

# City of Yelm

## Stormwater Management Plan



April 2016

**Parametrix**

ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES



# Stormwater Management Plan

*Prepared for*

**City of Yelm**

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# 1. INTRODUCTION

## 1.1 Background and Overview

Rainfall that strikes the ground and travels across developed areas like roads, rooftops, sidewalks, lawns, and agricultural fields is known as stormwater runoff. This runoff can pick up and transport materials from these surfaces, such as oils, heavy metals, bacteria, pesticides, and other chemicals, and carry them to local receiving waters such as streams, lakes, wetlands, groundwater, and eventually into Puget Sound. These pollutants can contaminate water quality, drinking water supplies, and habitat, thereby endangering human populations, fish, and wildlife.

As urbanization of an area removes vegetation and adds more impervious surfaces (hard surfaces such as roads and rooftops), stormwater runoff volumes increase. Higher stormwater runoff volumes can damage the landscape and habitat by eroding soils and scouring streambeds (Ecology 2015).

The City of Yelm Public Works Department is responsible for implementing management practices and technologies to address stormwater-related issues throughout the city. The City's surface water management mission is to:

- Prepare, execute, and update a comprehensive plan to evaluate, measure, protect, design, fund, and prepare for current and future surface water needs.
- Proactively address the City's surface water needs to achieve and maintain an appropriate level of service for all existing and future customers and accommodate system growth and expansion.
- Use the most appropriate, technologically sound, and cost-effective stormwater solutions, including "green" stormwater infrastructure.
- Promote surface water protection measures that will protect, enhance, and restore habitat conditions and surface water and groundwater sources.
- Operate, inspect, maintain, and repair the City's existing stormwater infrastructure to provide continued effective operation.

### **City of Yelm Surface Water Management Vision**

A thriving, fully functional Surface Water Management program protecting the residents, nurturing the environment, and actively contributing to the pride of the city

## 1.2 Purpose

The City has developed this Stormwater Management Plan (SWMP) to address stormwater conveyance and pollutant control. This plan discusses these obligations by outlining the current stormwater management program at the City (which includes everything from staff activities to the physical drainage structures in the ground); identifying data, mapping, and activity gaps; and outlining a program to address those gaps. The developed program is intended to identify and prioritize necessary day-to-day operations, lay the groundwork for future improvements, and provide information to the public. This SWMP also describes a plan to generate a more complete map and data set of the existing stormwater system (the drainage system of catch basins, pipes, ditches, ponds, and vaults) by identifying immediate, mid-term, and long-term mapping needs. In addition to addressing water quality

### **Overall Goal**

Address stormwater conveyance and pollutant control obligations

issues, this SWMP identifies health and safety issues related to water resources and recommends measures for the preservation of environmental and aesthetic benefits to the community.

This document is intended to work in conjunction with the City's other municipal plans, including the Comprehensive Plan (City of Yelm 2009a), Vision Plan (City of Yelm 1995), Parks Plan (City of Yelm 2008, 2013) and Transportation Plan (City of Yelm 2009b).

## 1.3 Grant Source and State Requirements

In July 2014, the City was awarded funds from the Washington State Department of Ecology (Ecology) to complete the SWMP under the Water Quality Combined Financial Assistance Agreement WQC-2015-YelmPW-00040 (grant agreement). This SWMP is organized to generally follow the outline in the grant agreement, which includes elements based on Ecology's Municipal Stormwater General Permit (Permit; Ecology 2014a). Because Yelm is outside of the geographic area subject to the Permit, the City is not seeking coverage under the Permit.

## 1.4 Gap Analysis

A gap analysis of the existing stormwater management program and mapping data set was conducted to assess the City's current activities and planning needs. This SWMP is based on the findings of that gap analysis, which is presented in Appendix A.

### **The City of Yelm Comprehensive Plan includes goals that support water resource protection, such as:**

- Reducing the inappropriate conversion of undeveloped land into sprawling, low-density development
- Encouraging efficient multimodal transportation systems
- Encouraging the conservation of productive forest lands and productive agricultural lands, and discouraging incompatible uses
- Retaining open space, conserving fish and wildlife habitat, and increasing access to natural resource lands and waters
- Protecting the environment and enhancing the state's high quality of life, including water quality and supply
- Encouraging the involvement of citizens in the planning process
- Ensuring that public facilities and services necessary to support development are adequate

## 2. CURRENT STORMWATER MANAGEMENT PROGRAM

### 2.1 Service Area Overview

The City's stormwater system service area (Figure 1) serves a population of over 8,000 people and collects runoff from approximately 6 square miles (3,840 acres). The service area includes over 18 linear miles of streets, 23 acres of parks, and nearly 125,000 square feet of building rooftops (U.S. Census Bureau 2015; City of Yelm 2015). Land use zones in the city (Figure 2) include basic, heavy, and large lot commercial; central business district; industrial; institutional; master-planned community; parks; open space; and low-, moderate-, and high-density residential (City of Yelm 2009a). Soils in and around Yelm (Figure 3) are predominantly gravelly/stoney sandy loam, which is classified as hydrologic soil group A and considered to have a high rate of infiltration (low runoff potential) and water transmission when thoroughly wet (NRCS 2015).

### 2.2 Program Elements

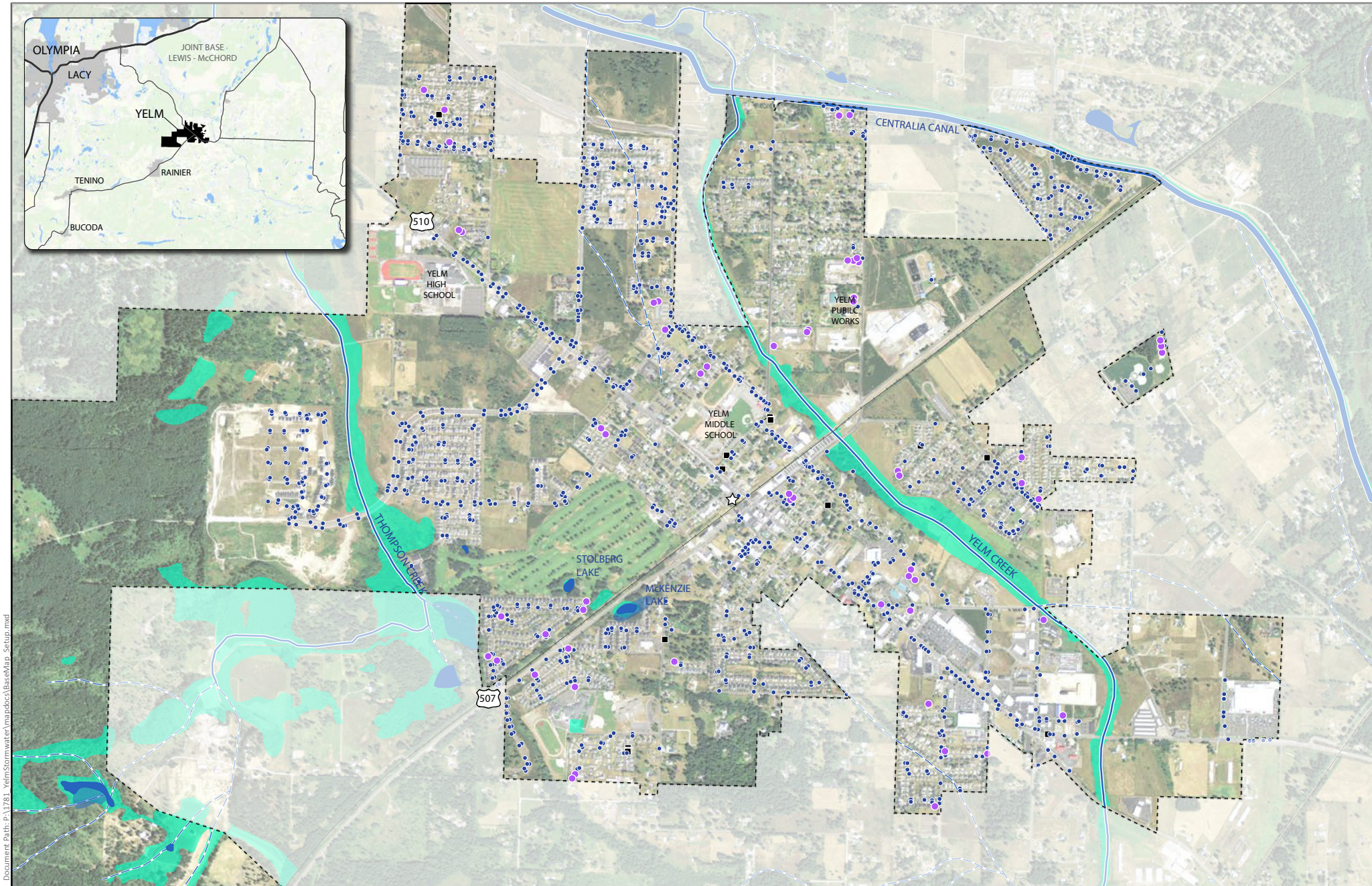
#### 2.2.1 Stormwater System

The City maintains a stormwater system (see Figure 1) consisting of catch basin inlets, conveyance pipes and ditches, flow control ponds and vaults, and water quality treatment facilities. Portions of the stormwater system discharge to surface receiving waters, including streams, marshes, and wetlands, while other portions of the system infiltrate water directly to the ground. The City does not have current mapping data for some components of the stormwater system, including over 50 privately-maintained systems. Mapping data needs are discussed further in Chapter 8.

#### 2.2.2 Stormwater Regulations and Guidance

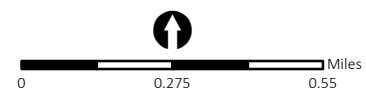
Municipal stormwater codes outline legal requirements for the planning and design of stormwater management practices and facilities, together referred to as Best Management Practices (BMPs). Municipal stormwater codes are often based on state or federal studies, guidance, and regulations that are supplemented to incorporate local needs. Stormwater design manuals outline additional technical guidance regarding planning and design of BMPs that may either be optional or required by municipal stormwater codes or permit requirements. In combination, municipal stormwater codes, permits, and design manuals establish a clear framework for the development community regarding expectations and practices for the management of stormwater runoff and protection of water quality and natural habitats. The City's municipal stormwater codes are listed in Table 2-1.





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Source: City of Yelm

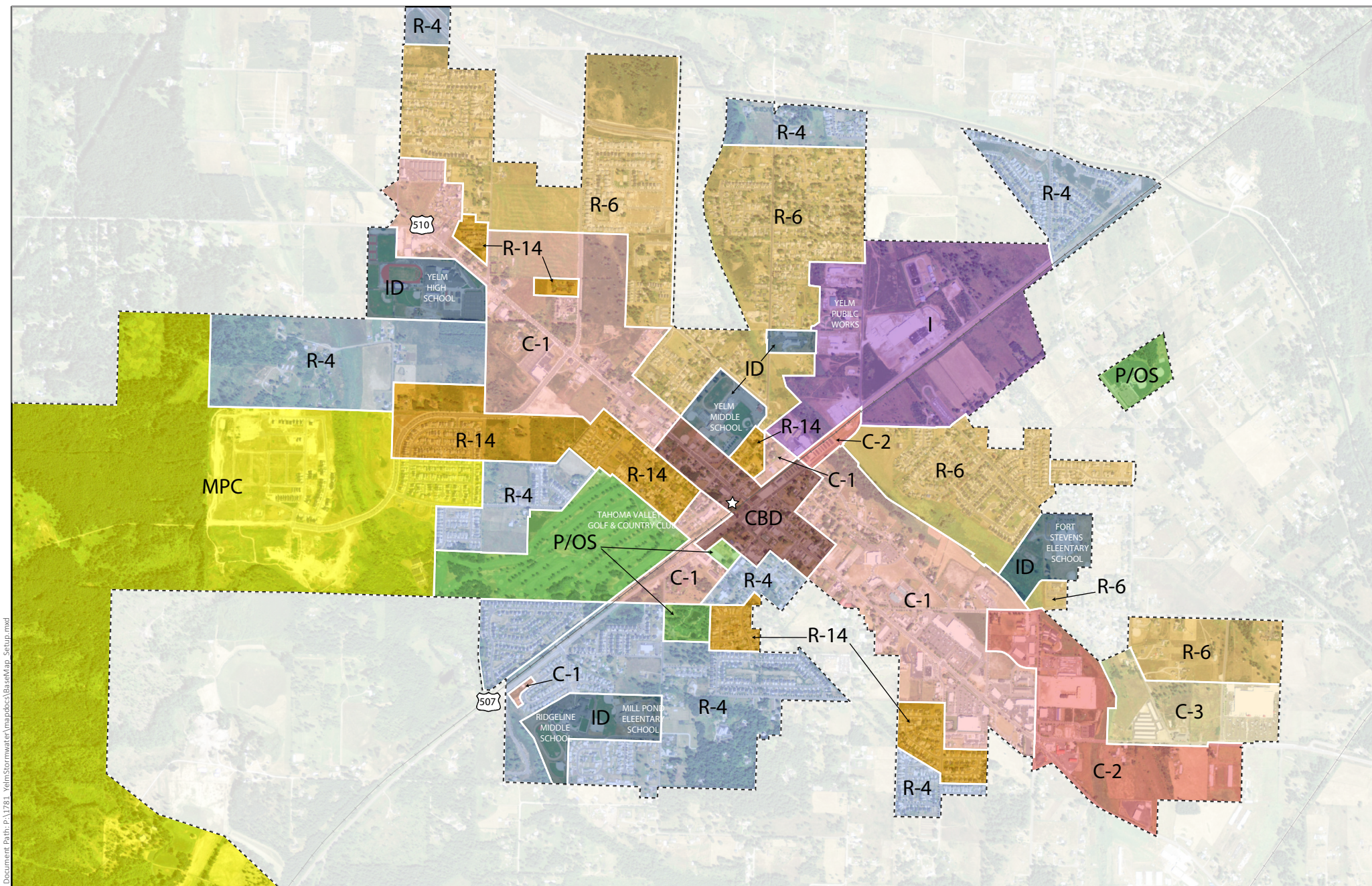
- Stormwater Catch Basin
- Stormwater Pond
- Stormwater Vault
- Perennial Stream
- - - Intermittent Stream
- Canal
- Lake
- Marsh
- Wetland
- ☆ City Hall
- - - City Limit

