STORM AND SURFACE WATER MASTER PLAN

Prepared for
City of Sequim

Prepared by
Herrera Environmental Consultants, Inc.

HERRERA

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STORM AND SURFACE WATER MASTER PLAN

Prepared for
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February 25, 2016

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EXECUTIVE SUMMARY

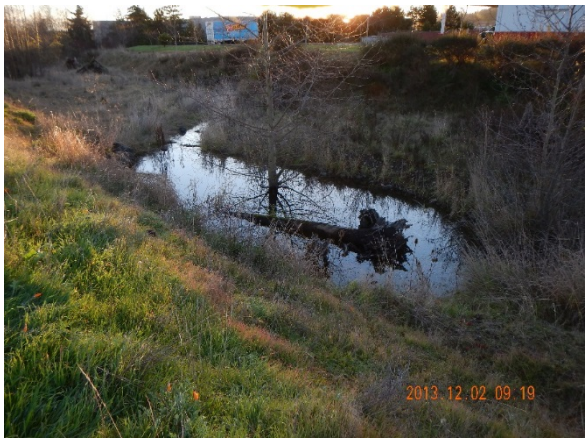
INTRODUCTION

This Storm and Surface Water Master Plan is intended to serve as Sequim's first comprehensive and strategic guide to managing stormwater and surface water as important resources in the city of Sequim. This plan includes:



Typical ponding along West Sequim Bay Road at Fairweather subdivision after a moderate rain event.

- Identification of, and proposed solutions to, drainage and water quality issues
- Actions necessary to ensure compliance with applicable federal, state, and local requirements
- Actions recommended for improving and expanding the City of Sequim's (City) existing stormwater program
- Staffing and resource needs to implement the plan recommendations
- Discussion of future growth and climate change strategies
- Discussion of opportunities for interdepartmental and interagency collaboration



Bell Creek restoration project behind Les Schwab, was completed years ago, when irrigation water was conveyed in the channel all summer.

This plan is necessary because urban development typically results in an increase in the volume of stormwater runoff generated and a decline in water quality downstream. Through better management of stormwater with flow control and water quality treatment facilities, the following benefits can be attained:

- Reduced localized flooding or ponding causing street and other property damage
- Reduced level of pollutants carried by stormwater (sediments, nutrients, metals, oils, and other contaminants)
- Protected fish and wildlife habitat provided by city streams
- Preservation and protection of drinking water supply (i.e., drought resilience)

There are several federal and state regulations and strategic planning efforts that apply to the City's storm and surface water program:

- State surface water quality standards (WAC 173-201A)
- Groundwater quality standards (WAC 173-200)
- Underground Injection Control (UIC) requirements
- Puget Sound Partnership (PSP) Action Agenda
- Dungeness Water Rule (WAC 173-518)
- National Flood Insurance Program (NFIP)
- Species and habitat protection



Oil sheen contributing pollutants to a catch basin connected to the stormwater system. In areas with heavy traffic, catch basins are required to have a filter that removes pollutants.

The goals of this Storm and Surface Water Master Plan are to:

- Demonstrate that stormwater is an important source of water that can be reused if controlled and managed effectively
- Lay out a plan for protecting and enhancing the quality of the City's groundwater and surface water resources
- Outline a practical, user-friendly plan for future stormwater program implementation supported by the public and City Council that will be followed by a financial analysis to determine the most appropriate funding strategy



Groundwater is the main source of drinking water for City and area residents, so it is important to keep it free of stormwater contaminants.

The objectives of this Storm and Surface Water Master Plan are to:

- Document the City's current stormwater program and funding sources and analyze existing stormwater issues and identify capital facility, maintenance, management, and public education solutions to these issues
- Reduce the potential for pollutants associated with stormwater to enter groundwater and surface water resources; incorporate water quality monitoring; and encouraging green stormwater infrastructure (GSI), infiltration, and stormwater re-use
- Anticipate impacts to water resources from growth, climate change, and future regulatory drivers
- Enhance relationships with water management partners and neighboring entities, identify the type and nature of practical management agreements needed, and promote public education and outreach and stewardship opportunities
- Align with goals of the City's Comprehensive Plan, and reclaimed water goals in the Water System Plan and General Sewer Plan
- Establish Sequim as a leader in responsible water quality and resource stewardship for the Dungeness watershed

BACKGROUND

The City currently does not have a formal stormwater management program, and is not currently bound by regulatory requirements such as the National Pollutant Discharge Elimination System (NPDES) municipal stormwater permit. However, in recent years and with the increased focus on the importance of managing water in an area of limited water resources, the City has come to recognize that stormwater should be treated as an important resource rather than a liability. The City is in a unique position to evaluate priorities and articulate goals for a future stormwater management program because it can do this without the regulatory confines of the NPDES program.



"Only rain in the drain" is the message on this typical storm drain in the City of Sequim. Continual outreach and education are key components of a program that effectively protects water quality and the environment.

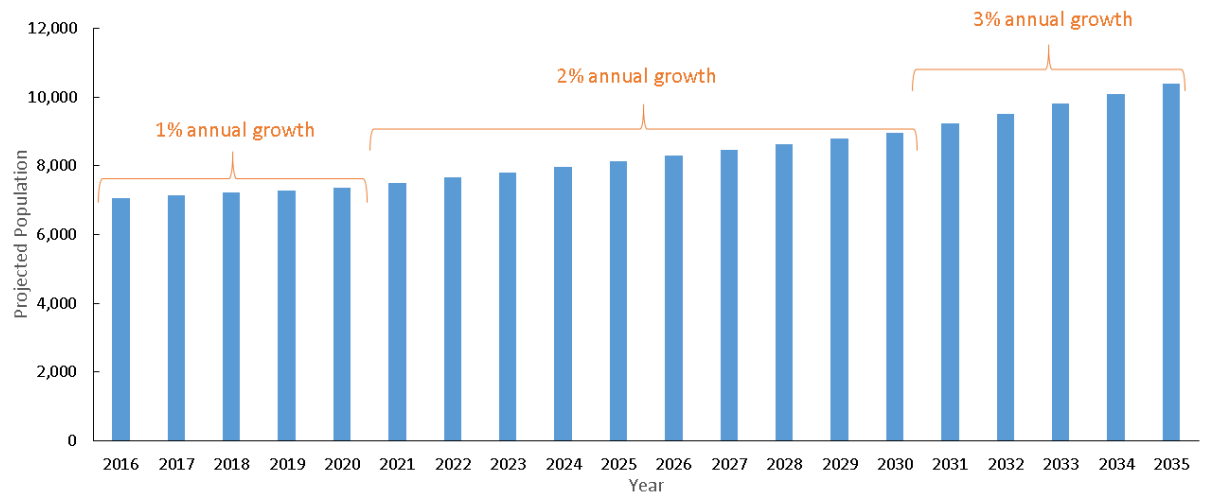
This plan provides the City with a parallel alternative to the plan requirements imposed on NPDES Phase II-regulated communities. While it covers the elements of regulatory program plans, it is customized to Sequim's unique environment, population, and needs as identified in the City's Stormwater Management Needs Assessment completed in 2014 (Sequim 2014).

The city is located in the Dungeness watershed on the North Olympic Peninsula, in the rain shadow of the Olympic Mountains, averaging just over 16 inches of precipitation per year.



Average monthly precipitation in Sequim. Source: Washington Regional Climate Center.

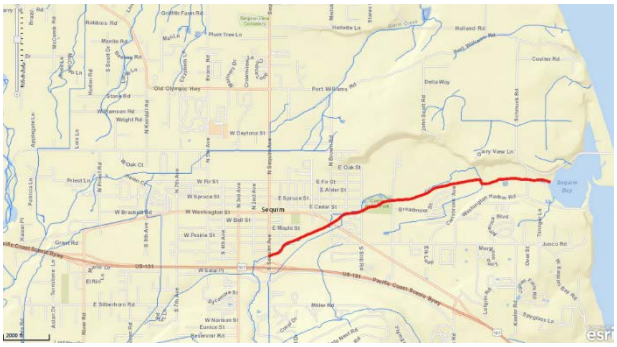
The city encompasses approximately 6.5 square miles in area, including 5,359 linear feet of marine shoreline. The Urban Growth Area encompasses 8.4 square miles in area. The current city population is 6,606 (2010 census). The population of Sequim has grown by over 80 percent since 1990 and is expected to continue to grow at rates as high as 2 or 3 percent each year, which would increase the city's population to 10,000 to 13,000 by 2035.



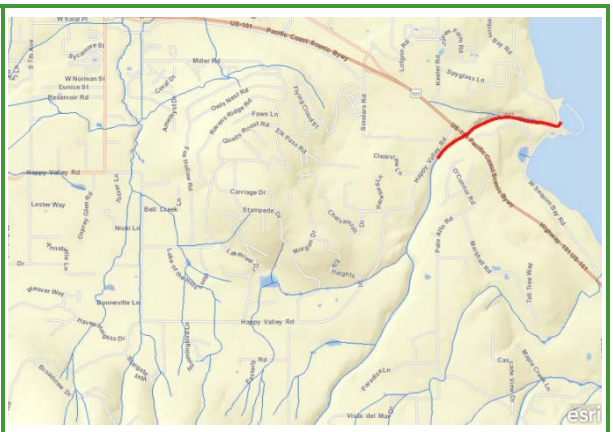
Projected annual population growth in Sequim. Source: City of Sequim DCD.

The city extends over three main drainage basins: Bell Creek Basin, Johnson Creek Basin, and Gierin Creek Basin. Small portions of the city also include areas in the Cassalery Creek Basin and the Dungeness River Basins. Ecology has included the following waterbodies on the 2012 303(d) list of impaired waters (Category 5) for the following parameters:

- The lower reaches of Bell Creek: fecal coliform bacteria, dissolved oxygen, and Benthic Index of Biological Integrity (B-IBI)
- Lower reaches of Johnson Creek: fecal coliform bacteria
- Sequim Bay: fecal coliform bacteria and dissolved oxygen



303(d) listings along Bell Creek.



303(d) listings along Johnson Creek.

In general, stormwater in the city includes runoff from private property and City-owned property within the city, as well as runoff from County property in the upland areas north and south of the city. Irrigation ditches that convey water from the Dungeness River for irrigation and stock water during summer also provide conveyance for stormwater during the wet season. In the city, privately-owned irrigation pipes and ditches converge with creeks and stormwater ditches, carrying stormwater and irrigation water across drainage basin boundaries. The City's stormwater system is composed primarily of short segments of open

ditches, pipes, and drywells/perforated pipes receiving runoff from City-owned streets, alleys, parks, and parking lots through catch basins and inlets.

Farmers in the arid and flat land in the upper portion of the Gierin Creek Basin (an area known as the Sequim Prairie) depend on water from the Dungeness River during the irrigation season (April 15 through September 15). Much of the agricultural land in the city is served either by an irrigation district or by an irrigation company. The irrigation districts and companies in the city include the Highland Irrigation District and the Sequim Prairie Tri-Irrigation Association, composed of the Independent Irrigation Company, Eureka Ditch Company, and Sequim Prairie Ditch Company.



Runoff absorbed by permeable pavement on 3rd Avenue trail near Gerhardt Park.



Typical drywell with perforations to allow street runoff to infiltrate into the ground.

The City's reclaimed water system includes the Water Reclamation Facility, approximately 4 miles of reclaimed water distribution piping, and a 28-acre Reuse Demonstration Site north of Carrie Blake Park. The reclaimed water produced at the Water Reclamation Facility is primarily used at the City Shop for truck filling, the Reuse Demonstration Site at Carrie Blake Park, irrigation of the landscaping in medians and rights-of-way (ROWs) for a portion of the downtown area, and for maintenance of Bell Creek flows.



Reclaimed water spigot at the Water Reuse Park.

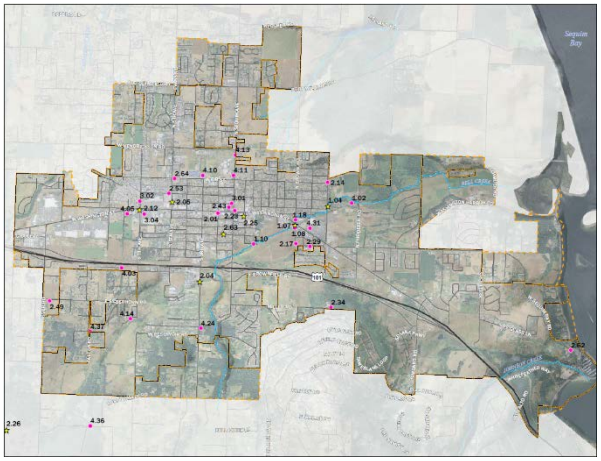


The City's Water Reclamation Facility off Schmuck Road adjacent to lower Bell Creek. Reclaimed water is piped back to town for irrigation and other non-potable uses.

KNOWN STORMWATER PROBLEMS AND RECOMMENDED CAPITAL SOLUTIONS

Stormwater flooding and water quality problems in the city are caused by multiple local and regional factors, including:

- Flow from upland development
- Misconnected street drains
- Flooded irrigation infrastructure
- Aging stormwater infrastructure
- Inadequate maintenance due to limited staffing and funding
- Unmanaged runoff from non-City-owned properties
- Direct stormwater discharge to surface water bodies



High priority stormwater problems and proposed capital improvement project locations within the City. Refer to Figure 6 for additional details.

Using input from the public and institutional knowledge, the City documented and mapped problem areas and identified 84 specific runoff and flooding problems in the Stormwater Management Needs Assessment. The development of the City's stormwater CIP project list builds on the stormwater problem identification and prioritization conducted for the Stormwater Management Needs Assessment. These 84 original runoff and flooding problems were placed in the following categories:

- Creek related runoff and flooding problems (17 sites)
- City-owned property runoff and flooding problems (60 sites)
- Misconnected street drain runoff and flooding problems (7 sites)

A fourth group (Non-City-Owned Properties) was added after the completion of the Stormwater Management Needs Assessment.

The higher priority problems identified by the City were further evaluated by conducting interviews with City staff and by performing field reconnaissance. Potential engineering solutions were identified to address these problems, and implementation of the solutions was prioritized based on several criteria. Project summary sheets and itemized planning level cost estimates were developed for ten projects.

This chapter is focused on resolution of flooding and water quality issues through capital project solutions rather than programmatic, or management, solutions.

STORMWATER PROGRAM EVALUATION AND RECOMMENDATIONS

Recommendations and improvements for the City's stormwater program include recommendations from the City's Stormwater Management Needs Assessment (Sequim 2014), as well as additional needs identified during the workshop and document review. Based on this assessment, the Plan makes the following high priority recommendations:

- **Capital Facilities:** Initiate a stormwater Capital Facility Program to address flooding and water quality issues within the city. The City should add stormwater projects to the City's overall CIP; Table 6 in this plan identifies priority capital projects.
- **Inspection Program**: Institute a private stormwater facility inspection program and develop and enforce maintenance standards for non-City-owned stormwater facilities. The inspection program may include development of inspection logs and plat language and private-owner education, coordination with school districts to clarify maintenance responsibilities, and improved coordination with homeowner associations and commercial landowners on shared maintenance responsibilities. Criteria and protocols for enforcement should also be developed.
- **Water Quality Compliance:** Develop and implement a pollution control plan for water bodies currently on the 303(d) list of impaired waters, surface water flow monitoring program (currently underway), and a plan to assess drywells classified as underground injection control wells (UICs). Consider monitoring to assess water quality and measure improvements over the long term resulting from stormwater management and water quality treatment of typical stormwater pollutants.
- **Species and Habitat Protection**: Participate in routine meetings of the Dungeness River Management Team (DRMT) and Water Rule implementation groups, and request smolt outmigration data from Bell Creek (and others as available) measured by the Jamestown S'Klallam Tribe (Tribe) or others.
- **Stormwater Design Guidance and Plan Review to control runoff from development during construction and post-construction:**
    - Review the 2012 Storm Water Management Manual for Western Washington (SWMMWW) (and 2014 modifications) and consider developing an amendment to the 2012 SWMMWW that provides guidelines and requirements specific to the City, which may include BMPs that are most effective in protecting groundwater quality while preserving recharge.
    - Develop a consistent stormwater plan review process, which may include handouts that summarize on-site stormwater management, treatment, and flow control thresholds for when the SWMMWW applies for single-family and commercial development projects.

	
Outside contractor conducting a storm drain manhole inspection.	The City vactor truck and crews performing annual maintenance such as cleaning debris and jetting infiltration lines.

- **Asset Management:** Continue to update the storm system map and database as needed.
- **Stormwater System Operations and Maintenance:** Establish maintenance agreements with irrigators and other stormwater management partners addressing type and frequency of maintenance activities as well as responsibilities for maintenance, add maintenance and inspection information to the storm system map in GIS, and consider hiring a seasonal worker/additional support for the catch basin inspection crew and inspecting and cleaning stormwater pipes and drywells.
- **Pollution Source Detection and Elimination:** Develop and implement a pollution source tracking program, obtain field equipment for illicit discharge tracking and source tracing, develop a system for tracking illicit discharges, develop a basic training program for City field staff, and develop a spill reporting hotline.
- **Public Education and Outreach:**
  - Develop outreach materials for residents, landscapers, and property managers/landowners, including additional guidance (e.g., fact sheets or brochures) for developers and builders on meeting the City's stormwater facility maintenance and construction requirements.
  - Attend regional meetings and conferences and participate in regional forums such as the West Sound Stormwater Managers' Coordination Group, the Sequim-Dungeness Clean Water Work Group, and the Association of Washington Cities (AWC). Continue to work toward coordination/leadership/agreements with other parties that may be necessary to achieve stormwater management/conservation goals (this may include reclaimed water and other supplies).



City of Sequim Interpretive Center at the Water Reuse Park (500 N Blake Ave).



Examining the drainage features map at the City's Stormwater Stewardship booth at the 2015 Irrigation Festival.

PLAN IMPLEMENTATION

Three tiers were evaluated for staffing, funding, and equipment needs:

A. Needed to meet minimum standards

B. Likely to be mandated

C. Proactively anticipating and reducing risk

The 2014 City budget included 1.75 full time equivalent (FTE) personnel designated to supporting stormwater activities: 0.75 FTE Operations and 1.0 FTE Capital (a temporary position). These numbers are used as the basis for the staffing recommendations presented in this plan, but may change in subsequent City budgets.

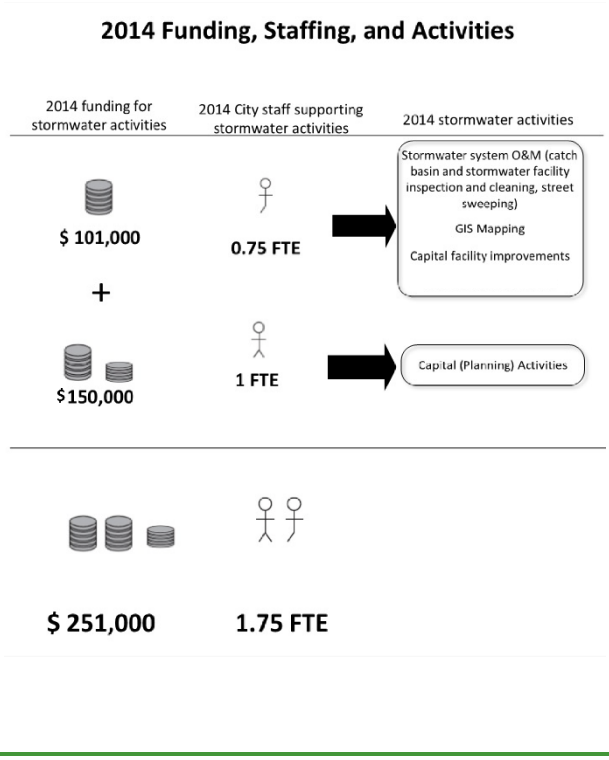
The estimated staff support indicated to be needed for each category includes the following:

- **Tier A:** 2.51 FTE permanent staff (0.75 FTE existing and 1.76 FTE additional staff)
- **Tier B:** 3.93 FTE permanent staff (0.75 FTE existing and 3.18 FTE additional staff)
- **Tier C:** 4.16 FTE permanent staff (0.75 FTE existing and 3.41 FTE additional staff)

The 2014 budget for stormwater as described above includes normal, ongoing operational activities such as stormwater system maintenance, GIS mapping, and minor capital facility improvements. An additional $75,000 was in the 2014 Capital budget for expenses related to development of a master plan. A $250,000 grant from Ecology for the Stormwater Stewardship project covers the period from July 2014 through March 2016. ($250,000 grant = 75 percent grant reimbursement of the $333,000 project cost.)

The estimated funding support needed for each category includes the following for operational as well as capital costs (note that grants will be needed for large capital expenses):

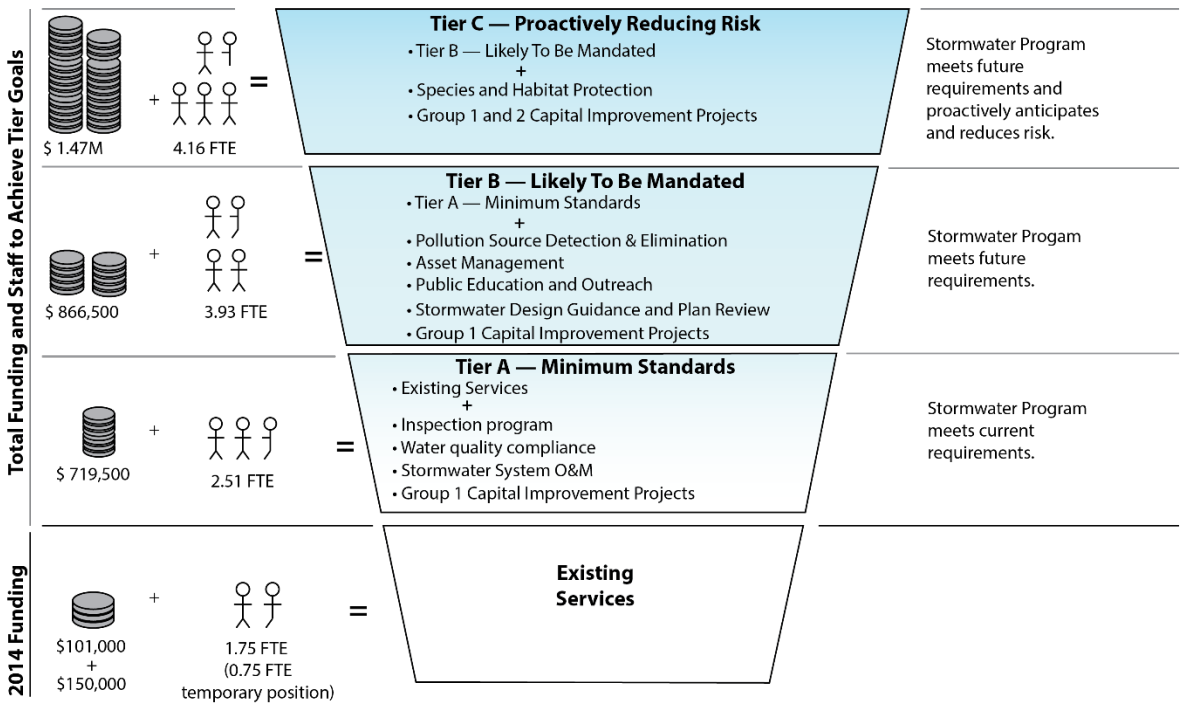
- **Tier A:** $719,500 ($101,000 existing and $618,500 additional funding)
- **Tier B:** $866,500 ($101,000 existing and $765,500 additional funding)
- **Tier C:** $1,472,500 ($101,000 existing and $1,371,500 additional funding)



Summary of 2014 Sequim stormwater program funding, staffing and activities.

Additional equipment that could be useful for maintenance, asset management, and pollution source detection inspections includes the following:

- **Tier A:** No new equipment needed
- **Tier B:** Pollution source field screening and source tracing equipment and field tablets for asset management data collection
- **Tier C:** Pollution source field screening and source tracing equipment, bioretention maintenance equipment, permeable pavement maintenance equipment



Summary of 2014 and proposed Tier A, Tier B, and Tier C Stormwater Program funding, staffing, and activities.

CONCLUSIONS

Based on discussions with City staff, Planning Commission, and City Council, the preferred approach for storm and surface water management is implementing the Tier A recommendations over the next one to three years (2016–2018) using existing resources without adding any new revenue. CIP projects will be implemented as grant and loan funding become available. City staff will report back to the City Council at the end of each year to provide an update on the activities performed during that year, activities that are planned for the upcoming year, and any changes that need to be made to increase success in terms of achievement of Tier A objectives, and impacts, if any, on other City programs. Staff will continue to seek grant and other outside funding to supplement these activities and CIP projects, while ultimately aiming toward Tier B levels of service.

CHAPTER 1 – INTRODUCTION

This section provides information on the following:

- Purpose of this Storm and Surface Water Master Plan, including the importance of managing stormwater, regulatory framework, and goals and objectives of the plan
- Overall document organization

PURPOSE OF THIS PLAN

This Storm and Surface Water Master Plan is intended to serve as a comprehensive and strategic guide to managing stormwater and surface water in the city of Sequim. This plan addresses needs identified in the Stormwater Management Needs Assessment (Sequim 2014) and includes:

- Identification of, and proposed solutions to, drainage and water quality issues
- Actions necessary to ensure compliance with applicable federal, state, and local requirements
- Actions recommended for improving and expanding capital and operational elements of the City's existing stormwater program
- Staffing and resource needs to implement the plan recommendations
- Discussion of future growth and climate change strategies
- Discussion of opportunities for interdepartmental and interagency collaboration

Importance of Managing Stormwater

Urban development typically results in an increase in the volume of stormwater runoff generated and a decline in water quality downstream. Within the City of Sequim, the native soils can handle and treat most of this stormwater runoff through the natural process of infiltration, if stormwater facilities are designed appropriately. There are some areas of the city with localized flooding or capacity issues (described in the *Known Stormwater Problems and Recommended Solutions* section of this plan), but overall, the drainage issues within the city do not create major public safety hazards. However, water quality in the city's streams, bays, and aquifers is impacted by stormwater runoff.

Through better management of stormwater with flow control and water quality treatment facilities such as ponds, wetlands, biofiltration swales, drywells, and infiltration trenches, the following benefits can be attained:

- Reduced localized flooding or ponding causing damage to streets and other property
- Reduced level of pollutants carried by stormwater (sediments, nutrients, metals, oils, and other contaminants)

- Protected fish and wildlife habitat provided by city streams
- Preservation and protection of drinking water supply (i.e., drought resilience)

Most of the stormwater in the city is managed through infiltration and therefore serves as a source of groundwater recharge. While this is a convenient and inexpensive way to manage stormwater, it does present a potential concern for protecting the quality of the city's groundwater supply. The city is unique when compared to most other cities in western Washington because of the relatively dry climate; therefore, City staff are especially concerned with conserving water resources and water resource management in the Dungeness watershed is an important focus in the area.

If stormwater structures (e.g., catch basins, ditches) and facilities (e.g., ponds, wetlands, biofiltration swales, drywells, and infiltration trenches) are not operated and maintained properly, they will fill with sediment and not perform or treat the runoff as designed. Without maintenance, the stormwater that enters these structures and facilities would bypass the facilities and cause ponding or flooding on roadways and parking lots throughout the city. Some of this water may even flow directly into city creeks, potentially resulting in water quality violations and harm to local aquatic species. Without stormwater site plan review, the City may also have facilities installed that are not sized correctly and overflows from these facilities could result in additional flow and water quality impacts.

Regulatory Framework

There are several federal and state regulations and strategic planning efforts that apply to the City's storm and surface water program. Each are summarized in detail in Appendix C including:

- State surface water quality standards (WAC 173-201A)
- Groundwater quality standards (WAC 173-200)
- Underground Injection Control (UIC) requirements
- Puget Sound Partnership (PSP) Action Agenda
- Dungeness Water Rule (WAC 173-518)
- National Flood Insurance Program (NFIP)
- Various species and habitat protection requirements (such as the Endangered Species Act, Watershed Planning Act, and Growth Management Act)
- The Sequim Municipal Code (SMC) (as it applies to the requirements listed above)

Appendix C also references evolving regulations and policies which include recent changes to the state surface water quality standards (not yet finalized) and the National Pollutant Discharge Elimination System (NPDES) municipal stormwater permit. The City is not currently a municipal stormwater permittee; however, many stormwater program elements highlighted in the NPDES permit are beneficial for the City to consider as part of implementing its current stormwater program—and have been included in this plan as appropriate to fill Sequim's unique needs.

Master Plan Goals and Objectives

The goals of this Storm and Surface Water Master Plan are to:

- Demonstrate that stormwater is an important source of water which can be reused if controlled and managed effectively
- Lay out a plan for protecting and enhancing the quality of the City's groundwater and surface water resources
- Outline a practical, user-friendly plan for future stormwater program implementation supported by the public and City Council that will be followed by a financial analysis to determine the most appropriate funding strategy

The objectives of this Storm and Surface Water Master Plan are to:

- Document the City's current stormwater program and funding sources
- Analyze existing stormwater issues and identify capital facility, maintenance, management, enforcement, and public education solutions to these issues
- Reduce the potential for pollutants associated with stormwater to enter groundwater and surface water resources
- Encourage green stormwater infrastructure (GSI), infiltration, and stormwater re-use
- Incorporate water quality monitoring
- Anticipate impacts to water resources from growth, climate change, and future regulatory drivers
- Enhance relationships with water management partners and neighboring entities, and identify the type and nature of practical management agreements needed
- Promote public education and outreach and stewardship opportunities
- Align with goals of the City's Comprehensive Plan, and reclaimed water goals in the Water System Plan and General Sewer Plan
- Establish Sequim as a leader in responsible water quality and resource stewardship for the Dungeness watershed

A summary of goals and policies in the Citywide Comprehensive Plan related to stormwater and surface water is included in the City's Stormwater Management Needs Assessment (Sequim 2014). These goals and policies are currently being updated through the Sequim 120 Comprehensive Plan update process (Sequim 2015).

PLAN ORGANIZATION

This Master Plan includes the following chapters:

- **Chapter 2 – Background:** A discussion of background material that is relevant to the stormwater program including study area characteristics, drainage basins, existing

stormwater system, irrigation system, and reclaimed water system. This section also includes a short section on future growth, climate change, and applicable regulations.

- **Chapter 3 – Known Stormwater Problems and Recommended Solutions:** A description of citywide and site-specific stormwater problems and recommended solutions.
- **Chapter 4 – Stormwater Problem Evaluation and Recommendations:** A description of the stormwater program current activities and recommendations to meet regulatory and City code requirements as well as programmatic goals.
- **Chapter 5 – Plan Implementation:** A plan for implementation of the recommended capital improvement projects and stormwater program activities that takes into account staffing needs, resource needs, future growth, climate change, interdepartmental collaboration, and interagency collaboration.
- **Chapter 6 – Conclusions:** An abbreviated summary of the information contained in this plan.

The Master Plan appendices provide more detailed background information, calculations, and data related to the plan's recommendations:

- **Appendix A** provides a list of definitions, acronyms, and abbreviations for terminology included in the Master Plan.
- **Appendix B** describes the methods used and the people involved in development of the Master Plan. It also includes a summary of public outreach efforts conducted related to the Master Plan.
- **Appendix C** includes a summary of Underground Injection Control (UIC) regulations, water quality standards, and other applicable regulations that guide the stormwater program. It also includes a summary of the NPDES Phase II Permit requirements (for future City planning).
- **Appendix D** includes a table that summarizes all of the identified stormwater problems in the city and outlines potential solutions for these problems.
- **Appendix E** provides a quantitative CIP project prioritization table.
- **Appendix F** provides summary sheets and conceptual cost estimates for ten of the CIP projects included in the Master Plan.
- **Appendix G** contains the Regulatory Gap Analysis and Compliance Strategy Report that was developed as part of this project and which provided the basis for the information summarized in the *Stormwater Program Evaluation and Recommendations* section of the Master Plan.
- **Appendix H** contains the Water Quality Data Analysis Report that was developed as part of this project.
- **Appendix I** contains the funding strategies memorandum.

