Stormwater Management Action Plan

City of Tumwater

March 2023

Prepared for
City of Tumwater

Prepared by
Herrera Environmental Consultants, Inc.

CITY OF TUMWATER

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Science + Planning + Design

Stormwater Management Action Plan

City of Tumwater

Prepared for
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March 2023

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PURPOSE

The City of Tumwater (City) Stormwater Management Action Plan (SMAP) is prepared to meet the requirements of S5.C.1.d.iii of the 2019 -2024 Western Washington Phase II National Pollutant Discharge Elimination System (NPDES) Stormwater Permit issued by the Washington Department of Ecology (Ecology).

The SMAP is organized according to the permit language and identifies the following for the high priority catchment identified as the Trosper Lake subbasin within the larger Percival Creek Watershed:

- A description of the stormwater facility retrofits needed for the area, including the best management practice (BMP) types and preferred locations.
- Land management/development strategies and/or actions identified for water quality management.
- Targeted, enhanced, or customized implementation of stormwater management actions related to permit sections within S5, including:
    - Illicit discharge detection and elimination (IDDE) field screening,
    - Prioritization of Source Control inspections,
    - Operations and Maintenance (O&M) inspections or enhanced maintenance, and
    - Public Education and Outreach behavior change programs.
- If applicable, identification of changes needed to local long-range plans, to address SMAP priorities.
- A proposed implementation schedule and budget sources for:
    - Short-term actions (i.e., actions to be accomplished within six years), and
    - Long-term actions (i.e., actions to be accomplished within seven to 20 years).
- A process and schedule to provide future assessment and feedback to improve the planning process and implementation of procedures or projects.

BACKGROUND

The City completed the first two phases of the NPDES permit-required SMAP process in 2022 with submittal of the "City of Tumwater Watershed Inventory and Assessment" in March (City of Tumwater 2022a) and the "City of Tumwater Watershed Prioritization" in June (City of Tumwater 2022b). While the permit requires only one catchment be selected for development of a detailed SMAP, the City has elected to develop a SMAP for three priority catchments—Trosper Lake subbasin and the West Mottman Industrial subbasin in the Percival Creek watershed and the Fish Pond Creek subbasin in the Black Lake watershed. The Watershed Inventory and Assessment is provided in Appendix A. The Watershed Prioritization is provided in Appendix B. See Figure 1 for a map of the three priority catchments.

These three subbasins were chosen because they are in priority watersheds with high degrees of stormwater influence and because they represent distinct land uses (i.e., mixed use, industrial, and rural) that will help inform broader stormwater management retrofit planning and program development across the remaining areas of the priority watersheds and Citywide.

The Trosper Lake SMAP is the first of the three to be developed and represents the official deliverable to Ecology by March 2023 to satisfy NPDES permit requirements. The rest of this document presents the Trosper Lake SMAP. The remaining SMAP documents for the West Mottman Industrial subbasin and the Fish Pond Creek subbasin will be completed later in 2023.

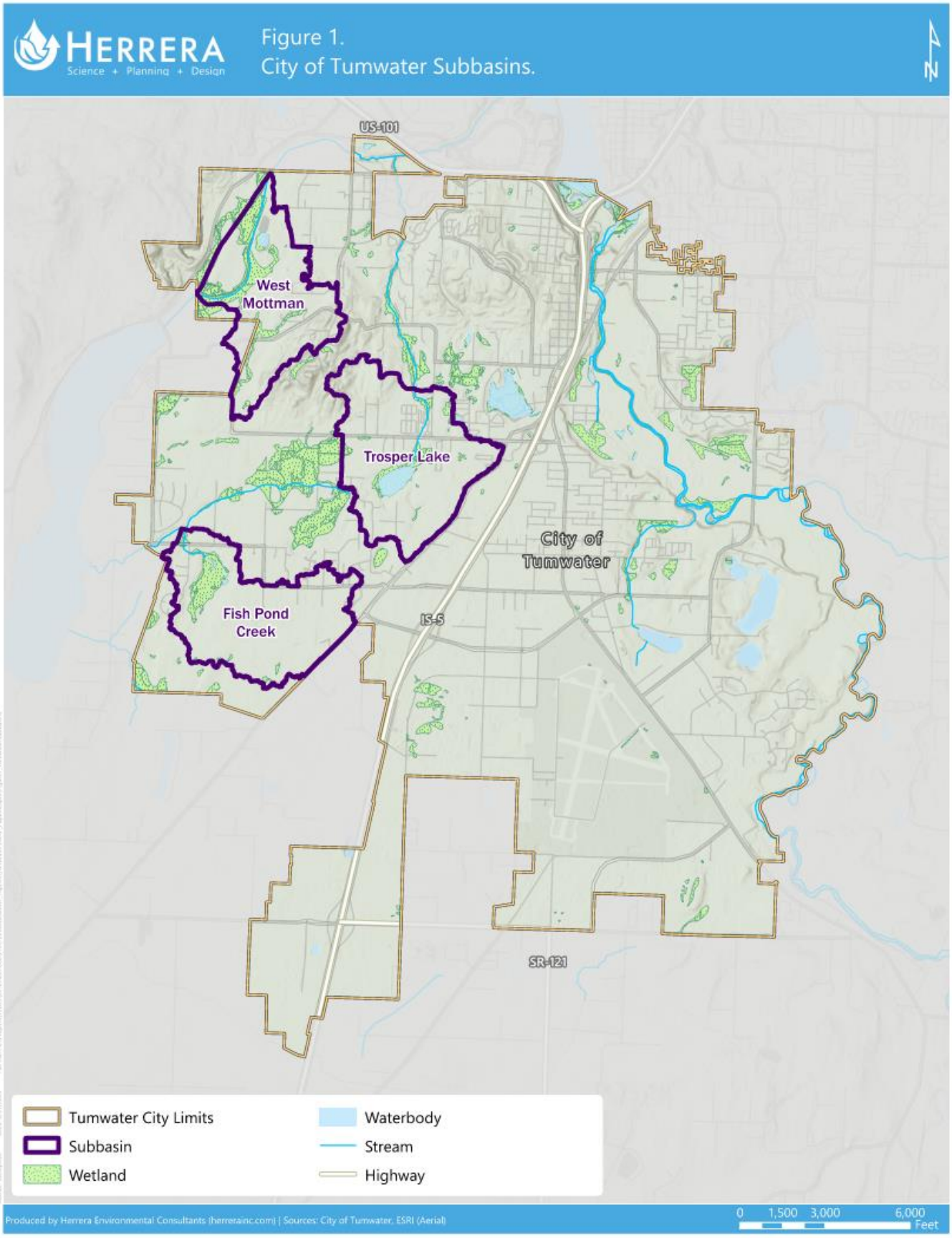
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Figure 1.
City of Tumwater Subbasins.
N
US-101
West Mottman
Trosper Lake
City of Tumwater
Fish Pond Creek
I5-5
SR-121
Tumwater City Limits
Subbasin
Wetland
Waterbody
Stream
Highway
Produced by Herrera Environmental Consultants (herrerainc.com) | Sources: City of Tumwater, ESRI (Aerial)
0 1,500 3,000 6,000
Feet

WATERSHED PRIORITIZATION SUMMARY

Seven watersheds were originally identified and considered as potential candidates for the SMAP during an initial screening performed for the City's watershed inventory. These include Lower Deschutes River, Salmon Creek, Black Lake, Percival Creek, Capitol Lake, Moxlie Creek, and Chambers Creek (City of Tumwater 2022a). Due to low stormwater influence, Moxlie Creek and Chambers Creek were omitted from the prioritization process. Receiving water conditions and stormwater influence were then evaluated for the remaining five watersheds to complete the watershed prioritization process (City of Tumwater 2022b).

The Percival Creek watershed was subsequently identified as a high priority for SMAP development based on several factors (City of Tumwater 2022b):

- The presence of industrial areas and projected residential development were determined to be prime targets for SMAP actions within the watershed.
- There is the potential for high quality salmon spawning in Percival Creek if conditions were improved.
- There is high potential for stormwater actions to improve water quality conditions and habitat for fish and wildlife in the watershed.
- The upper subbasin (Trosper Lake) lies entirely within the City limits and its scale is consistent with SMAP objectives.

Percival Creek Watershed Function

Approximately 46% of the 7.2 square mile Percival Creek watershed lies within City limits, including the headwaters at Trosper Lake. In addition to Percival Creek and Trosper Lake, the watershed also includes Black Lake Ditch, which drains nearby Black Lake.

Designated uses for Percival Creek include Salmonid habitat, wildlife habitat, and aesthetic values. Percival Creek is identified on Ecology's 303(d) list of impaired water bodies due to elevated temperature and low dissolved oxygen. Ecology has categorized this impairment as Category 5, meaning it must be addressed through a Total Maximum Daily Load (TMDL) or other cleanup plan. Sources of these impairments are primarily from unmanaged stormwater, including the Beehive Industrial area in the Trosper Lake subbasin. In addition, while Black Lake Ditch within the watershed meets bacteria water quality standards, Percival Creek does not, and additional source identification is warranted. Potential sources for the bacteria impairment may include sewage overflows, septic systems, recreational users, and homeless encampments.

The watershed was subdivided into 13 subbasins during the SMAP watershed characterization step. Of these, three subbasins were determined to be of appropriate size (i.e., 400 to 600 acres) to

consider in the SMAP process. Two of these three subbasins, the West Mottman Industrial subbasin and the Trosper Lake subbasin, were selected by the City to include in the SMAP process because of their stormwater influence and their overall importance to the health of the watershed.

Trosper Lake Subbasin Conditions

A brief description is provided below of the Trosper Lake subbasin's land use, growth potential, and stormwater influence. This background information regarding existing characteristics and potential future conditions was considered during development of the SMAP.

Land Use and Future Growth

The Trosper Lake subbasin is approximately 570 acres. Land use is diverse and comprised of distinct commercial, single-family residential, multi-family residential, and light industrial areas. Extensive open space and sensitive resources are also present. See Figure 2 for an overview of these areas.

Vacant lands and older existing developments are frequently targeted for redevelopment. The City projects moderate growth in the commercial and residential portions of the subbasin.

Stormwater Influence

In the older residential neighborhoods and in the Beehive Industrial area, existing stormwater management consists primarily of informal and roadside conveyance ditches and limited if any stormwater treatment. More recent commercial and residential developments throughout the subbasin are served by more formal stormwater systems, including curb and gutter, catch basins with piped conveyance, and private, centralized flow control and/or treatment facilities. Infiltration is a common treatment method in areas where treatment is provided. There are over 40 private stormwater facilities in the subbasin.

Unmanaged stormwater runoff has the potential to increase flows, temperature, and pollutants discharging to subbasin waterbodies. The density of residential housing is expected to increase near Trosper Lake, Percival Creek, and associated wetlands, which will contribute to further impairment within the subbasin.

The presence of unmanaged industrial areas and projected residential development are prime targets for SMAP projects within the subbasin. These actions would be expected to improve water quality conditions and habitat for fish and wildlife.

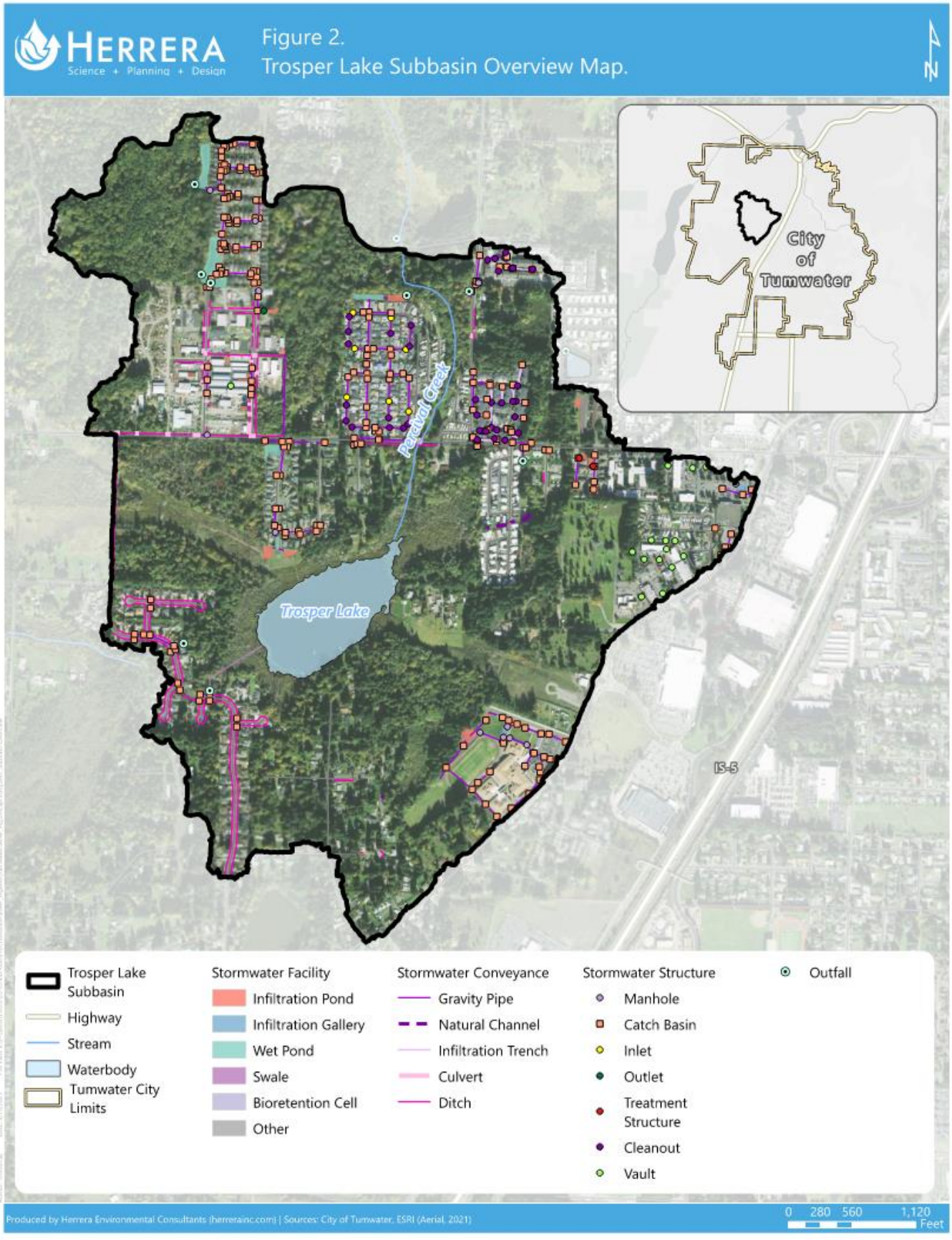
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Figure 2.
Trosper Lake Subbasin Overview Map.
N
City of Tumwater
Percival Creek
Trosper Lake
I5-5
Trosper Lake Subbasin
Highway
Stream
Waterbody
Tumwater City Limits
Stormwater Facility
Infiltration Pond
Infiltration Gallery
Wet Pond
Swale
Bioretention Cell
Other
Stormwater Conveyance
Gravity Pipe
Natural Channel
Infiltration Trench
Culvert
Ditch
Stormwater Structure
Manhole
Catch Basin
Inlet
Outlet
Treatment Structure
Cleanout
Vault
Outfall
Produced by Herrera Environmental Consultants (herrerainc.com) | Sources: City of Tumwater, ESRI (Aerial, 2021)
0 280 560 1,120
Feet

STORMWATER MANAGEMENT ACTIONS

Process to Identify Stormwater Management Actions

Identifying stormwater management actions included a detailed evaluation of landscape characteristics and the existing stormwater system in the Trosper Lake subbasin. Landscape characteristics included zoning, vacant lands, stream buffers, wetlands, geohazard areas, and road right-of-way (ROW). In addition, stormwater infrastructure, projects, and programs were reviewed. The assessment of the stormwater system included identifying existing stormwater problem areas, facilities and outfalls, including previously unmapped outfalls. Current capital improvement projects (CIPs) were also reviewed to identify projects that improve stormwater quality and/or flow control. Based on this information a series of 'actions' were identified to further protect and/or enhance ecosystem function of the Trosper Lake subbasin. Actions were selected based on greatest benefit per City capacity. The City's interdisciplinary team was involved in action prioritization, timing, and costing through bi-weekly meetings, fieldwork days, and three workshops conducted in November and December 2022 and February 2023.

The City also created a Story Map to use as an engagement tool that discusses the SMAP process and gathers feedback around ranking priority watersheds. The City received three responses during that time, with all respondents coming from the Lower Deschutes River receiving waterbody. Respondents were most concerned about pollutants entering surface waters and the aquifer (the source of the City's drinking water) and habitat loss/destruction. This feedback was used to help identify and prioritize land management strategies and stormwater program enhancements. In addition, the City is working to continue engaging residents of the Trosper Lake subbasin through mailings that direct residents to online resources with explanation and a Web Map of the subbasin's key natural resources, stormwater features, and proposed retrofit projects, and opportunities to provide feedback

The proposed stormwater management actions in this SMAP cover three categories: strategic retrofit project opportunities, land management strategies, and stormwater program enhancements. All strategic retrofit project opportunities are one-time actions. However, land management strategies and stormwater program enhancements can be conducted over varying time frames: one-time, pilot, or annually for the short-term (2024 – 2030) and/or long-term (2031 – 2044). Projects identified as annual projects, or 3-year pilot projects may be evaluated during and after the project to determine if it is beneficial to continue the action or end the action based on project success, effectiveness, and need.