**FIGURE 1**  
Stormwater System

Stormwater Management Plan  
Yelm, WA



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- |                                 |                                |                                    |                  |
|---------------------------------|--------------------------------|------------------------------------|------------------|
| Commercial (C-1)                | Industrial (I)                 | Low Density Residential (R-4)      | ☆ City Hall      |
| Heavy Commercial (C-2)          | Industrial District (ID)       | Moderate Density Residential (R-6) | ----- City Limit |
| Large Lot Commercial (C-3)      | Master Planned Community (MPC) | High Density Residential (R-14)    |                  |
| Central Business District (CBD) | Parks / Open Space (P / OS)    |                                    |                  |

**FIGURE 2**  
Zoning  
Stormwater Management Plan  
Yelm, WA



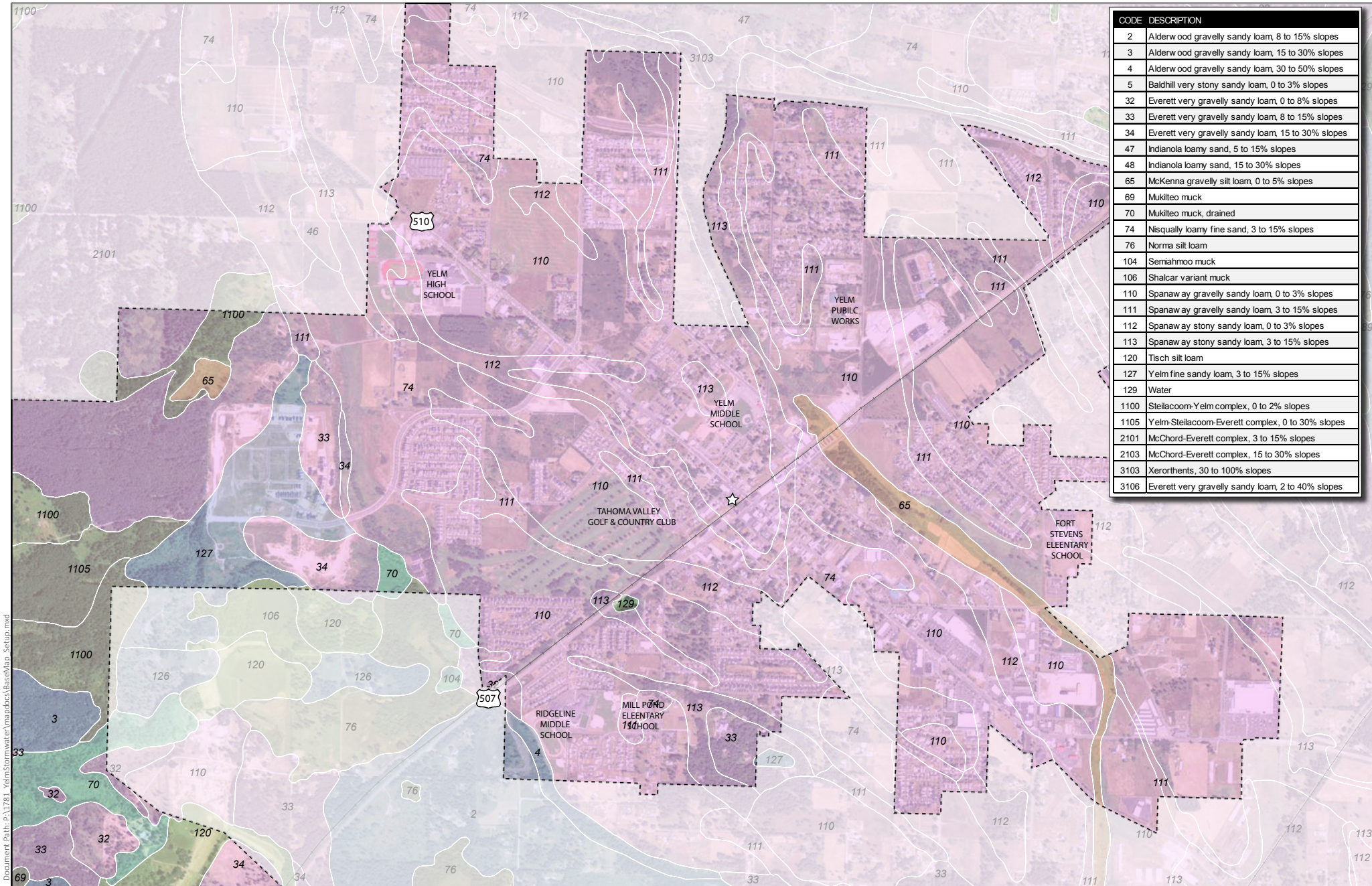


FIGURE 3

Soils

Stormwater Management Plan  
Yelm, WA

**Table 2-1. Municipal Stormwater Codes**

Yelm Municipal Code		
Title	Chapter	Elements
Title 13 – Water and Sewers	Chapter 13.10 – Stormwater System	Discusses development guidelines and utility charges related to stormwater
	Chapter 13.16 – Stormwater Management	Outlines stormwater management development thresholds, required permits, and required best management practices (BMPs). Adopts Ecology’s Stormwater Management Manual (Ecology 2014b) as the City’s official stormwater design manual. This chapter also prohibits illicit discharges (sanitary sewer connections, industrial process water, etc.) to the stormwater system.
	Chapter 13.20 – Stormwater Maintenance	Establishes inspection frequencies, access authority, and maintenance standards for public and private stormwater system components.
Title 18 – Unified Development Code	Chapter 18.27 – Stormwater Runoff	Addresses property protection; public health, safety and welfare; water quality degradation; aquifer protection; and fosters other beneficial public uses, including the use of low impact development strategies and technologies to the extent practicable.
	Chapter 18.28 – Engineering Specifications and Standard Details	Adopts the “Engineering Specifications and Standard Details, City of Yelm” document, which requires specific content for stormwater design drawings and specifications.
	Chapter 18.29 – Design Guidelines	Adopts the “Design Guidelines, City of Yelm” document, which provides both requirements and options guidance regarding size, placement, orientation, quality, and character of development components, including stormwater management features.

### 2.2.3 Utility and Fees

The Stormwater Utility is the portion of the City’s budget concerning the costs of managing stormwater and constructing or maintaining stormwater facilities. Stormwater utility fees are charges by the City to residents and businesses generally based on the residential rate category or a set impervious area.

The City’s storm water utility fee (Table 2-2) is a flat monthly rate for all developed single-family residential parcels, duplexes, multiple-family parcels, and condominiums. For other parcels, a sliding rate is used based on the percentage of impervious surface area on each parcel. Reductions in the rates are granted to qualifying senior citizens or permanently disabled heads of households. Annual revenues collected by the City’s Stormwater Utility are summarized in Table 2-3.

**Table 2-2. Stormwater Utility Fees**

Rate Category	Percent of Impervious Area	
	on Project Site	Monthly Service Charge per Unit/Gross Acre
Single-family or duplex	Not applicable	\$2.50 per unit
Multiple-family	Not applicable	\$1.25 per unit
Condominium	Not applicable	\$2.50 per unit
Commercial/ Industrial light	0 – 32%	\$4.00 base rate and \$1.00 per acre
Commercial/ Industrial moderate	33 – 66%	\$4.00 base rate and \$1.20 per acre
Commercial/ Industrial heavy	67 – 100%	\$4.00 base rate and \$1.40 per acre



**Table 2-3. Stormwater Utility Annual Revenues**

	2011	2012	2013	2014	2015 (Estimate)
Department of Ecology Grant	-	-	-	-	\$ 75,000
Stormwater Utility Fees	\$ 82,291	\$ 83,616	\$ 88,200	\$ 87,182	\$ 94,582
Department of Ecology Loan	-	-	-	-	\$ 25,000
Total Revenues	\$ 82,291	\$ 83,616.00	\$ 88,200	\$ 87,182	\$ 194,582

Source: City of Yelm 2014.

## 2.3 Department Responsibilities

### 2.3.1 Responsibilities of City

The City of Yelm is governed by the City Council and led by the Mayor as the chief executive and administrative officer of the City. The Mayor's office enforces laws, directs daily operations of the City government, prepares the budget, and implements the policies and programs initiated by the City Council. In addition, the Mayor directs and coordinates City departments, appoints all department directors, and authorizes all other personnel positions. The City is responsible for providing services, protecting the welfare of its citizens, and having the departments implement these services, as described below.

### 2.3.2 Public Works Department

Public Works is the largest department within the City of Yelm's municipal organization. In addition to overseeing stormwater management, this department also manages transportation facilities, drinking water facilities, sewer services, parks, animal control, and capital projects.

The Public Works stormwater staff manage and maintain the stormwater system. Typical activities include cleaning pipes and drains, removing sediment from ditches and ponds, cutting tree roots out of pipes, and using a video camera to inspect underground pipes to assess their condition. Public Works staff address a range of drainage issues, from fixing small drainage problems by moving or installing new catch basins to fixing larger drainage problems through Capital Improvement Projects. The staff also conduct stormwater-related permit application reviews in conjunction with the Community Development Department.

### 2.3.3 Community Development Department

The Community Development Department is responsible for comprehensive planning and implementation of adopted regulations, including review and implementation of stormwater codes. The department implements the stormwater codes through design review, design permit compliance assistance, and construction review and inspection.

### 2.3.4 Maintenance Staff

City maintenance staff are responsible for keeping the stormwater system's pipes, ditches, catch basins, and ponds maintained and working properly. Typical maintenance work includes cleaning pipes and drains; removing sediment from ditches and ponds; cutting tree roots out of pipes; fixing small drainage problems by moving or installing new catch basins; fixing larger drainage problems through Capital

Improvement Projects; and using a video camera to inspect underground pipes to assess their condition. Chapter 7 provides details on these inspection, cleaning, and repair activities, including frequency of activities.

## 2.4 Next Steps and Future Planning

This SWMP will serve as a foundation upon which the City will add more elements and update as the stormwater management program evolves. The following chapters outline stormwater management program elements that the City will focus on.

Based on the elements discussed in the following chapters, the City plans to develop the following stormwater program components, as time and funding allows:

- An evaluation system for assessing the condition of the stormwater system,
- An asset registry,
- A capital improvement plan,
- A stormwater management program rate analysis, and
- Additional system mapping data.

This program analysis does not assess a timeline or the resources needed to address the updates identified for the stormwater management program. Additional evaluation would be required to determine:

1. The timeline in which all identified planned program activities could be achieved with currently available staff and funding resources; or
2. Additional staff and funding resources needed to achieve all identified planned program activities within a desired timeline.

## 2.5 Capital Projects

The City held an internal staff workshop with Public Works operations crews to discuss the current stormwater system condition, identify known problems, and initiate conceptual surface water capital project planning. Known problems and concept resolution projects are presented in Appendix B.





### 3. PUBLIC EDUCATION AND OUTREACH

**City Goal:**

To expand public awareness of water quality and stormwater pollution prevention and encourage public participation in stewardship activities.

The public plays an important role in maintaining a functional stormwater system and healthy natural receiving waters. A public education and outreach program provides target groups, such as the public, businesses, engineers, contractors, developers, and land use planners, with the knowledge and tools necessary to avoid activities that may have adverse impacts on stormwater. This chapter discusses the City's current and planned public education and outreach efforts. Priorities are shown in Table 3-1.

#### 3.1 Current Activities

##### Information on City Website

The primary tool the City currently uses for public stormwater education is the City's website. The Public Works Department Stormwater and Surface Water website describes stormwater and its infrastructure, and explains what type of maintenance the City performs on its facilities. The page also provides links to information on current engineering and development standards, and current stormwater and surface water-related projects. A link to Ecology's Stormwater Permits website provides further regulatory information.

**City of Yelm Stormwater and Surface Water**  
<http://www.ci.yelm.wa.us/stormwater/>

##### Compliance Assistance for Project Design

The public can access numerous documents through the City's website, including support and guidance documents for the design and implementation of stormwater systems. Weblinks to the Yelm Municipal Code stormwater management regulations, Development Guidelines, and Design Guidelines are also included on the City's website.

