that cannot be exposed to periodic flooding. Partnerships could create habitat along the shoreline while achieving shared goals for flood adaptation. For example, a raised road can work together with a raised site to provide protection from flooding while optimizing access for maritime industrial use. The City would need to work with private property owners on either side of the raised road to ensure they can access the public street at its new elevation. Grading and fill in the flood-prone areas and Shoreline Zone would need to comply with the City of Seattle's Critical Areas regulations and Shoreline Master Program development standards.

In this example, opportunities for co-benefits include improvements to public streets and potential for shoreline habitat restoration where possible with partnerships. Public street improvements with a raised road could include street trees, pollinator plantings, and other green infrastructure, as well as safe walking and biking routes.

Community Feedback

Below are key themes from feedback on this example shared by community members.

Benefits

- Opportunity to work with private property owners to ensure they incorporate flood protection and other important improvements like habitat
- Provides public access along rights-of-ways
- Grading to improve operations on private sites

Concerns

- Potential contamination from industrial sites entering the river
- Complex permitting requirements
- Habitat opportunities may be limited

Community Priorities

Design Principle	Community Priorities
PUBLIC ACCESS & CO-BENEFITS	Design to include safe walking & biking routes, trees, and street end overlooks
HABITAT & ECOLOGY	Pursue partnerships to maximize riparian habitat restoration
ADAPTABILITY, EFFECTIVENESS, & FEASIBILITY	Ensure opportunities to use other strategies like floodwalls to increase protection as needed over time
EQUITY & PROSPERITY IN PLACE	Support continued maritime industry and local jobs
ECONOMIC IMPACT	Prioritize local hiring for significant habitat restoration/ maintenance/monitoring
PARTICIPATION & TRANSPARENT PROCESS	Conduct close coordination and partner with industrial businesses to meet their needs; conduct clear communication and robust engagement with community on public infrastructure elements

ACHIEVING THE DESIGN PRINCIPLES

In the next phases of adaptation project design, the City can use the Design Principles to evaluate projects to ensure they meet the vision. The following pages provide some specific examples of desired project elements that support each Design Principle.

Habitat & Ecology

Adaptation should improve habitat quantity and quality and restore tree canopy that supports improved ecological and public health. The study area is critical for migrating juvenile salmon. Flood adaptation efforts should seek opportunities and partnership to enhance riparian and intertidal habitat and consider how habitat conditions may change with future river levels. Tree canopy and green infrastructure can be enhanced as part of flood management and climate resilience efforts. The City can explore working with private property owners and agencies to collaborate on mitigation requirements related to flood adaptation.

NATURE-BASED SOLUTIONS

Adaptation should prioritize **nature-based solutions**, which are **actions or practices that incorporate natural features or processes into the built environment to promote resilience**. nature-based solutions can protect from flooding while enhancing river ecology. In the Duwamish Valley, this could include riparian, intertidal, and riverine habitat improvements integrated with development of a levee or other protection infrastructure along the shoreline. Integrating flood protection within high-quality habitat and open space improvements will maximize resilience. The City and partners can seek federal, state, and local funding to design and build nature-based solutions. Early actions include identifying appropriate site-specific solutions as part of SPU's Drainage and Conveyance Phase 2 Project, and as part of SPU's South Park Water Quality Facility (SPWQF), and outlining potential permitting and regulatory pathways.

SALMON HABITAT

Salmon prefer larger sites, ideally greater than 2 acres, that allow for shallow mudflat areas for juvenile fish to rest and feed during migration periods. No publicly-owned sites in the study area provide this acreage. Therefore, looking across multiple sites to pursue overall habitat connectivity along the river shoreline should also be prioritized. nature-based solutions could be integrated and maximized with SLR protection--for example, creating shallow, gently sloping mudflat areas. This can include critical off-channel habitat that allows juvenile salmon to rest during their transition from freshwater to saltwater fish. The Green Duwamish and Central Puget Sound Watershed (WRIA 9) Salmon Habitat Plan notes a need for these habitat types between River Mile 1 and 10 of the Duwamish River, noting a 10-year target for 40 acres of shallow water habitat along the shoreline. King County's updated Flood Hazard Plan also emphasizes opportunities for salmon habitat restoration with SLR protection efforts.

Example of nature based solutions, including a combination of habitat and human-made infrastructure in flood protection. (Portland, OR)

Salmon habitat restoration at Chinook Wind site in Tukwila, WA

RIPARIAN HABITAT

In areas where SLR protection is located near the shoreline but space for in-water habitat is limited, the City can prioritize riparian habitat improvements. This includes planting and restoring riparian forest and vegetation that provides shade and refuge for fish, birds, and insects, while creating cooler environments for wildlife and people. If SLR protection like a levee is located near the shoreline, riparian habitat can be accommodated by setting levees back to create enough space for riparian plantings and habitat along the river's edge. Riparian habitat can be improved on public sites or through partnerships on private sites if feasible for private owners. The WRIA 9 Salmon Habitat Plan notes a 10-year target for 170 acres of riparian forest restoration along the shoreline between River Mile 1 and 10.

UPLAND HABITAT

In addition to habitat in and near the river, investments in flood management can create and improve upland habitat that is not directly connected to the river. This includes planting trees in low-canopy areas and planting native and climate-adaptive plants that support pollinators, birds, and other wildlife. The lowest spots in the neighborhood may be good candidates for pockets of upland habitat, as these low areas may be increasingly impacted by high groundwater, making them difficult to use for other purposes. to the extent possible, upland habitat should create connected corridors, for example, "pollinator pathways" that create continuous zones for insects and birds to forage and move safely through the area. Upland habitat also provides human health benefits by improving air quality and providing shade.

GREEN INFRASTRUCTURE

Green infrastructure involves using plants and soils to manage stormwater in a way that mimics natural processes. This includes bioswales, rain gardens, green roofs, and permeable pavements designed to capture and treat stormwater runoff. Green infrastructure improvements deliver multiple benefits beyond stormwater management. For example, planting trees and rain gardens will help to reduce urban heat and can provide supplementary habitat for birds and insects, which can be particularly useful along the shoreline. There is an opportunity for pockets of planting in lowest areas in the neighborhood that may be most impacted by rising groundwater. Green infrastructure can also improve the water quality of runoff from industrial sites and roadways.