CHAPTER 2 – BACKGROUND

This section provides background information on:

- The City's current approach to stormwater management
- The physical environment in the city that affects stormwater management
- Waterbodies within the city limits
- Stormwater, irrigation, and reclaimed water systems in the city
- Climate change considerations
- A list of applicable regulations

CURRENT STORMWATER PROGRAM

The City currently does not have a formal stormwater management program, and is not currently bound by regulatory requirements such as the NPDES municipal stormwater permit. However, in recent years and with the increased focus on the importance of managing water in an area of limited water resources, the City has come to recognize that stormwater should be treated as an important resource rather than a liability. The City is in a unique position to evaluate priorities and articulate goals for a future stormwater management program because it can do this without the regulatory confines of the NPDES program.

Currently, funding for the City's limited stormwater program operations is equally shared by the City Sewer Utility and Water Utility. These utilities are restricted in the types of activities they can fund, limiting the City's ability to perform certain operational activities needed to meet stormwater program goals. The current funding approach as well as alternative funding options will be evaluated as part of the financial analysis.

Capital facility improvements are sometimes partly or fully subsidized with grant funding and new development fees. A small amount of stormwater-related communications, monitoring, and enforcement activities have been funded as needed by various other City funds (Sequim 2014).

STUDY AREA CHARACTERISTICS

The city is located in the Dungeness watershed on the North Olympic Peninsula, in the rain shadow of the Olympic Mountains, averaging just over 16 inches of precipitation per year. The city encompasses approximately 6.5 square miles in area, including 5,359 linear feet of marine shoreline (Sequim 2013a). The Urban Growth Area (UGA) encompasses 8.4 square miles in area. The current city population is 6,606 (2010 census). (Note: This plan only addresses stormwater issues within the city limits, but the UGA is included in text and figures when the UGA is relevant to stormwater management issues within the city limits.)

The City's land uses reflect blend of its small, farm town heritage and more recent influx of residential and commercial development. The city has been known as a retirement community due to its location in the rain shadow. The median age in the city is expected to remain around 60 (Sequim 2015). Single family residential development dominates the southern portion of the city south of Highway 101, while mixed use, multi-family residential, medical and professional, and commercial buildings dominate the north side of Highway 101. Parks and open space areas are found throughout the city, with the largest on the southwest and northeast corners of the city. Figure 1 depicts existing land uses in the city.

The soils in the city consist of floodplain soils, intermixed zones of glacial till, and wetland bogs (Figure 2). The majority of the city is dominated by Sequim (37 percent), Sequim-Carlsborg (19 percent), and Hoypus (3 percent) soils; these are floodplain soils that formed in coarse textured alluvium or glacial outwash that have high infiltration capacities. These soils are generally most suitable for stormwater infiltration applications. The remainder of the mapped soils in the city include, Yeary (21 percent), Clallam (17 percent), Catla (2 percent), and Beaches (1 percent); these are sandy or silty soils characterized by low permeability and relatively high runoff potential. These are less suitable for stormwater infiltration applications.

Sensitive groundwater areas in the city include Wellhead Protection Areas (WHPAs) and Critical Aquifer Recharge Areas (CARAs). The City Water System Plan (Sequim 2013b) defines a WHPA as the surface and subsurface area surrounding a groundwater source through which potential contamination can travel and eventually reach the source. WHPAs are based on Zones of Contribution (ZOCs) derived from the time of travel required for a contaminant to move from the point of introduction into the water bearing formation to the drinking water source, and are used to identify the area of influence around each drinking water well, and where land use management can help to reduce the risk of contamination. CARAs are defined as "areas with a critical recharging effect on aquifers used for potable water, including areas where an aquifer that is a source of drinking water is vulnerable to contamination that would affect the potability of the water, or is susceptible to reduced recharge" (WAC 365-190-030). Because WHPAs identify areas where land use is carefully regulated to avoid contamination of drinking water, groundwater in these areas should already be protected. Future development in WHPAs and CARAs through land use and activity regulation is defined and enforced through SMC 18.80. A majority of the city is designated as a High Aquifer Recharge Area. These protected areas constitute the following percentage of the city and are shown in Figure 3:

- **Wellhead Protection Areas (WHPAs)** – 27 percent
- **Critical Aquifer Recharge Areas (CARAs)** – 58 percent

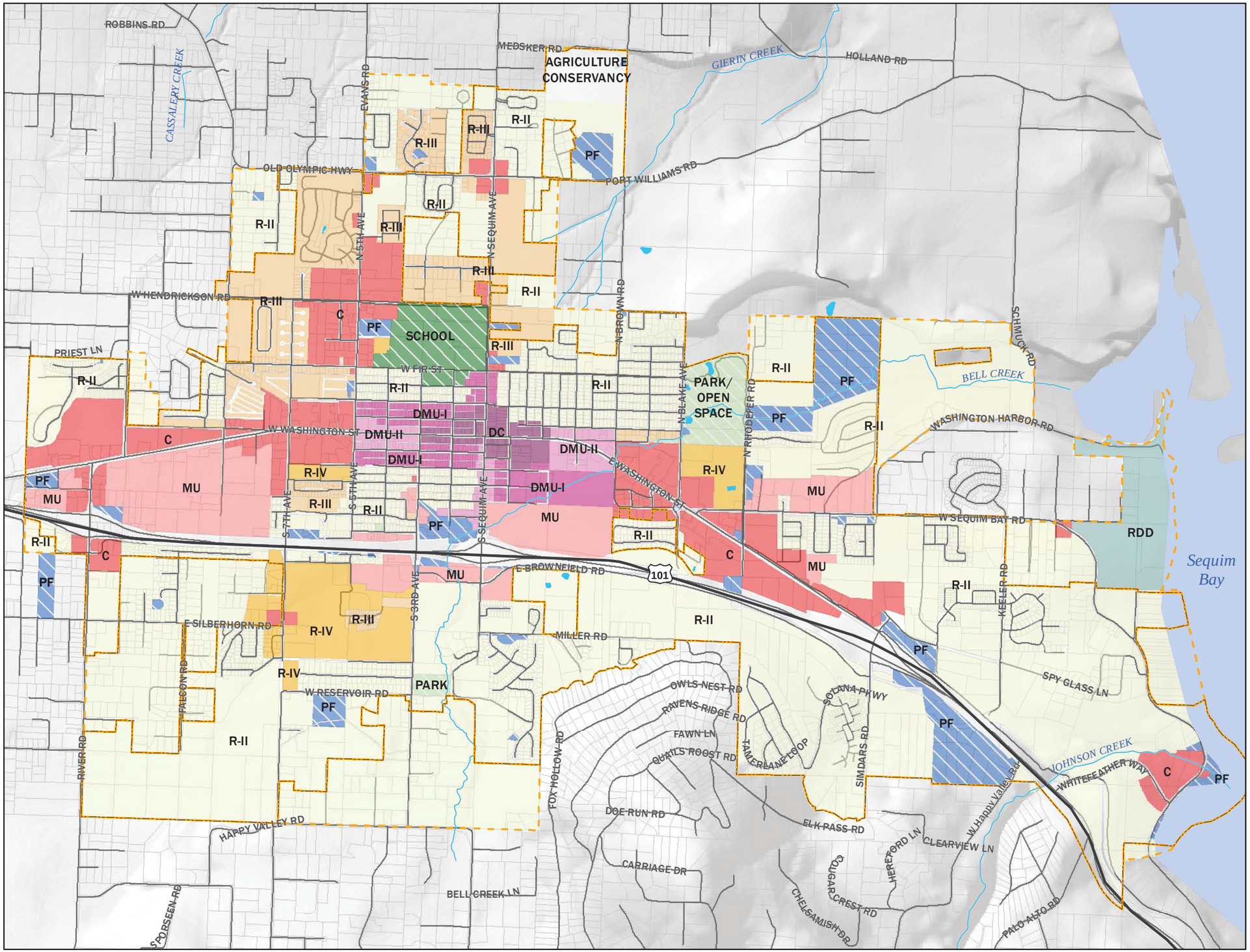


Figure 1.
Existing Land Use
in the City of Sequim.

Legend

- City limit
- Urban Growth Area (UGA)
- Parcel
- Stream
- Pond
- Highway
- Road

Land Use

- DC - Downtown Core
- DMU-I - Downtown Mixed Use I
- DMU-II - Downtown Mixed Use II
- C - Commercial
- MU - Mixed Use
- RDP - Research and Development Park
- PF - Public Facility/ Government Owned Parcel
- School
- Park/Open Space
- R-II - Residential
- R-III - Residential
- R-IV - Residential

Note: Land use data from the 2006 City of Sequim Comprehensive Plan.

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Washington State Plane North FIPS 4601 Feet

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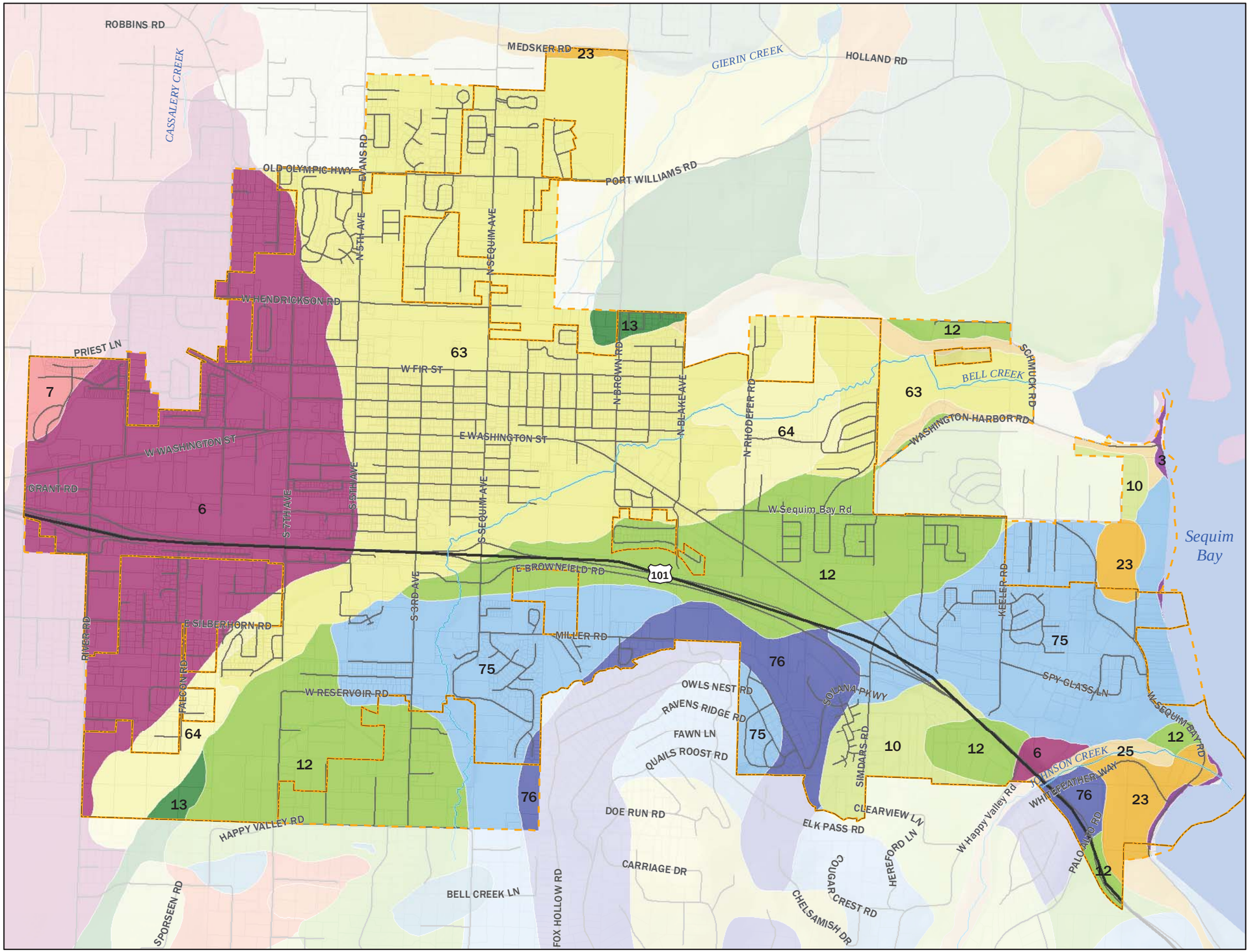


Figure 2.
Hydrologic Soil Groups
in the City of Sequim and UGA.

Legend

- City limit
- Urban Growth Area (UGA)
- Parcel
- Stream
- Road
- Highway

Soil Type

Rapid Infiltration-Floodplains Soils

- Carlsborg gravelly sandy loam, 0 to 5 percent slopes (6)
- Carlsborg-Dungeness complex, 0 to 5 percent slopes (7)
- Hoypus gravelly sandy loam, 0 to 15 percent slopes (25)
- Hoypus gravelly loamy sand, 30 to 65 percent slopes (23)
- Sequim very gravelly sandy loam (63)
- Sequim-McKenna-Mukilteo complex (64)

High Runoff-Glacial Till, Clay Soils

- Catla gravelly sandy loam, 2 to 15 percent slopes (10)
- Clallam gravelly sandy loam, 0 to 15 percent slopes (12)
- Clallam gravelly sandy loam, 15 to 30 percent slopes (13)
- Yeary gravelly loam, 0 to 15 percent slopes (75)
- Yeary gravelly loam, 15 to 35 percent slopes (76)

Others

- Beaches (3)

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USDA, Soils (2013)

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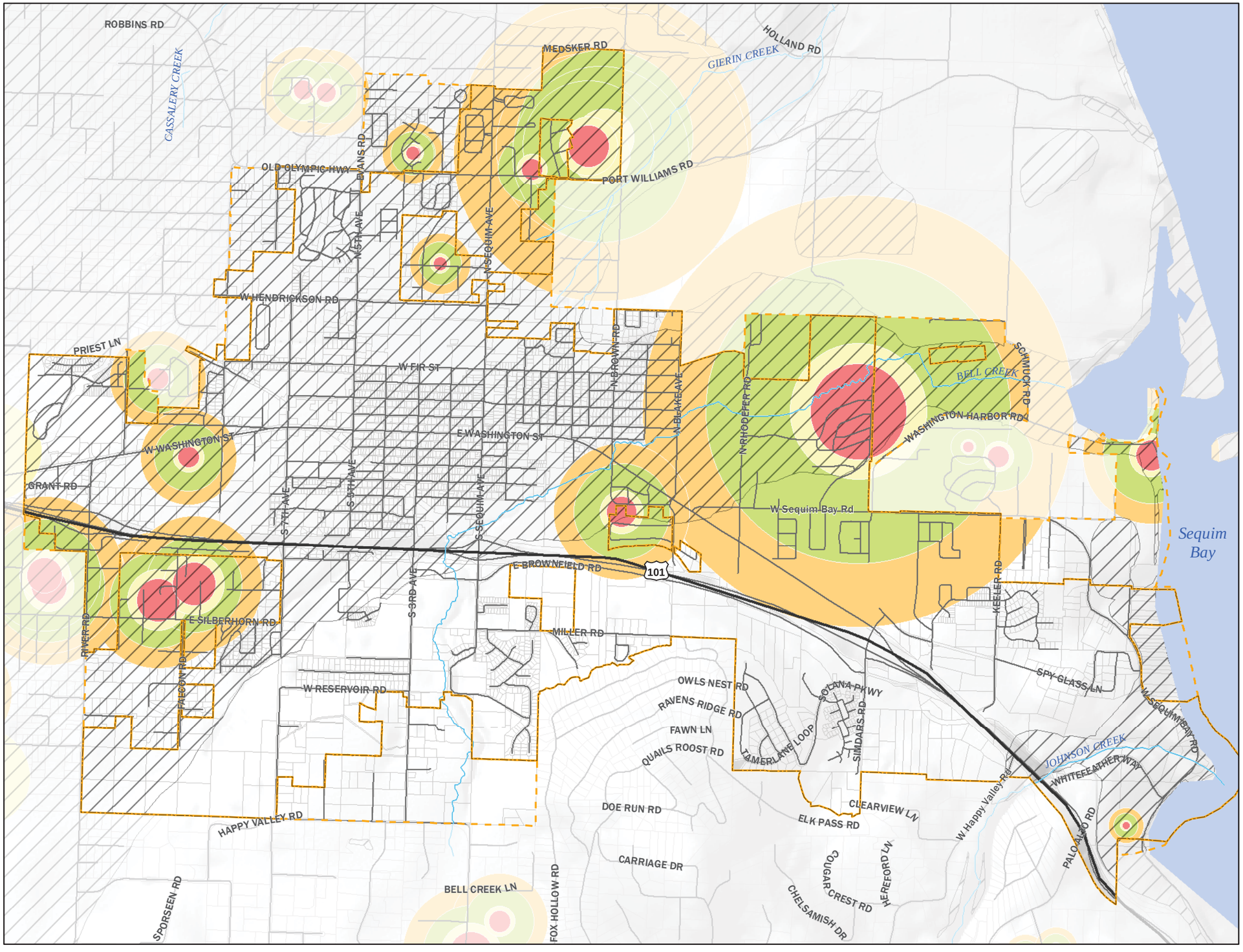


Figure 3.
Critical Aquifer Recharge Areas (CARA) and Well-head Protection Areas (WHPA) in the City of Sequim and Clallam County.

Legend

- Critical Aquifer Recharge Area (as defined by Clallam County)

WHPA

- 6 months
- 1 year
- 5 year
- 10 year
- City limit
- Urban Growth Area (UGA)
- Parcel
- Stream
- Road
- Highway

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Washington State Plane North FIPS 4601 Feet
Clallam County, CARA (2004)

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DRAINAGE BASINS

Sequim extends over three main drainage basins: Bell Creek Basin, Johnson Creek Basin, and Gierin Creek Basin. Small portions of the city also include areas in the Cassalery Creek Basin and the Dungeness River Basins. The drainage basin size and land cover composition based on data from the National Land Cover Database (NLCD) are summarized in Table 1 (NLCD 2011). The drainage basin boundaries are depicted on Figure 4.

Table 1. Drainage Basin Size and Land Cover for Basins Located Within the City of Sequim.

	Bell Creek	Johnson Creek	Gierin Creek	Cassalery Creek	Dungeness River
Total Area (square miles)	7.4	6.3	5.3	3.5	48.9
Basin Area Within City Limits	40%	14%	35%	4%	0.37%
City Area Within Basin[a]	46%	15%	29%	2.4%	2.9%
Land Cover (% of total basin)					
Developed, high intensity and medium intensity	16%	5%	26%	27%	8%
Developed, low intensity and open space	16%	7%	21%	16%	5%
Barren[c]	0%	1%	1%	0%	0%
Forest[d]	23%	43%	12%	4%	55%
Shrub/scrub[e]	2%	16%	0%	0%	10%
Herbacious[f]	1%	3%	2%	0%	2%
Planted/Cultivated[g]	39%	22%	29%	51%	14%
Wetlands[h]	2%	1%	6%	1%	4%
Water[i]	0%	2%	0%	0%	0%

Land cover category descriptions:

[a] The remaining 4.7 percent of the city drains to two unnamed basins (2.5 percent) and the West Happy Valley sub-watershed (2.2 percent).

[b] Developed areas category includes low intensity, medium intensity, and high intensity development.

[c] Barren areas are characterized by bare rock, gravel, sand, silt, clay, or other earthen material, with little or no vegetation present.

[d] Forest areas are characterized by tree cover where the tree canopy accounts for 25% to 100% of the cover. This category includes deciduous, evergreen, and mixed forest.

[e] Shrub/scrub areas are characterized by natural or semi-natural woody vegetation with aerial stems.

[f] Herbaceous areas are characterized by natural or semi-natural herbaceous vegetation. This category includes grassland/herbaceous and sedge/herbaceous.

[g] Planted/Cultivated areas are characterized by herbaceous vegetation that has been planted or is intensively managed for the production of food, feed, or fiber. This category includes pasture/hay and cultivated crops.

[h] Wetlands are areas that are characterized by soil or substrate that is periodically saturated with or covered with water. This category includes woody wetlands and emergent herbaceous wetlands.

[i] Water includes open water and perennial ice/snow cover.

Multiple locations within the Bell Creek, Johnson Creek, and Gierin Creek drainage basins have been monitored for water quality in recent years (Appendix H). Some of this water quality data has been used as part of the state's official water quality assessment submitted

to EPA. For this process Ecology groups waterbodies into five categories according to their level of impairment. These categories are:

- Category 1 (meets tested standards for clean waters)
- Category 2 (waters of concern)
- Category 3 (insufficient data)
- Category 4:
  - Category 4a (has a water cleanup plan, or TMDL)
  - Category 4b (has a pollution control program)
  - Category 4c (is impaired by a non-pollutant)
- Category 5 waterbodies have known water quality impairments and have exceeded water quality standards for one or more pollutants. All Category 5 waterbodies are included on the State's 303(d) list and the list is submitted to EPA. Total Maximum Daily Load (TMDLs) or water cleanup plans are required for all waterbodies identified on the 303(d) list. The most recent 303(d) list was approved by the EPA in 2012; however, the list is revised periodically and Ecology is currently finalizing the new list.

Bell Creek Drainage Basin

The Bell Creek drainage basin is bordered on the north by the Gierin Creek drainage basin and on the south by the Johnson Creek drainage basin (Figure 4). Bell Creek flows a total of 3.8 miles from the uplands of Happy Valley, where it receives runoff from Bell Hill and Burnt Hill, through the eastern portion of the City, and discharges to Washington Harbor at the north end of Sequim Bay (Elwha-Dungeness Planning Unit 2005). The total drainage basin area for Bell Creek is approximately 7.4 square miles, 40 percent of which is located within the city limits. Approximately 32 percent of the drainage basin is comprised of urban and rural development based on data from the NLCD with the remainder of the drainage basin primarily comprised of planted/cultivated areas (39 percent), forest (23 percent), and shrub/scrub (2 percent).

Until recently, the middle and lower reaches of Bell Creek were supplemented with irrigation water from the Dungeness River for the Highland Irrigation District for the duration of the irrigation season through a spillway near Bell Creek's canyon and ditches in the west Happy Valley drainage area (also referred to as the West Fork of Bell Creek) (Sequim 2014). Now, Bell Creek is considered an ephemeral stream fed primarily by groundwater and by stormwater. Without supplementation with Dungeness River flow, the middle reaches of Bell Creek are dry during the summer months. The Highland Irrigation District maintains a separate irrigation system that, in the summer, conveys Dungeness River water as far east as Sequim Bay in both open ditch and piped segments, which cross or discharge to Bell Creek at multiple locations, with tail water discharging to Johnson Creek. In the winter, the irrigation system conveys a relatively small amount of Dungeness River water during dry weather, and intercepts runoff from west of the Bell Creek drainage basin into Bell Creek or Johnson Creek during wet weather (when the head gate at the Dungeness River is shut). The Sequim Prairie Tri-Irrigation Association also maintains a separate irrigation system of pipes and ditches, some of which discharge runoff and/or irrigation tail water to Bell, Gierin, and Cassalery Creeks.

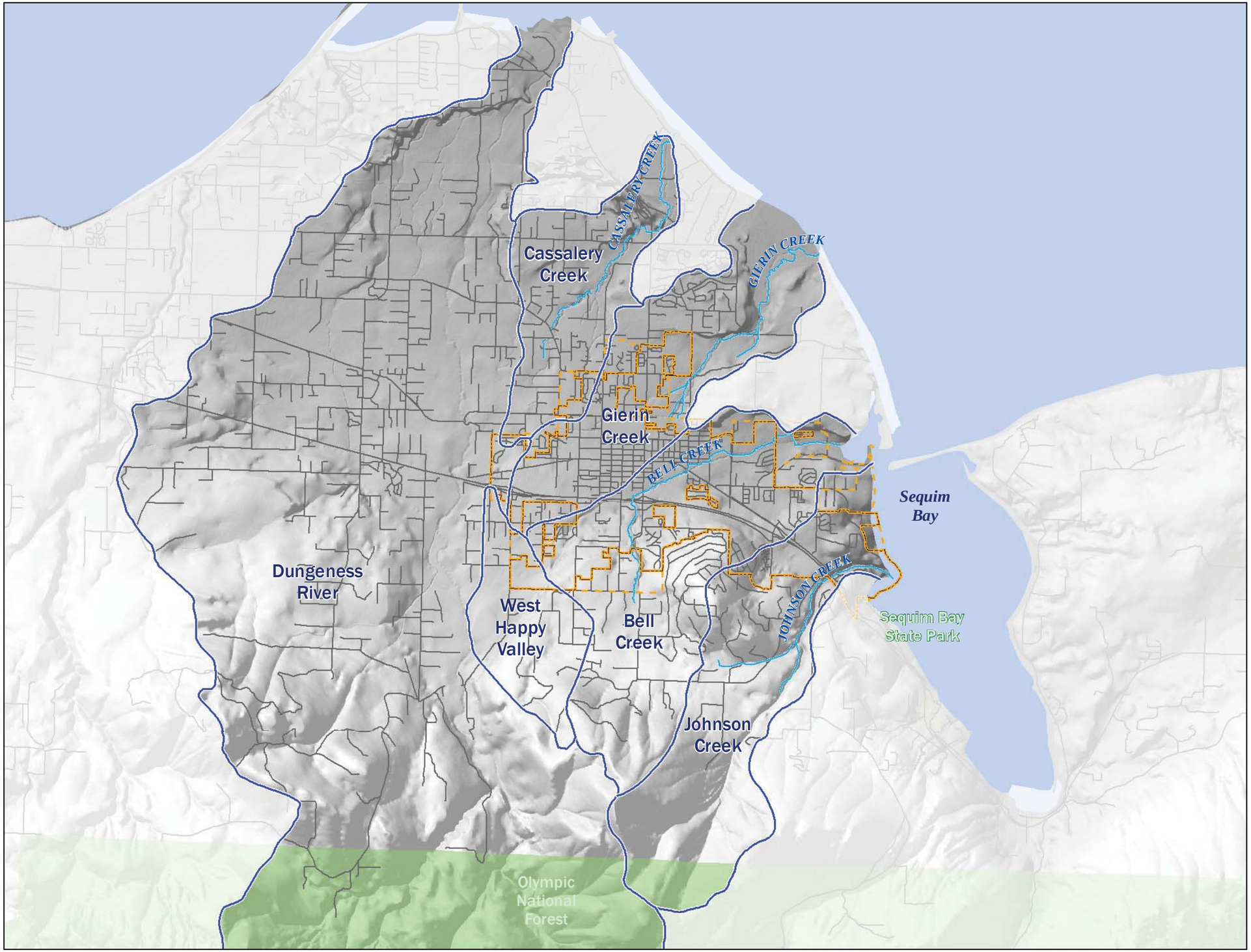


Figure 4.
Drainage Basins
Surrounding the City of Sequim.

Legend

- Subbasin
- City limit
- Urban Growth Area (UGA)
- Stream
- Road
- National Park
- State Park

Note: Dungeness River subbasin is approximate.

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The Jamestown S'Klallam Tribe monitors Coho, steelhead, and cutthroat salmon outmigration in Bell Creek, and federal assessments designate most of Bell Creek from the mouth to the crossing of the Highland Irrigation canal as critical habitat for threatened/endangered bull trout (USFWS 2010). A critical habitat designation is also proposed for Puget Sound steelhead in Bell Creek (NOAA 2013). Ecology has included the lower reaches of Bell Creek on the 303(d) list of impaired waters (Category 5) for fecal coliform bacteria, dissolved oxygen, and Benthic Index of Biological Integrity (B-IBI).

The data analyzed in the Water Quality Data Analysis Report (Appendix H) shows a documented declining trend in B-IBI scores in Bell Creek over time as well as distance downstream, presenting evidence of poor water quality. There is also some evidence of elevated nutrient concentrations (e.g., dissolved nitrate+nitrite nitrogen and total phosphorus), elevated dissolved copper concentrations, and likely sources of fecal coliform bacteria. Insufficient data were available to make a meaningful assessment for temperature, total arsenic, total chromium, dissolved lead, or sediment quality. Recommendations for additional monitoring in the Bell Creek drainage basin are summarized in the *Plan Implementation* section.

Johnson Creek Drainage Basin

The Johnson Creek drainage basin is bordered on the northwest by Bell Creek basin and on the southeast by an unnamed drainage basin in Clallam County (Figure 4). Johnson Creek drains eastern portions of Bell Hill, Happy Valley, Burnt Hill, and county areas that drain directly to the Highland Irrigation canal (which empties into Johnson Creek at RM 1.5). The stream enters the city just upstream of SR 101, runs along the eastern edge of the city, and discharges into Sequim Bay just south of Pitship Point (John Wayne Marina). The total drainage basin area for Johnson Creek is approximately 6.3 square miles, 14 percent of which is located within the city limits. Approximately 11 percent of the drainage basin is developed based on data from the NLCD with the remainder of the drainage basin primarily comprised of planted/cultivated areas (22 percent) and forest (44 percent).

Johnson Creek is considered suitable habitat for salmonids and is designated critical habitat for bull trout by the United States Fish and Wildlife Service (USFWS 2010). A critical habitat designation is also proposed for Puget Sound steelhead in Johnson Creek (NOAA 2013). Ecology has included the lower reaches of Johnson Creek on the 303(d) list of impaired waters (Category 5) for fecal coliform bacteria.

The data analyzed in the Water Quality Data Analysis Report (Appendix H) shows a documented declining trend in B-IBI scores in Johnson Creek with distance downstream; however, it is not as notable as what has been observed in Bell Creek. Limited fecal coliform bacteria sampling performed in Johnson Creek in 2010 did not show any exceedances of the single event criterion. Recommendations for additional monitoring in the Johnson Creek drainage basin are summarized in the *Plan Implementation* section.

Gierin Creek Drainage Basin

Gierin Creek basin is a small drainage basin, bordered on the south by Bell Creek basin and in the northwest by the Cassalery Creek basin (Figure 4). A large portion of what is known as

Sequim Prairie comprises the upper Gierin Creek Basin. Sequim Prairie is characterized by flat topography, gravelly soils, and arid climate. Gierin Creek's natural channel rarely has base flow within the city limits. The total drainage basin area is approximately 5.3 square miles, 35 percent of which is located within the city limits where drainage either infiltrates or is controlled by irrigation and SR 101 infrastructure. Approximately 49 percent of the drainage basin is developed based on data from the NLCD with the remainder of the drainage basin primarily comprised of planted/cultivated areas (29 percent), forest (13 percent), and wetlands (6 percent).

Gierin Creek is supplemented directly by Dungeness River water conveyed through the city in irrigation ditches during the summer, and receives stormwater (through sheet flow and stormwater roadside ditches) carried in these irrigation ditches during the winter. Groundwater recharge in this basin is of particular importance, since a portion of the basin (6 percent) is comprised of wetlands that are fed by groundwater (Sequim 2014). Gierin Creek is not included on the 303(d) list of impaired waters (Category 5). No fish habitat has been identified in the Gierin Creek basin within the city or its UGA; however, fish utilization of the channel within the city limits has been reported (Stocker testimony, July 7, 2015).

In-stream monitoring data were not available for the main stem of Gierin Creek; however, there is some fecal coliform data for Eureka Ditch (tributary to Gierin Creek). As summarized in the Water Quality Data Analysis Report (Appendix H), this ditch has elevated fecal coliform concentrations during storm events.