## 3.2 Planned Activities

### 3.2.1 High Priority Activities

#### Target Instructions to Businesses

Educating the businesses in Yelm about their role in protecting stormwater quality is considered a high priority. Many businesses store and use hazardous substances on site that could become a point source of pollution if not managed properly. It is important for all businesses to understand the negative effects these substances could have if they were accidentally released into the stormwater system.

The City could provide general educational materials to all businesses regarding common commercial activities that pose a risk, such as the use of a dumpster. In addition, the City could provide more targeted education materials depending on the business and potential pollutant source. The City would first identify key stormwater pollutants, such as automotive chemicals, car wash soaps, cleaning supplies, wood finish and paint, dry cleaning chemicals, cooking grease, and pesticides and fertilizers. The City would then focus on educating the specific businesses associated with these pollutants.

However, while educating target businesses is a high priority action, it cannot be achieved if the City does not have relevant educational materials. Therefore, the prerequisite for beginning this task is collection of materials and handouts to distribute, or working with Ecology and other entities that have already developed this information. The steps required to achieve this objective are discussed in Section 3.2.3.

#### Compliance Assistance for Project Design

Another high priority is assisting businesses and developers in understanding and complying with design requirements. Although the City currently has many documents available to provide guidance in complying with stormwater municipal codes, the City intends to achieve a more clear and unified presentation of these materials to the development community.

### 3.2.2 Medium Priority Activities

#### Proactive Messaging

The City's website provides a centralized location for educational material, but it cannot be assumed that all of the residents and business will visit the page. Increased proactive messaging, such as sending informational fliers with customer utility bills or placing advertisements on buses, has been identified as a medium priority.

#### Public Meetings

Public meetings, such as workshops and City Council meetings, are effective venues to present upcoming projects and initiatives to residents, businesses, and developers in Yelm. These meetings can

Table 3-1. Public Education and Outreach Priorities

SWMP Component	Priority High (1) to Low (3)
Target Instructions to Businesses	1
Compliance Assistance for Project Design	1
Proactive Messaging	2
Public Meetings	2
Public School Curriculum	2
Educational Materials for Distribution	3
Information on City Website	3
Tracking Impacts on Selected Target Group	3

also provide a forum to receive public feedback, as explained in Chapter 4. Increased use of public meetings by the Public Works stormwater staff has been identified as medium priority.

### Public School Curriculum

To promote a healthy stormwater system for the future, educating the next generation of stormwater system users is important. This can be achieved by providing Yelm's public schools with stormwater-related curriculum, which has been identified as medium priority. The City would make use of the many existing stormwater curriculum resources currently available. For example, the Nisqually River Education Project is a local watershed program that provides opportunities for schools to participate in educational activities geared towards protecting and enhancing the water quality and salmon habitat of the Nisqually River watershed. South Sound GREEN, a part of the Thurston Conservation District, is another local watershed education program that provides watershed education for Thurston County teachers and students. An additional list of national school curriculum resources is available in Appendix C.

#### **South Sound GREEN**

<http://www.thurstoncd.com/south-sound-green.html>

## 3.2.3 Low Priority Activities

### Educational Materials for Distribution

The City would distribute public education materials by using existing fliers and handouts currently available from various government agencies. For example, the Ecology website has several municipal public education and outreach materials available for public use, including examples from Thurston County and the Cities of Lacey, Olympia, and Tumwater. Examples of available resources include:

- Stormwater pollution brochure
- Poster highlighting proper disposal of restaurant greases and oils
- Auto shop poster
- Pet waste flier
- Yard care video
- Car wash kit demonstration video

### Information on City Website

Enhancing the City's website to provide more public stormwater information has been identified as a low priority. However, the City must maintain the site and ensure it is up-to-date with new educational materials and planning documents that are adopted throughout this process. The City may also choose to include additional links to the Ecology website on their Storm and Surface Water page, specifically the Public Education and Outreach site described in the previous section.

#### **Department of Ecology Public Education**

<http://www.ecy.wa.gov/programs/wq/stormwater/municipal/resources/PERMITTEproducts.html>

### Tracking Impacts on Selected Target Group

Tracking changes in public behaviors that prevent pollution and protect natural waters would help the City measure the effectiveness of the Public Education and Outreach program, but this is a low priority.

The City could generate survey questions for a selected target group regarding key elements and knowledge of water quality issues. The City would first pose these questions to the public before investing in the additional public education measures addressed above. The survey could be distributed to the utility customers with a monthly bill or via social media. Once educational activities have been implemented, the City would reissue the same survey. Results of the surveys will help the City to gauge if the selected public education measures are effective. In addition, the City would establish a system to organize and maintain records of public education and outreach activities so they can be easily accessed and referenced.

### Potential Future Activities

In the future, the City may initiate stewardship activities as another means for educating the public and getting the community involved, such as site trash clean-ups, assistance with planting at stormwater management sites, or catch basin stenciling.

The City may also choose to join Stormwater Outreach for Regional Municipalities (STORM). STORM comprises 83 cities and counties in the Puget Sound area who collaborate to effectively address their education and outreach requirements.

## 4. PUBLIC INVOLVEMENT

### City Goal:

Provide opportunities for the public to participate in the decision-making processes involving the City's stormwater management program.

Public involvement encourages those invested in the success of Yelm to provide feedback on the existing and future stormwater management program. This could be a formal approach, such as an advisory council, or as simple as a concerned citizen sending a comment through the City's website. This chapter describes opportunities the City currently provides for the public to get involved in the decision making process for the stormwater utility and outlines planned activities to increase that involvement. Priorities are shown in Table 4-1.

Table 4-1. Public Involvement Priorities

SWMP Component	Priority High (1) to Low (3)
Public SWMP Workshops	2
Participation in City Council Meetings	2
Public Access to Stormwater-Related Documents	3
Path to Receive Public Complaints/Questions/Comments	Achieved

### 4.1 Current Activities

City of Yelm residents take great pride in their city, and their input has helped to shape the community into what it is today. Current opportunities for public involvement are discussed below.

#### Participation in City Council Meetings

City Council meetings are held every second and fourth Tuesday at the Public Safety Building. The date, time, and location of these meetings are advertised on the City's website. The public is invited to attend all meetings, and each meeting includes time at the beginning for public comments, questions, or concerns.

The Public Works Department also occasionally participates in Council Study Sessions, which occur once a month. The Study Session is an opportunity to keep the Council involved and well-informed on a given topic. This helps to facilitate the approval process for decisions, projects, or policy changes that must be adopted by the City Council. The Study Session also serves as a venue for Public Works to give presentations or status updates on the program and existing projects.

#### Public Access to Stormwater-Related Documents

The City's website is a resource for the public to access a wide range of City documents relating to stormwater management. The Document Library has links to numerous planning documents, such as Comprehensive and Utility Planning Reports and the City budget. The Unified Development Code, Development Guidelines, and Design Guidelines have stormwater-related components, and are also accessible through the Document Library. With the ability to access these documents, the public is able to comment on them and related stormwater activities in Yelm.

#### Paths to Receive Public Complaints/Questions/Comments

City Council meetings are one avenue for the public to voice their complaints, questions, or comments. In addition, the City's website provides a link to send comments to the Mayor, as well as an electronic Citizen Comments form under the Popular Pages text box that appears on the majority of the

department's web pages. Also, the telephone number and email address for the Public Works Department is included on the Stormwater and Surface Water page.

## 4.2 Planned Activities

### 4.2.1 High Priority Activities

No high-priority public involvement activities have been identified at this time.

### 4.2.2 Medium Priority Activities

#### Public SWMP Workshops

As the City continues to develop the stormwater management program, it is important to provide opportunities for the public to contribute input. As a medium priority, the City would hold public workshops to solicit input from City staff, local residents, and elected officials regarding needs and priorities for addressing drainage, water quality, and habitat concerns within Yelm. This input would be used to identify and prioritize existing surface water issues, potential capital projects, staffing needs, maintenance effectiveness, pollution sources, and public awareness.

#### Participation in City Council Meetings

City Council meetings are an established avenue for the public to hear what is going on in their city and provide feedback. Continued contribution to City Council meetings by Public Works with increased focus on the stormwater management program has been identified as a medium-priority need. The City Council is responsible for approving projects and rate increases, as well as setting policies and budgets; therefore, involving the council early and often would be important to the success of the Stormwater and Surface Water Utility.

### 4.2.3 Low Priority Activities

#### Public Access to Stormwater-Related Documents

In addition to the stormwater-related documents currently available on the City's website, inclusion of this SWMP has been identified as a need, which is low priority. The City would also make hardcopies of this SWMP available to the public upon request.

## 5. ILLICIT DISCHARGE DETECTION AND ELIMINATION

### Goal:

Prevent, detect, characterize, trace, and eliminate illicit connections and illicit discharges into the municipal stormwater system.

This chapter discusses prevention and management of illicit discharges to the stormwater system. Illicit discharges are any discharges to the separated stormwater system not considered stormwater runoff, such as car wash water, industrial process water, or sewage. Illicit connections are unintended or illegal infrastructure connections and often originate from sources such as sanitary sewer connections or interior floor drains (40 Code of Federal Regulations [CFR] 122.26(b)(2)). Priorities are shown in Table 5-1.

Mapping to support the illicit discharge detection and elimination program is discussed in Chapter 8.

### 5.1 Current Activities

#### Regulatory Prohibition of Non-Stormwater Discharges

Chapter 13.16 of the Yelm Municipal Code specifically defines and prohibits illicit discharges to the stormwater system, and outlines escalating enforcement procedures and actions for code violations.

#### Field Screening and Enforcement

Public Works maintenance crews currently perform general inspections of stormwater catch basins, ditches, and stormwater ponds. These inspections are general and could potentially detect the presence of an illicit connection or discharge, although they are not specifically targeted toward those activities.

Table 5-1. Illicit Discharge Detection and Elimination Priorities

SWMP Component	Priority High (1) to Low (3)
Field Screening and Enforcement	1
Staff Training	1
Response Plan	1
Recordkeeping	2
Tracking Annual Illicit Discharges Discovered	3
Regulatory Prohibition of Non-Stormwater Discharges	Achieved
Mechanism for Public Reports of Spills	Achieved



## Mechanism for Public Reports of Spills

The City has established pathways to receive public reports of spills to the stormwater system or surface water bodies. The City's website has links to staff telephone numbers and an electronic citizen comment form. In addition, the Public Works Stormwater and Surface Water web page provides instructions on reporting spills, including an observation checklist and telephone and email contact information.

## Response Plan

Public Works staff investigate and respond to observed and reported spills and other illicit discharges to the stormwater system, but the City does not have a formal procedure for response and cleanup.

## Recordkeeping

Public Works keeps records of stormwater facility inspections and responses to reports of illicit discharges, but does not specifically track illicit discharge detection, enforcement, and response activity on an annual basis.

### Checklist for Reporting a Spill

Location

Time/date

Source, if known

Flow direction

How does the water look; is there a sheen?

Do you observe any dead fish?

Are there any odors?

Are there any other witnesses?

Take photographs

About taking samples: DON'T! Be careful - safety first! Do not attempt anything dangerous. Do not sample unknown liquids.

To report a spill, please call Public Works at 360-458-8406 or by email at [pwd@ci.yelm.wa.us](mailto:pwd@ci.yelm.wa.us).

## 5.2 Planned Activities

### 5.2.1 High Priority Activities

#### Field Screening and Enforcement

The Public Works staff currently conduct some stormwater system inspections, but formal and systematic procedures for conducting stormwater system investigations, including field screening and identifying potential sources, have been identified as high priority. A formal program would potentially add the following activities to current program elements:

- Assess availability of field staff
- Conduct desktop assessments of stormwater system, including systematic review of existing mapping
- Establish contracts for laboratory analysis
- Conduct outfall reconnaissance
- Develop an indicator monitoring strategy to identify the presence of non-stormwater flows
- Implement compliance strategies and enforcement actions authorized by the Yelm Municipal Code
- Develop documentation and communication procedures, such as form letters and processing deadlines, for corrective actions

Where possible, the City would make use of existing resources when developing these procedures, such as:

- The Illicit Discharge Detection and Elimination guide (Center for Watershed Protection 2004)
- Ecology's Source Identification Information Repository (SIDIR) website, which identifies opportunities for regional solutions to common illicit discharges and pollution problems.

**SIDIR Website**

<http://www.ecy.wa.gov/programs/wq/stormwater/municipal/rsmp/source.html>

## Staff Training

Training staff who are responsible for identification, investigation, termination, cleanup, and reporting of illicit discharges is considered high priority. An ongoing training program could have different levels of focus. General illicit discharge detection training could be provided to all City field staff, who, as part of their normal job responsibilities, might come into contact with or otherwise observe an illicit discharge or illicit connection to the stormwater system. More detailed training would be provided to staff responsible for confirming, assessing, and responding to illicit discharges and illicit connections. On-going training would be provided as needed to address changes in procedures, techniques, requirements, or staffing. The City would document and maintain records of the training provided and the staff trained.

