ADDENDUM TO THE

2015 WALLA WALLA COMPREHENSIVE STORMWATER MANAGEMENT PLAN

Prepared for
City of Walla Walla

Prepared by
Herrera Environmental Consultants, Inc.

HERRERA

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Prepared for
City of Walla Walla
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OVERVIEW

This addendum was prepared to update information included in the City of Walla Walla's 2015 Comprehensive Stormwater Management Plan (2015 Plan) related to growth/expansion of the City's green infrastructure and street tree maintenance program and the new requirements in the 2019-2024 National Pollutant Discharge Elimination System (NPDES) Phase II municipal stormwater permit (Phase II Permit).

Updates were identified for the following sections of the 2015 Plan and are summarized in this addendum:

- Section 1 – Introduction
    - Section 1.3 – Overview of the City's Stormwater Program
- Section 7 – Regulatory Assessment and Gap Analysis
    - Section 7.2.2 – City Stormwater System and Program Services
    - Section 7.2.3 – City Stormwater Program Organization
    - Section 7.3 – Overview of Stormwater Regulatory Requirements
- Section 8 – Funding Alternatives and Financial Plan
    - Section 8.9 (new) – Funding for Street Tree Maintenance

Supporting information is also included in the appendices to this addendum:

- Appendix A – Technical memorandum providing background information and recommendations for the City's green infrastructure and street tree maintenance program
- Appendix B – Green infrastructure and urban forestry presentation to the Joint Water/Wastewater and Parks, Recreation and Urban Forestry Advisory Committee/Board presented at the June 19, 2019 meeting

UPDATES TO THE 2015 PLAN

SECTION 1 – INTRODUCTION

The introduction provides an overview of the 2015 Plan authority, background & purpose, a summary of the City's stormwater infrastructure assets, and the document organization. Only Section 1.3 requires modification as detailed here.

Section 1.3 – Overview of the City's Stormwater Program

The stormwater infrastructure assets listed in the 2015 Plan did not include street trees or summarize green infrastructure (e.g., biofiltration swales and infiltration basins) separately from detention/retention facilities (e.g., ponds). The City does not currently own or operate any detention/retention ponds, so these were removed from the list of assets.

Based on 2019 data, this addendum clarifies which facilities are considered to be green infrastructure facilities and adds street trees to the list of assets identified in the 2015 Plan:

- 71 green infrastructure facilities
  - 50 biofiltration swales
  - 16 infiltration basins
  - 5 surface infiltration trenches
- 7,052 street trees

SECTION 7 – REGULATORY ASSESSMENT AND GAP ANALYSIS

The Regulatory Assessment and Gap Analysis section of the 2015 Plan reviews the core purpose and functions of the City's stormwater management program, analyzing the City's program with respect to federal and state regulatory requirements, and presents a plan to assist the City with complying with current and future stormwater regulations. Sections 7.2.2, 7.2.3, and 7.3 require modification as detailed here.

Section 7.2.2 – City Stormwater System and Program Services

Similar to Section 1.3 of the 2015 Plan, the stormwater infrastructure assets listed in Section 7.2.2 of the 2015 Plan did not include street trees or summarize green infrastructure

(e.g., biofiltration swales and infiltration basins) separately from detention/retention facilities (e.g., ponds). The City does not currently own or operate any detention/retention ponds, so these were removed from the list of assets.

Based on 2019 data, this addendum clarifies which facilities are considered to be green infrastructure facilities and adds street trees to the list of assets identified in the 2015 Plan:

- 71 green infrastructure facilities
    - 50 biofiltration swales
    - 16 infiltration basins
    - 5 surface infiltration trenches
- 7,052 street trees

Section 7.2.3 – City Stormwater Program Organization

The text provided in this section is intended as an update to Section 7.2.3 and replaces Table 7.1 in the 2015 Plan.

One of the key recommendations for the City's ongoing green infrastructure and street tree maintenance program is to have Parks Department staff conduct the maintenance of green infrastructure and street trees. This recommendation requires an update to Section 7.2.3, specifically in Table 7.1. In addition to the Stormwater Program Coordinator (SPC) and the Streets/Stormwater/Wastewater Collections Supervisor (SW Supervisor), the Parks Supervisor has been added to Table 7.1 as a responsible party to oversee municipal operations and maintenance activities conducted by Parks crews related to green infrastructure and street tree maintenance.

Table 7.1. Organization of Key Stormwater Program Responsibilities.			
Driver	**Program Component**		**Responsible Party**
Regulatory Requirements	Phase II Permit	Public Education & Outreach	SPC
		Public Involvement & Participation	SPC
		Illicit Discharge Detection & Elimination	SPC
		Construction Program	Engineering (Private) Engineering & Operations (Public)
		Post-Construction Program	Engineering (Plan Review, Site Inspection)
		Municipal Operations & Maintenance	SPC & SW Supervisor Park Maintenance Supervisor
		Compliance with TMDLs	SPC
		Monitoring & Assessment	SPC
		Record Keeping & Annual Reporting	SPC & SW Supervisor
		Program Implementation – SWMP Plan	SPC
	UIC Program		SPC
Core Utility Functions	Stormwater Program Equipment		SW Supervisor
	Stormwater Capital Improvement Program		Engineering
	Critical Stormwater System O&M Functions		SPC & SW Supervisor
	Utility Admin, Financing, & Support Services		PW Admin & Finance

SPC = Stormwater Program Coordinator

SW Supervisor = Streets/Stormwater/Wastewater Collections Supervisor

PW Admin = Public Works Administration

Section 7.3 – Overview of Stormwater Regulatory Requirements

Since the 2015 Plan was prepared and adopted, a new municipal stormwater permit has been released and became effective on August 1, 2019. Section 7.3.1 requires modification as detailed here. The updated Phase II Permit requirements are summarized in Section 7.3.1(B), a new section not included in the 2015 Plan. Recommendations for the expansion and reassignment of operations and maintenance activities are summarized in Section 7.4.1(B) which is intended to supplement, but not replace the text included in Section 7.4.1(B) of the 2015 Plan.

Section 7.3.1 – Eastern Washington Phase II Municipal Stormwater Permit

7.3.1(B) Updates to Stormwater Management Program Components

The Phase II Permit includes six main components. The implementation and enforcement of the six components is collectively referred to as a municipality's Stormwater Management Program (SWMP). The six components are listed below with key changes that apply to the newly issued 2019-2024 Phase II Permit.

1. **Public Education and Outreach (PE&O)**

    a. Eastern Washington permittees are now required to measure the understanding and adoption of the targeted behaviors for at least one audience in at least one subject area.

    b. Infiltration and underground injection control (UIC) criteria were added as a potential subject area for engineers, construction contractors, developers, development review staff, and land use planners.

2. **Public Involvement and Participation (PI&P)**

    No substantial revisions were made to this Phase II Permit section.

3. **Illicit Discharge Detection and Elimination (IDDE)**

    a. Electronic mapping of a specified list of storm drainage system components is now required.

    b. Eastern Washington permittees will be required to map known discharge points (does not include UICs, although mapping UICs is recommended by Ecology), permanent stormwater facilities owned or operated by the permittee, and connections to the MS4 (known and new connections authorized/approved by permittee, and connections to other municipalities or public entities).

    c. Permittees will also be required to submit additional data related to illicit discharges, including spills and illicit connections that were found by, reporting to, or investigated by the permittee

4. **Construction Site Stormwater Runoff Control (Construction Program)**

    a. Enhanced requirements for construction activities include:

        i. Inspection prior to clearing and grading for construction if a high potential for sediment transport is determined

        ii. Inspection during construction to ensure proper installation and maintenance of required erosion and sediment controls.

5. **Post-Construction Stormwater Management for New Development and Redevelopment (Post-Construction Program)**

    a. Enhanced requirements for post-construction activities include inspection of structural BMPs upon final installation or upon completion of the project.

6. **Municipal Operations and Maintenance (O&M Program)**

    a. Updates to the municipal O&M requirements include:

        i. Adding street cleaning to the O&M Plan

        ii. Adding detailed requirements to be included in a municipal Stormwater Pollution Prevention Plan (SWPPP)

In addition to these six minimum control measures, the Phase II Permit also requires compliance with Total Maximum Daily Loads (TMDLs), monitoring and program assessment, and record keeping and annual reporting.

- **Compliance with stormwater provisions of approved TMDLs**

    - Section S7 and Appendix 2 of the NPDES Permit address compliance with TMDL requirements. There were no specific requirements for the City of Walla Walla in the 2014–2019 Phase II Permit; however, the City does have specific requirements included in the 2019–2024 Phase II Permit for the Walla Walla River Basin Fecal Coliform Bacteria TMDL.

    - Actions required for the City of Walla Walla under the TMDL Implementation Plan include:

        (1) Inventory and inspection of the stormwater system to identify potential sources of fecal coliform,

        (2) Implement a pet waste education program,

        (3) Incorporate considerations into SEPA review process,

        (4) Beginning August 2020, select at least 2 outfall locations for sampling bacteria and turbidity,

        (5) Submit findings for IDDE investigation drainage areas,

        (6) Identify actions and implementation for any monitored outfall that has not progressed toward target reductions.

- **Monitoring and program assessment**

    - Designated Urban Areas (including the City of Walla Walla) are expected to collaborate to prioritize, plan, and begin implementation of a new stormwater management program effectiveness study by the end of the permit cycle.

- **Record keeping and annual reporting**

    - No substantial revisions were made to this Phase II Permit section.

