Stormwater Management Action Plan

City of Federal Way

Stormwater Basin Planning and Assessment

June 16, 2022

Public Works, Environmental Services
[Email address]

BACKGROUND

As a part of the 2019-2024 Western Washington Phase II Municipal Stormwater Permit issued by State of Washington's Department of Ecology (WADOE) in order to comply with the Clean Water Act National Pollutant Discharge Elimination System (NPDES); the City of Federal Way (City) is required to implement a Stormwater Management Action Plan (SMAP).

Development of the SMAP requires us to identify the watersheds within the City, rapidly assess the relative conditions of the receiving waters and the contributing areas with existing data, and to ultimately identify which basins to be included in the prioritization process.

Then develop and implement a prioritization method and process to determine which receiving waters will receive the most benefit from implementation of stormwater retrofits, tailored implementation of Stormwater Management Program (SWMP) actions, and other land/development management actions. The goal of the second component is to produce a document of the prioritized and ranked list of receiving waters. **For this component of the SMAP we are asking for your public comments based on information presented here.**

Finally, the last step is to develop and implement a SMAP for the high priority catchment area based on previous work. The SMAP is required to include descriptions of stormwater facility retrofits needed for the area, including BMP types and preferred locations, land management/development strategies for water quality management, targeted, enhanced, or customized implementation of stormwater management actions, identification of needed changes to local long-range plans to address SMAP priorities, proposed implementation schedule and budget sources for long/short term actions, and a process and schedule to provide future assessment/feedback to improve the planning process and implementation procedures or projects. A full description on the permit requirement language can be found in the permit S5.C.1.d. This document was prepared using the Stormwater Management Action Planning Guidance document published by WADOE.

This section will describe the environment in Federal Way that affects surface water management, water bodies within the city limits, and the urban growth area (UGA) that receives surface water or stormwater from within the city limits.

Study Area Characteristics

Federal Way is bordered on the south and southwest by the city of Tacoma, on the south and east by unincorporated King County, on the east by Auburn, and to the north by Kent and Des Moines The city limits encompass 23.7 square miles, and the current population is about 100,000 (Federal Way 2020a, as cited in Herrera, 2021).

Federal Way originated in the late 1800s as a logging settlement on Puget Sound. By the 1920s, Federal Highway 99 was complete, linking the community to the economic centers of Seattle and Tacoma. Rapid retail and residential growth created significant changes in the community during the 1970s and 1980s; and in February 1990, Federal Way incorporated to become the sixth largest city in the state. Today, the Federal Way community is residential and commercial with a population employed locally and in neighboring cities such as Sea Tac, Kent, Tacoma, Bellevue, and Seattle. Currently, Federal Way is the ninth largest city in Washington State, and the population is expected to exceed 107,000 by 2035 (Federal Way 2015, as cited in Herrera, 2021). An estimated 22,485 people are employed within the city limits (Federal Way 2020b, as cited in Herrera, 2021).

Land Use

Areas that do not infiltrate stormwater runoff (impervious area) in Federal Way are shown in Figure 1-1. City growth and changes in land use are guided by the City of Federal Way Comprehensive Plan (Federal Way 2015, as cited in Herrera, 2021), which was developed to comply with the requirements of the Growth Management Act (GMA). One of the goals of the GMA is to promote development inside the municipal Urban Growth Area (UGA) and to eliminate costly and environmentally damaging urban sprawl. This means that, within the city limits, the focus will be on redevelopment and infill; therefore, the City's Comprehensive Plan includes plans for a vibrant city center with mixed-use commercial and residential development in the downtown business area and access to public transportation.

As development and redevelopment projects occur, they will be required to comply with increasingly stringent standards for low impact development (LID) practices, onsite infiltration, stormwater treatment, and flow control. Therefore, it is expected that, over time, these projects will benefit surface water management, particularly in the context of redevelopment projects where sites without stormwater management are replaced by sites with modern stormwater management facilities.

