TMDL IMPLEMENTATION PLAN

For the Willamette River and Tributaries

City of Portland, Oregon
November 2023

ENVIRONMENTAL SERVICES
CITY OF PORTLAND
working for clean rivers

TMDL IMPLEMENTATION PLAN

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NOVEMBER 2023

Johnson Creek at Foster Floodplain Natural Area

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Acronyms and Abbreviations

BDS	Bureau of Development Services
BES	Bureau of Environmental Services
BMP	best management practice
BOD	biochemical oxygen demand
BPS	Bureau of Planning and Sustainability
City	City of Portland
DDT	dichloro-diphenyl-trichloroethane
DEQ	Oregon Department of Environmental Quality
DMA	designated management agency
EDT	Ecosystem Diagnosis and Treatment
EPA	U.S. Environmental Protection Agency
ESCM	Erosion and Sediment Control Manual
GIS	geographic information system
IDDE	Illicit Discharge Detection and Elimination
LA	load allocation
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NRI	Natural Resource Inventory
OAR	Oregon Administrative Rule
PAWMAP	Portland Area Watershed Monitoring and Assessment Program
PP&R	Portland Parks and Recreation
PWMP	Portland Watershed Management Plan
SCM	Source Control Manual
SDC	system development charge
SVS	settleable volatile solids
SWMM	Stormwater Management Manual
SWMP	stormwater management plan
TIP	TMDL Implementation Plan
TIR	thermal infrared imagery
TMDL	total maximum daily load
TSS	total suspended solids
WLA	waste load allocation
WQMP	Water Quality Management Plan
UIC	underground injection control

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SECTION 1
INTRODUCTION

1.1 Purpose

A total maximum daily load, or TMDL, serves as a restoration plan for waterways that have been impaired by pollution and habitat degradation. TMDLs have been developed for watersheds within and surrounding the Portland area, covering all local waterways for certain pollutants of concern.

This TMDL Implementation Plan (TIP) identifies management strategies that the City of Portland (the City) will use to reduce pollutants from nonpoint sources to restore and protect water quality in local waterways and the Willamette River. It updates the City's previous TIP (City of Portland, 2022a) following an Oregon Department of Environmental Quality (DEQ) TMDL survey to report on progress over the last 5 years. The survey and the 5-year retrospective provided an opportunity to identify improvements to management strategies. The City has identified several new or updated strategies and general improvements that are incorporated in this TIP. The City will implement the TIP strategies within its jurisdiction during the next 5-year implementation plan cycle.

This report is separated into eight sections, including this introductory Section 1. Section 2 summarizes TMDLs and associated watershed subbasins in the Portland area; Section 3 provides the management strategies implemented by the City to address TMDL pollutants; Section 4 discusses relevant goals and targets; Section 5 discusses performance monitoring and periodic plan review and revision; and Sections 6, 7, and 8 include additional required information about funding, legal authority, and compliance with land use requirements. Terms listed in ***bold italics*** are defined in the Glossary. All tables and figures are attached after the Glossary at the end of the document, and Appendix A provides the annual reporting matrices for management strategies and temperature goals.

1.2 Background

A TMDL is a regulatory mechanism under the Clean Water Act that serves as a plan for restoring impaired or polluted waters. It identifies the maximum amount of a specific pollutant that a body of water can receive while still meeting water quality standards. A document called a TMDL or a TMDL Plan is developed by the state that divides pollution "loads" into allocations. In Oregon, this process is conducted by DEQ. In a TMDL, ***load allocations*** (LAs) are identified for ***nonpoint sources*** of pollution, and ***waste load allocations*** (WLAs) are assigned to ***point source*** pollution discharges.[1] Point sources of pollutants and associated WLAs are regulated under the ***National Pollutant Discharge Elimination System*** (NPDES) permitting program, and nonpoint sources are managed by TIPs, such as this one. TMDLs in Oregon also include a ***Water Quality Management Plan*** (WQMP) that outlines specific implementation activities required for ***designated management agencies*** (DMAs). A DMA is a federal, state, or local government agency that has legal authority over a sector or source of contributing pollutants and is identified as such in the TMDL.

Great blue heron—Portland's official bird—on the banks of Crystal Springs Creek

1. A portion of a water body's pollutant loading may also be allocated to account for future growth and/or a margin of safety.

TMDL implementation relies on different mechanisms to achieve the goal of restoration. Point source discharges of pollutants (covered by WLAs) are regulated through conditions in applicable NPDES permits. For example, industrial and municipal stormwater and waste discharge NPDES permits include narrative or numeric effluent limits and/or required best management practices (BMPs) that address the WLAs identified in a TMDL. Alternatively, nonpoint sources of pollutants are addressed through a TIP that DMAs are required to develop.[2] For example, this TIP covers the City's nonpoint sources of mercury in the Lower Willamette Subbasin.

Like wastewater, municipal stormwater is governed through the NPDES program that regulates point source pollution. The ***Municipal Separate Storm Sewer System*** (MS4) NPDES permit requires a municipality to develop a stormwater management program (SWMP) document with mandatory measures that control pollutants in runoff. An MS4 permit also requires the municipality to establish pollutant load reduction benchmarks for relevant TMDL pollutants. However, a SWMP required by an MS4 NPDES permit addresses only some, but not all, sources of TMDL pollutants. For example, SWMPs are not required to address temperature sources because stormwater has been determined to not be a significant contributor of heat or "thermal loading" to surface waters. In addition, MS4 NPDES permits apply to a municipality's storm sewer system, which is considered to be a point source, and may not address nonpoint sources of TMDL pollutants. DMAs covered by MS4 NPDES permits are therefore expected to address temperature and nonpoint sources of TMDL pollutants not addressed by the MS4 SWMP in a TIP.[3] This is usually accomplished through submittal of a plan that addresses pollution reduction strategies for TMDL pollutants outside of areas covered by the SWMP and, in so doing, should complement rather than re-create a SWMP.[4]

Lower Columbia Slough

2. Implementation mechanisms are documented in DEQ's May 2007 TMDL Implementation Plan Guidance, which states that "plans are required by Oregon Administrative Rule (OAR) 340-042-0080(3) for nonpoint sources of pollution that are not covered by permits."

3. SWMPs that cover all TMDL parameters can serve as a TIP per DEQ if the SWMP is also applied in nonpoint source areas outside of the MS4. This can be done by including the additional parameters in the stormwater management plan at the permittee's discretion.

4. Over the years, confusion between DEQ and DMAs has obscured whether MS4 discharges should be considered point or nonpoint source discharges. Based on the Clean Water Act and the Oregon TMDL rule, MS4 discharges covered by an NPDES permit are point sources and must be assigned a WLA. MS4 discharges that are not covered by a permit (typically smaller cities) are considered nonpoint sources and should be assigned a load allocation. Given that the City's MS4 discharges are covered by a Phase I MS4 NPDES permit, they are a point source covered by WLAs.

1.3 Requirements

DMAs are required to develop a TIP, report on TIP implementation progress annually, and provide a summary of overall progress every 5 years. According to DEQ's TMDL Implementation Plan Guidance (DEQ, 2007), a TIP should document the ***management strategies*** necessary to prevent, control, and/or treat specific sources of TMDL pollutants.

The required components of a TIP are described in Oregon Administrative Rule (OAR) 340-042-0080(3) and include the following:

A. *Identify the management strategies the DMA or other responsible person will use to achieve load allocations and reduce pollutant loading;*

B. *Provide a timeline for implementing management strategies and a schedule for completing measurable milestones;*

C. *Provide for performance monitoring with a plan for periodic review and revision of the implementation plan;*

D. *To the extent required by [Oregon Revised Statute] ORS 197.180 and OAR chapter 340, division 18, provide evidence of compliance with applicable statewide land use requirements; and*

E. *Provide any other analyses or information specified in the WQMP.*

With respect to item E, the Oregon TMDL rules (OAR 340-042-0025) approved in 2002 require DEQ to develop WQMPs within the TMDL. The Columbia River and Columbia Slough TMDLs were issued prior to 2002 and, therefore, did not include WQMPs. The Willamette River and Tualatin River TMDLs were issued after 2002 and note that DMAs should include the following specific activities in their TIPs:

Willamette River TMDL 2006 (Chapter 14): Bacteria, DDT, Dieldrin, and Temperature

- *ODEQ believes that public involvement is essential to any successful water quality improvement process. When developing and implementing TMDL implementation plans, DMAs will determine how best to provide for public involvement based on their local needs and requirements.*
- *DMAs will be expected to provide a fiscal analysis of the resources needed to develop, execute, and maintain the management strategies described in their TMDL implementation plans.*
- *Local governments are expected to describe in their Implementation Plans their specific legal authorities to carry out the management strategies chosen to meet the TMDL allocations.*
- *DMAs located along the mainstem Willamette River from river mile 50 downstream to the confluence with the Columbia River need to address cold water refugia within their TMDL Implementation Plan.*

Willamette River TMDL 2021 (Chapter 13): Mercury

- *Implementation plans must provide an estimate of the technical and financial resources needed, associated costs, and the sources and authorities that will be relied upon to implement the plan.*
- *DEQ is requiring implementation of six stormwater measures to achieve needed nonpoint source reductions in mercury and sediment. As DMAs for nonpoint sources of mercury, MS4 permit holders must also implement the six stormwater control measures, as described in Table 13-11 in their jurisdictional areas outside of the urbanized area covered by their permit.*
- *TMDL implementation plans for cities and special districts that have MS4 permits must demonstrate how nonpoint source load allocations for mercury will be met by including management strategies to reduce runoff and erosion that discharge directly to waterbodies.*

- *Local governments are expected to describe in their Implementation plans their specific legal authorities to carry out the management strategies chosen to meet the TMDL allocations.*

Tualatin River TMDL 2012 (Chapter 4): Bacteria, Chlorophyll-a, Dissolved Oxygen, pH, Temperature

- *DMAs will determine how best to provide for public involvement based on their local needs and requirements and must include public participation activities in their TMDL Implementation Plans.*
- *DMAs and RPs [Responsible Party] will be expected to provide a fiscal analysis of the resources needed to develop, execute and maintain the programs described in their TMDL Implementation Plans.*
- *Local governments are expected to describe in their Implementation Plans their specific legal authorities to carry out the management strategies chosen to meet the TMDL allocations.*

1.4 Changes in Portland's Form of Government

In November 2022, Portland voters approved Ballot Measure 26-228,[5] changing Portland's election system and form of government. Under the new form of government, City Commissioners will no longer manage bureaus. Instead, they will focus on developing laws and policies, engaging constituents, and increasing community representation in decision-making. The Mayor will have executive authority over City business, collaborating with and delegating responsibilities to a city administrator who will oversee the bureaus. To facilitate the change in government, the City is currently undergoing an effort to develop a new reporting structure for the City's bureaus.[6]

At the time this TIP was being developed, the exact nature of the City's future organizational structure was not known. In November 2023, City Council will receive a draft organizational structure for consideration. Recognizing the overlap between some existing bureaus, the City Council directed those bureaus to develop a work plan for the integration of services related to nature, green infrastructure, watershed management, natural areas, urban tree canopy, and other areas of alignment.[7] Addressing this overlap may include a new Natural Resources work unit in the City's new organizational and reporting structure to reform and enhance central service delivery, meet regulatory and financial requirements, and implement best practices. Many City activities and programs related to the City's TMDL strategies may be housed in a new work unit, and while the activities and programs are expected to continue, how these activities will be delivered has not yet been finalized. These changes are expected to improve the way the City delivers services related to natural resources; however, some activities may be delayed during the transition process.

5. Measure 26-228, effective January 1, 2025. https://www.portland.gov/charter-code-policies/changes/2025/1/measure-26-228

6. More information about the City's transition is available at: https://www.portland.gov/transition

7. Resolution 37609: Establish focused transformation, alignment of services, and shared priorities for Portland City Government. Adopted February 1, 2023. https://www.portland.gov/council/documents/resolution/adopted/37609.

SECTION 2

PORTLAND AREA TMDLS

The subsections below provide details on Portland-area TMDL subbasins and pollutants, along with the suspected sources of those pollutants. The Applicability section (Section 2.2) discusses how TMDLs are implemented in Portland and how this TIP is applied to the different drainage and regulatory areas that exist in the city.

2.1 TMDLs and Pollutant Sources

Figure 1 shows the different watershed subbasins that make up the Portland area. With the exception of certain drainage areas along the northern portion of the city that discharge to the Columbia River, most subbasins ultimately flow into the Willamette River and are considered part of the Lower Willamette Subbasin. The City is a responsible party in four TMDLs: one in the Columbia Slough Watershed, one in the Tualatin Subbasin, and two in the Willamette Basin.[1]

Table 1 lists the TMDLs and associated watershed subbasins that are applicable in the Portland area, and Table 2 provides a summary of the suspected nonpoint sources of Portland-area TMDL pollutants and issues associated with those pollutants.

2.2 Applicability

Stormwater from roughly a third of the Portland area drains to surface waterways through the City's MS4 and other publicly or privately owned storm systems. The central Portland area drains to the City's combined sewer system connecting to the wastewater treatment plant. The remaining areas, mostly in southeast and northeast Portland, are served by underground injection control (UIC) sumps that drain into the ground and recharge groundwater. There are also nonpoint runoff sources of pollutants that discharge to local surface waters. Each of these areas is regulated differently with regards to TMDL applicability and implementation (see Figures 2 and 3).

- **Areas discharging to groundwater – TMDLs do not apply.** UICs do not discharge directly to surface waters and are therefore not regulated by the NPDES or TMDL programs.[2] In Portland, the City's UIC system is covered by a Water Pollution Control Facility (WPCF) permit. The TMDLs listed in Table 1 do not include allocations or implementation strategies that apply to these discharges; however, infiltration of stormwater into the ground does reduce pollutant loads that would otherwise discharge to surface waters. UICs also recharge groundwater, which supplements summer stream flows, therefore providing temperature-related benefits. Generally, the strategies used by the City to reduce pollutants in stormwater under the MS4 NPDES permit are also applied under the City's UIC WPCF permit.

Ash Creek stream enhancement project

1. There is a Columbia River TMDL that applies to the Lower Columbia River area, including Portland, but does not include specific WLAs or LAs for the City. Urban areas are included in an allocation type referred to only as "reserved."

2. Groundwater is regulated under the Safe Drinking Water Act, which does not address TMDLs. However, groundwater is discussed as a source of TMDL parameters in the Columbia Slough TMDL, but requirements for the City to address the source are not included.

- **Point source discharge areas – TMDLs are applied through NPDES permits.**
  - **Stormwater Discharges from the Separated Sewer Area.** In these areas, the City's MS4 is covered by a Phase I NPDES MS4 Discharge Permit. DEQ issued the City its first permit in 1995, renewed it for a second term in 2004 (with modifications in 2005), issued the third permit in 2011, and issued the City's fourth and current permit in 2021. For these areas within the Columbia Slough, Tualatin Subbasin, and Willamette Basin, DEQ is responsible for implementing TMDL requirements through MS4 permit conditions. The central element of the MS4 permit conditions is the development and implementation of the SWMP. Following the 2021 permit reissuance, the City submitted an updated SWMP document (City of Portland, 2022b), which was approved by DEQ in December 2022. In addition to pollutant load reduction strategies, DEQ's requirements in the MS4 permit have evolved since the first 1998 Columbia Slough TMDL to include relevant monitoring and development of TMDL pollutant load reduction benchmarks for all applicable TMDL WLAs. Benchmarks represent a targeted pollutant load reduction goal for the permit term and are intended to illustrate progress toward achieving WLAs. Benchmarks for temperature are not included in the City's NPDES MS4 permit for these TMDL basins because "temperature is generally not considered to be a significant contributor to stormwater pollution and thus is not addressed through a stormwater permit" (DEQ, 2006).
  - **Stormwater and Wastewater Discharges from the Combined Sewer Area.** For a portion of the city, stormwater and sanitary wastes are conveyed through a combined sewer system and conveyed to the City's Columbia Boulevard Wastewater Treatment Plant, which then discharges treated water to the Columbia River. Treatment plant discharges are covered by an NPDES Waste Discharge Permit (#101505) that includes effluent limits that incorporate applicable TMDLs.
  - **Wastewater Discharges from the Separated Sewer Area.** Treated wastewater from the Tryon Creek Wastewater Treatment Plant flows to the Willamette River and is covered by NPDES Waste Discharge Permit (#101614). The permit includes effluent limits that incorporate applicable TMDLs.
  - **Industrial Wastewater and Stormwater Discharges.** Most industrial facilities are required to obtain permits for their wastewater and/or stormwater discharges. Wastewater permits issued by DEQ contain effluent limits that incorporate TMDL WLAs. The 1200-Z stormwater discharge permits contain benchmarks that are derived from TMDL WLAs but do not address temperature because DEQ does not consider stormwater to be a source of elevated temperatures in receiving waters.
- **Non-City jurisdiction areas – City's TMDL WLAs/LAs do not apply.** Stormwater in some pockets of Portland is under the jurisdiction of non-City entities. Examples include stormwater system discharges from the Oregon Department of Transportation, Multnomah County, and the Port of Portland. These drainages are scattered throughout the city, and TMDLs may still apply in these areas, but implementation and coordination with DEQ are the responsibility of the respective parties.
- **Nonpoint source discharge areas – TMDLs are implemented through the TIP.** This TIP covers discharges to the TMDL waterbodies from nonpoint sources of pollution outside of the areas listed above. These areas are predominantly located in large, forested areas or along riparian corridors where runoff enters the waterways through diffuse, overland sources (i.e., surface runoff that is not conveyed through the City's storm sewer system). These areas are addressed under this TIP for all TMDL parameters listed in Table 1 for the Columbia Slough, Tualatin Subbasin, and Willamette Basin.

SECTION 3

MANAGEMENT STRATEGIES

The City is proposing a range of management strategies that will be used to reduce TMDL pollutants from sources in the Columbia Slough, Tualatin Subbasin, and Willamette Basin. These strategies are designed to restore and protect water quality in local waterways and the Willamette River.

The City implements these management strategies through different mechanisms. As noted above, DEQ implements TMDL requirements through NPDES permit conditions, including the City's MS4 permit. The City's SWMP document describes in detail the stormwater management strategies the City employs to meet MS4 permit conditions.[1] These strategies are designed to prevent and control pollution from stormwater discharges, including TMDL pollutants. Section 3.1 provides a brief overview of the stormwater management strategies described in the SWMP document.