7.4.1(F) Municipal Operations and Maintenance

Status of Existing Activities

In addition to the existing activities summarized under Municipal Operations and Maintenance in the 2015 Plan, the City's Parks and Recreation Department is responsible for maintaining street trees and trees planted in City parks. The City has had a long-standing emphasis on the importance of trees (e.g., Urban Forestry Management Plan adopted by City Council in 2003, 25 years as a Tree City USA recipient, etc.); however, it has struggled to fund maintenance. The lack of resources to maintain the current inventory coupled with an aging inventory puts the public at risk (e.g., failures, trimming to provide sight triangles, visibility of street signs, etc.). In addition, a court decision in recent years related to vegetation maintenance has increased liability to agencies. So, while trees provide numerous benefits to a community and the environment, the funds to maintain them have been in short supply.

Trends towards using green infrastructure for stormwater management have highlighted a potential partnership approach to maintaining both street trees and green infrastructure. In 2018, the City advertised a request for proposals (RFP) for a private contractor to provide the required maintenance of City-owned green infrastructure (e.g., bioinfiltration swales and infiltration basins). After receiving and analyzing bids, the Parks and Recreation Department determined it could better leverage those funds to not only maintain green infrastructure, but also assist with other right-of-way vegetation maintenance, such as the maintenance of street trees. Thus, in 2018 the City began piloting a green infrastructure maintenance program funded by the City's Stormwater Utility but performed by the Parks and Recreation Department. The Parks and Recreation Department assigned a dedicated crew member for stormwater-specific facility and right-of-way maintenance (with flexibility to utilize existing maintenance staff for large projects).

Maintenance activities for street trees and green infrastructure include:

- Replenishing mulch
- Protecting established trees and removing volunteer trees
- Trimming trees and shrubs to alleviate motor vehicle sight distance restrictions
- Removing downed tree limbs/branches
- Removing green waste, sediment build-up, and debris
- Managing weeds and undesirable vegetation
- Maintenance/winterization of irrigation systems.

Recommended Changes to Stormwater Management Program

In addition to the recommended changes to the Stormwater Management Program summarized under Municipal Operations and Maintenance in the 2015 Plan, the City should continue the pilot green infrastructure maintenance program with maintenance performed by the Parks and Recreation Department. A dedicated stormwater maintenance crew in the Parks and Recreation Department can meet or exceed the maintenance standards set forth in the 2018 RFP and complete additional tasks for greater value to the City.

SECTION 8 – FUNDING ALTERNATIVES AND FINANCIAL PLAN

Green infrastructure maintenance is currently funded by the City's Stormwater Utility. This addendum adds a new section (Section 8.9) to Section 8 of the 2015 Plan to elaborate on the funding needs for street tree maintenance.

8.9 – Funding for Street Tree Maintenance

To expand future maintenance activities to include street tree maintenance in addition to green infrastructure maintenance, the Parks and Recreation Department would need additional funding from the Stormwater Utility. The resources currently available for these activities are insufficient for staff to adequately address maintenance of green infrastructure and street trees in addition to park maintenance.

The requested additional funding identified in Table 8.7 will support staffing and expenses for the dedicated stormwater crew (or other Parks maintenance staff) to perform tree maintenance activities in addition to green infrastructure maintenance activities. The estimated budget outlined in Table 8.7 allots 60 percent of the Urban Forestry Program funding needs to street tree maintenance. (Street trees represent approximately 60 percent of the trees maintained by the City; the remaining 40 percent are located in City Parks). The total budget transfer from the Stormwater Utility to support green infrastructure and street tree maintenance was calculated to be $236,436 in 2019 and $241,017 in 2020.

Based on an estimated 18,000 equivalent residential units (ERUs) in the City, the 2020 projected costs equate to approximately 41 cents per month for green infrastructure maintenance per ERU and approximately 71 cents per month for street tree maintenance per ERU; for a total cost of approximately $1.11 per month per ERU.

Table 8.7. Green Infrastructure and Street Tree Maintenance Budget Recommendations.

Year	Green Infrastructure Maintenance	Street Tree Maintenance	Recommended Budget Transfer from Stormwater Utility to Support Green Infrastructure and Street Tree Maintenance
2019	$83,034	$153,402	$236,436
2020	$87,121	$153,896	$241,017

APPENDIX A

City of Walla Walla Green Infrastructure and Street Tree Maintenance Program Summary and Recommendations

HERRERA

TECHNICAL MEMORANDUM

Date: June 12, 2019

To: Ki Bealey, City of Walla Walla Public Works Director

Andy Coleman, City of Walla Walla Parks and Recreation Director

From: Rebecca Dugopolski, PE, Herrera Environmental Consultants, Inc.

Subject: City of Walla Walla Green Infrastructure and Street Tree Maintenance Program Summary and Recommendations

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INTRODUCTION

The City of Walla Walla (City) is proud to be a Tree City USA community (recently reaching the 25th consecutive year milestone in 2019) and plans to maintain and grow its Urban Forestry Program in the future as demonstrated by the following policies in the Walla Walla Comprehensive Plan Update (Walla Walla 2018):

- Community Character (CC) Policy 5.3: *Create a tree planting program to preserve, restore, and enhance the tree canopy. Include planting requirements for each new development or redevelopment*.

- Environment and Natural Resources (ENR) Policy 1.6: *Preserve and protect healthy mature trees in the community to the greatest extent possible, and promptly plant replacements when they cannot be saved*.

- Parks and Recreation (PR) Policy 1.3: *Provide adequate funding to support new parks, recreation programs, and urban forestry programs and to maintain the existing facilities. Explore the implementation of a Park Impact Fee and identify cost sharing opportunities to fund parks and recreation projects*.

Other actions that City Council has taken in support of urban forestry include:

- 1993 – Created the Urban Forestry Advisory Commission to advise and make recommendations to the City Council and the municipal arborist on matters relating to urban forestry.

- 2003 – Adopted the Urban Forestry Management Plan that has provided a guide for the City's urban forestry practices over the last 16 years.

- 2004 – Created a full-time arborist position.

- 2015 – Reestablished a part-time (0.4 FTE) arborist position.

Trees add beauty to the city and provide practical stormwater benefits. This technical memorandum will explore the benefits of trees and green infrastructure, address current challenges that the City faces regarding tree maintenance and expansion of the Urban Forestry Program, and provide recommendations for changes to the City's green infrastructure and street tree maintenance program. This technical memorandum includes the following content:

- Background information on the benefits of green infrastructure, the stormwater benefits of trees, and the National Pollutant Discharge Elimination System (NPDES) Permit and Total Maximum Daily Load (TMDL) requirements

- A summary of existing conditions including green infrastructure, street trees, and the City's current green infrastructure and street tree maintenance program
- Recommendations for the City's future green infrastructure and street tree maintenance program, the City's street tree list, upcoming NPDES Permit updates, and considerations for TMDLs
- Recommendations for Walla Walla Municipal Code (WWMC) and Comprehensive Stormwater Management Plan updates that may be needed to promote and support green infrastructure and street trees

BACKGROUND

Background information on the benefits of green infrastructure, the stormwater benefits of trees, and the NPDES Permit and TMDL requirements are presented in this section.

Benefits of Green Infrastructure

Green infrastructure (also commonly referred to as Low Impact Development or LID) includes facilities such as bioretention and permeable pavement that are designed to infiltrate, filter, and/or provide treatment. These green infrastructure facilities are intended to replicate natural systems by slowing, spreading, absorbing, and treating stormwater runoff. In addition to controlling stormwater runoff volumes and treating stormwater, several green infrastructure elements also provide benefits outside of flow control and runoff treatment. Amended soils integrated into green infrastructure facilities and as a stand-alone best management practice (BMP) improve the health of soils and promote landscapes that require less water and maintenance. Permeable pavement and vegetated roofs can reduce the heat island effect. Vegetated roofs can provide added insulation to buildings and help to reduce energy demands.

Stormwater Benefits of Trees

Trees capture or slow stormwater runoff, which helps to improve water quality and protect downstream areas from erosion, flooding, and property damage. A fact sheet prepared for the City that summarizes some of these benefits is included in Appendix A. The primary stormwater benefits of urban trees include:

- **Reduced runoff volume:** Leaves, branches, and trunks intercept and store rainfall, which reduces the overall speed and volume of runoff generated. Leaves delay the passage of water to the ground by up to 3 hours for low intensity rain events.

- **Increased soil storage capacity:** During transpiration, trees draw water from the soil and release it into the atmosphere as water vapor, allowing the soil to store additional stormwater runoff.
- **Increased soil infiltration:** Tree root growth and decomposition opens up gaps in the soil for water storage and loosens the soil to improve infiltration.
- **Improved soil stabilization:** Tree roots reduce soil erosion by holding soil in place.
- **Improved water quality and reduced soil contamination:** Trees absorb, store, and transform harmful pollutants such as metals, organic compounds, and oils through phytoremediation. Trees also help protect water quality by shading impervious surfaces and water bodies, thereby reducing in-stream temperatures.

In order to demonstrate the range of benefits of trees in the city, five trees, representing species commonly found in the city, were selected. The stormwater runoff benefits were calculated using the i-Tree MyTree online interface and include stormwater runoff avoided and rainfall intercepted. The i-Tree MyTree online tool is part of the i-Tree suite of tools, which is a peer-reviewed software suite developed with the support of the United State Department of Agriculture (USDA) Forest Service and several partners. Tree measurements (e.g., trunk diameter), tree condition, and building setback information are entered into the tool and are merged with local precipitation and air pollution concentration data based on the selected location. Based on the i-Tree evaluation, for the five trees selected, the annual avoided runoff volume ranged from 54 to 947 gallons; and the annual volume of rainfall intercepted ranged from 315 to 5,489 gallons (Table 1).

Table 1. Benefits of Five Walla Walla Trees.

Tree Species	Callery Pear	Flowering Dogwood	Hawthorn	Sugar Maple	London Planetree
Trunk Measurement (inches)	6	6	20	33	50
Annual Runoff Avoided (gallons)	54	102	142	488	947
Annual Rainfall Intercepted (gallons)	315	592	824	2,831	5,489

A complete set of input data and results from i-Tree is included in Appendix A.