Cassalery Creek Drainage Basin

Cassalery Creek is small independent drainage in the northwest portion of the Sequim Prairie that enters saltwater between Sequim Bay and the Dungeness River (Figure 4). Cassalery Creek is primarily fed by groundwater discharge from the north slopes of the Olympic Mountains (Pacific Groundwater Group 2008). The total drainage basin area for the Cassalery Creek is approximately 3.5 square miles, 4 percent of which is located within the city limits. Approximately 51 percent of the drainage basin is planted/cultivated areas based on data from the NLCD with the remainder of the drainage basin comprised of developed areas (43 percent), forest (4 percent), and wetlands (1 percent). Cassalery Creek may receive upland runoff from the county and city, but irrigation ditches run parallel and likely intercept any runoff, carrying it further east (Sequim 2014).

Dungeness River Drainage Basin

The Dungeness River drains a watershed of 270 square miles into the Strait of Juan de Fuca. Streams and tributaries that make up the watershed come to a total of 546 miles, the largest of which are the Grey Wolf River and Canyon Creek. The Dungeness River watershed cuts steeply through the high mountains of the Olympics, largely protected in National Park and Forest lands, emerging to the north in a flatter, broad lowland plain in the lower Sequim-Dungeness valley, and emptying into the Dungeness Bay (Elwha-Dungeness Planning Unit 2005). The total drainage basin area for the Dungeness River is approximately 48.9 square miles, 0.37 percent of which is located within the city limits. Approximately 55 percent of the drainage basin is comprised of forest, based on data from the NLCD, with the remainder of the drainage basin primarily comprised of planted/cultivated areas (14 percent), developed areas (13 percent), and shrub/scrub (10 percent). The Dungeness River would receive upland

runoff from the county and city except that it mostly infiltrates; in addition, several irrigation ditches run parallel and likely intercept runoff, carrying it north and east (Sequim 2014).

West Happy Valley Drainage

The west Happy Valley drainage area flows into what was once referred to as the West Fork of Bell Creek. The west Happy Valley area drains the north slope of Burnt Hill and west Happy Valley, elevated areas just south of the city. Runoff from these areas flows east into Bell and Johnson Creek basins and north to Gierin Creek basin through irrigation ditches and some roadside ditches. Irrigation ditches managed by the Highland Irrigation District (HID) or the Sequim Prairie Tri-Irrigation Association (SPT) run north and north-east across the drainage area. Irrigation ditch water historically entered Bell Creek just south of Highway 101; however, currently no continuous channel connects the irrigation ditches to Bell Creek at this location (Sequim 2014).

This area was subjected to flood irrigation historically, but over time has become more developed, with several ranches and large lots in the county and moderate-density subdivisions within the city limits. The uppermost layer of soil in this area is highly porous and has rapid infiltration, but is underlain by a shallow till or non-porous material (Sequim 2014). During the summer, the irrigation ditches convey irrigation water from the Dungeness River through the city. During the winter, when tendency for flooding in the area is high, runoff flows from West Happy Valley and Burnt Hill through roadside ditches and into the irrigation ditches. The irrigation ditches convey the stormwater flows efficiently until reaching the urban city area, where excess flows overwhelm the capacity of the downstream culverts and stormwater system (Sequim 2014).

EXISTING STORMWATER SYSTEM

In general, stormwater in the city includes runoff from private property and City-owned-property, as well as runoff from County property in the upland areas surrounding the city. Stormwater runoff from these areas is conveyed through the city in irrigation ditches, and through stormwater roadside ditches. The City's stormwater system is composed primarily of short segments of open ditches, pipes, and drywells/perforated pipes (Table 2) receiving runoff from City-owned streets, alleys, parks, and parking lots through catch basins and inlets.

There are also large sections of the city that have no curbs, gutters, or drains. Rainfall infiltrates in the right-of-way (ROW) or on private property, and then flows downhill to the nearest catch basin or inlet. Infiltration facilities primarily discharge to the ground instead of as discrete outfalls to streams, rivers, and lakes. This is distinctly different from most of the urban stormwater conveyance networks in western Washington that largely rely on a combination of underground stormwater pipes, catch basins, and conveyance ditches leading to stormwater outfalls that discharge to surface waters. The Sequim's stormwater system is more similar to a majority of eastern Washington cities. The City also has several publicly owned and operated water quality treatment and flow control facilities including biofiltration swales, detention/retention ponds, and stormwater vaults. Stormwater ponds are maintained as a stormwater facility not a wetland, based on City code, even if they have the characteristics of a wetland. Public and private stormwater facilities are summarized in Table 2 (as documented to date).

Stormwater that is not infiltrated, either due to the lack of stormwater management facilities or poorly infiltrating soils, discharges through irrigation ditch, sheet flow, or interflow (i.e., subsurface groundwater flow) into Bell Creek, Johnson Creek, or Gierin Creek (described in the *Drainage Basins* section). A map showing the current documentation of the City's stormwater system, including irrigation conveyances, is provided in Figure 5.

Table 2. Summary of the City of Sequim Stormwater System.

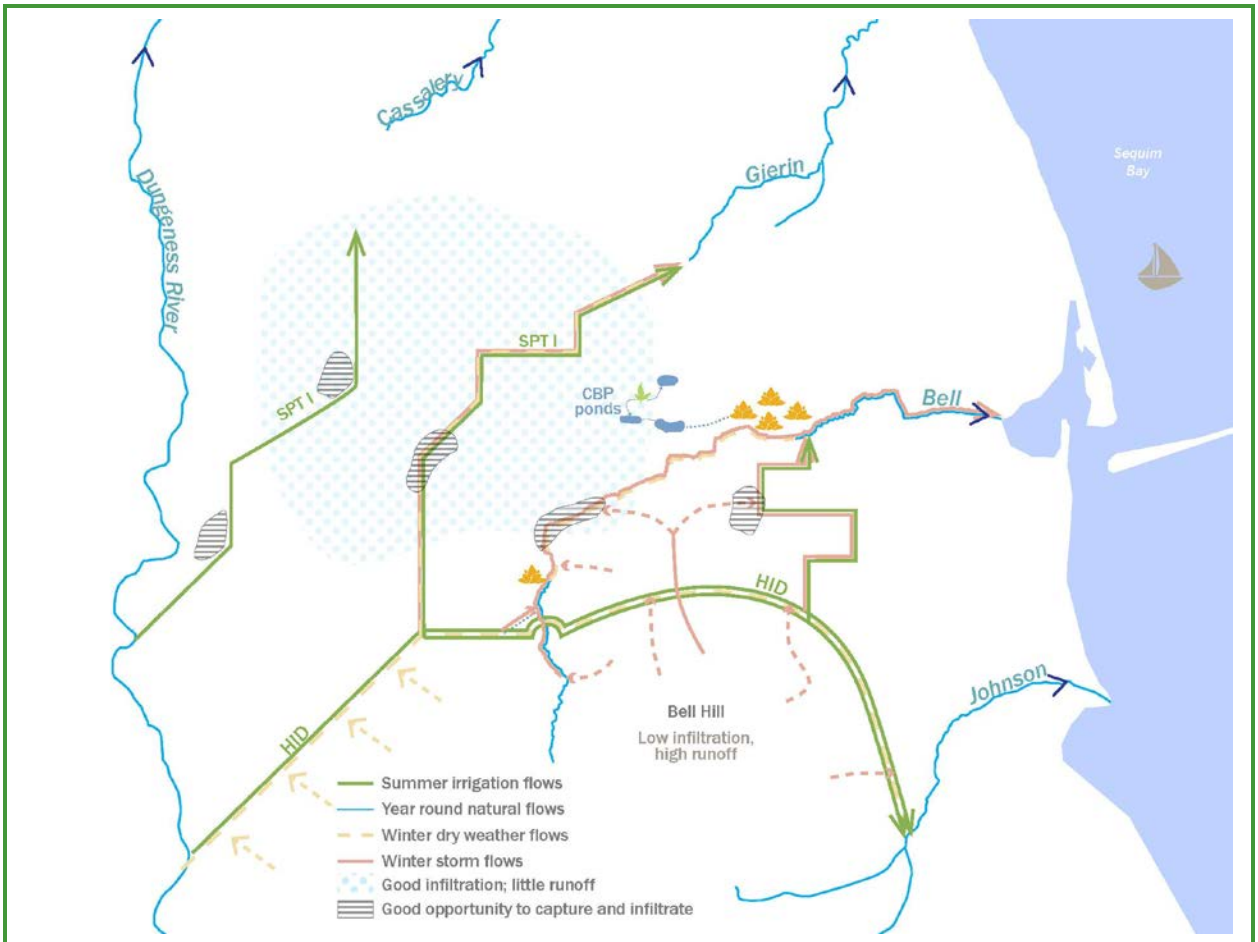
Item	Quantity	Units	Notes
Catch basin or inlet	1,018	each	
Drywell	153	each	Class V UIC
Oil-water separator	NA	each	113 installed for sewer system
Filter	2	Each	Private facilities
City stormwater perforated pipe drain field	169	sites	
City stormwater culvert ditch or stream	66	miles	
Pervious pavement	5	sites	
Biofiltration swale	18	each	
Detention/Retention Pond	43	each	
Flow Control	11	each	Usually overflow from a pond
Roadside ditch	~50	miles	
Stormwater curb and gutter	~80	miles	

Source: Sequim 2014

IRRIGATION SYSTEM

Farmers in the arid and flat land in the upper portion of the Gierin Creek Basin (an area known as the Sequim Prairie) depend on water from the Dungeness River during the irrigation season (April 15 through September 15). Much of the agricultural land in the city is served either by an irrigation district or by an irrigation company. In fact, irrigation is so important to the city that it is celebrated during the annual Irrigation Festival in May that marks the lifting of the first head gate on the Dungeness River in 1896.

The irrigation districts and companies in the city include the Highland Irrigation District and the Sequim Prairie Tri-Irrigation Association, composed of the Independent Irrigation Company, Eureka Ditch Company, and Sequim Prairie Ditch Company. The Highland Irrigation District occupies the southern portion of the city and carries approximately 4 to 10 cubic feet per second (cfs) of water from the Dungeness River during the irrigation season, while the Sequim Prairie Tri-Irrigation Association occupies the northern portion of the city (refer to Figure 5 for the irrigation district basins within the city).



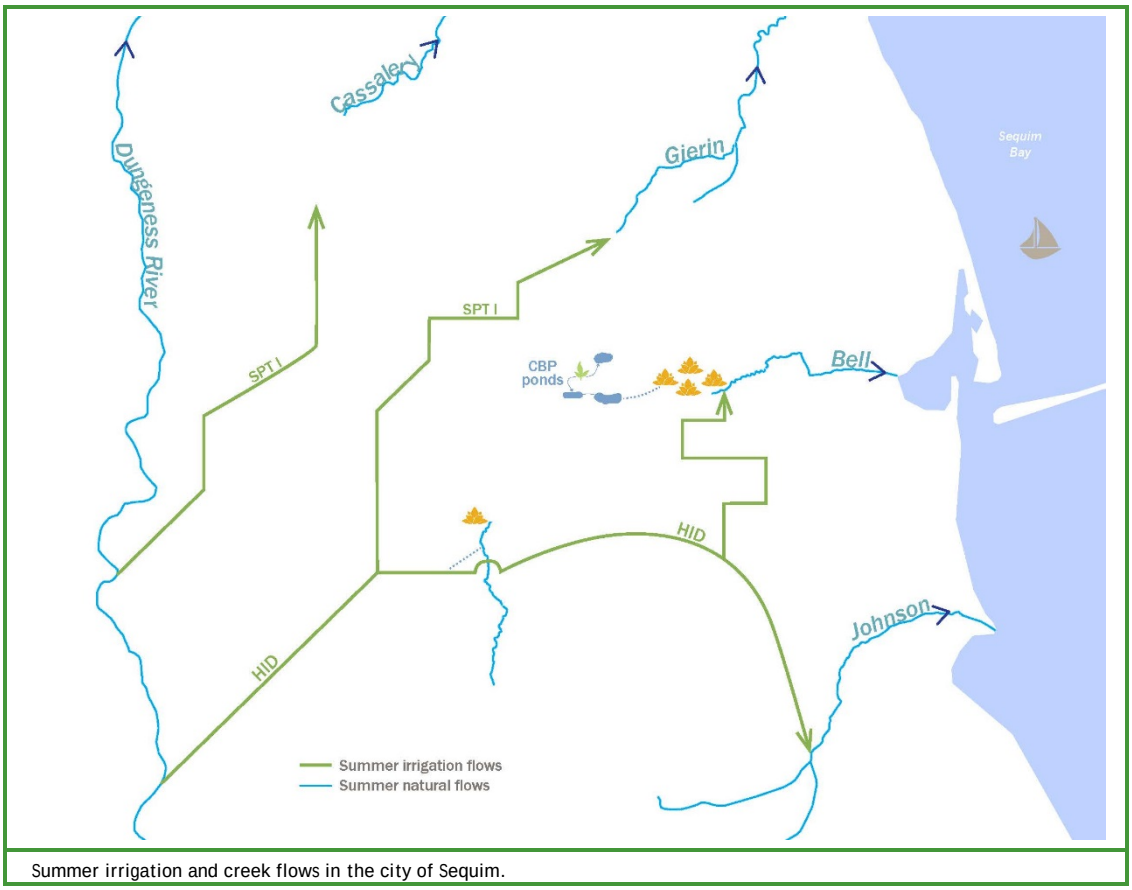
Stormwater, irrigation, and creek flows and groundwater recharge opportunities.

Irrigation ditches that convey water from the Dungeness River for irrigation and stock water during summer also provide conveyance for stormwater during the wet season. In the city, privately-owned irrigation pipes and ditches converge with creeks and stormwater ditches, carrying stormwater and irrigation water across drainage basin boundaries. The Highland Irrigation main canal intercepts subsurface groundwater flows and stormwater in the Bell Creek Basin and conveys these flows east to the Johnson Creek Basin. The Highland Irrigation system supplements the middle reach of Bell Creek intermittently with irrigation flows (Dungeness River water) throughout the irrigation season, and with stormwater during the rainy season. The Sequim Prairie irrigation ditches supplement flows in Gierin Creek in a similar manner. The Highland Irrigation main canal empties into Johnson Creek outside of the city limits (Sequim 2014). The irrigation system within the city is summarized in Table 3.

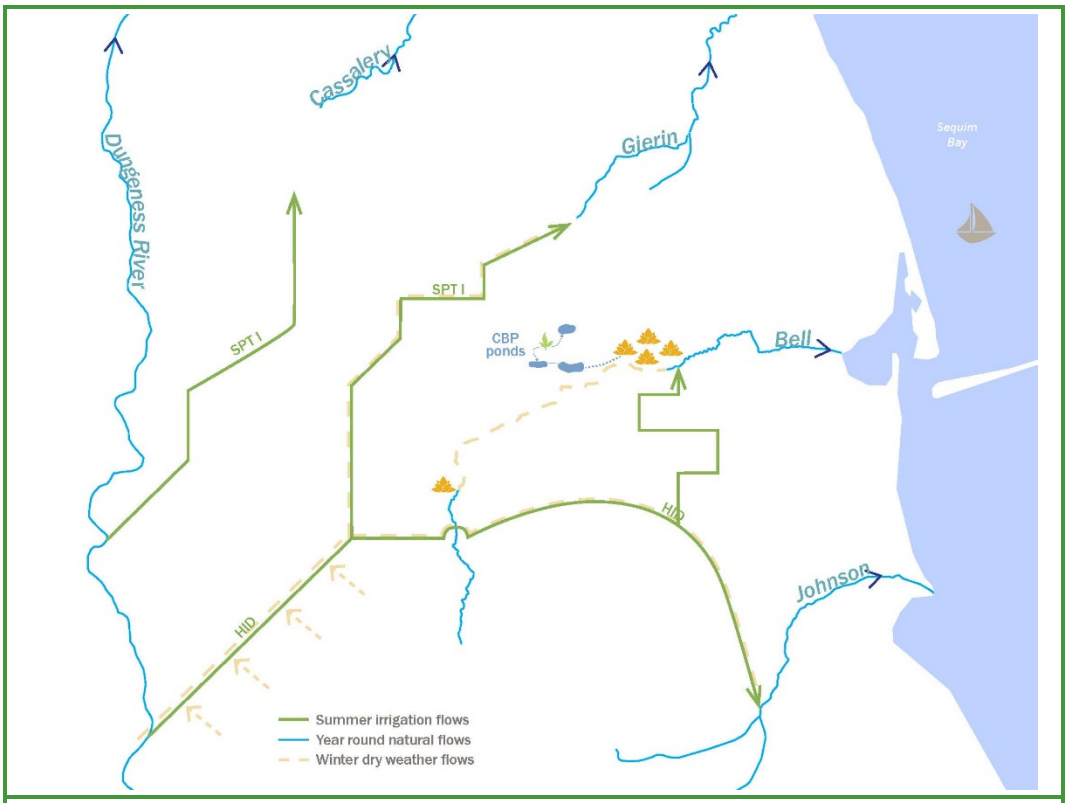
Table 3. Summary of the Irrigation System in the City of Sequim.

Item	Quantity	Units
Irrigation ditch (open, mostly unlined)	18.1	miles
Irrigation pipe[a]	17.4	miles
Total	**35.5**	**miles**

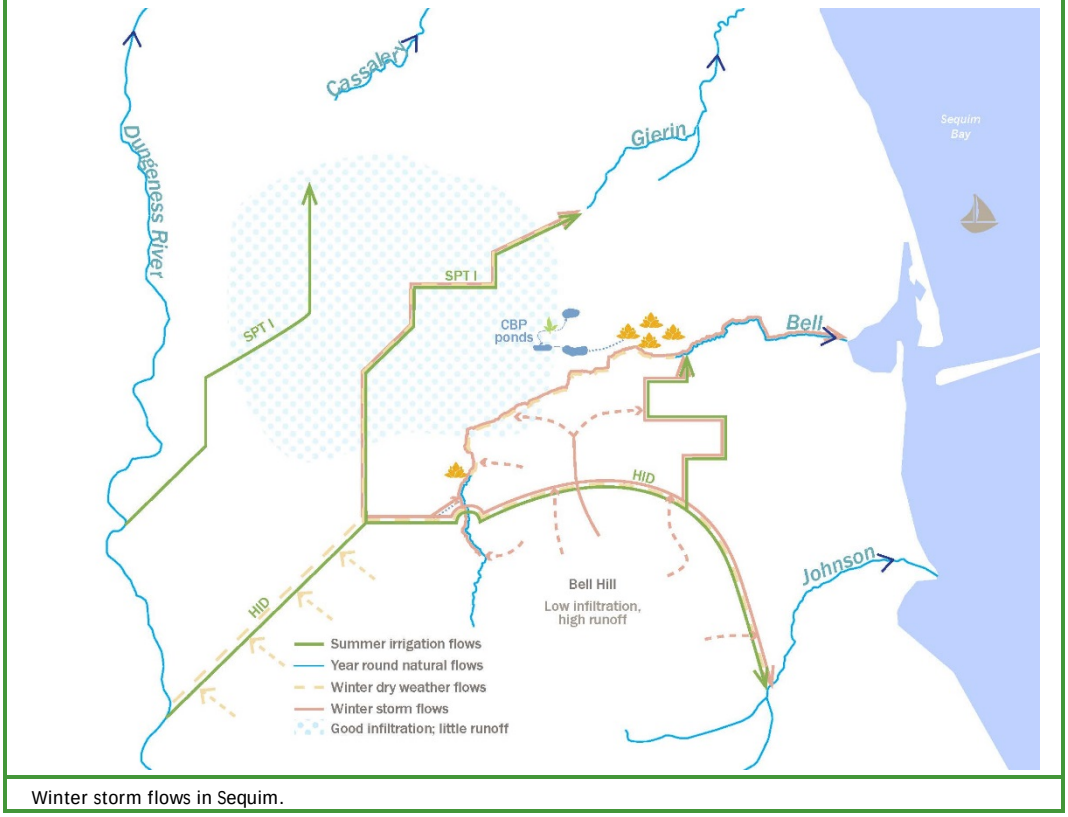
[a] Source: GIS data from City and Conservation District.



Summer irrigation and creek flows in the city of Sequim.



Winter dry-weather flows in Sequim.



Winter storm flows in Sequim.

RECLAIMED WATER SYSTEM

Most of the stormwater in the city is managed through infiltration and therefore serves as a source of groundwater recharge. While this is a convenient and inexpensive way to manage stormwater, it does present a potential concern for protecting the quality of the city's groundwater and drinking water supply. While the city's Port Williams well field is very deep and well protected from surface contamination, hundreds of private and smaller public wells are potentially at risk for contamination. City staff are especially concerned with conserving water resources due to the relatively dry climate and the focus on resource management in the Dungeness watershed.

The City's water conservation program has developed over time in response to updated State regulations. In 1995, the City developed a water conservation program based on the 1994 Conservation Planning Requirements, which was documented in the City's Water System Plan (Sequim 2013b). In 1997, the City received $3.4 million from the Washington State Legislature to implement its reclaimed water program (Sequim 2013c). Between 1997 and 1998, the City upgraded its secondary wastewater treatment facility to a Water Reclamation Facility (WRF) that produces Class A reclaimed water and Class A biosolids from the wastewater.

Today, the City's reclaimed water system includes the Water Reclamation Facility, approximately 4 miles of reclaimed water distribution piping, and a 28-acre Reuse Demonstration Site north of Carrie Blake Park (Sequim 2013c). The reclaimed water produced at the Water Reclamation Facility is primarily used at the City Shop for water truck filling, at the Reuse Demonstration Site at Carrie Blake Park, irrigation of the landscaping in medians and ROWs for a portion of downtown area, and for maintenance of Bell Creek flows.

The 2000 Water System Plan set a 20-year goal of reducing average yearly water demand by 15 percent, and reducing peak day demand by 15 percent. By 2006, the City was using approximately 20 percent of its reclaimed water for City projects. In the 2008 Water System Plan, the water conservation plan was revised to address the implementation of the Municipal Water Law. The 2008 Plan set a goal of reducing the water systems water use per equivalent residential unit (ERU) by 10 percent over a 10-year period, by increasing utilization of the reclaimed water produced at the Water Reclamation Facility. In the 2013 Water System Plan, the City retained the 2008 goal of reducing the water use per ERU value by 10 percent over the next 10 years, and added a goal of reducing the distribution system leakage (DSL) by 10 percent over the next 6 years, as required by the Department of Health (DOH) (Sequim 2013b).

Today, the City has goals of maximizing reuse of the reclaimed water, a reduction in potable water use for irrigation, and overall improvement to the Dungeness River Watershed (Sequim 2013c). Future uses for reclaimed water that will help the City achieve their reclaimed water program goals include supplementation of aquifer recharge areas, landscape irrigation, additional expansion of existing commercial use, additional City non-potable water use, and additional augmentation of Bell and Gierin Creeks and the Dungeness River (Sequim 2013c).

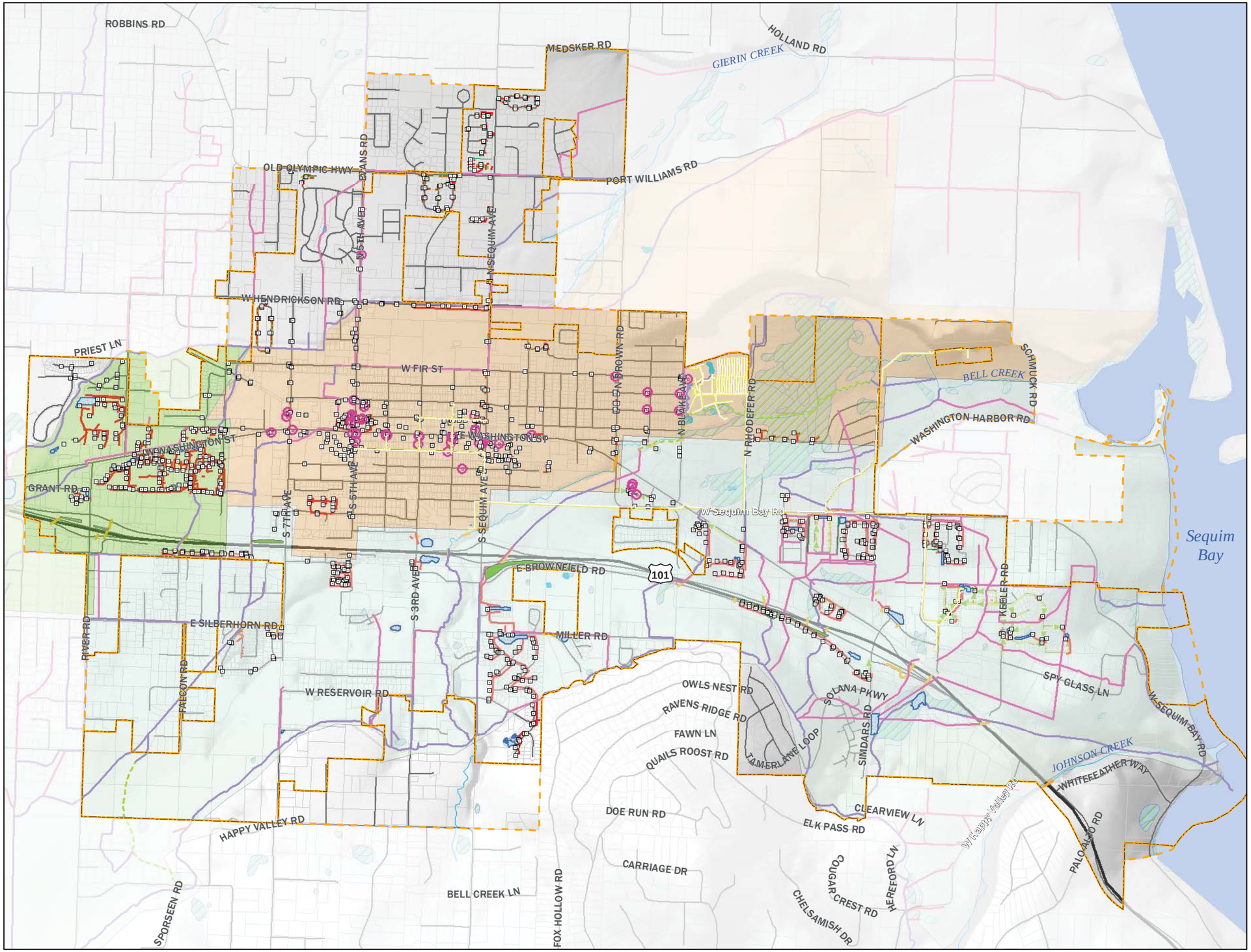


Figure 5.
Stormwater, Irrigation, and Reclaimed Water Systems and Facilities in the City of Sequim.

Legend

- City limit
- Urban Growth Area (UGA)
- Parcel
- Stream
- Road
- Highway
- Pond
- Wetland
- Reclaimed water system

Irrigation System

- Pipe
- Open ditch
- Ditch in creek
- Shared ditch

Stormwater System

- Culvert
- Storm drain pipe
- Perforated pipe
- Roadside ditch
- Bioswale
- Detention pond
- Retention pond
- Drywell
- Catchbasin
- Highland Irrigation District
- Independent Irrigation
- Eureka Irrigation District

N

0 1,000 2,000 4,000 ft

HERRERA

NAD 1983 HARN
Washington State Plane North FIPS 4601 Feet

Project: K:\Projects\Y2014-14-05826-000\Project\Master_Plan\stormwater_irrigation.mxd (5/20/2015)

FUTURE GROWTH

The population of Sequim has grown by over 80 percent since 1990 and is expected to continue to grow at rates as high as 2 or 3 percent each year, which would increase the city's population to 10,000 to 13,000 by 2035 (Sequim 2015). For the past 30 years, the population in the Sequim-Dungeness Valley outside the city limits has grown twice as fast as the city. Growth and associated development in the city and the Sequim-Dungeness Valley will put additional pressure on the City's stormwater system. Strategies to address these predicted future growth impacts are discussed in the *Plan Implementation* section.

CLIMATE CHANGE

Currently Sequim averages just over 16 inches of precipitation per year; snow is relatively rare and does not occur at all in some years. According to climate change prediction models, while changes in overall annual precipitation amounts are not projected to be significant, the timing and character of precipitation is projected to change which can affect stormwater infrastructure (Mote and Salathé 2010, Littell 2011, Muschinski and Katz 2013, Abatzoglou et al. 2014).

Given current climate change predictions, the city can expect more extreme precipitation events in the winter months. Winter precipitation on the Olympic Peninsula is expected to increase by 4.5 to 5 percent on average and depending on location (Littell 2011); although average projected winter increases in precipitation are not large relative to interannual variability (Littell et al. 2009). Projections of extreme precipitation events also vary significantly, but indicate future increases in extreme rainfall magnitudes throughout the state (Littell et al. 2009).

This will increase the city's susceptibility to flash floods as a secondary hazard from severe summer rainstorms as well as saturated soil hazards such as landslides and falling trees. These predicted changes will also increase flood risk potential in the city, which is currently relatively low except during large storm events. Increased flooding and reduced snow and ice cover in the Olympic Mountains are projected to increase sediment and flood debris carried by rivers and streams. Increases in saturated conditions and flooding can increase infiltration and inflow to the stormwater system, increasing the cost of protecting and maintaining infrastructure as well as strain current stormwater collection systems as they reach capacity. In addition, water quality may be affected by increasing sediment and nutrient loads (Snover et al. 2013). There may also be an increased need for emergency response to repair facilities from damage caused by extreme events.

Extreme events are more likely to affect stormwater infrastructure than are changes in average conditions (Hamlet 2011; WSDOT 2011). Also, vulnerability to extreme events varies by location. For example, stormwater infrastructure located above or below steep slopes, in low-lying areas subject to flooding, or along streams that are aggrading would be more vulnerable to calamity.

Summers in the city are also predicted to be warmer and drier. Increased average air temperature will produce increased average annual and summer surface water temperatures

as well as higher evapotranspiration. Higher water temperatures will increase the frequency and duration of incidents of low dissolved oxygen and could further impair city streams such as Bell Creek, which has reaches already on Ecology's 303(d) list of impaired waters as a Category 5 for fecal coliform bacteria, dissolved oxygen, and B-IBI. Warming waters within the city can affect the viability of many native aquatic plant and animal species, especially cold-water fish such as coho salmon, steelhead, and cutthroat trout found in some portions of city streams. Climate changes increase the importance of providing adequate water quality treatment for new and redevelopment projects, as well as retrofits of the City's existing stormwater system.

Table 4 outlines the stormwater elements that would be most affected by climate change in the city, and the resultant physical and biological responses.

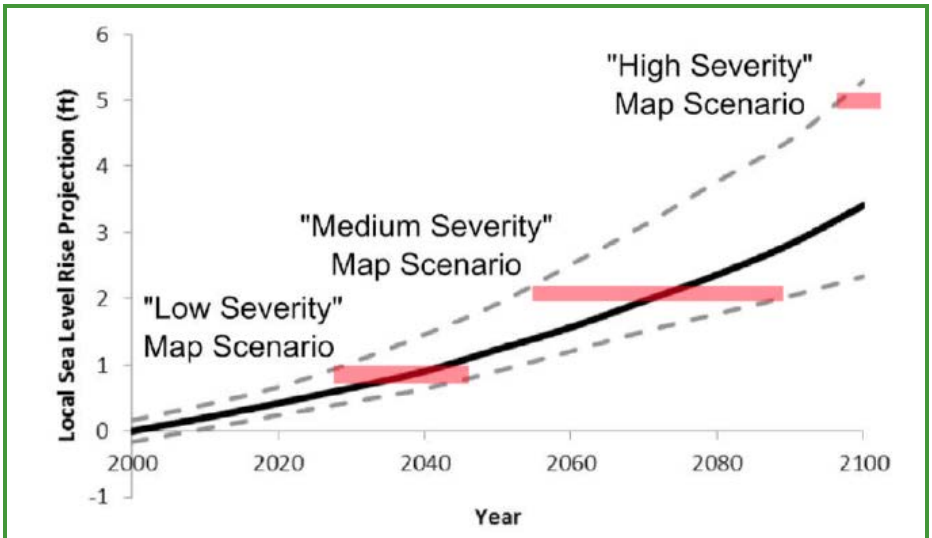
Table 4. Predicted Climate Change Effects on Stormwater Flows.