Youth and community participate in riparian planting

Example of pollinator plantings and tree canopy that provide habitat and shade

Example of green infrastructure plantings that soften and cool paved areas.

Public Access & Co-Benefits

Adaptation should provide access to the river and green spaces, and improve public health outcomes. This includes seeking opportunities to enhance public access, views, and water-dependent uses along the river. Public amenities should focus on improving quality of life, safety, and health for residents and workers, in balance with the needs of water-dependent industrial uses.

PUBLIC ACCESS & USE

Flood adaptation investments provide opportunities to improve existing public access to the river and provide new river view and access points with shoreline projects. Public street ends can provide river views and other elements consistent with the City's street end policies. Public shoreline adaptation projects can consider additional amenities such as small boat access or utilizing dock structures to bring public access out over the water.

IMPROVED COMMUNITY CONNECTIONS

Flood management and adaptation that includes street and drainage improvements in rights of way should also strive to incorporate improvements to sidewalks, bike lanes, and trees, in accordance with City standards. This includes safety improvements to facilitate freight movement and reduce conflicts between pedestrians and industrial vehicular areas like truck routes and driveways. An important goal for local public access is a continuous "Riverwalk" route that provides a safe, continuous walking and biking route as close to the Duwamish River shoreline as possible. SPU is working with SDOT to include new sidewalks between the SPWQF and Duwamish Waterway Park. This will help provide safe connections between local jobs, residential areas, and community uses in the surrounding neighborhoods. Overall, improvements to public streets should provide shade through addition of tree canopy.

PUBLIC OPEN SPACE

The City and partners can look for opportunities to improve public open space and green space as part of flood adaptation. This includes cleanup of contaminated soils to ensure healthy use of parks. Public open space investments should be prioritized near residential areas to maximize access and benefit to local residents.

Improved public open space can provide access to nature and greenery while supporting recreation and gathering for the community. Design of these spaces can include cultural and art features that represent and reflect the diversity of the Duwamish Valley community. The South Park Water Quality Facility and Pump Station projects provide examples of including open space, habitat, and art with infrastructure investments. Partnerships for public activities and programming of these spaces are vital to ensure functionality and vibrancy.

Example of public overlook and view opportunities

Example of a Public "Riverwalk"

Example of a public open space

SHORELINE RESTORATION & DECONTAMINATION

The City can work with industries and the Dept. of Ecology to clean up contaminated sites and reduce the potential for recontamination of the Duwamish River. Incentives or regulations can better support riparian habitat improvements at future tide levels. These tools can enhance river health and shoreline habitat around maritime industrial uses by encouraging or requiring shoreline softening and habitat restoration with private flood adaptation investments.

There are many contaminated sites in the Duwamish Valley. Some private properties in the area are already working to remediate soil contamination. Other sites may have undiscovered contamination from years of industrial use. SLR adaptation investments will need to consider contamination and the understand the potential for mitigating its spread.

Economic Impact

Adaptation can pursue opportunities to create economic benefits for local industrial and residential communities. Existing maritime businesses are a unique asset that provide local jobs, and SLR adaptation efforts should seek opportunities to improve the function, viability, and environmental performance of water-dependent industries.

IMPROVED MARITIME ACCESS

Partnerships with maritime industrial businesses can facilitate improvements to existing maritime access points that can be difficult for private owners to permit and modify on their own. Resilient industrial adaptation will preserve healthy and low-impact river access for current and future maritime industrial uses. At the same time, private owners may floodproof buildings, raise sites, relocate, or use other strategies to adapt to flooding. The City can explore permitting and funding partnerships with private property owners for habitat, shoreline stabilization, and flood management.

Equity & Prosperity In Place

To advance racial equity outcomes, SLR adaptation investments should focus on ensuring existing residents and businesses can remain and thrive in the Duwamish Valley. This includes innovative funding and financing strategies to ensure reinvestment in benefits for the neighborhoods while expanding economic opportunities.

PRESERVING AND GROWING JOBS

The City can explore partnerships with workforce training organizations and local industries to support existing local high-wage jobs while helping local employers grow and augment their skilled workforce. Programs and incentives that support clean and future-focused industry and workforce training in the Duwamish Valley could help local residents access economic opportunities that also support environmental health. Local workforce training initiatives that focus on local and green jobs, such as Dirt Corps and Maritime High School, should be important partners in this work.

An existing maritime industry on the Duwamish River

Maritime High School

Adaptability & Effectiveness

Adaptation should prioritize critical near-term investments to protect communities while maximizing long-term adaptability and resilience to other climate threats. This includes prioritizing multi-functional infrastructure that responds to climate impacts beyond flooding, such as urban heat. Infrastructure should also be adaptable and flexible to expand as needed--for example, through opportunities to add elevation to the infrastructure to respond to rising flood elevations.

GREY INFRASTRUCTURE

Grey infrastructure projects, including roads, pipes, tanks, and other engineered systems, will play an important role in the adaptability and effectiveness of SLR adaptation. These grey infrastructure strategies can be paired with other benefits, such as habitat improvements, tree canopy, public space, art, and local job opportunities. Near-term drainage and roadway improvement projects can integrate these multiple resilience benefits. Grey infrastructure systems should address urban flooding at future high tide levels and groundwater levels predicted with SLR.

Feasibility

Adaptation should prioritize achievable investments that are feasible to build and maintain over the long term. In response to the urgency of flood protection in the Duwamish Valley, the City can evaluate strategies and designs by how quickly they can be implemented. Near-term investments should balance feasibility and cost with the ability to phase in future investments to incrementally build toward a holistic flood adaptation approach. Feasibility also includes the City's and partner agencies' capacity and resources to maintain grey infrastructure, green infrastructure, and nature-based solutions over the long term, and include programming that enlivens spaces and connects community through education and activities

Flood walls can add height to a raised road or levee

The South Park Pump Station is an example of a grey infrastructure project that provides multiple benefits

Prioritizing local green jobs and training, including maintenance

Participation & Transparent Process

Adaptation projects can start from the foundation of previous community engagement efforts rather than starting from scratch and contributing to engagement fatigue. Beginning with an "engagement audit" to understand past conversations will help to make the best use of the limited time and energy of community members to participate in related processes. A strong understanding of past engagement will provide the foundation for successful co-creation with the community.