The management strategies described in detail in this TIP focus on those that address temperature. Temperature is not considered a stormwater pollutant and is not covered by the City's SWMP. Strategies that specifically address temperature and coldwater refugia are discussed in more detail in Sections 3.3 and 3.4 and summarized in Table 3. The City will implement the strategies identified in Table 3 within its jurisdiction during the current 5-year implementation plan cycle.[2]

3.1 Stormwater Strategies

The stormwater management strategies the City employs to reduce TMDL pollutants and improve water quality are outlined in the City's SWMP document.[3] These strategies are being conducted under the City's MS4 NPDES permit and associated SWMP, which describe the BMPs the City implements to reduce pollutants in stormwater runoff. Although the SWMP addresses discharges from the MS4, most of the SWMP strategies are applied citywide and reduce TMDL pollution from nonpoint sources as well.

Most of the management strategies described in the SWMP document are ongoing and will be implemented throughout and beyond the 5-year implementation plan cycle. The following sections provide a brief description of the City's stormwater management strategies. Stormwater strategies are discussed in more detail in the City's MS4 NPDES permit and SWMP document.

3.1.1 Public Education and Outreach

The City conducts multiple ongoing education and outreach programs to inform the public about the impacts of stormwater discharges on waterbodies and the steps they can take to reduce pollutants in stormwater runoff. These activities are implemented citywide, irrespective of specific MS4 coverage area, to inform the community through consistent and widespread messaging and to maximize behavior change with regards to environmental resiliency.

The City's Clean Rivers Education Program includes a variety of classroom and field study science programs provided free for kindergarten to college students in Portland. Students learn about watershed health; urban ecology; causes and effects of water pollution; and what they can do to protect rivers, streams, and riparian areas.

1. The City's MS4 permit and current Stormwater Management Program document are available online: https://www.portland.gov/bes/stormwater/ms4.

2. The 1998 Columbia Slough TMDL identifies specific DMA obligations related to biochemical oxygen demand (BOD), eutrophication, bacteria, lead, and toxics. This TIP addresses those obligations through the citywide management strategies described in the SWMP.

3. The City's MS4 permit and current Stormwater Management Program document are available online: https://www.portland.gov/bes/stormwater/ms4.

In addition to classroom programs, the City distributes information directly to the public regarding stormwater, water quality, and water resources management through customer newsletters sent with bills, Bureau of Environmental Services (BES) webpages, and various social media outlets. Outreach materials typically include information and suggestions on what residents and business owners can do to improve or prevent pollution of waterways and to protect natural resources.

The City participates in education and outreach opportunities with other jurisdictions as a member of the Oregon Association of Clean Water Agencies and other regional, opportunistic, and seasonal campaigns. The City participates in coordination activities for the statewide Clean Rivers Coalition. The coalition uses funds from participating jurisdictions to support the launch of branded, statewide clean water communications campaigns. The initial campaign focus is on pesticides and insecticides. The City's participation has included a sponsorship for marketing campaign development, community feedback, and participation in the identification of priority issues.

A qualitative evaluation of the City's programs, including the education and outreach efforts, are conducted through the City's annual reporting and adaptive management process. Education and outreach programs are required under the City's MS4 permit and are described in the current SWMP document.

The City tracks all educational events and communication materials. These efforts are summarized in the City's combined annual MS4 and TMDL report.

3.1.2 Public Involvement and Participation

The City implements multiple efforts and programs to facilitate public involvement in the development of stormwater control measures. As with the City's education and outreach strategies, these programs are implemented citywide, with a special focus on watershed and riparian enhancement and stewardship.

BES's Community Watershed Stewardship Program grants, in place since 1995, provide funds to citizens and organizations to encourage watershed protection projects. Projects must be within Portland, promote citizen involvement in watershed stewardship, and benefit the public. Additionally, the City invests in stewardship activities to promote public participation in activities that address invasive species and riparian restoration,

Crystal Springs Creek in 2017, flowing through Westmoreland Park in Southeast Portland, 4 years after the restoration project.

watershed stewardship, green streets and stormwater facility installations, tree planting and community "greening," and other pollution prevention efforts. These grant-funded projects and stewardship activities provide opportunities for public involvement in the development of stormwater control measures.

The City operates a publicly accessible website[4] that includes information on the City's stormwater control implementation, contact information, and educational materials. The information describes the City's activities to manage stormwater and provides information to the public on ways to get involved in pollution reduction efforts.

The City facilitates public involvement and participation in the development of stormwater control measures through the solicitation of public feedback on critical policies. For example, the Stormwater Management Manual (SWMM) and the Source Control Manual represent two of the City's tools for implementing stormwater control measures. As part of the development process for both manuals, the City hosts a public comment period. During this period, the City posts materials to the City's website and hosts public informational sessions. Where appropriate, feedback received during these public comment periods is incorporated into the final versions of the manuals. When implementing a public participation process, the City complies with all public notice requirements, including maintaining a publicly accessible website with information about the process, contact information, and educational materials.

3.1.3 Illicit Discharge Detection and Elimination

The City implements and enforces several programs to address illicit discharges and spills to the City's stormwater conveyance system. BES's Illicit Discharge Detection and Elimination (IDDE) program performs inspections of priority locations to identify and eliminate illicit discharges or cross-connections to the stormwater system. The City's Spill Response Program operates a citywide 24-hour spill response hotline and investigates pollution complaints that have the potential to impact the stormwater system. Portland City Code Title 17.39 defines and prohibits illicit discharges to the City's separate stormwater system and provides enforcement mechanisms (such as civil penalties and cost recovery). Staff investigate and enforce pollution complaints through Portland City Code 17.39 in the City's MS4 area where code authority applies. In non-MS4 areas, staff refer spills to DEQ or other jurisdictions as appropriate.

The Spill Response Program documents all received reports and complaints of illicit discharges into and from the City's stormwater conveyance system. These efforts are summarized in the City's combined annual MS4 and TMDL report.

The City implements other IDDE program controls citywide, such as addressing nonconforming sewers, sewer repairs, portable restroom deployment, and curbside solid waste collection, as described in the SWMP document. The City maintains a current map of the stormwater conveyance system. The map and digital inventory of the stormwater conveyance system includes the location of outfalls and an outfall inventory, details of the conveyance system, and stormwater control locations. The City hosts geographic information system (GIS) layers on the publicly accessible Portland Maps website, including the digital inventory of the City's stormwater conveyance system.[5]

3.1.4 Erosion Control for Construction Site Runoff

Consistent with the Phase I MS4 Permit, the City's Erosion Control Program applies to both public and private construction projects that involve ground-disturbing activities that affect an area that is 500 square feet or greater. Portland City Code Title 10 and the City's Erosion and Sediment Control Manual (ESCM) specify requirements and provide technical guidance for temporary and permanent erosion prevention, sediment control, and control

4. Available at www.portland.gov/bes/stormwater.

5. Publicly available GIS layers, including layers depicting the City's stormwater conveyance system, can be accessed online: https://gis-pdx.opendata.arcgis.com.

of other site development activities that can cause sediment-laden runoff during the construction process. The Erosion Control Program, including Portland City Code Title 10 and the ESCM, is applied citywide irrespective of MS4 service area. The City adopted a new ESCM in 2022 after a years-long effort to update the ESCM with new industry practices, policy clarifications, and more user-friendly formatting.

DEQ is responsible for administering 1200-C NPDES permits for construction runoff in the Portland area, but the City coordinates directly with both DEQ and potential permit registrants to ensure coverage is obtained. The City also coordinates with DEQ where necessary on site inspections and other activities for construction projects that are subject to both City and state erosion control regulations. A summary of permits issued, site inspections, and enforcement actions related to the City's construction site runoff program is provided in the City's combined annual MS4 and TMDL report.

3.1.5 Post-Construction Site Runoff for New Development and Redevelopment

Portland's SWMM[6] serves as the City's post-construction site runoff program and provides policy and design requirements for stormwater management citywide. The requirements in the SWMM and Portland City Code Title 17.38 apply to all development, redevelopment, and improvement projects within the city on private and public property and in public rights-of-way. Projects with 500 square feet or more of impervious area trigger stormwater management requirements, including those for retention, flow control, and water quality treatment facilities prioritizing green infrastructure.

The City imposes a stormwater retention requirement for project sites and a BMP hierarchy to promote infiltration-based and vegetated facilities that prevent or minimize offsite discharges of stormwater. Controls that treat offsite discharges are explicitly required by the current SWMM to achieve 70 percent total suspended solids (TSS) removal from the runoff, but robust technical evaluations in recent years demonstrate that the SWMM is meeting and likely exceeding the 80 percent minimum TSS reduction required in Table 13-11 of the Willamette WQMP.[7] Additionally, the City approves only manufactured stormwater treatment technologies that have a current general use level designation under the Washington State Department of Ecology Technology Assessment Protocol, which requires an 80 percent reduction in TSS. Concurrent with the City's new MS4 permit and associated post-construction requirements, the City anticipates an update to the SWMM in 2024.

The SWMM requires that all stormwater management facilities, conveyance features, and related components that are installed must be operated and maintained in a way that preserves intended functionality (see Section 3.1.6). These requirements apply to project sites under both public and private ownership. The City tracks the installation of stormwater management facilities and conducts subsequent facility inspections. Activities related to SWMM implementation and enforcement are summarized in the City's combined annual MS4 and TMDL report.

3.1.6 Post-Construction Long-Term Operation and Maintenance

The City operates a Maintenance Inspection Program (MIP) to ensure that stormwater management facilities are properly operated and maintained. The MIP team inventories, maps, and inspects stormwater management facilities installed under the SWMM. Staff conduct outreach, assistance, and enforcement activities in accordance with SWMM-required operation and maintenance agreements. Activities related to long-term operations and maintenance are summarized in the City's combined annual MS4 and TMDL report.

3.1.7 Pollution Prevention and Good Housekeeping for Municipal Operations

The City operates several maintenance yards and facilities that receive, store, and transport municipal waste. The City also manages other types of facilities and operations, such as parks and fleet services, that necessitate the use

6. The SWMM website, including the current manual and tools is https://www.portland.gov/bes/stormwater/swmm.

7. While the 2020 SWMM TSS reduction requirement is below the 80 percent target, many of the commonly used structural controls already meet or exceed this target. For example, water quality sampling conducted by BES staff has demonstrated that green street facilities reduce TSS by more than 90 percent (see Kohlsmith et al., 2021).

of BMPs to reduce the potential for discharge of pollutants in stormwater runoff. Municipal facilities are located throughout the city in both MS4 and non-MS4 areas. Regardless of the facility's location, the City employs a variety of structural stormwater and nonstructural source controls at each site. Typical controls include use of covers, berms, and other containment strategies for waste and recyclables; sweeping and good housekeeping practices; installation of filtration and absorbent inlet inserts in catch basins; and use of oil-water separators and other pollution prevention facilities.

DEQ administers NPDES industrial stormwater discharge permits directly for City-owned or operated facilities. The City works with municipal site managers to identify permit coverage for facilities where needed. Through these efforts, the City ensures that City-owned or -operated facilities with industrial activity identified in DEQ's 1200-Z Industrial Stormwater General Permit obtain and maintain coverage under this permit.

The City maintains records of municipal operations and activities at City-operated facilities. A summary of these activities is included in the City's combined annual MS4 and TMDL report.

3.1.8 Industrial and Commercial Facilities

To reduce pollutants in stormwater discharges from industrial and commercial facilities, the City implements the following: (1) the Industrial Stormwater Management Program, and (2) the Source Control Manual. These efforts work in tandem to control pollution from both pre-existing and development sites that pose high pollution risks from onsite activities and land uses.

Through an agreement with DEQ, the City administers the General NPDES Industrial Stormwater 1200-Z and 1200-A discharge permits as part of the Industrial Stormwater Management Program. The City Code also provides the legal authority to ensure that facilities posing an elevated pollution risk to the City's MS4 are properly controlled.

The City's Source Control Manual (SCM) is another policy that prevents pollution from high-risk activities in Portland. Similar to the SWMM, it is an administrative rule that is adopted, implemented, and enforced by BES. The purpose of the SCM is to describe source control requirements specific to certain higher-risk types of development and post-development activities that have the potential to discharge pollutants to surface waters; groundwater; or the City's storm, sanitary, or combined sewer systems.

Additionally, the City conducts outreach activities to industrial and commercial facilities as part of its Public Education and Outreach Strategy. This includes outreach efforts that provide both direct and indirect education and technical assistance to commercial and industrial facilities. Activities related to industrial and commercial facilities are summarized in the City's combined annual MS4 and TMDL report.

3.2 Mercury Strategies

The Willamette Basin Mercury TMDL includes total mercury LAs and WLAs, as well as percent reductions by source category for all subbasins in the Willamette. These allocations vary by source category or land management type within each subbasin. The TMDL reduction requirements that apply to both permitted and non-permitted stormwater in Portland are presented below.

	Tualatin Subbasin (17090010)	Lower Willamette Subbasin (17090012)
NPDES permitted stormwater point source discharges	75% reduction in total mercury loads	97% reduction in total mercury loads
Non-permitted urban stormwater	75% reduction in total mercury loads	75% reduction in total mercury loads

The 2019 Willamette Mercury TMDL WQMP requires that municipal MS4 permittees implement six stormwater control measures in areas not included in their MS4-coverage areas to achieve the necessary nonpoint source reductions in mercury and sediment.[8] The six stormwater control measures are:

1. Pollution Prevention and Good Housekeeping for Municipal Operations
2. Public Education and Outreach
3. Public Involvement and Participation
4. Illicit Discharge Detection and Elimination
5. Construction Site Runoff Control
6. Post-Construction Site Runoff for New Development and Redevelopment

As described in Section 3.1, the City implements many different programs that address these six stormwater control measures through the SWMP document. As noted previously, the City implements nearly all of its MS4 permit-required programs citywide (i.e., both inside and outside of areas technically covered by the City's MS4 permit). The City applies these stormwater strategies citywide to optimize consistency and environmental protection. Section 3.1 describes how the City's current programs meet the six stormwater control measures as required by the TMDL throughout the entirety of the City's jurisdiction.

As noted above, the Willamette Basin Mercury TMDL includes total mercury LAs and WLAs, as well as percent reductions by source category for all subbasins in the Willamette. The TMDL reduction requirements for land managers that apply to areas of the city, such as forested natural areas like Forest Park, are provided below.

	Tualatin Subbasin (17090010)	Lower Willamette Subbasin (17090012)
Agriculture, forest, shrub, developed, other (runoff and sediment)[9]	97% reduction in total mercury loads	97% reduction in total mercury loads

In addition to the stormwater control measures described in Section 3.1, the City implements management strategies to reduce runoff and erosion that discharges directly to waterbodies. To support this, the City applies strategies to reduce pollutant loading in all areas of the city, not only to the MS4 conveyance system, but also from sources directly adjacent to waterbodies.

The City implements multiple strategies to protect and enhance vegetation along the streams in Portland. These efforts include the planting and management of riparian vegetation. Riparian vegetation reduces the delivery of sediment, and hence mercury, to the stream through natural filtration of runoff and streambank stabilization. Additionally, the City protects riparian corridor and streamside vegetation through the environmental overlay zone code, which is applied citywide. Activities are restricted in these areas, including the removal of riparian vegetation. The City's riparian protection, management, and revegetation efforts reduce direct discharges of sediment and mercury to waterbodies in Portland and are described in more detail below in Section 3.3.

3.3 Temperature Strategies

The temperature TMDL for the Lower Willamette Subbasin includes load allocations for all perennial streams, including the Columbia Slough, Johnson Creek, and Tryon Creek. The Tualatin River subbasin temperature TMDL applies to the perennial or fish-bearing streams located in the Fanno Creek and Rock Creek basins. The TMDLs use ***percent effective shade*** as a surrogate for measuring temperature nonpoint source pollutant loading. Effective

8. Table 13-11, page 92, of the 2019 Willamette Mercury TMDL Water Quality Management Plan.
9. "Other" includes additional land uses: barren, grassland/herbaceous, pasture/hay, wetlands, and open water excluding the river network and lakes explicitly represented in the EPA HSPF watershed model.

shade is the proportion of solar radiation that is attenuated or scattered before reaching the stream. DEQ defines ***system potential shade*** as the maximum effective shade possible for a stream reach. System potential shade is achieved when the riparian plant community has reached its mature, undisturbed condition in which vegetation heights are at or near their expected potential, resulting in the maximum effective shade. The TMDL identifies restoration and protection of riparian vegetation as the primary methods for increasing stream shading and bases the nonpoint source load allocations on achieving system potential shade conditions.

Anthropogenic activities throughout the area have degraded riparian conditions, resulting in a loss of riparian vegetation and an increase in solar loading. Based on modeling for the 2006 TMDL, the loss of stream shade has resulted in a 25 percent increase in solar loading to the Columbia Slough mainstem. The increase in solar loading due to the loss of riparian shade, or excess thermal load, to the Johnson Creek mainstem was found to be 51 percent above system potential shade conditions.

The Lower Willamette Subbasin temperature TMDL includes site-specific shade targets for Tryon Creek, the Columbia Slough, and Johnson Creek mainstems, and the Tualatin temperature TMDL specifies similar targets for Fanno Creek and Rock Creek. These site-specific targets were calculated as part of the TMDL modeling. For the other perennial streams in the two subbasins, DEQ defines shade targets using "effective shade curves." Effective shade curves represent the relationship between the potential shade from mature vegetation and the physical characteristics of the stream (channel aspect and width). DEQ developed different effective shade curves for a range of vegetative characteristics found within the subbasin.

DEQ identified the following actions as the means of achieving the conditions necessary to meet system potential shade: (1) restoring and protecting riparian vegetation, (2) increasing instream flows, and (3) narrowing stream channel widths where appropriate. In the Columbia Slough, DEQ also identified the management of rooted aquatic macrophytes as an approach to addressing elevated water temperatures.

The City currently employs multiple strategies to address elevated stream temperatures in Portland streams and meet nonpoint source load allocations. The City uses a combination of approaches, including planning, resource protection through City Code, land acquisition, active restoration and planting, monitoring, and public outreach. The specific strategies are described in Table 3.

Maps of riparian corridors by subwatershed are presented in Figures 4A to 4F. Riparian corridors are defined as zones along waterways, 100 feet wide along each bank, drawn in one of two ways: (1) from the edge of water for larger features, and (2) from the center of streamlines for smaller features. The riparian corridors are categorized to highlight the relevance of temperature management strategies.

Crystal Springs Creek before (left) the removal of a large inline pond in Westmoreland Park and after (right) the City implemented the project to restore the natural stream channel. The pond added heat to Crystal Springs Creek, increasing water temperatures by 2-4°C. These substantial increases in temperature are no longer observed.

3.3.1 Assessment and Prioritization

The City engages in assessment and planning activities to protect and improve natural resources. These efforts bring together the different drivers for natural resource improvement (e.g., City, state, and federal requirements, operation and maintenance needs), available data, and the goals of the public.