Stormwater Element	Predicted Response to Climate Change
Storm intensity	• Increased magnitude and frequency of peak flows
Annual precipitation amount and seasonal distribution	• Moderate increase in winter precipitation • Moderate decrease in summer precipitation • Increased average runoff in winter and spring • Decreased summer base flow
Flood risk	• Increased flood risk from increased peak flow magnitudes • Increased flood risk from channel migration • Increased flood risk from more frequent saturated conditions • Increased strain on stormwater infrastructure
Marine flooding risk due to sea level rise	• Reduced capacity for low lying stormwater infrastructure • Increase in elevation of receiving waters • Potential saline intrusion of shallow groundwater near marine shorelines • Increase in erosion along the marine shoreline at higher elevations than in the past
Water temperature	• Increased average and summer water temperature • Lower dissolved oxygen • Increased algal blooms
Evapotranspiration	• Increased evapotranspiration • Lower soil moisture • Reduced summer base flow in creeks • Reduced groundwater recharge • Wetland conversion from perennial to seasonal

The potential hydrologic changes associated with climate change increase the importance of stormwater management practices that control flows, promote infiltration, and preserve and enhance water quality. Because the city's water resources are largely precipitation-driven and much of the city's water supply is from groundwater, ensuring deep infiltration of stormwater through groundwater recharge will become increasingly important as groundwater demands increase (due to higher temperatures and greater population), and especially if water resources become more scarce (due to altered precipitation patterns and higher temperatures).

Sea level rise is also a documented consequence of climate change. Sequim has a small part of its city limits within marine influence, including Pitship Estuary and John Wayne Marina. Although most of the city's marine shoreline is on a bluff, these low-lying coastal areas are somewhat vulnerable to sea level rise. Due to a gradient in tectonic uplift along the Strait of Juan de Fuca (Verdonck 2006), observed sea level rise over the twentieth century can be assumed to be an average of the rate observed at Port Angeles (approximately zero: NOAA 2015a) and Port Townsend (0.06 inches per year: NOAA 2015b). This equates to an estimated current rate of 0.03 inches rise in sea level per year for the city's marine shoreline. This is a lower rate than most other locations in western Washington due to tectonic uplift of the northwest corner of the Olympic Peninsula.

Recent work completed by the Jamestown S'Klallam Tribe planned for sea level rise using three "severity" levels that were based on a combination of eustatic sea level rise estimates from the Intergovernmental Panel on Climate Change and tectonic uplift measured by Central Washington University, including locations along Sequim Bay. Low severity assumed a rise of 0.8 feet, medium severity assumed 2.0 feet of rise, and high severity assumed 5.1 feet of rise by 2,100 (Adaptation International 2013). These estimates are significantly greater than those provided by the US Army Corps of Engineers (USACE). USACE guidance suggests designing for sea level rises of between 1.5 and 3 feet, depending on the criticality of the infrastructure affected, and assuming a 50-year design life (USACE 2013). A 100-year design life sea level rise estimate for the USACE would be between 3 and 8 feet depending on the criticality of the infrastructure. Given the modest sea level rise in the Olympic Peninsula region observed in the twentieth century due to tectonic uplift, the USACE guidance provides a more realistic estimate for planning and design of stormwater infrastructure within the city for areas that may be affected.



Average sea level rise trend line (dark black line) and sea level rise range (high and low dashed lines). Projections are based off the linear vertical land movement trend combined with the projected rates of sea level rise for the West Coast. "Low Severity" = 0.8 feet, "Medium severity" = 2.0 feet, and "High Severity" = 5.1 feet above the current sea level. Source: Adaptation International 2013.

Strategies to addressing these predicted climate change impacts are discussed in the *Plan Implementation* section.

APPLICABLE REGULATIONS

Federal and state regulations and strategic planning efforts that apply to the city's storm and surface water program and are summarized in detail in Appendix C include:

- State surface water quality standards (WAC 173-201A)
- Ecology's 303(d) list
- Groundwater quality standards (WAC 173-200)
- Model Toxics Control Act [MTCA]
- Federal Safe Drinking Water Act
- Underground Injection Control (UIC) requirements
- Puget Sound Partnership (PSP) Action Agenda
- Dungeness Water Rule (WAC 173-518)
- National Flood Insurance Program (NFIP), administered by the Federal Emergency Management Act (FEMA)
- Federal Endangered Species Act (ESA)
- State Salmon Recovery Planning Act
- Watershed Planning Act
- Growth Management Act (GMA)
- State Environmental Policy Act (SEPA)
- Shoreline Management Act (SMA)
- The SMC (as it applies to the requirements listed above)

Appendix C also references evolving regulations and policies which include recent changes to the state surface water quality standards (not yet finalized) and the NPDES municipal stormwater permit. The City is not currently a municipal stormwater permittee; however, many stormwater program elements highlighted in the NPDES permit are beneficial for the City to consider as part of implementing its current stormwater program.

CHAPTER 3 – KNOWN STORMWATER PROBLEMS AND RECOMMENDED CAPITAL SOLUTIONS

Stormwater flooding and water quality problems in the city are caused by multiple local and regional factors, including:

- Flow from upland development
- Misconnected street drains
- Flooded irrigation infrastructure
- Aging stormwater infrastructure
- Inadequate maintenance due to limited staffing and funding
- Unmanaged runoff from non-City-owned properties inside and outside city limits
- Direct stormwater discharge to surface water bodies

In 2013, the City asked the general public to report where they observed problems with runoff, ponding, and pollution. Using input from the public and institutional knowledge, the City documented and mapped the problem areas, and identified 84 specific runoff and flooding problems in the Stormwater Management Needs Assessment (Sequim 2014). The development of the City's stormwater CIP project list builds on the 2014 stormwater problem identification and prioritization in the Stormwater Management Needs Assessment and is described in the sections below.

This chapter focuses on capital project solutions to flooding and water quality problems. Chapter 4 is focused on programmatic, management-related solutions.

DOCUMENT REVIEW, WORKSHOP, AND SITE VISITS

The City evaluated several site-specific problems to develop planning level solutions and cost estimates for use in establishing the City's stormwater CIP plan and for scheduling non-CIP project implementation. A total of 84 runoff and flooding problems were originally identified in the Stormwater Management Needs Assessment and were placed in the following categories:

- Creek related runoff and flooding problems (17 sites)
- City-owned property runoff and flooding problems (60 sites)
- Misconnected street drain runoff and flooding problems (7 sites)

A fourth group (Non-City-owned Properties) was added after the completion of the Stormwater Management Needs Assessment. A workshop was held with City staff on November 18, 2014 (Appendix B), to discuss capital facility improvement needs and to identify the highest priority problems for field evaluation.

The higher priority problems identified by the City were further evaluated by conducting interviews with City staff and by performing field reconnaissance. Potential engineering solutions were identified to address these problems and implementation of the solutions was prioritized based on several criteria (described below). Project summary sheets and itemized planning level cost estimates were developed for ten projects that were considered to be higher priorities. This section of the plan identifies the problems, solutions, and prioritization process. Project summary sheets and itemized planning level cost estimates for the ten selected projects and proposed solutions are provided in Appendix F.

IDENTIFIED STORMWATER PROBLEMS AND SOLUTIONS

A complete list of runoff and flooding problems identified in the Stormwater Management Needs Assessment, through the workshop and interviews with City staff, is provided in Appendix D. Some of these problems are better addressed with capital project-type solutions, and others with management or programmatic solutions. Table 5 describes problems and proposed solutions for the higher priority problems related to capital facilities identified by the City. These problems were further evaluated and solutions were refined by performing field reconnaissance and through discussions with City staff. Figure 6 shows the locations of the higher priority capital projects as well as the ten selected CIP projects.

It should be noted that City staff and other local stakeholder knowledge of potential solutions may not be represented in Table 5. For example, abandoned irrigation pipes or other facilities discovered in the City ROW could possibly be utilized for storage or conveyance of stormwater. In addition, parks and other parcels with undeveloped open space could be utilized for stormwater management (storage, conveyance, infiltration, etc.).

Table 5. Higher Priority Stormwater Problems and Solutions.			
Proj. No.	**Project Name**	**Problem Description**	**Proposed Solution(s)**
1.00 (see CIP)	Sequim Area Stormwater-Watershed Plan	Long history of flooding problems along the Bell Creek Corridor and in western Sequim. Stormwater input via active and abandoned irrigation conveyances adds to flooding across city, and future development may increase flooding in already flooded/problem areas. It is an opportune time to implement a watershed wide solution while there is still available space to implement projects that will address water quantity and quality. The Plan would address problems 1.02, 1.04, 1.06, 1.07, 1.08, 1.09, 1.10, 2.17, 4.04, and 4.31.	Develop a Sequim Area Stormwater- Watershed Plan to identify a strategy to provide adequate surface water system capacity for future growth and habitat improvements. Project will include an assessment of existing conditions and will develop a plan for maintaining and improving stormwater conveyance, infiltration, and resource protection. A surface water and shallow groundwater system model would be used to better understand the causes of flooding in the stormwater system and develop effective long term solutions.
1.02	Bell Creek Overflow Channel Upgrade at Rhodefer Road (RM 1.4)	Channel very overgrown and culvert backs up, causing flooding of Carrie Blake Park as well as north to the Reuse Park.	Maintain or abandon overflow channel to north as part of Sequim Area Stormwater -Watershed Plan implementation.
1.04 (see CIP)	Bell Creek Culvert Upgrade at Blake Avenue, Park entrance (RM 1.5)	Two culverts along Bell Creek used to convey creek flows under driveway to Carrie Blake Park (off of North Blake Avenue) do not have adequate hydraulic capacity to handle high flows. Flooding has been observed in the park entry and road. High flows often spill onto private property to the east as well, adjacent to City Park, rather than staying in channel.	Evaluate culvert as part of 1.00 (Sequim Area Stormwater-Watershed Plan) implementation. Replace existing 42" wide x 26" high and 40" wide x 28" high culvert with fish passable culvert, unless evaluation indicates runoff can be re-routed or infiltrated upstream. Creek is channelized upstream of this site, with no floodplain. Flow comes out of channel and floods park and adjacent private property. Riparian restoration would benefit habitat and flood management aspects of site.
1.06	Bell Creek Culvert Upgrade at Blake Avenue (RM 1.6)	Culvert backs up and causes flooding of Gebhardt-Zwicker Park and spills onto Blake Ave. and private property to the north).	Evaluate culvert as part of 1.00 (Sequim Area Stormwater-Watershed Plan) implementation. Culvert may need to be resized unless runoff is re-routed or infiltrated upstream.
1.07 (see CIP)	Bell Creek Culvert Upgrade at Washington (RM 1.8)	Existing culvert downstream of Culvert 1.08 along Bell Creek does not have adequate capacity and the roadway at intersection of South Brown and East Washington Streets floods during high flow events. Culvert starts out heading north, angles northeast under East Washington and South Brown Intersection, then joins and 11-foot wide x 6-foot high culvert under Les Schwab driveway.	Evaluate culvert as part of 1.00 (Sequim Area Stormwater-Watershed Plan) implementation. Replace existing 48" dia. culvert with fish passable culvert, unless evaluation indicates runoff can be re-routed or infiltrated upstream.

Table 5 (continued). Higher Priority Stormwater Problems and Solutions.			
Proj. No.	**Project Name**	**Problem Description**	**Proposed Solution(s)**
1.08	Bell Creek Culvert Upgrade at RM 1.85 (driveway from S Brown into Bell Creek Café and Evergreen Collision)	Bell Creek and culvert under driveway along South Brown Rd flood during high flows. Flooding extends into roadway and driveway of business, but does not reach business parking lot to the north. Floodplain to the south receives some of the excess flows and also floods. Undeveloped area is lower in elevation than the adjacent parking lot to the north of Bell creek along this corridor, so excess flows will flood this area before flooding parking lot.	Evaluate culvert as part of 1.00 (Sequim Area Stormwater-Watershed Plan) implementation. May need to be resized unless runoff is re-routed or infiltrated upstream. Related site is 4.44, with parking lot storm drains discharging to Bell Creek at driveway.
1.09 (see CIP)	Middle Reach Bell Creek Corridor Planning	Bell Creek, Highland irrigation ditch, and stormwater culverts along Bell Creek corridor receive stormwater runoff from upland areas during storm events, causing facilities to back up and flood undeveloped property along the Creek during high flows. Would address problems 2.17/2.29 and 1.02, 1.04, 1.06, 1.07, 1.08, 1.10.	1 – Implement 1.00 (Sequim Area Stormwater -Watershed Plan). 2 – If 1.00 is not implemented, develop a plan for future development and resource protection in the undeveloped floodplain property along Bell Creek. Project will include an assessment of existing conditions and will develop a plan for maintaining and improving stormwater conveyance, infiltration, and resource protection.
1.10	Bell Creek Culvert Upgrade at Hammond (RM 2.2)	Bell Creek Culvert backs up onto private property on south side of East Hammond Road due to overgrown vegetation and possibly lack of capacity.	Maintain vegetation around culvert, inspect and repair if damaged. Evaluate culvert as part of 1.00 (Sequim Area Stormwater -Watershed Plan) implementation. May require maintenance agreement.
1.18	N Brown Road Drainage Improvements at Washington	Stormwater pipe along N Brown Road discharges untreated stormwater into Bell Creek downstream of culvert under Les Schwab driveway.	Install treatment BMP or infiltration system, or tie to existing facility.
2.01	S 2nd at Washington	Runoff from the east on Washington floods this intersection and erodes the ROW landscaping, which clogs other storm drains.	Need additional capacity in nearby stormwater facilities; possibly cut the curb in places so runoff can enter planted ROW (if grade allows).

Table 5 (continued). Higher Priority Stormwater Problems and Solutions.			
Proj. No.	**Project Name**	**Problem Description**	**Proposed Solution(s)**
2.04 (see CIP)	S 3rd Avenue (west ROW south of Bypass) Drainage Improvements	Storm water runoff from S 3rd Avenue just downstream of the Hideaway Homes Mobile Home Park and from the park itself flows down the steep slope on the west side of S 3rd Avenue and onto the Sequim School District Transportation Facility property, intermittently causing localized flooding. A poorly defined ditch runs along the base of the road fill slope to a culvert under the entry drive into the transportation facility; this ditch is filled with silt, sand, and gravel eroded from the S 3rd Avenue fill slope. Discharge from entry drive culvert flows to a catch basin approximately 10 feet north of the outlet end of the culvert; the catch basin is covered with silt, sand, and gravel eroded from the S 3rd Avenue fill slope.	Install an 18" diameter culvert under the Hideaway Homes Mobile Home Park driveway and a catch basin at the discharge end of the culvert. Install an outfall pipe down the steep slope with an energy dissipater at the outlet. Construct a new ditch line along the base of the fill slope (this ditch with be on School District property; an easement will be needed for these improvements). Construct a short ditch section from the end of the culvert under the Transportation Facility entry drive to the catch basin at the base of the roadway fill. Stabilize the fill slopes with quarry spall slope protection to prevent further erosion of the fill.
2.05 (see CIP)	N 5th Avenue and Cedar Street Structure Upgrade	Drywell at south east corner of West Cedar and North 5th Avenue intersection floods at inlet. Flooding extends along cross walk and up ramp, imposing risk to pedestrians (especially when icy). Maintenance was recently performed but the structure still does not provide adequate drainage.	Rehabilitate infiltration facility (drywell) to restore capacity. Empty drywell to clean and inspect facility. If drywell is compromised, install an infiltration trench and stormwater treatment unit.
2.12 (see CIP)	7th Avenue and Washington Upgrade	Flooding at south west inlet at intersection of S 7th Avenue and W Washington Street. Structure is full of sediment. Maintenance was recently performed but the structure still does not drain fast enough.	Install Filterra bio-filtration unit for treatment of runoff and protection of the infiltration facility, tie existing catch basins into Filterra, install extended infiltration trench for infiltration of runoff.
2.14	N Blake and E Fir Drainage Improvements	Flooding on south west corner of intersection. Four existing catch basins on corners are located at higher elevations than the surrounding grade and infiltration capacity may be inadequate. Catch basin piped to a drywell structure under the sidewalk. Maintenance was recently performed on the drywell structure, but ponding persists.	Rehabilitate infiltration facility to restore capacity; adjust grade of street surface to improve flow to drains. Overflow from this site affects ponding at entrance to Reuse Park across street (see 2.70).
2.17 (2.29 added) (see CIP)	S Brown and Hammond Drainage Improvements	Flooding at private property located on corner of E Hammond Street and S Brown Road.	Widen existing ditch and culvert system to convey runoff away from private property near the intersection of S Brown Road and E Hammond Street. Evaluate as part of 1.00 (Sequim Area Stormwater – Watershed Plan) for possible re-routing or infiltration of runoff upstream.

Table 5 (continued). Higher Priority Stormwater Problems and Solutions.			
Proj. No.	**Project Name**	**Problem Description**	**Proposed Solution(s)**
2.23 (see CIP)	Centennial Place Infiltration and Inflow Investigation	Stormwater runoff from parking lot flows to sanitary sewer.	Re-route stormwater to bioretention cells to the north east, perform maintenance on bioretention cells to improve performance.
2.25 (see CIP)	Etta Street Infiltration and Inflow Investigation	Surface runoff from alley drains to two existing catch basins and it is unclear where the catch basins drain (infiltration trench, drywell, or sanitary sewer). It appears that most of the runoff flows into a catch basin located out of the City ROW. Downspout connection appears to tie into sanitary sewer (actual connections to be confirmed).	Perform testing and investigations to confirm discharge locations of downspouts and catch basins. Divert downspouts and catch basins to Contech StormFilter. Re-grade parts of the alley to direct the stormwater to the existing catch basins or the Stormfilter. Install infiltration trench to dispose of surface runoff.
2.26 (see CIP)	River Road Storage Project	Flooding of private property within the City and UGA caused by runoff from west Happy Valley (outside of the UGA in the county) entering Eureka ditch near Mockingbird Lane. Would address problems 4.11, 4.14, and 4.36.	Construct a large storage facility to provide stormwater detention by storing water during high flows for use by the Dungeness Water Users Association during the low flow period. To provide stormwater benefits during the wet season, the facility would need to be operated in a manner that would reduce flow to downstream irrigation conveyance through the city of Sequim during storm events. The storage facility is one option under consideration by the Dungeness River Flow Enhancement Project. Project should consider stormwater conveyance for future developments as well as the potential to provide flow control to offset increased runoff from existing and future development.
2.28	W Fir between N 5th and Sequim Avenue	Major surface damage on W Fir from water ponding, runoff due to lack of adequate stormwater facilities. Reconstruction including stormwater facilities expected in 2016–18.	Check pervious pavement installations. Street is scheduled for reconstruction. Stormwater treatment and infiltration will be designed into street project; funding sources still being identified.
2.34 (see CIP)	Clara Crest Way/ Highland Hills Runoff Abatement	Detention ponds discharge large volumes of runoff downslope, into city roadside ditches along Miller Road and Clara Crest.	Re-evaluate problem and continue to work with HOA and local landowners to perform retrofits and/or ditch maintenance/ repair as needed. Retrofit detention pond(s) as needed. Evaluate runoff problem as part of 1.00 or 1.09. Also see 4.25.

Table 5 (continued). Higher Priority Stormwater Problems and Solutions.			
Proj. No.	**Project Name**	**Problem Description**	**Proposed Solution(s)**
2.49	Silberhorn and River Road Drainage Improvements	East side of intersection floods, no good drainage or facilities.	Add street and drainage improvements and facilities.
2.53	W Spruce Street Structure Upgrade	Catch basin and perforated pipe are causing flooding of roadway and nearby basement. Update Fall 2015: City recently cleaned structure, jetted perforated pipe, extended perf pipe, and added capacity.	Continue to monitor location for flooding. If flooding continues, upgrade the infiltration system again or add structure on north side of Spruce.
2.62	Roadside ditch along West Sequim Bay Road uphill from Marina	Ditch overflows when driveway culverts clog, washing out road.	Establish responsibilities of driveway property owners and irrigation providers (check whether this is an irrigation conveyance in season) relative to culvert maintenance/repair.
2.63 (see CIP)	W Prairie Street Green Street Upgrade (between Sequim Avenue and 2nd Avenue)	Typical of this area and type of development, no storm water management infrastructure exists. The streets have typically been paved to a nominal width of 24 feet and storm water runoff from the roadway flows to the roadside area and infiltrates into the porous subsoil. During periods of intense rainfall intermittent flooding can occur. In addition, oils and grease contained in the runoff can infiltrate into the porous subsoil and potentially enter the groundwater untreated.	Provide a demonstration facility using green infrastructure for the management of stormwater runoff from fully developed residential streets. The final street configuration would consist of 32 feet of pavement with curb and gutter and porous pavement sidewalks on both sides. Bioretention cells would be constructed between the back of the curb and the sidewalk at intervals along the roadway. For each city block, a total bioretention cell length of 120 feet would be required on each side of the street. Small cells, approximately 30 feet in length, would be constructed at several points along the roadway to avoid driveways and minimize roadway grading.
2.64	W Fir between 5th Avenue and Sequim Avenue Drainage Improvements	Street runoff enters school district property and ponds against Admin building; in largest storms, runoff continues east across yard and exits on Sequim Avenue.	Improve/upgrade storm drainage on W Fir as street is reconstructed in 2016-18. Also see 2.28 regarding W Fir street upgrade.
2.67	E Cedar south side east of Dunlap	Runoff from the west flows to private property (storage units) and continues to front yard of apartment complex down street.	Improve/upgrade drainage facilities on E Cedar between Dunlap and Ryser. Update Fall 2015: Streets crew added berm to direct drainage around storage units. Monitor drainage further down street.

Table 5 (continued). Higher Priority Stormwater Problems and Solutions.			
Proj. No.	**Project Name**	**Problem Description**	**Proposed Solution(s)**
2.68 (see CIP)	Emerald Highlands ponds	North and South detention ponds overgrown and silted in. Need maintenance. North pond overflows to Bell Creek at 101 off ramp. South pond drains to Bell Creek to the west.	Remove brush; check valves and outlets; restore capacity if needed. Update Fall 2015: North pond outlet valves cleared, ponds drained. City will monitor silt and water levels. South pond still needs maintenance.
2.74	Washington and Sequim intersection	CB fills and flows north across street to another CB connected to drywell. May lack sufficient capacity for infiltration.	Add capacity to drainage facilities in upstream area; if new facilities installed, add runoff treatment capability.
2.75	9th Avenue and Honeycomb	Drainage flows to Helen Court area; street surface degraded on north side where water sits.	Improve/upgrade drainage facilities on 9th Ave.
3.01 (also see 2.43, Appendix D)	Seal Street Drainage Improvements	Flooding of private and public parking lots at intersection of W Cedar Street and Seal Street due to limited capacity of infiltration system. Runoff originates in alley and drains into nearby apartments.	1 – Divert street runoff and alley/downspout runoff to existing underutilized (deep) drywells on Seal St. (may also require easement). 2- Divert street and alley runoff to new or existing underutilized storm drain on Cedar Street in City ROW. 3 – Extend capacity of infiltration line under parking lot.
3.02	N 7th Avenue Structure Maintenance/ Upgrade	City street drainage at the west gutter of N 7th Avenue is connected to private drywell in parking lot of flooring business along N 7th Avenue. Infiltration facility is very full of sediment and standing water and is causing flooding in parking lot. Update 12/2015: checked and found drywell connected inside ROW to west of drain.	Conduct maintenance and inspect system draining the street (catalog information in GIS database). Disconnect street drainage from private system or upgrade drywell/street drainage to restore capacity as necessary. Update 12/2015: existing drywell should handle infiltration well; if not, drains north and east down W Spruce St.
3.04	S 7th Avenue Drainage Improvements	Stormwater runoff from private parking lot on the west side of S 7th Avenue is piped under S 7th Avenue and potentially into irrigation vault/network on the east side of S 7th Avenue. (Based on field observations the stormwater may actually be piped into a perforated pipe under the planter or parking lot).	Inspect system and catalog information in GIS database. Re-route stormwater runoff from private parking lot to stormwater system (i.e., infiltration or conveyance to existing system) if it is entering irrigation pipe.

Table 5 (continued). Higher Priority Stormwater Problems and Solutions.			
Proj. No.	**Project Name**	**Problem Description**	**Proposed Solution(s)**
4.10	School Property Drainage and I/I Improvements	Runoff from school property flows to city streets, sewer and/or irrigation conveyances.	Confirm school district stormwater system connections, if any. Inspect system and catalog information in GIS database. Upgrade school system to infiltrate stormwater on-site.
4.11	N Sequim Avenue, N 5th Avenue and Fir Drainage Improvements	Flooding of roadway at the northeast corner of N Sequim Avenue and W Fir Street. Irrigation pipes reduce from 18 inches to 12 inches along W Fir Street and then make a 90 degree bend at the northeast corner of the intersection (high flows blow the lid off the catch basin). At N 5th Avenue and Fir, the D-box control mechanism is problematic; results in more stormwater going east along Fir than north on 5th Avenue.	Would be addressed by 2.26. Site specific option: Install a locking lid on the structure and install infrastructure on N 5th Avenue and W Fir Street to split the flow into the north and east irrigation pipes during the winter (using capacity of both pipes may eliminate problem). Would likely require downstream impact assessment.
4.14	East Silberhorn Road (east of Petal Lane) Drainage Improvements	Flooding on east end Silberhorn Road caused by unmitigated runoff from distant south and under-sized ditch and culvert (between S 7th Avenue and Petal Lane). New development to south would exacerbate. Existing ditch receives piped runoff from SW under Comfort Way, currently flows through undeveloped area and ends at Silberhorn Road. Private property on corner, north side of culvert under Silberhorn also floods.	Would probably be addressed by 2.26. Solution may be possible with appropriate future development plans 1 – Ensure that new development plans provide appropriate conveyance. 2 – Upstream detention/infiltration. (Requires coordination with upstream properties and future development.)
4.24	S 3rd Ditch Drainage Improvements	Flooding in irrigation ditch along S 3rd Avenue caused by runoff from county area on Bell Hill and partially collapsed concrete Highland irrigation pipe installed by original landowner (at Gerhardt Park).	Repair culvert (installed by former landowner, not irrigators; City is now owner; HID has easement).
4.31	E Washington at QFC complex Drainage Improvements	Irrigation ditch enters culvert pipe on west end of parking lot (former Staples), discharges to Bell Creek. Clogged culvert floods parking lot. Runoff from parking lot enters Bell Creek.	Implement 1.00 (Sequim Area Stormwater – Watershed Plan) to avoid future problems. Not a recurring problem except in extreme events. Impacts Bell Creek water quality.

Table 5 (continued). Higher Priority Stormwater Problems and Solutions.			
Proj. No.	**Project Name**	**Problem Description**	**Proposed Solution(s)**
4.36	West Happy Valley and Sporseen Ditch Improvements	Runoff overwhelms roadside ditch and culvert over Highland canal at West Happy Valley Road; also washes out hillslope to south side of West Happy Valley Road near River Rd intersection (irrigation canal also spills into roadside ditch east of Sporseen, adding to the volume) (all in county). Runoff eventually ends up in Eureka ditch as well as private property draining to Comfort Way/Silberhorn Road area and continues to overwhelm culverts and ditches in city.	Would be addressed by 2.26. Site specific option: Improve drainage in ditches and add storage and/or infiltration.
4.37	Highland Irrigation Canal breaches	Stormwater fills and over-tops canal wall, spilling runoff to downhill properties (esp. uphill from Jara and Falcon Road areas) and Eureka ditch. If canal wall blows out, it's a big emergency in the city.	Would partially be addressed by 2.26. Site specific option: develop a maintenance policy with the Irrigation District, and maintain canals accordingly.
4.38	Various single-family residential inflow investigation and elimination	Inflow evident from smoke testing.	Redirect sewer inflow to drainage solution. Project would include components for planning, outreach, and general design, as well as costs for drain and downspout disconnection and drainage upgrades to improve downstream detention, infiltration, or conveyance.
4.44	Bell Creek Café/ Evergreen Collision	Infiltration storm drain backs up into driveway and discharges to Bell Creek. Also see 1.08, culvert-caused flooding of Bell Creek.	Re-evaluate problem and contact landowner/ facility manager as needed. Need inspection program and enforcement.

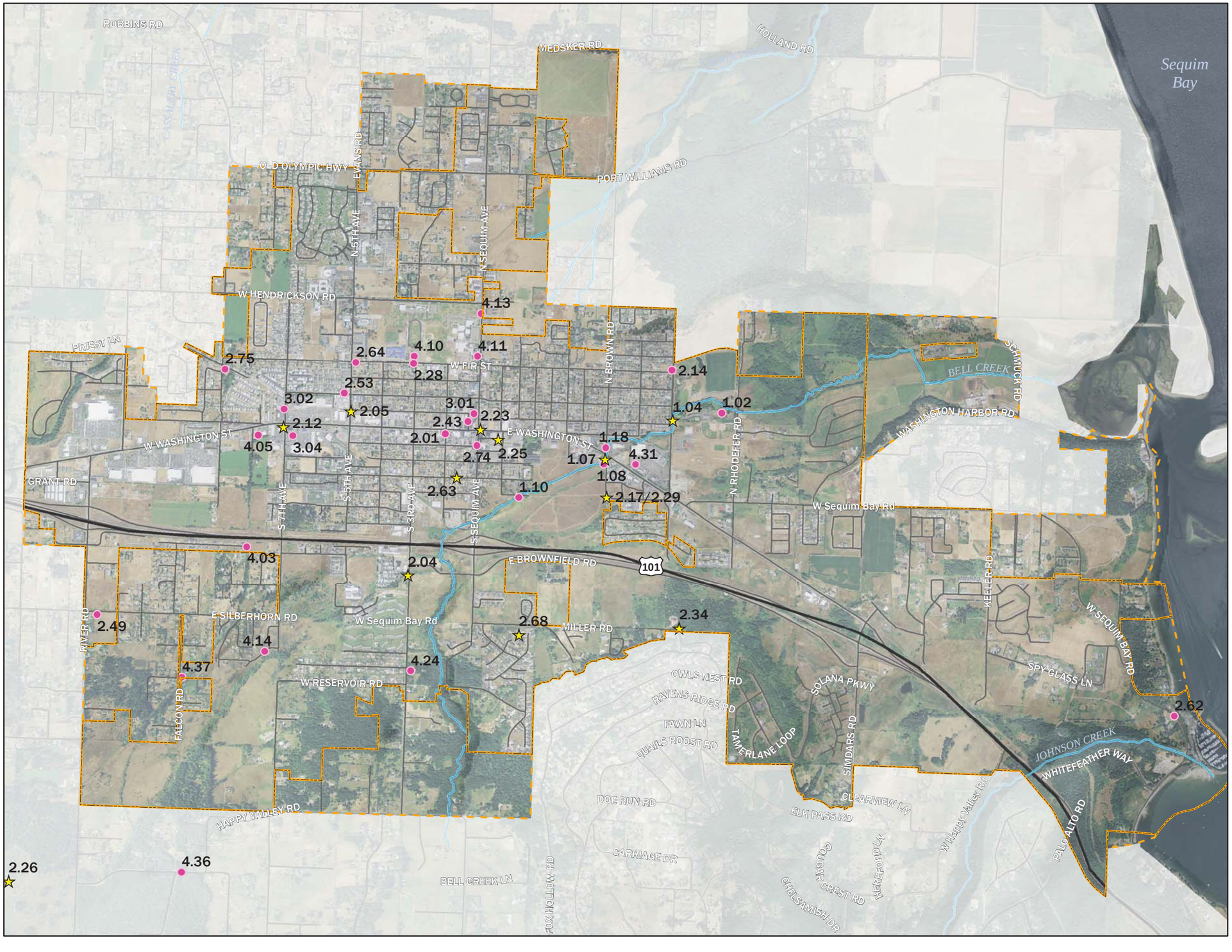


Figure 6.
Identified High Priority Stormwater Problems and CIP Project Locations.