Strategic Stormwater Retrofit Project Opportunities

Previous stormwater plans used to develop an initial list of stormwater retrofit project opportunities included:

- Annexation Area Drainage Study (Skillings Connolly 2011)
- Comprehensive Stormwater Management Plan (Herrera 2018)
- 2020 – 2025 Capital Facilities Plan (CFP) (City of Tumwater 2019)
- Analysis and Recommendations Technical Memorandum, City of Tumwater Beehive Industrial Park Drainage Evaluation (HDR 2021)
- Trosper Lake Subbasin Background Document (City of Tumwater 2022c).

The list of stormwater retrofit project opportunities was then evaluated using a desktop assessment to create a project opportunity matrix. The matrix was reviewed at a workshop with City staff and the top project opportunities from the workshop were assessed further during a field evaluation.

Based on the desktop and field assessments, two stormwater retrofit project opportunities were selected for further consideration in the Trosper Lake subbasin:

- Beehive Industrial Area Linear Facilities
- Rural Road Linear Facilities

The BMP types and implementation schedule for these stormwater retrofit project opportunities are described in Table 1 and locations of retrofit project opportunities are shown in Figure 3. More information about the opportunities can be found in Appendices C and D.

Table 1. Trosper Lake Subbasin Stormwater Retrofit Project Opportunities.

ID	Project Opportunity	BMP Type	Implementation Schedule
RP-1	Beehive Industrial Area Linear Facilities	Bioretention	Short-term (2024–2030)
RP-2	Rural Road Linear Facilities	Bioretention	Long-term (2031–2044)

RP = Retrofit Project Opportunity

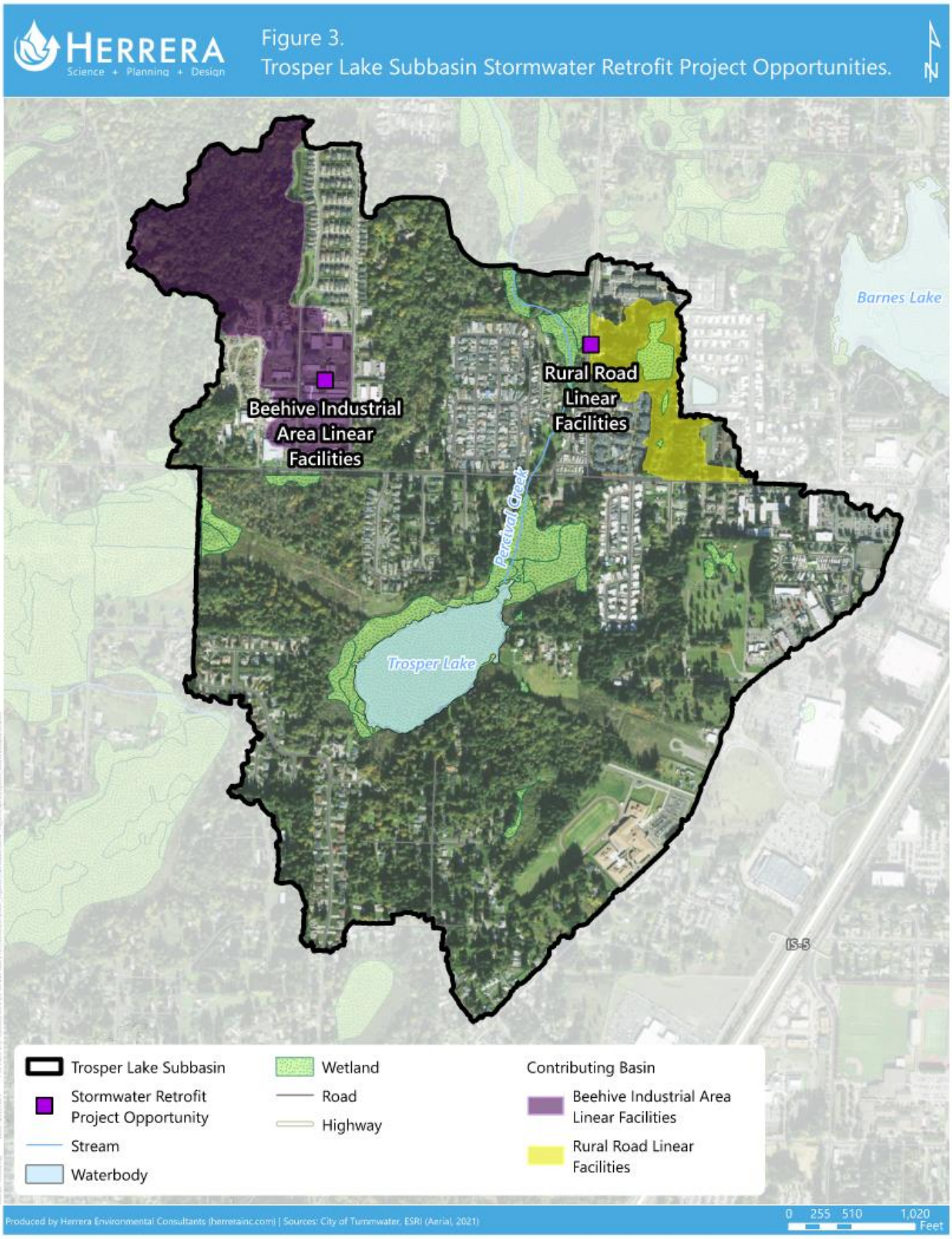
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Figure 3.
Trosper Lake Subbasin Stormwater Retrofit Project Opportunities.
N
Barnes Lake
Rural Road Linear Facilities
Beehive Industrial Area Linear Facilities
Percival Creek
Trosper Lake
I-5
Trosper Lake Subbasin
Stormwater Retrofit Project Opportunity
Stream
Waterbody
Wetland
Road
Highway
Contributing Basin
Beehive Industrial Area Linear Facilities
Rural Road Linear Facilities
Produced by Herrera Environmental Consultants (herrerainc.com) | Sources: City of Tumwater, ESRI (Aerial, 2021)
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Land Management Strategies

Four land management strategies were identified for the Trosper Lake subbasin. Table 2 outlines the strategies and descriptions. These strategies were refined over multiple workshops with City staff. Appendices E and F includes detailed information about anticipated costs.

Table 2. Trosper Lake Subbasin Land Management Strategies.

Strategy	Description	Implementation Schedule
LM-1: Conduct a monitoring needs assessment of Trosper Lake and the lake subbasin.	Scope the purpose, goals and costs to assess the lake and subbasin. Identify lake and subbasin monitoring needed to determine the existing lake aquatic habitat and water quality conditions. Conduct basic water quality monitoring program on the lake.	Short-term (2024–2030)
LM-2: Evaluate options for development of an ecosystem services asset management program.	Conduct initial study to identify how an ecosystem services asset management program would be developed, funded and applied to inform land use planning, restoration actions and overall benefit to receiving waters Citywide.	Short-term (2024–2030)
LM-3: Implement ecosystem services asset management program.	Based on the initial evaluation (LM-2), implement an ecosystem services asset management program. In addition, as information is available through development projects, update aquatic resources map every 3 - 5 years, including wetland, streams, and buffer areas Citywide.	Long-term (2031–2044)
LM-4: Coordinate with other City Departments to incorporate stormwater into projects, especially CFP projects.	Annually, meet with other department staff during planning of capital improvement projects (such as the annual Transportation Improvement Projects review, or Parks planning projects review) to determine how anticipated projects could incorporate stormwater planning and retrofits, especially projects related to the Transportation and Engineering Department.	Short-term (2024–2030) Long-term (2031–2044)

LM = Land Management Strategy

The City also explored other opportunities to protect/conserve land from impervious surface as well as change zoning and land use policies. Ultimately, it was decided that these efforts required longer term planning and increased discussions and are therefore not able to be added to the SMAP at this time. The City continues to work on protecting land and updating zoning policies in conjunction with other efforts outlined in this SMAP and other City-wide efforts.

Stormwater Program Enhancements

The City conducts a number of activities in compliance with the NPDES Phase II permit. These include activities associated with Monitoring and Assessment, Illicit Discharge Detection and Elimination, Source Control, Operations and Maintenance, and Public Education and Outreach objectives.

The City's existing procedures for implementing these activities were reviewed to consider what enhancements would be beneficial for accelerating water quality and habitat improvements in the Trosper Lake subbasin. This section describes the enhancements implemented within the Trosper Lake subbasin that will exceed NPDES permit required actions. Table 3 summarizes stormwater program enhancement (SE) actions. Appendices E and F include detailed information, anticipated costs, and implementation schedules.

Illicit Discharge Detection and Elimination

The permit requires the City to inspect an average of 12% of their municipal separate storm sewer system (MS4) annually. The City will conduct the below additional actions in the Trosper Lake subbasin:

- Implement enhanced IDDE screening (SE-1)

Source Control Program for Existing Development

The permit requires the City to implement a business source control inspection program starting on January 1, 2023, that directs the City to inspect 20% of the businesses and/or sites listed in their source control inventory annually and implement a progressive enforcement policy. Complaint response and follow up inspections count towards the total target inspection number. The City will conduct the following supplementary actions in the Trosper Lake subbasin:

- Provide enhanced Business Source Control Inspections and Technical Assistance in the Beehive Industrial Area (SE-2)
- Launch Dumpster Lid Campaign (SE-3)

Operations and Maintenance

The permit requires the City to inspect all City-owned or operated catch basins and inlets every two years and clean if inspection indicates cleaning is needed. Additional provisions exist for reduced cleaning based upon inspection. In the Trosper Lake subbasin, the City will conduct the subsequent additional actions:

- Provide additional O&M training (SE-4)
- Establish ditch maintenance program (SE-5)

Public Education and Outreach

The permit requires the City to implement public education and outreach programs to build awareness, foster behavior change, and provide stewardship opportunities related to water resource protection. The City will conduct the below additional actions in the Trosper Lake subbasin:

- Conduct targeted outreach for public stormwater education events (SE-6)
- Increase pet waste stations (SE-7)
- Develop and implement school environmental education program in partnership with educators and school district (SE-8)
- Provide free technical assistance to landowners (SE-9)

Riparian area along Percival Creek, north of Trosper Lake, in the project subbasin.

Monitoring and Assessment

The permit requires the City to participate in regional status and trends monitoring and in stormwater management program (SWMP) effectiveness and source identification studies. In addition to these requirements, the City will conduct the following additional actions in the Trosper Lake subbasin:

- Develop local stormwater monitoring program (SE-10)
- Develop and implement benthic index of biological integrity stream assessment monitoring program in Percival Creek (SE-11)

Table 3. Trosper Lake Subbasin Stormwater Program Enhancements.

Permit Section	Action	Description	Implementation Schedule
Illicit Discharge Detection and Elimination S.5.C.5	SE-1: Implement enhanced IDDE screening	Conduct intersection dry weather sampling supplemental to outfall screening.	Short-term (2024–2030)
Source Control Program for Existing Development S.5.C.8	SE-2: Provide enhanced Business Source Control Inspections and Technical Assistance in the Beehive Industrial Area	Focus on the Beehive Industrial area to track which businesses have industrial discharge permits and explore additional requirements or more frequent inspections. Partner with Ecology in the case of Industrial Stormwater General Permits (ISGP).	Short-term (2024–2030)
	SE-3: Launch Dumpster Lid Campaign	Use the Trosper Lake Subbasin as a pilot program to roll out the larger scale Dumper Lid Social Marketing Campaign, aiming to get businesses to close their dumpster lids and seek help from LeMay (waste disposal organization) as needed.	Short-term (2024–2030)

Table 3. Trosper Lake Subbasin Stormwater Program Enhancements.			
Permit Section	**Action**	**Description**	**Implementation Schedule**
Operations and Maintenance S.5.C.7	SE-4: Provide additional O&M training	Provide training to O&M staff and plan review training for engineering department.	Short-term (2024–2030)
	SE-5: Establish ditch maintenance program	Develop and implement ditch maintenance program to better address heavily vegetated ditches and alleviate flooding and water quality concerns.	Short-term (2024–2030)
Public Education and Outreach S.5.C.2	SE-6: Conduct targeted outreach for public stormwater education events	Conduct engagement and direct outreach to overburdened communities in Trosper Basin. Provide free, high-quality educational opportunities for all residents through hands-on science, workshops, and tours. Programming will be provided under the Stream Team brand and City of Tumwater brands and include in-person, online only, and hybrid events.	Short-term (2024–2030)
	SE-7: Increase pet waste stations	Expand the existing pet waste station program to target high-traffic dog areas and under resourced neighborhoods, conduct targeted outreach to these areas.	Short-term (2024–2030)
	SE-8: Develop and implement school environmental education program in partnership with educators and school district	Involve school and/or Educational Service District environmental and STEM educators with developing and implementing environmental education programs and/or educational signage around existing stormwater facilities.	Short-term (2024–2030)
	SE-9: Provide free technical assistance to landowners	Provide free technical assistance to landowners with questions/concerns about flooding or water quality issues. This includes site visits, over-the-phone assistance, and via email.	Short-term (2024–2030)
Monitoring and Assessment S.8.	SE-10: Develop local stormwater monitoring program	Develop a Trosper Basin long-term monitoring implementation and quality assurance project plan. Identify purpose, goals, indicators, frequency, analysis, and locations. Incorporate other existing monitoring and estimated annual costs. Develop with ability to expand to additional basins in the future.	Short-term (2024–2030)
	SE-11: Develop and implement benthic index of biological integrity stream assessment monitoring program in Percival Creek	Develop and implement benthic index of biological integrity stream assessment program for Percival Creek; identify opportunities for student involvement.	Short-term (2024–2030)

SE = Stormwater Program Enhancement

Changes to Long Range Plans

Changes to long range plans will be dependent upon the anticipated 2024-2029 NPDES permit requirements. The new permit may specify a portion of the SMAP plan is adequate to meet the permit requirement. Water Resources and Sustainability staff will work collaboratively with other City departments to incorporate SMAP elements into the City's 2024 Comprehensive Plan Periodic Update. The City anticipates conducting an update to their stormwater system plan beginning in 2025. This stormwater system plan update will consider incorporating elements of the SMAP into plan sections associated with implementation, capital project planning, level of service, and utility rates, as appropriate.

PROPOSED IMPLEMENTATION SCHEDULE AND BUDGET SOURCES

For each action, the City identified if the action would be implemented in the short-term or long-term. Short-term is assumed to be 2024 – 2030 and long-term is assumed to be 2031 – 2044 and is dependent on the NPDES stormwater permit re-issuance on August 1, 2024.

Budget sources are primarily from the existing stormwater utility fund, with the exception of those noted as potential future grant applications and the stormwater retrofit projects. Stormwater retrofit projects may be included in the future stormwater comprehensive plan update and incorporated into capital project planning. Future permit requirements for stormwater facility retrofits will be reviewed and applied to capital project planning.

Table 4 identifies the proposed implementation schedule and potential budget sources for each action. Appendices C and D include concept details and associated cost estimates for the stormwater retrofit projects. Appendix E (Tables E-1 and E-2) show the cost estimates and assumptions for both short and long-term land management and stormwater enhancement actions. Appendix F (Figures F-1 and F-2) include a schedule with cost breakdowns by year. Cost estimates and assumptions are in 2023 dollars and designed to inform the potential impact to the City stormwater funds of future NPDES permit requirements.

Table 4. Trosper Lake Subbasin Stormwater Management Actions Schedule.				
ID	Action	Schedule		Budget Source
		Short-term 2024 - 2030	Long-term 2031 - 2044	
Retrofit Project Opportunities				
RP-1	Design and Construct Beehive Industrial Area Linear Facilities	✓		Ecology Water Quality Combined Funding
RP-2	Design and Construct Rural Road Linear Facilities		✓	Ecology Water Quality Combined Funding
Land Management Actions				
LM-1	Conduct a monitoring needs assessment of Trosper Lake and the lake subbasin.	✓		Existing Stormwater Utility Fund
LM-2	Evaluate options for development of an ecosystem services asset management program.		✓	Grant Program (TBD)[a]
LM-3	Implement ecosystem services asset management program.		✓	Grant Program (TBD)[a]
LM-4	Coordinate with other City Departments to incorporate stormwater into projects.	✓	✓	Existing Stormwater Utility Fund
Stormwater Enhancements				
SE-1	Implement enhanced IDDE screening	✓		Existing Stormwater Utility Fund
SE-2	Provide enhanced Business Source Control Inspections and Technical Assistance in the Beehive Industrial Area	✓		Existing Stormwater Utility Fund
SE-3	Launch Dumpster Lid Campaign	✓		Existing Stormwater Utility Fund
SE-4	Provide additional O&M training	✓		Existing Stormwater Utility Fund
SE-5	Establish ditch maintenance program	✓		Existing Stormwater Utility Fund
SE-6	Conduct targeted outreach for public stormwater education events	✓		Existing Stormwater Utility Fund
SE-7	Increase pet waste stations	✓		Existing Stormwater Utility Fund
SE-8	Develop and implement environmental education program with educators and school district	✓		Existing Stormwater Utility Fund
SE-9	Provide free technical assistance to landowners	✓		Existing Stormwater Utility Fund
SE-10	Develop local stormwater monitoring program	✓		Existing Stormwater Utility Fund
SE-11	Develop and implement benthic index of biological integrity stream assessment monitoring program in Percival Creek	✓		Existing Stormwater Utility Fund

[a] Funding sources may include Department of Ecology Water Quality Combined Funding Source, Capacity Grants, or other funding programs/opportunities that may arise in the next seven to ten years.