Future efforts will look for opportunities to collaborate with community members on design. Near-term pilot projects for adaptation can take this approach. Rather than presenting pre-formed concepts, the intent is to begin community conversations to generate ideas before developing planning or design alternatives. In addition to residential communities, it will be important to include engagement with local industrial businesses and industry, for example through workshops and discussions to better define shared priorities and opportunities for partnership.

Beyond City-led adaptation efforts, community-led efforts will play an important role in advancing broader community resilience. The City will continue to coordinate with and learn from these projects to build capacity and identify opportunities for supportive investments that align with community goals.

The Duwamish Valley community has a proud legacy of grassroots engagement with environmental issues

Local maritime industrial business engagement

Duwamish Valley Youth Corps

"ADAPTATION TO SEA LEVEL RISE IN THE DUWAMISH VALLEY WILL BE ROOTED IN COMMUNITY RESILIENCE: POWER AND WEALTH BUILDING TODAY ARE AS CRITICAL AS ENGINEERED INFRASTRUCTURE TO RESPOND TO CLIMATE CHANGE IMPACTS TOMORROW."

ANN GRODNIK-NAGLE, SPU CLIMATE ADAPTATION POLICY ADVISOR

4_NEXT STEPS

This report helps to establish a basis and direction for the next phases of SLR adaptation and flood management. In addition to partnership with community, the City will need to strengthen and grow interagency coordination and partnerships for successful adaptation. SPU's Duwamish Valley Water Resilience Program and OSE's Duwamish Valley Program will continue to advance the SLR infrastructure strategies described in this report.

Phasing & Near-Term Infrastructure Investments

Near term steps will include both programmatic efforts and ongoing investments in physical facilities and infrastructure. Programmatic efforts include ongoing emergency preparedness, more detailed planning and visioning for holistic SLR adaptation, and ongoing community engagement. To inform long term, holistic investments in flood management and SLR adaptation for the Duwamish Valley, the City will continue to advance technical feasibility studies, including geotechnical assessments and defining potential regulatory and permitting pathways.

Beyond this, investment in holistic adaptation infrastructure to address SLR related flooding in South Park and Georgetown will begin with the most vulnerable areas of South Park before progressing to adaptation in Georgetown and the remaining areas of South Park. This will require more detailed planning and design before implementation. An early estimate of phasing indicates that these longer-term efforts could begin between 2026 and 2030 and target completion by 2040.

Related near-term infrastructure investments include the planned South Park Water Quality Facility and ongoing improvements to roadways and drainage in South Park. These should be completed by 2030.

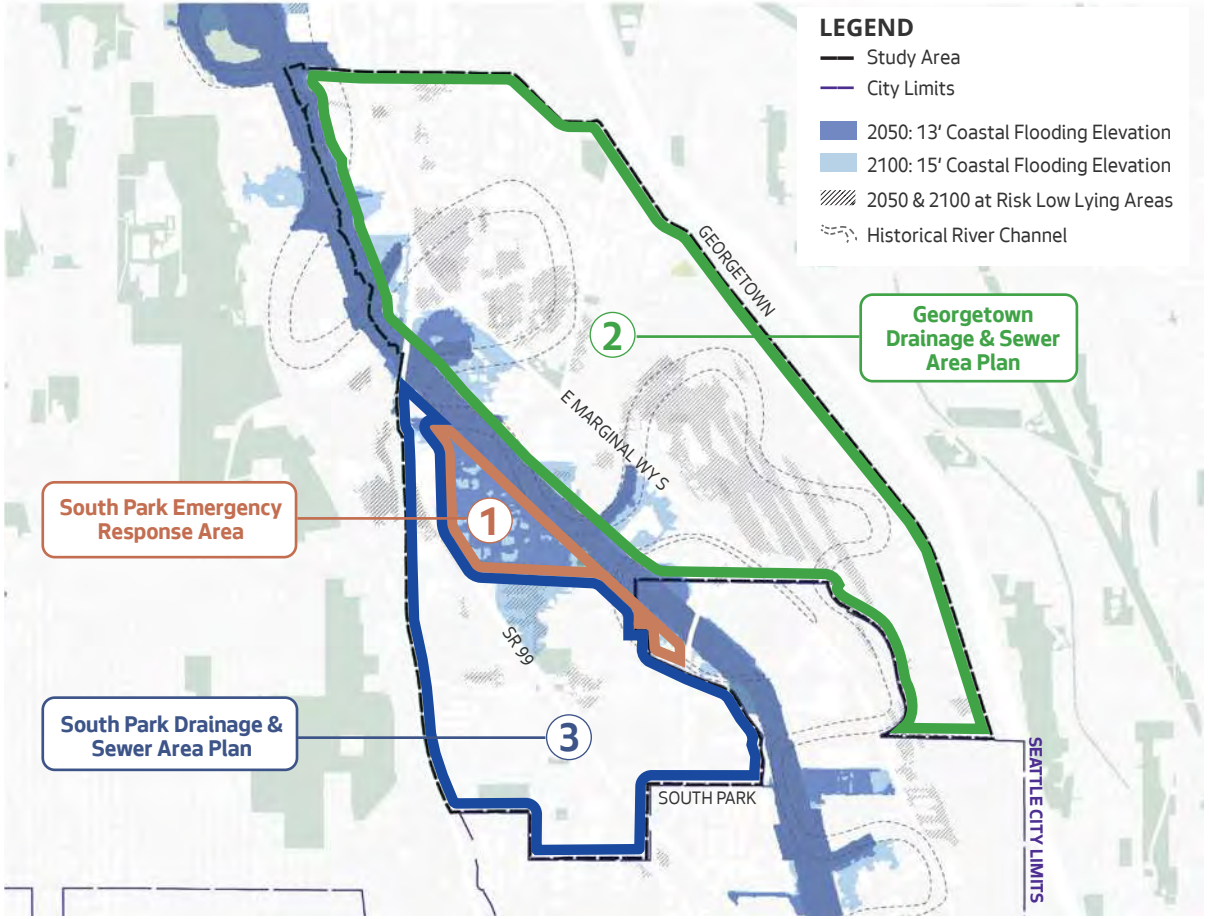


Figure 15. Potential Phases for SLR and Coastal Flood Adaptation

Phase	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Programmatic Efforts	Flood Preparedness and Response																		
	Continued Visioning and Technical Feasibility																		
	Community Engagement																		
Phase 1: South Park Emergency Response Plan Area	Planning, Design, & Construction																		
Phase 2: Georgetown	Planning, Design, & Construction																		
Phase 3: South Park Completion	Planning, Design, & Construction																		
Related Infrastructure Projects	South Park Water Quality Facility																		
	South Park Roadway and Drainage Improvements Phase 2																		
	South Myrtle Street Drainage and Water Quality Project																		