Legend

- CIP project location
- High priority stormwater problem location
- City limit
- Urban Growth Area (UGA)
- Stream
- Road
- Highway

Note:
Projects 1.00, 1.09, and 4.38 are programmatic or occur in multiple locations in the City, and are therefore not included in this figure.

N

0 1,000 2,000 4,000 ft

HERRERA

NAD 1983 HARN
Washington State Plane North FIPS 4601 Feet
USDA, Aerial (2013)

Project: K:\Projects\Y2014\14-05826-000\Project\Master_Plan\stormwater_problems.mxd (2/24/2016)

Stormwater CIP Project Prioritization

The stormwater CIP problems and solutions were prioritized based on the results of a qualitative evaluation that considered multiple criteria. The prioritization process input data is provided in Appendix E, Table E-1, and include findings from field reconnaissance, input from City staff, and review of background documentation such as GIS data.

The objective of the prioritization process was to identify the most important projects and develop a schedule for project implementation. Based on the cumulative input shown in Table E-1, a project implementation schedule was developed (Table E-1); in general, high priority projects were scheduled to occur sooner than low priority projects.

During the prioritization process, each project was assigned a classification category (e.g., maintenance, replacement, upgrade, expansion of the current system, or stormwater planning), and the following prioritization factors were evaluated as high, moderate, or low:

- Problem Risk
- Project Efficiency
- Funding Potential
- Public Sentiment
- Data Quality

Each of these prioritization factors is described in more detail below.

Following CIP project identification and development, a subset of projects were further analyzed and grouped into three distinct categories based on urgency, risk, and level of effort required:

- Group 1 projects represent projects that are most urgent, higher liability, and are compliance related or are on the critical path
- Group 2 projects represent projects that are less urgent, lower risk, and may require coordination with other entities
- Group 3 projects requires study or planning and are not urgent

Table 6. CIP Project Implementation Schedule (in 2015 dollars).

ID	Project Name	Priority[a]	Group	Total Cost[e]	Est. External Funding (%)	Total Cost to City[e]	2016	2017	2018	2019	2020	2021
Group 1 Projects												
1.09	Middle Reach Bell Creek Floodplain Planning[b, c]	High	1	$365,000	50%	$182,500[c]		$12,500	$75,000	$80,000	$15,000	
2.04	South 3rd Avenue (west ROW south of Bypass) Drainage Improvements	High	1	$70,000	0%	$70,000		$14,220	$55,780			
2.12	7th Avenue and Washington Upgrade	High-Moderate	1	$180,000	0%	$180,000				$180,000		
2.23	Centennial Place Inflow and Infiltration Repair	High-Moderate	1	$22,000	0%	$22,000		$22,000				
2.26	River Road Storage Project[d]	High	1	Unknown	100%	$24,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000
2.68	Emerald Highlands Detention Pond Repair/Maintenance	High-Moderate	1	$40,000	0%	$40,000	$40,000					
			Subtotal (Group 1)	**$677,000**	**NA**	**$518,500**	**$44,000**	**$52,720**	**$134,780**	**$264,000**	**$19,000**	**$4,000**
Group 2 Projects												
2.05	North 5th Avenue and Cedar Street Structure Upgrade	High-Moderate	2	$120,000	0%	$120,000						$120,000
2.34	Clara Crest Way /Highland Hills Runoff Abatement	High-Moderate	2	$55,000	0%	$55,000						$55,000
2.63	West Prairie Street Green Street Upgrade (between Sequim Avenue and 2nd Avenue)	High	2	$130,000	0%	$130,000					$20,760	$109,240
			Subtotal (Group 2)	**$305,000**	**NA**	**$305,000**	**$0**	**$0**	**$0**	**$0**	**$20,760**	**$284,240**
			Total (Groups 1 and 2)	**$982,000**	**NA**	**$823,500**	**$44,000**	**$52,720**	**$134,780**	**$264,000**	**$39,760**	**$288,240**
Group 3 Projects												
1.00	Sequim Area Stormwater-Watershed Plan[b, c]	High	3	$742,000	50%	$371,000[c]						
1.04	Bell Creek Culvert Upgrade at RM 1.5	High	3	$350,000	0%	$350,000						
1.07	Bell Creek Culvert Upgrade at RM 1.8	High-Moderate	3	$980,000	0%	$980,000						
2.17/ 2.29	S Brown & Hammond Drainage Improvements	High-Moderate	3	$30,000	0%	$30,000						
2.XX	Annual Stormwater System Rehabilitation	High-Moderate	3	$300,000	0%	$300,000						
			Subtotal (Group 3)	**$2,402,000**	**NA**	**$2,031,000**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
			Total (Groups 1, 2, 3)	**$3,384,000**	**NA**	**$2,830,500**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

[a] Project priority based on the results of a qualitative evaluation that considered multiple criteria. The prioritization process input data is provided in Appendix E.

[b] Total cost to the City assumes that 50 percent of the total project cost would be externally funded by grants as well as possible cost-sharing with Clallam County and Irrigators, etc.

[c] 1.00 Sequim-Area Stormwater-Watershed Planning (covers entire City) will be implemented as an alternative to 1.09 Middle Reach Bell Creek Floodplain Planning if additional grant funding and cost sharing are available.

[d] Implementation of this High-priority irrigation/stormwater storage reservoir requires external sources of funding and cost-sharing with project partners such as irrigation purveyors, Clallam County, and others. In-kind costs to the City are roughly estimated at $4,000/year.

[e] Includes a 30 to 40 percent contingency due to preliminary nature of project and estimate.

Problem Risk

The assessment of risk includes consideration of problem probability (i.e., frequency) and the potential losses resulting from the problem. Problems that occur frequently and have major potential losses associated with them, have higher risk, and thus are typically assigned a higher priority. Problems that occur infrequently with minor potential losses have less risk, and thus are typically assigned a lower priority. Probability and potential losses are summarized below.

- **Probability (i.e., frequency):** Probability of the problem occurring was evaluated qualitatively, based on the perceptions of City staff. Problems that occur more frequently were assigned a higher priority.
- **Potential Losses:** The potential losses associated with surface water problems can vary greatly. The highest potential losses were assigned to problems that cause a significant public safety hazard or extreme property damage, such as flooding of a major intersection that creates hazardous conditions. Problems with moderate potential losses could damage property, but pose a limited hazard to public safety. Problems with minor potential losses result in only a minor loss of use, such as flooding in the parking lane of a residential street (i.e., nuisance issues).

Project Efficiency

There are often opportunities to reduce costs or increase project efficiency by implementing multiple projects at once. For example, a storm drain replacement or extension project can be scheduled to coincide with other right- of- way improvements performed by the transportation department, such as an asphalt overlay, or construction of other utilities, such as replacement of a sewer main. Significant cost savings can be realized in these cases because the cost of surface removal or repair may be minimized or performed at a larger scale (i.e., economies of scale). Combining projects can also minimize the disruption in service, such as reducing the amount of time that a road is out of service.

Funding Potential

Project funding opportunities also play a role in project prioritization. Projects with likely cost sharing or grant opportunities were assigned a higher priority. For example, grant funding is regularly available for water quality improvement projects and some flood improvement projects have potential to share costs with the irrigation districts and the County.

Public Sentiment

Public sentiment and political will are often difficult to quantify, but can play an important role in prioritizing one project over another. For example, the visibility of a flooding problem to the general public and perceived impact on commerce could affect the priority level.

Data Quality

The quality of data used to understand the cause of the problem and assess the above factors, especially problem risk, is also important to consider during prioritization. For example, if the cause of a problem is not well understood, then it may also be difficult to identify a reliable solution; or if the frequency of occurrence is not known, then the impact of the problem is also not well known. Projects with low data quality are assigned a lower priority and data collection needs are identified.

STORMWATER CIP PRIORITIZATION SUMMARY

A qualitative assessment of the factors listed above for all high and moderate priority projects identified by staff is provided in Appendix E. The overall priority of each project was assigned based on consideration of all the factors. Risk was considered the primary factor during this evaluation, and other factors were considered secondary in importance.

The CIP project implementation schedule shown in Table 6 was generated based upon the overall priority shown in the right hand column of Table E-1. In general, higher priority projects are scheduled to occur earlier.

Refer to Appendix F for CIP Project Summary Sheets and conceptual cost estimates for ten CIP projects. Note that three additional CIP projects (2.23, 2.34, and 2.68) were identified after CIP project development, and are therefore not included in Appendix F.

CHAPTER 4 – STORMWATER PROGRAM EVALUATION AND RECOMMENDATIONS

This section summarizes the City's stormwater program. A summary of the status of the program element and recommendations is included for the following stormwater program categories:

1. Inspection Program
2. Water Quality Compliance
3. Species and Habitat Protection
4. Stormwater Design Guidance and Plan Review
5. Asset Management
6. Stormwater System Operations and Maintenance
7. Pollution Source Detection and Elimination
8. Public Education and Involvement

Each section includes a table with the proposed priority (high, medium, low) for each recommendation. The proposed priority was determined based on City input and professional judgment of risk associated with no action and benefit of action.

Additional detail regarding these accomplishments and recommendations is included in the Regulatory Gap Analysis and Compliance Strategy Report (Appendix G). Capital facilities are discussed in the previous section (*Known Stormwater Problems and Recommended Solutions*), thus are not included here.

INSPECTION PROGRAM

The SMC includes stormwater inspection requirements; however, the City does not currently have sufficient staff to conduct or enforce inspections.

Status

The City has established the legal authority to inspect and enforce construction and maintenance standards (SMC 13.104.370). SMC 13.108 sets minimum standards for the inspection and maintenance of all stormwater facilities within the city. Provisions include monthly and annual inspections of different types of facilities, waste disposal, compliance, and inspection authority.

Recommendations

The high priority recommendations summarized in Table 7 are necessary to meet the City's inspection program requirements as outlined in the City code. Moderate and low priority recommendations would result in a more robust inspection program.

Table 7. Inspection Program Recommendations.

Recommendation	Prioritization
Institute a stormwater facility inspection program and develop maintenance standards for non-City-owned stormwater facilities (drains, drywells, infiltration lines, retention/detention ponds, etc.). Develop inspection logs and plat language, and consider providing owner education. Maintain records of private stormwater facility as-builts, covenants, and inspection logs.	High
Improve coordination with homeowner associations, commercial landowners, and School Districts on shared maintenance responsibilities	High
Develop enforcement procedures for private stormwater facility maintenance, such as notification letters, required maintenance standards, maintenance tracking procedures, and a restitution process.	Medium

WATER QUALITY COMPLIANCE

The City is faced with several water quality compliance requirements related to 303(d) listings and Underground Injection Control (UIC) wells.

Status

The City does not currently have an active water quality protection program or dedicated staff.

Recommendations

Recommendations of the Water Quality Data Analysis Report (Appendix H) include additional monitoring of Bell Creek and Johnson Creek for dissolved metals, fecal coliform, and nutrients. Fecal coliform monitoring should be focused at key upstream stations (Bell 0.2, Bell 0.6, Bell 1.0, Bell 1.6, Johnson 0.0, Johnson 0.6, Johnson 1.4, and Johnson 2.0) for evaluating background sources and effects of source control activities. Nutrients should also be monitored at Johnson 0.6. These monitoring recommendations, in addition to other water quality compliance recommendations, are summarized in Table 8.

The City should continue to coordinate with local/regional water quality partners through the Sequim-Dungeness Clean Water Work Group and its members, which are often involved in monitoring water quality in and around the City and UGA. Also see Public Education and Involvement recommendations.

Water quality monitoring is beneficial to both assess current status and measure improvements over the long term resulting from stormwater management and water quality treatment of typical stormwater pollutants.

Table 8. Water Quality Compliance Recommendations.	
Recommendations	**Prioritization**
Develop and implement a pollution control program for water bodies currently on the 303(d) list of impaired waters	High
Develop and implement surface water flow monitoring program	High
Coordinate with the Sequim-Dungeness Clean Water Work Group (CWWG) on monitoring activities, especially for city creeks, Washington Harbor, and Sequim Bay.	High
Use GIS to identify UIC wells that need to be registered with Ecology	High
Use online form to register UIC wells	High
Develop and implement a plan to assess drywells classified as UICs	High
Consider implementing additional water quality monitoring recommendations included in the Water Quality Data Analysis Report: • 12 samples per year (6 during wet weather and 6 during dry weather) at 6 monitoring stations in Bell and Johnson Creek • Continuous monitoring of dissolved oxygen and temperature in Bell Creek during the summer months • Fecal source tracing in Bell Creek	Medium
Develop and implement a groundwater monitoring plan for stormwater constituents of concern	Medium
Develop and implement a nitrate groundwater monitoring plan	Low
Develop and implement a stormwater facility monitoring plan (including private facilities)	Low

SPECIES AND HABITAT PROTECTION

Status

The City does not currently have a species and habitat protection program, other than membership and participation in the Dungeness River Management Team (DRMT) and Water Management Rule Implementation committees. The following activities have recently been completed that have resulted in a benefit to species and habitat protection:

- Pitship Estuary Bridge on West Sequim Bay Road that reconnects tidal functions to the Pitship Pocket Estuary.
- Reclaimed water is used north of the Reuse Demonstration Park to irrigate Garry Oaks Park managed by the Washington Department of Fish and Wildlife and to augment ponds that benefit migratory waterfowl.
- Bell Creek flow is continuously augmented year-round with reclaimed water at a rate of 0.1 cfs.

The City also cooperated with the Jamestown S'Klallam Tribe on the Washington Harbor Estuary Bridge project to replace a causeway that supported the City's outfall pipe and blocked potential fish habitat.

Shellfish habitat within or just downstream of City jurisdiction in Sequim Bay can be impacted by urban runoff, and is important to protect. For example, Washington Harbor is now a target location for native Olympia oyster restoration by local organizations.

Recommendations

The high priority activity listed in Table 9 is recommended to meet the City's species and habitat protection requirements. Medium and low priority stormwater program recommendations are also summarized in this table.

Table 9. Species and Habitat Protection Recommendations.

Recommendation	Prioritization
The City should participate in Dungeness River Management Team (DRMT) routine meetings and with Water Rule implementation groups. The City should also request smolt outmigration data from Bell Creek measured by the Jamestown S'Klallam Tribe, and water quality information for Washington Harbor and Sequim Bay.	High
Ensure habitat access by examining and replacing all culverts if they pose barriers to fish passage.	Medium
Maintain riparian buffers to control water temperature and provide forage material	Medium
Utilize soft bank stabilization methods, levee setbacks, and limit the use of riprap and other bank hardening methods to allow natural stream migration and off-channel habitat formation.	Medium
Determine whether the City needs to update floodplain mapping within city limits to be in compliance with the National Floodplain Insurance Program (NFIP) and restrict development within the floodplain.	Low

STORMWATER DESIGN GUIDANCE AND PLAN REVIEW

Status

The City implements a variety of activities and programs for stormwater design guidance and plan review (for runoff control from development during construction and post-construction) that include the following:

- **Stormwater management design guidance:** The SMC requires use of "the latest edition" of Ecology's Stormwater Management Manual for Western Washington (SWMMWW) for designing stormwater systems. The latest edition was published in 2012 and revised in 2014 (Ecology 2012b).
- **Stormwater site plan review:** The City (Senior Planner, Department of Community Development) currently conducts drainage reviews for smaller developments, and contracts out the drainage review for larger developments within the city. The City does not typically use modeling software for plan review of residential projects.
- **LID code update/integration**: In 2009**,** City code recommendations related to incorporating the Low Impact Development (LID) principles and practices (BMPs) were developed (AHBL 2009). The code recommendations have not yet been adopted. The City code sections that were reviewed and a brief summary of the recommendations are provided in Appendix G.
- **Stormwater management ordinance and enforceable mechanisms:**
  - SMC 13.104.100 adopts the most recent version of Ecology's SWMMWW.

- **Recordkeeping and enforcement:**
  - As-built drawings are kept on file with the City.

The City has established the authority to enforce the stormwater management ordinance and issue a stop work order if needed (SMC 13.104.390).

Recommendations

Recommendations regarding the City's stormwater design guidance and plan review process to control runoff from development during construction and post-construction are provided in Table 10.

Table 10. Stormwater Design Guidance and Plan Review Recommendations.

Recommendation	Prioritization
Review the 2012 SWMMWW (and 2014 modifications) and consider developing an amendment to the 2012 SWMMWW that provides guidelines and requirements specific to the City.	High
Determine which BMPs are most effective in protecting groundwater quality while preserving recharge as part of the Master Plan and consider including these BMPs in an additional guidance document or amendment to the 2012 SWMMWW.	High
Develop handouts that summarize on-site stormwater management, treatment, and flow control thresholds for when the SWMMWW applies for single-family and commercial development projects. Update in the SMC as needed.	High
Improve/develop a consistent stormwater plan review process in consultation with the development industry, that includes checklists, sizing table tools, and plant lists for site plan review to increase efficiency.	High
Look for opportunities to partner with Clallam County in a watershed-scale planning effort	High
Review AHBL's Code Revision recommendations regarding LID, review additional sections of the SMC identified in the Stormwater Management Needs Assessment (Sequim 2014), update as needed, develop a brief summary report, and coordinate with City Council to review and approve proposed changes to SMC.	Medium
Promote upcoming training opportunities for designers (specifically on the 2012 SWMMWW)	Medium
Coordinate with the Clallam Conservation District and WSU Extension for additional training opportunities for staff.	Medium
Consider promoting or incentivizing secondary uses for stormwater such as rainwater collection (e.g., cisterns) and reuse for irrigation and toilet flushing.	Medium
Train staff when updates occur to planning, development, inspection, and enforcement of stormwater runoff controls.	Low

ASSET MANAGEMENT

Status

The City has mapped the majority of stormwater facilities and structures in its geographic information system (GIS) software, but does not have a formal asset management program for their stormwater infrastructure.

Recommendations

Asset management is a system for maintaining the desired level of service while minimizing the life cycle cost of stormwater assets. An effective asset management program ensures that assets continue to function over the long term and can significantly reduce the potential for system failure. An asset management program typically includes an inventory of assets, an assessment of their condition (updated with periodic maintenance checks), implementation of a GIS-based asset management data information tracking system, and prioritization of maintenance or capital repair projects based on assessing the likelihood of failure and consequences of failure for each asset. Table 11 summarizes the recommendations for the City related to Asset Management.

Table 11. Asset Management Recommendations.

Recommendation	Prioritization
Continue to update the storm system map and database as needed.	High
Develop a system to ensure that new development projects with stormwater components are incorporated into GIS.	Medium
Improve the existing asset inventory by updating stormwater system components in GIS with current conditions.	Medium

STORMWATER SYSTEM OPERATIONS AND MAINTENANCE

Status

The City currently implements a variety of stormwater system operations and maintenance (O&M) activities that include the following:

- **Inspections and O&M:**
  - City-owned catch basins and stormwater facilities (e.g., drywells, perforated pipes, detention ponds, retention ponds) inspections are conducted every 1 to 3 years, according to need
  - Street sweeping, most streets several times/year
  - Stormwater facility cleaning and maintenance, repair/replacement as needed
  - Flooding and storm response and repair, including checking/cleaning irrigation system trash racks

- **Spill Response:**
    - Spill control materials (i.e., sand bags, kitty litter, straw wattles, catch basin filters, etc.) are kept on hand in case of spills, including firefighting water.

The Streets crews also implement the following activities that may impact stormwater:

- **Snow and Ice Management:** Crews have used magnesium chloride since the winter of 2011-2012 as a de-icing agent on main arterials, overpasses, hills, and roundabouts. Magnesium chloride has been more cost-effective for the City than road salt or sand and is more environmentally friendly than most other de-icers. The use of magnesium chloride also does not require additional street sweeping (as required with sand) to pick up material after each storm event. De-icing materials are stored outdoors in storage tanks (8,000-gallon maximum capacity) on an uncovered impervious area.
- **Weed Management:** City crews occasionally use EPA-approved herbicides during the summer and early fall to keep sidewalks and street gutters free of weeds. Any herbicides used are applied to the minimum extent practicable and are applied by Washington State Department of Agriculture Pesticide licensed Public Works crew members. Herbicides are stored in the breezeway in containers or inside on a concrete pad. The City does not currently have an Integrated Pest Management Plan (IPMP).
- **Vactor Waste Disposal:** The City collects vactor waste from cleaning and maintenance of catch basins, detention facilities, and treatment structures or facilities. The vactor waste is transported to the City Shop facility and dumped at the decant facility. The decant liquids are sent to the sanitary sewer system. Clean solids are disposed of at the County gravel pit or land-applied to City-owned property next to the Shop. If a hot load is suspected, materials are tested prior to dumping and transported to the Port Angeles Landfill.
- **Street Sweeping Waste Disposal:** Street sweeping waste is transported to the City Shop facility and dumped on a dewatering slab where the liquids are decanted from the solids. The decant liquids are sent to the sanitary sewer system. Clean solids are disposed of at the County gravel pit or land-applied to City-owned property next to the Shop. If a hot load is suspected, materials are tested prior to dumping and transported to the Port Angeles Landfill.

Recommendations

The high priority stormwater program modifications summarized in Table 12 are recommended to improve the City's stormwater system O&M program. Medium and low priority stormwater program recommendations are also summarized in this table.

Table 12. Stormwater System Operations and Maintenance Recommendations.	
Recommendation	**Prioritization**
Establish maintenance agreements with irrigators and other stormwater management partners addressing type and frequency of maintenance activities as well as responsibilities for annual and storm-related maintenance.	High
Add maintenance and inspection information to the storm system map and database in GIS.	High
Ensure compliance with SMC requirements for regular inspection and maintenance.	High
Consider hiring seasonal workers to work on inspection/maintenance crew.	High
Increase staff support (permanent or seasonal) for inspecting and cleaning stormwater facilities including irrigation system track racks.	High
Evaluate street sweeping routine to determine if changes need to be made.	Medium
Develop a policy for City inheritance of private stormwater facilities that specifies the condition that a private stormwater facility should be in prior to being inherited by the City. Consider coordinating this policy with the inheritance of private streets.	Medium
Improve internal communications within Public Works to facilitate O&M activities.	Medium
Develop SOPs for O&M staff.	Medium
Review SWPPPs developed for other Cities and Counties to determine if a similar plan should be developed for the City Shop.	Medium
Require City O&M staff attendance at trainings, especially those related to maintenance of LID BMPs. Invite Irrigation District O&M staff to attend trainings.	Medium
Include the stormwater pond that drains part of the Shop parking lot in regular inspection and maintenance routines.	Medium
Develop an Integrated Pest Management Plan (IPMP) for ROW vegetation and stormwater facility maintenance.	Medium
Obtain additional tools and equipment to inspect, maintain, and repair LID facilities.	Low
Remove trash and litter from problem areas, set up a notification system and response, or implement a program for volunteer trash clean ups that prioritizes problem areas.	Low
Invite vendors to present on how to maintain their technologies.	Low

POLLUTION SOURCE DETECTION AND ELIMINATION

Status

Pollution Source Detection and Elimination refers to the detection and elimination of "illicit discharges," defined in SMC 13.104.040 as non-stormwater discharges to the storm drainage system that cause or contribute to a violation of state water quality, sediment quality or ground water quality standards. These discharges can include, but are not limited sanitary sewer connections, industrial process water, interior floor drains, car washing, and greywater systems. The City's activities related to pollution source identification and elimination include the following:

- **Stormwater system map updates:** Ongoing mapping of the City's stormwater facilities and pipes (both City and non-City-owned) is described under Asset Management.
- **Illicit discharge ordinance:** Adopted an illicit discharge ordinance prohibiting illicit discharges to stormwater drainage systems (SMC 13.104.120).
- **Enforcement:** Ecology and the EPA have enforced several past illicit discharges within the city.

Recommendations

The recommendations for establishing a proactive pollution source detection and elimination program are summarized in Table 13.

Table 13. Pollution Source Detection and Elimination Recommendations.

Recommendation	Prioritization
Develop and implement a pollution source tracking program that includes obtaining field equipment that can be used for illicit discharge field screening and source tracing, developing of a basic training program for City field staff, and developing of a system for tracking all illicit discharges reported and investigated.	High
Establish a policy for how charity car wash drainage should be handled.	High
Develop a spill reporting hotline or web form.	High
Update illicit discharge ordinance, or provide policy direction for interpreting it.	Medium
Provide pollution source detection and elimination education as part of the City's ongoing public education program to the general public and businesses.	Medium
Require staff involved in illicit discharge response to review the Illicit Connection/Illicit Discharge Field Screening and Source Tracing Guidance Manual that was developed for the State of Washington (Ecology 2013).	Medium
Develop and implement a pollution source field screening program for the City's stormwater system.	Low

PUBLIC EDUCATION AND INVOLVEMENT

Status

The City's stormwater public education and involvement currently includes the following activities, *all* directly related to the 2013-2015 Master Plan project, partially funded by a Centennial Clean Water grant from Ecology:

- **Education:**
  - Dungeness River Fest (September 2014)
  - Interpretive Center at Water Reuse Demonstration Park (grand opening in October 2014; open 2 hours every Wednesday morning and Thursday afternoon)
  - Public presentations to Chamber of Commerce, Dungeness River Management Team, Science Café, Sequim Association of Realtors, North Peninsula Builders Association, and others
  - Stormwater Stewardship flyer, Bell Creek poster, LID resource table and other elements displayed at the Interpretive Center
  - Website on surface water management, including a page on the Stormwater Stewardship project, and a virtual tour of local water resources
  - Creek sign installation (Bell, Johnson, and Gierin Creeks)

- **Opportunities provided for public involvement:**
  - Website for the Stormwater Management Needs Assessment (Sequim 2014) project to solicit reports of flooding and problem areas within the city
  - Volunteer program, including storm drain inventory, flow monitoring, data entry, watershed education, and other activities
  - Bell Creek Discovery Tour online or on-the-ground educational tour of sites from headwaters to mouth (prizes for those completing tour April-May 2015)
  - Monthly Stormwater Stewardship project updates offered by email to subscribers via website
- **Coordination with stakeholders:** Directly consults with stakeholder groups (e.g., irrigators, Clallam Conservation District, WSU Extension, Clallam County, homeowner groups, tribes, Olympic Region Clean Air Agency [ORCAA], and others) regarding stormwater management, water quality, habitat, and regional water supplies including water conservation.

Recommendations

The high priority stormwater program modifications summarized in Table 14 are recommended to improve the City's stormwater public education programs. Medium and low priority stormwater program recommendations are also summarized in this table.

Table 14. Public Education and Involvement Recommendations.

Recommendation	Prioritization
Provide additional guidance (e.g., factsheets, brochures, checklists) for developers and builders on meeting the City's stormwater facility design, maintenance, and construction requirements.	High
Develop outreach materials for residents, landscapers, and property managers/landowners, the general public, and businesses.	High
Attend regional conferences and meetings on stormwater and surface water management.	High
Continue to coordinate and create agreements with other parties as necessary to achieve stormwater management goals, water quality goals, and water resource management for the Dungeness watershed.	High
Utilize resources available from partner agencies including Clallam Conservation District, WSU Extension, Ecology, and Association of Washington Cities (AWC).	High
Attend regional meetings and participate in regional forums and such as the West Sound Stormwater Managers' Coordination Group, the Sequim-Dungeness Clean Water Work Group, and the Association of Washington Cities (AWC).	High
Identify opportunities for public participation throughout Master Plan implementation.	Medium
Create a hotline and system for logging and responding to general stormwater-related complaints.	Medium
Promote rain barrels and cisterns for storing roof runoff for future irrigation.	Medium
Re-establish storm drain marking program—using storm drain markers, for example.	Low
Measure adoption of targeted behaviors and adapt program to best meet goals.	Low
Continue to develop a Communications Plan.	Low
Evaluate the costs and benefits of having a stormwater public education and outreach program.	Low

CHAPTER 5 – PLAN IMPLEMENTATION

This section describes a plan for implementation of the recommended CIP projects and stormwater program activities that takes into account staffing needs, funding needs, equipment needs, future growth, climate change, interdepartmental collaboration, interagency collaboration, and concurrent planning.

SUMMARY OF RECOMMENDATIONS

Three tiers were evaluated for staffing, funding, and equipment needs:

A. Needed to meet minimum standards

B. Likely to be mandated

C. Proactively anticipating and reducing risk

Table 15 identifies the Stormwater Program elements that fall into each tier.

Table 15. Stormwater Program Element Priorities Included in Tier A, B and C.

Stormwater Program Element	Tier A	Tier B	Tier C
Capital Facilities	Group 1	Group 1	Group 1 and 2
Inspection Program	H, M	H, M	H, M (no L priorities)
Water Quality Compliance	H	H, M	H, M, L
Species and Habitat Protection			H (no M or L priorities)
Stormwater Design and Plan Review		H, M	H, M, L
Asset Management		H, M	H, M (no L priorities)
Stormwater System O&M	H	H, M	H, M, L
Pollution Source Detection and Elimination		H	H, M, L
Public Education and Involvement		H	H, M, L

A summary of the work items and costs required to implement the recommendations of this plan is provided in Table 16.

Table 16. Stormwater Program and CIP Recommendations.

Stormwater Program Element	Summary of Tier A Recommendations	Additional Funding	Additional Staff Support (FTE)
Capital Facilities	Implement Group 1 and 2 CIP Projects (see Chapter 3 – Known Stormwater Problems and Recommended Solutions section).	Tier A – $518,500 Tier B – $518,500 Tier C – $823,500	Not applicable (additional funding includes design and construction management costs)
Inspection Program	• Institute a stormwater facility inspection program • Develop maintenance standards, inspection logs, and plat language • Coordinate with School Districts • Improve coordination with homeowner associations and commercial landowners • Develop enforcement procedures for maintenance of private stormwater facilities	$0	Tier A – 0.17 FTE Tier B – 0.17 FTE Tier C – 0.17 FTE
Water Quality Compliance	• Develop and implement a pollution control plan for waterbodies currently on the 303(d) list of impaired waters • Develop and implement surface water flow monitoring program • Coordinate with CWWG on monitoring activities • Use GIS to identify UIC wells that need to be registered • Use online form to register wells • Develop and implement a plan to assess drywells classified as UICs	Tier A – $100,000 Tier B – $148,000 Tier C – $158,000	Tier A – 0.20 FTE Tier B – 0.27 FTE Tier C – 0.29 FTE
Species and Habitat Protection	• No Tier A recommendations	$0	Tier C – 0.04 FTE
Stormwater Design Guidance and Plan Review	• No Tier A recommendations	Tier B – $40,000 Tier C – $40,000	Tier B – 0.23 FTE Tier C – 0.27 FTE
Asset Management	• No Tier A recommendations	Tier B – $6,000 Tier C – $6,000	Tier B – 0.61 FTE Tier C – 0.61 FTE
Stormwater System O&M	• Establish maintenance agreements with irrigators and other stormwater management partners addressing type and frequency of maintenance activities as well as responsibilities for annual vs. storm-related maintenance. • Add maintenance and inspection information to the storm system map and database in GIS. • Consider hiring seasonal workers to work on inspection/maintenance crew • Increase staff support for inspecting and cleaning stormwater facilities including irrigation system trash racks.	Tier A – $0 Tier B – $15,000 Tier C – $281,000	Tier A – 1.39 FTE Tier B – 1.54 FTE Tier C – 1.54 FTE

Table 16 (continued). Stormwater Program and CIP Recommendations.			
Stormwater Program Element	**Summary of Tier A Recommendations**	**Additional Funding**	**Additional Staff Support (FTE)**
Pollution Source Detection and Elimination	• No Tier A recommendations	Tier B – $14,000 Tier C – $24,000	Tier B– 0.11 FTE Tier C – 0.19 FTE
Public Education and Involvement	• No Tier A recommendations	Tier B – $24,000 Tier C – $39,000	Tier B – 0.24 FTE Tier C – 0.29 FTE
Total Additional Funding and Staff Support Needed		Tier A – $618,500 Tier B – $765,500 Tier C – $1,371,500	Tier A – 1.76 FTE Tier B – 3.18 FTE Tier C – 3.41 FTE

Staffing Needs

When this Plan was developed (mid-2015), the City budgeted 1.75 full time equivalent (FTE) personnel designated to supporting stormwater activities: 0.75 FTE Operations and 1.0 FTE Capital (a temporary position largely reimbursed with grant funds).