FUTURE ASSESSMENT AND FEEDBACK

This SMAP identifies and describes retrofit projects, land management strategies, and stormwater program enhancement activities that are intended to protect or enhance the receiving waters in the Trosper Lake subbasin. The City will assess implementation of this SMAP by tracking project implementation and program effectiveness. The City will use the results of this assessment to adjust SMAP implementation over time. Assessment and feedback may be altered based on future permit requirements.

Retrofit projects will be reviewed and tracked as part of capital project planning and budgeting. More detailed stormwater program assessment, capital project planning, and financial analysis will occur on a 6-year cycle as part of comprehensive planning and provide an additional opportunity for tracking. The SMAP as a whole will be updated in alignment with Tumwater's comprehensive planning effort, starting in 2025.

Progress on land management strategies will be assessed annually and staff allocation will be shifted as needed to meet implementation goals.

Stormwater program activities will be reviewed annually during NPDES Phase II Permit reporting. Staff and budget allocation will be shifted as-needed to meet implementation goals.

City staff will continue to monitor water quality data collected by Ecology, neighboring jurisdictions, and partners to determine if SMAP implementation is adequate to meet receiving water improvement goals, if additional actions are required, or if actions should be modified based on improved BMPs or emerging science.

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APPENDIX A

City of Tumwater Watershed Inventory and Assessment

City of Tumwater Receiving Water Inventory and Assessment

Contents

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Lower Deschutes River

Receiving Water Inventory

Relative Conditions:

The Deschutes River is under pressure from growth, resulting in many small, uncontrolled sources of pollution entering the river. In 1998, the Deschutes River was placed on Ecology's 303(d) list of impaired waters due to temperature, fecal coliform bacteria, dissolved oxygen, and fine sediment problems. Now that a Total Maximum Daily Load (TMDL) study has been completed and an Implementation Plan is in place (Ecology 2015b), the Deschutes River is listed as Category 5 (Polluted waters that require a TMDL or other cleanup plan) for these same constituents plus pH and fine sediment (Ecology 2015). It is also listed as Category 4 (Polluted waters that do not require a cleanup plan.) Often this is because a plan (e.g., a TMDL) is already in place, but it can also refer to waters with problems that cannot be addressed through a cleanup plan, such as flow impairments or aquatic plant problems) due to low instream flows.

Total Watershed Area:

17.70 mi^2

Watershed Area in City Limits:

8.96 mi^2

Percent of the total watershed area in Tumwater city limits:

50.62%

Receiving Water Assessment

Designed Uses:

Recreation
Fishing
Salmon Habitat
Wildlife Corridor
Aquifer Recharge
Aesthetics

Desired Water Quality Conditions:

Temps for Salmon Rearing
Minimal Sediment Transport
Sufficient Oxygenation
Consistent In-Stream Flows
Variable Sediment Composition
Wildlife corridor habitat
Optimal pH
Reduced bacteria counts

Known Water Quality Impairments:

Temperature
Fecal coliform or E. coli bacteria
Dissolved oxygen
Fine sediment
pH
In stream flows
The Deschutes River is under pressure from growth, resulting in many small, uncontrolled sources of pollution entering the river. In 1998, the Deschutes River was placed on Ecology's 303(d) list of impaired waters due to temperature, fecal coliform bacteria, dissolved oxygen, and fine sediment problems. Now that a Total Maximum Daily Load (TMDL) study has been completed and an Implementation Plan is in place (Ecology 2015b), the Deschutes River is listed as Category 5 (Polluted waters that require a TMDL or other cleanup plan) for these same constituents plus pH and fine sediment (Ecology 2015). It is also listed as Category 4 (Polluted waters that do not require a cleanup plan. Often this is because a plan (e.g., a TMDL) is already in place, but it can also refer to waters with problems that cannot be addressed through a cleanup plan, such as flow impairments or aquatic plant problems) due to low instream flows.

Land Use (limited and unreliable):

The Lower Deschutes Watershed within Tumwater is primarily urban areas with green spaces that include Pioneer Park, The Tumwater Valley Golf Course and the Brewery Park at Tumwater Falls. The industrial area known as the Olympia Brewery still occupies areas of the waterfront across from Brewery Park at Tumwater Falls, but remains vacant.

Zoning (Top 5):

Airport Industrial - 21%
Single Family Low Density - 14.9%
Open Space - 14.6%
Single Family Medium Density - 12.1%
Light Industrial - 10.2%

Tree Canopy (%):

32.82%

Impervious Surface (%):

31.44%

Sensitive/Critical Areas:

31.44%

Projected Growth:

The Lower Deschutes River Watershed includes a wide variety of accepted land uses and zoning. There is robust growth projected throughout the watershed for commercial and residential properties.

What are the causes for impairment?

Reduced channel complexity and flood plain connectedness

Tree canopy loss due to development

Bank erosion at Pioneer Park

Untreated stormwater from East Linwood Basin and M St. outfall

Other stormwater inputs include bacteria, nutrients, oil and other pollutants.

What are solutions to impairment?

Implement restoration projects to improve and restore riparian and channel conditions.

Maintain riparian buffer throughout the golf course and Brewery District

Design and construct stormwater treatment for the East Linwood Basin

Maintain Salmon Safe Certification for the Tumwater Valley Golf Course

NPDES Permit implementation (IDDE, E &O, O&M, inspection programs, etc.)

Reduce anthropogenic sources of heat including stormwater outfall retrofits to retain runoff and encourage infiltration; evaluate runoff from large areas of impervious surface, with focus on on-site retention and infiltration.

Consider a regional stormwater facility

Assess current land use and future development and consider adjusting to improve and protect water quality.

Overburdened Communities Evaluation:

NA

Data Sources:

2018 SW Comp Plan

Deschutes River, Percival Creek, and Budd Inlet Tributaries Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH and Fine Sediment TMDL Water Quality Improvement Report and Implementation Plan

SMAP Findings

Stormwater Management Influence Assessment findings. (See the guidance document for definitions and description of this assessment):

SMAP requirements that affect the Deschutes River will not have a significant impact on the overall health of the Deschutes Watershed, however, Tumwater is pursuing improvements in stormwater treatment for the Watershed such as East Linwood Basin Stormwater Treatment Project, Tumwater Valley Golf Course Parking Lot Stormwater Treatment Project, Pioneer Park Restoration Project, and Tumwater Regional Stormwater Facility Project.

Will receiving water be included in the prioritization process?

Yes

SMAP Stormwater Management Influence (high, medium, or low):

Medium

Salmon Creek

Receiving Water Inventory

Relative Conditions:

The Salmon Creek Watershed is relatively flat (.014% grade) and is defined by the surface and groundwater sources that contribute to recharge of Salmon Creek. Above average rainfall typically causes localized flooding due to the high groundwater table in the watershed. There is very little impervious surface in the watershed that contributes to flooding. Only about 8-10% of the land in the Salmon Creek Basin is covered by impervious surface (2004). Some flooding concerns are addressed through the Hopkins Ditch District and the Hickman Ditch District.
Stormwater management strategies that require infiltration are challenging due to high groundwater table. If detention and treatment facilities are inundated by high groundwater or flooding, it is not possible to treat stormwater and then discharge off site.
Very little water quality information exists specifically for the Salmon Creek Watershed.

Total Watershed Area:

11.52 mi^2

Watershed Area in City Limits:

1.81 mi^2

Percent of the total watershed area in Tumwater city limits:

15.71%

Receiving Water Assessment

Designed Uses:

Recreation
Fish Habitat
Wildlife Habitat/Corridor
Aquifer Recharge
Aesthetics

Desired Water Quality Conditions:

Sufficient oxygenation
Consistent in stream flows
Reduced flooding

Known Water Quality Impairments:

High temperature
Low oxygen
Bacteria

Land Use (limited and unreliable):

Industrial, low-density residential (4-7 units per acre), forest (38% in 2004), pasture land (51% in 2004

Zoning (Top 5):

Light Industrial - 58.3%
Airport Light Industrial - 20%
General Commercial - 5.2%
Single Family Medium Density - 4.7%
Single Family Low Density - 2.2%

Tree Canopy (%):

36.75%

Impervious Surface (%):

21.42%

Sensitive/Critical Areas:

15.86%

Projected Growth:

Salmon Creek is targeted for growth in planning documents and projections. The 1995 Tumwater-Thurston County Joint Plan designates Urban Growth Area boundaries that stretch into the Salmon Creek Basin, but also recognize that some areas are unsuitable for development due to flooding from surfacing groundwater. The plan directs Thurston County and the City of Tumwater to determine appropriate stormwater management in advance of development in areas where existing soils make drainage difficult.
Critical Areas Ordinance affect the density on 72% of the basin's undeveloped land.
City of Tumwater Stormwater Comprehensive Plan Update (1995) identifies Salmon creek Watershed as a lower priority for planning activities.

What are the causes for impairment?

Flooding concerns
High ground water
Failed septic systems

What are solutions to impairment?

Integrate SW solutions into development

Install a basin wide sewer system

Preserve tree cover

Overburdened Communities Evaluation:

NA

Data Sources:

Salmon Creek Comprehensive Drainage Study
2018 Comp Plan

SMAP Findings

Stormwater Management Influence Assessment findings. (See the guidance document for definitions and description of this assessment):

Salmon Creek Watershed is limited in Tumwater with only 15% of the watershed delineated within the city limits. High groundwater in this area limits future development potential. The watershed lacks water quality data to fully understand reactions to stormwater management actions. Due to limits on the amount of watershed within the City limits as well as limited opportunities to affect stormwater management, Salmon Creek Watershed ranks lower on the prioritization list.

Will receiving water be included in the prioritization process?

Yes

SMAP Stormwater Management Influence (high or low):

Medium

Black Lake

Receiving Water Inventory

Relative Conditions:

General water quality conditions in the Black Lake Watershed are rated as fair (TCEH Black Lake Water Quality Report 2019), however Black Lake is eutrophic. In 2019, the mean Total Phosphorus (TP) concentration was above the action level. Productivity was high and transparency was lower than average. The TP concentration has declined since 2016, when the Black Lake Special District applied alum. Samples for algal toxins have not been above the Washington State advisory levels since 2015. The main portion of the Black Lake Watershed within Tumwater City Limits is the Fish Pond Creek sub-basin. Fish Pond Creek drains an extensive wetland system that extends East to the vicinity of Trosper Lake and south to the vicinity of Black Hills High School. The area is considered to be good beaver habitat and is suspected to be fish bearing, although no recent fish surveys have been conducted to confirm the presence of fish. The sub-basin has numerous undersized culverts identified in the Annexation Area Drainage Report (2011). The combination of undersized culverts and the presence of beaver activity make the sub-basin susceptible to localized flooding during heavy rain events. Maintenance needs and capitol improvement projects for upgrading conveyance and treatment are identified in the Mottman Industrial Area Basin Evaluation (2020)

Total Watershed Area:

8.10 mi^2

Watershed Area in City Limits:

2.74 mi^2

Percent of the total watershed area in Tumwater city limits:

33.83%

Receiving Water Assessment

Designed Uses:

Recreation
Fish Habitat
Wildlife Habitat/Corridor
Aquifer Recharge
Aesthetics

Desired Water Quality Conditions:

Decreases in excess nutrients and seasonal temperatures.
Reduced algal blooms

Known Water Quality Impairments:

Recent improvements in Phosphorus are due in part to the Black Lake Management District's actions to apply alum to treat for algae blooms, however seasonally high nutrient levels can have other negative impacts to water quality.

Land Use (limited and unreliable):

Predominately residential
Extensive wetland systems on the south and north ends of the lake

Zoning (Top 5):

Single Family Low Density - 54.1%
Single Family Medium Density - 17.5%
Residential/Sensitive Resource - 13.8%
Light Industrial - 6.7%
Multi-Family Medium Density - 4.1%

Tree Canopy (%):

42.68%

Impervious Surface (%):

17.94%

Sensitive/Critical Areas:

41.53%

Projected Growth:

The majority of the Black Lake Watershed is in the Urban Growth Area and is subject to moderate development of single family residences. Within Tumwater, stormwater treatment within the watershed is usually addressed on a site by site basis and larger developments have stormwater treatment and infiltration within the neighborhood. The Tikner Farm Development (~1,200 single family homes) is scheduled to begin in 2022-2023 and will have extensive onsite stormwater treatment facilities included in the design. WRS anticipates an enhanced level of TESC inspections for this project.

What are the causes for impairment?

Excess nutrient
Algal blooms (although this seems to have been addressed by the Black Lake Management District).
DO (source of Black Lake Ditch)
Temperature (source of Black Lake Ditch)
Potential: Construction related runoff from new development
Lack of Conveyance and infiltration capacity in the Mottman Industrial Area

What are solutions to impairment?

Potential: Waterfront property owners lawn care practices
Overburdened Communities Evaluation:

NA

Data Sources:

WRIA 13 Freshwater Prioritization Summary Memo
TCEH Black Lake Water Quality Report, 2019
City of Tumwater Annexation Area Drainage Study
Mottman Industrial Area Basin Evaluation (2020)

SMAP Findings

Stormwater Management Influence Assessment findings. (See the guidance document for definitions and description of this assessment):

There are opportunities to improve flooding conditions during heavy rain events through increasing conveyance capacity in select locations. Opportunities also exist for enhanced TESC inspections and LID installations at new development locations. The Black Lake Watershed ranks high due to potential improvements for conveyance at culverts and opportunities for stormwater facilities and BMPS for future development.

Will receiving water be included in the prioritization process?

Yes

SMAP Stormwater Management Influence (high or low):

High

Percival Creek

Receiving Water Inventory

Relative Conditions:

Percival Creek is considered to rank as a Category 5 (Polluted waters that require a TMDL or other cleanup plan) according to the Ecology's water body assessment. The creek is considered polluted and requires a TMDL or other clean up plan specifically for elevated temperature and low dissolved oxygen. While Black Lake Ditch meets the bacteria water quality standards, Percival Creek does not, and additional source identification is warranted. Potential sources include recreational users and homeless populations. Maintenance needs and capitol improvement projects for upgrading conveyance and treatment are identified in the Beehive Industrial Area Drainage Evaluation Analysis (2021).

Total Watershed Area:

7.19 mi^2

Watershed Area in City Limits:

3.28 mi^2

Percent of the total watershed area in Tumwater city limits:

45.62%

Receiving Water Assessment

Designed Uses:

Salmonid Habitat
Wildlife Corridor
Aesthetics

Desired Water Quality Conditions:

High Quality Salmonid Habitat
Sediment Composition
Water Quality parameters within state standards

Known Water Quality Impairments:

Fecal coliform/E coli
Seasonal turbidity
Seasonal DO
Seasonal temperature
Fish passage barriers

Land Use (limited and unreliable):

Urban
Suburban residential
Commercial/industrial

Zoning (Top 5):

Single Family Low Density - 24.7%
Light Industrial - 21.8%
Residential/Sensitive Resource - 16.6%
Single Family Medium Density - 9.5%
Green Belt - 8.8%

Tree Canopy (%):

49.05%

Impervious Surface (%):

30.85%

Sensitive/Critical Areas:

40.99%

Projected Growth:

Modest development for residential and commercial. Increases in stormwater runoff could impact the stream through degraded water quality, stream bank erosion, hillslope failures, and channel scour.

What are the causes for impairment?

Sewage overflows / Elevated bacteria levels
Sediment Composition due to scour
stormwater runoff
Fish Passage Barriers
Lack of conveyance and treatment Beehive Industrial Area

What are solutions to impairment?

Increased surveillance for E. coli. (bracket sampling)
Increase inspections for construction sites
Increase street sweeping
Complete fish passage barrier removal
Maintenance and capitol improvement projects at the Beehive Industrial Area

Overburdened Communities Evaluation:

There are two areas within the watershed that are identified as "elevated burden" (index score 5 and 6). One area is identified as "decreased burden" (index score = 1). One area is identified as "limited burden" (index score = 0).

Data Sources:

WRIA 13 Freshwater Prioritization Summary Memo
IDDE Reports
SAM Puget Sound Small Stream Monitoring website
Deschutes River, Percival Creek, and Budd Inlet Tributaries Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH and Fine Sediment TMDL Water Quality Improvement Report and Implementation Plan, Ecology 2015.
2018 Stormwater Comp Plan
Thurston County Annual WQ Monitoring Report (2011)
Percival Creek Comprehensive Drainage Basin Plan (1993)
Beehive Industrial Area Drainage Evaluation Analysis and Recommendations (2021)

SMAP Findings

Stormwater Management Influence Assessment findings. (See the guidance document for definitions and description of this assessment):

The presence of industrial areas and projected residential development are prime targets for SMAP projects within the watershed. The upper watershed lies entirely within the City limits and its scale is consistent with SMAP objectives. There is the potential for high quality salmon spawning in Percival Creek if conditions were improved. Percival Creek Watershed has a high potential for stormwater actions to improve water quality conditions and habitat for fish and wildlife.