REGULATORY & POLICY CONSIDERATIONS

Existing Regulatory & Policy Context

As an early programmatic step, the City will need to address any existing policy and regulatory barriers that may not currently be compatible with potential SLR adaptation strategies such as levees, raised roads, flood walls, fill to raise sites, in-water habitat improvements, and combinations of these strategies. These elements would be located within areas regulated by state, federal, and City governments. In general, adaptation infrastructure is not directly addressed in City regulations, which means a variety of different development regulations apply, including shoreline stabilization, fill and/or road projects. In addition, in-water work within the Duwamish Waterway is regulated by the state and federal government. Without an overall policy or regulatory strategy addressing SLR infrastructure, permitting these types of projects will be challenging.

Applicable City of Seattle codes and regulations include Environmentally Critical Areas (ECA) (SMC Chapter 25.09), Floodplain Development (25.06 SMC), Shoreline Master Program (SMC Chapter 23.60A), other provisions of the Land Use Code (Title 23 SMC) such as zoning, and the requirements contained in Streets Illustrated for Street and Sidewalk Use (Title 15).

Shoreline Master Program. Construction of shoreline stabilization and flood protection works are discouraged by the SMP (23.60A.152.C). *"All shoreline developments, shoreline modifications, and uses shall be located, designed, constructed, and managed to prevent the need for shoreline defense and stabilization measures and flood protection works such as bulkheads, other bank stabilization, fills, levees, dikes, groins, jetties, dredging, or substantial site regrades to the extent feasible except as allowed in Section 23.60A.188."*

SLR infrastructure or flood hazard reduction are not specifically addressed in the SMP. Absent specific policy and regulatory guidance, SLR infrastructure such as levees, floodwalls and raised roadways may be categorized as shoreline stabilization measures. Shoreline stabilization measures are limited to the minimum necessary to protect buildings and uses that are in imminent danger of erosion, a standard that is difficult to meet for SLR that may not be "imminent".

Environmentally Critical Areas/Floodplain Development. The study area is within flood-prone areas regulated as special flood hazard areas under SMC Chapter 25.09 and 25.06. Since fill or raised roadways could result in a change to boundaries of special flood hazard area or result in a change to Base Flood Elevations (BFE), engineering studies or documentation could be needed to support SLR adaptation infrastructure. Changes to BFE or special flood hazard area boundaries would require a Conditional Letter of Map Amendment (CLOMR) from FEMA and could affect flood insurance rates. SLR Infrastructure that would raise the BFE may be difficult to permit.

Streets Illustrated designates streets in the study area as "Minor industrial access" requiring a 60 foot right-of-way to accommodate features such as pedestrian and bicycle circulation, loading, parking and landscaping. SPU will need to carefully design, and coordinate with SDOT and adjacent properties to incorporate SLR infrastructure in the existing 60 feet of right-of-way. This may require pursuing multiple types of infrastructure, seeking deviations from standards and/or working with adjacent properties to secure grading easements.

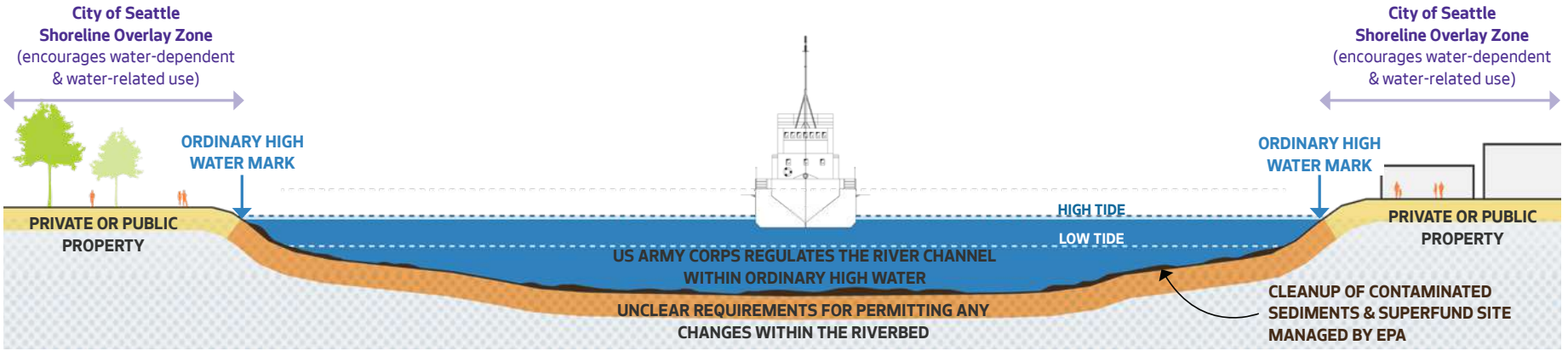


Figure 16. Regulatory layers on the Duwamish River and shoreline areas.

Federal and State Clean Water Act 404 and **Rivers and Harbors Section 10 permits (USACE)** and **Washington State Hydraulic Project Approvals (WDFW)** would be triggered by any in-water work that might be necessary for construction of adaptation infrastructure or associated habitat restoration or mitigation. The proposed use/development and the amount of disturbance would determine whether the project could be permitted through a Nationwide Permit (NWP) or whether an individual permit would be required.