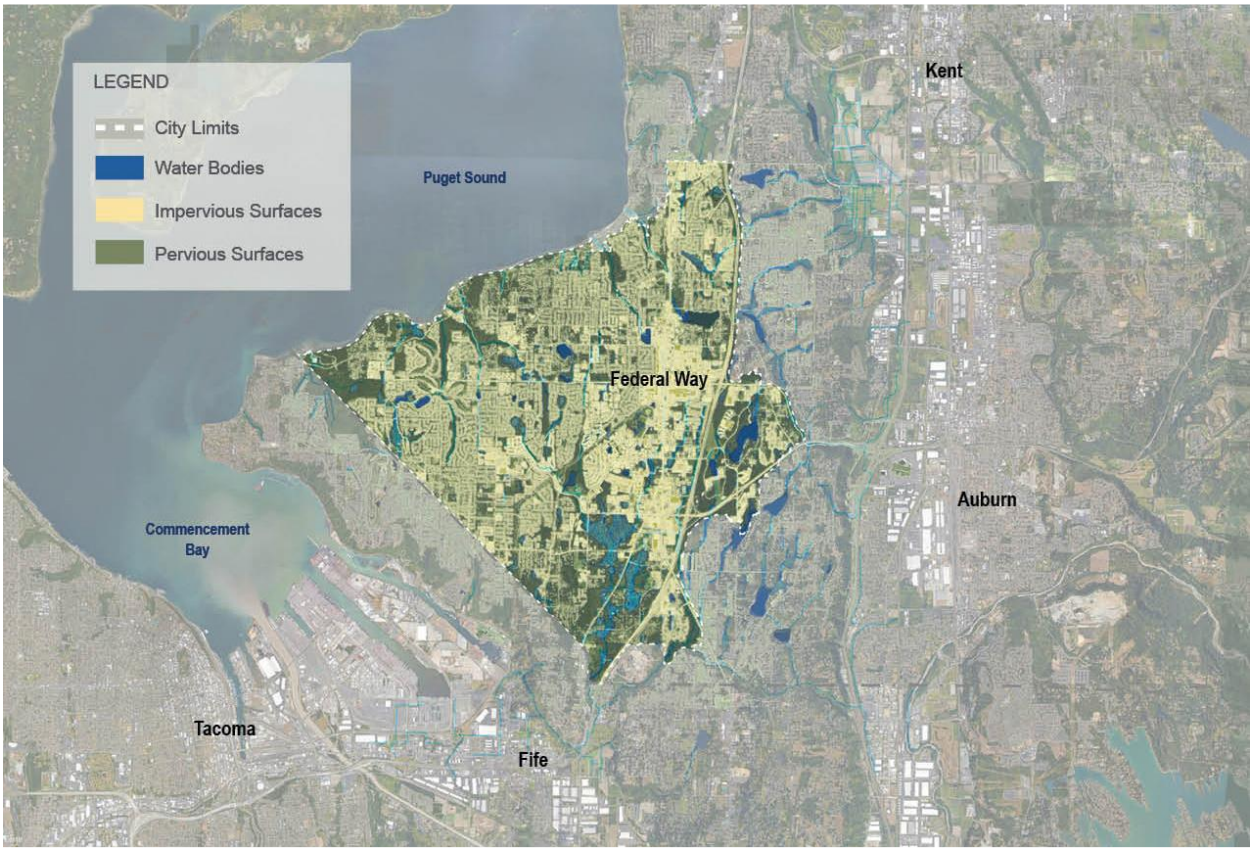


Figure 1-1. Vicinity Map of Federal Way with Delineated Impervious Areas.