Will receiving water be included in the prioritization process?

Yes

SMAP Stormwater Management Influence (high or low):

High

Capitol Lake

Receiving Water Inventory

Relative Conditions:

General water quality conditions in Capitol Lake are considered poor according to the Thurston County Annual Water Quality Monitoring Report (2011). The lake is listed on the state's 303(d) list of water quality impaired water bodies for total phosphorus and fecal coliform. Sediment deposition in the lake from the Deschutes River, Percival Creek, shoreline erosion, and landslides has been an on-going issue since the lake was created. Excessive aquatic plant and algae growth in the summer severely impedes navigation on the lake. Control is ongoing for an infestation of the noxious aquatic plant, Eurasian water milfoil. In 2009 another invasive species, the New Zealand mud snail, was discovered in the lake. Efforts are underway to control the spread of the mud snail.
The 2021 Thurston County Basin Report lists Capitol Lake as "degraded" to "very degraded" based on amount of impervious surface, forest canopy cover and intact riparian land cover in the watershed. Stormwater runoff from I-5 and Hwy 101 have negative impacts, especially as more is known about the 6PPD chemical.

Total Watershed Area:

2.56 mi^2

Watershed Area in City Limits:

0.97 mi^2

Percent of the total watershed area in Tumwater city limits:

37.89%

Receiving Water Assessment

Designed Uses:

Recreation
Wildlife habitat
Aesthetics
Salmon corridor

Desired Water Quality Conditions:

Management plan dependent on desired lake or estuary habitat.

Known Water Quality Impairments:

Bacteria
Sedimentation
Phosphorus
Invasive species

Land Use (limited and unreliable):

Residential
Commercial
Brewery District Industrial
Green space

Zoning (Top 5):

Single Family Medium Density - 41.2%
Historic Commercial - 11.6%
Multi-Family Medium Density - 11.6%
Open Space - 8.8%
Green Belt - 4.9%

Tree Canopy (%):

42.79%

Impervious Surface (%):

35.20%

Sensitive/Critical Areas:

30.60%

Projected Growth:

The Capitol Lake Watershed consists primarily of established neighborhoods and open/green space in the form of parks and greenbelts. Development and redevelopment usually happens at a small scale and future development and redevelopment should continue on a small scale. Due to the nature of runoff sources, retrofit projects could enhance stormwater runoff into the lake.

What are the causes for impairment?

Sewage overflows in Percival Creek
Homeless encampments
Sediment from the Deschutes River and Percival Creek

What are solutions to impairment?

Specific invasive species remediation activities
Source control and illicit connection investigations for phosphorus and bacteria
TMDL actions for reduced sediment

Overburdened Communities Evaluation:

NA

Data Sources:

Thurston County Annual WQ Monitoring Report (2011)
Thurston County Basin Conditions Report (2021)

SMAP Findings

Stormwater Management Influence Assessment findings. (See the guidance document for definitions and description of this assessment):

Capitol Lake ranks moderately high for opportunities for stormwater action planning, however considerations should be made for the fate of Capitol Lake as an estuary or freshwater lake. WSDOT highways are a considerable input into Capitol Lake and SMAP projects would benefit from partnering with WSDOT. This watershed could benefit from retrofit projects and enhanced maintenance activities.

Will receiving water be included in the prioritization process?

Yes

SMAP Stormwater Management Influence (high or low):

High

Moxlie Creek

Receiving Water Inventory

Relative Conditions:

High levels of bacteria, phosphorus, and ammonia have negative impacts on the health of Moxlie Creek. The Moxlie Creek Watershed is heavily impacted by urbanized land uses. The creek is piped through downtown Olympia before entering Budd Inlet.

Total Watershed Area:

2.17 mi^2

Watershed Area in City Limits:

.04 mi^2

Percent of the total watershed area in Tumwater city limits:

1.84%

Receiving Water Assessment

Designed Uses:

Recreation
Aesthetics
Aquatic life habitat

Desired Water Quality Conditions:

Unknown

Known Water Quality Impairments:

Fecal coliform
Stormwater runoff from highways and city streets

Land Use (limited and unreliable):

Unknown

Zoning (Top 5):

NA

Tree Canopy (%):

28.02%

Impervious Surface (%):

50.87%

Sensitive/Critical Areas:

0%

Projected Growth:

Growth within the city limits will be limited. There is an established neighborhood with limited projected development.

What are the causes for impairment?

Illicit sewer connections
Stormwater runoff

What are solutions to impairment?

Illicit connection investigations including bracket sampling
Enhanced catch basin cleaning

Overburdened Communities Evaluation:

NA

Data Sources:

Thurston County Annual WQ Monitoring Report (2011)
Thurston County Basin Conditions Report (2021)

SMAP Findings

Stormwater Management Influence Assessment findings. (See the guidance document for definitions and description of this assessment):

Moxlie Creek will not be considered in the Watershed scale Stormwater Management Influence Assessment due to the limited area of the watershed within the City of Tumwater (1.84%)

Will receiving water be included in the prioritization process?

No

SMAP Stormwater Management Influence (high or low):

Low

Chambers Creek

Receiving Water Inventory

Relative Conditions:

Chambers Creek suffers from tree canopy loss, sedimentation problems, and fish passage barriers. Seasonal variations in nutrients, in stream flows, DO and turbidity have negative impacts in the overall health of the stream, however the mouth seems to have the highest quality habitat for salmon spawning and rearing.

Total Watershed Area:

0.96 mi^2

Watershed Area in City Limits:

.01 mi^2

Percent of the total watershed area in Tumwater city limits:

1.04%

Receiving Water Assessment

Designed Uses:

Recreation
Aesthetics
Aquatic life habitat
Salmon spawning and rearing habitat

Desired Water Quality Conditions:

Unknown

Known Water Quality Impairments:

Sedimentation
Fish passage barriers
Bacteria
Seasonal variations in DO, turbidity, and nutrients

Land Use (limited and unreliable):

Unknown

Zoning (Top 5):

NA

Tree Canopy (%):

52.43%

Impervious Surface (%):

33.78%

Sensitive/Critical Areas:

0.23%

Projected Growth:

The area within the Tumwater City limits that lies within the Chambers Creek Watershed is an established neighborhood with a functioning stormwater treatment facility and infiltration system. Very limited growth is projected for this area.

What are the causes for impairment?

Stormwater runoff
Tree canopy loss

What are solutions to impairment?

Stormwater treatment
Enhanced tree canopy cover in riparian areas

Overburdened Communities Evaluation:

NA

Data Sources:

Chambers-Ward-Hewitt Drainage Basin Plan (1995)

SMAP Findings

Stormwater Management Influence Assessment findings. (See the guidance document for definitions and description of this assessment):

Chambers Creek will not be considered in the Watershed scale Stormwater Management Influence Assessment due to the limited area of the watershed within the City of Tumwater (1.04%)

Will receiving water be included in the prioritization process?

No

SMAP Stormwater Management Influence (high or low):

Low

Combined Receiving Water Assessment

Receiving Water	Overall Size (sq. mi)	Size within City of Tumwater (sq. mi)	% within Tumwater's jurisdiction	Stormwater Management Influence	Include in prioritization process (S5.C.a.d.ii)?
Lower Deschutes River	17.70 mi^2	8.96 mi^2	50.62%	Medium	yes
Salmon Creek	11.52 mi^2	1.81 mi^2	15.71%	Medium	yes
Black Lake	8.10 mi^2	2.74 mi^2	33.83%	High	yes
Percival Creek	7.19 mi^2	3.28 mi^2	45.62%	High	yes
Capitol Lake	2.56 mi^2	0.97 mi^2	37.89%	High	yes
Moxlie Creek	2.17 mi^2	.04 mi^2	1.84%	Low	no
Chambers Creek	0.96 mi^2	.01 mi^2	1.04%	Low	no

APPENDIX B

City of Tumwater Watershed Prioritization

Permit Requirement S5.C.1.d.ii: Sub-Basin Prioritization:

Permittees shall develop and implement a prioritization method and process to determine which receiving waters will receive the most benefit from implementation of stormwater facility retrofits, tailored implementation of SWMP actions, and other land/development management actions (different than the existing new and redevelopment requirements).

Watershed	Watershed Prioritization Findings	Include in the prioritization process (S5.C.a.d.ii)	Stormwater Mangement Influence	Catchment ID	Is the sub-basin within the size criteria (~400-600 acres)	Is >90% of the sub-basin within city limits?	Are there land uses that have high potential for pollution?	Type of land uses?	Sub-basin prioritization ranking
Percival Creek	1	yes	High	P1 - Trosper Lake	yes	yes	yes	Multi-Family Residential Single Family Residential Manufactured Home Park Commecial Industrial Sensitive Resource Green Belt Open Space	1
				P2 - Linwood Pond	yes	yes	no	Multi-Family Residential Single Family Residential Manufactured Home Park Neighborhood Commercial Sensitive Resource Open Space	4
				P3 - Somerset Hill	yes	no			
				P4	no				
				P5 - West Mottman	yes	yes	yes	Single Family Residential Industrial Green Belt	2
				P6 - Mottman	yes	no			
				P7	no				
				P8	no				
				P9	no				
				P10	no				
				P12	no				
				P11	no				
Black Lake	2	yes	High	BL1	no				
				BL2	no				
				BL3 - Fish Pond Creek	yes	yes	no	Multi-Family Residential Single Family Residential Manufactued Home Park Mixed Use	3
				BL4	no				
				BL5	no				
				BL6	no				
				BL7	no				

Permit Requirement S5.C.1.d.ii: Sub-Basin Prioritization:

Permittees shall develop and implement a prioritization method and process to determine which receiving waters will receive the most benefit from implementation of stormwater facility retrofits, tailored implementation of SWMP actions, and other land/development management actions (different than the existing new and redevelopment requirements).

Watershed	Watershed Prioritization Findings	Include in the prioritization process (S5.C.a.d.ii)	Stormwater Mangement Influence	Catchment ID	Is the sub-basin within the size criteria (~400-600 acres)	Is >90% of the sub-basin within city limits?	Are there land uses that have high potential for pollution?	Type of land uses?	Sub-basin prioritization ranking
Lower Deschutes River	3	yes	Medium	LDR1	no				
				LDR2 - Swamp Creek	yes	yes	yes	Multi-Family Residential Airport Reated Industrial Industrial Sensitive Resource Green Belt	5
				LDR3 - Munn Lake	yes	yes	yes	Multi-Family Residential Single-Family Residential Commercial Industrial Green Belt Open Space	6
				LDR4	no				
				LDR5	no				
Salmon Creek	4	yes	Medium	SC1 - Hopkins Ditch	yes	no			
				SC2	no				
Capitol Lake	5	yes	High	CL1 - Capitol Lake	no				
Moxlie Creek	6	no	NA						
Chambers Creek	7	no	NA						

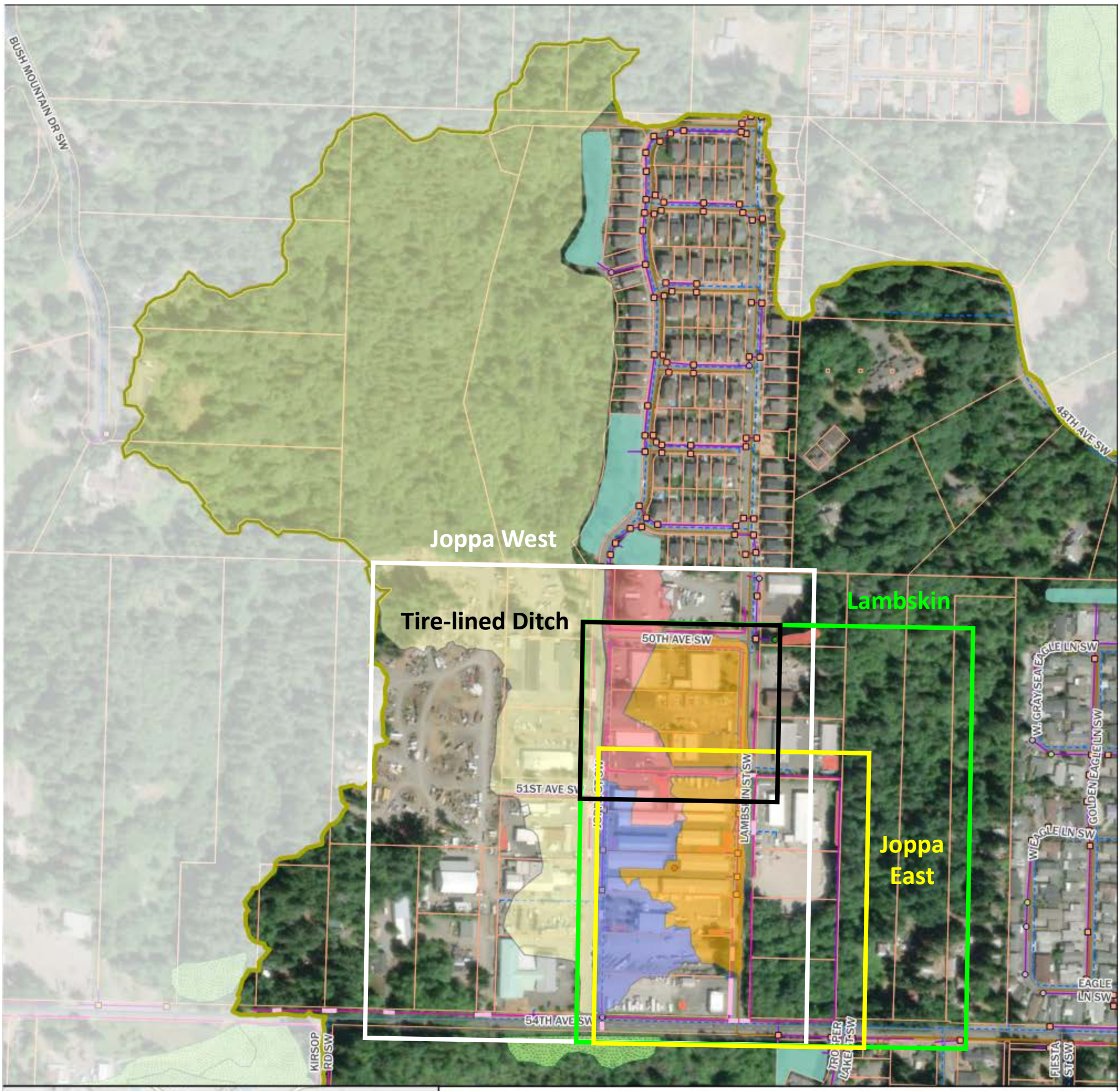
APPENDIX C

Project Summary Sheet:
Beehive Industrial Area Linear Facilities

City of Tumwater Stormwater Management Action Plan – Trosper Lake Subbasin Retrofit Project Opportunities

BEEHIVE INDUSTRIAL AREA LINEAR FACILITIES

Vicinity Map



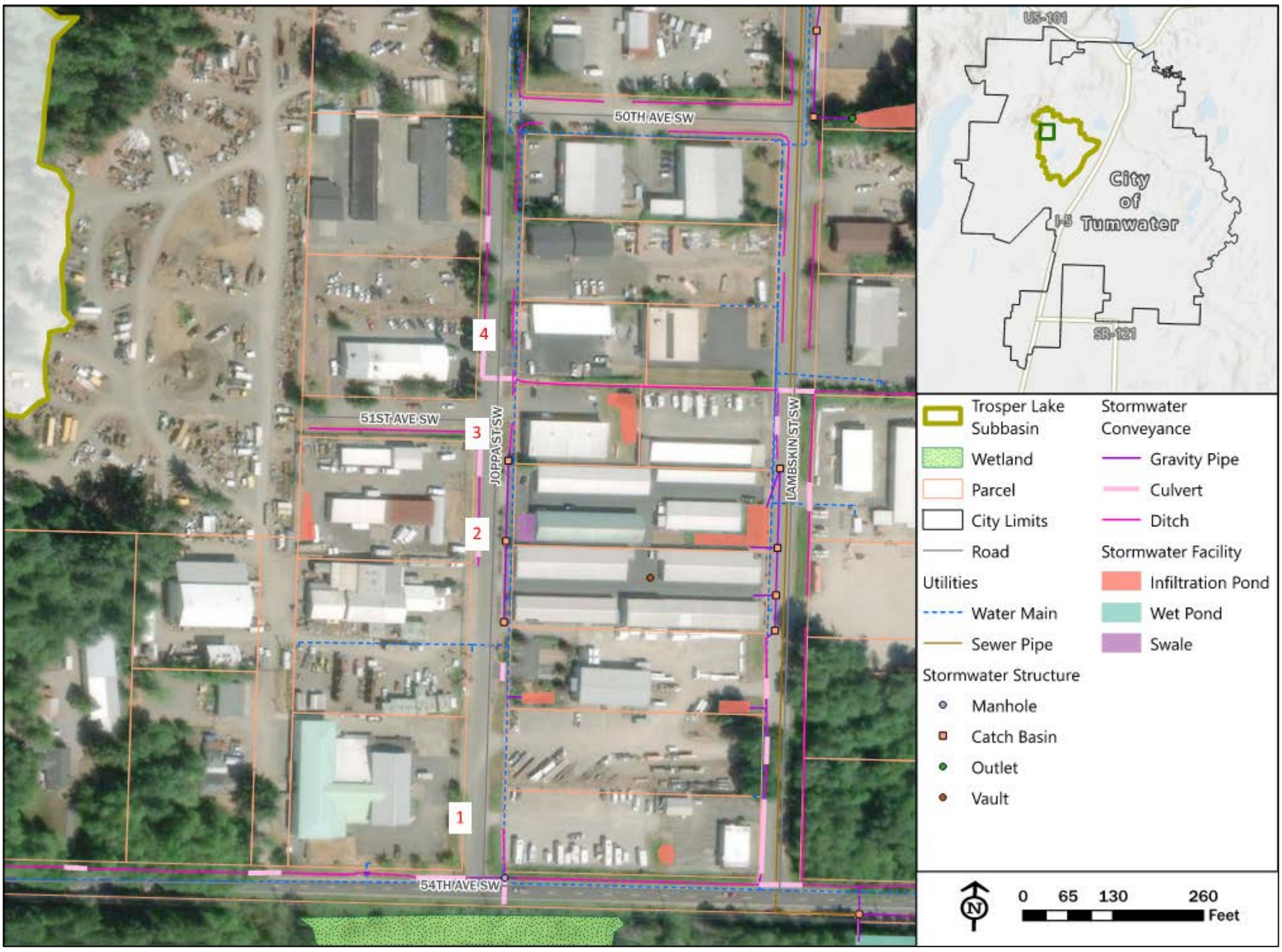
City of Tumwater Stormwater Management Action Plan – Trosper Lake Subbasin Retrofit Project Opportunities

BEEHIVE INDUSTRIAL AREA – JOPPA WEST

Problem Description

There is some ponding and little water quality treatment on the Joppa Street NW in the Beehive Industrial Area. Some water quality treatment is occurring from grass-lined ditches in the right-of-way.