## Response Plan

The City does not currently have a formal spill response plan that includes coordination with a qualified spill responder, which would include response to illicit discharges and illicit connections into the stormwater system. Development of a response plan is considered high priority.

### 5.2.2 Medium Priority Activities

No medium priorities have been identified for the City's illicit discharge detection and elimination program.

### 5.2.3 Low Priority Activities

#### Recordkeeping

Public Works staff currently document and track inspections conducted of the stormwater system components; additional illicit discharge detection and elimination activities would be added to the current recordkeeping system. Some improvements to the recordkeeping procedures, such as upgrading from hardcopy records to an electronic, searchable database, would increase efficiency and search capabilities. However, upgrades to the recordkeeping program are considered low priority.

#### Tracking Annual Illicit Discharges Discovered

Tracking the number of illicit discharges discovered and addressed over time would assist the City in assessing the effectiveness of illicit discharge prevention activities and evaluating staff needs and resources. However, until other elements of the program are more firmly established, tracking of the illicit discharge program is considered low priority.



## 6. CONTROLLING RUNOFF FROM NEW DEVELOPMENT, REDEVELOPMENT, AND CONSTRUCTION SITES

### Goal:

Reduce stormwater runoff pollutants from new private and public development, redevelopment, and construction site activities.

This chapter describes the City's program and future plans for reducing pollutants in runoff draining to the stormwater system from new development, redevelopment, and construction site activities. The overall program applies to private and public development, including roads and residential developments. Long-term facility inspection and maintenance discussed in this chapter applies to privately owned stormwater facilities, while operation and maintenance of City-owned facilities is discussed in the next chapter. Priorities are shown in Table-6-1.

### 6.1 Current Activities

#### Runoff Control Regulations and Enforcement

Chapter 13.10 of the Yelm Municipal Code establishes development guidelines for projects that add to or modify the stormwater system. Chapter 13.16 of the Yelm Municipal Code establishes the minimum level of compliance for stormwater management of new development, redevelopment, and construction activities within Yelm. This chapter adopts the latest version of Ecology's Stormwater Management Manual (Ecology 2014b) and outlines minimum requirements, inspection, and enforcement provisions. Chapter 13.20 of the Yelm Municipal Code establishes stormwater maintenance requirements applicable to both City-owned and privately owned facilities. This chapter includes provisions for inspection of all facilities by City staff and enforcement of maintenance standards.

Table 6-1. Controlling Runoff Priorities

SWMP Component	Priority High (1) to Low (3)
Construction Inspections	1
Low Impact Development Regulatory Review	2
Recordkeeping	2
Staff Training	2
Permitting Process and Plan Review	2
Privately-Owned Facility Inspections	3
Ensuring Privately-Owned Facility Maintenance	3
Zoning Review with Planning Department	3
Runoff Control Regulations and Enforcement	Achieved

#### Permitting Process and Plan Review

The Community Development Department implements the City's permitting process, including site plan review, inspection, and enforcement of the standards established by the Yelm Municipal Code. The Community Development Department collaborates with the Public Works Department on plan reviews and site inspections as necessary.

#### Staff Training

The Public Works Department currently provides as-needed training to staff responsible for inspection of stormwater facilities in the city.

## Construction Inspections

The Community Development Department conducts construction site inspection in cooperation with the Public Works Department as part of the City's permitting process.

## Privately Owned Facility Inspections

Public Works staff currently perform inspections of privately owned treatment and flow-control facilities, such as stormwater ponds and vaults, on a minimal basis or will perform inspections upon request of the property owner(s), homeowners' association representatives, or designees.

## Ensuring Privately Owned Facility Maintenance

When an inspection of a privately owned stormwater management facility identifies the need for maintenance, Public Works staff follow up with the facility owner to make sure that the maintenance is performed.

## Recordkeeping

The Public Works Department currently maintains hardcopy records of construction site and privately owned facility inspections and enforcement actions by staff, including inspection reports, warning letters, notices of violations, and other enforcement records.

## Zoning Review with Planning Department

The Public Works Department has collaborated with the Community Development Department in the past regarding land use zoning boundaries within the city.

# 6.2 Planned Activities

## 6.2.1 High Priority Activities

### Construction Inspections

Improvement of the City's construction site inspection program has been identified as high priority. Enhancements to the program could include:

1. Provide notice, before clearing and construction begin, that construction is about to start followed by pre-inspection to confirm that all proper controls are in place and, if required, stormwater sampling plans have been developed
2. Conduct periodic inspection of all permitted development sites during construction to verify proper installation and maintenance of required erosion and sediment controls and proper conduct of any required construction stormwater quality sampling
3. Inspect all permitted development sites upon completion of construction and prior to final approval or occupancy to ensure proper installation of permanent stormwater facilities
4. Verify that a maintenance plan is completed and responsibility for maintenance is assigned for stormwater treatment and flow control BMPs and facilities
5. Inspect all permanent stormwater treatment and flow control facilities in new residential developments every 6 months until 90 percent of the lots are constructed (or when construction

is stopped and the site is fully stabilized) to identify maintenance needs and enforce compliance with maintenance standards as needed

6. Initiate enforcement actions as necessary based on the above inspections

## 6.2.2 Medium Priority Activities

### Low Impact Development Regulatory Review

As discussed in Chapter 2, soils in and around Yelm (see Figure 3) are predominantly classified as hydrologic soil group A, which is considered to have a high potential for runoff infiltration (NRCS 2015). Soils of these types are good candidates for the application of low impact development approaches. Historically, however, provisions of municipal codes have often been found to unintentionally limit the application of low impact development approaches to stormwater management. For example, planter strip widths might be set at a maximum width that does not adequately allow for the addition of a bioinfiltration swale. Therefore, review and revision of the Yelm Municipal Code for compatibility with low impact development approaches has been identified as medium priority.

The code update could include the following types of provisions:

- Minimization of impervious surfaces
- Preservation of native vegetation
- Other measures to minimize stormwater runoff, such as infiltration where appropriate
- Finding and removing code barriers to applying low-impact approaches

Where possible, the City would make use of existing resource guides, such as Integrating LID into Local Codes: A Guidebook for Local Governments (Puget Sound Partnership 2012).

### Recordkeeping

The Public Works Department currently maintains hardcopy records of construction site and privately owned facility inspections and enforcement actions by staff; however, improvement to the recordkeeping procedures has been identified as medium priority. Inspection recordkeeping improvements could include upgrading from hardcopy records to an electronic, searchable database. Use of an electronic database could increase efficiency, search capabilities, and identification of maintenance needs, as well as support more timely enforcement actions.

### Staff Training

In addition to the as-needed staff training provided by the Public Works Department, development of a formal training program for stormwater staff is considered medium priority. The training program could have different components focusing on staff responsible for permitting, plan review, construction site inspections, privately owned facility inspections, or enforcement. A baseline training could be provided to new staff, with annual (or more frequent, as needed) follow-up training provided to address changes in procedures, techniques, requirements, or staffing. The City would document and maintain records of the training provided and the staff trained.

### Permitting Process and Plan Review

Development of a more formal process through which the Community Development Department collaborates with the Public Works Department on plan reviews and site inspections has been identified as medium priority. The process could include identification of specific types of projects or permit

applications that would always need to be reviewed by a Public Works stormwater staff member, and designated Public Works inspectors for construction and permanent stormwater management facilities.

### 6.2.3 Low Priority Activities

#### Privately-Owned Facility Inspections

Increasing the frequency and regularity of privately owned stormwater management facility inspections has been identified as a program gap, but is considered low priority.

#### Ensuring Privately-Owned Facility Maintenance

Increasing the enforcement of maintaining privately owned stormwater management facilities has been identified as a program gap, but is considered low priority.

#### Zoning Review with Planning Department

A formal and systematic review of the zoning within Yelm by the Public Works Department in cooperation with the Community Development Department could provide the following benefits to the stormwater management program:

- Identify priority future growth areas that could be served by regional stormwater facilities
- Prioritize retrofit and infill areas to identify sub-regional stormwater facilities and retrofit projects or incentives for stormwater controls to encourage infill and redevelopment
- Facilitate municipal code updates matching appropriate localized BMP requirements with specific land uses based on zones
- Identify barriers in the code to low impact development

A zoning review has been identified as low priority.



## 7. OPERATIONS AND MAINTENANCE

### Goal:

Prevent or reduce pollutant runoff from municipal operations.

This section describes the City's current activities and future plans for preventing or reducing pollutant runoff from municipal operations, including long-term maintenance of City-owned stormwater management facilities. Priorities are shown in Table 7-1.

**Table 7-1. Operations and Maintenance Priorities**

SWMP Component	Priority High (1) to Low (3)
City-Owned Catch Basin and Conveyance System Inspections	1
City-Owned Facility Inspections	1
Source Control Practices, Policies, and Procedures	1
City-Owned Facility Maintenance	1
Tracking Facility Inspections and Maintenance Response	2
Municipal Stormwater Pollution Prevention Plans	2
Staff Training	2
Long-Term Operation and Maintenance Plans	2
Recordkeeping	2
Adopt Maintenance Standards	Achieved

### 7.1 Current Activities

#### Adopt Maintenance Standards

Chapter 13.20 of the Yelm Municipal Code establishes stormwater maintenance requirements applicable to both City-owned and privately owned facilities. This chapter includes provisions for inspection of all facilities by City staff and enforcement of maintenance standards.

#### Source Control Practices, Policies, and Procedures

The City currently implements practices, policies, and procedures to reduce pollutants in stormwater runoff from City-owned properties such as streets, parking lots, buildings, parks, open spaces, maintenance yards, and stormwater treatment and flow control facilities. These activities include:

- Cleaning pipes and drains
- Removing sediment from ditches and ponds
- Cutting tree roots out of pipes
- Installing or relocating utilities
- Managing trash and pet waste
- Conducting building exterior cleaning and maintenance
- Cleaning streets
- Repairing and resurfacing roads, including pavement grinding
- Maintaining roadside areas, including vegetation management
- Controlling dust
- Managing snow and ice conditions
- Controlling sedimentation and erosion
- Ensuring controlled use of fertilizers, pesticides, and herbicides to minimize environmental impacts
- Conducting landscape maintenance and vegetation disposal

## Municipal Stormwater Pollution Prevention Plans

The Public Works Department has developed Stormwater Pollution Prevention Plans for some municipal operations that may generate stormwater pollutants, such as heavy equipment maintenance or storage yards, and material storage facilities.

## Long-Term Operation and Maintenance Plans

Long-term operation and maintenance plans provide a centralized record of activities needed to keep stormwater system components and BMPs operating properly. These plans can be as robust as multi-volume reports or as simple as single-page checklists. The Public Works Department currently has some stormwater system operation and maintenance plans in place.

## City-Owned Catch Basin and Conveyance System Inspections

Public Works maintenance crews currently perform periodic inspections of City-owned catch basins and conveyance system components.

## City-Owned Facility Inspections

Public Works maintenance crews currently perform general inspections of City-owned stormwater treatment and flow control facilities.

## City-Owned Facility Maintenance

Public Works includes stormwater maintenance activities in its annual budget and allocates as many staff and resources to maintenance as possible. However, the current level of resources available for maintenance does not consistently meet all stormwater system needs.

## Staff Training

Public Works currently provides as-needed training for staff responsible for operation and maintenance of stormwater system components in Yelm.

## Recordkeeping

Public Works currently maintains hardcopy records of inspections and maintenance or repair activities conducted on stormwater system components.

# 7.2 Planned Activities

## 7.2.1 High Priority Activities

### City-Owned Catch Basin and Conveyance System Inspections

Increasing the frequency and regularity of inspections of City-owned catch basins and conveyance systems has been identified as high priority. The City would potentially try to reach a goal of inspecting 25 percent of the catch basins within a drainage sub-basin at least once every 2 years to identify maintenance needs. The City would then conduct cleaning of the catch basins within the immediate drainage area as indicated by inspection results.

## City-Owned Facility Inspections

Public Works staff currently conduct some stormwater system inspections, but development of formal and systematic procedures for conducting inspections has been identified as high priority. A formal program would potentially add the following types of activities for inspecting City-owned facilities:

- Assess the resources needed to conduct additional inspections and availability of existing resources and field staff
- Conduct desktop assessments of the stormwater system, including systematic review of existing mapping
- Develop a plan for maintenance or repair response to inspection findings
- Conduct visual spot checks of potentially damaged permanent stormwater treatment and flow control facilities after major storm events
- Identify future sites for further water quality assessment
- Reach a goal of achieving at least 95 percent of facilities inspected annually

## Source Control Practices, Policies, and Procedures

Improving the consistency and expanding the pollutant-reduction measures that the City currently implements for City-owned lands have been identified as high priority. Improvements could include expanding the areas in which the measures are implemented; increasing the frequency in which source control practices are conducted; developing more formal documentation of practices that are already in place; and establishing specific policies regarding the prioritization, delegation, or implementation of source control activities.

## City-Owned Facility Maintenance

The Public Works Department includes stormwater maintenance activities in its annual budget and allocates as many staff and resources to maintenance as possible. While the current level of resources available for maintenance meets minimum obligations, the City would like to improve the operation of the stormwater system by increasing the level of maintenance provided. Therefore, increasing the frequency and extent of stormwater maintenance activities has been identified as high priority.