NPDES Permit and TMDL Requirements

The City's stormwater program is regulated under the Eastern Washington NPDES Phase II Municipal Stormwater Permit (NPDES Permit), which will be reissued by the Washington State Department of Ecology (Ecology) in July 2019. The current NPDES Permit (2014–2019) does not include specific requirements related to tree retention and tree planting, but it does require permittees to incorporate language into City codes and policies to allow Low Impact Development (LID) techniques, incorporate measures to minimize the creation of impervious surfaces, and incorporate measures to minimize the disturbance of native soils and vegetation. The *2019 Stormwater Management Manual for Eastern Washington* also includes a best management practice (BMP F6.62) that provides a flow control credit for retained trees and newly planted trees.

The Walla Walla Watershed currently has four approved TMDLs (Ecology 2008):

- Chlorinated pesticides and polychlorinated biphenyls (PCBs)
- Fecal coliform bacteria
- Temperature
- pH and dissolved oxygen

Section S7 and Appendix 2 of the NPDES Permit address compliance with TMDL requirements. There were no specific requirements for the City of Walla Walla in the 2014–2019 NPDES Permit; however, the City does have specific requirements included in the draft 2019–2024 NPDES Permit for the Walla Walla River Basin Fecal Coliform Bacteria TMDL.

None of the required actions in the draft 2019–2024 NPDES Permit are directly linked to green infrastructure or street tree maintenance. Recommendations related to the TMDL requirements are included in the TMDL Considerations section of this memorandum.

Existing Conditions

A summary of existing conditions including green infrastructure, street trees, and the City's current green infrastructure and street tree maintenance program is presented in this section.

Green Infrastructure

Existing green infrastructure owned and maintained by the City primarily consists of bioinfiltration swales and infiltration basins (see Table 2).

Table 2. Existing City-Owned Green Infrastructure in the City of Walla Walla.	
Facility Type	**Total Number**
Bioinfiltration Swale	45
Infiltration Basin	15
Total	**60**

Street Trees

Over 11,000 trees are mapped in the City's GIS geodatabase (March 2019). More than half of these trees (approximately 7,000) are classified as street trees, and the majority of the other mapped city trees are located in City-owned parks as summarized in Table 3.

Table 3. Locations of Existing Trees in the City of Walla Walla.	
Tree Classification	**Mapped Trees**
Park	4,193
Street	7,052
Total	**11,245**

According to the City's GIS geodatabase (summary data included in Appendix B), the top 10 street tree species, in terms of number of trees planted, are summarized in Table 4.

Table 4. Top Ten Street Trees in the City of Walla Walla.	
Tree Common Name	**Number of Street Trees**
Flowering dogwood	761
Callery pear	663
Norway maple	620
Crabapple	461
Plum	361
Red maple	314
Silver maple	309
White ash	241
Sweetgum	199
London planetree	182

The City has also developed a Street Tree Listing with recommended tree species. Trees on the Street Tree Listing are grouped into the following four categories:

1. Small Trees (Class I): Heights up to 25 feet, for planting strips that are 3 to 5 feet wide
2. Medium Trees (Class II): Heights from 25 to 50 feet, for planting strips that are 5 to 8 feet wide

3. Large Trees (Class III): Heights from 50 to 70 feet, for planting strips that are 8 to 15 feet wide

4. Very Large Trees (Class IV): Heights from 70 feet or more, for planting strips that are 15 feet wide or more without overhead power lines

Appendix C includes a street tree matrix grouped into the four categories listed above that summarizes the following information:

- Species and common name
- Mature height and width
- Included on the City Street Tree Listing?
- Number of trees planted in the City (from the GIS street tree database)
- Native species in Washington?
- Evergreen or deciduous?
- Canopy cover/stormwater interception benefits (on a low, medium, high scale)
- Recommendations/concerns related to inclusion on the City Street Tree Listing
- Recommendations/concerns related to maintenance

Current Maintenance Program

The City's Parks and Recreation Department is currently responsible for maintaining street trees and trees planted in City parks. The City has had a long-standing emphasis on the importance of trees (e.g., Urban Forestry Management Plan adopted by City Council in 2003, 25 years as a Tree City USA recipient, etc.); however, it has struggled to fund maintenance. The lack of resources to maintain the current inventory coupled with an aging inventory puts the public at risk (e.g., failures, trimming to provide sight triangles, visibility of street signs, etc.). In addition, a court decision in recent years related to vegetation maintenance has added additional liability to agencies. So, while trees provide numerous benefits to a community and the environment, the funds to maintain them have been in short supply.

Trends towards using green infrastructure for stormwater management have highlighted a potential partnership approach to maintaining both street trees and green infrastructure. In 2018, the City advertised a request for proposals (RFP) for a private contractor to provide the required maintenance of City-owned green infrastructure (e.g., bioinfiltration swales and infiltration basins). After receiving and analyzing bids, the Parks and Recreation Department determined it could better leverage those funds to not only maintain green infrastructure, but

also assist with other right-of-way vegetation maintenance, such as the maintenance of street trees. Thus, in 2018 the City began piloting a green infrastructure maintenance program funded by the City's Stormwater Utility but performed by the Parks and Recreation Department. The Parks and Recreation Department assigned a dedicated crew member for stormwater-specific facility and right-of-way maintenance (with flexibility to utilize existing maintenance staff for large projects). A dedicated stormwater maintenance crew can meet or exceed the maintenance standards set forth in the 2018 RFP and complete additional tasks for greater value to the City.

Maintenance activities for street trees and green infrastructure include:

- Replenishing mulch
- Protecting established trees and removing volunteer trees
- Trimming trees and shrubs to alleviate motor vehicle sight distance restrictions
- Removing downed tree limbs/branches
- Removing green waste, sediment build-up, and debris
- Managing weeds and undesirable vegetation
- Maintenance/winterization of irrigation systems.

Funding for the green infrastructure maintenance program through 2020 is shown in Table 5 and is based upon the low bid received in 2018.

Table 5. Green Infrastructure Maintenance Budget Summary.

Year	Stormwater Utility	General Fund	CP	Total Budget
2018	$88,150	$20,974	$18,602	$127,726
2019	$83,034	$23,261	$19,667	$125,962
2020	$87,121	$23,954	$20,255	$131,330

In addition to the green infrastructure maintenance budget summary in Table 5, the Parks and Recreation Department is currently responsible for providing tree maintenance through the Urban Forestry Program. The estimated 5-year funding needs for the Urban Forestry Program (including street trees and park trees) through 2023 are summarized in Table 6.

Table 6. Urban Forestry Program Funding Needs.

Year	Salaries and Benefits (arborist and part time)	Contractors	Equipment and Supplies (including replacement)[a]	Other[b]	Total Budget
2019	$110,670	$60,000	$75,000	$10,000	$255,670
2020	$115,494	$100,000	$16,000	$25,000	$256,494
2021	$118,970	$115,000	$16,000	$10,000	$259,970
2022	$122,540	$118,450	$16,000	$10,000	$266,990
2023	$126,230	$122,004	$16,000	$10,000	$274,234

[a] Cost for bucket truck purchase in 2019 ($55,000) was included under Equipment and Supplies.

[b] Other includes Tree Canopy Evaluation ($15,000 in 2020), Solid Waste ($5,000 annually), and Tree Replacement ($5,000 annually).

RECOMMENDATIONS

This section includes recommendations for the future green infrastructure and street tree maintenance program and corresponding sources of funding for these activities, as well as initial high-level recommendations for the City's Street Tree Listing, the upcoming NPDES Permit requirements, TMDL considerations, and revisions to the WWMC and 2015 Comprehensive Stormwater Management Plan.

Future Maintenance Program

To expand future maintenance activities to include street trees maintenance in addition to green infrastructure maintenance, the Parks and Recreation Department would need additional funding from the Stormwater Utility. The resources currently available for these activities are insufficient for limited staff to adequately address maintenance of green infrastructure and street trees in addition to park maintenance.

The requested additional funding identified in Table 6 will support staffing and expenses for the dedicated stormwater crew (or other Parks maintenance staff) to perform tree maintenance activities in addition to green infrastructure maintenance activities. Approximately 40 percent of the City's trees are classified as park trees; the remaining approximately 60 percent (see Table 3) of City trees are classified as street trees, which provide significant value as discussed in the *Stormwater Benefit of Trees* section. Assuming that park trees and street trees would receive equal care and maintenance, the estimated budget outlined in Table 7 allots 60 percent of the Urban Forestry Program funding needs (summarized in Table 6) to street tree maintenance, with a total budget transfer from the Stormwater Utility of $236,436 in 2019 and $241,017 in 2020.

Table 7. Green Infrastructure and Street Tree Maintenance Budget Recommendations.

Year	Green Infrastructure Maintenance	Street Tree Maintenance	Recommended Budget Transfer from Stormwater Utility to Support Green Infrastructure and Street Tree Maintenance
2019	$83,034	$153,402	$236,436
2020	$87,121	$153,896	$241,017

The Stormwater Utility is an appropriate source of funding for street tree maintenance due to the stormwater benefits provided by street trees outlined earlier in this technical memorandum. Other Washington jurisdictions support some or all of their urban forestry programs with funding from the Stormwater Utility.

One example is the Urban Forestry Program in Vancouver, Washington, that is primarily supported by surface water management fees (97 percent). The remaining percentage (3 percent) is supported by compensatory mitigation via a Tree Fund (C. Ray, personal communication, July 6, 2016). The City of Vancouver does not include specific language regarding Urban Forestry as part of their Stormwater Management – Regulations and Charges code (Chapter 14.09); however, their Urban Forestry Management Plan (Vancouver 2007) includes the following language:

- "In a renewed effort to not only protect the dwindling urban forest but also significantly restore canopy coverage, City Council approved a funding program for Urban Forestry in 2004, utilizing a portion of its surface water management fees in recognition of the green infrastructure and stormwater management benefits of trees."