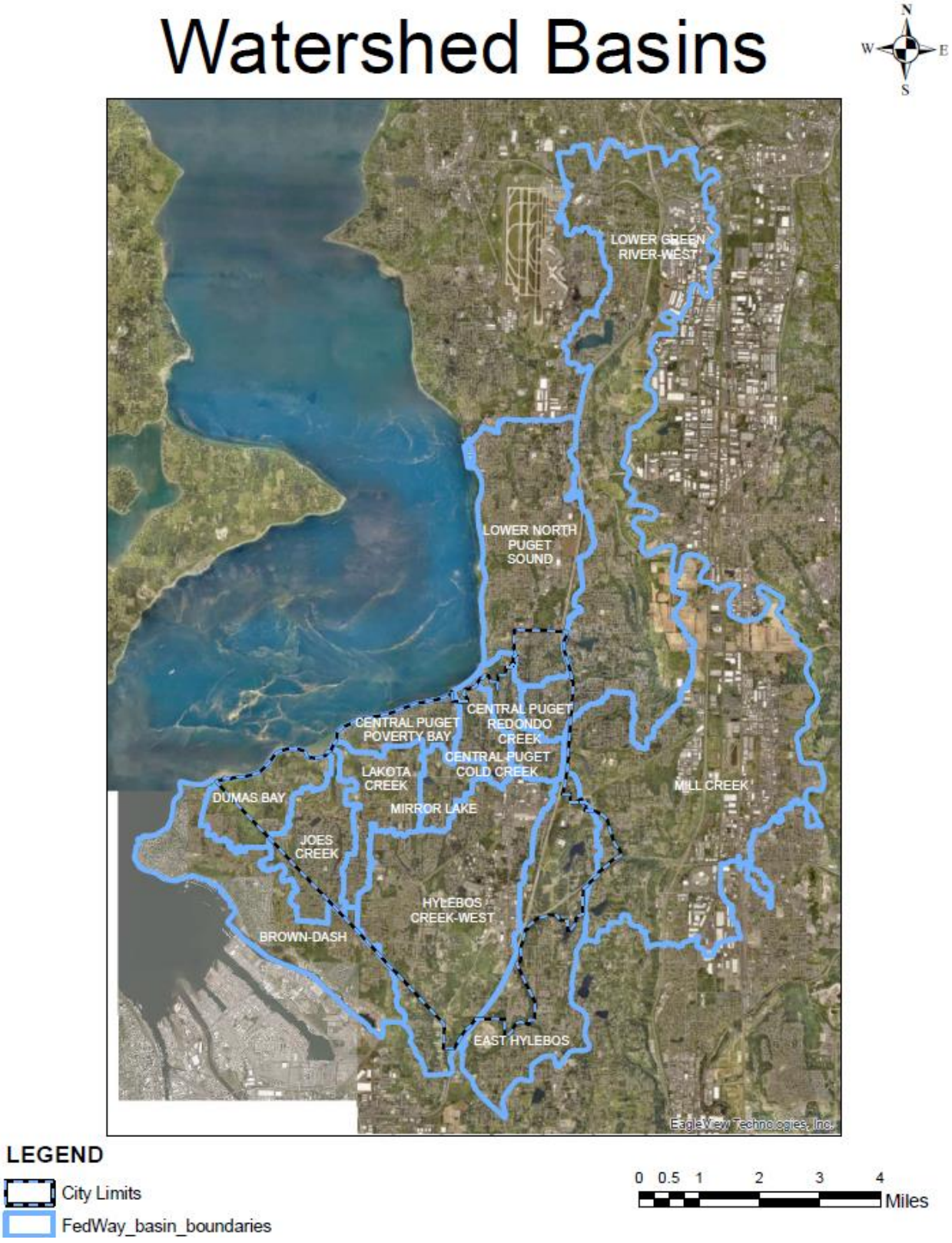
Soil Characteristics

The primary soil type in Federal Way is Alderwood gravelly sandy loam, a moderately well drained soil overlaying a restrictive layer of glacial till at about 40 inches below the ground surface (Natural Resources Conservation Service 2019, as cited in Herrera, 2021). While Alderwood soils are classified as hydrologic Soil Group B, indicating high infiltration capacity, the presence of the underlying till layer makes this soil less suitable for stormwater infiltration applications. Slopes are generally steeper in the northern half of the city bordering Puget Sound, with more wetland areas in the southern half of the city draining to Hylebos Creek.

Water Bodies

Water bodies in Federal Way are shown in Figure 1-2. Stormwater runoff within the city limits drains to 12 basins along the Puget Sound: Hylebos Creek – West, Hylebos Creek – East, Lower Green River – West, Mill Creek, Browns-Dash, Central Puget Poverty Bay, Joes Creek, Central Puget Redondo Creek, Dumas Bay, Lakota Creek, Lower North Puget Sound, and Central Puget Cold Creek (Figure 1-2). Water quality issues and habitat resources are described for each basin.

Figure 1-2. Water Bodies in Federal Way



Water Quality Assessments

Ecology assesses the quality of all water bodies in the state to determine whether they are impaired by pollutants and require a water improvement project or Total Maximum Daily Load (TMDL). Ecology's 303(d) list contains the water bodies whose beneficial uses such as drinking, recreation, aquatic habitat, and industrial use are impaired by pollutants according to water quality assessments.

Habitat Resources

Where available, Benthic Index of Biotic Integrity (BIBI) data and data from the Puget Sound Watershed Characterization Project are also used to assess habitat. BIBI scores quantify the health of benthic macroinvertebrates in streams because they are good indicators of biological health. The BIBI scoring system can be used to compare and rank the health of different streams or the same stream across time, with higher scores indicating healthier streams.

Hylebos Creek – West

The Hylebos Creek – West drainage basin is approximately 5,840 acres. It is the largest basin in the city, with approximately 91 percent of the basin inside the city limits. The Hylebos basin includes three subbasins:

- West Fork
- East Fork
- Lower Hylebos

Hylebos Creek drains directly to Commencement Bay in Puget Sound. The West Fork drains the central and southern portions of the city, with several smaller tributaries that converge at West Hylebos Wetland Park. Hylebos Creek provides spawning habitat for threatened fall-run Chinook salmon (*Oncorhynchus tshawytscha*) and has documented presence of threatened winter-run steelhead (*O. mykiss*) (WDFW 2020a, 2020b, as cited in Herrera, 2021). The Hylebos basin has experienced significant development and urbanization. Hylebos Creek and the West Fork of Hylebos Creek are included on Ecology's 303(d) list for bacteria, dissolved oxygen, and temperature (Ecology 2019a, as cited in Herrera, 2021).