3.3.1.1 Effective Shade Assessment

To support and help meet nonpoint source load allocations of the Lower Willamette Subbasin temperature TMDL, the City has assessed the current level of effective shade along the streams in the city covered by the load allocation. This assessment builds off of efforts that were conducted under the previous TIP and more accurately evaluates the City's progress toward meeting the TMDL load allocation of system potential shade.

As part of the assessment, the City evaluated four scenarios using the shade module of DEQ's Heat Source model.[9] The first three scenarios are based on the existing condition of the riparian tree canopy using 2007, 2014, and 2019 LiDAR data. The final scenario models the anticipated effective shade that will be achieved when riparian areas that have already been planted reach maturity. Both scenarios have been compared with the TMDL load allocation of system potential shade that is described in the Lower Willamette Subbasin temperature TMDL.

By comparing the modeling scenarios to system potential shade, the City can evaluate the current progress toward meeting the nonpoint source load allocation and identify areas for future riparian plantings. The results are being used to inform prioritization of possible additional restoration areas.

3.3.1.2 Stream Habitat Assessment

One of the key components of the City's integrated planning approach is an inventory and assessment of the condition of all assets that comprise the stormwater system, including rivers and streams. Knowledge of an asset's condition is necessary to understand the issues that may impact its function. During the previous TIP cycle, BES conducted stream habitat surveys throughout Portland to characterize the current condition of the City's streams. The surveys provide information on both instream habitat and riparian conditions. The City has compiled and analyzed the stream survey data, identified where high-quality habitat can be enhanced or protected, and which stream reaches would benefit from restoration. The results are being used by City staff to identify priorities and guide investments to improve habitat and water quality. All of the perennial Portland streams covered by the Lower Willamette Subbasin TMDL were surveyed as part of this effort.

3.3.1.3 Ecosystem Diagnosis and Treatment Analysis

BES developed an Ecosystem Diagnosis and Treatment (EDT) model to evaluate the availability of existing stream habitat to support endangered salmonids and to evaluate the benefit that restoration work has had on fish populations. Model results forecast the benefits of planned projects, as well as incorporate the anticipated impacts from climate change. During the previous TIP cycle, EDT models were developed for Johnson and Tryon creeks for Chinook and coho salmon and steelhead trout.

The EDT model includes a structure for evaluating and rating the quality, diversity, and abundance of habitat for a focal species within a stream reach. The analysis assesses the habitat needs—which includes both physical habitat and water quality requirements—for the different life stages of each species of interest. Using species-specific, life-stage habitat requirements and the reach-scale environmental conditions, the model calculates population performance for the species of interest. BES evaluated multiple scenarios to estimate current fish population performance and expected performance under future conditions. The results highlight priority reaches where investment in watershed restoration is projected to have the largest benefit to salmonids. The EDT model results are being incorporated into the City's watershed restoration prioritization efforts and are informing future restoration projects.

9. More information about the Heat Source model is available at: https://www.oregon.gov/deq/FilterDocs/heatsourcemanual.pdf.

3.3.2 Environmental Conservation and Protection

The City employs multiple strategies to conserve and protect aquatic resources within Portland watersheds. Environmental protections through the City Code, regulations, and zoning restricts activities that may negatively impact the City's aquatic resources. Figures 4A to 4F show areas of privately owned riparian corridor covered by Conservation or Protection zones ("C-zones" or "P-zones"), which are discussed further below, in orange and yellow. A privately owned riparian corridor located outside environmental zones is shown in red.

3.3.2.1 Floodplain, Riparian, and Wetland Protection

The City protects floodplains, riparian areas, and wetlands through natural resource inventories, protection plans, and environmental overlay zones. The environmental overlay zone code (City Code Chapter 33.430: Environmental Zones; Chapter 33.475: River Overlay Zones) is intended to protect and conserve natural resource values and functions, including water quality and fish and wildlife habitat. The City's adopted Natural Resource Inventory (NRI) and protection plans identify features to which the environmental overlay zones are applied; those features include floodplains, wetlands, riparian and upland vegetation, and waterways.

The total area of riparian corridor protected by environmental overlay zones is over 6,000 acres and about 9 times the size of Portland's downtown core.

The environmental and river overlay zones are a key component of the City's strategy to protect and preserve floodplain and riparian plant communities that will help the City meet the nonpoint source load allocation of system potential shade. The environmental and river overlay zone regulations require that proposed development meet development standards, avoid adversely affecting natural resources where practicable, and/or mitigate for unavoidable impacts.

There are three environmental overlay zones:

1. **The Environmental Protection zone** (P-zone in Figures 4A to 4F) provides the highest level of protection to the most important resources and functional values. Development is approved in the Environmental Protection zone only in rare and unusual circumstances.
2. **The Environmental Conservation zone** (C-zone in Figures 4A to 4F) conserves important resources and functional values in areas where the resources and functional values can be protected while allowing environmentally sensitive urban development.
3. **The River Environmental overlay zone** (shown in Figures 4A-1 and 4A-2 only) protects, conserves, and enhances important natural resource functions and values while allowing environmentally sensitive development. The purpose of the zone is to limit the impacts from development and vegetation maintenance on the natural resources and functional values contained within the overlay zone. The environmental regulations encourage flexibility and innovation in site planning and provide for development that is carefully designed to be sensitive to the site's protected resources. Mitigation is required for unavoidable impacts and is intended to have no net loss of natural resource features or functions over time. The River Environmental overlay zone applies to specific natural resource areas identified in the detailed study Willamette River Central Reach Natural Resources Protection Plan (Chapter 33.475.010; City of Portland, 2017a) and to the developed and undeveloped floodplain. Figures 4A-1 and 4A-2 show the area of privately owned riparian corridor within the River Environmental overlay zone in magenta. The precise extent of coverage and specific rules governing uses within this zone are currently under development and mapping extents and chart values are approximate.

The City's three environmental overlay zones limit development activities in these sensitive areas, including the removal of trees and encroachment into the floodplain. Title 33 requires that all trees with a diameter at breast height greater than or equal to 6 inches that are removed from a site be replaced with at least two replacement trees per removed tree, or payment must be made to a mitigation fund that is used to plant trees in the same watershed (Chapter 33.430.140).

To help protect Portland's natural resources, the City developed the NRI, which documents the location, extent, and condition of Portland's aquatic resources (including rivers, streams, floodplain, wetlands, and the lands adjacent to these waterbodies) and wildlife habitat. The City's NRI builds on an earlier inventory completed by Metro. As part of the NRI, the relative quality of a natural resource is evaluated for specific ecological functions relating to watershed hydrology, water quality, and fish and wildlife habitat. The City uses the NRI to inform zoning and planning activities.

During the previous TIP cycle, Portland's Bureau of Planning and Sustainability (BPS) completed an effort to update and refine the environmental overlay zones. The Environmental Overlay Zone Map Correction Project synchronized the mapped location of the overlay zones with the location of existing identified natural resources, including mapped wetland areas. The project did not alter the protections placed on the City's natural resources through the environmental overlay zones. Rather, the project identified and protected additional natural resources—such as streams and wetlands—that were not covered by the existing environmental overlays. This effort brings the zoning code into alignment with the City's 2035 Comprehensive Plan, which addresses Statewide Planning Goals and Metro requirements. The project ensures that resources across Portland are mapped accurately and regulated in a consistent way.

BPS is continuing to update the City's environmental overlay zones with the Columbia Corridor and Industrial Lands Environmental Overlay Zone Project.[10] This project is a continuation of the Map Correction project and will adjust the location of environmental overlay zones in the Columbia Corridor and other industrial areas to match the locations of streams, wetlands, sloughs, vegetation, and wildlife habitat.

The City is increasing the protection of floodplains in Portland to reduce the impacts of future flooding on people and buildings, as well as the impacts of development on floodplain habitat. BPS is drafting the Floodplain Resiliency Plan, which will update the rules for new development near Portland's rivers and streams and strengthen protections for wildlife in these crucial habitat areas. Once adopted, the Plan will update the City's zoning code (Title 33), establish new minimum requirements for removal and replacement of trees and vegetation in the floodplain, and expand mitigation requirements to increase habitat.[11]

In addition to Portland's environmental overlay zones, the City protects the integrity of vegetation communities through the City's Outdoor Maintenance Requirements (Chapter 29.20.010). Title 29 requires the eradication of all invasive plants identified on the City's Nuisance Plants and Required Eradication Lists. The code applies to all property owners, covering both riparian and upland areas.

3.3.2.2 Tree Protection

In addition to the environmental overlay zones, the City's Tree Code (Portland City Code, Title 11) also helps to preserve the City's tree canopy. The code limits the removal of trees from a property. In development situations, the Code requires preservation of larger trees on private property or payment to a mitigation fund at the cost per replacement tree (Chapter 11.50.040).

10. More information about the Columbia Corridor and Industrial Lands Environmental Overlay Zone Project is available at: https://www.portland.gov/bps/planning/environ-planning/industrial-ezones.

11. More information about the Floodplain Resilience Plan is available at: https://www.portland.gov/bps/planning/environ-planning/floodplain-project.

BOONES FERRY BRIDGE AND RESTORATION PROJECT

Removing a Fish Passage Barrier on Tryon Creek

Tryon Creek is one of the few major remaining tributaries in the city that flows freely to the Willamette River from Portland's West Hills. As one of the few coldwater tributaries to the Willamette River in Portland, Tryon Creek provides valuable habitat for fish and wildlife. Originating from springs in southwest Portland, Tryon Creek flows southeast for approximately seven miles, continuing through the Tryon Creek State Natural Area before reaching its confluence with the Willamette River below the Highway 43 crossing in Lake Oswego.

The SW Boones Ferry Road culvert was identified by the City of Portland as one of two major fish passage barriers on the mainstem of Tryon Creek. The Boones Ferry Bridge and Restoration Project removed an undersized 60-inch, 140-foot-long corrugated metal pipe culvert that carried Tryon Creek under SW Boones Ferry Road. The culvert was replaced with a new single-span steel girder bridge that allows for fish passage and provides a safer crossing for both pedestrians and wildlife. The original culvert restricted stream flow and did not allow fish to access Tryon and Arnold creeks upstream of SW Boones Ferry Road. As part of the project, the City also added large wood to the stream, planted 3 acres with native trees and understory plants, and removed invasive species along both Tryon and Arnold creeks. The project expands upstream habitat and provides significant benefits to fish that use the streams, including cutthroat trout.

Metro's Nature in Neighborhoods Capital Grant Program helped to support the project.

3.3.2.3 Onsite Stormwater Retention and Low Impact Development

As noted in the Lower Willamette Subbasin TMDL, reduced summer baseflows can have a negative effect on stream temperatures. The TMDL nonpoint source load allocation does not affect groundwater recharge; however, actions that improve summer stream flows will likely have a positive benefit on stream temperatures. Within Portland, impervious surfaces can limit stormwater infiltration, reducing groundwater recharge. To address stormwater issues, the City manages impervious areas through the City's SWMM.

The SWMM provides policy and design requirements for stormwater management throughout the city. The requirements in the manual apply to all development, redevelopment, and improvement projects within Portland on private and public property and in the public right-of-way. The SWMM prioritizes stormwater infiltration, requiring that stormwater must be infiltrated onsite to the maximum extent feasible, before any flows are discharged offsite. By prioritizing stormwater infiltration on a property, the City is encouraging actions that will increase infiltration and groundwater recharge within Portland, supporting summer stream flows that may benefit summer stream temperatures.

3.3.2.4 Invasive Species Management and Treatment

Invasive species management is one of the City's key strategies to maintain healthy riparian communities within Portland's watersheds. In addition to active planting, the City provides vegetation management in many of Portland's natural areas.

Additionally, the City conducts surveys for invasive wood-boring pests that would negatively impact tree health and lead to a future loss of tree canopy. To date, the focus has been on two insects that would impart substantial loss of riparian canopy in the region: the Asian longhorned beetle and the emerald ash borer. City staff visually monitor for signs of both species and actively set and monitor traps for emerald ash borers with state and federal partners. These efforts are particularly important due to the recent discovery of the emerald ash borer near Portland in Forest Grove in June 2022. The City also acts as a partner with state-led surveys and controls for both Asian and European gypsy moths.

3.3.3 Watershed Restoration

In addition to the protection strategies described above, the City engages in active restoration to improve natural resources throughout Portland. The City's restoration efforts include revegetation and restoration programs that aim to improve stream conditions, including actions to address water quality impairments such as excess stream temperatures. Figures 4A to 4F show areas currently or previously managed through revegetation or restoration activities in dark green. Areas classified as "Restoration Potential," shown in light green, are publicly owned and may represent future opportunities for similar enhancements. Project potential depends on numerous factors, including effective shade and stream conditions.

3.3.3.1 Riparian Revegetation

The City conducts vegetation management and planting in natural areas throughout the city, including riparian areas. The City's focused effort on riparian plantings and natural areas restoration and management began in 1995 in the Columbia Slough watershed. Today, the City conducts work in all of Portland's watersheds and includes the planting of native trees and shrubs in riparian areas throughout Portland as part of revegetation efforts. Planting riparian trees and shrubs is a key strategy in addressing stream temperatures and meeting the nonpoint source load allocations identified in the TMDL.

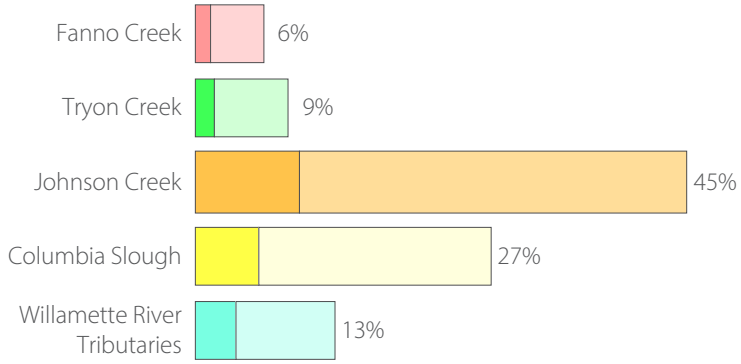
3.3.3.2 Hydrologic Connectivity

The City actively works to restore hydrologic connectivity by implementing restoration projects and by purchasing and restoring properties. BES also actively works with the Portland Bureau of Transportation and the Oregon Department of Transportation to identify and replace culverts that are current fish passage barriers to improve hydrologic connectivity. When conducting watershed restoration, the City relies on the Portland Watershed

Management Plan (PWMP) to inform project objectives and identify actions that will contribute to the City's overall goals for watershed health (City of Portland, 2005a).

The PWMP was developed in 2005 and guides City decisions and projects by providing a comprehensive approach to restoring watershed health. The PWMP identifies priority actions and areas that require attention, and it provides both a structure to evaluate watershed health and a long-term commitment to adapt and improve watershed management measures over time. The PWMP is a citywide effort that relies on the coordination of City bureaus and community partners to address the complex issues associated with urban watershed management.

THE CITY PLANTED
162,170 NATIVE TREES AND SHRUBS
FROM 2019-2023



Percent of total plantings across the City by watershed
(Shrubs/Trees - shrubs are the light shade and trees are the darker shade)

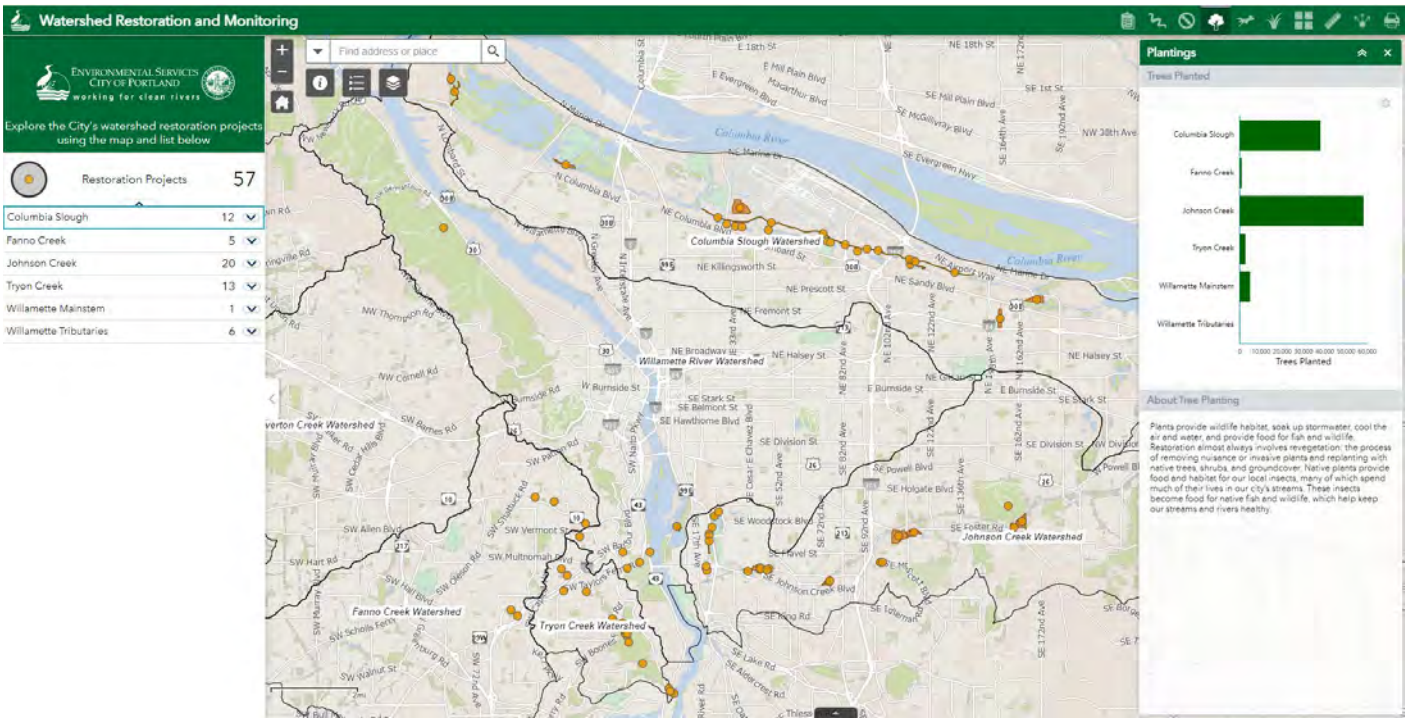
The plan is built on a scientifically sound foundation that addresses the sources and causes of environmental problems rather than focusing on symptoms. Portland's watershed approach is described in the City's Framework for Integrated Management of Watershed Health (City of Portland, 2005b). The framework describes watershed health goals, why the goals are desirable, and relevant ecological principles and restoration guidelines that support the goals, which comprise the following:

- Hydrology: Move toward normative stream flow conditions to protect and improve watershed and stream health, channel functions, and public health and safety.
- Physical habitat: Protect, enhance, and restore aquatic and terrestrial habitat conditions and support key ecological functions and the improved productivity, diversity, capacity, and distribution of native fish and wildlife populations and biological communities.
- Water quality: Protect and improve surface water and groundwater quality to protect public health and support native fish and wildlife populations and biological communities.
- Biological communities: Protect, enhance, manage, and restore native aquatic and terrestrial species and biological communities to improve and maintain biodiversity in Portland's watersheds.