### 7.2.2 Medium Priority Activities

#### Tracking Facility Inspections and Maintenance Response

Monitoring the number of stormwater facility inspections and level of maintenance response would assist the City in assessing the effectiveness of operation and maintenance activities and evaluating staff needs and resources. Tracking of stormwater inspections and maintenance has been identified as medium priority.

#### Municipal Stormwater Pollution Prevention Plans

Development of SWPPPs for all heavy equipment maintenance or storage yards, and material storage facilities that do not currently have SWPPPs has been identified as medium priority. SWPPPs would be developed for facilities that are not otherwise covered under a state stormwater permit. Each SWPPP would include a schedule for implementation of structural BMPs, as applicable, including periodic visual

observations to evaluate the effectiveness of the BMP. General SWPPPs that could be applied at multiple sites could be developed.

### Staff Training

In addition to the as-needed staff training provided by the Public Works Department, development of a formal training program for stormwater maintenance staff is considered a medium priority. The training program would instruct staff on the importance of protecting water quality, operation and maintenance standards, inspection procedures, selection of appropriate BMPs, ways to perform job activities to prevent or minimize impacts on water quality, and procedures for reporting water quality concerns. A baseline training could be provided to new staff, with annual (or more frequent, as needed) follow-up training provided to address changes in procedures, techniques, requirements, or staffing. The City would document and maintain records of the training provided and the staff trained.

### Long-Term Operation and Maintenance Plans

Development of long-term operation and maintenance plans for all stormwater management system components and BMPs that do not currently have plans has been identified as medium priority.

### Recordkeeping

Improvement to the recordkeeping procedures has been identified as medium priority. Maintenance recordkeeping improvements could include upgrading from hardcopy records to an electronic, searchable database. Use of an electronic database could increase efficiency, search capabilities, and identification of maintenance needs, as well as facilitate future financial planning.

## 7.2.3 Low Priority Activities

No low priorities have been identified for the City's operation and maintenance program.

**Goal:**

Document the existing stormwater conveyance and management facilities to adequately support implementation of other program elements.

## 8. MAPPING

This chapter discusses the City's existing mapping and future data collection and mapping needs. Priorities are shown in Table 8-1.

### 8.1 Current Data

#### Inlets and Conveyances Discharging to Outfalls of 24 Inches or Larger

The City has currently mapped most of the stormwater catch basins within the stormwater system (see Figure 1).

#### Surface Receiving Waters

The City has mapped local surface receiving waters, including streams, lakes, marshes, and wetlands (see Figure 1).

#### City-Owned Stormwater Management Facilities

The City has currently mapped most of the City-owned stormwater treatment and flow control facilities (see Figure 1).

**Table 8-1. Mapping Priorities**

SWMP Component	Priority High (1) to Low (3)
Outfalls of 24 Inches or Larger and External Connections	1
Areas Discharging to Ground	2
Drainage Basin Boundaries	2
Inlets and Conveyances Discharging to Outfalls of 24 Inches or Larger	2
City-Owned Stormwater Management Facilities	2
Surface Receiving Waters	Achieved

### 8.2 Planned Data Collection

#### 8.2.1 High Priority Data

##### Outfalls of 24 Inches or Larger and External Connections

The City does not currently have mapping data on stormwater system outfalls. Therefore, collection of data and mapping of outfalls 24 inches in diameter or larger have been identified as high priority.

#### 8.2.2 Medium Priority Data

##### Areas Discharging to Ground

Several areas of the Yelm stormwater system discharge to the ground; however, the City does not have mapping data specifically identifying these areas. Collection of data necessary to identify areas discharging to the ground has been identified as medium priority.

##### Drainage Basin Boundaries

Delineation of the Yelm drainage basin boundaries would aid in illicit discharge detection and elimination, support regional stormwater management facility placement and sizing, focus conveyance system maintenance and inspection, and facilitate future planning. Drainage basin delineation has been identified as medium priority.

## Inlets and Conveyances Discharging to Outfalls of 24 Inches or Larger

Collection of the following data for all inlets, external permitted connections to the stormwater system (such as those from privately owned facilities or other municipalities), and conveyances (including pipes and channels) discharging to outfalls 24 inches or larger has been identified as medium priority:

- Tributary conveyance type
- Material
- Size where known

## City-Owned Stormwater Management Facilities

Collection of mapping data for the remainder of the City-owned stormwater treatment and flow control facilities has been identified as low priority.

### 8.2.3 Low Priority Data

No low priorities have been identified for the City's mapping program.

## 9. MONITORING

### 9.1 Program Monitoring

Monitoring the types, frequencies, and costs of stormwater management activities can aid the City in evaluating the current efficiency of the stormwater management program and assessing future resource and funding needs. The City does not currently have a formal monitoring program for elements of the stormwater management program. However, planned monitoring activities have been identified and are summarized in Table 9-1 below.

#### Goal:

Assess the efficiency and effectiveness of the stormwater management program.

**Table 9-1. Planned Monitoring Activities**

Monitoring Activity	Priority	SWMP Chapter
Tracking Facility Inspections and Maintenance Response	Medium	7. Operations and Maintenance
Tracking Impacts on Selected Target Group	Low	3. Public Education and Outreach
Tracking Annual Illicit Discharges Discovered	Low	5. Illicit Discharge Detection and Elimination

### 9.2 Water Quality Sampling

As discussed in Section 6.2.1, improvement of the City's construction site inspection program, which includes ensuring that required construction stormwater quality sampling is conducted by developers, has been identified as a high priority. In addition, as discussed in Section 7.2.1, development of a formal program for inspecting City-owned stormwater facilities, which would include identifying future sites for further water quality assessment has been identified as a high priority.

The City would plan to make use of available operational water quality sampling results and recommendations from the Stormwater Work Group for Puget Sound (SWG). The SWG is a group of federal, tribal, state, and local government, business, environmental, agriculture, and research interests. The goal of the SWG is to continue to develop and implement a sustainable, cooperative stormwater monitoring and assessment framework that provides meaningful management data, promotes greater understanding of stormwater and other surface water pollution source issues, and supports a larger, integrated effort to protect and restore the Puget Sound ecosystem by enabling local jurisdictions to

#### SWG Website

<https://sites.google.com/site/pugetsoundstormwaterworkgroup/>

know whether stormwater management efforts are reducing harm caused by stormwater and other surface water sources. The SWG developed a regional stormwater sampling and assessment strategy for Puget Sound, recommended a comprehensive monitoring approach for the next NPDES municipal stormwater permits, and continues to make broader and more detailed recommendations for stormwater monitoring.





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# Appendix A

## Final GAP Analysis



## TECHNICAL MEMORANDUM

**DATE:** December 30, 2015  
**TO:** Chad Bedlington, City of Yelm Public Works Manager  
**FROM:** Julie Brandt, P.E., Parametrix  
**SUBJECT:** FINAL - Program and Mapping Gap Analysis  
**CC:** Brian Bunker, P.E., Parametrix  
**PROJECT NUMBER:** 216-1781-035 (01/02 & 01/03)  
**PROJECT NAME:** City of Yelm Stormwater Management Plan

### INTRODUCTION

#### Background

The City of Yelm (City) Stormwater Utility is responsible for implementing practices and technologies to address stormwater-related issues throughout the city. The Stormwater Utility's mission is to:

- Prepare, execute, and update a comprehensive plan to protect, measure, evaluate, fund, and prepare for future surface water needs.
- Address the City's surface water needs to achieve and maintain an appropriate level of service for all existing customers and consider future growth.
- Use appropriate, technologically sound, and cost-effective stormwater solutions, as identified in adopted guidance manuals.
- Promote surface water protection measures that will protect or restore habitat conditions and water quality of surface water and groundwater sources.
- Operate, maintain, inspect, and repair the City's existing stormwater infrastructure to provide continued effective operation.

The City is developing a Stormwater Management Plan (SWMP) to address stormwater conveyance and water quality control obligations by outlining the current stormwater management activities at the City; identifying data, mapping, and activity gaps; and laying out a program to address those gaps. Following completion of the SWMP, the City plans to develop a stormwater system condition assessment system, an asset registry, a capital improvement plan, and a stormwater management program rate analysis. Additional system mapping data will also be collected as time and funding allows.

## Purpose

The program and mapping gap analysis described in this memorandum has been conducted in support of the SWMP. This memorandum provides a summary of the identified data, mapping, and activity gaps and ranks the gaps in order of priority.

## How to Use this Analysis

The information presented in this memorandum is intended to provide a high-level summary of stormwater management and mapping gaps identified in the City's current program. In addition, each selected element has been prioritized based on its level of influence on the Surface Water Management Division's mission and current degree of achievement by the City. However, the necessary implementation sequence of each program element and data-collection sequence of each mapping element has not been included when assigning priority. Instead, these sequences will be outlined in the SWMP. For example, some "high-priority" program elements may have one or more prerequisite "low-priority" elements that must be achieved before the "high-priority" implementation can begin. For mapping elements, order of data collection will be heavily influenced by geometric connectivity. This order of operations will be discussed in the SWMP; therefore, this gap analysis is intended to be used in conjunction with the SWMP.

The methodology for assigning priority that is outlined in this memorandum is intended to be universal to the City's program and may be applied as other stormwater management elements become applicable in the future.

## METHOD OF ANALYSIS

### Element Selection

The stormwater management and mapping elements selected for the City's program and evaluated in this gap analysis are based in part on the Washington State Department of Ecology (Ecology) stormwater grant agreement through which the development of the SWMP is being funded. The scope of the SWMP outlined in the grant agreement is partially based on the stormwater management program plan elements outlined in the National Pollution Discharge Elimination System Western Washington Phase II Municipal Stormwater Permit (Permit, Ecology 2014). Therefore, the major categories of stormwater management for the City's program and many of the underlying activities and mapping elements have been selected from those outlined in the Permit. In addition, stormwater management elements and mapping priorities for the City's program have also been selected from known needs of the City based on document review and applicable elements from the stormwater management programs of other comparable municipalities. Elements from all of these sources which were determined to be inapplicable to the stormwater management and mapping needs in the vicinity of Yelm have not been included in the gap analysis.

### Level of Influence

Each of the elements selected as relevant to Yelm's stormwater needs was evaluated for its potential degree of influence in supporting the Surface Water Management Division's mission. This evaluation was conducted by reviewing the City's needs and current conditions, reviewing similar successful programs, and application of best professional judgment. Based on this evaluation, each element has been assigned one of the following levels of influence:

5 - Immediate need; direct impact on safety, environment, costs (Highest)

4 - Important need, critical to overall program success (High)

- 3 - Influence is direct but small, cumulative, or long-term (Moderate)
- 2 - Supplemental support of other elements (Low)
- 1 - Indirect impact on overall program success (Lowest)

### Degree of Attainment

Each of the selected elements has also been assigned a degree of attainment within the City's current stormwater management and mapping program. The following degrees of attainment were assigned based on data review and City staff input:

- 5 - Supports mission and customer service all of the time (Full Attainment)
- 4 - Supports mission and customer service most of the time (High)
- 3 - Supports mission and customer service some of the time (Moderate)
- 2 - Activities do not currently support mission or customer service (Low)
- 1 - Few or no activities (Lowest)

### Priority

Priority has been assigned to each element based on the combination of its level of influence and degree of attainment, as outlined in Table 1. Also, priorities have been assigned relative to the overall program, regardless of the main program category in which each element is classified.

**Table 1. Method for Assigning Stormwater Management Priority**

Priority	Combined Influence and Attainment	Rank Within Priority
First	Highest levels of influence with low degrees of attainment.	5-1, 5-2, 4-1, 4-2
	Highest levels of influence with moderate degree of attainment.	5-3, 4-3
Middle	Moderate level of influence with low to moderate degrees of attainment.	3-1, 3-2, 3-3
	High to moderate levels of influence with higher degree of attainment.	5-4, 4-4, 3-4
Last	Lowest levels of influence with low to high degrees of attainment.	2-1, 2-2, 2-3, 2-4, 1-1, 1-2, 1-3, 1-4
	All levels of influence with full attainment.	5-5, 4-5, 3-5, 2-5, 1-5

## RESULTS

Results of the program and mapping gap analysis are presented in Table 2. In addition, mapping analysis elements and gaps are also shown on Figures 1 through 3.

## CONCLUSION AND RECOMMENDATIONS

The priorities shown in Table 2 and on Figures 1 through 3 summarize which stormwater program and mapping elements need the most immediate attention. For the program elements, it is recommended that the City's initial efforts be distributed across all of the highest-ranked First Priority elements to increase each element's degree of

attainment. Eventually, as each First Priority element's degree of attainment increases, it can be reclassified to Middle Priority. Therefore, it is recommended that effort be distributed across First Priority elements until they have all achieved Middle Priority status. At that point, it is recommended that the Middle Priority elements be evenly addressed to incrementally increase their degree of attainment, and so forth. Elements currently identified as First Priority should not receive continual focus until they are fully attained, as this would divert resources away from other elements that will eventually become more urgent. For mapping elements, it is recommended that mapping begin at the major outfalls and subsequent data collection should follow the conveyance network upstream. The City's should consider mapping one complete sub-basin before moving on to the next.