The lower main stem and lower West and East Forks flow through Puyallup Tribal Lands. The Muckleshoot Tribe maintains fishing rights on Hylebos Creek, which was formerly home to substantial runs of coho (*O. kisutch*), chum (*O. keta*), and Chinook salmon, as well as cutthroat (*O. clarki*) and steelhead trout; these populations are now diminished. The Puyallup Tribe releases between 10,000 and 20,000 juvenile fall Chinook salmon into the West Fork on an annual basis (Schwartz 2016, as cited in Herrera, 2021). The Salmon Habitat Protection and Restoration Strategy for water resource inventory area (WRIA) 10 does not prioritize Hylebos Creek as an area for salmon recovery due to the small populations it contains compared to populations in the main stem Puyallup, White, and Carbon Rivers.

Assessment of Hylebos Creek

This basin is 100% within the urban growth area. The whole Hylebos basin within Federal Way includes the West and East Hylebos sub basins. The Hylebos basin was separated into two sub basins due to its significant size compared to other basins within Federal Way jurisdiction. A majority of the zoning within the basin and jurisdiction was 30.5% for high-density single-family residential, followed by 20.8% zoned for medium-density single-family residential, 13.3% zoned for multi-family residential, 10.1% zoned for office parks which allows for mix of office and compatible light manufacturing activities, 8.2% zoned for commercial enterprises (Costco, Wal-Mart, Home Depot), 4.9% zoned for low-density suburban estate,

3.8% zoned as City Center Frame (intended to look and feel similar to the City Core and provide a zone of less dense commercial/residential mixed-use development), 3.6% zoned for community businesses, 3.3% zoned as City Core (intended for higher-density, mixed-use designation for office, retail. Government, and residential uses are concentrated), 1.3% zoned for neighborhood business, and 0.2% zoned for professional offices. Total impervious surfaces area covers 29.3% (2.4 mi^2) of the West Hylebos basin within jurisdiction. The impervious area in the West Hylebos is significantly higher than all other basins with a coverage of 2.4 miles squared follow by the Lakota basin with 0.83 miles squared. Based on Federal Way Spill Analysis 2013-2020, 266 of 481 (55.3%) spills occurred in this basin. The most common spill was petroleum products (21.8% of spills), followed by sediment (20.0% of spills), and food wastes (18.0%). Majority of high trafficked arterial roads are located within the West Hylebos basin.

Majority of the proposed capital improvements project in the SWM Comprehensive Plan was for the West Hylebos both for water quality and drainage. There were 7 proposed water quality projects which includes, a West Hylebos education center site (estimated cost $1,700,0000), S 359th St culvert replacement (estimated cost $890,000), S 356th St culvert replacement (estimated cost $1,400,000), West Hylebos watershed trail (estimated cost $7,800,000), north fork West Hylebos watershed trail (estimated cost $5,200,000), West Hylebos basin land acquisition (estimated cost $2,378,000), and analyzing options for retrofitting hidden pond on Kim's property (estimated cost $60,000). The 2 drainage capital improvement projects were the 324th and Hwy 99 drainage improvements (estimated cost $350,000), and upsize pipes at SW Campus Dr (estimated cost $30,000). The West Hylebos has had many improvement projects over the years. One in 1997 called West Fork Hylebos Rehabilitation (Additional info?). In 1999 at the North Fork of Hylebos between S 359th St and S 364th St there was a project that involved a weir repair and a culvert removal. In 2004, there was a West Hylebos Creek Restoration Project which involved installing log weirs, engineered log jams for habitat, log revetments for stream stabilization, and augmented existing log jams. In 2014, there was a regional detention facility retrofit project along S 356th St funded by stormwater retrofit and LID grant among other projects. Based on the Puget Sound watershed characterization project metals, nitrogen, and pathogen should be dealt with by restoring source processes. To manage phosphorus, we should be restoring the sinks. As for sediment it should be dealt with by protecting source processes.

Hylebos Creek – East

The Hylebos Creek – East drainage basin area is approximately 3,900 acres, with approximately 45 percent of the basin inside the city limits. Refer to the Hylebos Creek – West description for general information regarding the larger Hylebos basin. The East Fork begins with several smaller tributaries in the eastern portion of the city near North Lake and Lake Killarney, which is located along the outer boundary of the city. The Hylebos Creek – East drainage contains threatened fall-run Chinook salmon spawning habitat and threatened winter-run steelhead documented presence (WDFW 2020a, 2020b, as cited in Herrera, 2021).

North Lake is a 55-acre mesotrophic lake that is currently managed by a Lake Management District formed in 2010 to provide a funding mechanism for ongoing aquatic vegetation management, water quality monitoring, public education, and other lake improvement programs. North Lake has a maximum depth of 34 feet, has a boat ramp (no gas engines allowed), and is stocked with rainbow trout (King County 2015a, as cited in Herrera, 2021).