In addition to the watershed goals, the PWMP includes watershed objectives. The objectives describe the desired changes in watershed conditions and functions needed to achieve watershed health. The goals and objectives were used to help identify and prioritize six "watershed improvement strategies". Improving stream temperature is a key objective of the PWMP, and revegetation is one of the six watershed improvement strategies. Consequently, achieving the goals of the PWMP also contributes toward meeting TMDL nonpoint source load allocations.

3.3.3.3 Stream, Floodplain, and Wetland Restoration

The City's aim is to restore natural stream functions and processes through watershed restoration projects, including floodplain reconnection, riparian plantings, wetland restoration, habitat enhancement for fish, and treatment facilities to improve water quality. Active restoration improves instream and riparian conditions, which contribute toward the TMDL load allocation of system potential shade.



Watershed Restoration and Monitoring web map: https://pdx.maps.arcgis.com/apps/webappviewer/index.html?id=807ed51bb0314f9cbd31815c73ff9b6e

The City began implementing watershed restoration projects in the 1990s. Projects are located across Portland and work to restore natural stream functions. During the past TIP cycle, the City completed an effort to develop an interactive web map to share the results of the City's watershed restoration work. The interactive map shares with the public the location of projects, their restoration objectives, and accomplishments.

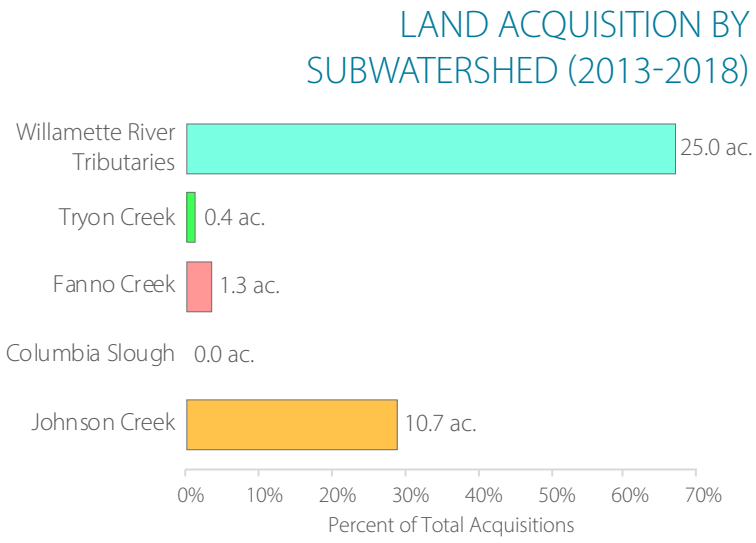
3.3.3.4 Land Acquisition

Acquiring properties with significant ecological resources to protect and/or restore is a component of the City's restoration work. Through different programs, the City is able to purchase parcels of land to prevent the loss of natural resources to development and to implement restoration projects that improve hydrologic connectivity. Properties purchased through these programs are managed by the City as natural areas to support ecological functions and, where applicable, to support riparian conditions. Riparian corridors within the natural areas managed by the City are planted and stewarded to promote healthy conditions that will achieve a mature riparian canopy. These mature conditions help shade the stream and achieve the TMDL nonpoint source load allocation of system potential shade. Targeted property acquisition helps facilitate the restoration or enhancement of priority stream reaches, and property owners are under no obligation to sell their property; but if they do, the City offers fair market value for the property.

In 1997, BES developed the Johnson Creek Willing Seller Land Acquisition Program. The program helps move people and properties out of areas that frequently flood. As part of the program, BES offers willing sellers the fair market value for their floodplain property. Owners are under no obligation to sell their property. Properties that are purchased by the City have deed restrictions that designate them as open space in perpetuity and ensure no future development on the property. Once purchased, the City implements restoration projects to create constructed wetlands; floodplain terraces; and open space for flood management, habitat, and passive recreation. Revegetation work on these acquired properties frequently

The City acquired over 37 acres from 2019-2023. That's over 18 soccer fields of newly protected lands.

includes riparian plantings and invasive species management. The Willing Seller Land Acquisition Program is an implementation strategy for the 2001 Johnson Creek Restoration Plan, which addresses nuisance flooding, water quality problems, and fish and wildlife declines as related issues (City of Portland, 2001). The plan identifies common solutions to restore natural floodplain functions.



Portland Parks and Recreation (PP&R) operates a land acquisition program to purchase new properties for the City's park system. The program funds the acquisition of land for all park types, including natural areas. To guide the program, PP&R developed a land acquisition strategy that provides a framework for determining which potential acquisition projects to pursue. For natural areas, the strategy specifically targets properties with streams, wetlands, and riparian areas. The objectives of the PP&R land acquisition program are to establish an interconnected system of natural areas, protect the City's natural areas and environmentally sensitive habitats, and increase natural area land within the city as identified in the 2006 Natural Area Acquisition Strategy (City of Portland, 2006).

3.3.3.5 Upland Tree Planting

Upland trees provide a benefit to those living in Portland. The urban forest canopy intercepts rain, which reduces stormwater runoff, provides shade and habitat for wildlife, and helps reduce the urban heat-island effect. Through partnerships with nonprofits, community members, businesses, and schools, the City actively enhances watershed health by planting trees in the upland built environment using community engagement and volunteer support. These trees expand the urban forest canopy, managing stormwater locally while improving habitat connectivity in the urban matrix between natural areas.

3.3.3.6 Restoration and Planting Partnerships

Through partnerships with nonprofits, community groups, and schools, the City actively enhances natural areas using volunteer support. Activities include invasive plant species removal, native plant installation, and community education.

3.4 Coldwater Refugia

The Willamette Basin temperature TMDL designates the mainstem of the Willamette from its confluence with the Columbia River upstream to River Mile 50 as a year-round salmon and steelhead migration corridor. For this migration corridor, the TMDL establishes a numeric criterion for water temperature and a narrative criterion for ***coldwater refugia***. OAR 340-041-0002(10) defines coldwater refugia as "those portions of a water body where, or times during the diel temperature cycle when, the water temperature is at least 2 degrees Celsius colder than the daily maximum temperature of the adjacent well-mixed flow of the water body. Refugia include habitats and locations where temperature sensitive cold water species may find refuge when ambient stream temperatures are stressful." In addition to the comprehensive strategies described in previous sections to meet TMDL nonpoint source load allocations, the City is also working to identify, preserve, and enhance coldwater refugia in the Lower Willamette Subbasin.

In 2011, thermal infrared imagery (TIR) was collected to capture the surface temperature of the Willamette River. The data included imagery of tributary confluences, which was used to identify whether they provided cold water to the mainstem Willamette River during summer. Using TIR data, the City identified multiple sources to the Willamette River that were at least 2°C colder than the main channel. The City and its partners have implemented multiple restoration projects at these tributary confluences to enhance conditions and provide essential cold-water habitat for both juvenile and adult migrating salmonids.

In addition to the City's internal efforts, City staff assisted with DEQ's effort to develop a coldwater refuge plan for the lower 50 miles of the Willamette River (DEQ, 2020). BES staff provided DEQ with an inventory of all available temperature data for Portland area waterways and served on DEQ's scientific expert and peer review panel on coldwater refuges in the Lower Willamette River. The City continues to use the findings from DEQ's comprehensive study. Over the next TIP cycle, the City will update the inventory of coldwater refugia in Portland based on new findings from temperature monitoring data.

While the City and its partners have successfully implemented restoration projects at many coldwater confluences, the City is continuing to evaluate the feasibility of additional refugia enhancement projects. The City continues to use the TIR data, along with more recent continuous stream temperature data, to guide the implementation of restoration projects along the mainstem Willamette. Additionally, the City's watershed restoration efforts on tributaries to the Willamette River described above, also serve to protect or enhance coldwater refugia in the Willamette River. For example, during the summer of 2013, the City removed an in-line pond from Crystal Springs Creek (a tributary to Johnson Creek) that was warming the stream. After the removal, the daily maximum summer stream temperatures were reduced by 3 to 4°C. Due to Crystal Springs' consistent summer discharge, the thermal benefit of the project persists from the confluence with Johnson Creek to the confluence of Johnson Creek with the Willamette River. In 2017 the City found that the daily maximum Johnson Creek water temperatures recorded by the U.S. Geological Survey gage at Milwaukie were approximately 2 to 3°C cooler than the temperatures upstream of the Crystal Springs confluence. The restoration work on Crystal Springs provides a benefit to the stream system itself, but it also provides a coldwater benefit to the lower 2 miles of Johnson Creek and at the Willamette River confluence. The City is actively exploring other projects that may benefit tributary streams and enhance coldwater refugia.

Restoration of Crystal Springs Creek between SE Tenino Street and SE Umatilla Street. Two culverts were replaced to provide fish passage and large wood and boulders were added to the channel to provide habitat.

SECTION 4

GOALS AND TARGETS

As noted in Section 3, many of the City's key stormwater management strategies to reduce TMDL pollutants and improve water quality are conducted under the City's MS4 Permit and associated SWMP. The SWMP document defines the key performance indicators, goals, and reporting milestones associated with implementing BMPs to reduce pollutants in stormwater runoff. While the focus of the SWMP is to address discharges from the MS4, many strategies described in the SWMP document are applied citywide and reduce TMDL pollution from nonpoint sources as well.

As part of this TIP, the City has identified specific goals and targets to assess progress toward meeting nonpoint source temperature load allocations. The City's TMDL goals and targets for the temperature strategies identified in Section 3 are provided in Table 3.

Columbia Slough

SECTION 5

PERFORMANCE MONITORING AND PLAN UPDATES

This section provides a summary of activities conducted by the City to evaluate performance of the TMDL management strategies and to support the adaptive management process for reviewing and revising this TIP. Section 5.1 provides a summary of environmental monitoring, Section 5.2 provides an overview of the process to assess performance and conduct adaptive management, Section 5.3 summarizes the process to coordinate the review and revision of strategies with the City's MS4 permit, and Section 5.4 discusses public involvement that can inform TIP updates.

5.1 Environmental Monitoring

The City conducts extensive storm and surface water monitoring as required under the MS4 permit. The monitoring supports multiple objectives, including pollutant source evaluation, stormwater runoff characterization, assessment of instream water quality trends, TMDL pollutant load reduction benchmarking, and programmatic adaptive management. These monitoring activities are detailed in the Municipal Separate Storm Sewer System Monitoring Plan, dated November 2022 (City of Portland, 2022c). The monitoring program includes comprehensive stormwater monitoring for an extensive list of pollutant parameters. In response to the City's new MS4 permit in 2021, the City updated the MS4 Monitoring Plan in 2022 to address new permit requirements.

The watershed monitoring activities implemented by the City that support TMDL implementation include the collection of water quality and benthic macroinvertebrate samples, instream time-series data, physical stream habitat surveys, bird surveys, and fish surveys. The City currently monitors water quality (including continuous stream temperature) at 80 sites on perennial streams throughout Portland as part of the Portland Area Watershed Monitoring and Assessment Program (PAWMAP). PAWMAP is a coordinated long-term monitoring effort designed to measure the City's current and changing ecological resources that began in 2010. The program is intended to systematically measure changes in habitat, water quality, and biological communities over time. As part of the program, the City monitors stream temperature using continuous loggers at each sampling site.

Lower Tryon Creek

The City also conducts project-specific monitoring to evaluate the City's watershed restoration projects. As part of project monitoring, the City collects pre- and post-project data to evaluate the success of a restoration project relative to both project and citywide restoration targets. The data collected through the monitoring effort is used to facilitate project and permit reporting as required by the U.S. Army Corps of Engineers and Oregon Department of State Lands, and the data also informs both site-specific adaptive management needs and recommendations for future restoration projects based on lessons learned. In 2020, BES staff finalized a comprehensive manual for monitoring restoration projects that standardizes the City's data collection efforts across projects, establishes monitoring protocols, defines the frequency of data collection, and facilitates improved project reporting. Monitoring the effectiveness of watershed restoration projects is an important strategy that the City uses to assess progress toward meeting nonpoint source load allocations for temperature included in the Lower Willamette and Tualatin TMDLs. Ongoing monitoring ensures that a restoration project continues to function as intended and remains on a trajectory to reach mature conditions or system potential.

5.2 Adaptive Management

The City conducts an annual adaptive management process while also preparing its annual MS4 and TMDL status reports. This annual review is used to identify whether the City's TMDL programs are being implemented in accordance with the TIP and whether any adjustments are needed. The City submits the progress reports to DEQ each year on or by November 1. The reports summarize strategy implementation and identify programmatic issues or modifications identified as part of the annual review. An updated version of the City's annual TMDL reporting matrix is provided in Appendix A.

In addition, every 5 years, the DEQ requires DMAs to review the implementation of management strategies that are in their TIPs. The last 5-year review was conducted in 2018, and the next 5-year review is due by November 1, 2023. The resulting report indicates whether the plan is adequately meeting pollution reduction goals. As part of the process, the City reviews the TIP to assess its strategies and progress toward meeting goals and to propose changes as appropriate. Existing strategies are reviewed and refined to reflect progress made over the previous 5 years, and the TIP is updated accordingly, if needed, and included with the 5-year review materials on November 1, 2023. This revised plan will be effective from November 1, 2023, through October 31, 2028. Similarly, the TIP may require updates if DEQ issues new TMDLs in the Portland area or revises existing TMDLs.

5.3 Regulatory Driver Updates

Many TMDL strategies listed in this TIP are conducted to comply with the City's MS4 NPDES permit and associated SWMP. It is the City's intent to maintain consistency between the SWMP and the TIP, as most of these programs are applied citywide regardless of regulatory applicability. The City's SWMP is reviewed and changes are evaluated in accordance with the MS4 permit renewal process prior to the end of each 5-year permit term. The SWMP is updated at MS4 permit reissuance to comply with new permit conditions and as needed thereafter. The timelines associated with the City's MS4 permit renewal and subsequent SWMP development and TIP cycle do not always align. To maintain consistency between the two plans, the City may update the TIP to align with stormwater management strategies that are updated as part of the MS4 NPDES program when they occur. These updates will be reflected in the following year's TMDL annual progress report.

IMPORTANT DATES

2023 TIP implementation:
11/1/2023 to 10/31/2028

TIP 5-year review:
Due 11/1/2023

2028 TIP update:
Due 11/1/2028

Annual reports:
November 1 of each year
(except 2028)

5.4 Public Involvement

The City conducts a variety of public involvement activities related to TIP implementation and the management strategies identified, including the following:

- The City's current TIP, annual reports, 5-year evaluations, and other relevant information are posted online and made publicly available. The website provides contact information for those who have questions or want to provide input on the City's plans, strategies, and other environmental program activities.
- Starting with the 2019 TIP update (City of Portland, 2019), the City's TIP was designed to be more accessible, easier to use, and understandable by the public. The City added clarifying language and regulatory background, a table summarizing the applicable TMDLs and associated surface waters, information related to potential TMDL pollutant sources, an acronyms and definitions section, and graphics and maps to clearly illustrate basin boundaries and coverage areas.
- A significant amount of public involvement and outreach activities (i.e., grant distribution, community events, workshops, and stewardship projects) are undertaken as part of the stormwater management strategies associated with the City's MS4 permit. Additional details can be viewed in the City's MS4 and TMDL annual reports (City of Portland, 2022d; City of Portland, 2022e).

SECTION 6

FUNDING

The Tualatin Subbasin and Willamette Basin TMDLs state that DMAs are expected to perform a fiscal analysis to estimate the resources needed to develop, execute, and maintain the programs described in their implementation plans.

Since 1995, the City has invested more than $1.6 billion in stormwater management services and facilities. The majority of the funding sources required to implement the strategies identified in the TIP and related environmental activities are financed directly through BES utility fees. The remaining sources include system development charges (SDCs) and a smaller portion coming from other services, fees, grants, and penalties. The Portland City Council approves revised monthly user fees and SDCs at the start of each fiscal year. Rate adjustments are based upon cost-of-service principles, which aim to ensure equity by charging ratepayers and developers based on the amount of sewer and drainage service they use.

- **Monthly User Fees.** Monthly user fees are adjusted to reflect operating, maintenance, and capital costs of the City's sanitary sewer and drainage system.
- **SDCs - Stormwater.** SDCs are assessed for new development and significant redevelopment based on two things: (1) onsite stormwater management — the charge for stormwater facilities that handle runoff from individual properties and (2) public right-of-way runoff management — the cost of stormwater facilities that handle runoff from public rights-of-way. Riparian properties that drain directly to the Columbia Slough, Columbia River, or Willamette River are exempt from the onsite portion of the fee. Discounts may be granted only for the "onsite" part of the charge for facilities constructed as part of new development.

While investments in stormwater and watershed programs and projects will vary from year to year, implementation of this TIP is expected to be fully financially supported given the stability of these funding mechanisms. Current and out-year investment fluctuates annually based on a variety of factors, including the nature and cost of capital improvement projects, the stage and timing of project completion at any point in the year, operational improvements, and inflationary factors.