The estimated staff support needed for each category includes the following:

- **Tier A:** 2.51 FTE permanent staff (0.75 FTE existing and 1.76 FTE additional staff)
- **Tier B:** 3.93 FTE permanent staff (0.75 FTE existing and 3.18 FTE additional staff)
- **Tier C:** 4.16 FTE permanent staff (0.75 FTE existing and 3.41 FTE additional staff)

A detailed staffing breakdown by position is included in the Regulatory Gap Analysis and Compliance Strategy Report (Appendix G). Note that temporary and/or part-time staff may be used to fulfill FTE needs, and supplementary grant funds will most likely be needed.

Funding Needs

The 2014 budget for stormwater was $251,000. Of this, $101,000 is used for stormwater system maintenance, GIS mapping, capital facility improvements, and education and outreach activities (refer to Appendix G for details) and $150,000 is used for capital (planning grant).

The estimated funding support needed for each category includes the following for operational as well as capital costs (note that grants and/or loans will be needed to help cover these needs, especially for large capital projects):

- **Tier A:** $719,500 ($101,000 existing and $618,500 additional funding)
- **Tier B:** $866,500 ($101,000 existing and $765,500 additional funding)
- **Tier C:** $1,472,500($101,000 existing and $1,371,500 additional funding)

Equipment Needs

The primary City equipment currently used for the stormwater program includes two vactor trucks (one new in Fall 2014), a street sweeper, a motorized camera, a "push" camera, and equipment that is used for jetting infiltration lines.

Additional equipment that could be useful for maintenance, asset management, and pollution source detection inspections include the following:

- **Tier A:** No new equipment needed
- **Tier B:** Pollution source field screening and source tracing equipment and asset management software and field tools
- **Tier C:** Pollution source field screening and source tracing equipment, bioretention maintenance equipment, permeable pavement maintenance equipment

A more detailed equipment breakdown is included in the Regulatory Gap Analysis and Compliance Strategy Report (Appendix G). Grant funds are sometimes available for equipment needs.

FUNDING STRATEGIES

The City currently funds stormwater activities (primarily street sweeping, catch basin cleaning, and capital expenses) with about $100,000 from Water and Sewer Utility funds supplemented with an Ecology grant. The state allows sewer funds to be used for stormwater activities (RCW 35.92.020). The 2013 budget for stormwater was $141,000. The 2014 budget for stormwater was $251,000 (refer to Appendix G for details).

A financial analysis was performed in late 2015. The Funding Strategies Memorandum is attached as Appendix I.

The projected annual cost of the three tiers through 2022 is compared with existing stormwater expenses as follows:

- No Change annual cost: $110,000
- Tier A annual cost: $565,000
- Tier B annual cost: $675,000
- Tier C annual cost: $825,000

The financial analysis assessed the following five potential funding options for programmatic stormwater activities (grant funding is expected to be needed for many capital projects):

1. Continuing to pay from water and sewer utility revenues
2. Ad valorem property tax assessment
3. Establishing a stormwater fee
4. Forming a special purpose district
5. Combination of the above funding sources

Under Alternative 1 (the City's current approach), the Water Utility and Sewer Utility pay for stormwater services. The financial impact varies depending on total water use and winter water use, but is projected to be $1.60 to $2.10 per month for most single-family residential customers. With the implementation of the Tier A recommendations, that financial impact would increase to $8.60 to $11 per month.

Alternative 2 (Ad valorem property tax assessment) results in a projected cost of $0.686 per $1,000 of assessed valuation, or $10.58 of new property taxes per month, for implementation of the Tier A recommendations. P

Alternative 3 (Establishing a stormwater fee) results in a projected cost of $12 to $18 per month, for implementation of the Tier A recommendations.

Projected costs for Tier B and Tier C, a discussion of equity considerations, and administrative and implementation considerations are included in Appendix I.

Alternatives 4 and 5 were also evaluated; however, financial impacts were not developed for either alternative. Additional detail regarding these two alternatives can be found in Appendix I.

FUTURE GROWTH STRATEGIES

This section identifies programmatic and capital project strategies for handling future growth. The needs will evolve with growth, which means these strategies will need to be revisited on a regular basis.

Stormwater Program Strategies

Future growth will increase the need for resources in all stormwater program elements, in particular, growth is expected to increase the effort required for providing stormwater design guidance and plan review, construction inspection, stormwater system O&M, and public education and involvement. Providing adequate resources for education, design guidance, and inspection will help ensure that development projects occur in accordance with applicable stormwater regulations and minimize the increased burden on the storm and surface water system. Future development will expand the transportation and stormwater systems, and lead to additional effort required for O&M, including inspection and cleaning the stormwater system and street sweeping. During future years, the City will need to consider whether staffing and equipment resources need to be increased to address the needs of growth.

Capital Project Strategies

This plan includes stormwater CIP projects that will lay the groundwork for future development of the storm and surface water system. In particular, three CIP projects focus largely on planning for future development:

- 1.00 Sequim Area Stormwater-Watershed Plan
- 1.09 Middle Reach Bell Creek Floodplain Planning
- 2.26 River Road Storage Project

Projects 1.00 and 1.09 are needed to address several important growth considerations:

- Balance the City's development density goals with natural resource protection, including managing stormwater in ways that ensure adequate groundwater recharge and protect groundwater quality.
- Include a watershed-based approach for stormwater management that may include development of regional stormwater infrastructure plans for conveyance, flow control, and water quality treatment, as well as resource protection projects; watershed-specific regulations may also be indicated. Typical regional plans are aimed at constructing natural (streams and wetlands) or built (pipes and pond) elements to convey, detain, treat, and infiltrate stormwater from developed properties without causing erosion of streams or degradation of water quality that would be harmful to fish and wildlife.
- Outline funding strategies that may include fee-in-lieu approaches where regional stormwater projects may be funded through fees on future development.
- Be adaptable to future land use plan changes.
- Address the City's goals for reclaimed water. As an example, projects focused on stormwater treatment and infiltration may be designed to receive reclaimed water during the dry season to further increase aquifer recharge and could also create wildlife habitat.
- Consider land use planning elements, such as reduced lot size and increased open space, in order to minimize the stormwater impacts of future development.

Project 2.26, as described in this plan, would include construction of a large reservoir outside of the city limits that could benefit the City by detaining flow in irrigation canals during the wet season and by alleviating existing flooding problems in the city. As this project concept is developed, the City should consider whether the reservoir can also be used to provide to offset stormwater management needs of future growth. If the wet season detention benefits of the reservoir are great enough, the City may be able to establish credits by which future developments could discharge treated stormwater into the irrigation canals. These credits could help reimburse the reservoir construction. Secondary benefits of a large reservoir could include wildlife habitat and possible recreation opportunities.

CLIMATE CHANGE STRATEGIES

Stormwater management adaptation is less costly and disruptive if necessary measures are undertaken in advance of anticipated changes. Sequim is working to identify stormwater infrastructure vulnerable to climate risks and implement adaptation strategies to maintain public safety and working stormwater infrastructure. A primary adaptation strategy will be to consider climate risks in the planning, funding, design, and construction of new or replaced stormwater infrastructure. Second, the City will promote improvements in the most vulnerable areas. Many infrastructure improvements made for other reasons, such as seismic retrofits, fish passage improvements, and culvert replacements, also make infrastructure more resistant to climate change impacts. The City will also strengthen contingency plans to prepare for and respond to more frequent and severe weather, as well as water shortages.

Given climate change risk factors, the City may want to consider modeling its stormwater system to determine what areas are at or near flow capacity and thus prone to increased flood risk in the future; particularly in neighborhoods where redevelopment is expected to occur, or where large capital improvement projects are planned. But aside from modeling, flood-prone problem areas reported in the City's Stormwater Management Needs Assessment (Sequim 2014) and further defined in this plan, are a good place to start to understand the potentially vulnerable links in the City's stormwater system.

As identified in Table 4, declining water quality is expected as a result of increasing summer and average temperatures leading to lower levels of dissolved oxygen and increased frequency of algal blooms. The City could reduce its vulnerability to expected continued decline in water quality by retrofitting existing stormwater facilities for better treatment performance, or constructing new stormwater infrastructure, such as constructed wetlands, or LID facilities, that more effectively treat water quality in areas that have surface runoff. LID and GSI could be implemented as cost-effective methods of dealing with potential increases in precipitation intensity. The City has identified basin-specific studies that would provide better data for adapting stormwater system infrastructure. This is important as climate changes could produce varying levels of impact due to differences in topography, watershed size, level of development, and existing infrastructure drainage capacity that vary by basin.

Future changes in climate that alter precipitation intensity or duration would have consequences for urban stormwater discharge, particularly where stormwater detention and conveyance facilities were designed under assumptions that may no longer be correct. Modifications to the defined 'design storm' may be needed to account for future precipitation changes. Design storm frequency predictions for use in stormwater system modeling that account for predicted precipitation changes remains a data gap, but recent research has indicated a 25 percent increase may be sufficient to design for expected larger events (Rosenberg et al. 2010) and provide adequate adaptability when designing stormwater management systems.

Adaptations used in other jurisdictions to address projected flow increases include increasing stormwater detention on public and private property as well as increasing stormwater detention on streets. Rosenberg et al. (2010) recommends increasing stormwater detention on public and private property by 25 cubic yards per impervious acre, and increasing stormwater detention on streets by 20 cubic yards per impervious acre. Retrofits of privately-owned stormwater ponds is another way to add storage capacity. Planned inspections of key drainages during large storm events can identify erosion concerns that need to be addressed and prevent clogging if the debris and sediment is cleared at the same time.

Finally, in the broader picture, Sequim is working with the North Olympic Peninsula Resource Conservation and Development Council (NOPRC&D) in 2015 to plan for climate change on the North Olympic Peninsula. Members of NOPRC&D include Jefferson County, Clallam County, the cities of Port Angeles, Sequim and Port Townsend, Clallam Economic Development Council, Ports of Port Townsend and Port Angeles, Clallam Conservation District, the Clallam PUD, the Jefferson PUD, Jamestown S'Klallam Tribe, Makah Tribe, Elwha Klallam Tribe, and Team Jefferson Economic Development Council.

A region-specific climate assessment that summarizes the observed trends and projected changes in the climate for the North Olympic Peninsula (changes in precipitation, air and water temperatures, etc.) and the projected impacts of climate change on the North Olympic

Peninsula has been completed. In addition, a prioritized risk assessment of climate change and a vulnerability assessment of the North Olympic Peninsula was conducted based on: 1) how the climate is changing; 2) how sensitive key sectors, resources, or areas are to those changes; and 3) the ability of our systems and environment to adapt to those changes. NOPRC&D plans to develop potential solutions and actions for reducing risk and increasing resilience for the prioritized higher risk areas through research and workshops with local experts in 2015.

In September 2015, the NOPRC&D completed a Climate Preparedness Plan for the North Olympic Peninsula, created outreach materials, and presented the plan to municipalities (including planning commissions), watershed planning organizations, and other groups in Jefferson and Clallam Counties. The plan's purpose is to inform decision-making with specific local information and strategies to reduce risks from climate change; key strategies for Sequim are listed under *Concurrent Planning*, below. Currently, the NOPRC&D is tracking implementation of solutions and actions recommended in the Climate Preparedness Plan.

Based on the predicted long-term trends and changing risks, it is recommended that City collaborate with its partners on a long-term, comprehensive water management strategy that institutes adaptive management and water conservation. This strategy will help ensure that regional water supplies, including stormwater, drinking water, irrigation water, reclaimed water (and potentially gray water), streams and other surface waters, will effectively meet the needs of residents, industry, agriculture and the natural environment.

INTERDEPARTMENTAL COLLABORATION

The stormwater program is currently led by the Resource Manager in the Public Works Department. Within the Public Works Department, several divisions assist with stormwater program activities including Utilities, Engineering, and Streets. The Engineering division works with the Department of Community Development (DCD) to implement stormwater program activities. Representatives from these departments and divisions were involved in the development of this Master Plan. These representatives are identified in Appendix B.

As the stormwater program becomes more robust, it is critical to align stormwater CIP project planning with the Transportation, Sewer, and Water Master Plans, the Parks and Recreation Master Plan, and the City's reclaimed water projects. Future opportunities will be sought for managing stormwater along with the City's reclaimed water system, potentially using the same infiltration facilities, to utilize both sources to the greatest extent possible.

There may be opportunities to coordinate stormwater management with land use planning, particularly when undeveloped open spaces (including parks and public right-of-way) could be available for storage, conveyance, or infiltration of stormwater.

INTERAGENCY COLLABORATION

To address ongoing regional coordination needs, the City will continue to work with regional stakeholder groups and other local governments in shared drainage basins to protect groundwater and surface water quality and to manage and treat stormwater effectively. These entities include (among others):

- Clallam County
- Irrigation districts and companies (Highland Irrigation District and Sequim Prairie Tri-Irrigation Association, comprised of Independent Irrigation Company, Eureka Ditch Company, and Sequim Prairie Ditch Company)
- Clallam Conservation District
- Sequim School District
- Jamestown S'Klallam Tribe
- Home Owner Associations

The types of agreements discussed in this plan include the following:

- Maintenance and management agreements addressing type and frequency of maintenance/management activities as well as separate and shared responsibilities
- Information sharing agreements with data collection partners, such as members of the Sequim-Dungeness Clean Water Work Group (a subcommittee of the Dungeness River Management Team) and other water quality, fish habitat/use, stormwater monitoring and management information
- Other agreements necessary to achieve stormwater and long-term regional water management and water conservation goals

State and federal agency coordination will also be important as the Storm and Surface Water Master Plan is implemented, especially to communicate that the City is taking certain actions specifically to prevent the need to have the NPDES permit requirements imposed. Other state-agency drivers include water quality regulations and the Puget Sound Action Plan and its "Puget Sound Vital Signs," several of which would be addressed with Plan implementation.

Key state and federal agencies include:

- Washington Department of Ecology
- Washington Department of Health
- Washington Department of Fish & Wildlife
- Washington Department of Transportation
- Puget Sound Partnership
- US Environmental Protection Agency
- US Fish & Wildlife Service
- National Marine Fisheries Service (with NOAA)
- Federal Emergency Management Agency
- Olympic Region Clean Air Agency (ORCAA)

CONCURRENT PLANNING

After the release of the draft Storm and Surface Water Master Plan in May 2015 and before it was finalized in February 2016, there were several key planning processes that concluded with results relevant to this plan.

First, a 2016 budget was prepared and adopted by City Council that includes stormwater operations and capital elements slightly different from what was current in May 2015. Pertinent sections have been updated in the final version of this plan to reflect these differences. Appendix I contains a funding analysis based on the 2014 and 2015 stormwater budgets; these details were not updated.

Sequim 2015–2035 Comprehensive Plan

On October 26, 2015, the City Council adopted the Comprehensive Plan Update resulting from the Sequim 120 planning process conducted by DCD. When the draft Storm and Surface Water Master Plan was developed, the most current Comprehensive Plan draft was from March 11, 2015 (Sequim 2015). Since then, City staff made several changes to the most pertinent section, Chapter 9/ Energy & Environment, which have improved compatibility with the Storm and Surface Water Master Plan.

Significant themes in the adopted Comprehensive Plan Update include:

- Preserving and protecting water supplies and water quality, both surface water and groundwater
- Protecting and enhancing stream habitat, especially Bell Creek
- Managing long-term risk and costs through sustainable practices and environmental sensitivity when developing
- Working with regional water management partners and utilize reclaimed water resources

Climate Change Preparedness Plan for the North Olympic Peninsula

There are several references in this plan to the multi-stakeholder planning process undertaken in 2014–15 by the North Olympic Peninsula Resource Conservation & Development Council, with funding from the US EPA, to plan for impacts related to climate change. City of Sequim staff and City Council participated at various stages of this process, as mentioned in earlier in this chapter.

The final plan was released in September 2015 and presented to the City Council at a Study Session on November 9, 2015, with a list of "adaptation strategies" especially pertinent to Sequim. In fact, this plan already contains several recommendations that parallel those in the Preparedness Plan. Appendix A of the Climate Change Preparedness Plan contains a comprehensive list of adaptation strategies categorized as follows: Ecosystem (E), Water Supplies (WS), and Critical Infrastructure (CI).

Some of the most relevant strategies in the Climate Change Preparedness Plan include:

- E-5: Increase regional capacity for water storage
- E-16: Develop community climate action plans
- E-34: Replace undersized culverts to anticipate climate-influenced runoff events
- WS-1: Enhance education on drought and water supplies issues for the peninsula
- WS-15: Enhance residential water conservation through incentives and outreach
- WS-21: Explore opportunities for artificial recharge of groundwater aquifers
- CI-1: Update emergency management and response planning to include climate change
- CI-2: Reduce inflow and infiltration (I&I) to wastewater systems
- CI-8: Improve on-site stormwater management practices

CHAPTER 6 – CONCLUSIONS

Adoption and implementation of a Storm and Surface Water Master Plan in Sequim is important to attain the following benefits:

- Compliance with existing requirements for maintenance, inspection and enforcement
- Reduced localized flooding or ponding resulting in less nuisance and property damage
- Reduced level of pollutants carried by stormwater (sediments, nutrients, metals, oils, and other contaminants) resulting in fewer water quality impairments
- Protected fish and wildlife habitat provided by city streams and downstream resources including Washington Harbor
- Preservation and protection of drinking water supply and groundwater quality
- Comprehensive water management/conservation to ensure future water supply resilience

Most of the stormwater in the city is managed through infiltration and therefore serves as a source of groundwater recharge. While this is a convenient and inexpensive way to manage stormwater, it does present a potential concern for protecting the quality of the city's groundwater supply. The city is unique when compared to most other cities in western Washington because of the relatively dry climate; therefore, City staff are especially concerned with conserving water resources and water resource management in the Dungeness watershed is an important focus in the area.

Recommendations and improvements for the City's stormwater program include recommendations from the City's Stormwater Management Needs Assessment (Sequim 2014), as well as additional needs identified during the workshop and document review. Based on this assessment, this Plan makes the following high priority recommendations:

- **Capital Facilities:** Initiate a stormwater Capital Facility Program to address flooding and water quality issues within the city. The City should add stormwater projects to the City's overall CIP; Table 6 in this plan identifies priority capital projects.
- **Inspection Program**: Institute a stormwater facility inspection program and develop and enforce maintenance standards for non-City-owned stormwater facilities. The inspection program may include development of inspection logs and plat language and private-owner education, coordination with school districts to clarify maintenance responsibilities, and improved coordination with homeowner associations and commercial landowners on shared maintenance responsibilities. Criteria and protocols for enforcement should also be developed.
- **Water Quality Compliance:** Develop and implement a pollution control plan for water bodies currently on the 303(d) list of impaired waters, surface water flow monitoring program, and a plan to assess drywells classified as underground injection control wells (UICs).Consider monitoring to assess water quality and measure improvements

over the long term resulting from stormwater management and water quality treatment of typical stormwater pollutants.

- **Species and Habitat Protection**: Participate in routine meetings of the DRMT and Water Rule implementation groups, and request smolt outmigration data from Bell Creek measured by the Tribe and Sequim Bay water quality data.
- **Stormwater Design Guidance and Plan Review to control runoff from development during and post-construction:**
  - Review the 2012 SWMMWW (and 2014 modifications) and consider developing an amendment to the 2012 SWMMWW that provides guidelines and requirements specific to the City, which may include BMPs that are most effective in protecting groundwater quality while preserving recharge.
  - Develop a consistent stormwater plan review process, which may include handouts that summarize on-site stormwater management, treatment, and flow control thresholds for when the SWMMWW applies for single-family and commercial development projects.
- **Asset Management:** Continue to update the storm system map and database as needed.
- **Stormwater System Operations and Maintenance:** Establish maintenance agreements with irrigators and other stormwater management partners addressing type and frequency of maintenance activities as well as responsibilities for maintenance, add maintenance and inspection information to the storm system GIS database, and consider hiring additional support for the inspection/maintenance crew and inspecting and cleaning stormwater pipes and drywells.
- **Pollution Source Detection and Elimination:** Develop and implement a pollution source tracking program, obtain field equipment for illicit discharge tracking and source tracing, develop a system for tracking illicit discharges, develop a basic training program for City field staff, and develop a spill reporting hotline.
- **Public Education and Outreach:**
  - Develop outreach materials for residents, landscapers, and property managers/landowners, including additional guidance (e.g., fact sheets or brochures) for developers and builders on meeting the City's stormwater facility maintenance and construction requirements.
  - Attend regional meetings and conferences and participate in regional forums and such as the West Sound Stormwater Managers' Coordination Group, the Sequim-Dungeness Clean Water Work Group, and the AWC. Continue to work toward coordination/leadership/agreements with other parties that may be necessary to achieve stormwater and overall water resource management/conservation goals (this may include reclaimed water and other supplies).
- **Planning and Collaboration**: Continue to plan and coordinate with local water managers to ensure future water supply resilience.

During development of this plan (in mid-2015), the City's stormwater program included an annual operational budget of $101,000, which funded 0.75 FTE permanent staff (maintenance), and an Ecology grant which funded the capital planning project. With this

budget, the City is struggling to provide basic stormwater services such as stormwater system O&M (complete catch basin and stormwater facility inspection and cleaning, street sweeping), GIS mapping, and minor capital facility improvements. The recommendations and activities outlined in this Master Plan include a three tier approach to providing future stormwater program support—which will need to be supplemented with grant funds.

Tier A includes stormwater program activities necessary to meet minimum standards. This tier includes Group 1 capital projects, a City inspection program (currently in the City code, but unfunded), high priority recommendations to meet water quality compliance, and high priority recommendations for stormwater system O&M. Tier A would include $618,500 additional funding and 1.76 FTE additional staff. This would result in a total of $719,500 funding and 2.51 FTE staff for the City's stormwater program.

Tier B includes stormwater program activities that are likely to be mandated. This tier includes Tier A activities and adds Group 1 capital projects, high priority stormwater design and plan review activities, an asset management program, medium priority recommendations to meet water quality compliance and stormwater system O&M, medium and high priority recommendations for stormwater design and plan review, and high priority recommendations for pollution source detection and elimination and public education and involvement. Tier B would include $765,500 additional funding and 3.18 FTE additional staff. This would result in a total of $866,500 funding and 3.93 FTE staff for the City's stormwater program.

Tier C allows for proactive stormwater program activities to reduce risk. This tier includes Tier B activities and adds Group 2 capital projects, species and habitat protection activities, stormwater design and plan review activities, and all remaining activities (primary medium and low priority recommendations for the remaining stormwater program categories). Tier C would include $1,371,500 additional funding and 3.41 FTE additional staff. This would result in a total of $1,472,500 funding and 4.16 FTE staff for the City's stormwater program.

For all three tiers, grants and/or loans would be needed to supplement the budget, particularly for capital projects.

A financial analysis was performed in late 2015. The Funding Strategies Memorandum is attached as Appendix I. The financial analysis assessed the following five potential funding options:

1. Continuing to pay from water and sewer utility revenues
2. Ad valorem property tax assessment
3. Establishing a stormwater fee
4. Forming a special purpose district
5. Combination of the above funding sources

PREFERRED APPROACH

Based on discussions with City staff, Planning Commission, and City Council, the preferred approach for storm and surface water management is implementing the Tier A recommendations over the next one to three years (2016–2018) using existing resources without adding any new revenue. CIP projects will be implemented as grant and loan funding

become available. City staff will report back to the City Council at the end of each year to provide an update on the activities performed during that year, activities that are planned for the upcoming year, and any changes that need to be made to increase success in terms of achievement of Tier A objectives, and impacts, if any, to other City programs. Staff will continue to seek grant and other outside funding to supplement these activities and CIP projects, while ultimately aiming toward Tier B levels of service.

CHAPTER 7 – REFERENCES

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APPENDIX A

Terminology

Acronyms and Abbreviations

AWC	Association of Washington Cities
B-IBI	Benthic Index of Biotic Integrity
BMP	best management practice
CARA	critical aquifer recharge area
CIP	Capital Improvement Program
DCD	Department of Community Development
DRMT	Dungeness River Management Team
EPA	Environmental Protection Agency
ERU	equivalent residential unit
ESA	Endangered Species Act
FTE	full-time equivalent
GIS	Geographic Information Systems
GMA	Growth Management Act
GSI	green stormwater infrastructure
HID	Highland Irrigation District
LID	low impact development
MTCA	Model Toxics Control Act
NFIP	National Floodplain Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NLCD	National Land Cover Database
NOPRC&D	North Olympic Peninsula Resource Conservation and Development Council
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
SEPA	State Environmental Policy Act
SMA	Shoreline Management Act
SMC	Sequim Municipal Code
SOP	standard operating procedure

SPT	Sequim Prairie Tri-Irrigation Company
SWMMWW	*Stormwater Management Manual for Western Washington*
SWPPP	Stormwater Pollution Prevention Plan
TMDL	total maximum daily load
UGA	Urban Growth Area
UIC	underground injection control
USACE	US Army Corps of Engineers
USFWS	US Fish and Wildlife Service
WAC	Washington Administrative Code
WHPA	well head protection area
WRF	water reclamation facility
WSDOT	Washington State Department of Transportation
ZOC	zone of contribution

APPENDIX B

Master Plan Development

MASTER PLAN DEVELOPMENT

Significant research was conducted to develop the Storm and Surface Water Master Plan. Herrera Environmental Consultants (Herrera) conducted a workshop with City of Sequim (City) staff to kick off the project. Several follow-up meeting, telephone conversations, and field reconnaissance trips were held with City staff following the initial workshop. Past studies and reports were reviewed for information on drainage and water quality issues, historic water quality and sediment monitoring data, and to evaluate the City's existing stormwater program. The City also hosted public outreach events. This appendix describes the workshop, document review, gap analysis and needs assessment, water quality and sediment data analysis, and a summary of public outreach events.

Workshop

To examine the components of the City stormwater program in more detail and to identify previously undocumented issues, City staff members representing all aspects of the City's stormwater program and an irrigation representative participated in a workshop on November 18, 2014, at the Sequim Planning and Public Works Building. A stormwater program questionnaire was distributed to participants in advance of the workshop to gather staff input and perspectives on a consistent set of questions. The completed questionnaire was used to facilitate the workshop discussion of stormwater program activities, staffing and funding needs, and other issues of concern (e.g., operations and maintenance, drainage and water quality issues). A list of the workshop attendees is included in Table B-1 and the questionnaire is included in Appendix G.

Table B-1. City of Sequim Stormwater Plan Workshop Attendees.

Staff	Department	Title
Ann Soule	Public Works	Water Resource Project Manager
David Garlington	Public Works	City Engineer/Interim Public Works Director
Mike Brandt	Public Works	Streets Manager
Pete Tjemsland	Public Works	Utilities Manager
Ann Hall	Department of Community Development	Building Official
Lisa Hopper	Department of Community Development	Code Compliance Officer
Chris Hugo	Department of Community Development	Director of Community Development
Charisse Deschenes	Department of Community Development	Senior Planner
Troy Saghafi	Public Works	Engineer Tech II
Ty Brown	Public Works	Sewer Division Lead
Rick Irish	Public Works	Streets Division Lead
Scott Carter	Public Works	Shop
Jacob McBride	Public Works	Shop
Gary Smith	Sequim Prairie Tri-Irrigation Association	Board Officer
Rebecca Dugopolski	Herrera Environmental Consultants	Senior Engineer
Matt Fontaine	Herrera Environmental Consultants	Senior Engineer
Steve Zenovic	Zenovic and Associates	Consulting Principal Engineer

Document Review

Staff from Herrera Environmental Consultants (Herrera) reviewed all pertinent documents related to the City's stormwater program, including drainage basin studies and City planning documents, to provide a foundation for the Storm and Surface Water Master Plan. The most relevant documents to the Master Plan development effort are summarized in Table B-2. In addition to the documents summarized below, information on the existing stormwater system infrastructure was derived mostly from geographic information system (GIS) data provided by the City.

Table B-2. Relevant Documents to Support the Sequim Storm and Surface Water Plan.

Document Name	Author	Date
City of Sequim Stormwater Management Needs Assessment	City of Sequim (Ann Soule)	May 2014
Recommendations from the LID Local Regulation Assistance Project	AHBL	2009
City codes and ordinances pertaining to stormwater (and draft ordinances), including documents referenced in code such as Ecology's stormwater management manual(s)	City of Sequim	2014-15
Citywide Comprehensive Plan (2006)	City of Sequim	Aug. 2006
Sequim 120 Draft Comprehensive Plan	City of Sequim	March 2015
2011-2016 City of Sequim Transportation Improvement Program (TIP) project list (includes the 6-year and 20-year project lists)	Fehr & Peers	June 2013
2013 General Sewer Plan	Gray & Osborne	Dec. 2013
2013 Water System Plan	Gray & Osborne	June 2013
Sequim Downtown Plan	City of Sequim	July 2011
Clallam County Streamkeepers Data and Report (STORET)	Clallam County Department of Community Development (DCD)	Sept. 2012
Clean Water District water quality data from Ecology's EIM database	Ecology (submitted by Clallam County Streamkeepers)	2010
City of Sequim 2008 Hydrologic Monitoring Report	Pacific Groundwater Group	Dec. 2009
2013 Water System Plan Figure 5-3, Wellhead ZOCs	Gray & Osborne	2013
Information on projected growth as well as planned developments or land use changes from the DCD	City of Sequim (Chris Hugo)	Nov. 2014
Elwha-Dungeness/WRIA 18 Watershed Management Plan	Entrix	May 2005
Dungeness Water Rule	Clallam County webpage	Jan. 2013
2008 Dungeness Groundwater Flow Model Design, Construction, Calibration and Results	Pacific Groundwater Group	March 2009

Table B-2 (continued). Relevant Documents to Support the Sequim Storm and Surface Water Plan.		
Document Name	**Author**	**Date**
Hydrogeologic Assessment of the Sequim-Dungeness Area	USGS	1999
Potential Stormwater Impacts on Sediment Quality in Urbanizing Clallam County Streams	Battelle	2003
Shoreline Master Program	City of Sequim	2013
Assessment of Wetland Functions and Wetland Management Guidance for the Lower Dungeness River Area and Sequim Bay Watersheds	Clallam County DCD	1995
Designation of critical habitat for Puget Sound Steelhead	National Oceanic and Atmospheric Administration	2013
Assessment of Baseflow in Small Streams of the Dungeness Watershed, Technical Memo	Pacific Groundwater Group	Jan. 2008
Surface Water Management Plan: Bell Creek and Johnson Creek	Quadra Engineering, Inc.	May 2003
Benthic Index of Biological Integrity (B-IBI), Clallam County	Streamkeepers of Clallam County	Aug. 2012
Bull Trout Final Critical Habitat Justification: Rationale for Why Habitat is Essential, and Documentation of Occupancy	US Fish and Wildlife Service	Sept. 2010
Adapting to Climate Change at Olympic National Forest and Olympic National Park	US Forest Service	Aug. 2011
Jamestown S'Klallam Tribe Climate Vulnerability Assessment and Adaptation Plan	Adaptation International	August 2013

Gap Analysis and Needs Assessment

In 2013-2014, the City conducted a Stormwater Management Needs Assessment (Sequim 2014). The Stormwater Management Needs Assessment included a compilation of data from technical reports, maps, GIS and other datasets, field inventories and inspections, and interviews and input from City streets and utility crews. This information was used to document current physical and operational conditions of stormwater management in the City as well as existing hydrologic and habitat conditions, capital facilities, flooding and water quality issues, and regulatory drivers pertinent to the City. Program gaps and needs were identified for each of the topics.