Lake Killarney is a 31-acre mesotrophic lake that has a maximum depth of 15 feet and a mean depth of 9 feet. The lake is located primarily outside the city limits in a public park, has a boat ramp (no gas engines allowed), and is stocked with bass and rainbow trout. As of 2017,

monitoring data indicates that the lake has fairly clear water with moderate algal growth and fairly high nutrient concentrations (King County 2015b, as cited in Herrera, 2021) resulting in a 303(d) listing for total phosphorus. Algal blooms were reported in 2017 and 2018; however, data trends indicate decreasing nitrogen and phosphorus concentrations (King County 2017, 2018a, and Ecology 2019a, as cited in Herrera, 2021).

Assessment of East Hylebos

This basin is 100% within the urban growth area. The whole Hylebos basin within Federal Way includes the West and East Hylebos sub basins. The Hylebos basin was separated into two sub basins due to its significant size compared to other basins within Federal Way jurisdiction. Around 32% of the basin is zoned for high density residential, followed by 29% of cooperate park such as the IRG property (formerly owned by Weyerhaeuser) around North Lake, followed by 20% of office parks which allows for light manufacturing activities and offices, followed by 11% zoned for multifamily, followed by 4% for commercial enterprises which includes retailers like Home Depot and Costco (high trafficked big box stores). Total impervious surface area covers 8.4% (0.23 mi^2) of basin within jurisdiction. Based on Federal Way Spill Analysis 2013-2020, 27 of 481 (5.4%) spills occurred in this basin. The most common spill was turbid water, followed by construction related discharges, and finally petroleum products. One potential capital improvement project has been proposed for drainage improvement on 33rd Pl S that involves extending the existing stormwater pipe westward to improve drainage conditions with estimated cost of $340,000. Due to the fact that there is a large percentage of high-density single-family zones, that the basin is within an urban growth area, a segment of I-5 is within the basin, high trafficked big box stores, we can summarize that the basin has high potential for non-point source runoff impacts. However, the East Hylebos basin is spawning habitat for fall chinook salmon and winter steelhead, and of the 44.7% of the basin within jurisdiction about 8.7% is impervious surface (about 19.5% impervious if we only consider basin within jurisdiction). With the facts presented and utilizing the management matrix for restoration and protection we have designated the basin for Restoration of Sources Processes and/or Protection of Source Processes specifically for sediment.

Joes Creek

The Joes Creek basin is approximately 1,530 acres; approximately 80 percent of the basin is located inside city limits. Upper Joes Creek is a highly modified urban stream that discharges into Dumas Bay in Puget Sound. The Joes Creek Basin also includes Lake Jeane and Lake Lorene (the Twin Lakes), both of which were recommended for lake restoration analysis in the Upper Joes Creek Watershed Nutrient Reduction Project due to phosphorus and related algae issues attributed to both surface water inputs and internal loading. Upper Joes Creek has nutrient concentrations similar to other King County streams and was found to be the primary source (84 percent) of the total phosphorus load to Lake Lorene (Herrera 2017, as cited by Herrera, 2021). This basin has presumed presence of federally listed threatened fall-run Chinook salmon and winter-run steelhead (WDFW 2020a, 2020b, as cited by Herrera, 2021). BIBI scores are available for two locations on Joes Creek from 2014: 14.5 (very poor) and 10.3 (very poor). Joes Creek is on Ecology's 303(d) list for temperature (Ecology 2019a, as cited by Herrera, 2021). There is also documented presence of Coho salmon at the mouth of Joes Creek (WDFW 2019b, as cited by Herrera, 2021).

The Twin Lakes Golf Club and County Club is located in this basin and uses water from Lake Jeane as irrigation during the summer and pumps groundwater into the lake to replace the water used for irrigation.

Assessment of Joes Creek

This basin is 100% within the urban growth area. Majority of area is zoned for high-density single-family homes which covers about 81% of the basin within jurisdiction, followed by 2.4% zoned for neighborhood businesses which includes dentist, grocery stores, dry cleaners, banks, etc., followed by 1.5% zoned for multi-family homes, and lastly, 1.2% zoned for medium density single family. Total impervious surface area covers 23.0% (0.43 mi^2) of basin within jurisdiction. Based on Federal Way Spill Analysis 2013-2020, 29 of 481 (6.03%) spills occurred in this basin. The most common spill was petroleum products, followed by sediment, and sewage. A potential capital improvement project mentioned in City of Federal Way's Surface Water Management Comprehensive Plan Comprehensive to improve water quality is to address the erosions issues in the stream that caused transport of gravel downstream by stabilizing the channel upstream with no estimated cost. The downstream portion of the stream has a 303(d) impairment for temperature based on temperature data from 2008. Joes Creek designated as core summer salmonid habitat and primary contact recreation. In 2006, Federal Way conducted a salmon habitat restoration project for Joes Creek. This involved new channel design to accommodate modeled 100-year storm (259 ft3/second), replacing a street culvert, and installation of a stilling well to dissipate energy, and creating a wetland at the north end of driving range. Based on the Puget Sound Watershed Characterization Project, Joes Creek should prioritize on restoration of source processes for pathogens and phosphorus; restoration of sinks for metals and nitrogen; and protection of source processes for sediment. Restoration of source processes for pathogen and phosphorus seem like the higher priority because Joes Creek flows through the Twin Lake's golf course which is a source of excess nutrients due to fertilization and pathogens from water fowl.