Existing Site Plan



Site Characteristics and Constraints

Available Space	Grades and Elevations	Soils and Groundwater	Critical Areas	Utility Conflicts
• Limited space in the right-of-way	• Steep slopes in forested area northwest of the project site	• Mix of Norma silt loam, Indianola loamy sand, and Schneider very fine gravelly loam • Norma silt loam: moderately low runoff potential, but may be in areas with a high water table • Indiana loamy sand: low runoff potential • Schneider very fine gravelly loam: moderately low runoff potential • Not located in a high groundwater area	• No critical areas present on project sites • Wetlands and steep slopes adjacent to project boundaries	• Potential conflicts with water mains and service lines • Overhead power

Existing Conditions

Ponding on the Southwest Corner of Trosper and Joppa Facing North

Gravel-lined Ditch between Trosper and 51st Facing North

Small Ditch on the Corner of 51st and Joppa Facing North

Ditch between 50th and 51st on Joppa Facing North

CITY OF TUMWATER

HERRERA

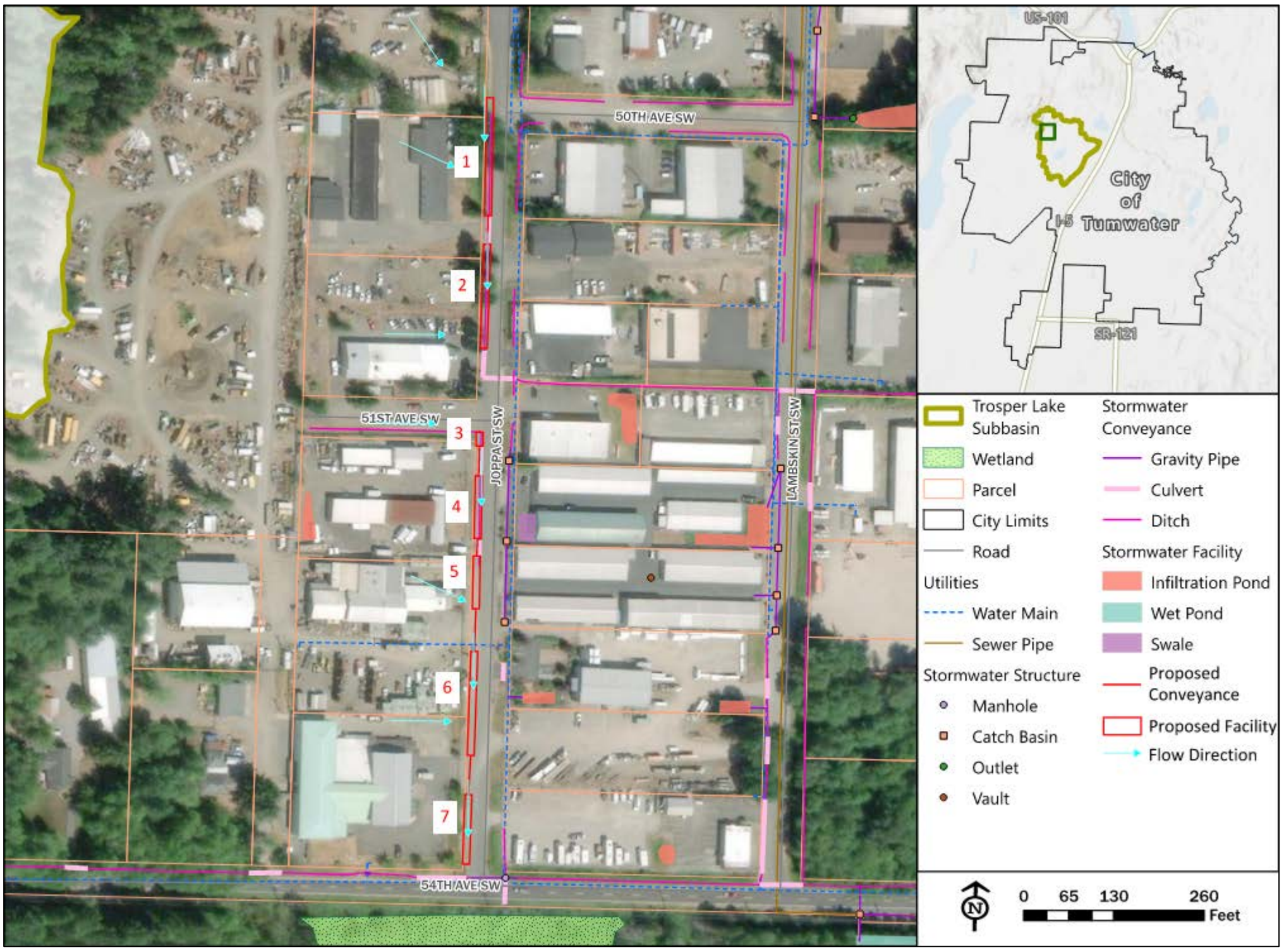
City of Tumwater Stormwater Management Action Plan – Trosper Lake Subbasin Retrofit Project Opportunities

BEEHIVE INDUSTRIAL AREA– JOPPA WEST

Project Description

Install linear, connected bioretention facilities on the west side of Joppa Street SW to improve water quality treatment. The facilities are proposed between Trosper Avenue SW (54th Avenue SW) and 50th Avenue SW. Pollutants removed by the facilities may include metals, organics, suspended solids, and coliform bacteria.

Concept Site Plan



Design Parameters

Facility Footprint ID	Joppa West 1 –7	Bottom Length	750 ft (14 – 164 ft)
Facility Footprint Area	7,560 sf (200 – 1,700 sf)	Bottom Width	4 ft
Native Soil Design Infiltration Rate	0.5 in/hr	Bottom Area	3000 sf (56 – 656 sf)
Ponding Depth	0.5 ft	Side Slope	3H:1V

Estimated Costs

Design Cost	$75,000
Construction Cost	$225,000
Total Cost	$300,000
Cost per Acre Treated	$7,200

Design Precedents


Bioretention Examples (Seattle, Washington)

Catchment Area Characteristics

Catchment Area	42 acres
Pollution Generating Impervious Surface	8 acres (19.1%)
Non-pollution Generating Impervious Surface	1 acre (2.4%)
Non-pollution Generating Pervious Surface	32.9 acres (78.5%)

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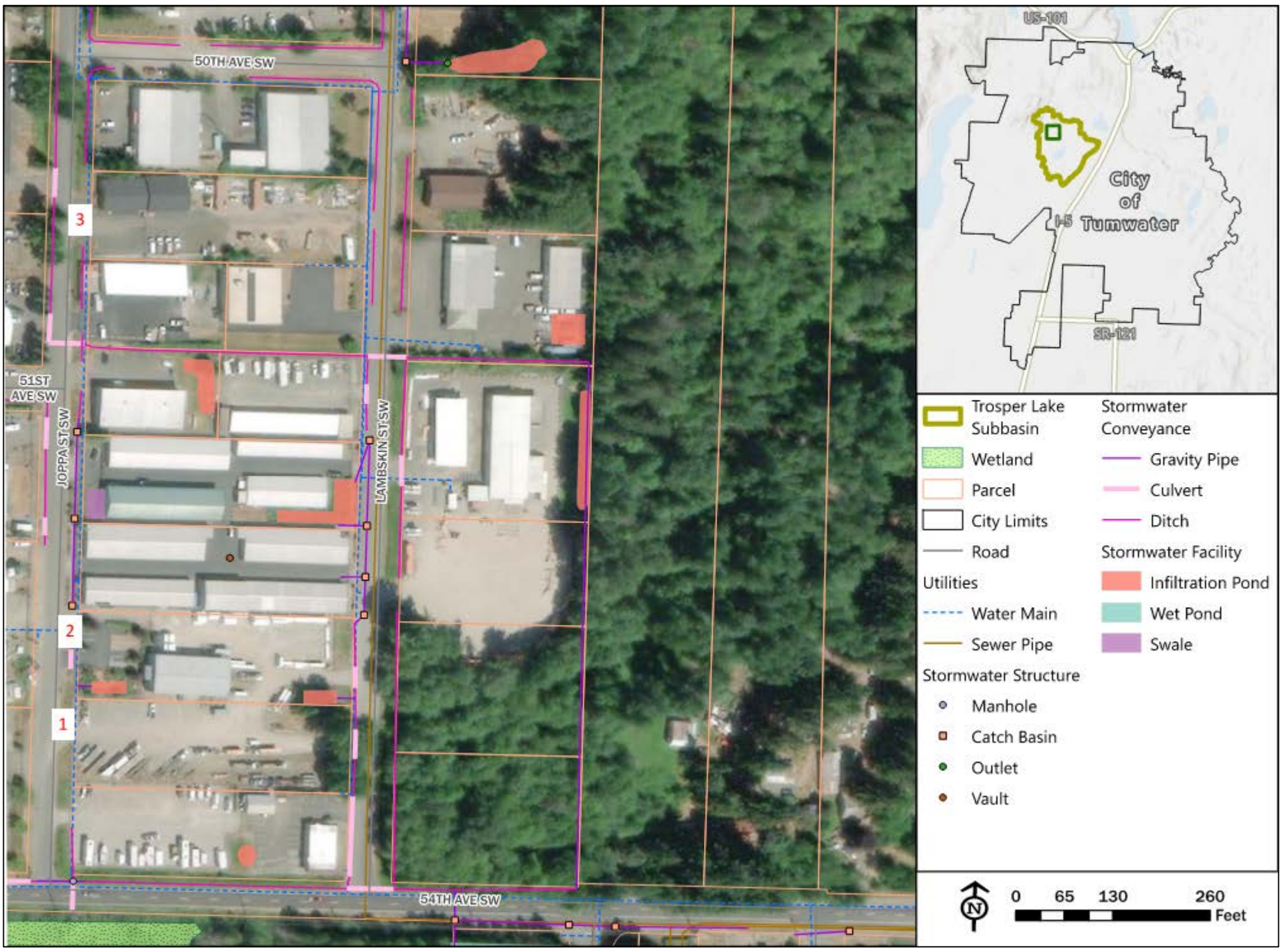
City of Tumwater Stormwater Management Action Plan – Trosper Lake Subbasin Retrofit Project Opportunities

BEEHIVE INDUSTRIAL AREA – JOPPA EAST

Problem Description

There is some ponding and little water quality treatment on the Joppa Street NW in the Beehive Industrial Area. Some water quality treatment is occurring from grass-lined ditches in the right-of-way.

Existing Site Plan



Site Characteristics and Constraints

Available Space	Grades and Elevations	Soils and Groundwater	Critical Areas	Utility Conflicts
• Limited space in the right-of-way	• Steep slopes in forested area northwest of project site	• Mix of Norma silt loam, Indianola loamy sand, and Schneider very fine gravelly loam • Norma silt loam: moderately low runoff potential, but may be in areas with a high water table • Indiana loamy sand: low runoff potential • Schneider very fine gravelly loam: moderately low runoff potential • Not located in a high groundwater area	• No critical areas present on project sites • Wetlands and steep slopes adjacent to project boundaries	• Potential conflicts with water mains and service lines • Overhead power

Existing Conditions

Ponding on the Southeast Corner of Trosper and Joppa Facing North

Ponding on Joppa Facing North

Grass-lined ditches on the east side of Joppa between 50th and 51st (Photo Courtesy of Google Earth)

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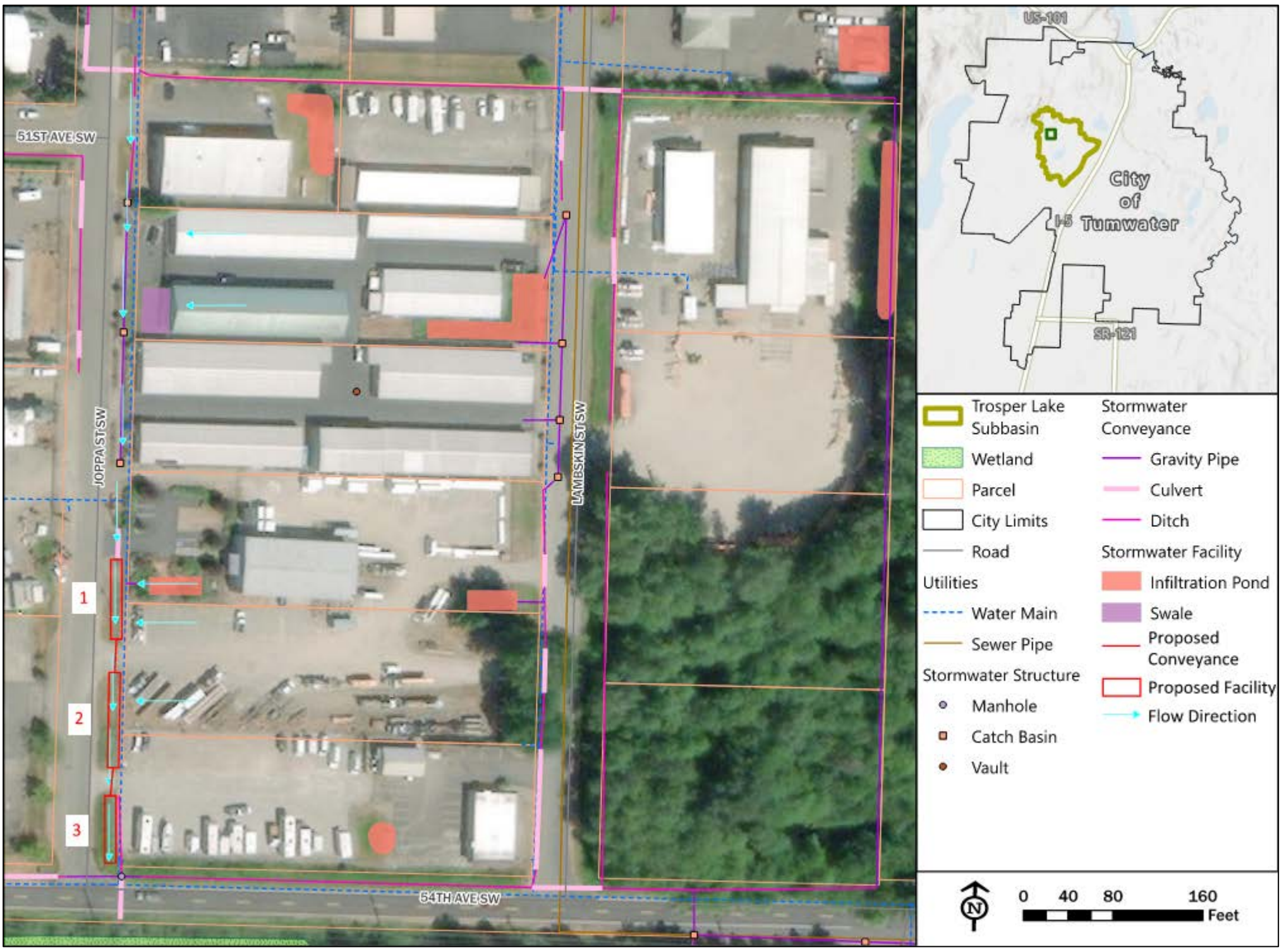
BEEHIVE INDUSTRIAL AREA – JOPPA EAST

Project Description

Install bioretention facilities on the east side Joppa Street SW to improve water quality treatment. The facilities are proposed between Trosper Avenue SW (54th Avenue SW) and 51st Avenue SW. Pollutants removed by the facility may include metals, organics, suspended solids, and coliform bacteria.