This analysis did not evaluate a timeline or resources needed to address the identified gaps. Additional evaluation would be required to determine:

1. The timeline in which all identified gaps could be addressed with currently available staff and funding resources; or
2. Additional staff and funding resources needed to address all identified gaps within a desired timeline.

As discussed earlier, the program implementation and mapping data-collection sequence that includes consideration of any necessary prerequisites will be outlined in the SWMP.



Table 2. Gap Analysis Results

SWMP Component	Degree of Influence High 5 - Low 1	Degree of Attainment High 5 - Low 1	Priority First 1 - Later 3	Comment
<b>Public Education and Outreach</b>				
Target Instructions to Businesses	4	1	1	
Compliance Assistance for Project Design	4	3	1	
Proactive Messaging	3	1	2	
Public Meetings	3	1	2	
Public School Curriculum	3	1	2	
Educational Materials for Distribution	2	1	3	
Information on City Website	2	4	3	
Tracking Impacts on Selected Target Group	1	1	3	
<b>Public Involvement</b>				
Public SWMP Workshops	3	1	2	
Participation in City Council Meetings	3	4	2	
Public Access to Stormwater-Related Documents	1	2	3	
Path to Receive Public Complaints/Questions/Comments	4	5	Achieved	
<b>Illicit Discharge Detection and Elimination</b>				
Field Screening and Enforcement	5	2	1	
Staff Training	4	1	1	
Response Plan	5	3	1	
Recordkeeping	3	4	2	
Tracking Annual Illicit Discharges Discovered	2	3	3	
Regulatory Prohibition of Non-Stormwater Discharges	5	5	Achieved	YMC <sup>1</sup> 13.16.060.C Illicit Discharges Prohibited
Mechanism for Public Reports of Spills	3	5	Achieved	
<b>Controlling Runoff from New Development, Redevelopment, and Construction Sites</b>				
Construction Inspections	5	3	1	
Low Impact Development Regulatory Review	3	1	2	
Recordkeeping	3	2	2	Limited library of record drawings.
Staff Training	3	2	2	
Permitting Process and Plan Review	5	4	2	YMC <sup>1</sup> 13.16 Stormwater Management
Privately-Owned Facility Inspections	2	2	3	
Ensuring Privately-Owned Facility Maintenance	2	2	3	
Zoning Review with Planning Department	2	2	3	
Runoff Control Regulations and Enforcement	5	5	Achieved	YMC <sup>1</sup> 13.16 Stormwater Management; Ecology SWMMWW (YMC 13.16.060)

Table 2. Gap Analysis Results (continued)

SWMP Component	Degree of Influence High 5 - Low 1	Degree of Attainment High 5 - Low 1	Priority First 1 - Later 3	Comment
<b>Operations and Maintenance</b>				
City-Owned Catch Basin and Conveyance System Inspections	4	2	1	No records of inspections for 2014 onward.
City-Owned Facility Inspections	4	2	1	No records of inspections for 2014 onward.
Source Control Practices, Policies, and Procedures	5	3	1	
City-Owned Facility Maintenance	4	3	1	One field crew FTE from streets department budgeted in-part for stormwater. Additional field crew FTEs not dedicated (budgeted by other departments). Hours budgeted based on historic use.
Tracking Facility Inspections and Maintenance Response	3	1	2	
Municipal Stormwater Pollution Prevention Plans	3	2	2	
Staff Training	3	2	2	
Long-Term Operation and Maintenance Plans	3	3	2	
Recordkeeping	3	3	2	Hard copy inspection forms for catch basins, ponds, and privately owned facilities saved in Stormwater Program binders. Records available for 2011, 2012, and 2013. No records for 2014 onward. City recently purchased Beehive tracking software, not yet implemented.
Adopt Maintenance Standards	3	5	Achieved	YMC <sup>1</sup> 13.20 Stormwater Maintenance
<b>Mapping</b>				
Outfalls of 24 Inches or Larger and External Connections	4	1	1	
Areas Discharging to Ground	3	1	2	
Drainage Basin Boundaries	3	1	2	
Inlets and Conveyances Discharging to Outfalls of 24 Inches or Larger	3	2	2	
City-Owned Stormwater Management Facilities	4	4	2	
Surface Receiving Waters	4	5	Achieved	

1. YMC: Yelm Municipal Code.



## ELEMENTS TO BE IDENTIFIED AND MAPPED, IN SEQUENTIAL ORDER

### ACHIEVED ELEMENTS

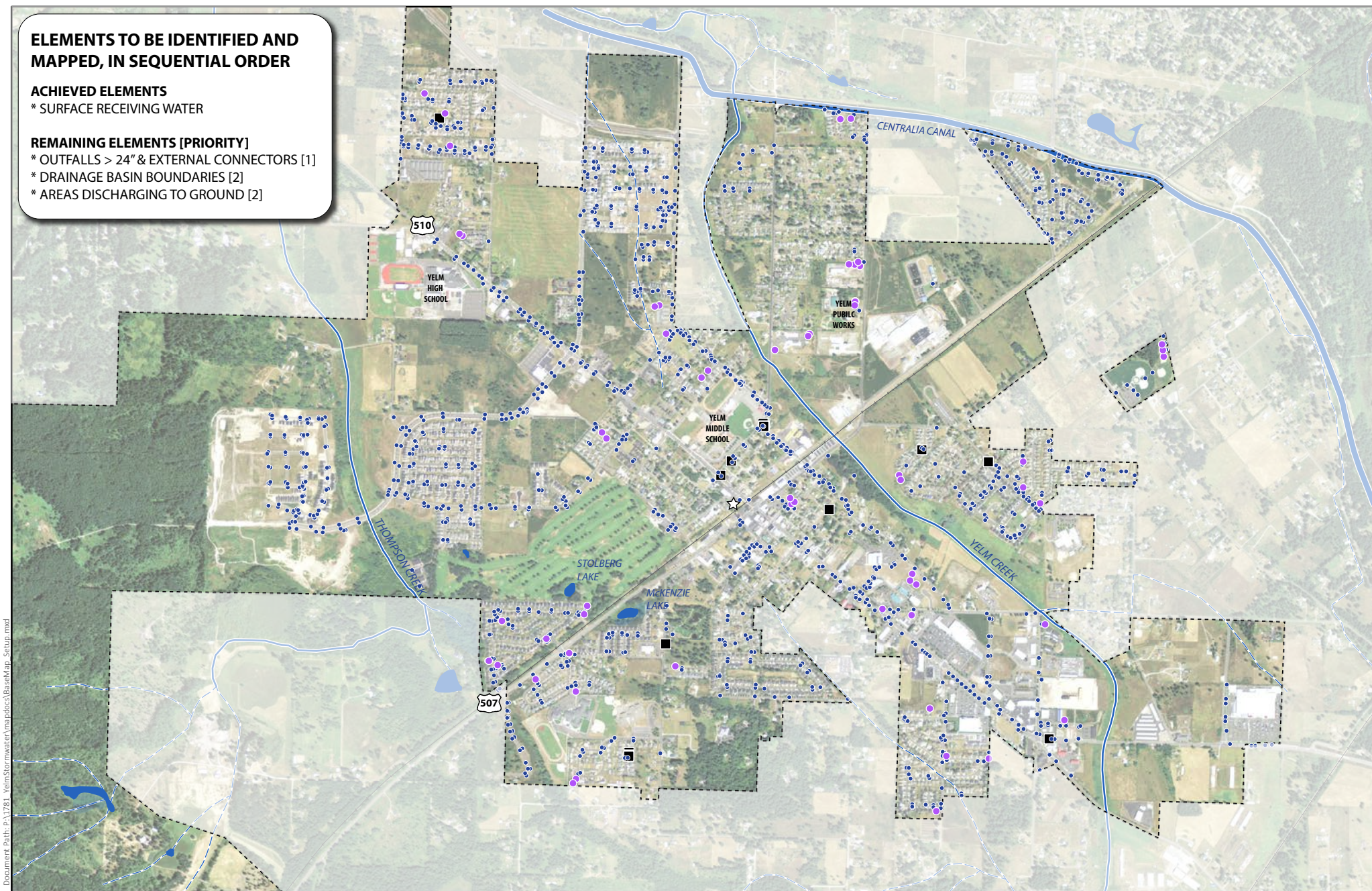
\* SURFACE RECEIVING WATER

### REMAINING ELEMENTS [PRIORITY]

\* OUTFALLS > 24" & EXTERNAL CONNECTORS [1]

\* DRAINAGE BASIN BOUNDARIES [2]

\* AREAS DISCHARGING TO GROUND [2]



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- Stormwater Catch Basin
- Stormwater Pond
- Stormwater Vault

- Perennial Stream
- - - Intermittent Stream
- Canal

- Lake
- Marsh

- ☆ City Hall
- - - City Limit



Source: City of Yelm

**FIGURE 1**  
Surface Water Basin Map  
SWMP Gap Analysis  
Yelm, WA



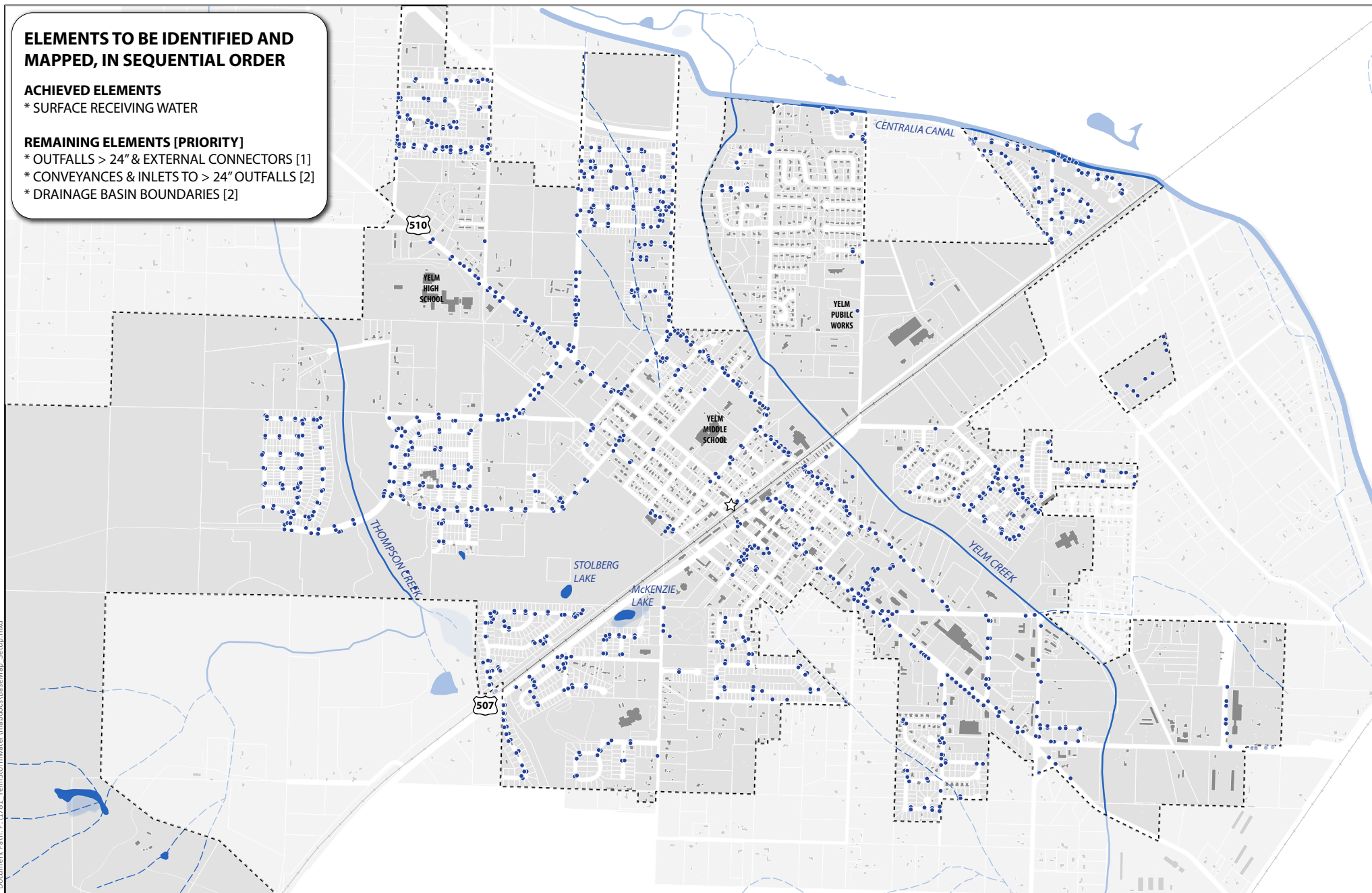
## ELEMENTS TO BE IDENTIFIED AND MAPPED, IN SEQUENTIAL ORDER

### ACHIEVED ELEMENTS

- \* SURFACE RECEIVING WATER

### REMAINING ELEMENTS [PRIORITY]

- \* OUTFALLS > 24" & EXTERNAL CONNECTORS [1]
- \* CONVEYANCES & INLETS TO > 24" OUTFALLS [2]
- \* DRAINAGE BASIN BOUNDARIES [2]