Central Puget Redondo Creek

The Central Puget Redondo Creek Basin is approximately 800 acres, approximately 90 percent of which is located within the city limits. Redondo Creek drains from Steel Lake directly to Poverty Bay in Puget Sound and is severely incised. The Central Puget Redondo Creek Basin has presumed presence of federally listed fall-run Chinook salmon and winter-run steelhead, and documented presence of state-listed coastal cutthroat trout (WDFW 2020a, 2020b, as cited by Herrera, 2021). Heavy erosion occurs during high flows; and poor water quality is present in the creek from nonpoint pollution, predominantly residential and commercial (FHWA et al. 2003, as cited by Herrera, 2021). Redondo Creek is on Ecology's 303(d) list for fecal coliform bacteria, specifically near the outlet to Puget Sound where it flows between Wooton Park and Redondo Beach Park (Ecology 2019a, as cited by Herrera, 2021). Several fish passage barriers have been identified, including culvert crossings along Redondo Way South (which generally, follows the entire stream length), and the final crossing at Redondo Beach Drive South prior to discharge into Poverty Bay (WDFW 2019b, as cited by Herrera, 2021). This basin is located within the boundary of Poverty Bay Shellfish Protection District (PBSPD) (King County 2018b, as cited by Herrera, 2021). SR 509 and SR 99 are major roads in this basin.

Steel Lake is a 46-acre mesotrophic lake that is managed by a Lake Management District formed in 2003 to support vegetation management and water quality projects. Steel Lake has very good water quality (King County 2015c, as cited by Herrera, 2021). The lake has a maximum depth of 24 feet, a boat ramp (no gas engines allowed), and is stocked with rainbow trout.

Assessment of Central Puget Redondo Creek

This basin is 100% within the urban growth area. Over 78.9% of the zoning area within the basin and jurisdiction is designated as high-density single family. Followed by 8.8% zoned for multi-family, 8.3% zoned for community business, and 3.7% zoned for medium density single family. Based on zoning data we can expect this basin to be significantly impacted by effects generally caused by high density residential zones. Total impervious surface area covers 22.4% (0.24 mi^2) of basin within jurisdiction. Based on Federal Way Spill Analysis 2013-2020, 60 of 481 (12.5%) spills occurred in this basin. The most common spill was turbid water, followed by petroleum products, and finally construction related activity. Disclaimer, the Spill Analysis began before Herrera was contracted to help us with our SWM Comp Plan and revised our watershed delineations, therefore Redondo Creek and Cold Creek share the same Spill Analysis statistics. A couple of potential capital improvement projects have been proposed which includes a creek culvert replacement at 16th Ave S with a fish-passable culvert (estimated cost $1,100,000) and/or an outfall erosion prevention project for outfall #256 (estimated cost $160,000). In 2009, Redondo Creek was classified as a minor stream due to fish passing barriers which includes a 10-feet-high natural waterfall south of S 293 Pl and downstream of waterfall there is a stream channel with a 12% longitudinal gradient. Due to percentage of high-density single-family zones, that it's within an urban growth area, and that a segment of SR-99 is within the basin we can summarize that the basin has high potential for non-point source runoff loading. The discharge point goes into Poverty Bay and is on the 303(d) list of bacteria. This receiving water basin is not fish passible and only has a presumed presence of fall chinook and winter steelhead according to WDFW. Based on collected information and using the management matrix for restoration and protection we recommend designating the basin for Restoration with Development or Restoration 2. Specifically, on protecting sinks for phosphorus, nitrogen, and metals. Protect source processes for pathogens. Restoring sinks and protect source processes for sediment.

Lakota Creek

The Lakota Creek basin is approximately 1,965 acres and is located entirely within the city limits. Lakota Creek drains from Lake Ponce De Leon and discharges directly to Puget Sound. The lower reaches of Lakota Creek have a presumed presence of federally listed fall-run Chinook salmon and winter-run steelhead. Approximately 27 percent of the drainage basin is impervious surface. Based on the City's GIS mapping, approximately 18 percent of the drainage basin is zoned for increased development density in potentially sensitive areas. The Lakota Wastewater Treatment Plant is located in this basin.