- "Currently, Public Works supports Urban Forestry through dedication of a portion of the City's surface water management fees. These funds are used specifically to provide City services related to canopy restoration: coordination of contractor and volunteer tree planting efforts, outreach and education to promote environmental stewardship, and enhanced customer service. The use of this funding source is in recognition of the importance of the urban forest for stormwater management functions, water quality protection, and Clean Water Act, Clean Air Act, and Endangered Species Act compliance."

Another example is the City of Kirkland's Surface Water Utility, which currently supports a half-time (20 hours per week) Urban Forestry position ($47,558) and 50 percent of a full-time Field Arborist position (D. Powers, personal communication, July 13, 2016). The City of Kirkland does not include specific language regarding Urban Forestry as part of their Surface Water Utility code (Chapter 15.56); however, their 20-year Forest Restoration Plan (Green Kirkland Partnership 2008) includes the following language:

- "The Surface Water Utility (SWU) is part of the Public Works Department. SWU interests intersect with Green Kirkland Partnership forest restoration efforts that directly contribute to water quality, stormwater management and habitat, especially near

streams. Parks will collaborate with SWU when planning restoration events along streams. In return, SWU will provide guidance and support, continue public outreach and education on the importance of forested natural areas to water quality and other Public Works programs, engage volunteers in a water quality monitoring program for lakes and streams such as Forbes Lake, Totem Lake, and Forbes Creek, and conduct city-funded riparian and fish passage habitat improvements."

- Consider increasing "… fees or rates for utility ratepayers for management of forested natural areas as stormwater management (and other ecosystem services) infrastructure."

A third example is the City of Longview's Urban Forestry Program which is partially (63 percent) supported by the Storm Water Utility fund (C. Nedved, personal communication, September 22, 2016). The City of Longview does not include specific language regarding Urban Forestry as part of their Stormwater Utility code (Chapter 15.80). The municipal code broadly states that the "storm water utility shall have authority and responsibility … for planning, design, construction, maintenance, administration, and operation of all city stormwater conveyances and facilities." This language is similar to the existing WWMC language presented below.

Based on these three examples and the City's goals outlined in the Walla Walla Comprehensive Plan Update, allocation of Stormwater Utility funds to support green infrastructure and street tree maintenance is in alignment with the WWMC. The existing language in Chapter 13.06 of the WWMC on the authority and responsibility of the Stormwater Utility is currently fairly broad and includes maintenance related to storm and surface water facilities:

> *The [stormwater] utility will have primary authority and responsibility for carrying out the city's comprehensive drainage and storm sewer plan, including responsibilities for planning, design, construction, maintenance, administration, and operation of all city storm and surface water facilities, as well as establishing standards for design, construction and maintenance of improvements on private property where these may impact storm and surface water and management.*

Street Tree Listing

As demonstrated by the example i-Tree MyTree results presented in this technical memorandum, rainfall interception by street trees can provide significant stormwater benefits by reducing the gallons of rainfall that are converted to stormwater runoff. The following types of trees provide the largest benefit for runoff volume reduction:

- Conifers and broadleaf evergreens are more efficient than deciduous trees in terms of water uptake and interception.

- Larger diameter trees typically perform better than smaller diameter trees at water uptake and interception.

- Deciduous canopies are also beneficial for interception (i.e., deciduous trees with large, dense canopies such as oak trees are more effective at interception than a small, flowering plum), especially during spring rainfall.

The City's current Street Tree Listing does not include any conifers or broadleaf evergreens, and few of these trees are currently planted within the city limits without any ecological basis. For maximum stormwater benefit and resiliency of plantings, it is recommended that the City update the Street Tree Listing to include conifers and broadleaf evergreens and add native deciduous tree species. The City should also prioritize planting Class III and Class IV trees where possible since they can provide the most efficient water uptake and interception.

The street tree matrix included in Appendix C includes a few initial recommendations/concerns:

- European mountain ash is invasive and should be removed from the City's Street Tree Listing
- Norway maple is considered increasingly invasive in parts of Washington; plant with caution
- Ponderosa pine should be added to the City's Street Tree Listing—it is a native species, large evergreen, and well-adapted for the City
- Northern red oak should be added to the City's Street Tree Listing—it is drought-tolerant once established

Several concerns related to maintenance are also included in the street tree matrix included in Appendix C. Additional recommendations for tree species to be added or removed from the City's Street Tree Listing can be developed during the next phase of this project if requested.

NPDES Permit Updates

This section includes a high-level summary of proposed changes in the 2019–2024 NPDES Permit. Ecology also made other revisions to the NPDES Permit to refine, clarify, and consolidate text, in addition to consistency edits related to other permits and guidance. Topics summarized below are intended to focus on permit changes that may have a programmatic or operational effect on the City, or require updates to code and/or guidance.

Public Education and Outreach (S5.B.1)

Eastern Washington permittees are now required to measure the understanding and adoption of the targeted behaviors for at least one audience in at least one subject area. Infiltration and underground injection control criteria were added as a potential subject area for engineers, construction contractors, developers, development review staff, and land use planners.

Illicit Discharge Detection and Elimination (S5.B.3)

Electronic mapping of a specified list of storm drainage system components is now required. Eastern Washington permittees will be required to map known discharge points (does not include UICs, though mapping UICs is recommended by Ecology), permanent stormwater facilities owned or operated by the permittee, and connections to the MS4 (known and new connections authorized/approved by permittee, and connections to other municipalities or public entities). Permittees will also be required to submit additional data related to illicit discharges, including spills and illicit connections that were found by, reporting to, or investigated by the permittee.

Construction Site Stormwater Runoff Control (S5.B.4)

Enhanced requirements for construction activities include:

- Inspection prior to clearing and grading for construction if a high potential for sediment transport is determined
- Inspection during construction to ensure proper installation and maintenance of required erosion and sediment controls.

Post-Construction Stormwater Management for New Development and Redevelopment (S5.B.5)

Enhanced requirements for post-construction activities include inspection of structural BMPs upon final installation or upon completion of the project.

Municipal Operations and Maintenance (S5.B.6)

Updates to the municipal O&M requirements include:

- Adding street cleaning to the O&M Plan
- Adding detailed requirements to be included in a municipal Stormwater Pollution Prevention Plan (SWPPP)

Compliance with Total Maximum Daily Load Requirements (S7)

See the TMDL Considerations section of this technical memorandum for NPDES permit updates associated with the Walla Walla River Basin TMDL.

Monitoring and Assessment (S8)

Designated Urban Areas (including the City of Walla Walla) are expected to collaborate to prioritize, plan, and begin implementation of a new stormwater management program effectiveness study by the end of the permit cycle.

TMDL Considerations

Green infrastructure and street trees can improve water quality by intercepting contaminated stormwater runoff, which in turn can help meet TMDL goals for target pollutants; however, the effectiveness of green infrastructure and street trees in improving water quality can vary for each pollutant.

Limited data is currently available regarding fecal coliform bacteria removal by green infrastructure, such as biofiltration swales and infiltration basins. The *Minnesota Stormwater Manual* (Minnesota Pollution Control Agency 2017) assumes that bacteria removal is assumed to be 100 percent for all green infrastructure that relies on infiltration, which would include the bioinfiltration swales and infiltration basins installed in the city. A laboratory study on bioinfiltration system columns also showed that relatively local percentages of bacteria were remobilized during intermittent flows (Mohanty et al. 2013), so infiltration facilities such as bioinfiltration swales and infiltration basins could be a good solution for areas of the city impacted by the fecal coliform bacteria TMDL.

Limited data is also available to quantify the reduction in bacteria loading that can be attributed to street trees. Fecal coliform bacteria is not a contaminant that is taken up by trees; however, through intercepting and slowing stormwater runoff (both of which are quantifiable ways of reducing stormwater runoff volume), canopy coverage provided by street trees is expected to reduce the volume of contaminated stormwater that flows to the Walla Walla River and in this indirect way could reduce bacteria loading to the river.

Regarding the other TMDLs for the Walla Walla Watershed that are not currently listed in the draft 2019–2024 NPDES permit (e.g., temperature, pesticides, and PCBs), trees provide multiple benefits for potential water quality improvement. Canopy coverage can be beneficial for temperature reduction by providing shade. Because trees help to stabilize soil and reduce erosion, the presence of trees is also likely to reduce the amount of pesticides and PCBs that are mobilized to surface waters attached to soil particles.

Code and Document Revisions

Walla Walla Municipal Code (WWMC)

The City's existing code language related to preservation and protection of trees (WWMC 20.106.120) is strong as currently written, but it may be helpful to revisit the definition of "an unreasonable burden to a development" related to tree retention or protection to ensure that trees are being considered during the site assessment and layout for new development and redevelopment projects.

Green infrastructure facilities (e.g., bioretention and permeable pavement) are also currently included in the stormwater facility definition in Chapter 13.06 WWMC:

> *"Stormwater facility" means any constructed component of a stormwater drainage system designed or constructed to provide one or more of the following functions: collection, conveyance, retention, detention, infiltration, diversion, treatment, or filtration of stormwater. Stormwater facilities include, but are not limited to, pipes, swales, ditches, culverts, street gutters, detention ponds, retention ponds, constructed wetlands, infiltration devices, catch basins, oil/water separators, biofiltration swales, underground injection control facilities, bioretention, and permeable pavement.*

Street trees are not listed as a stormwater facility or BMP in Chapter 13.06 WWMC. Since street trees are not commonly included in a stormwater facility definition, but are considered to be a stormwater BMP, the current stormwater facility terminology could be modified to stormwater BMP/facility (which would include street trees) or a separate definition could be added for stormwater BMPs (which would include street trees).