A Stormwater Gap Analysis and Compliance Strategy Report (Gap Analysis) was prepared as part of the Master Plan to present a summary of the work that has already been performed, develop recommendations for the needs identified in the City's Stormwater Management Needs Assessment (Sequim 2014), and develop recommendations associated with needs identified in an initial stormwater workshop and from a review of existing documents. The Gap Analysis documents all of these needs and recommendations in a single document and evaluates the staffing and funding needs to implement these recommendations (Appendix G).

The Gap Analysis was used to provide direction and strategic guidance for the City's stormwater program and as the framework for the City's Master Plan. The recommendations from the Gap Analysis are summarized in the Stormwater Program Evaluation and Recommendations section of the Master Plan.

Water Quality and Sediment Data Analysis

A Water Quality Data Analysis Report was prepared as part of the Master Plan (Appendix H). Since 2008, the Clallam County Streamkeepers (Streamkeepers) has conducted water quality monitoring on streams, ditches, and storm drains within Clallam County. To date, a comprehensive analysis of these water quality data has not been performed. The Water Quality Data Analysis Report analyzes and summarizes the subset of sites monitored by the Streamkeepers pertaining to streams and stormwater runoff within the City. Water quality and sediment data availability and monitoring locations are summarized, followed by an assessment of the quality of the existing data. The report then provides an evaluation of the data organized by stream. Conclusions (including monitoring recommendations) are presented at the end of the report.

Public Outreach Conducted for this Plan

The City developed a strategic communications plan as part of the Storm and Surface Water Master Plan project. The goal of the strategic communications plan is:

> "To develop operational and fiscal support for stormwater management in the City, in the context of water resource management overall – including surface and groundwater quality and quantity."

The three primary objectives of the public outreach process include:

1. Public and council support or consent for stormwater management activities proposed by Public Works (e.g., infrastructure, outreach, monitoring, a funding strategy)
2. Documentation of increased awareness of problems and potential solutions, including costs
3. Developing a volunteer base to assist with outreach and other labor-intensive activities (e.g., 'Friends of Bell Creek' to assist with monitoring, facility inventory, rain gardens, installing signs, storm drain art, habitat restoration, etc.)

The following activities, materials, and public involvement opportunities have been developed, conducted, or implemented as part of the public outreach process for this plan:

- **Branding:** The terminology for this planning process that is being used for public outreach is the "Sequim Stormwater Stewardship Project"
- **Printed Materials:** A 1-page project fact sheet/flyer for the Sequim Stormwater Stewardship Project and a poster summarizing the history of Bell Creek were developed.

- **Website:** The City's website includes surface water pages, videos (YouTube channel) showing runoff problems, etc.
- **Listserv:** Interested parties can sign up to receive updates via e-mail (as of May 1, 2015, there were 75 subscribers to the listserv)
- **Hotline:** Interested parties can contact Ann Soule (City Water Resource Specialist) with questions.
- **City News:** City newsletter and media releases occasionally include updates on this project.
- **Volunteer Opportunities:** Volunteers can get involved with the storm drain inventory, monitoring flow in streams and ditches, data entry, and outreach projects.
- **Festivals:** The City had a booth at the Dungeness River Festival at Railroad Bridge Park in September 2014 and at the Irrigation Festival Family Fun Day in May 2015 that contained information about the Sequim Stormwater Stewardship Project.
- **Interpretive Center:** Grand opening in October 2014. Regular hours are Wednesdays from 8:00–10:00 am and Thursdays from noon to 2:00 pm. Displays include a large format map with drainage elements, information on low impact development, a poster summarizing the history of Bell Creek, annual precipitation data, and more.
- **Contest:** "Guess the Date" contest for when Bell Creek started flowing last fall/winter.
- **Signage:** Creek sign installation at Bell, Johnson, and Gierin Creeks
- **Tours**:

  Bell Creek Discovery driving/walking tour:

  http://wa-sequim.civicplus.com/index.aspx?NID=676

  Virtual tour of local water resources: http://arcg.is/1DXQgst
- **Public Presentations:** Chamber of Commerce, Dungeness River Management Team, Science Café, Sequim Association of Realtors, North Peninsula Builders Association, and others.
- **Comments:** The general public was welcomed to provide comments and input on the draft Storm and Surface Water Master Plan. Public comments received are itemized in the public record for Planning Commission and City Council meetings.
- **Open Houses:** Every Wednesday and Thursday in June at the Interpretive Center during the hours specified above.
- **Planning Commission Presentations:**
  - Plan Overview: June 2, 2015
  - Funding Strategies: November 17, 2015

- **City Council Study Session Presentations:**
  - Plan Overview: June 22, 2015
  - Stormwater Capital Improvement Plan: August 24, 2015
  - Operational and Programmatic Elements: September 28, 2015
- **City Council Meeting:** July 13, 2015

APPENDIX C

Regulatory Framework

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INTRODUCTION

This appendix summarizes regulations related to surface water management, water quality, flood protection, and species and habitat protection that affect stormwater and surface water in the City of Sequim (City).

ACRONYMS AND ABBREVIATIONS

AKART	All Known, Available and Reasonable methods of prevention, control and Treatment
B-IBI	Benthic Index of Biotic Integrity
BMP	Best Management Practices
City	City of Sequim
CFR	Code of Federal Regulations
DOH	Washington Department of Health
DRMT	Dungeness River Management Team
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FEMA	Federal Emergency Management Act
FIRM	Flood Insurance Rate Maps
GIS	geographic information systems
GMA	Growth Management Act
HPA	Hydraulic Project Approval
JARPA	Joint Aquatic Resource Application
LID	Low Impact Development
MS4	Municipal Separate Storm Sewer System

MTCA	Model Toxics Control Act
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NWP	Nationwide Permits
OHWM	Ordinary High Water Mark
PCBs	polychlorinated biphenyls
PSP	Puget Sound Partnership
RCW	Revised Code of Washington
RM	River Mile
SEPA	State Environmental Policy Act
SMA	Shoreline Management Act
SMC	Sequim Municipal Code
SWMP	Stormwater Management Program
SMP	Shoreline Master Program
TMDL	Total Maximum Daily Load
UGA	Urban Growth Area
UIC	Underground Injection Control
USACE	United States Army Corps of Engineers
USC	United States Code
USFWS	United States Fish and Wildlife Services
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resources Inventory Area
WSDOT	Washington Station Department of Transportation

CURRENT REGULATIONS AND REGULATORY POLICIES

This section highlights current water quality standards, Underground Injection Control (UIC) requirements, recommendations in the Puget Sound Action Agenda, flood protection, and species and habitat protection.

Water Quality Standards

Various federal and state laws related to water and sediment quality significantly affect stormwater management in the City. The primary regulatory influences are the federal Clean Water Act and several state-administered water quality programs, including the Washington State Department of Ecology (Ecology) surface water quality standards set forth in Washington Administrative Code (WAC) 173-201A, and water cleanup plans (Total Maximum Daily Loads [TMDLs]) that may be implemented in the future to address water quality management for surface waterbodies listed on Ecology's 303(d) list. This section also summarizes groundwater quality standards.

State Surface Water Quality Standards

Surface water quality standards describe the quality of water expected to support beneficial surface water uses. Section 303(c) of the Clean Water Act states that water quality standards are the responsibility of states and qualified tribes. Ecology administers water quality standards in Washington state to be "consistent with public health and public enjoyment of the waters and the propagation and protection of fish, shellfish, and wildlife" (WAC 173-201A).

Effective July 2003, Ecology restructured its surface water quality standards to more explicitly define water quality requirements for aquatic life, recreation, water supply, and other miscellaneous uses. For example, designated uses for aquatic life include: *char spawning and rearing; core summer salmonid habitat; salmonid spawning, rearing, and migration; salmonid rearing and migration only; non-anadromous interior redband trout; and indigenous warm water species*. There are now 18 designated uses in WAC 173-201A, and Ecology has established water quality criteria (such as maximum temperature and fecal coliform bacteria levels) for each of them. Human-health-based criteria have not yet been implemented in Washington State, but are discussed in the Evolving Regulations and Policies section of this appendix.

Listings

Specific reaches of the following waterbodies in Sequim have been assessed through the Water Quality Assessment program and assigned Category 2 (waters of concern) or Category 4c (impaired by a non-pollutant) (Ecology 2012):

- Bell Creek: fecal coliform, pH, and temperature (Category 2)
- Johnson Creek: fecal coliform, pH, and bioassessment (Category 2)
- Dungeness River: bioassessment (Category 2)
- Sequim Bay: dissolved oxygen(Category 2)

- Independent irrigation ditch (Sequim Prairie Tri): pH (Category 2)
- Strait of Juan de Fuca East: fish and shellfish habitat (Category 4c)

Ecology (2012) has included the following waterbodies on the 303(d) list of impaired waters (Category 5) for the following parameters:

- The lower reaches of Bell Creek: fecal coliform bacteria, dissolved oxygen, and Benthic Index of Biotic Integrity (B-IBI)
- Lower reaches of Johnson Creek: fecal coliform bacteria
- Sequim Bay: fecal coliform bacteria and dissolved oxygen

Additional listings on the recently proposed 2015 303(d) list of impaired waters (Category 5) include the following parameters:

- The lower reaches of Bell Creek: pH, temperature
- Middle (ephemeral) reach of Bell Creek: pH, fecal coliform bacteria, dissolved oxygen, and bioassessment
- Upper (perennial) reaches of Bell Creek: fecal coliform bacteria and dissolved oxygen
- Johnson Creek (entire length): pH and fecal coliform bacteria

Groundwater Quality Standards

Groundwater quality is regulated through various state and federal laws separate from the Clean Water Act. Those most pertinent to stormwater discharges into the ground include:

- Model Toxics Control Act (MTCA) – Chapter 70.105D RCW
- Federal Safe Drinking Water Act and associated state Water Pollution Control Act – Chapter 90.48 RCW
- Groundwater quality standards (Chapter 173-200 WAC/Chapter 90.46.080 RCW) and associated implementation guidance

All are administered by Ecology except the federal Safe Drinking Water Act which is administered by the Washington State Department of Health (DOH) through regulation of public water systems. DOH also administers the federal Well Head Protection Program, which is focused on source control for contaminants potentially entering the recharge areas of public water systems.

Applicability

The City is responsible for regulating surface water discharges to receiving waters in its jurisdiction to meet Ecology's surface water and groundwater quality standards. None of the receiving waters in the City or downstream of the City are explicitly addressed in Ecology's surface water quality standards. However, the City needs to manage discharges from its stormwater systems in a manner that supports achieving the water quality standards for all surface waters and groundwater.

To date, no water cleanup (TMDL) plans have been developed by Ecology for impaired waterbodies or any other waterbodies or watersheds within the City limits. In order to avoid a future TMDL, the City could take action to develop a pollution control program for waterbodies currently on the Category 5 303(d) list of impaired waters; this would change the designation to Category 4b. The components of a pollution control program are described in the Stormwater Program Evaluation and Recommendations section in the main text of the Storm and Surface Water Master Plan under Water Quality Compliance.

Underground Injection Control Requirements

Chapter 173-218 WAC (UIC Program) satisfies Part C of the Federal Safe Drinking Water Act and the Washington State Water Pollution Control Act, Chapter 90.48 RCW. The most common type of UIC well in Washington is a Class V injection well. Class V injection wells include manmade subsurface fluid distribution systems designed to discharge fluids into the ground and consists of an assemblage of perforated pipes, drain tiles, or other similar mechanisms, or a dug hole that is deeper than the largest surface dimension (WAC 173-218-040). Examples include drywells, pipe or French drains, drain fields, and other similar devices that are used to discharge stormwater directly into the ground (Ecology 2006).

Chapter 173-218-090(1) WAC states that the following must be implemented for UICs:

- UIC wells must be registered
- New UIC wells must be constructed according to Chapter 173-218 WAC specifications
- A well assessment must be completed for all existing wells
- Existing UIC wells that are determined to be a high threat to groundwater must be retrofitted

UIC wells constructed prior to February 3, 2006, are considered to be existing wells. Owners of 50 or fewer wells were expected to register their wells by February 3, 2009, and complete their well assessment by February 3, 2011. Owners of more than 50 wells were expected to register their wells by February 3, 2011, and complete their well assessment by February 3, 2013.

Applicability

The City owns more than 50 UIC wells; therefore the City should identify all wells (includes some facilities not currently identified as drywells in the stormwater geographic information systems [GIS] data), register all wells, and conduct well assessments, and begin planning and constructing retrofits for wells with a high threat to groundwater.

Puget Sound Partnership Action Agenda

The Puget Sound Partnership (PSP) was established by Washington State statute in 1983 as the Puget Sound Water Quality Authority, later becoming the Puget Sound Action Team, and eventually the PSP in 2007. This group was directed to identify pollution-related threats to Puget Sound's resources, conduct risk assessments, and coordinate and report on information relating to water quality in Puget Sound.

In December 2008, the PSP published an Action Agenda for restoration and protection of Puget Sound which was revised in May 2009 (PSP 2009). This document supersedes the previous water quality management plan, encompassing a wider range of ecological, social, and economic issues in addition to water quality. The Action Agenda calls on all governments and citizens in the Puget Sound basin to support its priorities and initiatives. In the 2011 update to the Action Agenda, the PSP added a list of ecosystem recovery targets to aid in achieving substantial restoration and recovery of the Puget Sound by the year 2020 (PSP 2011). The 2012 Action Agenda identifies strategies and actions to help reduce the effect of five main pressures on the ecosystem: land development, shoreline alteration, runoff from the built environment, wastewater, and loss of floodplain function (PSP 2012). Decisions are based on science, focusing on actions that have the biggest impact, and hold people and organizations accountable for results. The City is located in the Strait of Juan de Fuca Action Area, which includes the following high priority local strategies in the 2014–2015 Action Agenda (PSP 2014):

1. Support efforts to monitor, adaptively manage, and restore the Elwha River ecosystem
2. Implement salmon recovery 3-year work plans
3. Support improvements in oil spill prevention, preparedness, and response, within the strait action area and adjacent waters
4. Develop and adopt shoreline master programs, and work to coordinate implementation of these programs among local governments
5. Update and implement stormwater management programs and work to coordinate implementation of these programs using a watershed-based approach
6. Develop, adopt, and implement water resources management program rules
7. Support climate change mitigation, adaptation, and implementation of programs and plans
8. Implement water quality cleanup plans

A total of 39 local near-term actions are identified for the Strait of Juan de Fuca Action Area in the 2014–2015 Action Agenda Update (PSP 2014). The near-term actions related to Sequim and the City's stormwater program include the following:

- **STRT1:** Assess vulnerabilities of local communities, tribes, and natural resources to the effects of climate change and concurrent human population increases.
- **STRT2:** Implementation of water quality cleanup plans for Sequim-Dungeness Bay and East Jefferson County Clean Water Districts
- **STRT17:** Implement the highest priority projects listed within the City of Sequim Restoration Plan, a part of the City's updated Shoreline Master Program
- **STRT24:** Expand pilot Ecosystem Services Valuation analysis conducted along the Central Strait nearshore to other shorelines within the Strait Action Area and North Olympic Peninsula.
- **STRT28:** Develop and adopt a Storm and Surface Water Management Plan for the City of Sequim.
    - Conduct a stormwater management needs assessment

- Develop a Storm and Surface Water Management Master Plan
- Adopt Low Impact Development (LID) incentives and stormwater ordinances to support surface water pollution reduction

- **STRT35:** Complete the collection of habitat information for use by the Washington State Department of Transportation (WSDOT) to inform the prioritization of stormwater road retrofits within the Strait Action Area.

The City should closely monitor implementation of the Action Agenda, as this may lead to opportunities for grant funding, partnering with other local governments, and assistance with technical guidance that is of interest to the City.

Applicability

A key theme of the Action Agenda is stormwater pollution. The Action Agenda and other work by the PSP is not legally binding on the City. However, because the City is located within the Strait of Juan de Fuca drainage basin, many of the provisions of PSP's plan will affect the decisions of regulatory authorities in the region, indirectly affecting the City's stormwater program. The development of this Storm and Surface Water Master Plan is also identified as a near-term action (STRT28) in the 2014–2015 Action Agenda Update (PSP 2014).

Dungeness Water Rule

The Water Resources Management Program for the Dungeness portion of the Elwha-Dungeness Water Resources Inventory Area (WRIA) 18 or Dungeness Water Rule (WAC Chapter 173-518) was adopted on November 16, 2012. This rule applies to all surface and groundwaters within the Dungeness River watershed, excluding the Elwha-Morse watershed basin. The chapter generally enacts recommendations from the Elwha-Dungeness Watershed Management Plan (Elwha-Dungeness Planning Unit 2005), which was approved on April 15, 2004, by the Dungeness River and Elwha-Morse management teams (with City of Sequim participation) and adopted by Clallam County in 2005. In-stream flow requirements are outlined for the following creeks that have a portion of their drainage basins within the City limits (but with all control points downstream of the city limits):

- Bell Creek at Schmuck Road (River Mile [RM] 0.2)
- Cassalery Creek at Woodcock Road (RM 1.8)
- Gierin Creek at Holland Road (RM 1.7)
- Dungeness River at Schoolhouse Bridge (RM 0.8)

The Dungeness Water Rule also states that all future new surface and groundwater uses, other than collection of rainwater, shall be measured. Consumptive water use may be mitigated through the purchase of credits available through the Dungeness Water Exchange. Ecology's 2008 Dungeness Groundwater Flow Model is the basis for determining mitigation credits. A proponent may also choose to submit a mitigation plan as an alternative to the Dungeness water exchange.

Applicability

The City contains drainage area within multiple subbasins that are in the Dungeness Water Rule area. Instream flow requirements apply within this area for Bell Creek, Cassalery Creek, Gierin Creek, and the Dungeness River. Future projects, if involving new consumptive water use, may be impacted by having to purchase mitigation credits or preparing a mitigation plan.

Flood Protection

The US Congress established the National Flood Insurance Program (NFIP) with the passage of the National Flood Insurance Act of 1968. The NFIP is a federal program enabling property owners in participating communities to purchase insurance as protection against flood losses, in exchange for floodplain management regulations that reduce future flood damages. Participation in the NFIP is based on an agreement between local communities and the federal government. If a community adopts and enforces a floodplain management ordinance to reduce future flood risk for new construction, the federal government will make flood insurance available within the community as a financial protection against flood losses. This insurance is designed to provide an alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods. The Federal Emergency Management Act (FEMA) is currently responsible for the NFIP.

On September 22, 2008, the National Marine Fisheries Service (NMFS) issued a Biological Opinion that required changes to the implementation of the NFIP in order to meet the requirements of the Endangered Species Act (ESA) in the Puget Sound watershed (NMFS 2008). FEMA offers several ways to meet this ESA requirement:

- Prohibit all development in the floodway and other areas as specified by the Reasonable and Prudent Alternatives in the Biological Opinion
- Enact regulations that allow development that meet the criteria specified in the Biological Opinion by either:
    - Adopting a Model Ordinance, or enforce the same requirements in other ordinances, such as growth management, zoning, or critical areas regulations, or
    - Showing compliance with ESA on a permit-by-permit basis. This will typically involve requiring applicants for floodplain development permits to develop in the Special Flood Hazard Area to submit permit applications to the NMFS. If this option is chosen, NFIP communities must ensure that permit applicants have demonstrated compliance with ESA before issuing a floodplain development permit.

Applicability

Section 1315 of the National Flood Insurance Act prohibits FEMA from providing flood insurance unless a community adopts and enforces floodplain management regulations that meet or exceed floodplain management criteria established under Section 1361(c) of the act. These floodplain management criteria are specified in the Code of Federal Regulations (CFR), Title 44, Part 60, Criteria for Land Management and Use. The emphasis of the NFIP floodplain management requirements is focused on reducing threats to lives and the potential for damages to property in flood-prone areas.

In addition to providing flood insurance and reducing flood damages through floodplain management regulations, the NFIP identifies and maps the nation's floodplains. Mapping of floodplains creates broad-based awareness of the flood hazards and provides the data needed for floodplain management programs and for determining flood insurance rates for new construction.

The City complies with the NFIP with a flood control ordinance and explicit code requirements for development in flood hazard areas (Sequim Municipal Code [SMC] 8.36.080). The City currently manages floodplain hazards through its Flood Damage Prevention code (SMC Chapter 8.36) which address areas of special flood hazard as identified by the Federal Insurance Administration in *The Flood Insurance Study for the Clallam County, Washington Unincorporated Areas*, revised February 23, 2001. This study includes flood profiles and accompanying Flood Insurance Rate Maps (FIRMs). The code adopts these maps and any future revisions (SMC 8.36.040), and requires the best available information for flood hazard area identification (SMC 8.36.050(B)) be used as the basis for regulation until new flood insurance rate map is issued that incorporates new data. A flood risk mapping project is currently underway in Clallam County through FEMA Region X; interim results are imminent.

The flood hazard area code is also consistent with the requirements of the Growth Management Act (GMA) wherein local governments are required to designate and protect five types of *critical areas*, including flood hazard areas. Wetlands and streams and their buffers are also protected as critical areas and generally correspond with FEMA floodplains. The combination of development restrictions for floodplains, wetlands, and streams limit development within the FEMA designated floodplains. Refer to the *Growth Management Act* section for an understanding of development regulations as they relate to public facilities (e.g., stormwater facilities) maintenance and/or construction within critical areas.

Species and Habitat Protection

This section summarizes the requirements of the ESA, State Salmon Recovery Planning Act, Watershed Planning Act, GMA, State Environmental Policy Act (SEPA), Shoreline Management Act, and other applicable regulations.

The Endangered Species Act

The 1973 ESA is a federal act administered by the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) NMFS (i.e., the Services) that provides for protection of species determined to be threatened or endangered of becoming extinct, and their habitat (i.e., critical habitat). The USFWS is responsible for predominant freshwater species (e.g., Puget Sound bull trout), terrestrial wildlife, and plants, whereas NMFS is responsible for predominant marine species (e.g., Puget Sound Chinook). The Services consider a species endangered when it is "in danger of extinction throughout all or a significant portion of its range" and threatened when it is "likely to become endangered within the foreseeable future throughout all or a significant portion of its range."

The ESA prohibits take of listed species defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in such conduct." Take also includes "significant modification or degradation of critical habitat." The take prohibition applies to all persons including private citizens and federal, state, and local government

entities. Proponents of activities with a federal nexus (e.g., carried out by a federal agency, federally funded, or require a federal permit) are required to consult with the Services according to Section 7 of the ESA unless they are exempted according to a Section 4(d) rule as discussed below.

For species listed as *endangered*, Section 9 take prohibitions are applied. The Services protect threatened species through a more flexible ESA Section 4(d) rule that prohibits take. On July 10, 2000, NMFS published a final rule under Section 4(d), which prohibits actions that result in take of Puget Sound salmon species listed as *threatened*. On September 25, 2008, NMFS included Puget Sound steelhead within this rule based on its recent listing as threatened. The rule follows the standard practice of prohibiting the take of a threatened species without written authorization. However, the rule does not prohibit all take. The rule exempts certain activities from take prohibitions if the take occurs as the result of a program approved by NMFS that adequately protects listed species and their habitat. NMFS specifies 13 categories of activities that can limit the situations in which take prohibitions apply, known as 4(d) limits. By providing limitation from take liability, NMFS encourages governments and private citizens to adjust their programs and activities to be salmon safe.

Applicability

Listed species potentially present in the City's marine and tidally influenced waters include those listed in Table C-1. Additionally, stormwater management activities and related development could affect listed species in tributaries of nearby waters such as the Dungeness River, where chinook and steelhead are present (WDFW 2015) and critical habitat is designated (64 FR 14308 and 78 FR 2725). The Strait of Juan de Fuca supports several ESA-listed fish species including threatened Chinook salmon (*Oncorhynchus tshawytscha*), coho (*Oncorhynchus keta*), steelhead trout (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*), endangered bocaccio (*Sebastes paucispinis*), threatened canary rockfish (*Sebastes pinniger*), threatened yelloweye rockfish (*Sebastes ruberrimus*), and endangered southern resident killer whale (*Orcinus orca*). Furthermore, the Strait of Juan de Fuca and marine waters are listed as critical habitat for Chinook salmon and southern resident killer whale, and critical habitat is proposed for steelhead trout.

Within city limits, the Hood Canal summer-run evolutionarily significant unit (ESU) of coho salmon is documented by the Washington Department of Fish and Wildlife (WDFW 2015) as occurring in Johnson Creek and Gierin Creek. Hood Canal summer-run chum salmon includes all naturally spawned populations of summer-run chum salmon in Hood Canal and its tributaries as well as populations in Olympic Peninsula rivers between Hood Canal and Dungeness Bay, including Sequim Bay.

Table C-1. ESA Status of Species Under the Jurisdiction of NMFS and USFWS in City of Sequim and Vicinity.

Species	Species Listing Status	Critical Habitat Designation	Location
Coastal-Puget Sound Bull Trout (*Salvelinus confluentus*)	Threatened Nov. 1, 1999 (64 FR 58909)	Oct. 18, 2010 Revision (75 FR 63898)	Dungeness River and associated tributaries; Bell Creek; Johnson Creek
Georgia Basin Bocaccio DPS (*Sebastes paucispinis*)	Endangered July 27, 2010 (75 FR 22276)	Not designated	Strait of Juan de Fuca
Georgia Basin Canary Rockfish DPS (*S. pinniger*)	Threatened July 27, 2010 (75 FR 22276)	Not designated	Strait of Juan de Fuca
Georgia Basin Yelloweye Rockfish DPS (*S. ruberimus*)	Threatened July 27, 2010 (75 FR 22276)	Not designated	Strait of Juan de Fuca
Hood Canal Summer-run Chum ESU (*Oncorhynchus keta*)	Threatened March 25, 1999 (63 FR 14507)	August 12, 2005 (70 FR 52630)	Strait of Juan de Fuca, Sequim Bay, Dungeness River
Humpback Whale (*Megaptera novaeangliae*)	Endangered Dec. 2, 1970 (35 FR 18319)	Not designated	Strait of Juan de Fuca
Marbled Murrelet (*Brachyramphus marmoratus marmoratus*)	Threatened Oct. 1, 1992 (57 FR 45328)	May 24, 1996 (61 FR 26256)	Potentially forested areas (nesting) and marine water (foraging), no designated critical habitat in City limits or UGA
Puget Sound Chinook ESU (*Oncorhynchus tshawytscha*)	Threatened March 24, 1999 (64 FR 14308)	Sept. 2, 2005 (70 FR 52630)	Dungeness River and associated tributaries, Sequim Bay and Strait of Juan de Fuca nearshore
Puget Sound Steelhead ESU (*Oncorhynchus mykiss*)	Threatened June 11, 2007 (72 FR 26722)	Proposed Jan. 14, 2013 (78 FR 2725)	Dungeness River and associated tributaries, Gierin Creek, Bell Creek, Johnson Creek
Southern Pacific Eulachon DPS (*Thaleichthys pacificus*)	Threatened May 17, 2010 (75 FR 13012)	Oct. 20, 2011 (76 FR 65324)	Strait of Juan de Fuca Critical habitat is not designated within the City
Southern Resident Killer Whale DPS (*Orcinus orca*)	Endangered Nov. 18, 2005 (70 FR 69903)	Nov. 26, 2006 (71 FR 69054)	Strait of Juan de Fuca

DPS = Distinct Population Segment
ESU = Evolutionarily Significant Unit
UGA = Urban Growth Area

Because City tributaries and stormwater systems flow into waterbodies where listed species are present, there is the potential for the "taking" of listed species. Consultation with the Services is required for activities with a federal nexus (e.g., carried out by a federal agency, federally funded, or require a federal permit) proposed by the City, other government entities, or individuals, that could directly or indirectly modify critical habitat, or kill or injure listed species. Specific examples include:

- Constructing or maintaining barriers that eliminate or impede a listed species' access to habitat essential for its survival or recovery
- Removing, poisoning, or contaminating plants, fish, wildlife, or other biota required by the listed species for feeding, sheltering, or other essential functions
- Discharging pollutants (including those in stormwater runoff) into a listed species' habitat
- Removing or altering rocks, soil, gravel, vegetation, or other physical structures that are essential to the integrity and function of a listed species' habitat
- Removing water or otherwise altering streamflow when it is likely to impair spawning, migration, or other essential functions
- Releasing non-indigenous or artificially propagated individuals into a listed species' habitat
- Constructing or operating inadequate fish screens or fish passage facilities at dams or water diversion structures in a listed species' habitat
- Constructing or using inadequate bridges, roads, or trails on stream banks or unstable hill slopes adjacent or above a listed species' habitat
- Constructing or using inadequate pipes, tanks, or storage devices containing toxic substances, where the release of such a substance is likely to significantly modify or degrade listed species' habitat
- Conducting timber harvest, grazing, mining or other land use activities that increase sediment loading to streams
- Disturbing streambeds so as to trample eggs or trap adult fish preparing to spawn
- Altering lands or waters in a manner that promotes unusual concentrations of predators
- Shoreline and riparian disturbances that retard or prevent the development of habitat conditions upon which listed species depend
- Filling or isolating side channels, ponds and intermittent waters upon which listed species depend for refuge during high flows

Many of these activities are applicable to the City because the City is either engaged in them or writes permits for private developments that also have a federal nexus. The City does not have specific regulations addressing "take" as it applies to ESA, but does address ESA-listed species through SEPA compliance (SMC Chapter 16.02) and critical areas regulations (SMC Chapter 18.80). In accordance with the SEPA (RCW 43.C.120 and SEPA rules, WAC 197-11-904), permit applicants are required to identify ESA species in their project area. The City also applies protection for fish and wildlife habitat conservation areas (SMC Chapter 18.80) in accordance with the GMA requirements for critical areas. Thus, it is the City's policy to require site planning and habitat management to avoid or minimize damage to habitat conservation areas including nesting and feeding areas for rare and endangered birds and habitat for fish and other wildlife including those that are rare and endangered. Official designation of fish and wildlife habitat conservation areas include areas with which state or

federally designated endangered, threatened, and sensitive species have primary association. Although SEPA and the critical areas ordinance require the consideration of listed species, these regulations do not require analysis to determine the potential for "take" of listed species if they are determined to be present in the vicinity of a proposed project. That analysis is, instead, explicitly addressed under the requirements of the ESA.

Project proponents with a federal nexus may be required to assess the project's potential impact on listed species and critical habitat in greater detail, and in the case of no-effect may be required to write a Biological Assessment report in support of consultation with the Services or federal funding or permitting agency (e.g., the US Army Corps of Engineers).