Potential Policy & Regulatory Strategies

An overall policy or regulatory strategy for SLR adaptation infrastructure could include the following regulatory or programmatic components:

Shoreline Master Program (SMP)

The Washington Department of Ecology (Ecology) is incorporating climate change into its Shoreline Management Act (SMA) by requiring local governments to update their Shoreline Master Programs (SMPs) to be more resilient. Key updates involve planning for sea level rise, more frequent and severe flooding, and other climate impacts like drought and wildfire. The City can work with state-wide conversations about future SMP updates for opportunities to incorporate guidance on climate resilience and flood hazard reduction. Potential policy and regulatory considerations could include:

- Defining sea level rise infrastructure and updating policies and regulations to include specific guidance.
- Periodically updating the City's shoreline inventory to identify areas at risk of SLR where adaptation infrastructure may be needed or appropriate.
- Updating the City's shoreline restoration plan to balance the need for habitat and restoration associated with the Duwamish Waterway with the need for infrastructure to protect life and property from SLR.

Environmentally Critical Areas/Floodplain Development

In 2025, SDCI completed proposed permanent Floodplain Development Regulations and published the Threshold Determination. The new permanent regulations will adopt FEMA's 2020 new Flood Insurance Rate Maps and Flood Insurance Study and will continue to regulate flood prone areas mapped by Seattle Public Utilities.

- During planning phases conduct areawide engineering studies or evaluation of the potential impacts to on and off-site flooding and benefits that could result from SLR infrastructure involving filling of floodprone areas.
- Consider whether SLR adaptation designs will need to include compensatory flood storage, habitat restoration/mitigation or other elements to mitigate development in flood prone areas.
- Determine if SLR infrastructure can lead to removal of protected areas from the FEMA Floodplain and City flood-prone areas maps.

Comprehensive Plan

In future comprehensive plan updates, evaluate the comprehensive plan climate resilience elements and policies for updates that may be necessary to maintain consistency with Shoreline Master Program or ECA regulatory changes supporting SLR adaptation infrastructure.

Streets Illustrated

Evaluate the need for alternative minimum standards for streets that would also function as SLR infrastructure. The City may also want to consider street vacations in specific locations and develop an overall public benefits strategy that could guide street vacation proposals.

National Environmental Policy Act (NEPA) and/or State Environmental Policy Act (SEPA)

Climate is one area of the environment that Washington's SEPA requires agencies to evaluate. The application of this has typically involved potential contribution to greenhouse gases. There may be opportunities to consider adaptation as well as mitigation. For holistic SLR strategies, a programmatic EIS covering a larger area as well as individual sites could facilitate subsequent site-by-site environmental review. In addition to efficiency, environmental impacts related to flooding are not limited to individual sites, and some of the strategies extending across a larger area could trigger an Environmental Impact Statement.

Federal in-water permitting (USACE)

Investigate the potential to develop a programmatic CWA 404/Section 10 permit that allows a variety of in-water habitat restoration activities to occur throughout the study area. This could facilitate habitat restoration on a larger scale.

TECHNICAL CONSIDERATIONS

When planning and designing SLR adaptation infrastructure, it is important to understand the technical considerations that will influence design and construction. Future, more detailed design study will be needed to build flood adaptation infrastructure. As the SPU Water Resilience Section leads this technical analysis, the additional information will create a broader basis for the City and community to evaluate project costs and benefits. The following technical information will be important to consider.

Contaminated Soils and Groundwater

It is highly likely that the sites where SLR infrastructure will be sited will have contaminated soil and / or groundwater. Any excavation and construction activities at these locations could trigger clean-up requirements. While removal of contamination would benefit the community and environment, it can also be time-consuming and expensive.

During the next phases of conceptual design, complete a preliminary assessment, using existing records, to identify where proposed infrastructure is likely to encounter contaminated soils. Include large contingency in cost estimates to account for potential contamination.

During detailed design, undertake site-specific assessments of potential environmental contamination at preferred locations.

Groundwater & Geotechnical Conditions

The USGS is collaborating with King County on a study of the Duwamish River Valley's groundwater system to understand how flooding, tidal changes, and climate change may affect it. The study aims to create a detailed hydrogeologic model to predict the impacts of these events on the groundwater table and salinity. Groundwater can impact the design and cost of SLR infrastructure for several reasons. Depth of groundwater will impact the type and size of foundations and footings. Flow direction of groundwater will impact whether pumping of groundwater around the SLR infrastructure is needed. SLR infrastructure keeps the river water in the river, but could also prevent groundwater from draining by gravity into the river. The relationship between tide and groundwater also needs to be understood to determine whether groundwater will need to be pumped out from behind SLR infrastructure. Figure 17 shows potential impacts from groundwater by 2100 assuming ~3 feet of SLR.

Geotechnical conditions also impact the needed size and resulting cost of SLR infrastructure. These conditions are not fully known, but are likely to be varied because the project area includes imported fill when the river was channelized. Conceptual design will rely on readily-available groundwater and geotechnical information, incorporating these considerations into design and cost estimating.

Detailed design will include geotechnical exploration and a groundwater model to understand the impact of proposed SLR infrastructure.

Liquifiable Soils & Earthquake Risk

Stabilization of SLR infrastructure against lateral movement during an earthquake could be very expensive, but could provide a benefit to the neighborhood more broadly by reducing potential earthquake damage. SLR infrastructure could be built without stabilization against lateral movement – some options would perform better during an earthquake than other options.

Conceptual design will include contingency for lateral stabilization and use earthquake resilience as a criterion when comparing infrastructure options. For more detailed design, decisions should be made about whether to include lateral stabilization.