Parametrix  
ENGINEERING, PLANNING, ENVIRONMENTAL SCIENCES

• Stormwater Catch Basin

— Perennial Stream

— Lake

☆ City Hall

- - - Intermittent Stream

— Marsh

- - - City Limit

— Canal

**FIGURE 2**  
Stormwater Conveyance System

SWMP Gap Analysis  
Yelm, WA



Source: City of Yelm

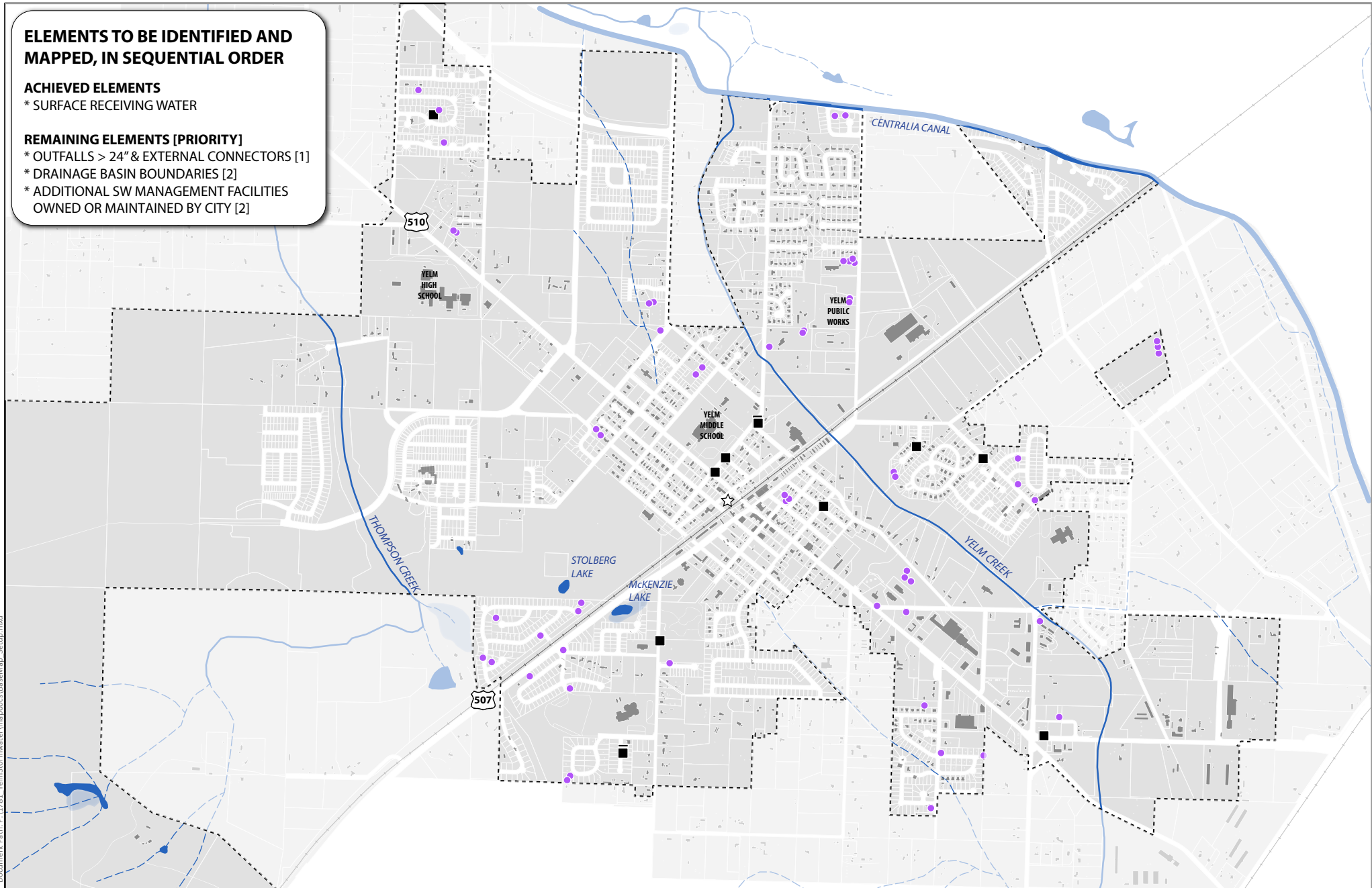
## ELEMENTS TO BE IDENTIFIED AND MAPPED, IN SEQUENTIAL ORDER

### ACHIEVED ELEMENTS

- \* SURFACE RECEIVING WATER

### REMAINING ELEMENTS [PRIORITY]

- \* OUTFALLS > 24" & EXTERNAL CONNECTORS [1]
- \* DRAINAGE BASIN BOUNDARIES [2]
- \* ADDITIONAL SW MANAGEMENT FACILITIES OWNED OR MAINTAINED BY CITY [2]



**FIGURE 3**  
Stormwater Ponds & Vaults  
SWMP Gap Analysis  
Yelm, WA

## REFERENCES

Ecology, Washington State Department of. 2014. National Pollutant Discharge Elimination System Western Washington Phase II Municipal Stormwater Permit. Washington State Department of Ecology Water Quality Program. Olympia, Washington. Issued August 2012, Modified January 2014.

## Appendix B

### Stormwater System Condition Assessment and Concept Improvements





**City of Yelm Stormwater Management Plan**

**Conceptual Capital Improvement Planning (Based on Workshop with Public Works Staff 04/05/2016)**

<b>Project Number</b>	<b>Location</b>	<b>Reported Observations and Deficiencies</b>	<b>Potential Evaluations and Solutions</b>	<b>Goals/Potential Benefit(s)</b>
1	SR 507 near 1208 Yelm Ave E	<ul style="list-style-type: none"> <li>• Drywell failure</li> <li>• Lack of adequate water quality treatment</li> <li>• Undersized infiltration gallery</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluate water quality treatment alternatives</li> <li>• Test soil infiltration rates</li> <li>• Retrofit new water quality facility with infiltration</li> </ul>	<ul style="list-style-type: none"> <li>• Remove/reduce stormwater pollutants in receiving water (groundwater)</li> </ul>
2	Vancil Road SE at SR 507 NE corner of intersection ,	<ul style="list-style-type: none"> <li>• Existing swale lacks outfall or infiltration capability</li> <li>• Original engineered design failure</li> <li>• Adjacent street flooding as a result</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluate water quality treatment alternatives</li> <li>• Test soil infiltration rates</li> <li>• Retrofit new water quality facility with infiltration</li> </ul>	<ul style="list-style-type: none"> <li>• Remove/reduce stormwater pollutants in receiving water (groundwater)</li> <li>• Protect public safety</li> </ul>
3	SR 507 at Clark Rd SE, near Prairie Park Ln	<ul style="list-style-type: none"> <li>• Three catch basins at this location, northeast side have unknown discharge locations</li> <li>• Not designed for infiltration</li> <li>• Despite maintenance, conveyance continues to be overwhelmed with street sediment annually.</li> <li>• Excessive maintenance</li> <li>• Urban flooding in fall/winter</li> </ul>	<ul style="list-style-type: none"> <li>• CCTV conveyance system and determine system discharge location</li> <li>• Evaluate sources of excessive sedimentation into the system</li> <li>• Determine alternative maintenance and/or repair needs of conveyance system</li> </ul>	<ul style="list-style-type: none"> <li>• Identify discharge location to better protect receiving water quality</li> <li>• Improve management of street sediment to remove pollutants from system discharge</li> <li>• Protect public safety</li> </ul>
4	Clark Rd SE, from SR 507 to south side of NE 103 <sup>rd</sup> Ave	<ul style="list-style-type: none"> <li>• Five drywells in the area that are designed for infiltration need maintenance</li> <li>• Infiltration rates are not adequate to support drainage basin area in current condition</li> <li>• Major water over road at Clark Rd SE and SR 507 intersection during peak wet weather events</li> </ul>	<ul style="list-style-type: none"> <li>• Additional CCTV work to review inlet to the drywell locations near 509 E Yelm Ave</li> <li>• Review adjacent private property drainage systems to confirm runoff characteristics</li> </ul>	<ul style="list-style-type: none"> <li>• Protect public safety</li> </ul>

Project Number	Location	Reported Observations and Deficiencies	Potential Evaluations and Solutions	Goals/Potential Benefit(s)
5	Middle Rd, near south end of sidewalk at Cochrane Park	<ul style="list-style-type: none"> <li>Existing catch basin at this location is inadequate for drainage basin</li> <li>Outfall from catch basin is unknown and likely obstructed</li> <li>Significant debris accumulation in catch basin sump requires excessive cleaning frequency</li> </ul>	<ul style="list-style-type: none"> <li>Clean catch basin and CCTV inlet/outlet pipes to determine flow path</li> <li>Repair any damaged or obstructed conveyance</li> </ul>	<ul style="list-style-type: none"> <li>Identify discharge location to better protect receiving water(s)</li> <li>Improve performance of catch basin sumps to capture and remove more pollutants from system discharge</li> </ul>
6	SR 510, Edwards to Longmire near Yelm Middle School	<ul style="list-style-type: none"> <li>Inadequate catch basins and conveyance exists along SR 510</li> <li>Only one catch basin inlet between school entry and Solberg St NW intersection</li> <li>Water accumulates near school bus exit/entry during heavy rainfall and enters SR 510 roadway causing hazard</li> <li>Problem exacerbated by WSDOT overlay project completed in 2015</li> </ul>	<ul style="list-style-type: none"> <li>Design/engineer improved collections and conveyance of stormwater in the area</li> <li>Evaluate improved water quality needs</li> </ul>	<ul style="list-style-type: none"> <li>Increase number of catch basin sumps to capture and remove more pollutants from system discharge</li> <li>Provide additional water quality treatment to capture and remove more pollutants from system discharge</li> <li>Protect public safety</li> </ul>
7	SW McKenzie (Midblock), Longmire to Sohlberg	<ul style="list-style-type: none"> <li>Old chip seal road with failing conveyance and inlets</li> <li>Significant standing water in road as a result of inadequate sheet flow conveyance to existing catch basins; catch basins set too far off paved areas in gravel parking strips</li> <li>Catch basins cleaned in 2012, but still significant sediment loading</li> </ul>	<ul style="list-style-type: none"> <li>Clean system and CCTV to determine outlets (currently unknown)</li> <li>Pull berm in area and create better inlet controls to catch basins to get positive drainage</li> <li>Review water quality in the area and consider open channel conveyance for basic treatment or enhanced treatment alternatives</li> </ul>	<ul style="list-style-type: none"> <li>Identify discharge location to better protect receiving water(s)</li> <li>Provide additional water quality treatment to capture and remove more pollutants from system discharge</li> <li>Protect public safety</li> </ul>
8	SR 510, southwest side adjacent to City Hall	<ul style="list-style-type: none"> <li>Existing drainage in this area is through curb 2" pipe to existing grass area between 101 W Yelm Ave and City Hall</li> <li>Through curb inlets plug regularly and allow excessive water accumulation on SR 510 causing road hazard</li> </ul>	<ul style="list-style-type: none"> <li>Add improved through-curb inlets via slotted drains or similar</li> <li>Review enhance water quality treatment alternatives to replace swale being discharged to</li> <li>Add additional curb inlets for redundancy during heavy rainfall events, two locations minimum</li> </ul>	<ul style="list-style-type: none"> <li>Provide additional water quality treatment to capture and remove more pollutants from system discharge</li> <li>Protect public safety</li> </ul>