Another section of the WWMC (12.49.130) currently addresses routine care and maintenance of street trees using the following language:

> *Owners of property abutting any street tree are responsible to provide routine care and maintenance to such tree and at property owner's cost, unless agreed to otherwise by the city.*

WWMC 12.49.130 should be reviewed by City staff to determine where the responsibility for street tree maintenance lies. If the Parks Department will be responsible for maintaining all street trees in the future, this code language should be updated to reflect that policy.

2015 Comprehensive Stormwater Management Plan

Revisions that may be needed to the City's 2015 Comprehensive Stormwater Management Plan (URS 2015) include updating the City Stormwater Program Organization (Section 7.2.3) to include Parks Department staff supporting maintenance of green infrastructure and street trees.

The City may also want to review and update the Overview of Stormwater Regulatory Requirements (Section 7.3) to include the proposed or updated 2019–2024 NPDES Permit requirements.

The specified inspection frequency for bioinfiltration swales and infiltration basins in the 2015 Comprehensive Stormwater Management Plan is twice per year. The 2015 Comprehensive Stormwater Management Plan also references the City's 2011 O&M Plan, which may be updated to meet the 2019–2024 NPDES Permit requirements. The structural BMP inspection frequency in the 2015 Comprehensive Stormwater Management Plan will need to be updated to add the new post-construction inspection requirement in the 2019–2024 NPDES Permit.

The City should also consider adding a statement to the 2015 Comprehensive Stormwater Management Plan encouraging consideration of green infrastructure as an alternative to traditional stormwater facilities.

CONCLUSION

This technical memorandum provides a summary of the existing and proposed City of Walla Walla's green infrastructure and street tree maintenance program and provides recommendations for the future green infrastructure and street tree maintenance program. This technical memorandum also provides initial high-level recommendations for modifications to the City's Street Tree Listing, WWMC, and 2015 Comprehensive Stormwater Management Plan. Next steps in this project include developing specific recommendations for updating the City's Street Tree Listing, WWMC, and 2015 Comprehensive Stormwater Management Plan.

REFERENCES

Ecology. 2008. Walla Walla Watershed PCBs, Chlorinated Pesticides, Fecal Coliform, Temperature, pH & Dissolved Oxygen Total Maximum Daily Load Water Quality Implementation Plan. Publication No. 08-10-094. December.

Green Kirkland Partnership. 2008. 20-Year Forest Restoration Plan. Prepared by the City of Kirkland, Cascade Land Conservancy, and King Conservation District. March.

Minnesota Stormwater Manual. 2017. Prepared by the Minnesota Pollution Control Agency.

Mohanty, S., A.A. Torkelson, H.M. Dodd, K.L. Nelson, and A.B. Boehm. 2013. Engineering Solutions to Improve the Removal of Fecal Indicator Bacteria by Bioinfiltration Systems during Intermittent Flow of Stormwater. Environmental Science & Technology 47(19):10791–10798. October.

URS. 2015. Walla Walla Comprehensive Stormwater Management Plan. July.

Vancouver. 2007. City of Vancouver Urban Forestry Management Plan. Prepared by the City of Vancouver and Conservation Technix, Inc. December.

Walla Walla. 2018. Walla Walla Comprehensive Plan Update. Prepared by the City of Walla Walla. June.

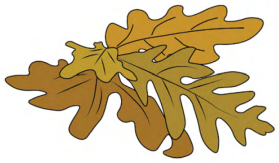
APPENDIX A

Stormwater Benefits of Walla Walla Trees

Stormwater Benefits of Trees

Why is Stormwater a Problem in Urban Areas?

Rain hits the pavement and becomes stormwater runoff. As this runoff flows over streets, sidewalks, and parking lots, it collects debris, sediment, fertilizers, pesticides, oils, metals, and other pollutants. Most of this runoff eventually makes its way to rivers or streams, which are used for swimming, fishing, and other types of recreation.



Why are Trees Important in Urban Areas?

Planting and protecting trees in urban areas can improve water quality and protect downstream areas from erosion, flooding, and property damage. In addition to these stormwater benefits, trees also can provide the following benefits:

- Improved air quality
- Reduced heat island effect
- Reduced energy usage
- Habitat creation and preservation
- Increased property values
- Improved aesthetics
- Reduced crime

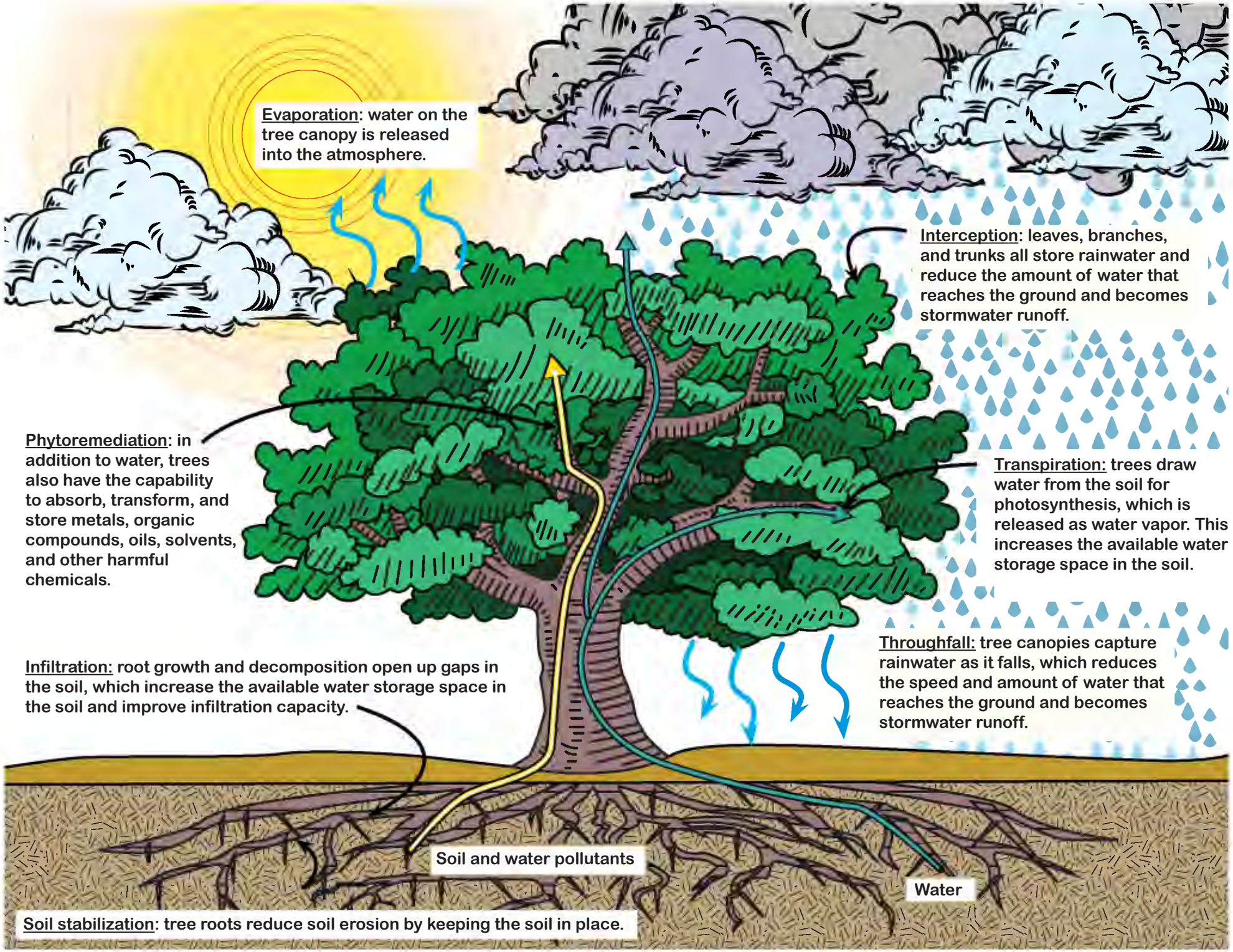
Urban Tree Facts

- Walla Walla has over 6,000 street trees.
- A study in Spokane, WA, showed:
  - Over $290,000 is saved annually in stormwater mitigation by rain interception and storage from 76,000 street trees.
  - A typical tree can intercept an average of 760 gallons of water.
- Tree canopies delay the passage of water to the ground from 10 minutes to up to three hours for low intensity storm events.
- Rainfall intensity is 15% to 20% lower under a tree canopy compared to an open area.
- Conifers and evergreens intercept more rainfall than deciduous trees during winter months since they retain their needles and leaves.

Resources

- Calculate the stormwater benefits of a specific tree on your property: itreetools.org/mytree
- Walla Walla has been a Tree City USA community for over 25 years: arborday.org/programs/treecityusa/directory.cfm
- View the City of Walla Walla street tree listing: wallawallawa.gov/government/parks-and-recreation/street-trees
- Find additional resources at EPA's Soak Up the Rain webpage: epa.gov/soakuptherain/soak-rain-trees-help-reduce-runoff
- Find additional resources at the Trees & Stormwater website: treesandstormwater.org

This fact sheet was modified from a fact sheet developed by the King County-Cities Climate Collaboration (K4C)-King Conservation District (KCD) Sustaining Urban Forests Working Group.


Evaporation: water on the tree canopy is released into the atmosphere.
Interception: leaves, branches, and trunks all store rainwater and reduce the amount of water that reaches the ground and becomes stormwater runoff.
Phytoremediation: in addition to water, trees also have the capability to absorb, transform, and store metals, organic compounds, oils, solvents, and other harmful chemicals.
Transpiration: trees draw water from the soil for photosynthesis, which is released as water vapor. This increases the available water storage space in the soil.
Throughfall: tree canopies capture rainwater as it falls, which reduces the speed and amount of water that reaches the ground and becomes stormwater runoff.
Infiltration: root growth and decomposition open up gaps in the soil, which increase the available water storage space in the soil and improve infiltration capacity.
Soil and water pollutants
Water
Soil stabilization: tree roots reduce soil erosion by keeping the soil in place.