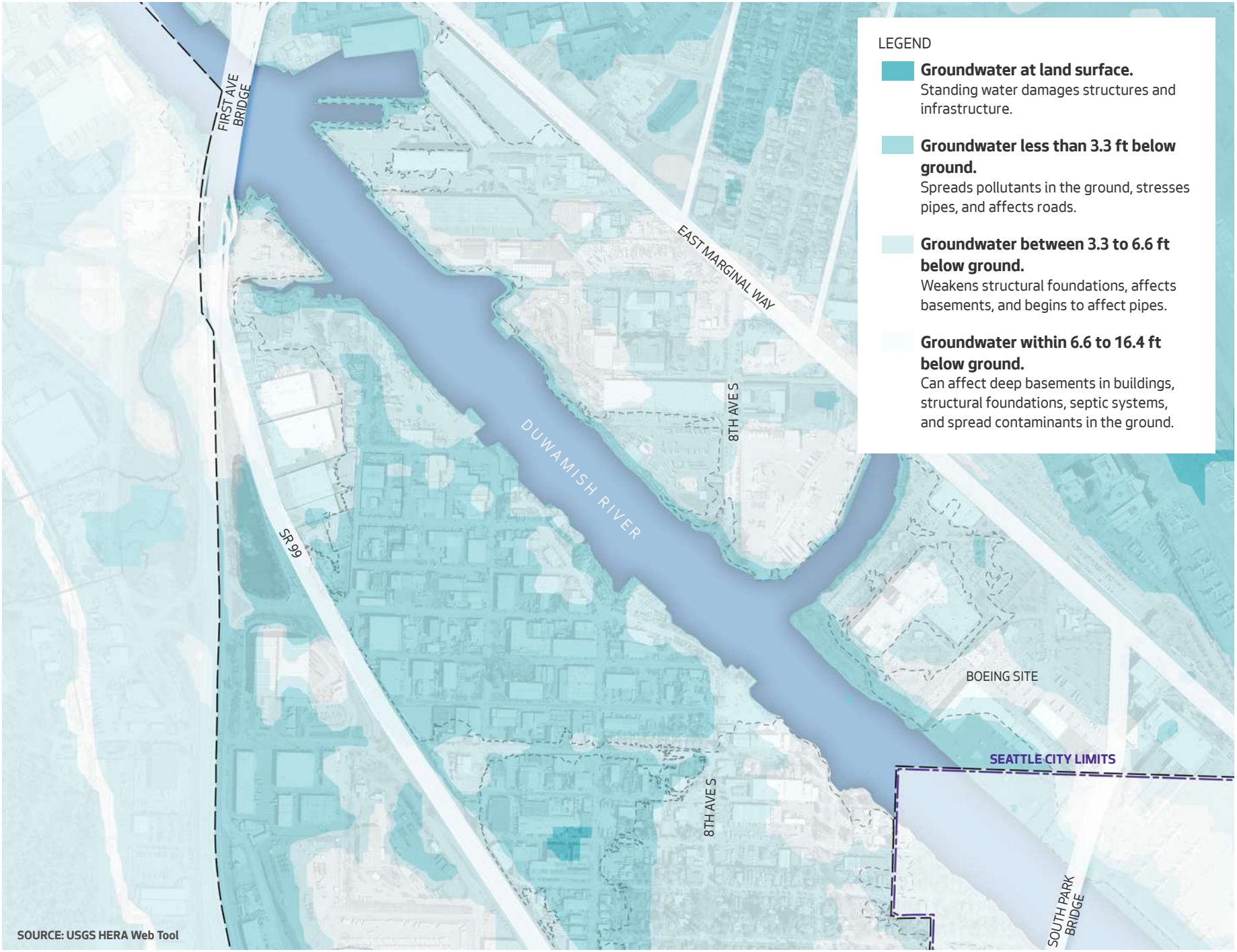


Figure 17. Potential groundwater depths with three feet of SLR. In addition to groundwater, infrastructure projects will consider seismic risks.

Property Ownership & Use

The area of the Duwamish Valley where SLR infrastructure is likely to be sited consists of many different parcels with different owners, and land in the river is stewarded by the Port of Seattle. Additionally, it will be important to continue to accommodate water-dependent and water-related uses in this area. Implementation of SLR adaptation infrastructure will require coordination with numerous property owners and the community.

For planning and conceptual design:

- Map out property ownership.
- Develop partnerships with existing owners along the shoreline to build consensus on early approaches to flood control.
- Include contingency in schedule for partnerships and coordination.

For detailed design:

- Identify property owner engagement needs and opportunities for collaboration/ coordination.

Defining Adaptation Pathways

One of the key design criteria for SLR infrastructure is how high it needs to be built by what point in time. The timing of SLR will dictate what infrastructure is needed where and by when. Initial efforts will be focused on addressing low spots that are impacted by near-term SLR and current flooding patterns.

In future steps of SLR adaptation planning, **adaptation pathways** will be an excellent tool for the City to use to adapt to an uncertain future. Adaptation pathways are a range of options that can be used on their own, or in combination with each other, to adapt to coastal hazards over time.

An adaptation pathways approach includes determining **signals, triggers and thresholds**. **Signals** are early warning signs--for example, a certain frequency of flooding emergencies. Signals indicate that a trigger is approaching. **Triggers** are measurable indicators that action needs to be taken--for example, an increased frequency of flooding emergencies. Triggers should be set to provide enough time to cover community engagement, design and construction and funding for adaptation infrastructure before a threshold is reached. A **threshold** is the point at which agreed objectives or community values are no longer being met or start to fail--for example, daily flooding from high tides. Thresholds are usually defined by a change in conditions rather than a particular time.

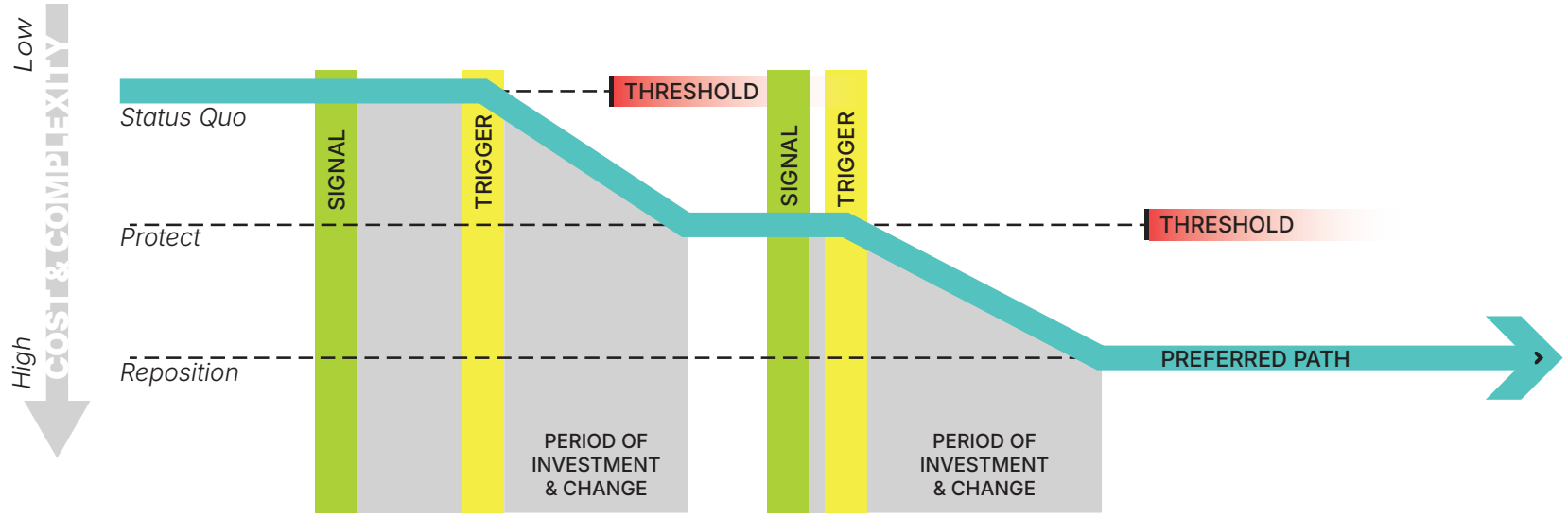
Determining specific adaptation pathways for the Duwamish Valley will allow decision makers to take action in time to ensure that community values are met through adaptation efforts.