BIBI scores are available for Lakota Creek from 2014: 42.8 (fair) and 16.4 (very poor). A significant portion of the stream runs along SR 509. Multiple fish passage barriers are present, including two dams and multiple culvert road crossings (WDFW 2019a, as cited by Herrera). Salmon are known to be present in Lakota Creek.

Assessment of Lakota Creek

This basin is 100% within the urban growth area. As for zoning within the basin and jurisdiction, majority of the area is zoned for high-density single-family residential with covers about 73.4%, followed by 11.7% zoned for medium-density single family residential, 9.6% zoned for multi-family residential, 1.8% for neighborhood business zones, 1.8% zoned for low-density suburban estate, 1.1% zoned for professional offices, and lastly 0.6% zoned for office parks. Total impervious surface area covers 26.95% (0.83 mi^2) of basin within jurisdiction. Based on Federal Way Spill Analysis 2013-2020, 30 of 481 (6.2%) spills occurred in this basin. The most common spill was sediment, followed by food waste, wash water,

and sewage were all tied for the second most common discharge in Lakota identified by our IDDE program. One potential water quality capital improvement project was proposed in the SWM Comprehensive plan which involved considering an alternative design for the additional over pipe over near 31411 3rd Pl S due to access difficulties and can potentially be a mitigation project with Sound Transit. Two restoration projects have been completed on Lakota Creek. One in 2004 which involved removing invasive and nuisance plants and planting over 6,000 plants and stream restoration improvements along the mainstem and west branch of Lakota Creek. Another in 2005, which involved stream restoration improvements along the east branch of Lakota Creek. Based on the Puget Sound Watershed Characterization Project the Lakota basin we should restore its sinks for nitrogen, pathogens, metals, and phosphorus. As for sediment we should be protecting the source processes.

Central Puget Cold Creek

The Central Puget Cold Creek basin is approximately 680 acres, with over 90 percent located within the city limits. Approximately 15 percent of this basin is zoned for increasing development density in potential areas of ecological concern. Cold Creek drains from Easter Lake and flows directly to Puget Sound. The stream has been piped and channeled in several locations. Federally listed fall-run Chinook salmon and winter-run steelhead have a presumed presence, and state-listed coastal cutthroat trout are documented within this basin (WDFW 2020a, 2020b, as cited by Herrera, 2021). Two fish passage barriers have been identified in the stream; the SR 509 crossing is designated as zero percent passable (WDFW 2019a, as cited by Herrera, 2021). This basin is also located within the boundary of Poverty Bay Shellfish Protection District (PBSPD) (King County 2018b, as cited by Herrera, 2021).

Assessment of Central Puget Cold Creek

The basin is 100% within the urban growth area. A majority of area within the basin and jurisdiction is zoned for high density single family residential at 66.4%, followed by 12% zoned for medium density single family residential, 10.9% zoned for community businesses, 9.6% zoned for multi-family residential, 0.8% zoned for city center frame, and lastly 0.3% for professional offices. Total impervious surfaces area covers 28.2% (0.28 mi^2) of the Cold Creek basin within jurisdiction. Based on Federal Way Spill Analysis 2013-2020, 60 of 481 (12.5%) spills occurred in this basin. The most common spill was turbid water, followed by petroleum products, and finally construction related activity. Disclaimer, the Spill Analysis began before Herrera was contracted to help us with our SWM Comp Plan and revised our watershed delineations, therefore Redondo Creek and Cold Creek share the same Spill Analysis statistics. There was one potential Capital Improvement Project for Cold Creek to improve water quality by performing a Cold Creek culvert replacement due to failing culvert under Marine Hills pool and channel stabilization to address the upstream and downstream erosion with estimated cost of $3,800,000. Based on the Watershed Characterization Project we should be prioritizing protection of source processes for sediment and pathogen. As for phosphorus, metals, and nitrogen we should be protecting the sinks.

Basins Not Included in Prioritization Process

The basins below were not included in Step 4 of the Receiving Water Conditions Assessments regarding “Assessment of Relative Conditions and Contributions”, referenced in the SMAP Guidance document, because they were expected to have low hydrological impacts and pollutant loading and therefore by

definition low expected Stormwater Management Influence as defined by Ecology. Basins defined as having low expected Stormwater Management Influence are not included the prioritization process. Please see basin assessment spreadsheet for additional information.

Mill Creek

The Mill Creek drainage basin (also called Hill Creek) is located in WRIA 9 (Duwamish-Green), predominantly in south King County. The larger drainage basin is roughly 15 square miles in size and includes portions of the cities of Kent, Auburn, Algona, and Federal Way. A small percentage (approximately 2 percent) of the basin is located inside the city limits and includes federally listed spawning fall-run Chinook salmon and winter-run steelhead, and documented presence of federally listed bull trout and state-listed coastal cutthroat trout (WDFW 2020a, 2020b). According to King County, most of the basin (76 percent) is developed (King County 2016, as cited in Herrera, 2021). Monitoring indicates that water quality (e.g., turbidity, total suspended solids [TSS], fecal coliform bacteria, nutrients) has generally improved in Mill Creek since 1979; however, Mill Creek has low dissolved oxygen, high ortho-phosphorus, and high fecal coliform bacteria counts relative to the Green-Duwamish Watershed (King County 2016 as cited in Herrera, 2021).