SECTION 7

LEGAL AUTHORITY

The City's legal authority to implement TMDL management strategies is provided by relevant Oregon State Constitution sections, Oregon state statutes, and City charter and code. Specific Portland City Code sections and authorities relevant to TMDL implementation are listed below:

- ***Title 10 - Erosion and Sediment Control Regulations.*** *This title provides requirements related to sediment and erosion control for development and construction-related activities. These requirements are intended to: (1) reduce sediment and pollutants contained in erosion caused by construction and development, (2) reduce the amount of sediment and pollutants entering storm drainage systems and surface waters from ground-disturbing activities, (3) prevent dirt and mud from accumulating on the public streets and surrounding properties during construction and development, and (4) reduce or prevent airborne dust during ground-disturbing activities. Title 10 gives legal authority to the Bureau of Development Services (BDS) and BES to administer and enforce erosion and sediment control requirements.*
- ***Title 11 - Trees.*** *This title provides requirements to address trees in both development and nondevelopment situations and seeks to enhance the quality of the urban forest and optimize the benefits that trees provide. Relevant objectives in this title include helping to filter stormwater and reduce stormwater runoff; maintaining slope stability and preventing erosion; reducing the urban heat island; and meeting the objectives of the Urban Forest Plan, including reaching and sustaining canopy targets for various urban land environments. This title provides the legal authority for the City Forester and Director of BDS to administer and enforce all regulations in Title 11.*
- ***Title 17 – Public Improvements.*** *This title regulates public improvements, including sewer and stormwater collection systems. Chapters specific to the TMDL management strategies listed in this TIP include the following:*
  - *17.32 – Public Sewer & Drainage System Permits. This chapter regulates access and connection to, and the use, construction, modification, maintenance, repair, or removal of components of the City sewer, storm sewer, and drainage systems and their easements. It operates in conjunction with Chapter 17.38 (below) to regulate the collection, conveyance, and disposal of sanitary and stormwater discharges from public and private properties.*
  - *17.33 – Required Public Sewer Connection. This chapter facilitates timely connection of individual properties to the public sewer system when available, facilitates conversion of nonconforming private sewer systems, and provides for financial assistance to property owners required to make a new sewer connection.*
  - *17.38 - Drainage and Water Quality. This chapter details requirements for the effective management of stormwater, groundwater, and drainage and to protect and improve water quality. It includes details for the protection of drainageways and stormwater management requirements related to new development and redevelopment.*
  - *17.39 - Stormwater System Discharges. This chapter contains requirements for discharges to the City's storm system to convey, manage, and protect water quality. It includes details regarding allowable discharges, prohibited discharges, notifications, and control of illicit connections and discharges.*
- ***Title 24 – Building Regulations.*** *This title establishes standards for building and construction, including clearing, grading, earthwork, and erosion control on private property. Title 24 also restricts or prohibits uses that are dangerous to health, safety, or property in times of flood or that cause increased flood heights or velocities. It also requires that building uses and structures vulnerable to floods be protected from flood danger at the time of initial construction. Title 24 complies with Metro's Title 3 (Water Quality and Flood Management) by incorporating Metro's Water Quality and Flood Management Area Maps in Title 24 and includes many requirements for meeting the federal National Flood Insurance Program.*
- ***Title 29 – Property Maintenance Regulation.*** *This title has requirements pertaining to outdoor property maintenance requirements. Section 29.20 requires the eradication of all plants identified on the City's Nuisance Plants List and on the City's Eradication List.*

- ***Title 33 – Planning and Zoning.*** *The City's zoning code is intended to implement Portland's Comprehensive Plan and related land use plans to protect the health, safety, and general welfare of the citizens of Portland. Section 33.430 (Environmental Zones) describes the City's environmental conservation zones to conserve important resources and functional values in areas where they can be protected while allowing environmentally sensitive urban development. Section 33.440 (Greenway Overlay Zone) protects; conserves; enhances; and maintains the natural, scenic, historical, economic, and recreational qualities of lands along Portland's rivers. The Greenway Overlay zone includes a vegetated corridor that separates protected water features from development and protects and improves water quality by maintaining or reducing stream temperatures and natural stream corridors. It also stipulates minimizing erosion, nutrient, and pollutant loading while stabilizing slopes to prevent landslides contributing to sedimentation of water features. Section 33.475 (River Overlay Zones) promotes the protection, conservation, restoration, enhancement, and maintenance of the economic, natural, scenic, and recreational qualities of lands along the central reach of the Willamette River. This is achieved by applying regulations that control development of land, change of use, and intensification of use*

SECTION 8

COMPLIANCE WITH LAND USE REQUIREMENTS

One of the required elements of a TIP is evidence or acknowledgment that the management strategies to significantly affect land use are carried out in a manner that complies with the statewide land use goals and are compatible with comprehensive plans.

The City is required to adopt a Comprehensive Plan that implements the applicable Statewide Planning Goals at a local level. After a 4-year update process, the City's 2035 Comprehensive Plan was adopted in June 2016. In December 2017, the plan was approved and acknowledged by the Land Conservation and Development Commission to be compliant with the Statewide Planning Goals. The plan became effective in May 2018. Portland's plan is a long-range one intended to help the City prepare for and manage expected population and employment growth and to coordinate major public investments.

One of the five guiding principles used to shape the individual policies and projects in the 2035 Comprehensive Plan is related to environmental health, and it includes "weaving nature into the city and fostering a healthy environment that sustains people, neighborhoods, and fish and wildlife." It also recognizes "the intrinsic value of nature and sustaining the ecosystem services of Portland's air, water and land." Chapter 7 of the plan covers environment and watershed health and includes goals and policies related to this TIP:

- Recognize the economic, health, cultural, and intrinsic values of nature, and the importance of community stewardship.
- Preserve natural resources and the beneficial functions and services they provide. Improve air quality and watershed health, including hydrology, water quality, fish and wildlife habitat, and biodiversity.
- Prevent incremental environmental degradation, including the spread of invasive species, loss of habitat, and adverse impacts of additional impervious surfaces.
- Advance good decisions and adaptive management through better data collection.
- Provide guidance that addresses the distinct ecological issues of specific watersheds.
- Ensure that plans and investments are coordinated with relevant policies from other City plans such as the PWMP, Urban Forest Management Plan, Climate Action Plan, Climate Change Preparation Strategy, PP&R plans, Natural Hazard Mitigation Plan, and plans addressing environmental equity.

The TMDL management strategies outlined in this TIP support and align with the City's 2035 Comprehensive Plan.

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GLOSSARY

Best management practices (BMPs)	Activities, controls, prohibition of practices, maintenance procedures, and other management practices designed to prevent or reduce pollution. BMPs also include treatment requirements, operating procedures, and practices to control stormwater runoff (MS4 permit).
Coldwater refugia	Those portions of a waterbody or times during the diel temperature cycle when the water temperature is at least 2°C colder than the daily maximum temperature of the adjacent well-mixed flow of the waterbody (OAR 340-041-0002[10]).
Designated management agency (DMA)	A federal, state, or local governmental agency that has legal authority over a sector or source of contributing pollutants and is identified as such by the Department of Environmental Quality in a TMDL (OAR 340-042-0030[2]).
Load allocation (LA)	The portions of the receiving water's loading capacity that are allocated to existing nonpoint sources, including runoff, deposition, soil contamination, and groundwater discharges, or to background sources (OAR 340-042-0040[4][h]).
Management strategies	Strategies to control the addition of pollutants to waters of the state and include application of pollutant control practices, technologies, and processes; siting criteria; operating methods; best management practices; or other alternatives (OAR 340-042-0030[6]).
Maximum extent practicable (MEP)	The statutory standard that establishes the level of pollutant reductions that operators of regulated MS4s must achieve. This standard is considered met if the conditions of the permit are met (MS4 Permit).
Municipal Separate Storm Sewer System (MS4)	An MS4 is a conveyance or system of conveyances including roads with drainage systems, An MS4 is a conveyance or system of conveyances including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains that are defined as follows: a. Owned or operated by a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to state law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under state law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian Tribal organization, or a designated and approved management agency under §208 of the Clean Water Act that discharges to waters of the United States. b. Designed or used for collection or conveying stormwater. c. Not a combined sewer. d. Not part of a publicly owned treatment works, as defined by 40 CFR §122.2.
National Pollutant Discharge Elimination System (NPDES)	The NPDES program is a national regulatory program for issuing, modifying, revoking, reissuing, terminating, monitoring, and enforcing permits and for imposing and enforcing pretreatment requirements under Section 307, 402, 318, and 405 of the Clean Water Act for the discharge of pollutants to surface waters of the state from point sources. These permits are referred to as NPDES permits and, in Oregon, administered by the Oregon DEQ.
Nonpoint source	Nonpoint sources are typically defined as those sources that enter surface waters through more diffuse and dispersed overland flow (e.g., surface runoff from agricultural and forested lands) and are not covered by NPDES permits. Load allocations are listed in the TMDL for these nonpoint sources.
Percent effective shade	The proportion of solar radiation that is attenuated or scattered before reaching a stream.

Point source	Point sources are typically defined as sources that are covered by an NPDES permit and enter surface waters through a pipe or defined conveyance system (i.e., municipal and industrial stormwater and/or wastewater). They include "any discernible, confined, discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft from which pollutants are or may be discharged" (OAR 340-045-0010[17]). Waste load allocations are listed in the TMDL for these point sources.
Stormwater Management Program (SWMP)	A comprehensive set of activities and actions, including policies, procedures, standards, ordinances, criteria, and best management practices established to reduce the discharge of pollutants from the municipal separate storm sewer system to the "maximum extent practicable" to protect water quality and to satisfy the appropriate water quality requirements of the Clean Water Act (MS4 permit).
System potential shade	The maximum effective shade possible for a stream reach. System potential shade is achieved when the riparian plant community has reached its mature, undisturbed condition where vegetation heights are at or near their expected potential, resulting in the maximum effective shade.
Total maximum daily load (TMDL)	A written quantitative plan and analysis for attaining and maintaining water quality standards and includes the elements described in OAR 340-042-0040. These elements include a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet state water quality standards, allocations of portions of that amount to the pollutant sources or sectors, and a Water Quality Management Plan to achieve water quality standards (OAR 340-042-0030[15]).
Total suspended solids (TSS)	TSS is the dry weight of suspended particles that are not dissolved in a sample of water that can be trapped by a filter and are analyzed using a filtration apparatus.
Waste load allocation (WLA)	Portions of the receiving water's loading capacity that are allocated to existing point sources of pollution, including all point source discharges regulated under the Water Pollution Control Act Section 402 (33 USC Section 1342). For purposes of assigning WLAs, point sources include all sources subject to regulation under the NPDES program, e.g., wastewater treatment facilities, industrial waste discharges, some stormwater discharges (industrial and municipal), and concentrated animal feeding operations (OAR 340-042-0040[4][g]).
Water Quality Management Plan (WQMP)	This plan is an element of a TMDL plan describing strategies to achieve allocations identified in the TMDL to attain water quality standards. The elements of a WQMP are described in OAR 340-042-0040(4)(l).

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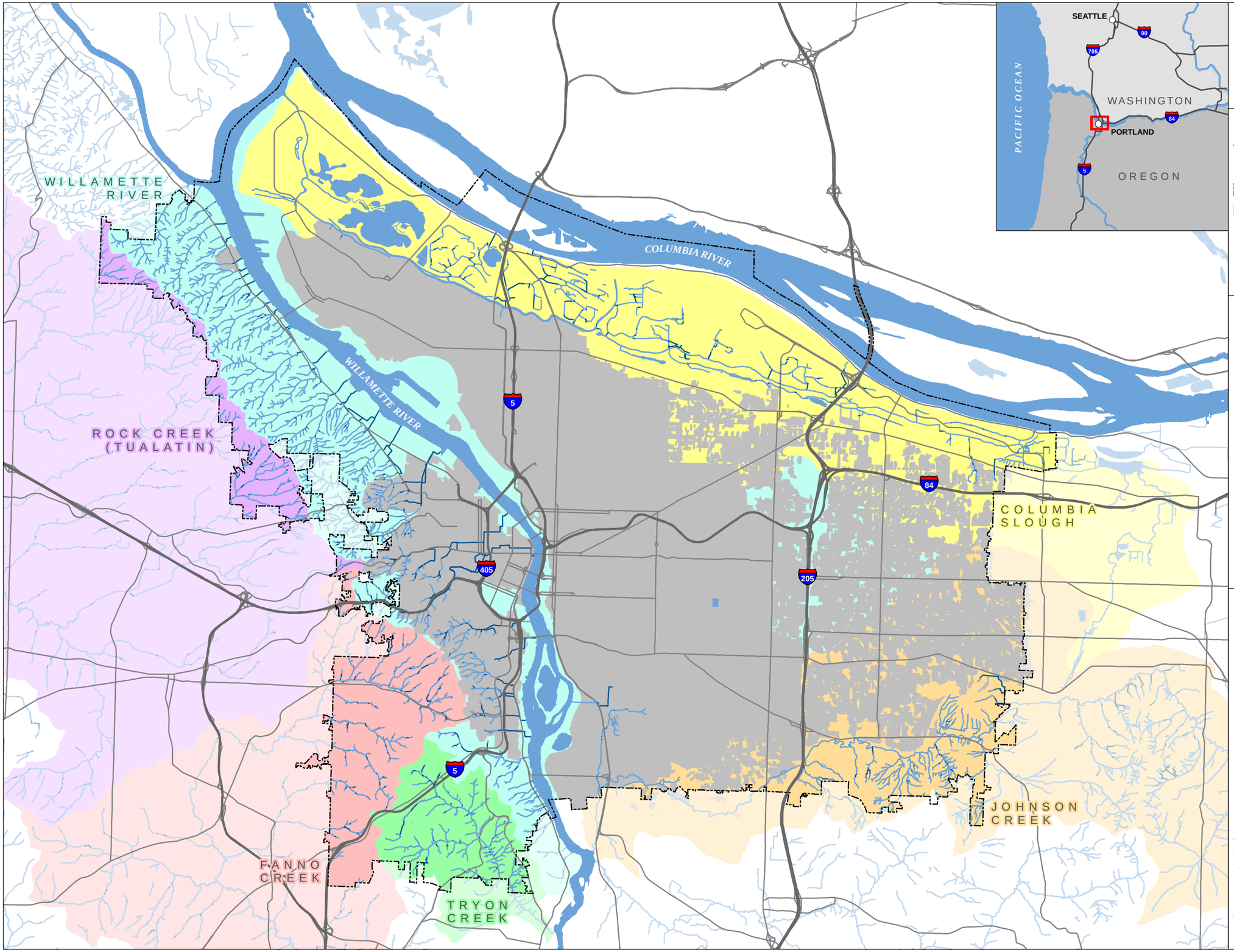
FIGURE 1

Watershed Basins Map

TMDL IMPLEMENTATION PLAN - NOVEMBER 2023



LEGEND

- Piped Waterway
- Waterway
- City of Portland Boundary
- Combined Sewer/City UIC Area

N

0 4,500 9,000 Feet

1: 108,000
1 in = 9,000 feet

PERCENT OF ENTIRE SUBWATERSHED WITHIN CITY LIMITS

Willamette River & Tributaries	0.5%
Columbia Slough	82%
Johnson Creek	38%
Fanno Creek	23%
Tryon Creek	72%
Rock Creek (Tualatin)	8%

Percent of subwatershed describes the portion of each total watershed area located within City limits, indicating the extent to which the City's management strategies in the plan may be applied to each subwatershed.

SUBWATERSHED AREA (ACRES) INSIDE CITY LIMITS

Willamette River & Tributaries	17,319	21,575
Columbia Slough	17,189	10,027
Johnson Creek	5,322	7,864
Fanno Creek	4,635	
Tryon Creek	3,045	
Rock Creek (Tualatin)	1,798	

The acreage within each topographic subwatershed is the total of colored and gray bar segments. Fanno, Tryon and Rock Creeks are not served by combined systems or UICs. Colored segments show acreage flowing to surface waters potentially subject to the City's management strategies described in the plan. Gray segments represent areas managed by either the City's combined sewer or UIC systems, where stormwater is conveyed to the wastewater treatment plant or to groundwater through sumps.

Gray shows acreage within combined sewer and UIC service areas

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Figure 2: TMDL Applicability in the City of Portland

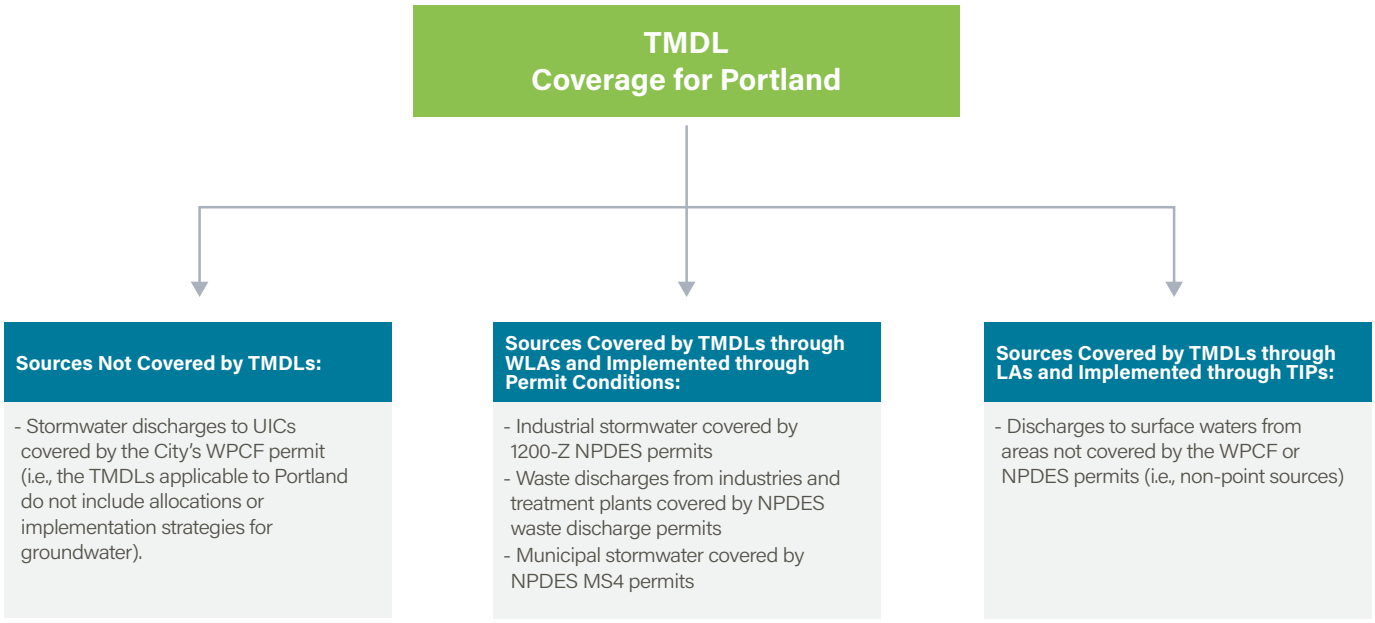

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FIGURE 3

MS4/System Coverage Map

TMDL IMPLEMENTATION PLAN - NOVEMBER 2023

LEGEND

- Piped Waterway
- Waterway
- City of Portland Boundary

System Coverage

City Combined Sewer
This City system carries both sewage and stormwater in the same pipes to the treatment plant. Many of Portland's older neighborhoods have a combined system.

City Underground Injection Control (UIC) System
UICs are drywells, perforated pipes, or drain tiles that are used to discharge fluids underground. In Portland, this is generally a drywell system that collects and filters stormwater before allowing it to soak into the ground. The water then replenishes groundwater supplies.