Concept Site Plan



Design Parameters

Facility Footprint ID	Joppa East 1 – 3	Bottom Length	210 ft (54 – 79 ft)
Facility Footprint Area	2,160 sf (600 – 850 sf)	Bottom Width	4 ft
Native Soil Design Infiltration Rate	0.5 in/hr	Bottom Area	840 sf (216 – 316 sf)
Ponding Depth	0.5 ft	Side Slope	3H:1V

Estimated Costs

Design Cost	$35,000
Construction Cost	$75,000
Total Cost	$110,000
Cost per Acre Treated	$41,200

Design Precedents


Bioretention Examples (Seattle, Washington)

Catchment Area Characteristics

Catchment Area	2.7 acres
Pollution Generating Impervious Surface	2.1 acres (78%)
Non-pollution Generating Impervious Surface	0.6 acres (22%)
Non-pollution Generating Pervious Surface	0 acres (0%)

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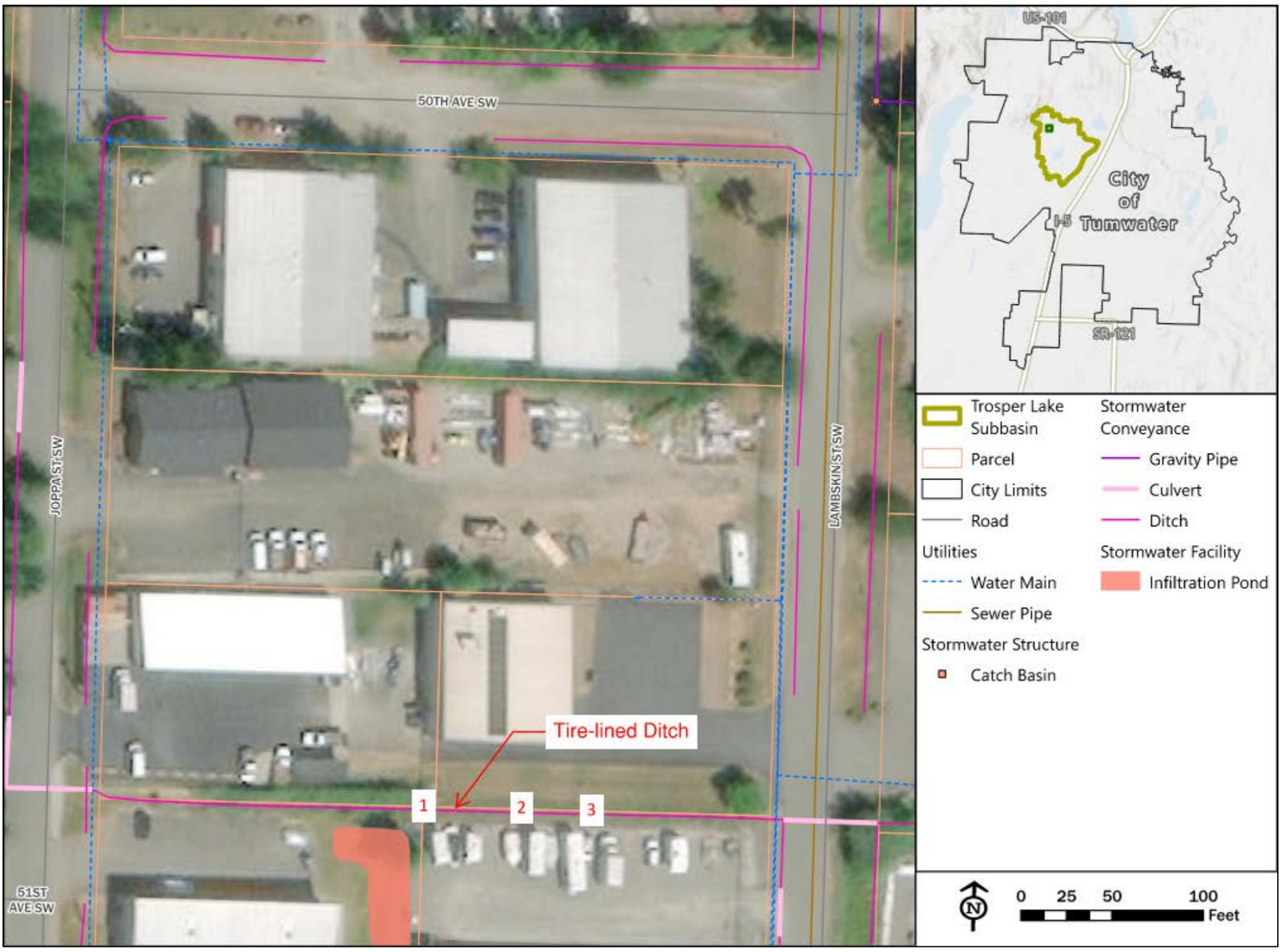
City of Tumwater Stormwater Management Action Plan – Trosper Lake Subbasin Retrofit Project Opportunities

BEEHIVE INDUSTRIAL AREA – TIRE-LINED DITCH

Problem Description

There is a tire-lined ditch between Joppa Street SW and Lambskin Street SW. The ditch is providing minimal water quality treatment and the tire lining may be leaching pollutants, including 6PPD-quinone, a highly toxic pollutant in tire rubber that has been shown to lead to salmon mortality.

Existing Site Plan



Site Characteristics and Constraints

Available Space	Grades and Elevations	Soils and Groundwater	Critical Areas	Utility Conflicts
• City of Tumwater has easement between the two properties	• Steep slopes in forested area northwest of project site	• Mix of Norma silt loam, Indianola loamy sand, and Schneider very fine gravelly loam • Norma silt loam: moderately low runoff potential, but may be in areas with a high water table • Indiana loamy sand: low runoff potential • Schneider very fine gravelly loam: moderately low runoff potential • Not located in a high groundwater area	• No critical areas present on project sites • Wetlands and steep slopes adjacent to project boundaries	• No known utility conflicts

Existing Conditions

Tire-Lined Ditch Facing East

Tire-lined Ditch Facing South

Tire-lined Ditch Facing West

CITY OF TUMWATER

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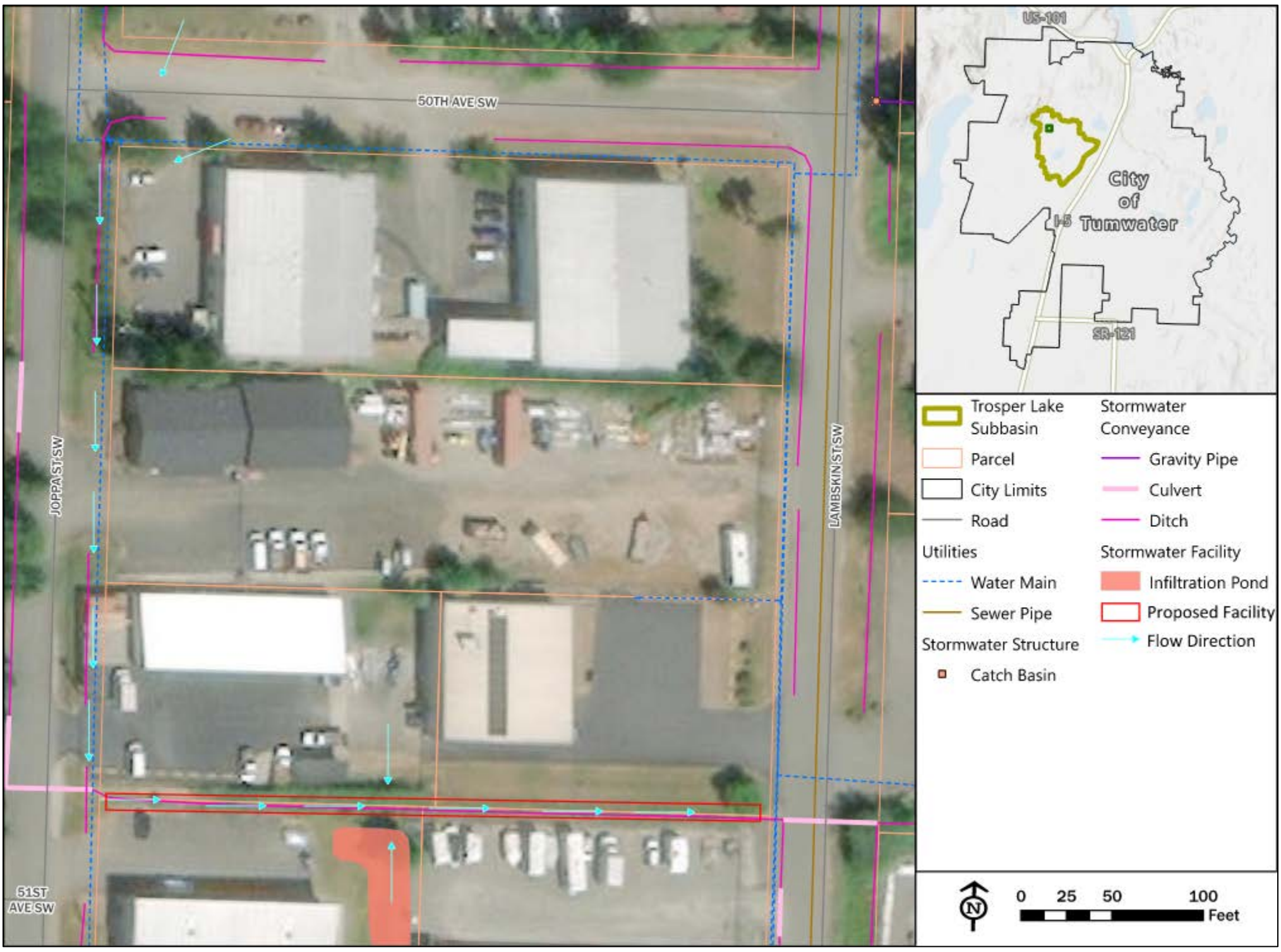
City of Tumwater Stormwater Management Action Plan – Trosper Lake Subbasin Retrofit Project Opportunities

BEEHIVE INDUSTRIAL AREA – TIRE-LINED DITCH

Project Description

Replace the tire-lined ditch with a bioretention facility to improve water quality treatment. The facility is proposed between Joppa Street SW and Lambskin Street SW. Pollutants removed by the facility may include metals, organics, suspended solids, and coliform bacteria.

Concept Site Plan



Design Parameters

Facility Footprint ID	Tire-lined Ditch	Bottom Length	359 ft
Facility Footprint Area	3,285 sf	Bottom Width	3 ft
Native Soil Design Infiltration Rate	0.5 in/hr	Bottom Area	1,077 sf
Ponding Depth	0.5 ft	Side Slope	3H:1V

Estimated Costs

Design Cost	$25,000
Construction Cost	$75,000
Total Cost	$100,000
Cost per Acre Treated	$37,300

Design Precedents

Bioretention Examples (Seattle, Washington)

Catchment Area Characteristics

Catchment Area	2.7 acres
Pollution Generating Impervious Surface	2.2 acres (80%)
Non-pollution Generating Impervious Surface	0.5 acres (20%)
Non-pollution Generating Pervious Surface	0 acres (0%)

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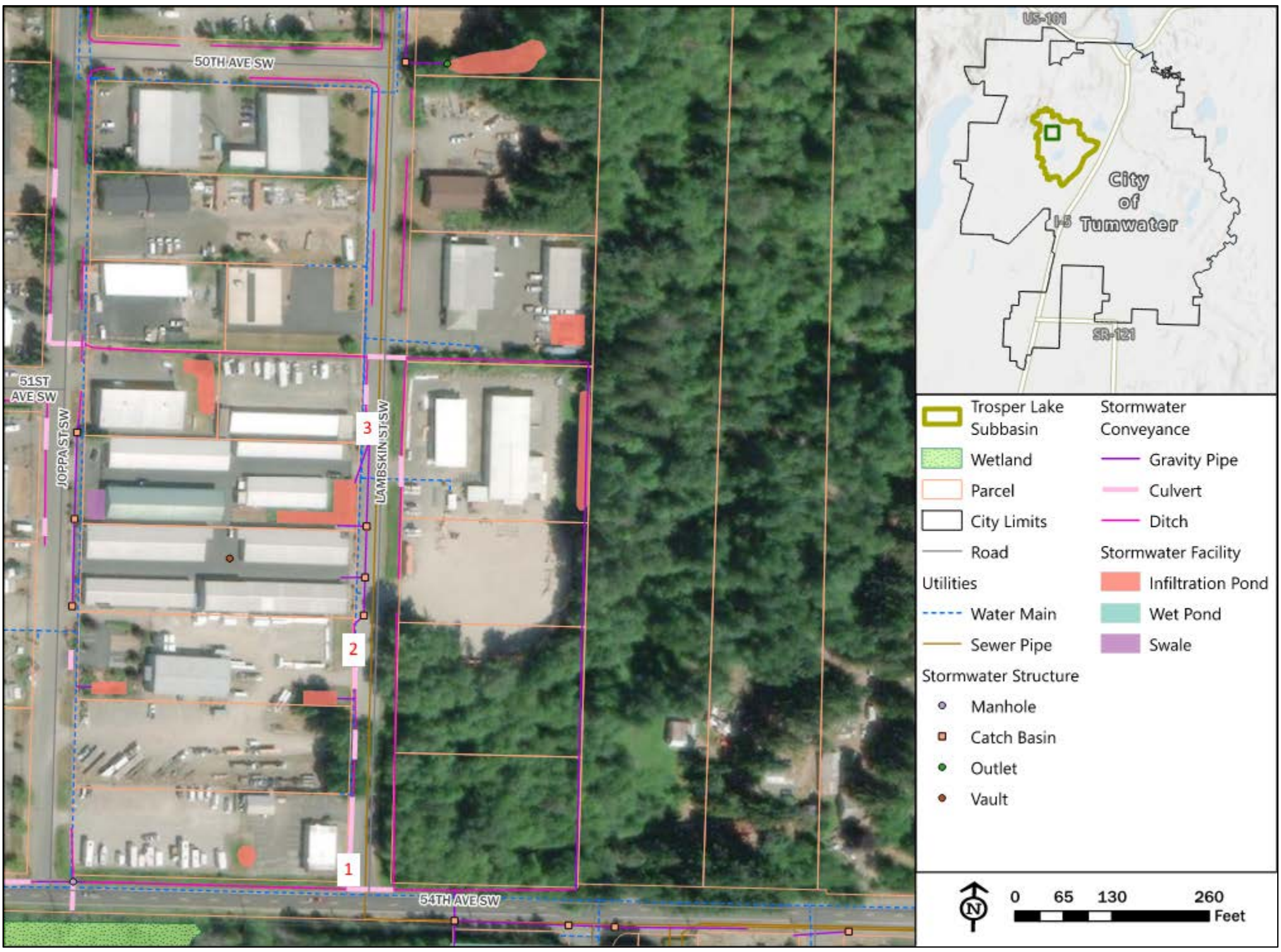
City of Tumwater Stormwater Management Action Plan – Trosper Lake Subbasin Retrofit Project Opportunities

BEEHIVE INDUSTRIAL AREA – LAMBSKIN

Problem Description

There is some ponding and little water quality treatment on the Lambskin Street NW in the Beehive Industrial Area. Some water quality treatment is occurring from grass-lined ditches in the right-of-way.