Input Data for the i-Tree MyTree Model

Table A-1. Input Data for Five Walla Walla Trees.

Tree Species	Callery Pear	Flowering Dogwood	Hawthorn	Sugar Maple	London Planetree
Address	215 East Rose Street	100 Stanton Street	East Cherry Street and Tukanon Street	414 East Rose Street	613 Locust Street
Name	TI13-0570	TI14-0057	TI13-0656	TI15-0429	TI16-0417
Tree Condition	Good	Good	Good	Good	Good
Trunk Measurement (inches)	6	6	20	33	51 (modeled as 50 due to model limitations)
Sun Exposure	Full Sun	Full Sun	Full Sun	Partial Sun	Full sun (3 sides)
Within 60 Feet of Building?	Yes	Yes	Yes	Yes	Yes
Building Vintage	Built after 1980	Built after 1980	Built after 1980	Built after 1980	Built after 1980
Distance to Building (feet)	0–20	39–59	39–59	20–39	20–39
Compass Direction from Tree to Building	Southeast	Northeast	Northwest	Southeast	South

Output Data from the i-Tree MyTree Model

MyTree Benefits

(TI13-0570 (Callery pear at Safeway)) Pear, Callery (Pyrus calleryana)
Serving size: 6" dbh, Good condition

Total benefits for this year	**$9.22**
Carbon Dioxide (CO_2) Sequestered	**$1.75**
Annual CO_2 equivalent of carbon[1]	75.36 lbs
Storm Water runoff avoided	**$0.49**
Runoff avoided	54.28 gal
Rainfall intercepted	314.79 gal
Air Pollution removed each year	**$0.00**
Carbon monoxide	< 0.10 oz
Ozone	1.28 oz
Nitrogen dioxide	< 0.10 oz
Sulfur dioxide	< 0.10 oz
Particulate matter < 2.5 microns	< 0.10 oz
Energy Usage each year[2]	**$5.83**
Electricity savings (A/C)	16.02 kWh
Fuel savings (Natural Gas,Oil)	0.28 MMBtu
Avoided Energy Emissions	**$1.15**
Carbon dioxide	48.64 lbs
Carbon monoxide	0.23 oz
Nitrogen dioxide	0.14 oz
Sulfur dioxide	0.25 oz
Particulate matter < 2.5 microns	< 0.10 oz
Carbon Dioxide (CO_2) Stored to date[3]	**$7.78**
Lifetime CO_2 equivalent of carbon[3]	334.62 lbs

Benefits are estimated based on USDA Forest Service research and are meant for guidance only.www.itreetools.org

[1]Large trees: sequestration is overtaken by CO_2 loss with decay/maintenance.

[2]Positive energy values indicate savings or reduced emissions. Negative energy values indicate increased usage or emissions.

[3]Not an annual amount or value.

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i-Tree MyTree v1.5
powered by the i-Tree Eco engine

MyTree Benefits

(TI14-0057) Dogwood, Flowering (Cornus florida)
Serving size: 6" dbh, Good condition

Total benefits for this year	**$3.25**
Carbon Dioxide (CO_2) Sequestered	**$1.37**
Annual CO_2 equivalent of carbon[1]	58.76 lbs
Storm Water runoff avoided	**$0.91**
Runoff avoided	102.10 gal.
Rainfall intercepted	592.10 gal.
Air Pollution removed each year	**$0.17**
Carbon monoxide	0.13 oz
Ozone	2.53 oz
Nitrogen dioxide	< 0.10 oz
Sulfur dioxide	< 0.10 oz
Particulate matter < 2.5 microns	< 0.10 oz
Energy Usage each year[2]	**$0.69**
Electricity savings (A/C)	3.76 kWh
Fuel savings (Natural Gas,Oil)	< 0.10 MMBtu
Avoided Energy Emissions	**$0.11**
Carbon dioxide	4.76 lbs
Carbon monoxide	NaN oz
Nitrogen dioxide	< 0.10 oz
Sulfur dioxide	< 0.10 oz
Particulate matter < 2.5 microns	< 0.10 oz
Carbon Dioxide (CO_2) Stored to date[3]	**$6.28**
Lifetime CO_2 equivalent of carbon[3]	270.23 lbs

Benefits are estimated based on USDA Forest Service research and are meant for guidance only:www.itreetools.org

[1]Large trees: sequestration is overtaken by CO_2 loss with decay/maintenance.

[2]Positive energy values indicate savings or reduced emissions. Negative energy values indicate increased usage or emissions.

[3]Not an annual amount or value.

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MyTree Benefits

(TI13-0656) Hawthorn (Crataegus species)
Serving size: 20" dbh, Good condition

Total benefits for this year	**$15.23**
Carbon Dioxide (CO_2) Sequestered	**$9.47**
Annual CO_2 equivalent of carbon[1]	407.26 lbs
Storm Water runoff avoided	**$1.27**
Runoff avoided	142.11 gal
Rainfall intercepted	824.10 gal
Air Pollution removed each year	**$0.00**
Carbon monoxide	0.18 oz
Ozone	3.87 oz
Nitrogen dioxide	0.10 oz
Sulfur dioxide	< 0.10 oz
Particulate matter < 2.5 microns	< 0.10 oz
Energy Usage each year[2]	**$3.73**
Electricity savings (A/C)	8.15 kWh
Fuel savings (Natural Gas,Oil)	0.19 MMBtu
Avoided Energy Emissions	**$0.76**
Carbon dioxide	32.21 lbs
Carbon monoxide	0.19 oz
Nitrogen dioxide	< 0.10 oz
Sulfur dioxide	0.16 oz
Particulate matter < 2.5 microns	< 0.10 oz
Carbon Dioxide (CO_2) Stored to date[3]	**$146.29**
Lifetime CO_2 equivalent of carbon[3]	6290.35 lbs

Benefits are estimated based on USDA Forest Service research and are meant for guidance only www.itreetools.org

[1]Large trees: sequestration is overtaken by CO_2 loss with decay/maintenance

[2]Positive energy values indicate savings or reduced emissions. Negative energy values indicate increased usage or emissions.

[3]Not an annual amount or value

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MyTree Benefits

(TI15-0429) Maple, Sugar (Acer saccharum)
Serving size: 33" dbh, Good condition
Total benefits for this year **$51.06**

Carbon Dioxide (CO_2) Sequestered	**$7.28**
Annual CO_2 equivalent of carbon[1]	313.19 lbs
Storm Water runoff avoided	**$4.36**
Runoff avoided	488.17 gal.
Rainfall intercepted	2830.92 gal.
Air Pollution removed each year	**$0.00**
Carbon monoxide	0.61 oz
Ozone	11.30 oz
Nitrogen dioxide	0.30 oz
Sulfur dioxide	0.18 oz
Particulate matter < 2.5 microns	0.10 oz
Energy Usage each year[2]	**$32.76**
Electricity savings (A/C)	71.70 kWh
Fuel savings (Natural Gas,Oil)	1.69 MMBtu
Avoided Energy Emissions	**$6.66**
Carbon dioxide	283.07 lbs
Carbon monoxide	1.28 oz
Nitrogen dioxide	0.80 oz
Sulfur dioxide	1.45 oz
Particulate matter < 2.5 microns	0.13 oz
Carbon Dioxide (CO_2) Stored to date[3]	**$591.29**
Lifetime CO_2 equivalent of carbon[3]	25424.42 lbs

Benefits are estimated based on USDA Forest Service research and are meant for guidance only:www.itreetools.org

[1]Large trees: sequestration is overtaken by CO_2 loss with decay/maintenance.

[2]Positive energy values indicate savings or reduced emissions. Negative energy values indicate increased usage or emissions.

[3]Not an annual amount or value.

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MyTree Benefits

(TI16-0417) Planetree, London (Platanus hybrida)
Serving size: 50" dbh, Good condition

Total benefits for this year	**$58.32**
Carbon Dioxide (CO_2) Sequestered	**$11.04**
Annual CO_2 equivalent of carbon[1]	474.70 lbs
Storm Water runoff avoided	**$8.46**
Runoff avoided	946.56 gal
Rainfall intercepted	5489.12 gal
Air Pollution removed each year	**$0.00**
Carbon monoxide	1.19 oz
Ozone	7.00 oz
Nitrogen dioxide	0.17 oz
Sulfur dioxide	0.12 oz
Particulate matter < 2.5 microns	< 0.10 oz
Energy Usage each year[2]	**$32.18**
Electricity savings (A/C)	61.77 kWh
Fuel savings (Natural Gas,Oil)	1.71 MMBtu
Avoided Energy Emissions	**$6.64**
Carbon dioxide	282.69 lbs
Carbon monoxide	1.26 oz
Nitrogen dioxide	0.80 oz
Sulfur dioxide	1.45 oz
Particulate matter < 2.5 microns	0.12 oz
Carbon Dioxide (CO_2) Stored to date[3]	**$504.64**
Lifetime CO_2 equivalent of carbon[3]	21698.55 lbs

Benefits are estimated based on USDA Forest Service research and are meant for guidance only www.itreetools.org

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[2]Positive energy values indicate savings or reduced emissions. Negative energy values indicate increased usage or emissions.