City Municipal Separate Storm Sewer System (MS4)
This City system carries stormwater in pipes either directly to a local creek or stream, or to green infrastructure, where it can soak into the ground close to where the rain fell.

Non-City MS4
These MS4 systems are managed by other owners than the City of Portland.

Non-Point/Private Drainage
This category includes areas of open water in addition to natural drainages, private pipes, private UICs, green streets, and open spaces.

Stormwater runoff is generated from rain and snowmelt that flows over land or impervious surfaces, such as paved streets, parking lots, and building rooftops, and does not naturally soak into the ground. As it flows, stormwater can pick up pollution along the way before it is managed by one of the Portland's three stormwater systems.

N

0 4,500 9,000
Feet

1: 108,000
1 in = 9,000 feet

Y:\0110_BES\Source_Figures\180_MS4_Monitoring_Program

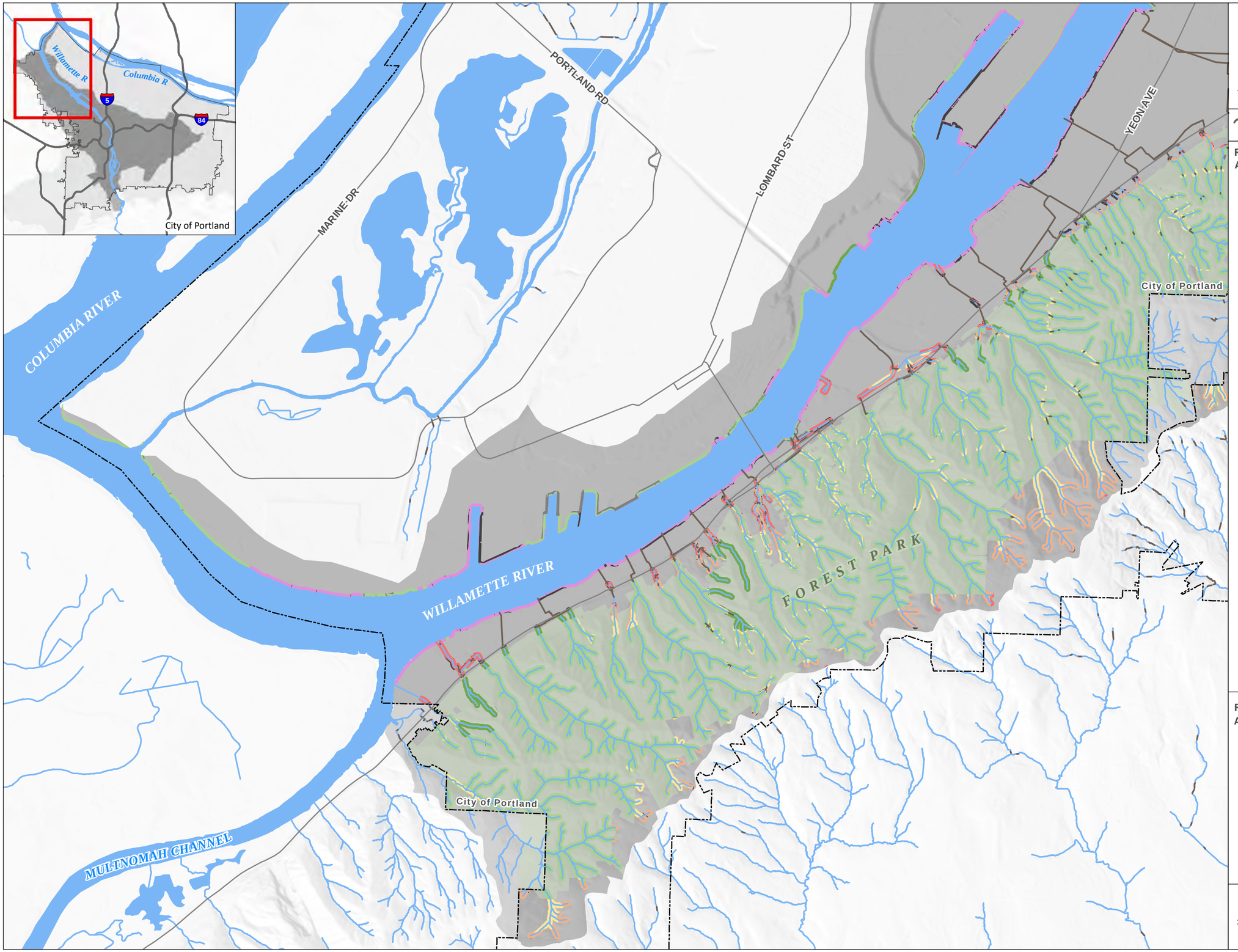


FIGURE 4A-1

Willamette Subwatershed Riparian Corridor

TMDL IMPLEMENTATION PLAN - NOVEMBER 2023

Piped Watercourse | Watercourse | Park

RIPARIAN CORRIDOR IN SUBWATERSHED BY CATEGORY

Acres	Key	%	Riparian Category	Acres	Key	%
70	MAINSTEM	13%	Impervious & Private	74		3%
				5		0.2%
				134	TRIBUTARIES	5%
22		4%	Impervious & Public			
			No E-zone & Private	299		10%
			C-zone & Private			
			P-zone & Private	277		10%
226		43%	River E-zone			
				1747		60%
108		21%	Restoration Potential & Public			
99		19%	Revegetation Management Area	362		13%
524			Total Riparian Corridor	2,899		

riparian corridor based on 100-foot buffers along each bank

RIPARIAN CORRIDOR BY SUBWATERSHED AS PERCENT OF CITY TOTAL

Willamette Tributaries	38%
Columbia Slough	20%
Johnson Creek	13%
Fanno Creek	8%
Tryon Creek	7%
Willamette Mainstem	7%
Rock Creek (Tualatin)	6%

N

0 1,600 3,200 Feet

1: 38,400
1 in = 3,200 feet

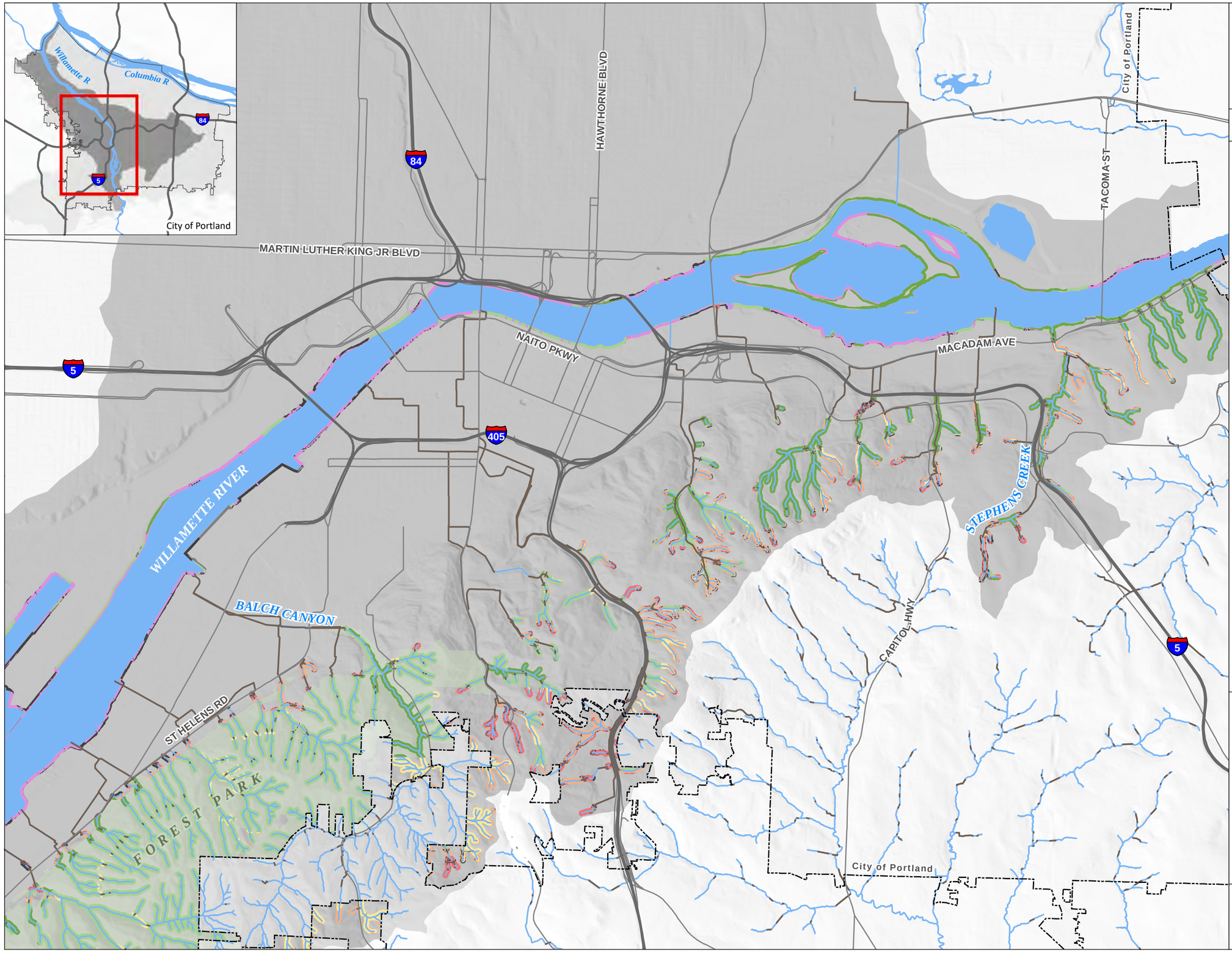


FIGURE 4A-2

Willamette Subwatershed Riparian Corridor

TMDL IMPLEMENTATION PLAN - NOVEMBER 2023

Piped Watercourse | Watercourse | Park

RIPARIAN CORRIDOR IN SUBWATERSHED BY CATEGORY

Acres	Key	%	Riparian Category	Acres	Key	%
70	MAINSTEM	13%	Impervious & Private	74	TRIBUTARIES	3%
				5		0.2%
				134		5%
22		4%	Impervious & Public	299		10%
			No E-zone & Private			
			C-zone & Private			
			P-zone & Private	277		10%
226		43%	River E-zone			
				1747		60%
108		21%	Restoration Potential & Public			
99		19%	Revegetation Management Area	362		13%
524			Total Riparian Corridor	2,899		

riparian corridor based on 100-foot buffers along each bank

RIPARIAN CORRIDOR BY SUBWATERSHED AS PERCENT OF CITY TOTAL

Willamette Tributaries	38%
Columbia Slough	20%
Johnson Creek	13%
Fanno Creek	8%
Tryon Creek	7%
Willamette Mainstem	7%
Rock Creek (Tualatin)	6%

N

0 1,600 3,200 Feet

1: 38,400
1 in = 3,200 feet

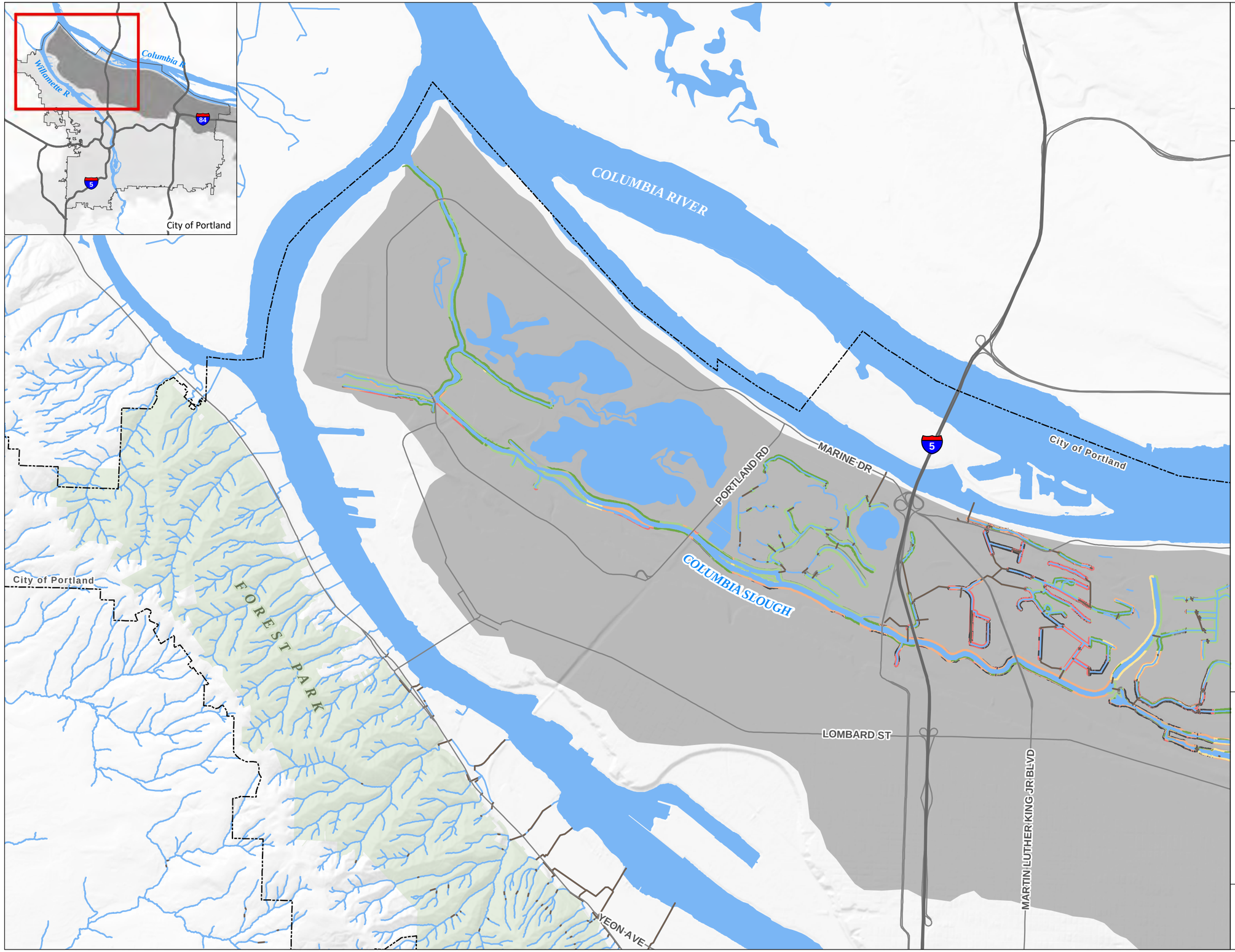


FIGURE 4B-1
Columbia Slough Subwatershed Riparian Corridor

TMDL IMPLEMENTATION PLAN - NOVEMBER 2023

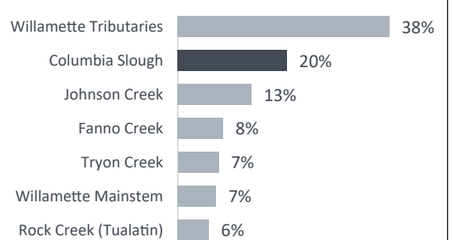
Piped Watercourse | Watercourse | Park

RIPARIAN CORRIDOR IN SUBWATERSHED BY CATEGORY

Riparian Category	Acres	Key	%
Impervious & Private	176		12%
Impervious & Public	37		3%
No E-zone & Private	134		9%
C-zone & Private	180		12%
P-zone & Private	115		8%
Restoration Potential & Public	435		29%
Revegetation Management Area	417		28%
Total Riparian Corridor	1,495		

riparian corridor based on 100-foot buffers along each bank

RIPARIAN CORRIDOR BY SUBWATERSHED AS PERCENT OF CITY TOTAL



N

0 2,000 4,000 Feet

1: 48,000
1 in = 4,000 feet

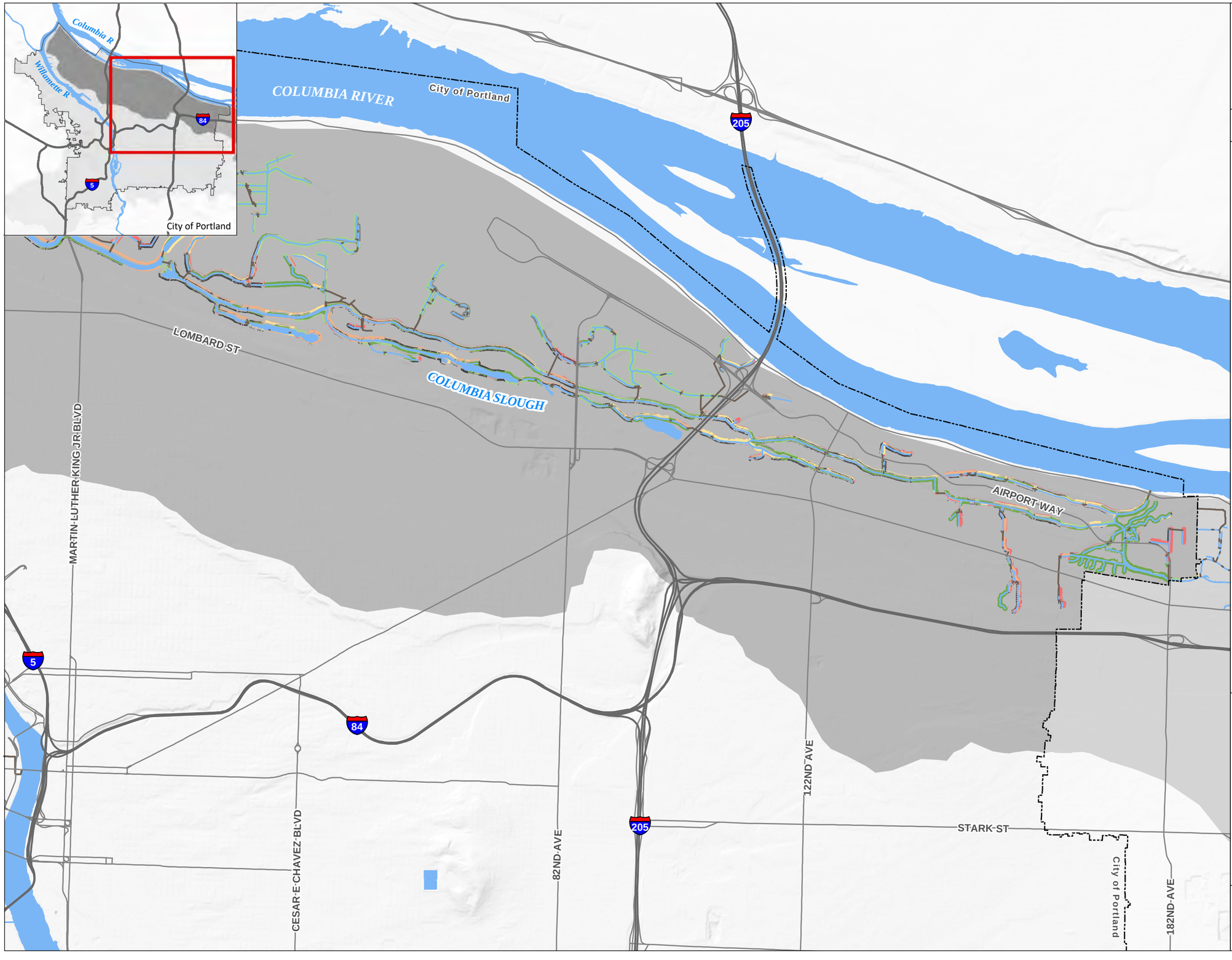


FIGURE 4B-2
Columbia Slough Subwatershed Riparian Corridor

TMDL IMPLEMENTATION PLAN - NOVEMBER 2023

Piped Watercourse | Watercourse | Park

RIPARIAN CORRIDOR IN SUBWATERSHED BY CATEGORY

Riparian Category	Acres	Key	%
Impervious & Private	176		12%
Impervious & Public	37		3%
No E-zone & Private	134		9%
C-zone & Private	180		12%
P-zone & Private	115		8%
Restoration Potential & Public	435		29%
Revegetation Management Area	417		28%
Total Riparian Corridor	1,495		

riparian corridor based on 100-foot buffers along each bank

RIPARIAN CORRIDOR BY SUBWATERSHED AS PERCENT OF CITY TOTAL

Willamette Tributaries	38%
Columbia Slough	20%
Johnson Creek	13%
Fanno Creek	8%
Tryon Creek	7%
Willamette Mainstem	7%
Rock Creek (Tualatin)	6%