Existing Site Plan



Site Characteristics and Constraints

Available Space	Grades and Elevations	Soils and Groundwater	Critical Areas	Utility Conflicts
• Limited space in the right-of-way	• Steep slopes in forested area northwest of project site	• Mix of Norma silt loam, Indianola loamy sand, and Schneider very fine gravelly loam • Norma silt loam: moderately low runoff potential, but may be in areas with a high water table • Indiana loamy sand: low runoff potential • Schneider very fine gravelly loam: moderately low runoff potential • Not located in a high groundwater area	• No critical areas present on project sites • Wetlands and steep slopes adjacent to project boundaries	• Potential conflicts with water mains and service lines • Overhead power

Existing Conditions

Available Space on the Southwest Corner of Trosper and Lambskin (Photo Courtesy of Google Earth)

Grass-lined Ditch on Lambskin Facing South

Gravel-lined Ditch on Lambskin Facing North

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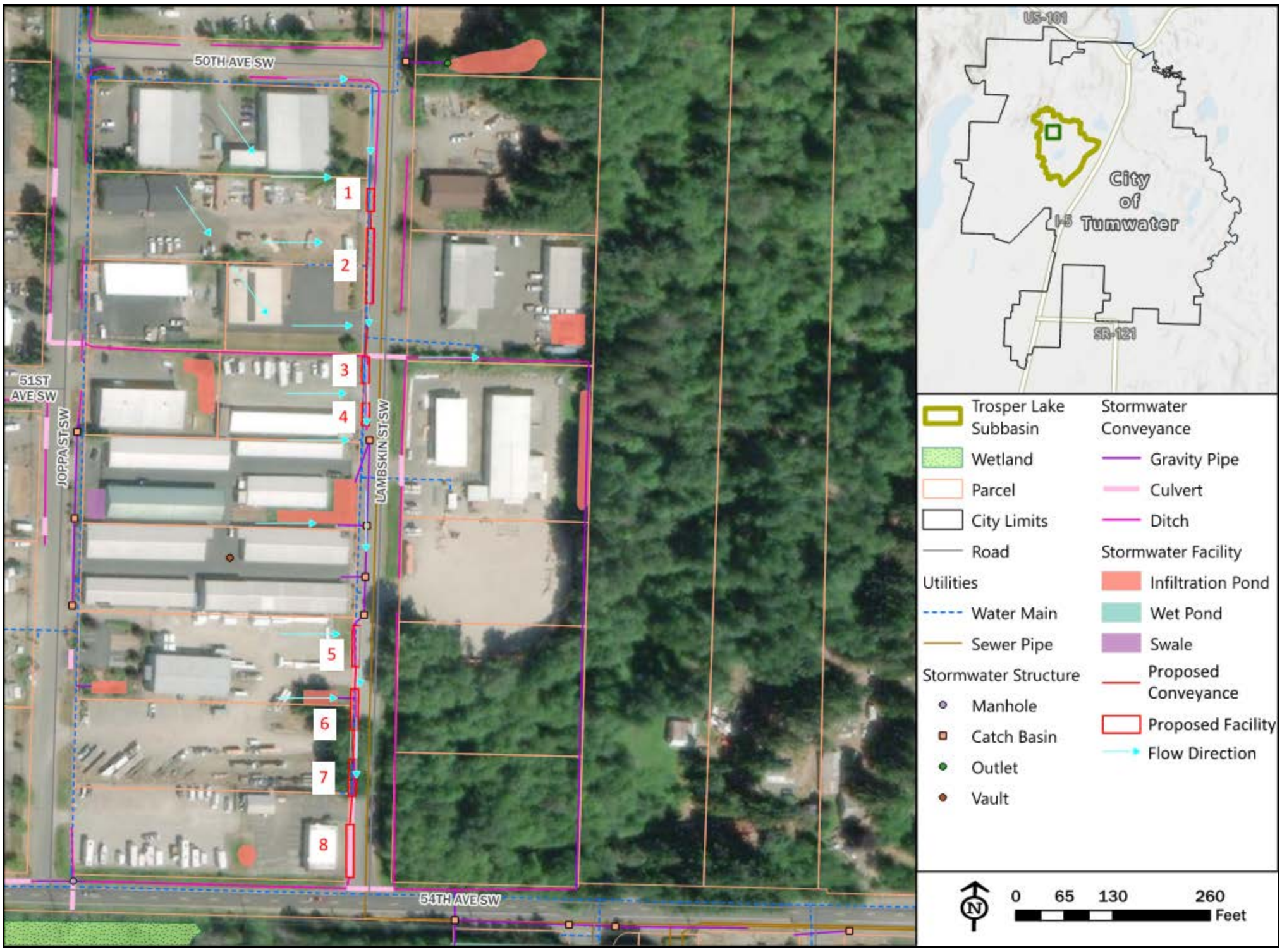
City of Tumwater Stormwater Management Action Plan – Trosper Lake Subbasin Retrofit Project Opportunities

BEEHIVE INDUSTRIAL AREA – LAMBSKIN

Project Description

Install bioretention facilities on the west side Lambskin Street SW to improve water quality treatment. The facilities are proposed between Trosper Avenue SW (54th Avenue SW) and 50th Avenue SW. Pollutants removed by the facility may include metals, organics, suspended solids, and coliform bacteria.

Concept Site Plan



Design Parameters

Facility Footprint ID	Lambskin 1 – 8	Bottom Length	420 ft (24 – 94 ft)
Facility Footprint Area	3,834 sf (300 – 1,000 sf)	Bottom Width	4 ft
Native Soil Design Infiltration Rate	0.5 in/hr	Bottom Area	1,680 sf (96 – 376 sf)
Ponding Depth	0.5 ft	Side Slope	3H:1V

Estimated Costs

Design Cost	$50,000
Construction Cost	$150,000
Total Cost	$200,000
Cost per Acre Treated	$40,000

Design Precedents


Bioretention Examples (Seattle, Washington)

Catchment Area Characteristics

Catchment Area	5 acres
Pollution Generating Impervious Surface	4 acres (78%)
Non-pollution Generating Impervious Surface	1 acre (22%)
Non-pollution Generating Pervious Surface	0 acres (0%)

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City of Tumwater Stormwater Management Action Plan – Trosper Lake Subbasin Retrofit Project Opportunities

BEEHIVE INDUSTRIAL AREA LINEAR FACILITIES

Summary

Facility Footprint ID	Joppa West	Joppa East	Tire-lined Ditch	Lambskin
Catchment Area	42 acres	2.7 acres	2.7 acres	5 acres
Pollution Generating Impervious Surface	8 acres (19.1%)	2.1 acres (78%)	2.2 acres (80%)	4 acres (78%)
Non-pollution Generating Impervious Surface	1 acre (2.4%)	0.6 acres (22%)	0.5 acres (20%)	1 acre (22%)
Non-pollution Generating Pervious Surface	32.9 acres (78.5%)	0 acres (0%)	0 acres (0%)	0 acres (0%)
Design Cost	$75,000	$35,000	$25,000	$50,000
Construction Cost	$225,000	$75,000	$75,000	$150,000
Total Cost	$300,000	$110,000	$100,000	$200,000
Cost per Acre Treated	$7,200	$41,200	$37,300	$40,000

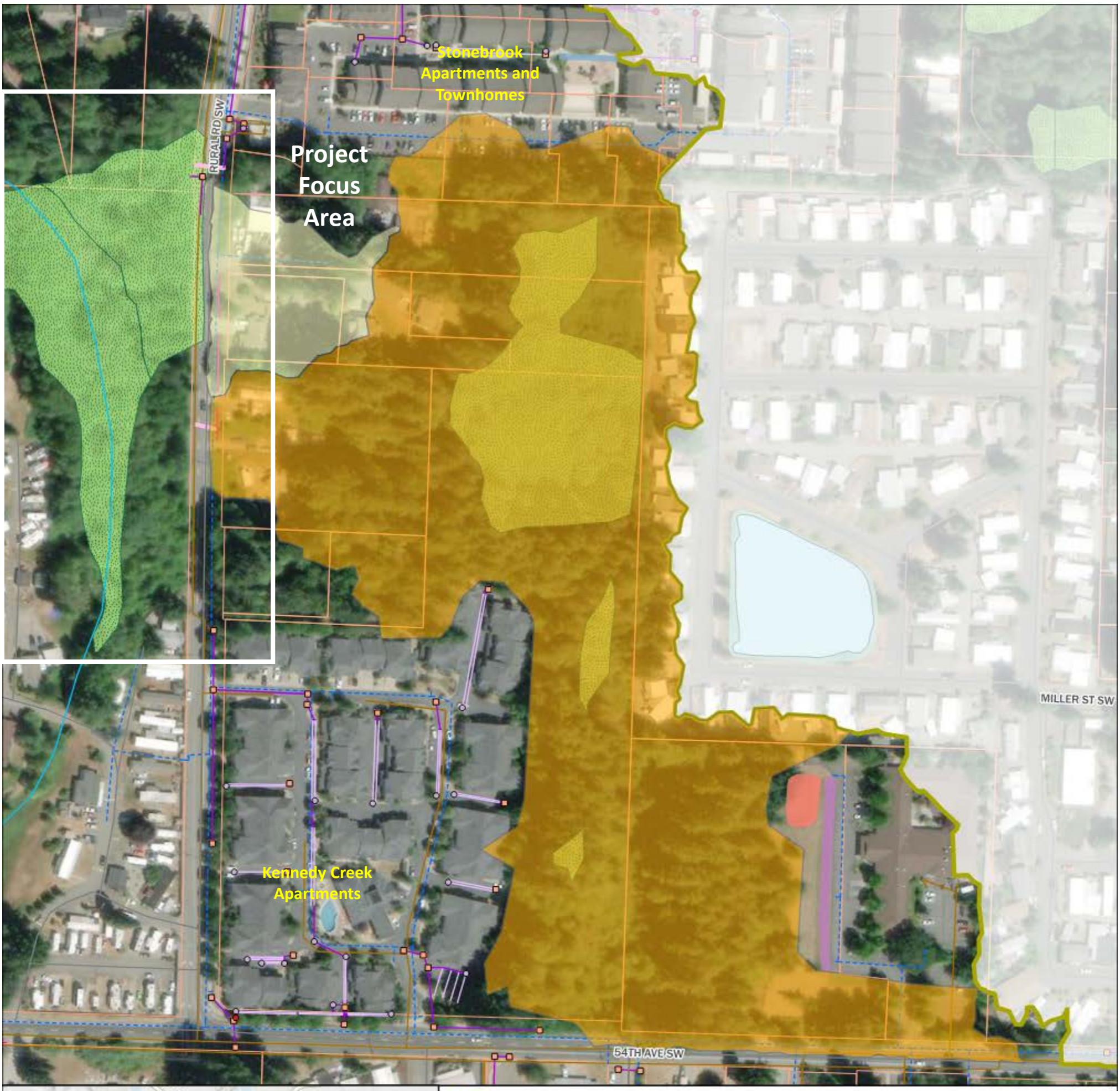
APPENDIX D

Project Summary Sheet:
Rural Road Linear Facilities

City of Tumwater Stormwater Management Action Plan – Trosper Lake Subbasin Retrofit Project Opportunities

RURAL ROAD LINEAR FACILITIES

Vicinity Map



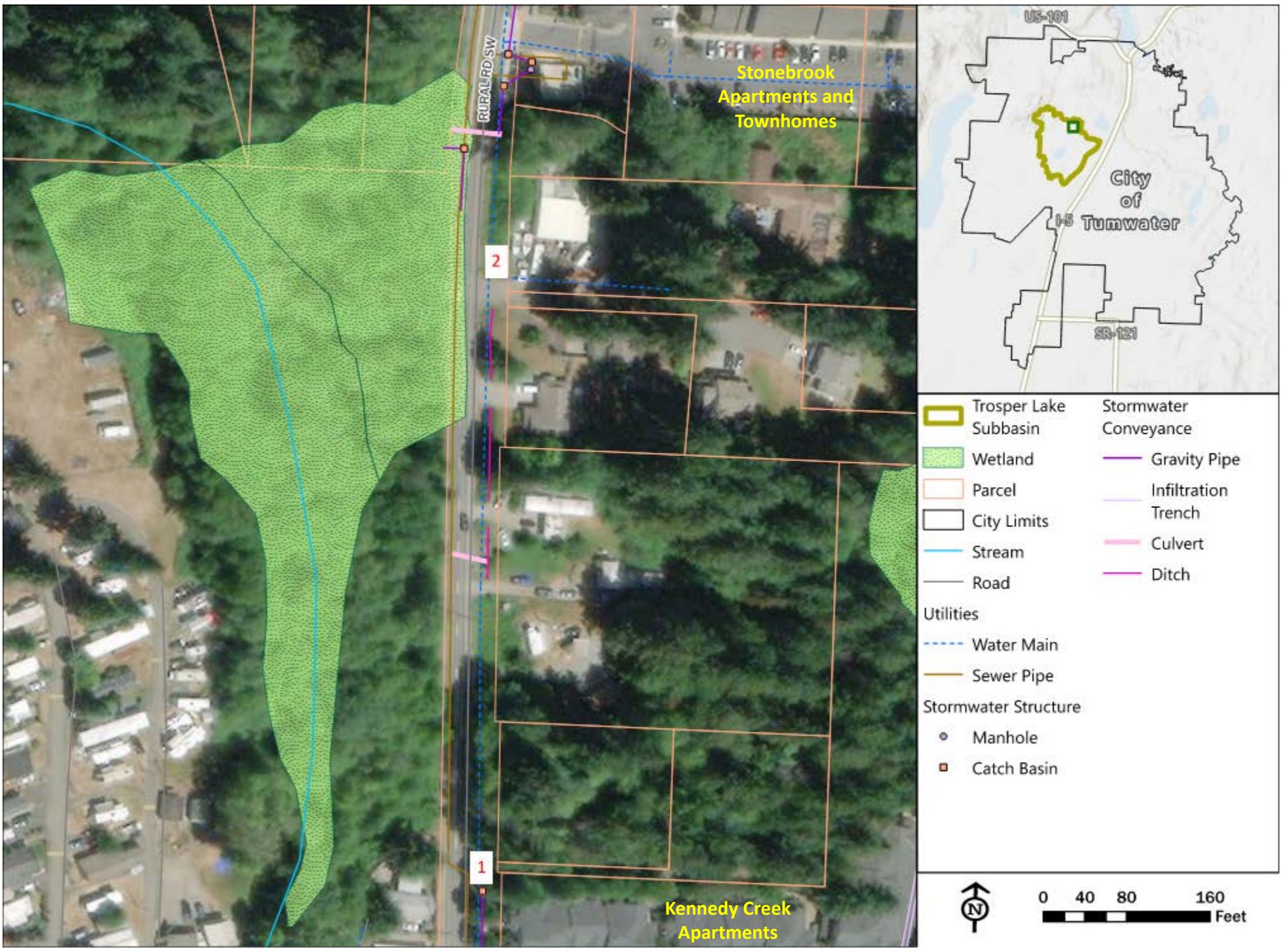
City of Tumwater Stormwater Management Action Plan – Trosper Lake Subbasin Retrofit Project Opportunities

RURAL ROAD LINEAR FACILITIES

Problem Description

There is no water quality treatment in the middle third of Rural Road SW between Stonebrook Apartments and Townhomes to the north and Kennedy Creek Apartments to the south. Untreated runoff in this area is discharged via culvert directly to Percival Creek and adjacent wetlands. In addition, periodic flooding has been reported at the residential properties on the east side of Rural Road SW.

Existing Site Plan



Site Characteristics and Constraints

Available Space	Grades and Elevations	Soils and Groundwater	Critical Areas	Utility Conflicts
• Limited space in the right-of-way	• Moderate slopes within the right-of-way of Rural Road SW (~5-8%)	• Mix of Indianola loamy sand and Norma silt loam • Indiana loamy sand: low runoff potential • Norma silt loam: moderately low runoff potential, but may be in areas with a high water table • Not known to be located in a high groundwater area	• No critical areas present at proposed facility locations • Wetlands adjacent to project boundaries	• Potential conflicts with water mains and service lines on east side of Rural Road • Mostly overhead power with some underground power

Existing Conditions

5316 Rural Road SW Facing North (Photo Courtesy of Google Earth)

4856 Rural Road SW Facing North (Photo Courtesy of Google Earth)

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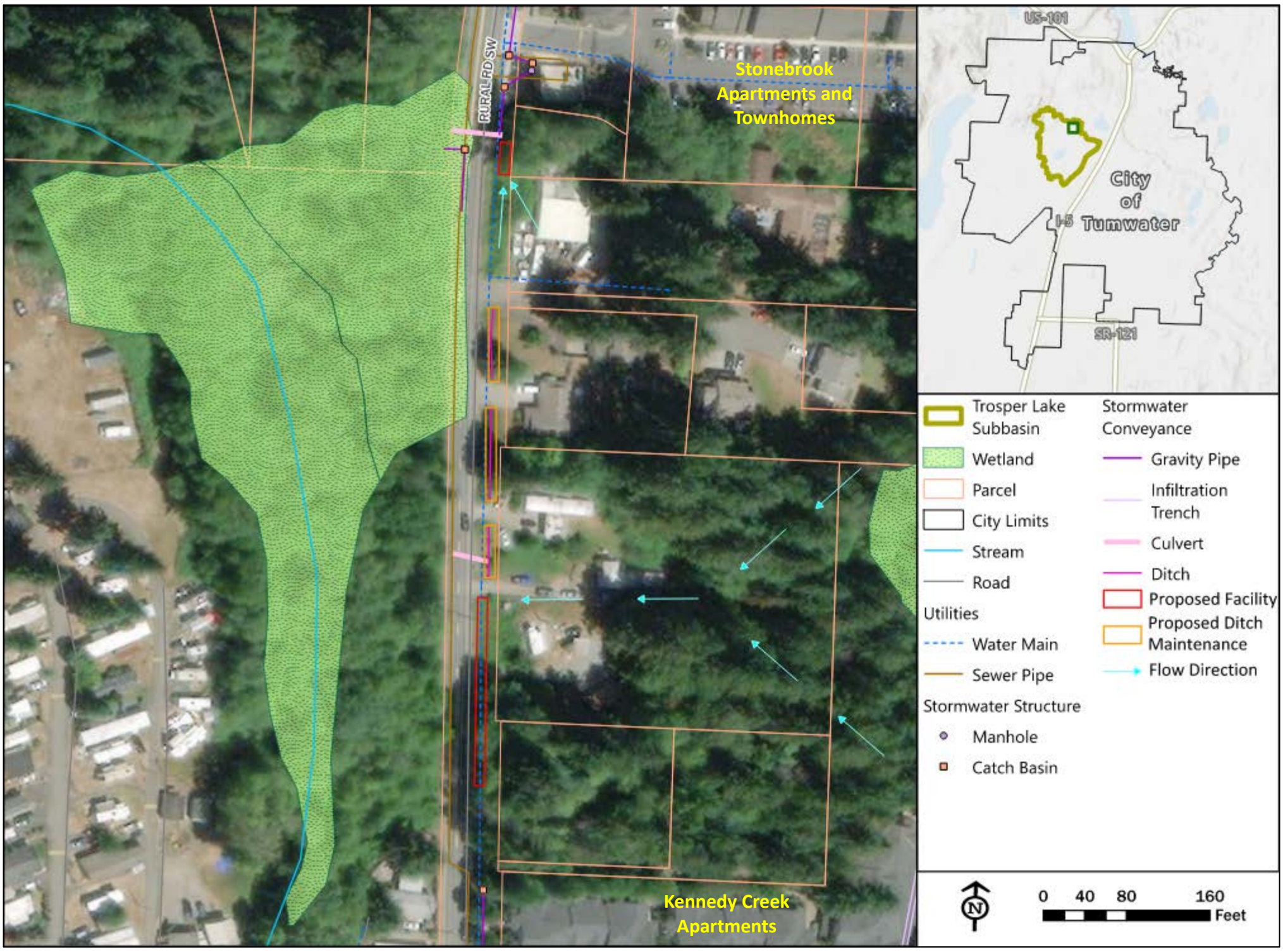
City of Tumwater Stormwater Management Action Plan – Trosper Lake Subbasin Retrofit Project Opportunities

RURAL ROAD LINEAR FACILITIES

Project Description

Install bioretention facilities in the middle portion of Rural Road SW to improve water quality treatment. The facilities are proposed between two culverts that discharge into nearby wetlands and Percival Creek. Pollutants removed by the facilities may include metals, organics, suspended solids, and coliform bacteria. Also perform ditch maintenance to ensure adequate flow to the facilities and prevent flooding on nearby properties. More information about ditch maintenance is included in Stormwater Program Enhancement SE-5.