[3]Not an annual amount or value

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APPENDIX B

Summary Data from the Walla Walla Street Tree Database

Table B-1. Summary of Planted Street Trees in the City of Walla Walla.	
Tree Common Name	**Number of Street Trees**
Flowering dogwood	761
Callery pear	663
Norway maple	620
Crabapple	461
Plum	361
Red maple	314
Silver maple	309
White ash	241
Sweetgum	199
London planetree	182
Eastern redbud	180
Green ash	159
Serviceberry	142
Honeylocust	141
American sycamore	139
Dogwood	121
Hawthorn	120
Littleleaf linden	112
Black locust	97
European white birch	96
Freeman maple	96
Sycamore maple	92
European hornbeam	86
Caucasian ash	74
Japanese Zelkova	66
Ginkgo	59
Other species	59
Cherry plum	51
Spruce	51
Pine	46
Southern catalpa	44
Katsura tree	40
Tree of heaven	38
Amur maple	35
American basswood	32
Maple	32
Paper birch	31
China Snow Lilac	30
English walnut	28
Paperback Maple	27

Table B-1 (continued). Summary of Planted Street Trees in the City of Walla Walla.	
Tree Common Name	**Number of Street Trees**
Black walnut	26
Northern hackberry	25
Horsechestnut	24
Magnolia	24
Northern red oak	24
Hedge maple	23
Elm	22
Japanese Maple	21
Purple blow Maple	21
Black cottonwood	19
Black Gum	19
Lilac	19
Sugar maple	19
Willow	19
American mountain ash	15
(blank)	15
Basswood	14
Bur oak	14
Scarlet oak	14
American elm	13
Goldenrain tree	12
Japanese tree lilac	12
Ash	10
Blue spruce	10
Beech	9
Hazelnut	9
Maackia	9
Parrotia Persica	8
American smoketree	7
European beech	7
Quaking aspen	7
English oak	6
Northern catalpa	6
Douglas fir	5
Kwanzan cherry	5
Pin oak	5
Rose of Sharon	5
Tulip tree	5
Western redcedar	5
White mulberry	5
American chestnut	4

Table B-1 (continued). Summary of Planted Street Trees in the City of Walla Walla.

Tree Common Name	Number of Street Trees
Fir	4
Incense Cedar	4
Mountain Ash	4
Pear Tree	4
Birch	3
Boxelder	3
Broadleaf Deciduous Large Other	3
Cottonwood	3
cypress	3
Dawn redwood	3
Golden-chain tree	3
Italian alder	3
Juniper	3
Scotch pine	3
Smooth hawthorn	3
American Sweetgum	2
Common chokecherry	2
Curly Willow	2
European alder	2
Kentucky coffeetree	2
Peach	2
River birch	2
Apricot	1
Blue ash	1
Eastern white pine	1
European larch	1
Katsura	1
Paperbark maple	1
Red mulberry	1
Sargent cherry	1
Smoke tree	1
Sumac	1
Turkish hazelnut	1
[Unknown]	2
Grand Total	**7,052**

APPENDIX C

Walla Walla Street Tree Matrix

Table C-1. Small Trees (Class I) on the City Street Tree Listing and Planted in the City.

Species	Common Name	Mature Height (feet)	Mature Width (feet)	Included on City Street Tree Listing? (Y or N)	Number of Trees Planted in the City	WA Native? (Y or N)	Evergreen (E)/ Deciduous (D)	Canopy Cover/ Stormwater Interception Benefits (Low, Med, High)	Recommendations/Concerns
Acer griseum	Paperbark maple	25	20	Y	< 20	N	D	Low	
Acer palmatum	Japanese maple	20	20	Y	21	N	D	Low	Not suitable for ROW planting.
Amelanchier laevis 'Snowcloud'	Snowcloud serviceberry	25	15	Y	0	N	D	Low	
Amelanchier sp	Serviceberry	8–20	4–15	Y	142	See comment	D	Low	*Amelanchier alnifolia* is a WA native serviceberry.
Carpinus betulus cultivars	European hornbeam	40	30	N	86	N	D	Low	
Carpinus caroliniana	American hornbeam	25	20	Y	0	N	D	Medium	
Cercis canadensis	Eastern redbud	20–30	25–35	N	180	N	D	Low	
Cornus florida	Flowering dogwood	20	20	Y	761	N	D	Low	Susceptible to numerous diseases.
Cornus sp. cultivars	Dogwood cultivars	15–30	15–30	N	121	N	D	Low	*C. kousa, C. florida, C. mas, C. alternifolia, C. nuttallii* and *C. controversa* all have crosses and cultivars. Review individual species for more information.
Cotinus coggygria	Smoketree	12–15	12–15	N	< 10	N	D	Low	
Crataegus laevigata 'Paul's Scarlet'	Paul's Scarlet hawthorn	25	20	Y	< 10	N	D	Low	Very susceptible to leaf blights and rusts, causing severe defoliation.
Crataegus × lavallei	Lavalle hawthorn	25	20	Y	0	N	D	Low	Resistant to fireblight and rusts.
Crataegus phaenopyrum	Washington hawthorn	25	20	Y	120	N	D	Low	
Malus sp cultivars	Ornamental crabapple	15–25	15–25	N	461	N	D	Low	Prone to structural issues and some pests and diseases.
Parrotia persica	Persian ironwood	30	20	Y	< 10	N	D	Medium	
Prunus cerasifera 'Newport'	Newport flowering plum	15–20	15–20	Y	369	N	D	Low	
Prunus sargentii 'JFS-KW58'	Pink Flair flowering cherry	25	15	Y	< 10	N	D	Low	Intolerant of pollution, drought, and poor drainage.
Prunus x yedoensis	Yoshino cherry	25	25	Y	0	N	D	Low	Intolerant of drought. Pests and diseases may be an issue.
Sorbus americana	American mountain ash	15–20	20	N	15	N	D	Low	Intolerant of dry soils and hot, humid summers. Fairly intolerant of air pollution.
Styrax japonicus	Japanese snowbell	20	20	Y	0	N	D	Low	
Syringa reticulata	Japanese tree lilac	20	15	Y	61	N	D	Low	
Zelkova 'City Sprite'	City Sprite zelkova	24	18	Y	0	N	D	Medium	

Table C-2. Medium Trees (Class II) on the City Street Tree Listing and Planted in the City.

Species	Common Name	Mature Height (feet)	Mature Width (feet)	Included on City Street Tree Listing? (Y or N)	Number of Trees Planted in the City	WA Native? (Y or N)	Evergreen (E)/ Deciduous (D)	Canopy Cover/ Stormwater Interception Benefits (Low, Med, High)	Recommendations/Concerns
Acer negundo	Box elder	30–50	30–50	N	< 10	Y	D	High	Weak-wooded, which can be a problem in ROW planting.
Acer rubrum cultivars	Red maple	20–40	15	Y	489	N	D	High	
Betula jacquemontii	Himalayan birch	25–40	25–40	Y	< 10	N	D	Low	Very susceptible to bronze birch borer.
Betula pendula	European white birch	30–40	15–30	N	96	N	D	Low	Very susceptible to bronze birch borer.
Catalpa bignonioides	Southern catalpa	30–40	30–40	N	44	N	D	High	Structural issues and prone to limb breakage.
Cercidiphyllum japonicum	Japanese katsuratree	45	40	Y	40	N	D	High	
Cladrastis kentukea	Yellowwood	40	40	Y	< 10	N	D	High	
Fraxinus oxycarpa 'Raywood'	Raywood ash	50–60	50–60	Y	84	N	D	Medium	Emerald ash borer is an increasingly large insect issue in other parts of the country. The borer could decimate the entire ash population if it gets established in the city.
Fraxinus quadrangulata	Blue ash	50–70	35–60	Y	< 10	N	D	Medium-High	Emerald ash borer is an increasingly large insect issue in other parts of the country. The borer could decimate the entire ash population if it gets established in the city.
Ginkgo biloba	Maidenhair tree, Ginkgo	40	35	Y	75	N	D	High	
Juglans regia	English walnut	40–60	40–60	N	28	N	D	High	Can become aggressive.
Koelreuteria paniculata	Goldenrain tree	30	30	Y	< 10	N	D	High	
Nyssa sylvatica	Black tupelo	30–50	20–30	N	19	N	D	High	
Pyrus calleryana cultivars	Callery pear	30–40	20–30	Y	722	N	D	Low	Weak-wooded, with short life-span.
Quercus robur 'Fastigiata'	Fastigate English oak	45	25	Y	35	N	D	Low	
Robinia pseudoacacia	Black locust	30–50	20–35	N	445	Y	D	High	Weedy, and aggressive; not ideal for street tree.
Sorbus aucuparia	European mountain ash	35	25	Y	< 10	N	D	Low	Invasive, recommend removing from Street Tree Listing.

Table C-3. Large Trees (Class III) on the City Street Tree Listing and Planted in the City.

Species	Common Name	Mature Height (feet)	Mature Width (feet)	Included on City Street Tree Listing? (Y or N)	Number of Trees Planted in the City	WA Native? (Y or N)	Evergreen (E)/ Deciduous (D)	Canopy Cover/ Stormwater Interception Benefits (Low, Med, High)	Recommendations/Concerns
Acer platanoides cultivars	Norway maple	40–50	35–50	Y	1099	N	D	High	Considered increasingly invasive in parts of WA. Plant with caution.
Acer saccharinum	Silver maple	50–70	30–50	N	309	N	D	High	Structural issues and prone to limb breakage.
Acer saccharum	Sugar maple	60–75	40–50	Y	207	N	D	High	
Calocedrus decurrents	Incense cedar	30–80	10–20	N	< 10	N	E	Very High	
Celtis occidentalis	Common hackberry	50	40	Y	64	N	D	High	Seed drop can be problematic near sidewalks.
Fraxinus americana cultivars	White ash	60–80	60–80	N	423	N	D	High	Emerald ash borer is an increasingly large insect issue in other parts of the country. The borer could decimate the entire ash population if it gets established in the city.
Fraxinus pennsylvanica	Green ash	50–70	35–50	Y	478	N	D	High	Emerald ash borer is an increasingly large insect issue in other parts of the country. The borer could decimate the entire ash population if it gets established in the city.
Gleditsia triacanthos var. inermis	Thornless honey locust	60–80	60–80	N	141	N	D	Medium-High	Tolerant of deer browse.
Picea pungens	Blue spruce	30–60	10–20	N	56	N	E	Very High	Requires irrigation in dry weather.
Pinus nigra	Austrian pine	50–60	20–40	N	24	N	E	Very High	Tolerant of deer browse.
Tilia cordata	Littleleaf linden	50–70	35–70	Y	237	N	D	High	

Table C-4. Very Large Trees (Class IV) on the City Street Tree Listing and Planted in the City.