N

0 2,000 4,000 Feet

1: 48,000
1 in = 4,000 feet

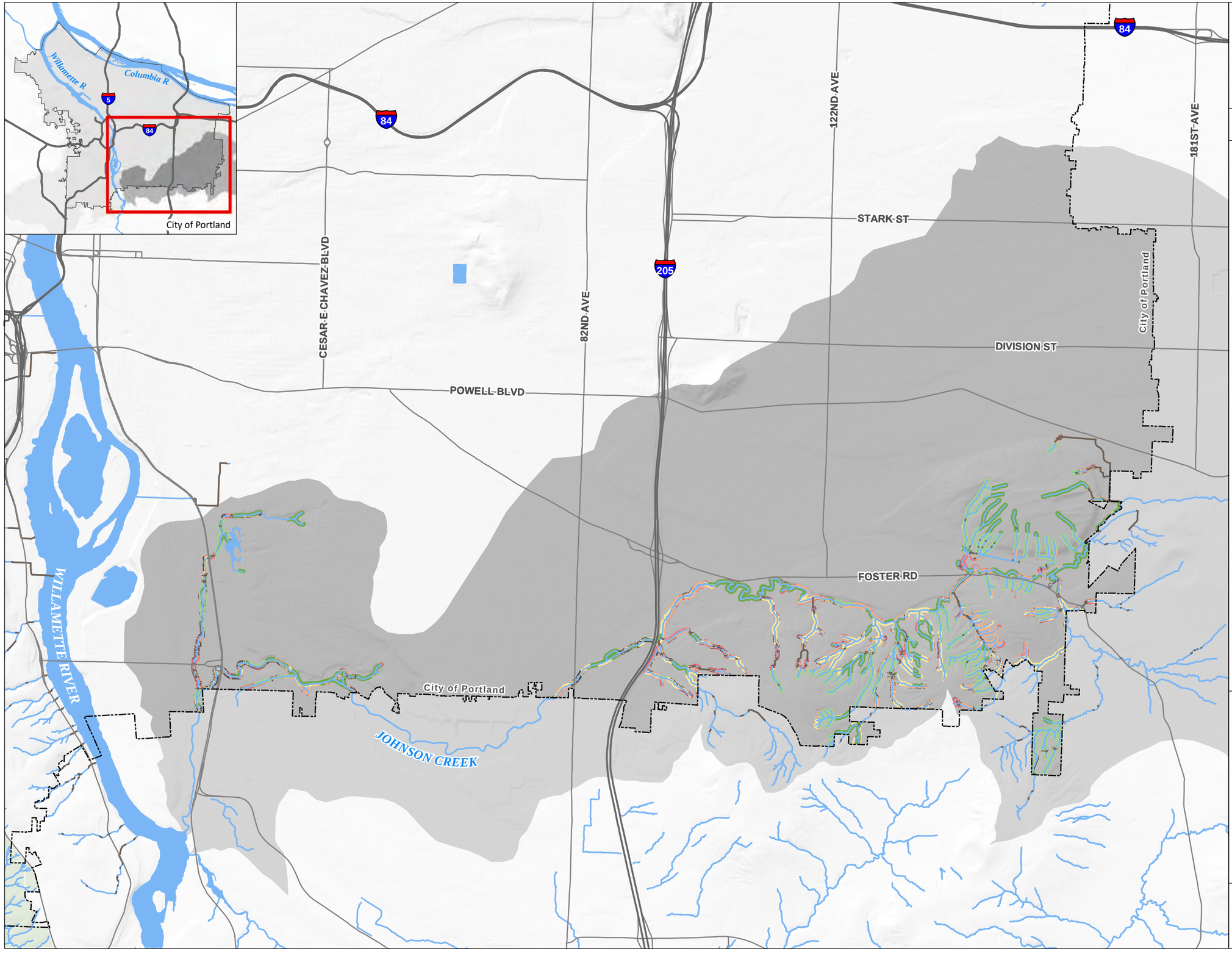


FIGURE 4C
Johnson Creek Subwatershed Riparian Corridor

TMDL IMPLEMENTATION PLAN - NOVEMBER 2023

Piped Watercourse | Watercourse | Park

RIPARIAN CORRIDOR IN SUBWATERSHED BY CATEGORY

Riparian Category	Acres	Key	%
Impervious & Private	59		6%
Impervious & Public	2		0.2%
No E-zone & Private	66		6%
C-zone & Private	136		14%
P-zone & Private	165		16%
Restoration Potential & Public	301		30%
Revegetation Management Area	280		28%
Total Riparian Corridor	1,009		

riparian corridor based on 100-foot buffers along each bank

RIPARIAN CORRIDOR BY SUBWATERSHED AS PERCENT OF CITY TOTAL

Willamette Tributaries	38%
Columbia Slough	20%
Johnson Creek	13%
Fanno Creek	8%
Tryon Creek	7%
Willamette Mainstem	7%
Rock Creek (Tualatin)	6%

N

0 2,000 4,000 Feet

1: 48,000
1 in = 4,000 feet

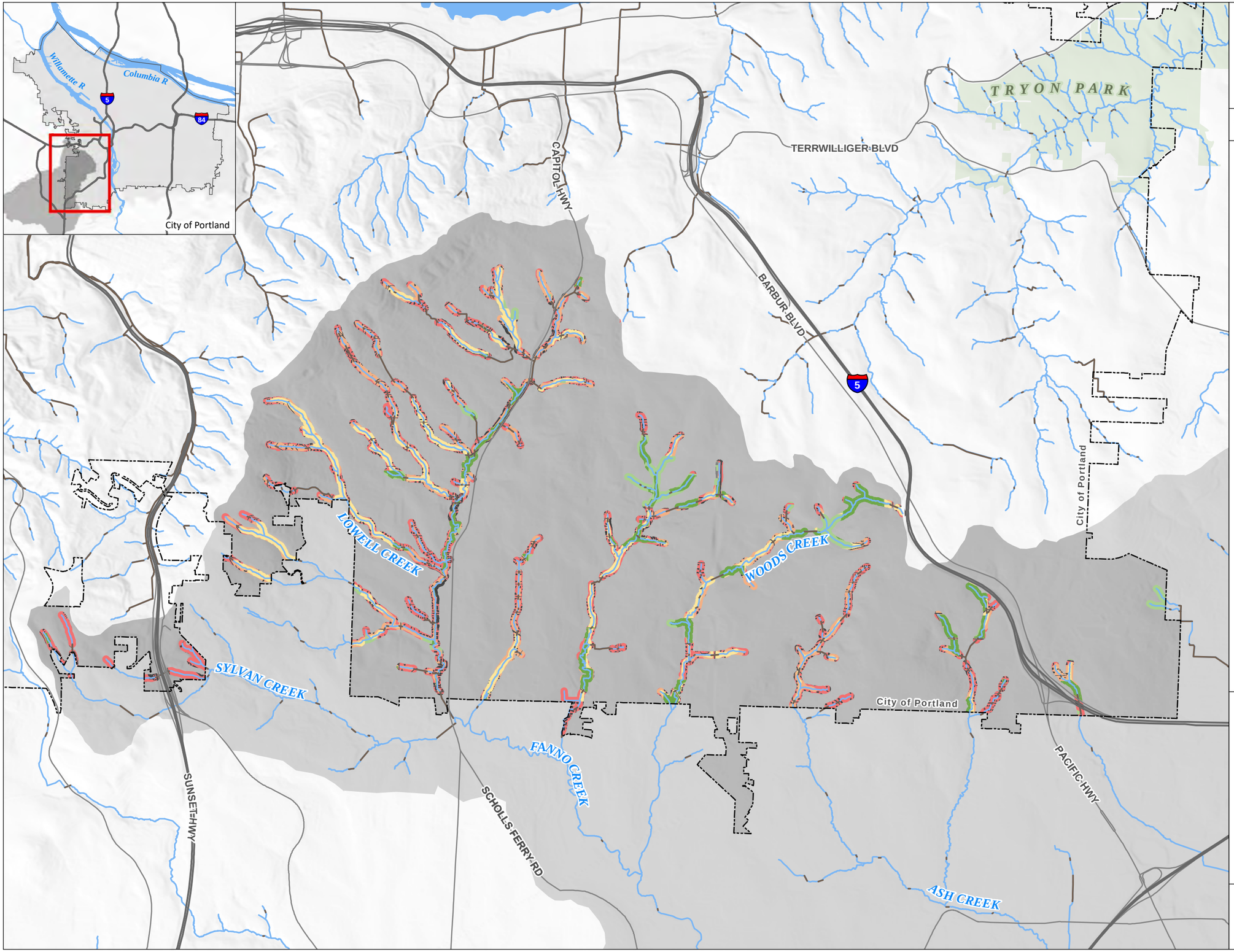


FIGURE 4D

Fanno Creek Subwatershed Riparian Corridor

TMDL IMPLEMENTATION PLAN - NOVEMBER 2023

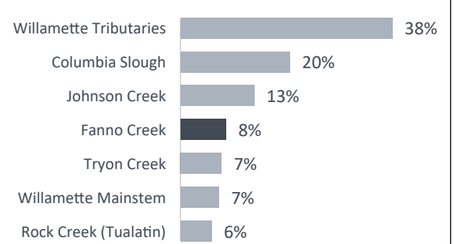
Piped Watercourse | Watercourse | Park

RIPARIAN CORRIDOR IN SUBWATERSHED BY CATEGORY

Riparian Category	Acres	Key	%
Impervious & Private	81		13%
Impervious & Public	1		0.2%
No E-zone & Private	157		25%
C-zone & Private	109		18%
P-zone & Private	133		21%
Restoration Potential & Public	39		6%
Revegetation Management Area	102		16%
Total Riparian Corridor	622		

riparian corridor based on 100-foot buffers along each bank

RIPARIAN CORRIDOR BY SUBWATERSHED AS PERCENT OF CITY TOTAL



N

0 1,250 2,500 Feet

1: 30,000
1 in = 2,500 feet

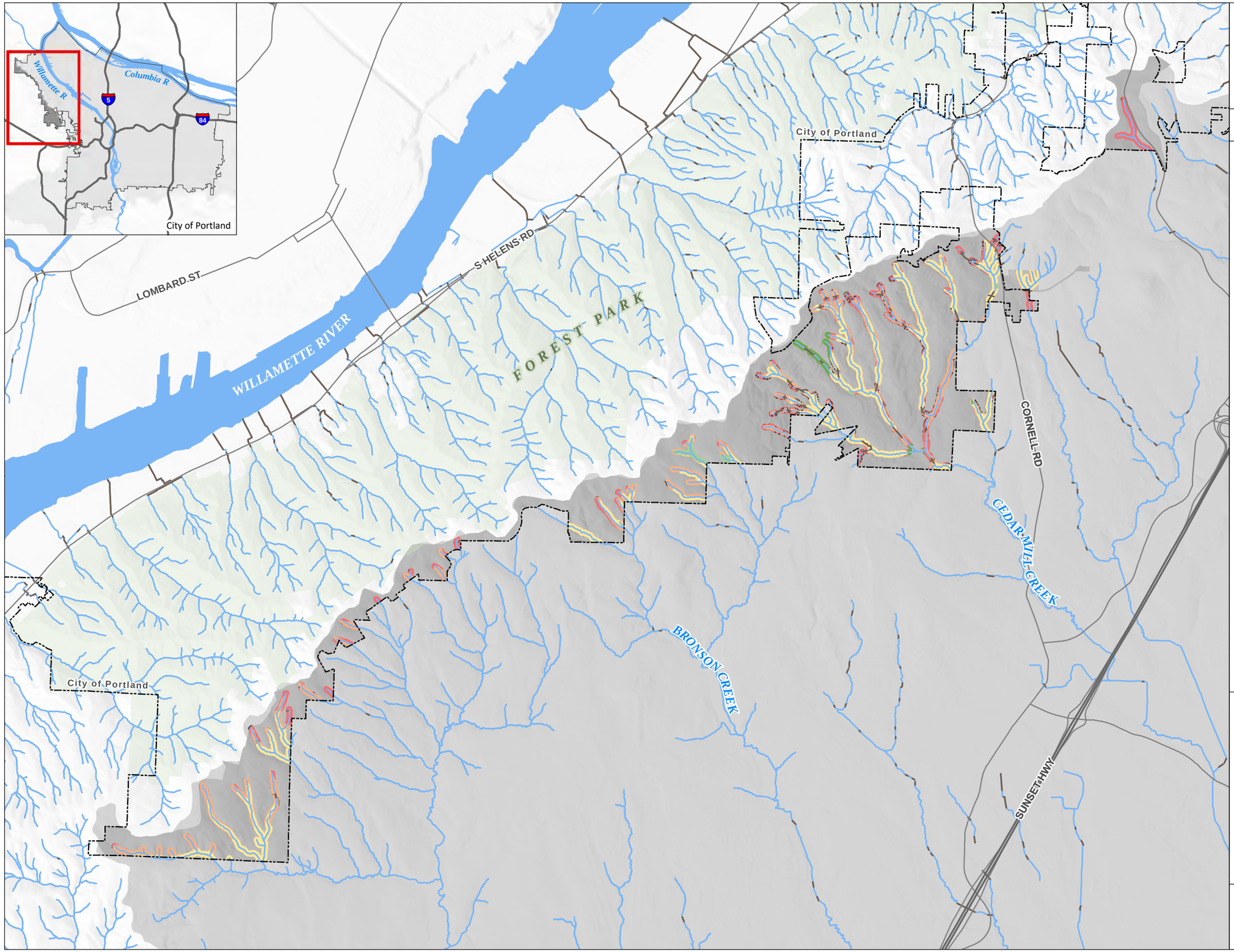


FIGURE 4E
Rock Creek Subwatershed Riparian Corridor

TMDL IMPLEMENTATION PLAN - NOVEMBER 2023

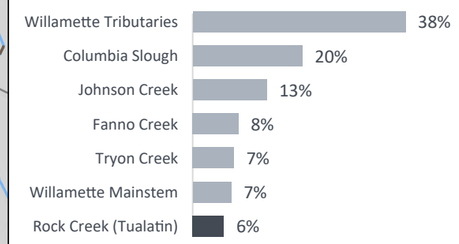
Piped Watercourse | Watercourse | Park

RIPARIAN CORRIDOR IN SUBWATERSHED BY CATEGORY

Riparian Category	Acres	Key	%
Impervious & Private	15		3%
No E-zone & Private	68		16%
C-zone & Private	115		27%
P-zone & Private	205		48%
Restoration Potential & Public	8		2%
Revegetation Management Area	13		3%
Total Riparian Corridor	425		

riparian corridor based on 100-foot buffers along each bank

RIPARIAN CORRIDOR BY SUBWATERSHED AS PERCENT OF CITY TOTAL



N

0 1,500 3,000 Feet

1: 36,000
1 in = 3,000 feet

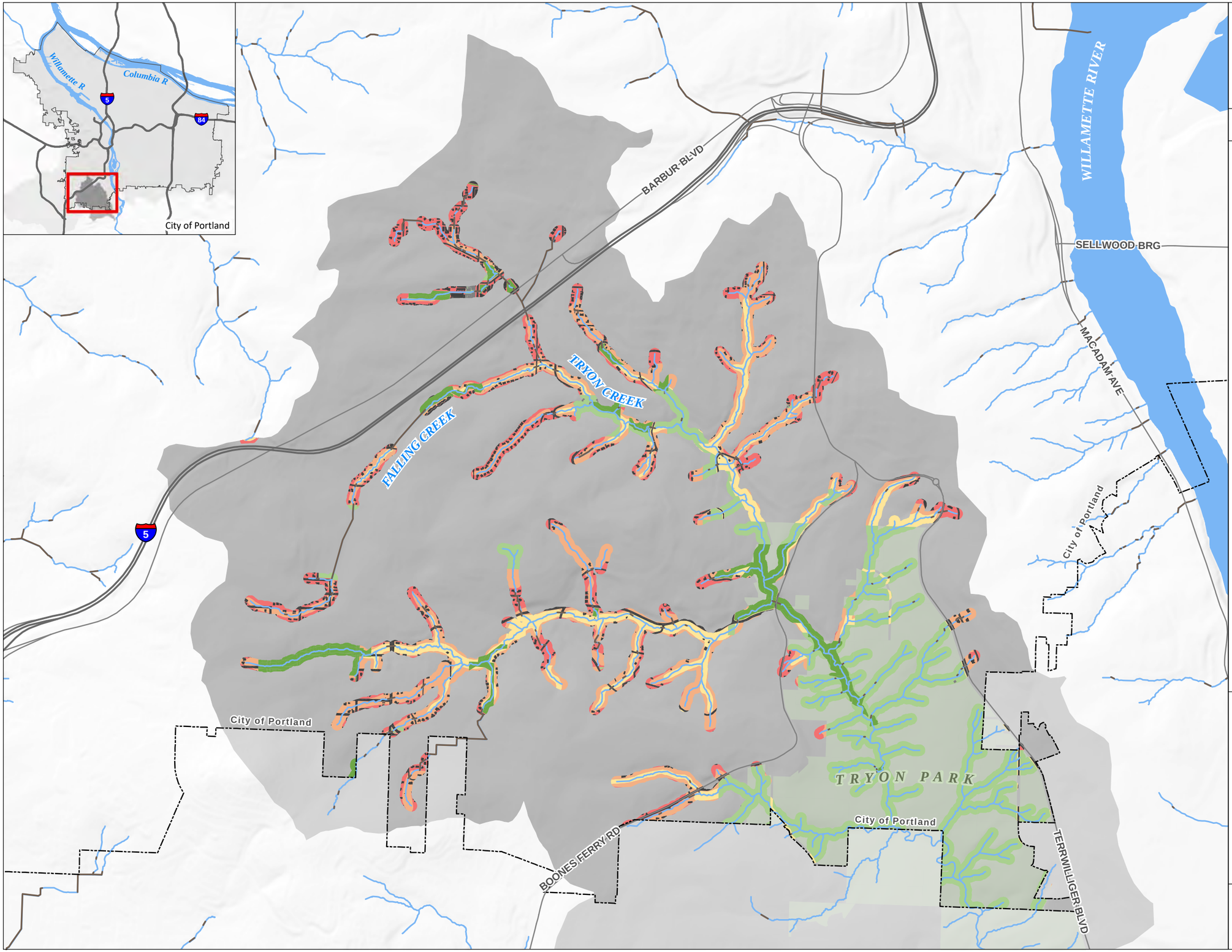


FIGURE 4F
Tryon Creek Subwatershed Riparian Corridor

TMDL IMPLEMENTATION PLAN - NOVEMBER 2023

Piped Watercourse | Watercourse | Park

RIPARIAN CORRIDOR IN SUBWATERSHED BY CATEGORY

Riparian Category	Acres	Key	%
Impervious & Private	49		9%
Impervious & Public	1		0.1%
No E-zone & Private	65		12%
C-zone & Private	121		28%
P-zone & Private	76		14%
Restoration Potential & Public	195		35%
Revegetation Management Area	53		9%
Total Riparian Corridor	561		

riparian corridor based on 100-foot buffers along each bank

RIPARIAN CORRIDOR BY SUBWATERSHED AS PERCENT OF CITY TOTAL

Willamette Tributaries	38%
Columbia Slough	20%
Johnson Creek	13%
Fanno Creek	8%
Tryon Creek	7%
Willamette Mainstem	7%
Rock Creek (Tualatin)	6%