Concept Site Plan



Design Parameters

Facility Footprint ID	Rural Road	Bottom Lengths	25 ft, 175 ft
Facility Footprint Areas	310 sf, 1,810 sf	Bottom	4 ft
Native Soil Design Infiltration Rate	0.5 in/hr	Bottom Areas	100 sf, 700 sf
Ponding Depth	0.5 ft	Side Slope	3H:1V

Estimated Costs

Design Cost	$30,000
Construction Cost	$80,000
Total Cost	$110,000
Cost per Acre Treated	$6,100

Design Precedents

Bioretention Examples (Seattle, Washington)

Catchment Area Characteristics

Catchment Area	18.1 acres
Pollution Generating Impervious Surface	1.7 acres (9.3%)
Non-pollution Generating Impervious Surface	0.9 acres (5.1%)
Non-pollution Generating Pervious Surface	15.5 acres (85.7%)

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APPENDIX E

Stormwater Program Enhancements and Land Management Strategies Costs and Assumptions

Table E-1. City of Tumwater Land Management and Stormwater Enhancement Short-Term Action Cost Assumptions.									
ID	**Action**	**Description**	**Action Type**	**One-time Funding**	**Ongoing Funding**	**Total Funding**	**Cost Assumptions [a] [b]**	**Cost Basis**	**Budget Source**
LM-1	Conduct a monitoring needs assessment of Trosper Lake and the lake subbasin.	Scope the purpose, goals, and costs to assess the lake and subbasin. Identify lake and subbasin monitoring needed to determine the existing lake aquatic habitat and water quality conditions. Conduct basic water quality monitoring program.	Create new program	$16,000	$32,000 ($8,000/ year for 4 years)	$48,000	Startup costs: $6,000 for equipment and $10,000 to create monitoring plan. Ongoing costs: five years of $8,000/year for year-round trophic state monitoring with additional nutrient, phytoplankton sampling.	Professional judgement; itemized cost	Existing Stormwater Utility Fund
LM-4	Coordinate with other City Departments to incorporate stormwater into projects, especially CFP projects.	Annually, meet with other department staff during planning of capital construction projects (such as the annual Transportation Improvement Projects review, or Parks planning projects review) to determine how anticipated projects could incorporate stormwater planning and retrofits, especially projects related to Transportation and Engineering.	Create new program; on-going into long-term	$0	$11,200 ($1,600/ year for 7 years in short-term; long-term in separate table)	$11,200	Staff time: 20 hours of City management staff time to review planning documents and attend project planning meetings, annually. Assumed to continue for 20 years, spanning short and long-term action lists.	Professional judgement; itemized cost	Existing Stormwater Utility Fund

Table E-1. City of Tumwater Land Management and Stormwater Enhancement Short-Term Action Cost Assumptions.									
ID	**Action**	**Description**	**Action Type**	**One-time Funding**	**Ongoing Funding**	**Total Funding**	**Cost Assumptions [a] [b]**	**Cost Basis**	**Budget Source**
SE-1	Implement enhanced IDDE screening	Conduct intersection dry weather sampling supplemental to outfall screening.	Expand existing program	$0	$ 23,300 ($11,650/ year every 4 years; once in 2025 and once in 2029)	$11,650	Staff time: 16 hours for preparation - map locations, assembling equipment and field kits/lab analyses/collection bottles. 4 field days of sampling. 4 field days for follow up on suspect samples. Sample costs: $150 per sample (20 samples) for combination of lab analysis and field kits (bacteria, detergent, ammonia, phosphorus, temperature, conductivity and pH).	Professional judgement; itemized cost	Existing Stormwater Utility Fund
SE-2	Provide enhanced Business Source Control Inspections and Technical Assistance in the Beehive Industrial Area	Focus on the Beehive Industrial area to track which businesses have industrial discharge permits and explore additional requirements or more frequent inspections. Partner with Ecology in the case of Industrial Stormwater General Permits (ISGP).	Expand existing program	$0	$16,800 ($3,360/ year for 5 years)	$16,800	Staff time: 4 hours of City field technician/O&M staff time to support each of the 14 identified businesses in the Beehive Industrial area each year.	Analog cost; itemized cost	Existing Stormwater Utility Fund

Table E-1. City of Tumwater Land Management and Stormwater Enhancement Short-Term Action Cost Assumptions.									
ID	**Action**	**Description**	**Action Type**	**One-time Funding**	**Ongoing Funding**	**Total Funding**	**Cost Assumptions [a] [b]**	**Cost Basis**	**Budget Source**
SE-3	Launch Dumpster Lid Campaign	Use the Trosper Lake Subbasin as a pilot program to roll out the larger scale Dumper Lid Social Marketing Campaign, aiming to get businesses to close their dumpster lids and seek help from LeMay (waste disposal organization) as needed.	Expand existing program	$0	$14,400 ($4,800/ year for 3 years)	$14,400	Staff time: 40 hours of City field technician/O&M staff time acquiring and implementing messaging developed by STORM. 40 hours for data collection and analysis each year over three years.	Itemized cost	Existing Stormwater Utility Fund
SE-4	Provide additional O&M training	Provide training to O&M staff and plan review training for engineering department.	Expand existing program	$10,000	$3,000 ($1,000/ year for 3 years)	$13,000	External training: Cost for 5 staff to attend one additional training provided by the WSU Stormwater Center or other similar training program in a three-year period. Internal training: One-time plan review training is developed and provided by a consultant after the new stormwater manual update is adopted. Conducted at the City once during implementation period.	Analog cost; itemized cost	Existing Stormwater Utility Fund

Table E-1. City of Tumwater Land Management and Stormwater Enhancement Short-Term Action Cost Assumptions.									
ID	**Action**	**Description**	**Action Type**	**One-time Funding**	**Ongoing Funding**	**Total Funding**	**Cost Assumptions [a] [b]**	**Cost Basis**	**Budget Source**
SE-5	Establish ditch maintenance program	Develop and implement ditch maintenance program to better address heavily vegetated ditches and alleviate flooding and water quality concerns.	Create new program	$12,100	$0	$12,100	Staff time: 60 hours of consultant and 20 hours city management staff time, or some other combination of expertise, to conduct research and develop ditch maintenance protocols.	Professional judgement; itemized cost	Existing Stormwater Utility Fund
SE-6	Conduct targeted outreach for public stormwater education events	Conduct engagement and direct outreach to overburdened communities in the Trosper Lake subbasin. Provide free, high-quality educational opportunities for residents through hands-on science, workshops, and tours. Programming will be provided under the Stream Team and City of Tumwater brands and include in-person, online only, and hybrid events.	Expand existing program	$4,800	$72,000 ($24,000/year for 3 years)	$76,800	Staff time: 60 hours of city management staff time to develop a public education plan. Annually over three years, 240 hours of city management staff time implementing the plan and 60 hours for revising the approach, attending overburdened community engagement training, and program evaluation.	Analog cost; itemized cost	Existing Stormwater Utility Fund

Table E-1. City of Tumwater Land Management and Stormwater Enhancement Short-Term Action Cost Assumptions.									
ID	**Action**	**Description**	**Action Type**	**One-time Funding**	**Ongoing Funding**	**Total Funding**	**Cost Assumptions [a] [b]**	**Cost Basis**	**Budget Source**
SE-7	Increase pet waste stations	Expand the existing pet waste station program to target high-traffic dog areas and under resourced neighborhoods, conduct targeted outreach to these areas.	Expand existing program	$7,600	$12,000 ($2,400/ year for 5 years)	$19,600	Start-up: 60 hours total of City field technician/O&M staff time including 2 field days to conduct windshield survey for locations. Ongoing staff time: 40 hours annually for maintaining stations, replacing equipment, and outreach. Equipment and bags: $3,000 for 10 sites	Professional judgement; itemized cost	Existing Stormwater Utility Fund
SE-8	Develop and implement school environmental education program in partnership with educators and school district	Involve school and/or Educational Service District environmental and STEM educators with developing and implementing environmental education programs and/or educational signage around existing stormwater facilities.	Expand existing program	$0	$96,000 ($19,200/ year for 5 years)	$96,000	Staff time: 120 hours city management staff time coordinating with local STEM educational district program and 120 hours preparing and conducting classroom or field trips. Allows for up to $4,800 in equipment and materials cost annually.	Professional judgement; itemized cost	Existing Stormwater Utility Fund

Table E-1. City of Tumwater Land Management and Stormwater Enhancement Short-Term Action Cost Assumptions.									
ID	**Action**	**Description**	**Action Type**	**One-time Funding**	**Ongoing Funding**	**Total Funding**	**Cost Assumptions [a] [b]**	**Cost Basis**	**Budget Source**
SE-9	Provide free technical assistance to landowners	Provide free technical assistance to landowners with questions/concerns about flooding or water quality issues. This includes site visits, over the phone assistance and via email.	Expand existing program	$0	$37,500 ($7,500/ year for 5 years)	$37,500	Staff time: 120 hours of City field technician/O&M staff time to field inquiries and conduct 10 site visits annually for five years.	Professional judgement; itemized cost	Existing Stormwater Utility Fund
SE-10	Develop local stormwater monitoring program	Develop a Trosper Basin long-term monitoring implementation and quality assurance project plan. Identify purpose, goals, indicators, frequency, analysis, locations, incorporate other existing monitoring and estimated annual costs. Develop with ability to expand to additional basins in the future.	Create new program	$25,875	$0	$25,875	Staff time: 125 hours of consultant time and 50 hours of city management staff time, or some other combination of hours.	Professional judgement; itemized cost	Existing Stormwater Utility Fund

Table E-1. City of Tumwater Land Management and Stormwater Enhancement Short-Term Action Cost Assumptions.									
ID	**Action**	**Description**	**Action Type**	**One-time Funding**	**Ongoing Funding**	**Total Funding**	**Cost Assumptions [a] [b]**	**Cost Basis**	**Budget Source**
SE-11	Develop and implement benthic index of biological integrity stream assessment monitoring program in Percival Creek	Develop and implement benthic index of biological integrity stream assessment program for Percival Creek; identify opportunities for student involvement.	Create new program	$3,000	$40,960 ($10,230/ year for 4 years)	$43,960	Staff time: 20 hours for developing simple protocols document, 6 field days for sample collection at 5 sampling stations, 80 hours for data management and reporting. Equipment: $500 Sample analysis: $350 per sample for analysis	Analog cost; itemized cost	Existing Stormwater Utility Fund

LM= Land Management; SE = Stormwater Enhancement

[a] Cost estimates are in 2023 dollars. Inflation and escalation of costs were not incorporated into these cost estimates.

[b] Cost estimates assume billing rates of $80/hour for City Management, $60/hour for City Field Technician/O&M Staff, and $175/hour for a consultant.

Table E-2. City of Tumwater Land Management and Stormwater Enhancement Long-Term Action Cost Assumptions.									
ID [a]	**Action**	**Description**	**Action Type**	**One-time Funding**	**Ongoing Funding**	**Total Funding**	**Cost Assumptions [a] [b]**	**Cost Basis**	**Budget Source**
LM-2	Evaluate options for development of an ecosystem services asset management program.	Conduct initial study to identify how an ecosystem services asset management program would be developed, funded and applied to inform land use planning, restoration actions and overall benefit to receiving waters citywide.	Create new program	$150,000	$0	$150,000	Staff time: combination of consultant hours and City management staff time.	Analog cost	Grant Program (TBD)[c]
LM-3	Implement ecosystem services asset management program.	Based on the initial evaluation (LM-2), implement an ecosystem services asset management program. In addition, as information is available through development projects, update aquatic resources map every 3 - 5 years, including wetland, streams, and buffer areas Citywide.	Create new program	$0	$250,000 ($83,333/ year for 3 years)	$250,000	Staff time: combination of consultant hours and City management staff time. Suggest revisiting estimate in the future.	Analog cost	Grant Program (TBD)[c]
LM-4	Coordinate with other City Departments to incorporate stormwater into projects, especially CFP projects.	Annually, meet with other department staff during planning of capital construction projects (such as the annual Transportation Improvement Projects review, or Parks planning projects review) to determine how anticipated projects could incorporate stormwater planning and retrofits, especially projects related to Transportation and Engineering Departments.	Create new program; on-going from short-term	$0	$20,800 ($1,600/ year for 13 years in long-term; short-term in separate table)	$20,800	Staff time: 20 hours of City management staff time to review planning documents and attend project planning meetings, annually. Assumed to continue for 20 years total.	Professional judgement; itemized cost	Existing Stormwater Utility Fund

LM= Land Management; SE = Stormwater Enhancement

[a] Cost estimates are in 2023 dollars. Inflation and escalation of costs were not incorporated into these cost estimates.

[b] Cost estimates assume billing rates of $80/hour for City Management, $60/hour for City Field Technician/O&M Staff, and $175/hour for a consultant.

[c] Funding sources may include Department of Ecology Water Quality Combined Funding Source, Capacity Grants, or other funding programs/opportunities that may arise in the next seven to ten years.

APPENDIX F

Stormwater Management Actions Costs and Schedules

Figure F-1. Trosper Lake Subbasin Stormwater Management Short-Term Actions.

Short-term Actions

	Action	Year							Total Action Cost (Rounded)
		2024	2025	2026	2027	2028	2029	2030	
LM-1	Trosper Lake monitoring needs assessment	$16,000	$8,000	$8,000	$8,000	$8,000			**$50,000**
LM-4	Incorporate stormwater into City projects	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	**$15,000**
SE-1*	Enhanced IDDE screening		$11,650				$11,650		**$25,000**
SE-2*	Enhanced Business Source Control Inspections	$3,360	$3,360	$3,360	$3,360	$3,360			**$20,000**
SE-3*	Dumpster Lid Campaign	$4,800	$4,800	$4,800					**$15,000**
SE-4*	Additional stormwater O&M training	$1,000	$1,000	$1,000	$10,000				**$15,000**
SE-5	Ditch maintenance program		$12,100						**$15,000**
SE-6*	Public stormwater education events	$28,800	$24,000	$24,000					**$80,000**
SE-7*	Increase pet waste stations		$7,560	$2,400	$2,400	$2,400			**$15,000**
SE-8*	School environmental education program	$19,200	$19,200	$19,200	$19,200	$19,200			**$100,000**
SE-9*	Technical assistance for landowners		$7,500	$7,500	$7,500	$7,500	$7,500		**$40,000**
SE-10	Local stormwater monitoring program			$25,875					**$30,000**
SE-11	Monitoring program in Percival Creek	$13,230	$10,230	$10,230	$10,230				**$45,000**
RP-1	Design and construct Beehive Industrial Area Linear Facilities			$142,000	$142,000	$142,000	$142,000	$142,000	**$710,000**
	Total Yearly Cost (Rounded)	**$90,000**	**$115,000**	**$250,000**	**$205,000**	**$185,000**	**$165,000**	**$145,000**	

Key: Proposed Schedule; Alternate Schedule Options

Short-term actions are best to implement for a limited term, and then reviewed if the action is: no longer needed, has minimal demand, challenging to continue, subject to funding changes, or not effective.

LM= Land Management; SE = Stormwater Enhancement; RP = Retrofit Project

*Indicates ongoing programs that would be expanded.

Figure F-2. Trosper Lake Subbasin Stormwater Management Long-Term Actions.