Species	Common Name	Mature Height (feet)	Mature Width (feet)	Included on City Street Tree Listing? (Y or N)	Number of Trees Planted in the City	WA Native? (Y or N)	Evergreen (E)/ Deciduous (D)	Canopy Cover/ Stormwater Interception Benefits (Low, Med, High)	Recommendations/Concerns
Aesculus hippocastanum	Horse chestnut	50–75	40–65	N	24	N	D	High	Leaf blight is a big issue in some parts of the country. Considered an invasive in certain parts of Western WA.
Fagus grandifolia	American beech	50–80	40–80	Y	0	N	D	Medium-High	Does not typically grow well in urban settings.
Fagus sylvatica cultivars	European beech	50–60	35–45	Y	16	N	D	High	Low branching may require pruning near sidewalks.
Juglans nigra	Black walnut	75–100	75–100	N	50	N	D	High	Black walnut roots produce checmicals that are toxic to other plants (typically planted within the dripline). Messy nuts and allelopathic tendencies make it often unsuitable as a street tree.
Liquidambar styraciflua	American sweetgum	60–80	40–60	N	273	N	D	High	Tolerant of deer browse. Seed pods can be problematic near sidewalks.
Liriodendron tulipifera	Tuliptree	60–90	30–50	Y	25	N	D	High	Tolerant of deer browse. Prone to limb breaks.
Metasequoia glyptostroboides	Dawn redwood	70–100	15–25	N	10	N	D	Medium-High	Tolerant of deer browse. Loses needles in fall.
Pinus ponderosa	Ponderosa pine	60–125	25–30	N	89	Y	E	Very High	Large evergreen, native and well-adapted for the City. Tolerant of deer browse.
Pinus strobus	Eastern white pine	50–80	20–40	N	< 10	N	E	Very High	Tolerant of deer browse. Prone to a variety of diseases in areas with hot summers.
Platanus x acerifolia	London plane tree	75–100	60–75	Y	249	N	D	High	
Platanus occidentalis	American sycamore	75–100	75–100	N	146	N	D	High	Tolerant of deer browse.
Populus balsamifera	Black cottonwood	100	40	N	85	Y	D	High	Can be weak wooded.
Pseudotsuga menziesii	Douglas Fir	50–80	20–40	N	39	Y	E	Very High	Tolerant of deer browse. Prone to a variety of diseases in areas with hot summers.
Quercus macrocarpa	Bur oak	60–80	60–80	Y	63	N	D	High	Drought-tolerant once established.
Quercus rubra	Northern red oak	60–75	45–50	N	70	N	D	High	Drought-tolerant once established.
Sequoiadendron giganteum	Giant sequoia	60–200	25–60	N	< 10	N	E	Very High	Tolerant of deer browse. Prone to a variety of diseases in areas with hot summers.
Tilia americana c ultivars	American basswood	60–80	30–60	N	59	N	D	High	
Tilia tomentosa	Silver linden	50–70	30–50	Y	< 10	N	D	High	Tolerant of deer browse.
Thuja plicata	Western red cedar	50–70	20–30	N	31	Y	E	Very High	Tolerant of deer browse. Prone to a variety of diseases in areas with hot summers.
Ulmus americana	American elm	60–80	40–70	N	64	N	D	High	Susceptible to Dutch elm disease
Zelkova serrata	Japanese zelkova	50–80	50–80	Y	88	N	D	High	Used as a substitute for *Ulmus americana* , since it is resistant to Dutch elm disease.

APPENDIX B

Green Infrastructure and Urban Forestry Presentation to the Joint Water/Wastewater and Parks, Recreation and Urban Forestry Advisory Committee/Board

Green Infrastructure and Urban Forestry

Joint Water/Wastewater and Parks, Recreation and Urban Forestry Advisory Committee/Board Meeting
June 19, 2019

Presented by:
Andy Coleman
Kl Bealey

City of Walla Walla

Prepared by:
Rebecca Dugopolski
HERRERA

Purpose

Seeking a recommendation from each committee on the policy proposal for the Stormwater Utility to assist with funding an Urban Forestry Program

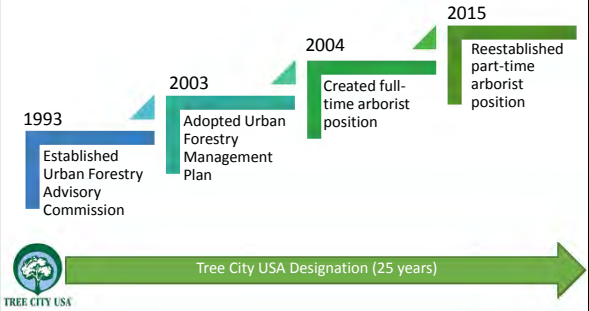
Urban Forestry

City Policies

- CC Policy 5.3 – Create a tree planting program
- ENR Policy 1.6 – Preserve and protect healthy mature trees
- PR Policy 1.3 – Provide adequate funding to support urban forestry programs and to maintain existing facilities

Urban Forestry

City Council Actions



Urban Forestry

Benefits of Street Trees

- Improve water quality
- Protect downstream areas from erosion, flooding, and property damage
- Improve air quality
- Reduce heat island effect
- Reduce energy usage
- Create and preserve habitat
- Increase property values
- Improve aesthetics

Urban Forestry

Benefits of Street Trees (cont.)

- A study in Spokane, WA showed:
  - Over $290,000 is saved annually in stormwater mitigation by rain interception and storage from 76,000 street trees
  - A typical tree can intercept an average of 760 gallons of water annually
- Rainfall intensity is 15% to 20% lower under a tree canopy area compared to an open area

URBAN FORESTRY

BENEFITS OF STREET TREES (CONT.)

- Walla Walla has 7,052 street trees
- An evaluation of 5 tree types in Walla Walla showed:
  - 54 to 947 gallons of annual avoided runoff volume per tree
  - 315 to 5,489 gallons of annual intercepted rainfall per tree

URBAN FORESTRY

MAINTENANCE PROGRAM

- Replenish mulch depth in tree wells
- Protect established trees and remove volunteer trees
- Trim trees and shrubs to alleviate motor vehicle sight distance restrictions
- Remove downed tree limbs/branches

URBAN FORESTRY

FUNDING NEEDS

Year	Salaries and Benefits (Arborist and Part Time)	Contractors	Equipment and Supplies (including replacement)	Other	Total Budget
2019	$110,670	$60,000	$75,000	$10,000	$255,670
2020	$115,494	$100,000	$16,000	$25,000	$256,494
2021	$118,970	$115,000	$16,000	$10,000	$259,970
2022	$122,540	$118,450	$16,000	$10,000	$266,990
2023	$126,230	$122,004	$16,000	$10,000	$274,234

URBAN FORESTRY

REGIONAL SUPPORT

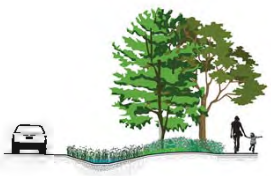
- Several Pacific Northwest jurisdictions recognize the importance of trees in relation to stormwater benefits and have designated a portion of their Stormwater Utility Fund to support urban tree and urban forest planning, planting, and management.

- Washington: Redmond, Vancouver, Tacoma, Kirkland, Longview, and Spokane
- Oregon: Gresham, Fairview, and Portland

GREEN INFRASTRUCTURE

BENEFITS

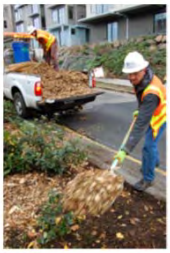
- Green infrastructure is designed to infiltrate, filter, and/or provide treatment
- Amended soils improve soil health and promote landscapes that require less water and maintenance
- Permeable pavement and vegetated roofs can reduce the heat island effect



GREEN INFRASTRUCTURE

MAINTENANCE

- Edge and trim
- Remove green waste, sediment build-up and debris
- Manage weeds and undesirable vegetation
- Replenish mulch
- Maintain/winterize irrigation systems



RECOMMENDATIONS

RECOMMENDED BUDGET: GREEN INFRASTRUCTURE AND STREET TREE MAINTENANCE

Year	Green Infrastructure Maintenance	Street Tree Maintenance	Recommended Budget Transfer from Stormwater Utility
2019	$83,034	$153,402	$236,436
2020	$87,121	$153,896	$241,017

~ 41 cents/month per ERU

~ 71 cents/month per ERU

~ $1.11/month per ERU

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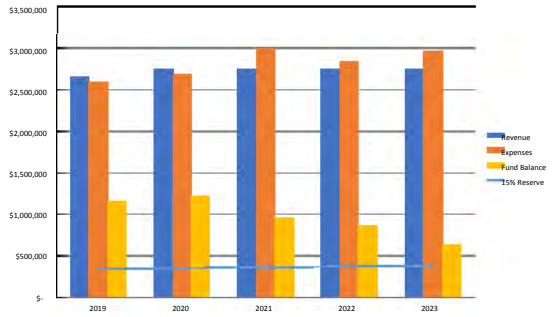
SUMMARY

STORMWATER FUND (W/ GIM AND URBAN FORESTRY)



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NEXT STEPS

1. **Recommendation** from both committees on the policy proposal of the Stormwater Utility assisting in funding an Urban Forestry Program
2. **Present** to City Council for consideration
3. **Prepare** an addendum to the Comprehensive Stormwater Management Plan
4. **Propose** minor revisions to the WWMC
5. **Provide** recommendations to the City's Street Tree Listing
6. **Review and update** rates in 2021

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