N

0 800 1,600 Feet

1: 19,200
1 in = 1,600 feet

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Table 1. Portland TMDLs

Basin	TMDL Subbasins *Applicable to Portland*	Date	Pollutant	TMDL Season	Surrogate[d]
Columbia River[a]	Lower Columbia River	1991	Dioxin	Annual	
	N/A	2002	Total dissolved gas (TDG)	Annual	
Columbia Slough[b]	Columbia Slough	1998	DDT/DDE	Annual	
			Dieldrin	Annual	
			Dioxin	Annual	
			PCBs	Annual	
			Lead, dissolved	Annual	
			Phosphorus	Spring through fall	
			Dissolved oxygen	Annual	BOD_5
			pH	Spring through fall	Phosphorus
			Chlorophyll a	Spring through fall	Phosphorus
			Bacteria	Annual	E. coli
Willamette Basin[b]	Lower Willamette *All tributaries not otherwise specified*	2021	Mercury	Annual	TSS
		2006	Temperature	Annual	Effective shade
			Bacteria	Annual	E.coli
	Columbia Slough	2006	Temperature	Annual	Effective shade
	Johnson Creek	2006	DDT	Annual	
			Dieldrin	Annual	
			Bacteria	Annual	E. coli
			Temperature	Annual	Effective shade
	Tryon Creek	2006	Temperature	Annual	Effective shade
	Springbrook Creek	2006	Bacteria	Annual	E.coli
Tualatin Subbasin[c]	Fanno Creek	2001	Temperature	Annual	Effective shade
			Bacteria	Seasonal storm	E. coli
			Chlorophyll a	Summer	Phosphorus
			pH	Summer	Phosphorus
			Dissolved oxygen	Summer	TSS[e]
	Rock Creek	2001	Temperature	Annual	Effective shade
			Bacteria	Seasonal storm	E. coli
			Chlorophyll a	Summer	Phosphorus
			pH	Summer	Phosphorus
			Dissolved oxygen	Summer	TSS[e]

a. There is a Columbia River TMDL for dioxin, but it does not include WLAs or LAs for Portland. Urban areas are included in an allocation type referred to as "reserved." The only WLA is for pulp and paper mills. For total dissolved gas, only four dams (not under Portland's jurisdiction) are listed as sources.

b. The 2006 Willamette Basin TMDL includes the Columbia Slough subbasin for temperature and mercury only. The Columbia Slough mercury TMDL (as outlined in the 2006 Willamette Basin TMDL) was replaced by the 2021 Willamette Basin Mercury TMDL. Per the 2006 Willamette Basin TMDL, p. 5-13, "the 1998 TMDL established for the Slough remains in effect." Mercury, temperature and bacteria apply to all tributaries in the Lower Willamette Subbasin. The Columbia Slough, Johnson Creek, Tryon Creek and Springbrook Creek (all of which are in the Lower Willamette Subbasin) are listed separately because they have unique WLAs and/or they have additional TMDL parameters.

c. The Tualatin TMDL was originally released in 2001 but was amended in 2012 to reflect further refinement of wastewater treatment plant limits. The Tualatin River is covered in the Willamette River TMDL for mercury.

d. Pollutant surrogates are identified in a TMDL as alternative targets for meeting the TMDLs for certain pollutants. Additional surrogates are used by the City but were not specifically identified in the TMDL documents (e.g., TSS is used by the City as a surrogate for DDT/DDE, dieldrin, dioxin, and PCBs).

e. TSS is a surrogate for settleable volatile solids (SVS), which in turn, is a surrogate for dissolved oxygen.

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Table 2. TMDL Nonpoint Pollutant Sources

Pollutant Category	Parameter	Sources	Potential Issues
Bacteria	E. coli	• Animal wastes (droppings from wild and domestic animals) • Human wastes (incidental or leaking sewage, homeless camps, seepage from septic tanks)	E. coli are a commonly used indicator for pathogens. Water contact may cause eye and skin irritations and gastrointestinal diseases if swallowed.
Heavy metals	Dissolved lead	• Lead-based paints • Leaded gasoline • Vehicles (improper disposal of car batteries, wear/tear of body and brakes) • Metal corrosion • Manufacturing and other specific industrial sources such as scrap metal yards	Heavy metals are toxic to freshwater aquatic ecosystems. Some can bioaccumulate in fish, which poses a risk to those whose diets include regular consumption.
	Mercury	• Sediment (from resuspension and native soil erosion) • Heavy industrial operations, esp. scrap metal yards, auto recycling, etc. • Atmospheric deposition (from both local and far-field sources)	
Nutrients	Phosphorus *(as cause for low dissolved oxygen, high pH, and high chlorophyll a)*	• Landscaping activities (i.e., fertilizer) and yard debris • Eroded topsoil • Human waste (leaks from septic tanks and sanitary sewers) • Animal wastes • Agricultural activities (i.e., fertilizer) • Detergents (car washing) • Food processing	Elevated phosphorus loads can cause excess aquatic plant growth, surface algal scums, dense mats of algae, reduced oxygen levels, elevated pH levels, potentially toxic blue-green algae blooms, taste and odor problems, and reduced aesthetic quality of waterbodies.
Sediment & Solids	Total suspended Solids (TSS) *(surrogate for metals, dissolved oxygen, toxics, and settleable volatile solids)*	• Channel erosion from increased stream flows • Construction site runoff • Landscaping activities • Agricultural or hobby farm activities • Other activities where the ground surface is disturbed	Heavy metals and toxic organic compounds have low solubility in water and are typically associated with suspended solids. TSS is used as a surrogate for volatile suspended solids, which indicates a sediment oxygen demand resulting in reduced dissolved oxygen.
Toxic organic compounds	• DDT/DDE • Dieldrin • Dioxin • PCBs	• Spills and illegal dumping • Illicit connections • Leaks from drums and storage tanks • Stockpiling and storage of contaminated materials (e.g., old transformers) • Pest control • Aerial deposition • Manufacturing byproducts (PCBs) • Contaminated soil • Agricultural activities (DDT and dieldrin/ aldrin on crops)	These TMDL parameters are toxic to aquatic life at very low concentrations and can bioaccumulate to high concentrations.

Table 2. TMDL Nonpoint Pollutant Sources			
Pollutant Category	**Parameter**	**Sources**	**Potential Issues**
Biochemical Oxygen Demand (BOD)	Dissolved oxygen	• De-icers • Plant debris • Animal waste • Trash • Fertilizers	High BOD indicates greater oxygen depletion which can negatively affect aquatic life.
Temperature	Temperature	• Reduced groundwater recharge causing low summer flows • Reduced riparian shading (e.g., excessive inputs of solar radiation) • Point source discharges with elevated temperatures • Reservoir and dam operations	Elevated temperatures can directly harm aquatic organisms and reduce dissolved oxygen concentrations.

Table 3. Goals and Targets for Temperature TMDL Strategies				
Goal ID	**Category**	**Target/Description**	**Timeline**	**Performance Metrics**
TIP-01	Effective Shade Assessment	Conduct a geospatial assessment of riparian conditions within Portland and progress toward meeting the TMDL nonpoint source load allocations	By end of TIP cycle	Completed assessment
TIP-02	Floodplain, Riparian, and Wetland Protection	Complete the Columbia Corridor and Industrial Lands Environmental Overlay Zone Project	Anticipate public hearings in 2024 and adoption by the end of the TIP cycle	Updated Overlay Zone Map
TIP-03	Floodplain, Riparian, and Wetland Protection	Complete the Floodplain Resiliency Plan	Anticipate public hearings in 2023 and adoption in 2024	Adopted Plan and updated City Code
TIP-04	Onsite Stormwater Retention and LID	Revise and update the Stormwater Management Manual (SWMM)	Within the next MS4 permit term	Updated SWMM
TIP-05	Invasive Species Management and Treatment	Perform management, assessment, and treatment of invasive species on 5,000 acres	By end of TIP cycle	Acres managed, assessed, and treated
TIP-06	Invasive Species Management and Treatment	Survey the Lower Columbia Slough for invasive aquatic macrophytes and treat where identified. Extent is 9.4 miles on center or 18.8 miles total along left and right banks.	80% or more of extent by end of TIP cycle	Linear miles surveyed
TIP-07	Riparian Revegetation	Plant 100,000 trees and shrubs in natural and riparian areas	By end of TIP cycle	Number of Plantings
TIP-08	Land Acquisition	Evaluate the potential for land acquisition for strategic restoration and protection of watershed hydrology*	Throughout the TIP cycle	Acres acquired
TIP-09	Upland Tree Planting	Plant 7,500 upland trees during the plan term through partnerships with nonprofits, community members, businesses, and schools	By end of TIP cycle	Trees planted
TIP-10	Coldwater Refugia	Evaluate and update the inventory and mapping of coldwater refugia in the Lower Willamette River in Portland	By end of TIP cycle	Provide status updates
TIP-11	Hydrologic Connectivity (Watershed Restoration)	Advance five restoration projects through the project development cycle. Restoration projects may address canopy closure, enhancing refugia, removing heat source due to water impoundment, groundwater recharge, and/or protecting springs/coldwater sources**	By end of TIP cycle	Projects planned, designed, and/or constructed (#)

*Feasibility of land acquisition depends on willing sellers and real estate markets for land acquisition, landowner permissions, and availability of funding.

**Feasibility of project advancement depends on willing sellers and real estate markets for land acquisition, landowner permissions, availability of funding, and the permitting process. The project development process is typically composed of five phases (conceptual, 30%, 60%, and 90% design phases, followed by construction).

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APPENDIX A - Reporting Matrices

The tables provided in Appendix A – Reporting Matrices show the annual reporting format developed for use during the term of the TIP. Beginning with reporting for FY 2018-19, annual TMDL reports are integrated with the City's MS4 permit annual reports as an appendix. Combining the two types of reports allows for the many stormwater-related report elements to be presented in the MS4 report with the TMDL report referencing that material by the location in the MS4 report. The related reporting matrices are:

- Goals and Targets for Temperature TMDL Strategies
- Projects for Temperature Goal TIP-11 Hydrologic Connectivity (Watershed Restoration)

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Goals and Targets for Temperature TMDL Strategies											
Goal ID	**Category**	**Target/Description**	**Timeline (Goal)**	**Performance Metrics**	**Interim Milestones and Timelines**	**Reporting Activities**					
TIP-01	**Effective Shade Assessment**	Conduct a geospatial assessment of riparian conditions within Portland and progress toward meeting the TMDL nonpoint source load allocations.	Complete by end of TIP cycle	Completed assessment	1. FY 2023–24: Review previous effective shade assessment. 2. FY 2024–25: LiDAR acquisition. 3. FY 2025–26: Process LiDAR and GIS datasets. 4. FY 2026–27: Complete modeling and compile effective shade results. 5. FY 2027-28: Report effective shade results.						
TIP-02	**Floodplain, Riparian, and Wetland Protection**	Complete the Columbia Corridor and Industrial Lands Environmental Overlay Zone Project	Anticipate public hearings in 2024 and adoption by the end of the TIP cycle	Updated Overlay Zone Map	1. FY 2023–24: Publish preliminary draft environmental overlay zones. 2. FY 2024–25: Public hearings on the draft environmental overlay zones. 3. FY 2027–28: Complete the Columbia Corridor and Industrial Lands Environmental Overlay Zone Project.						
TIP-03	**Floodplain, Riparian, and Wetland Protection**	Complete the Floodplain Resiliency Plan	Anticipate public hearings in 2023 and adoption in 2024	Adopted Plan and updated City Code	1. FY 2023–24: Release draft plan and accept public testimony. 2. FY 2024–25: Adopt Plan and update City Code.						
TIP-04	**Onsite Stormwater Retention and LID**	Revise and update the Stormwater Management Manual (SWMM).	Within the next MS4 permit term	Updated SWMM	N/A – Schedule is outlined in accordance with provisions of the SWMP document and renewed Phase I NPDES MS4 permit.						
TIP-05	**Invasive Species Management and Treatment**	Perform management, assessment, and treatment of invasive species on 5,000 acres.	By the end of the TIP cycle	Acres managed, assessed, and treated	Perform management, assessment, and treatment of invasive species on 1,000 acres each year on average.	Acres	2023–24	2024–25	2025–26	2026–27	2027–28
						Annual	-	-	-	-	-
						Cumulative	-	-	-	-	-
						% of Goal	-	-	-	-	-
TIP-06	**Invasive Species Management and Treatment**	Survey the Lower Columbia Slough for invasive aquatic macrophytes and treat where identified. Total extent is 9.4 miles on center or 18.8 miles along left and right banks.	80% or more of total extent by end of TIP cycle	Linear miles surveyed	Survey the Lower Columbia Slough for invasive aquatic macrophytes and treat where identified. Work to cover 80% or more of the total extent: at least 7.5 miles on center or 15 miles at banks.	Miles	2023–24	2024–25	2025–26	2026–27	2027–28
						On Center	-	-	-	-	-
						At Banks	-	-	-	-	-
						% of Goal	-	-	-	-	-
TIP-07	**Riparian Revegetation**	Plant 100,000 native trees and shrubs in identified natural and riparian areas.	By end of TIP cycle	Plantings (#)	Plant 20,000 native trees and shrubs in identified natural and riparian areas each year on average.	Plantings	2023–24	2024–25	2025–26	2026–27	2027–28
						Annual	-	-	-	-	-
						Cumulative	-	-	-	-	-
						% of Goal	-	-	-	-	-
TIP-08	**Land Aquisition**	Evaluate the potential for land acquisition for strategic restoration and protection of watershed hydrology*	By end of TIP cycle	Acres acquired (#)	Due to the uncertainty associated with feasibility, interim milestones and timelines are not feasible. The City will report on all land acquisition activities annually.	Acres	2023–24	2024–25	2025–26	2026–27	2027–28
						Annual	-	-	-	-	-
						Cumulative	-	-	-	-	-
						% of Goal	-	-	-	-	-
TIP-09	**Upland Tree Planting**	Plant 7,500 upland trees during the plan term through partnerships with nonprofits, community members, businesses, and schools.	By end of TIP cycle	Trees planted (#)	Plant an average of 1,500 upland trees each year during the plan term through partnerships with nonprofits, community members, businesses, and schools.	Trees	2023–24	2024–25	2025–26	2026–27	2027–28
						Annual	-	-	-	-	-
						Cumulative	-	-	-	-	-
						% of Goal	-	-	-	-	-

Goals and Targets for Temperature TMDL Strategies						
Goal ID	**Category**	**Target/Description**	**Timeline (Goal)**	**Performance Metrics**	**Interim Milestones and Timelines**	**Reporting Activities**
TIP-10	**Cold water Refugia**	Evaluate and update the inventory and mapping of coldwater refugia in the Lower Willamette River in Portland	By end of TIP cycle	Provide status updates	Annually evaluate new temperature data collected during the year and identify new coldwater refugia where indicated by the data.	
TIP-11	**Hydrologic Connectivity (Watershed Restoration)**	Advance five restoration projects through the project development cycle. Restoration projects may address canopy closure, enhancing refugia, removing heat source due to water impoundment, groundwater recharge, and/or protecting springs/coldwater sources**	By end of TIP cycle	Projects planned, designed, and/or constructed (#)	Advance one project per year to the next project phase.	See reporting matrix below for a list of projects, including status and description for each.

*Feasibility of land acquisition depends on willing sellers and real estate markets for land acquisition, landowner permissions, and availability of funding.
**Feasibility of project advancement depends on willing sellers and real estate markets for land acquisition, landowner permissions, availability of funding, and the permitting process. The project development process is typically composed of five phases (conceptual, 30%, 60%, and 90% design phases, followed by construction).

Projects for Temperature Goal TIP-11 Hydrologic Connectivity (Watershed Restoration)		
Project Name	**Status***	**Description & Benefits**
<Project Name> <Waterbody>	<Status Description> 	<Project Description & Details> <List of project benefit categories>

*Status Notes: Design is typically comprised of four phases: Conceptual, 30%, 60%, and 90%. Gray markers indicate status in the previous report year. Black arrows indicate status in the current report year.

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