For conceptual design:

- The City can develop a system of adaptation pathways, including signals, triggers, and thresholds for specific actions, to inform conceptual design alternatives.
- Designs will be developed based on the level of flooding protection needed for SLR projections of 3' by 2100. The design alternatives can be framed in terms of near-term (within ~10 years), medium-term (by 2050) and long-term (by 2100). Near-term flood protection infrastructure may be designed for medium and/or long-term SLR projections in order to provide protection against major flood events as early as possible.
- This phase will identify low spots and flooding pathways based on readily available data such as NOAA's SLR datasets.
- This phase will explore modular design strategies that can easily be made higher.

For detailed design and future processes:

- Future analyses could conduct a benefit-cost analysis on various SLR conditions.
- Update SLR projections and resulting design criteria as SLR continues to advance and future projections are refined through scientific advances.
- Confirm or model actual flow paths for flooding to establish where flooding starts and how it progresses.



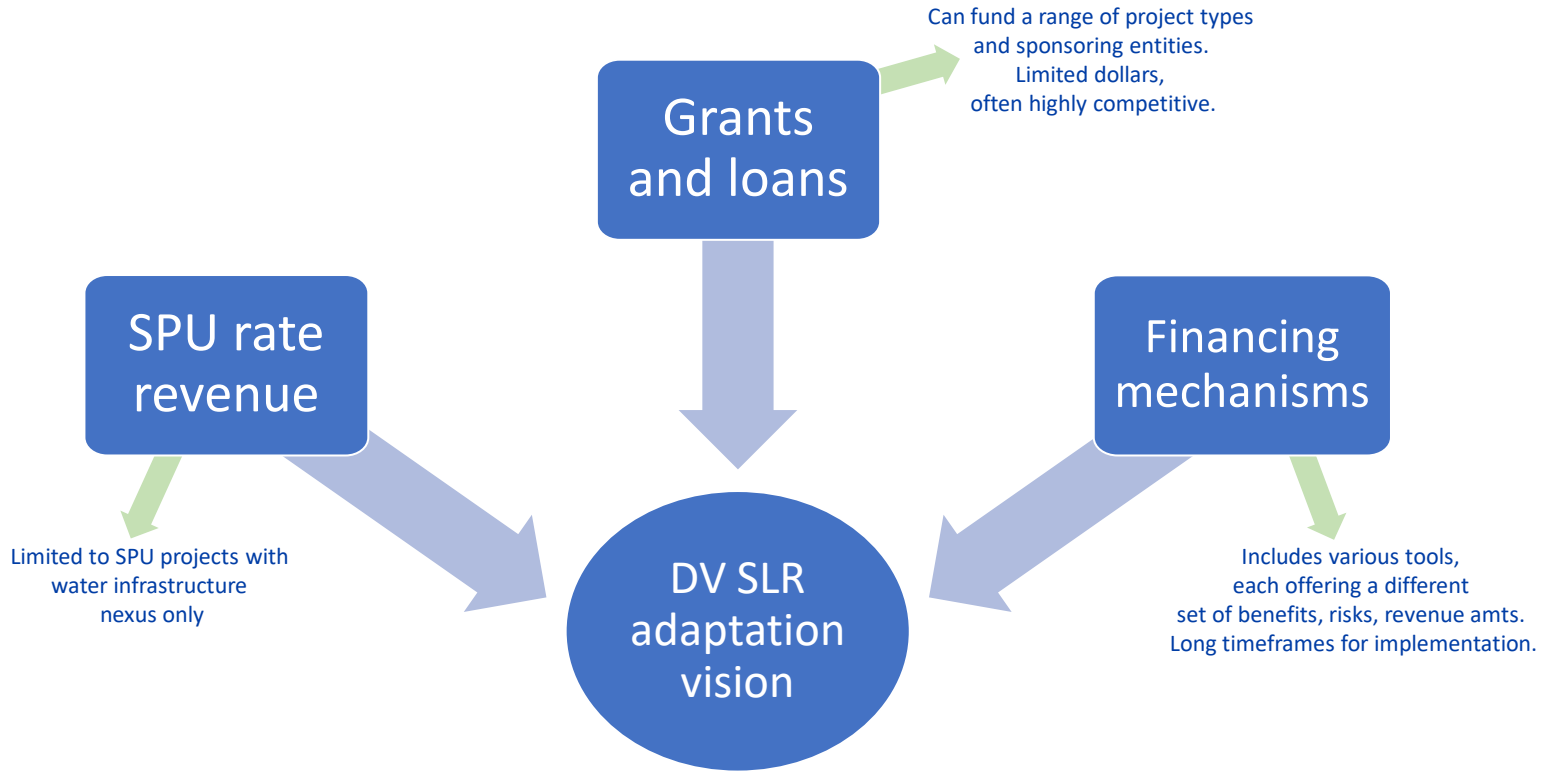
Example of an adaptation pathways diagram that shows signals and triggers that initiate action before thresholds are met.