Browns-Dash

The Browns-Dash drainage basin is approximately 3,400 acres, with less than 2 percent of the basin located within city limits. Most of the basin is in Pierce County (unincorporated UGA of the city of Tacoma). There are no named streams and only minor unnamed streams mapped within the basin, which drains directly to Commencement Bay in Puget Sound and includes presumed presence of federally listed fall-run Chinook salmon and winter-run steelhead (WDFW 2020a, 2020b, as cited in Herrera, 2021). The Browns-Dash basin borders the Port of Tacoma and includes the North Shore Golf Course. There are several nearshore 303(d) listings close to this basin, including polychlorinated biphenyls (PCBs) in Dalco Passage and East Passage, and dissolved oxygen, phthalates, and PCBs in Commencement Bay (Outer) (Ecology 2019a, as cited in Herrera, 2021).

Central Puget Poverty Bay

The Central Puget Poverty Bay drainage basin is approximately 820 acres and is located almost entirely (99 percent) within the city limits. The Central Puget Poverty Bay drainage basin is currently 19 percent impervious. There are no named streams in this basin, but several mapped unnamed streams drain directly to Puget Sound. Although there is no documented use by federally listed or state-listed species (WDFW 2020a, 2020b, as cited by Herrera, 2021), and there are no fish passage barriers associated with these unnamed streams (WDFW 2019a, as cited by Herrera, 2021), there is documented residential fish use by these unnamed streams (WDFW 2019b). Portions of the shoreline are identified by the City for bluff restoration and bluff conservation. This basin is also located within the boundary of Poverty Bay Shellfish Protection District (PBSPD) (King County 2018b, as cited by Herrera, 2021).

Lower Green River – West

The Lower Green River – West drainage basin area is approximately 9,300 acres, with a small percentage (approximately 5 percent) of the basin inside the city limits. Bingaman Creek is located in this drainage basin; the stream begins at Laurelwood Park, is crossed by Interstate 5 (I-5) (total fish passage blockage), and drains away from the city through Bingaman Pond Natural Area. There is some discrepancy in naming between Bingaman and Bingamon drainages, which appear to converge with drainage from Star Lake and form an eventual tributary to the Green River. The Green River is spawning habitat for Endangered Species Act (ESA) threatened

fall-run Chinook salmon and threatened winter-run steelhead and has documented presence of threatened bull trout (*Salvelinus confluentus*) and state-listed coastal cutthroat trout, which may extend to Bingaman Creek (WDFW 2020a, 2020b, as cited in Herrera, 2021). The Green River (which does not flow within city limits) has a TMDL for temperature.

Lower North Puget Sound

The Lower North Puget Sound basin is approximately 4,270 acres, with approximately 11 percent of the basin within the city limits. There are no named streams in this basin mapped inside the city limits. Mapped streams in this basin that are outside the city limits include Barnes Creek, Massey Creek, and McSorley Creek; all three streams are on Ecology's 303(d) list for fecal coliform bacteria and dissolved oxygen (Ecology 2019a, as cited by Herrera, 2021). Although there are no federally listed species within this basin, the streams include documented presence of state-listed coastal cutthroat trout (WDFW 2020a, 2020b, as cited by Herrera, 2021). This basin is located within the boundary of Poverty Bay Shellfish Protection District (PBSPD) (King County 2018b, as cited by Herrera, 2021). The portion of the basin within the city is ranked in the "Highest Restoration" category (high importance and high degradation) by the Puget Sound Characterization Project. SR 99 passes through this drainage basin.

Dumas Bay

The Dumas Bay basin is approximately 1,284 acres, approximately 67 percent of which is located within the city limits. Approximately 16 percent of the drainage basin is impervious surface, and SR 509 bisects the drainage basin. A significant portion of the drainage basin within the city limits is occupied by Dash Point State Park. The Twin Lakes Golf Course is also located in the basin. No named streams are mapped in this drainage basin; however, several partial unnamed streams are present, which discharge into Dumas Bay and have mapped fish presence (WDFW 2019b, as cited by Herrera, 2021). This basin has a presumed presence of federally listed fall-run Chinook salmon and winter-run steelhead (WDFW 2020a, 2020b, as cited by Herrera, 2021). A portion of this basin is ranked in the "Highest Restoration" category (high importance and high degradation) by the Puget Sound Characterization Project (Ecology 2020, as cited in Herrera, 2021).