## Appendix C

### Stormwater Education Resources for Schools



Lesson Plan	Quick Picks	Suggested Grade Levels								Water Overview	Human Use of Water	Habitats	Pollution & Treatment	Rainwater	LID / GSI *	Source/Additional Resources
		K	1	2	3	4	5	6	7	8						
A Day in the Life of a Drop	*				X	X	X	X			O	O	O	O		<a href="http://yosemite.epa.gov/water/owrcatalog.nsf/7322259e90d060c885256f0a0055db68/938738a84906a48b852574b400676a31!opendocument">http://yosemite.epa.gov/water/owrcatalog.nsf/7322259e90d060c885256f0a0055db68/938738a84906a48b852574b400676a31!opendocument</a>
Be Hydro-Logical (fact sheet)						X	X	X	X	X		O		O		<a href="http://www3.epa.gov/safewater/kids/index.html">http://www3.epa.gov/safewater/kids/index.html</a>
Create a Fish					X	X	X	X	X	X			O			<a href="http://www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx">www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx</a>
Darby Duck - No Water off a Duck's Back	*	X	X	X	X	X	X	X	X				O	O		<a href="http://www.epa.gov/polluted-runoff-nonpoint-source-pollution/darby-duck-aquatic-crusader-no-water-ducks-back">http://www.epa.gov/polluted-runoff-nonpoint-source-pollution/darby-duck-aquatic-crusader-no-water-ducks-back</a>
Deep Subjects - Wells and Groundwater (aquifer in a box)					X	X	X	X			O	O				<a href="http://www3.epa.gov/safewater/kids/index.html">http://www3.epa.gov/safewater/kids/index.html</a>
Excuse Me, Is This the Way to the Drain Pipe?	*	X	X	X	X	X	X	X			O	O		O	O	<a href="http://www3.epa.gov/safewater/kids/index.html">http://www3.epa.gov/safewater/kids/index.html</a>
Fish and Ladders							X	X	X	X			O			<a href="http://www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx">www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx</a>
Fix a Leak Week					X	X	X	X				O		O	O	<a href="http://www3.epa.gov/watersense/our_water/learn_more.html#tabs-6">http://www3.epa.gov/watersense/our_water/learn_more.html#tabs-6</a>
Focus Stm Wtr 1: Why Stormwater is a Problem ++								X	X	X				O	O	O <a href="http://www.greenlearningstation.org">www.greenlearningstation.org</a>
Focus Stm Wtr 2: Calculating Stormwater Runoff	*							X	X	X				O	O	<a href="http://www.greenlearningstation.org">www.greenlearningstation.org</a>
Focus Stm Wtr 3: Green Stormwater Planning	*							X	X	X				O	O	O <a href="http://www.greenlearningstation.org">www.greenlearningstation.org</a>
Focus Stm Wtr 4: Testing Soil's Ability to Drain	*							X	X	X				O	O	<a href="http://www.greenlearningstation.org">www.greenlearningstation.org</a>
Focus Stm Wtr 5: Get to Know Your Raingarden Site	*							X	X	X				O	O	O <a href="http://www.greenlearningstation.org">www.greenlearningstation.org</a>
Focus Stm Wtr 6: How Big Should Your Raingarden Be?	*							X	X	X				O	O	O <a href="http://www.greenlearningstation.org">www.greenlearningstation.org</a>
Focus Stm Wtr 7: Design Your Raingarden	*							X	X	X				O	O	O <a href="http://www.greenlearningstation.org">www.greenlearningstation.org</a>
Go With the Flow	*							X	X	X	O			O	O	<a href="http://www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx">www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx</a>
Habitat For Sale		X	X	X	X	X	X	X	X	X			O			<a href="http://www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx">www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx</a>
Habitat Hunt	*				X	X	X	X					O			<a href="http://www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx">www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx</a>
Habitat Web	*				X	X	X	X					O			<a href="http://www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx">www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx</a>
How Do You Feel About Water? (quiz)					X	X	X	X	X	X	O					<a href="http://www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx">www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx</a>
How People Get Their Water (reservoir in a box)		X	X	X	X	X	X	X			O		O	O		U.S. Environmental Protection Agency, adopted from "Water Wizards," Massachusetts Water Resources Authority, Boston, MA, 1993.
Investigate a Rotten Log	*	X	X	X	X	X							O			<a href="http://www.nwf.org/Kids/Big-Backyard/Fun/Outdoors.aspx">www.nwf.org/Kids/Big-Backyard/Fun/Outdoors.aspx</a>
Know Where It All Goes (poster)	*	X	X	X	X	X	X	X			O	O	O	O	O	<a href="http://www.environment.nsw.gov.au/stormwater/">www.environment.nsw.gov.au/stormwater/</a>

Lesson Plan	Quick Picks	Suggested Grade Levels								Water Overview	Human Use of Water	Habitats	Pollution & Treatment	Rainwater	LID / GSI *	Source/Additional Resources
		K	1	2	3	4	5	6	7	8						
Matching Game: How Much Water?	*					X	X	X	X	X	O					<a href="http://www3.epa.gov/safewater/kids/index.html">http://www3.epa.gov/safewater/kids/index.html</a>
Non-Point Source Pollution	*					X	X	X	X	X		O	O	O		<a href="http://yosemite.epa.gov/water/owrccatalog.nsf/7322259e90d060c885256f0a0055db68/f9eab23474c94eb685256d83004fd7e21opendocument">http://yosemite.epa.gov/water/owrccatalog.nsf/7322259e90d060c885256f0a0055db68/f9eab23474c94eb685256d83004fd7e21opendocument</a>
Role of Plants In Water Filtration	*					X	X	X	X	X			O	O	O	<a href="http://www3.epa.gov/safewater/kids/index.html">http://www3.epa.gov/safewater/kids/index.html</a>
Schoolyard Habitat Project Guide (manual 132 pp)						X	X	X	X	X		O				<a href="http://www.fws.gov/letsgooutside/educators.html">www.fws.gov/letsgooutside/educators.html</a>
SWC 01: Watershed in a Box						X	X	X	X	X	O		O	O	O	Salt Lake City Stormwater Quality Education Lesson and Activity Plans; 3rd Edition - Decemeber 2005
SWC 02: Watershed Boundaries	*						X	X	X	X	O			O		Salt Lake City Stormwater Quality Education Lesson and Activity Plans; 3rd Edition - Decemeber 2005
SWC 03: Topographical Map Making					X	X	X	X	X	X				O		Salt Lake City Stormwater Quality Education Lesson and Activity Plans; 3rd Edition - Decemeber 2005
SWC 04: Making Ecosystem Connections					X	X	X	X	X	X		O				Salt Lake City Stormwater Quality Education Lesson and Activity Plans; 3rd Edition - Decemeber 2005
SWC 05: Water Canaries						X	X	X	X	X		O	O			Salt Lake City Stormwater Quality Education Lesson and Activity Plans; 3rd Edition - Decemeber 2005
SWC 06: Fred the Fish and Urban Stew	*				X	X	X	X	X	X	O	O	O			Salt Lake City Stormwater Quality Education Lesson and Activity Plans; 3rd Edition - Decemeber 2005
SWC 07: Fed Up	*						X	X	X	X	O	O	O			Salt Lake City Stormwater Quality Education Lesson and Activity Plans; 3rd Edition - Decemeber 2005
SWC 08: Probing into Pesticides	*							X	X	X	O		O	O	O	Salt Lake City Stormwater Quality Education Lesson and Activity Plans; 3rd Edition - Decemeber 2005
SWC 09: Seed Sprouting Experiment	*				X	X	X	X	X	X	O	O	O	O		Salt Lake City Stormwater Quality Education Lesson and Activity Plans; 3rd Edition - Decemeber 2005
SWC 10: Walking in the Watershed							X	X	X	X				O		Salt Lake City Stormwater Quality Education Lesson and Activity Plans; 3rd Edition - Decemeber 2005
SWC 11: Analyzing Storm Water Issues							X	X	X	X	O	O	O	O	O	Salt Lake City Stormwater Quality Education Lesson and Activity Plans; 3rd Edition - Decemeber 2005
SWC 12: Watered Down History	*					X	X	X	X	X	O	O	O	O	O	Salt Lake City Stormwater Quality Education Lesson and Activity Plans; 3rd Edition - Decemeber 2005
SWC 13: A Pollution Prevention Message					X	X	X	X	X	X			O	O		Salt Lake City Stormwater Quality Education Lesson and Activity Plans; 3rd Edition - Decemeber 2005
SWC 14: Creative Erosion Control							X	X	X	X			O	O		Salt Lake City Stormwater Quality Education Lesson and Activity Plans; 3rd Edition - Decemeber 2005
SWC 15: Designing a Community with Storm Water in Mind	*						X	X	X	X	O	O	O	O	O	Salt Lake City Stormwater Quality Education Lesson and Activity Plans; 3rd Edition - Decemeber 2005
SWC*: Glossary of Water Terms						X	X	X	X	X	O	O	O	O	O	Salt Lake City Stormwater Quality Education Lesson and Activity Plans; 3rd Edition - Decemeber 2005
The Water Cycle (Terrarium)				X	X	X	X	X	X	X	O			O		<a href="http://www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx">www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx</a>
The Young Scientist's Introduction to Wetlands						X	X	X	X	X		O	O			<a href="http://el.erdc.usace.army.mil/wetlands/ysi.html">el.erdc.usace.army.mil/wetlands/ysi.html</a>
Thirstin Builds an Aquifer (in a cup)	*	X	X	X	X						O		O			<a href="http://www3.epa.gov/safewater/kids/index.html">http://www3.epa.gov/safewater/kids/index.html</a>



Lesson Plan	Quick Picks	Suggested Grade Levels								Water Overview	Human Use of Water	Habitats	Pollution & Treatment	Rainwater	LID / GSI *	Source/Additional Resources
		K	1	2	3	4	5	6	7	8						
Thirstin's Ground Water Movement Activity		x	x	x	x						o					<a href="http://www3.epa.gov/safewater/kids/index.html">http://www3.epa.gov/safewater/kids/index.html</a>
Thirstin's Water Cycle Adventure (coloring sheet)	*	x	x	x	x						o			o		<a href="http://www3.epa.gov/safewater/kids/index.html">http://www3.epa.gov/safewater/kids/index.html</a>
Thirstin's Wacky Water Adventure	*	x	x	x	x						o	o	o			<a href="http://www3.epa.gov/safewater/kids/index.html">http://www3.epa.gov/safewater/kids/index.html</a>
Thirstin's Water Cycle Activity	*	x	x	x	x						o			o		<a href="http://www3.epa.gov/safewater/kids/index.html">http://www3.epa.gov/safewater/kids/index.html</a>
Tree Detectives			x	x	x	x	x	x				o				<a href="http://www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx">www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx</a>
Water Facts Of Life (factsheet)		x	x	x	x	x	x	x	x	x	o	o	o			<a href="http://www3.epa.gov/safewater/kids/index.html">http://www3.epa.gov/safewater/kids/index.html</a>
Water Filtration	*					x	x	x	x	x			o			<a href="http://www3.epa.gov/safewater/kids/index.html">http://www3.epa.gov/safewater/kids/index.html</a>
Water Purification By Evaporation and Condensation	*					x	x	x	x		o		o			<a href="http://yosemite.epa.gov/water/owrcatalog.nsf/7322259e90d060c885256f0a0055db68/71b5154fa8a3ef7685256d83004fd8f31opendocument">http://yosemite.epa.gov/water/owrcatalog.nsf/7322259e90d060c885256f0a0055db68/71b5154fa8a3ef7685256d83004fd8f31opendocument</a>
Water Trivia Facts	*					x	x	x	x	x	o	o	o			<a href="http://yosemite.epa.gov/water/owrcatalog.nsf/7322259e90d060c885256f0a0055db68/1b1093d3b452fe0785256d83004fd9bb1opendocument">http://yosemite.epa.gov/water/owrcatalog.nsf/7322259e90d060c885256f0a0055db68/1b1093d3b452fe0785256d83004fd9bb1opendocument</a>
Water, Water Everywhere	*	x	x	x	x	x	x	x	x	x	o	o				<a href="http://www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx">www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx</a>
Watershed Web Field Trip		x	x	x	x	x	x	x	x	x	o	o	o			<a href="http://www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx">www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx</a>
What's Your Habitat?		x	x	x	x	x	x	x	x	x		o				<a href="http://www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx">www.nwf.org/Get-Outside/Be-Out-There/Educators/Lesson-Plans.aspx</a>
Where Does Your Water Come From?						x	x	x	x	x	o	o	o			<a href="http://yosemite.epa.gov/water/owrcatalog.nsf/7322259e90d060c885256f0a0055db68/d06baf5e5668a759a85256d83004fd8f21opendocument">http://yosemite.epa.gov/water/owrcatalog.nsf/7322259e90d060c885256f0a0055db68/d06baf5e5668a759a85256d83004fd8f21opendocument</a>
Word Scramble	*					x	x	x	x	x	o	o				<a href="http://www3.epa.gov/safewater/kids/index.html">http://www3.epa.gov/safewater/kids/index.html</a>

\* LID/GSI: Low Impact Development / Green Stormwater Infrastructure

## **Acid Rain Science Experiments (9-12)**

For most of the science experiments below, you will need a pH indicator, such as wide-range litmus or pH paper, a garden soil pH testing kit, or a pH indicator that you can make yourself in Experiment 3.

<http://www.epa.gov/acidrain/education/experiments.html>

## **Cyber Salmon (K-12)**

At this web site, you can learn about chum, Chinook, pink, sockeye, and coho salmon, the five Pacific salmon species found in the Yukon River drainage.

<http://cybersalmon.fws.gov/>

## **Down the Drain – How Much Water Do You Use? (4-8)**

This Internet-based collaborative project will allow students to share information about water usage with other students from around the country and the world. Based on data collected by their household members and their classmates, students will determine the average amount of water used by one person in a day. They will compare this to the average amount of water used per person per day in other parts of the world.

<http://www.ciese.org/curriculum/drainproj/overview/>

## **Project WET (General)**

Worldwide Water Education – Educate, Empower, Act. The mission of Project WET is to reach children, parents, educators and communities of the world with water education. (Educational materials available for purchase.)

<http://store.projectwet.org/index.php/>

## **Thirstin's Build Your Own Aquifer (9-12)**

Interactive Flash site that guides you through the steps of building your own groundwater aquifer.

[http://www.epa.gov/ogwdw/kids/flash/flash\\_aquifer.html](http://www.epa.gov/ogwdw/kids/flash/flash_aquifer.html)

## **Thirstin's Interactive Water Cycle (K-3)**

A flash animated activity that lets you control the water cycle as you learn.

[http://www.epa.gov/ogwdw/kids/flash/flash\\_watercycle.html](http://www.epa.gov/ogwdw/kids/flash/flash_watercycle.html)