FUNDING AND FINANCING STRATEGIES

Designing and implementing SLR adaptation strategies will require multiple funding and financing pathways that enable significant support beyond SPU's ratepayer revenue. SPU's ratepayer revenue is limited to funding projects with a specific stormwater, drainage, or wastewater infrastructure nexus and is prohibited from being applied to other types of SLR adaptation work.

Traditional grants and low interest loans are one pathway to fund SLR adaptation work. To date, SPU has already secured more than $6 million for various elements of flood preparedness and prevention and SLR adaptation planning and community visioning, including from the Robert Wood Johnson Foundation, the Center for Community Investment, Seattle Foundation, the Federal Emergency Management Agency (FEMA) Building Resilient Infrastructure and Communities (BRIC) program, and the King County Flood Control District. Existing sources will continue to support SLR planning through 2027.

The City has developed and will continue to refine its long-term external funding strategy to support all aspects of the SLR adaptation effort. This includes identifying and pursuing traditional grants and loans and legislatively-directed funds ("earmarks"), as well as coordinating with and supporting community groups and other partners to pursue funding opportunities that advance the larger vision.



Funding and financing pathways for SLR adaptation

In addition, the City has been exploring a variety of financing mechanisms to advance and implement the SLR adaptation vision. Examples include:

- **Local improvement district (LID)** or **Tax increment financing (TIF)**. A LID is a mechanism that uses special assessments on properties directly benefiting from a public improvement. TIF is a mechanism to allocate a portion of property or sales taxes to finance public improvements in designated areas. Both tools have expressly stated time periods for collecting revenue.
- **Conduit lending.** The City can pursue grants or low-cost loans and then act as a passthrough entity, distributing funds to local business owners, homeowners, or industrial and commercial partners that incorporate multiple benefits within design of their adaptation projects.
- **Anchor institution capital campaign.** Partnering with a local business, professional organization, or academic institution to donate a portion of proceeds to advance community-led projects is an effective strategy for closing smaller funding gaps.
- **Green bank financing and partnerships.** A green bank, a mission-driven financial institution, or a Community Development Financial Institute (CDFI) can make use of innovative financing tools to support resilience investments, including land acquisition and redevelopment.
- **Land value capture.** Land value capture mechanisms, such as property taxes, can be a useful repayment mechanism for infrastructure financing but need to be structured to ensure equitable outcomes. Proactive planning and engagement with community-based organizations and affordable housing programs prior to large-scale investment is critical to avoid potential harmful effects of land value capture.

SPU's Duwamish Valley Water Resilience Program will continue to lead on funding and financing strategies for SLR adaptation and associated community benefits. SPU will pursue traditional grants and low interest loans, which will help fund a small portion of the work, while also aligning policy and regulatory frameworks to enable the use of creative and sustainable financing mechanisms to implement the SLR adaptation vision.

Example: The City of Spokane used the CWSRF program for a major water quality infrastructure and public space project .

Craft3, an existing regional CDFI, provides funding to local community projects that build resilience.

SLR Adaptation Grants (as of December 2025)

Granter	Amount
Center for Community Investment	$200,000
The Seattle Foundation	$50,000
Robert Wood Johnson Foundation	$600,000
FEMA BRIC	$420,000
King County Flood Control District*	$500,000

SLR Adaptation Grants (as of December 2025)
**Note: does not reflect District funds for flood preparedness and response.*

ONGOING ENGAGEMENT & PARTNERSHIPS

Continuing authentic engagement with local communities will be critical to successful adaptation that delivers multiple benefits while supporting racial equity outcomes.

ONGOING ENGAGEMENT

The City can facilitate transparency in engagement by clearly articulating the role of community voices at various decision points, and seeking opportunities to increase informed engagement.

An early opportunity for further conversations includes reviewing the outcomes of work that the UW EDGE Center and Duwamish River Community Coalition produce as part of their "Living with Water" collaboration.

Through partnerships, the City can work with community stakeholders to advance a range of strategies to help businesses and residents thrive in place and adapt over time. Future opportunities for collaboration may include exploring creative funding and financing arrangements with community partners; Increasing the capacity of community organizations to educate, and organizing community members so that they can be informed participants at the decision-making table with agencies and other implementation partners.

PARTNERSHIPS FOR SUCCESS

In addition to collaboration with local communities, the City will continue to strengthen partnerships with other agencies and projects around climate resilience and flood management in the Duwamish Valley.

Given the connected nature of the Green-Duwamish River watershed, City-led adaptation to flooding along the lower Duwamish River will include close coordination with other agencies and entities, including the King County Flood Control District. Established in 2007, the Flood Control District brings a comprehensive approach to flood management across the watershed. It provides funding to improve aging and inadequate flood protection facilities. The Flood Control District's 2024 Flood Management Plan places a high priority on reducing risks and damages from coastal flooding and SLR in this tidally-influenced area of the Duwamish River.

City-led adaptation will also coordinate with salmon recovery efforts in the watershed. WRIA 9 is the Water Resource Inventory Area for the Green/Duwamish and Central Puget Sound Watershed, a collaborative effort among several governments and organizations to protect and restore salmon habitat. WRIA 9's 2021 Salmon Habitat Plan notes a need for additional habitat in the Duwamish River.

Ongoing integration with Superfund cleanup efforts will ensure that adaptation design can incorporate cleanup designs and potentially enhance areas that are already cleaned up, for example through additional habitat restoration.

Washington State's Department of Ecology (ECY) will adopt amendments to the Shoreline Management Act in 2026, which will provide updated guidance on planning for SLR in the City's Shoreline Master Program. The City can work closely with ECY to understand and integrate the new guidance in adaptation work.

Collaboration between departments, local, state, and federal agencies, and other external partners should reflect the multi-faceted nature of a holistic approach to community and climate resilience. The City will continue to seek out engagement with other public agencies and private partners to advance SLR adaptation in the Duwamish Valley in a manner that reflects community values and priorities.

FLEXIBLE AND ADAPTABLE VISION

The vision laid out in this report represents a first step in coordination with community. The City will continue to adjust and update this vision and direction for flood adaptation based on ongoing community engagement, including the Community Advisory Group and the broader public.

Duwamish Valley Youth Corps

Reconnect South Park

Maritime Industrial Charrette

Multilingual Open House

Multilingual Open House

5_APPENDIX

LIST OF APPENDICES