The following are examples of actions that may trigger impacts on ESA-listed species:

- Grading of a site
- Clearing of a site
- Work below the ordinary high watermark of any wetlands or creeks that have ESA listed species present, ESA species habitat, or drain to watercourses that have habitat for ESA listed species
- Installation of additional impervious surfaces
- Discharge of stormwater to watercourses that have ESA listed species, ESA species habitat, or drain to watercourses that have habitat for ESA listed species
- Processing, handling, storage, or treatment of hazardous substances in the vicinity of ESA listed species or their habitat
- Withdrawal, interception, or injection of groundwater
- Landscaping or reoccurring activities that require the application of herbicides, pesticides, and fertilizers
- Physical alterations to a watercourse or its banks

Clallam County participates in the Regional Road Maintenance Forum, which has developed a joint routine road maintenance program for NOAA Fisheries. Thirty agencies, including Clallam County, have received a Biological Opinion from NOAA that states that the proposed road maintenance activities are not likely to jeopardize the continued existence of ESA-listed salmon or adversely modify their designated critical habitat. The City of Sequim should consider participating in this forum and apply for its own Biological Opinion for road maintenance activities.

State Salmon Recovery Planning Act

The State has responded to the ESA listings described above by enacting legislation authorizing (but not requiring) local governments, and other stakeholders to take certain actions to promote salmon recovery. The Washington state legislature established the Salmon Recovery Planning Act (Revised Code of Washington [RCW] 77.85) through House Bill 2496 for the improvement and recovery of salmonid fish runs throughout the state. This act established a Salmon Recovery Office within the Office of the Governor to coordinate a

state strategy for salmon recovery to healthy sustainable population levels with the purpose of coordinating and assisting the development of salmon recovery plans.

Applicability

The City is located in the Hood Canal Salmon Recovery Region. The Hood Canal area is in the Puget Sound Salmon Recovery Region for Chinook and steelhead, but is a separate salmon recovery region for summer chum. PSP is the regional salmon recovery organization charged with overseeing salmon recovery efforts for and implementing the regional recovery plan for Puget Sound salmon (SSPS 2007) finalized and adopted by NMFS in 2007. The summer-run Chum recovery plan (HCCC 2005) was approved by NMFS in 2007 and is led by the Hood Canal Coordinating Council.

The Puget Sound Salmon recovery plan includes measures that address stormwater and wastewater. It encourages retrofitting stormwater systems to improve water retention and treatment. It also promotes land use practices that prevent stormwater flows, monitoring and wastewater reuse, and a street sweeping program. The plan also includes strategies to identify flow related problems and develop instream flow protection and enhancement actions. It calls for an aggressive and coordinated effort among all interested parties. The summer chum recovery plan addresses mostly site specific and programmatic actions in the counties around hood canal. However, the City's stormwater management practices should support the overall goal of chum salmon recovery and objectives to protect and restore water quality and habitat for chum salmon.

Watershed Planning Act

The Watershed Planning Act (Chapter 90.82 RCW) was passed by the State Legislature in 1998 (and amended in 2003) to provide a forum for citizens of the watershed to develop and implement locally-based solutions to watershed issues. The intent of the Watershed Management Act is, "meeting the needs of a growing population and a healthy economy statewide; meeting the needs of fish and healthy watersheds statewide; and advancing these two principles together, in increments over time." The Watershed Management Act goes on to state that, "The legislature finds that improved management of the State's water resources, clarifying the authorities, requirements, and timelines for establishing instream flows, providing timely decisions on water transfers, clarifying the authority of water conservancy boards, and enhancing the flexibility of our water management system to meet both environmental and economic goals are important steps to providing a better future for our State."

Applicability

The City is located in WRIA 17 (Quilcene/Snow Watershed) and WRIA 18 (Elwha/Dungeness Watershed). The portion of the City that drains into Sequim Bay is within WRIA 17. Watershed planning for the portions of both WRIAs that include the City is led by Clallam County, the lead agency. Watersheds in the City are included in the Elwha-Dungeness Watershed Plan (Elwha-Dungeness Planning Unit 2005), which covers WRIA 18 and Sequim Bay in northwestern WRIA 17. The City is not one of the five initiating governments in the planning unit (which were designated by statute), but is represented on the Dungeness River Management Team (DRMT) implementing the plan. The plan includes recommendations for protecting and enhancing water quality and quantity to support beneficial uses, as well as recommendations

for comprehensive stormwater management. For the City, the plan recommends focus on minimizing stormwater and associated impacts to the natural stream channels. Many other recommendations related to monitoring, impervious surfaces, and LID, for example, are also applicable to the City's stormwater management.

Growth Management Act

The GMA was passed by the Washington state legislature in 1990. The GMA was enacted in response to rapid population growth and concerns about suburban sprawl, environmental protection, and quality of life. The GMA has been amended several times and is codified primarily in Chapter 36.70A of the RCW. Under the requirements of Section 4 of the GMA, the City must develop and adopt comprehensive plans and development regulations that prevent the adverse effects of uncontrolled development, and poor land use practices. One of the key directives of the GMA is to use *best available science* to support effective land use planning that can avert environmental degradation.

Applicability

The GMA provides a framework for regional coordination. To satisfy GMA requirements, the City's comprehensive planning must include the following elements: land use, housing, capital facilities, utilities, and transportation. The City's planning must be consistent with Clallam County's planning efforts and growth management policies.

To protect critical areas as required by the GMA, the City established Critical and Environmentally Sensitive Areas regulations contained in SMC Chapter 18.80. Wetlands, streams, flood hazards, geologic hazards (erosion, landslide, seismic), steep slopes, fish and wildlife habitat areas, locally unique features (ravines, marine bluffs, beaches) and protective buffers, and critical aquifer recharge areas constitute critical areas that are of special concern to the City and regulated under SMC 18.80. The City is responsible for updating these regulations as best available science is developed.

Comprehensive Plan

City zoning and development regulations (SMC Title 18) are consistent with the intent of the GMA and current comprehensive plan adopted in 2006. The City is in the process of updating their comprehensive plan and has prepared a preliminary draft of the comprehensive plan for public review (Sequim 2015). It contains a future land use map, and goals and policies that provide guidance to the City as it grows and changes to meet the demands of a growing region. The 2015 Comprehensive Plan outlines the City's policy and vision with respect to urban growth, land use, transportation, capital facilities and utilities, housing, parks and recreation, economic development, energy, and environment.

Critical Areas

Activities related to stormwater management that involve normal repair, maintenance and operation are exempt from the requirements of critical areas protection as long as they are not prohibited by any other ordinance or law and are conducted using best management practices (BMPs) (SMC 18.80.055). This would include normal repair and routine maintenance and operation of existing utilities (e.g., water and sewer lines) and irrigation and drainage ditches. The repair and maintenance must not involve expansion (SMC 18.80.055(A)).

Replacement, expansion, relocation or placement of new utility service lines are subject to critical area protection standards in the SMC (Section 18.80.055(B)).

Modifications to existing structures including remodeling, reconstruction, or replacing, is allowed as a development exception provided that the new construction does not further disturb or encroach upon a critical area or its buffer (SMC 18.80.080(B)). The code also allows public drainage facilities in some critical areas with certain conditions (SMC 18.80.080(E)). Category III or IV wetlands and their buffers, and stream buffers, may be altered for use as a public drainage facility; provided that all requirements of the City stormwater management plan and all other local, state, and federal laws are satisfied, and so long as increased and multiple natural resource functions are achievable and the benefits outweigh any lost resource. Public drainage facilities in buffers may be approved by the Department of Community Development director only when long-term impacts are minimal or when there are no practicable or reasonable alternatives and mitigation is provided. Public drainage facilities are also limited to the outer 25 percent of a buffer. According to development standards in SMC 18.80.070(F)(4)(h), stormwater management facilities in wetlands and wetland buffers are a regulated activity requiring a permit from the City.

Similarly, utilities (i.e., water, sewer, stormwater) in streams and stream buffers may be approved when there is no practicable or reasonable upland alternative. Utilities development would also be subject to criteria for stream crossing established in the code (SMC 18.80.080(H)), which are designed to protect fish and fish habitat, and flood-carrying capacity.

Development in critical areas that may be allowed under SMC 18.80.080 are also subject to mitigation sequencing requirements (SMC 18.80.080(K)). The adverse impacts of any allowed development exception must be unavoidable but mitigatable by the following sequence of actions:

1. Avoiding the impact altogether by not taking a certain action or parts of an action;
2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps to avoid or reduce impacts;
3. Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
4. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action;
5. Compensating for the impact by replacing, enhancing, or providing substitute resources or environments; and/or
6. Monitoring the impact and taking appropriate corrective measures.

State Environmental Policy Act

SEPA (Chapter 43.21C RCW) was adopted in 1971 to ensure that environmental values were considered during decision-making by state and local agencies. SEPA provides a way to identify possible environmental impacts that may result from government decisions. These decisions may be related to issuing permits for private projects, constructing public facilities, or adopting regulations, policies or plans. Information provided during the SEPA review

process helps agency decision-makers, applicants, and the public understand how a proposal will affect the environment. This information can be used to change a proposal to reduce likely impacts, or to condition or deny a proposal when adverse environmental impacts are identified.

Applicability

Under SMC Environmental Policy, Chapter 16.04.010, the City adopts SEPA, RCW 43.21C.120, and the SEPA Rules, WAC 197 11-904. Under SEPA, the City assumes the role of lead agency responsible for environmental review of private and City proposals, with the exception of other public agencies that have SEPA authority. SMC 16.04 contains the City's SEPA rules and procedures.

SEPA requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An Environmental Impact Statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. A SEPA checklist is typically prepared to determine whether an EIS is required. However, not all projects require SEPA, and are considered *categorically exempt*. Categorical exemptions are reserved for projects that either are unlikely to have a significant adverse environmental impact or were designated exempt by the State legislature.

Stormwater construction and maintenance activities are categorically exempt from threshold determination and Environmental Policy Act requirements as described under WAC 197-11-800(23)(b): *all storm water, water and sewer facilities, lines, equipment, hookups, or appurtenances including utilizing or related to lines twelve inches or less in diameter*.

Shoreline Management Act

The Shoreline Management Act (SMA) was passed by the Washington state legislature in 1971 (RCW 90.58). The primary goal of the SMA is *to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines*. Under the SMA, each city and county with *shorelines of the state* must prepare and adopt a Shoreline Master Program (SMP) that is based on state laws and rules but is tailored to the specific geographic, economic and environmental needs of the community. All SMPs must satisfy the requirements of WAC 173-26, state master program approval and amendment procedures, master program guidelines, and WAC 173-27.

Applicability

The City completed a comprehensive SMP update in November 2013 (Sequim 2013), which is implemented through the City's Shoreline Master Program Code (SMC Chapter 19.05). The SMP and SMC Chapter 19.05 are applicable to the shoreline environment of marine and tidally influenced waters within the City. The City's shoreline jurisdiction, or regulated shoreline, includes all the submerged lands from the mid-channel to the adjacent shorelands located within 200 feet of the Ordinary High Water Mark (OHWM). The City does not have any streams or rivers that meet the 20 cubic feet per second (cfs) requirement for shorelines regulated under the SMA, though the portion of Johnson Creek tidally influenced by Sequim Bay falls within the shoreline jurisdiction. The City's shoreline jurisdiction also includes shorelines of

statewide significance, which are those submerged lands extending from extreme low tide to mid-channel. One associated wetland falls within the City's shoreline jurisdiction.

The wetland commonly known as Pitship Marsh is within 200 feet of the OHWM and hydrologically connected to Sequim Bay; as such, the entire wetland falls within the City's shoreline jurisdiction. Similarly, the wetland in Washington Harbor along the inner portion of South Spit near Pacific Northwest National Laboratory/Battelle is an associated wetland, but is not yet within the City's jurisdiction because it lies within the City's Urban Growth Area (UGA). The City's regulations have no effect in the UGA until annexed into the City (Sequim 2013).

The City's SMP is essentially a shoreline-specific combined comprehensive plan, zoning ordinance, critical areas ordinance, and development permit system. In the City, shoreline permitting and enforcement procedures related to the SMP are intended to meet the SMP goals and policies. Within the City, all non-exempt substantial development undertaken within the shorelines of the state must first obtain a Shoreline Substantial Development, Shoreline Conditional Use, or Variance Permit from the City.

The type of shoreline permit can vary depending on the type of activity and the shoreline environment where work is proposed. Unless exempted, a development, use, or activity shall not be undertaken within the jurisdiction of the SMA unless a shoreline substantial development permit has been obtained. The SMP Section 7.2 identifies those activities that are considered exempt (e.g., normal maintenance and repair) from the requirement to obtain a shoreline substantial development permit. However, regardless of an exemption, activities that occur in the shoreline are required to adhere to the conditional development standards. A development or use that is listed as a conditional use or unlisted use must obtain a conditional use permit even though a substantial development permit is not required.

The City has established six environmental designations: urban, urban conservancy, shoreline residential, research district, natural, and aquatic, as identified in Figure 5-1 in the SMP. Each designation sets out the classification criteria, management policies, and regulations associated with that designation. These categories represent a relative range of development land use preferences:

- **Urban** designation provides for high intensity water-oriented commercial, transportation, and industrial uses while protecting existing ecological functions and restoring previously degraded ecological functions.
- **Research District** designation provides for research and development uses associated with environment, biotechnology, energy efficiency, marine and coastal security, and public and private educational partnerships. Protection or enhancement of existing ecological resources is a recognized objective of this designation.
- **Shoreline residential** accommodates residential development and associated structures that are consistent with the SMA (RCW 90.58) and that provide appropriate public access and recreational uses
- **Urban Conservancy** is designed to protect and restore ecological functions of open space, flood plain and other sensitive lands where they exist in urban and developed settings, while allowing a limited variety of compatible uses.

- **Natural** designation is to protect those shoreline areas that are relatively free of human influence or that include intact or minimally degraded shoreline functions intolerant of human use. These systems require that only very low intensity uses be allowed in order to maintain the ecological functions and ecosystem-wide processes. Consistent with the policies of the designation, local government should include planning for restoration of degraded shorelines within this environment.
- **Aquatic** is a designation intended to protect, restore, and manage the unique characteristics and resources of the areas waterward of the OHWM.

For each shoreline environmental designation, the SMP specifies shoreline standards (e.g., building height, marine buffers, and building setbacks), allowed uses, prohibited uses, allowed shoreline modifications, and permitting requirements. In general, utilities (including stormwater management facilities) may be permitted within all of the shoreline environment designations, except that in natural and aquatic environments they may be permitted as a conditional use only (refer to SMP Chapter 6).

Other Regulations

In addition to local requirements, wetland and stream regulations are imposed by federal and state agencies. These regulations require permitting and mitigation for impacts on wetlands and streams. The Clean Water Act sections 404, 401, and Hydraulic Project Approval (HPA) are the most common permits that would be required for work associated with surface water management projects. The following describes the permits in greater detail.

Clean Water Act Sections 404 and 401

Section 404 of the federal Clean Water Act regulates activities in waters of the United States, including wetlands (33 United Stated Code [USC] 1344), but not wetland buffers. The United States Army Corps of Engineers (USACE) administers the permitting program under this law. Such permits include nationwide (general) permits or individual permits. Nationwide permits (NWP) cover a category or categories of activities that are either similar in nature and cause only minimal individual and cumulative adverse impacts. Individual permits are intended for projects where activities have more than minimal adverse impacts and evaluation of the permit application involves more thorough review of the potential effects of the proposed activity. Close coordination with USACE to confirm the type of review necessary is an integral part of project planning. The difference in review timeframes for an individual permit versus a nationwide permit could have implications on schedule.

Section 401 of the Clean Water Act requires that proposed dredge and fill activities permitted under Section 404 be reviewed and certified by Ecology to ensure that the project meets state water quality standards. These regulations will be applicable if any portion of the on-site wetlands are filled, dredged, or otherwise affected by project activities.

Joint Aquatic Resources Permit Application (JARPA)

Several types of aquatic permits can all be applied for through a streamlined permit application called the Joint Aquatic Resource Application (JARPA) including Clean Water Act permits (Section 404, Section 10, Section 401), City shoreline permits, other City permits (e.g., critical areas), HPAs, and Aquatic Use Authorizations. Activities that trigger these

permits are associated with work in a surface water body (e.g., streams, lakes, tidal waters) or a wetland (e.g., bogs, riverine wetlands, salt marshes).

Surface waters and wetlands are also considered Environmentally Sensitive Areas under the GMA, and thereby are subject to City regulations (SMC Chapter 18.80). For both the purposes of local regulations and those of state and federal entities (e.g., Ecology, USACE), it is important that the extent of the surface waterbody or wetland be properly defined, rated by professional scientists, and the amount of dredge or fill be appropriately calculated by certified engineers.

Finally, it is also important to understand that although this is one permit application, the typical review schedules vary among the regulatory authorities reviewing the application. It is also important to understand where there may be a need for prior approval for a separate permit or authorization before approval under the JARPA. For example, the HPA permit (Washington Department of Fish and Wildlife [WDFW]) is typically reviewed in a shorter timeframe than a Section 404 permit (USACE); however, the HPA permit cannot be approved until the SEPA determination is finalized. To avoid project delays, it is recommended to meet with the regulatory agencies making permitting decisions. Oftentimes they will require more information or materials not specifically required in the JARPA. Early coordination with all of the regulatory agencies may prevent delays in the processing of the JARPA.

EVOLVING REGULATIONS AND POLICIES

The City faces several evolving regulations relevant to stormwater management. These regulations are expected to increase the City's obligations to protect water quality and fish habitat, and require greater integration and coordination between programs aimed at improving environmental protection. This section focuses on upcoming state water quality standards that the City will need to accommodate in its ongoing stormwater management program.

Upcoming State Water Quality Standards

Following is a summary of upcoming revisions to the state water quality standards based on evolving human health criteria, and methods for compliance with the revised standards.

Washington State Surface Water Quality Standards (WAC 173-201A)

Ecology is working on the following updates to the Surface Water Quality Standards (WAC 173-201A) (<www.ecy.wa.gov/programs/wq/ruledev/wac173201A/1203inv.html>):

1. Establishing new human health criteria
2. Providing new implementation and compliance tools for dischargers

Prior to adoption of the new final rule, Ecology implemented a water quality policy forum to educate and obtain feedback from municipal stormwater permittees and other stakeholders

on these updates. A preliminary draft rule package was released on September 30, 2014. The public review period was open from January 12, 2015, through March 25, 2015.

Human Health Criteria

Washington's surface water quality standards include aquatic life criteria for toxic substances, but lack human health criteria for toxic substances. EPA requested that Washington use new science and information to update the standards with human health criteria for toxic substances to protect people who consume water, fish, and shellfish. Ecology has been using the 1992 National Toxics Rule mandated by EPA for developing 303(d) lists of impaired waters, TMDLs, and discharge permits to protect human health from toxic substance consumption. This rule is outdated and EPA has since recommended national human health criteria for 114 toxic substances (<http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm>). These EPA criteria recommend maximum concentrations of toxic substances in surface waters (or fish tissue for methylmercury only) that vary by designated uses of the surface water for protection from consumption of either 1) water and organism (fish/shellfish) or 2) organism only.

Human health criteria for organism (fish/shellfish) consumption are of primary concern for stormwater dischargers. These criteria vary directly with the reference dose (daily intake), relative source contribution (from other sources), and human body weight, vary inversely with the fish consumption rate and bioconcentration factor, and can also vary by the carcinogen risk factor. Criteria adopted by Ecology will likely be lower than the EPA criteria due to the high fish consumption rate of tribal and other populations in Washington State.

Mercury and polychlorinated biphenyls (PCBs) are examples of persistent bioaccumulative toxins that will be most challenging for human health criteria development, and discharge permit compliance because they are commonly associated with 303(d) listings and TMDLs, and largely originate from out-of-state sources of atmospheric deposition. For example, Oregon recently adopted human health criteria in 2011 for methylmercury and PCBs that are 10 times lower than EPA criteria because they are based on a 10 times higher fish consumption rate (175 versus the 17.5 grams per day used for EPA criteria, and compared to only 6.5 grams per day currently used by Washington from the 1992 National Toxics Rule) (<http://www.deq.state.or.us/wq/standards/toxics.htm>). The majority (74 percent) of current 303(d) listings for freshwater fish tissue are for two carcinogens: PCBs and dichloro-diphenyl-trichloroethane (DDT; including dichlorodiphenyldichloroethylene [DDE] and dichlorodiphenyldichloroethane [DDD] degradation products). Ecology may choose to use a lower risk factor for some carcinogens, such as the risk factor of 10^{-5} used by Great Lakes states versus EPA's and Washington's current risk factor of 10^{-6}, which would increase criteria for carcinogens and possibly negate a decrease from a revised consumption rate.

Implementation and Compliance Tools

New human health criteria may result in lower discharge permit limits that will be challenging for permitted municipalities and industries to achieve. Recognizing this, Ecology is concurrently revising the water quality standards rule to allow permit compliance while toxic substance source control efforts and technologies are improved. At water quality policy forums, Ecology has provided examples of permitting scenarios for various types of

dischargers to 303(d) listed or unlisted waterbody segments. These forums include the following response to a question on the potential impact of new human health criteria to municipal stormwater permittees:

"The most immediate impact would likely be additional 303(d) listed waterbody segments as criteria are implemented (under the current 303(d) listing policy). The current permits contain requirements for discharges to 303(d) listed waterbody segments for which TMDL studies have been completed and approved by EPA. These requirements contain a series of actions for permittees to take if the TMDL identifies municipal stormwater discharges as a cause of or contributor to the impairment, and if the actions for the stormwater system go beyond the regular permit requirements. Ecology incorporates them when reissuing the permit, unless there is a compelling reason to bring them in sooner. Actions required in the permits provide a path for permittees to address situations where criteria are exceeded in waters. Permittees that follow this path are not in violation of the permit."

Initially, increased listings of impaired water body segments would not require additional actions by municipal stormwater permittees unless Ecology determines that stormwater treatment requirements currently defined as All Known Available and Reasonable methods of prevention, control, and Treatment (AKART) in stormwater manuals are no longer protective of water quality. However, new TMDL implementation plans resulting from those listings ultimately may require additional source control, treatment, and monitoring by municipal stormwater permittees.

Adoption of human health criteria is not likely to increase 303(d) listings for conventional, microbial, and inorganic substances because either these parameters do not have human health criteria or the human health criteria are higher than the aquatic life criteria. Exceptions include arsenic that typically exceeds EPA human health criteria but not aquatic life criteria in surface waters, and manganese that often exceeds human health criteria in surface waters and has no aquatic life criteria. Adoption of human health criteria is likely to increase 303(d) listings for some organic chemical substances that are detected in surface waters, and either do not have aquatic life criteria or the human health criteria are lower than the aquatic life criteria, and commonly observed concentrations. Examples (and the associated human health criterion for organism only) include bis(2-ethylhexyl) phthalate (2.2 micrograms per liter [µg/L]), several polycyclic aromatic hydrocarbons (0.018 µg/L), and total PCBs (0.000064 µg/L). Currently, the City has no Water Quality Assessment listings for the water quality parameters that may be further regulated by human health criteria.

National Pollutant Discharge Elimination System Municipal Stormwater Permit

The City is currently not a permittee under the state National Pollutant Discharge Elimination System (NPDES) municipal stormwater permit; however, several nearby jurisdictions (Gig Harbor, Oak Harbor, Port Angeles, Port Orchard, Port Townsend, and Poulsbo) are Phase II permittees. The rules that outline when a small municipal separate storm sewer system (MS4) may be designated for coverage under Phase II include the following:

1. **Automatic designation:** all MS4s located in a census-defined urban area.
2. **Required evaluation:** Ecology must evaluate cities located outside of the census-defined urban areas with a population greater than 10,000.

3. **Petition:** Any person may petition Ecology to evaluate whether a jurisdiction not otherwise covered by Phase II should be regulated.

Waivers can be issued if the MS4 serves a population less than 1,000 if:

- They are not contributing significantly to the pollutants loadings of an interconnected regulated MS4
- A TMDL has not been completed for pollutant(s) in its stormwater discharges

NPDES Phase II permittees must implement a stormwater management program (SWMP) that includes the following five elements:

- Public Education and Outreach
- Public Involvement and Participation
- Illicit Discharge Detection and Elimination
- Controlling Runoff from New Development, Redevelopment, and Construction Sites
- Municipal Operations and Maintenance

Additional NPDES Phase II Permit requirements apply for the following:

- Compliance with TMDLs
- Monitoring and Assessment
- Reporting

The Regulatory Gap Analysis and Needs Assessment (Appendix G) summarizes additional stormwater program elements that the City would need to address if they were to become a permittee in the future.

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APPENDIX D

Full Stormwater Problems and Solutions Table

Table D-1. Inventory of Drainage Problems on City Creeks.					
Problem No.	**Location**	**Problem/ Project Name**	**Problem**	**Recommended Approach**	**Priority**
1.00	Citywide	Sequim Area Stormwater – Watershed Plan	Long history of flooding problems along the Bell Creek Corridor and in western Sequim. Stormwater input via active and abandoned irrigation conveyances adds to flooding across city, and future development may increase flooding in already flooded/problem areas.	Plan proposed for CIP. Solution provided in Table 5 of the Master Plan and Appendix F.	CIP Table 6
1.01	West end Schmuck Road culvert (Clallam County)	Bell Creek flooding at RM 0.2	Creek backs up in extreme events, flows onto private property.	Potential future capital project(s) to mitigate flow upstream and improve capacity at Schmuck Road. (Outside city/ UGA)	Less urgent
1.02	West end Rhodefer Road culvert	Bell Creek Overflow Channel Upgrade at RM 1.4	Channel very overgrown and culvert backs up, causing flooding of Carrie Blake Park as well as north to the Reuse Park.	Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan.	MP Table 5
1.03	Lower pond at Carrie Blake Park	Bell Creek flooding at RM 1.45	Creek flows out of pond to north onto City property (Re-use Park).	Maintain pond outlet. Potential future capital project to improve capacity; also related to 1.02.	Less urgent
1.04	Carrie Blake Park entrance	Bell Creek Culvert Upgrade at RM 1.5	Two culverts along Bell Creek used to convey creek flows under driveway to Carrie Blake Park (off of North Blake Avenue) do not have adequate hydraulic capacity to handle high flows. Flooding has been observed in the park entry and Blake Avenue.	Proposed for CIP. Solution provided in Table 5 of the Master Plan and Appendix F.	CIP Table 6
1.05	East end N Blake Avenue culvert	Bell Creek flooding at RM 1.6	Creek flows out of channel onto private and City property to the east.	Re-evaluate problem and perform culvert and channel maintenance if needed. Potential future capital project.	Less urgent
1.06	West end N Blake Avenue culvert	Bell Creek Culvert Upgrade at RM 1.6	Culvert backs up and causes flooding of Gebhardt-Zwicker Park and spills onto Blake Avenue and private property.	Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan. Evaluate culvert as part of 1.00 or 1.09.	MP Table 5

Table D-1 (continued). Inventory of Drainage Problems on City Creeks.

Problem No.	Location	Problem/ Project Name	Problem	Recommended Approach	Priority
1.07	South side E Washington culvert	Bell Creek Culvert Upgrade at RM 1.8	Existing culvert downstream of Culvert 1.08 along Bell Creek does not have adequate capacity and the roadway at intersection of S Brown and E Washington Streets floods during high flow events. Culvert starts out heading north, angles northeast under E Washington and N Brown Intersection, then joins and 11-foot-wide by 6-foot-high culvert under Les Schwab driveway.	Proposed for CIP. Solution provided in Table 5 of the Master Plan and Appendix F. Evaluate culvert as part of 1.00 or 1.09.	CIP Table 6
1.08	S Brown at south end private driveway (to Bell Creek Café and Evergreen Collision)	Bell Creek Culvert Upgrade at RM 1.85	Bell Creek and culvert under driveway along S Brown Road flood during high flows. Flooding extends into roadway and driveway of business, but does not reach business parking lot to the north. Floodplain ("sponge") to the south receives some of the excess flows and also floods. Undeveloped sponge area is lower in elevation than the adjacent parking lot to the north of Bell Creek along this corridor, so excess flows will flood this area before flooding parking lot.	Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan. Evaluate culvert as part of 1.00 or 1.09. Also see discharge from parking lot to Creek, #4.44.	MP Table 5
1.09	RM 2.2 to 1.8 (primarily Burrowes property)	Middle Reach Bell Creek Floodplain Planning	Bell Creek, Highland irrigation ditch, and stormwater culverts along Bell Creek corridor receive stormwater runoff from upland areas during storm events, causing facilities to back up and flood undeveloped property along the Creek during high flows. Would address problems 2.17, 2.29.	Proposed for CIP as an alternative to 1.00. Solution provided in Table 5 of the Master Plan and Appendix F.	CIP Table 6
1.10	South end E Hammond ROW culvert (across from apartments)	Bell Creek Culvert Upgrade at RM 2.2	Bell Creek Culvert backs up onto private property on south side of E Hammond Road due to overgrown vegetation and possibly lack of capacity.	Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan. Evaluate culvert as part of 1.00 or 1.09.	MP Table 5

Table D-1 (continued). Inventory of Drainage Problems on City Creeks.

Problem No.	Location	Problem/ Project Name	Problem	Recommended Approach	Priority
1.11	S Sequim Avenue culvert (WS DOT)	Bell Creek culvert gravel accumulation at RM 2.5	Gravel accumulation and mounding in arch culvert.	Re-evaluate problem and perform culvert maintenance if needed. Evaluate culvert as part of 1.00 or 1.09. (Property of WS DOT)	Less urgent
1.12	City shop property, west of Sequim Avenue	Bell Creek culvert back up at RM 2.6	Culvert may back up (based on appearance of floodplain upstream).	Evaluate culvert to improve capacity as part of 1.00 or 1.09.	Less urgent
1.13	Highway 101 (WS DOT)	Bell Creek culvert gravel accumulation at RM 2.7	Gravel accumulation may be a problem in box culvert. Estimated 2- to 3-foot deep gravel/sediment.	Re-evaluate problem and perform culvert maintenance if needed. Evaluate culvert as part of 1.00 or 1.09.	Less urgent
1.14	Highland irrigation ditch spillway (HID)	Bell Creek spillway discharge from irrigation ditch at RM 3.5	Spillway (weir) up-ditch from siphon dumps stormwater and Dungeness River water into Bell Creek periodically throughout year. Erosion from outfall could affect water quality; irregular use creates irregular hydrology, fills storage capacity in floodplain below.	Irrigation system upgrade needed to resolve erosion problem. Evaluate situation as part of 1.00 (Sequim Area Stormwater – Watershed Plan).	Less urgent
1.15	Highland irrigation ditch siphon (HID)	Bell Creek valve discharge from siphon at RM 3.6	When valve opened up, water discharges into creek bank, causing erosion. Erosion of stream bank may affect habitat and water quality.	Irrigation system upgrade needed to resolve erosion problem, such as an energy dissipater to control erosion. (Highland Irrigation District)	Less urgent
1.16	West side of N Brown Road culvert (Clallam County)	Gierin Creek culvert back up at RM 2.6	Potential culvert backing up due to runoff partially originating in City.	Private system upgrade. Evaluate problem as part of 1.00 (Sequim Area Stormwater – Watershed Plan). (outside city/UGA)	Less urgent
1.17	Highland ditch tail water discharge, east from Happy Valley Road via ditch easement road (Clallam County)	Johnson Creek habitat concerns at RM 1.6	Erosion, habitat damage and water quality impacts may occur. Outside city and UGA, but may influence water quality and habitat in city.	Irrigation system upgrade may be needed. Evaluate problem as part of 1.00 (Sequim Area Stormwater – Watershed Plan). (Highland Irrigation District)	Less urgent

Table D-1 (continued). Inventory of Drainage Problems on City Creeks.					
Problem No.	**Location**	**Problem/ Project Name**	**Problem**	**Recommended Approach**	**Priority**
1.18	N Brown Road at Bell Creek/Les Schwab	N Brown Road Drainage Improvements at Les Schwab	Stormwater pipe along N Brown Road discharges untreated stormwater runoff from City streets into Bell Creek downstream of culvert under Les Schwab driveway.	Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan.	MP Table 5
1.19	Happy Valley Road at Bell Creek (UGA line)	Happy Valley Road at RM 3.8 (County road)	Potential for clogged culvert, would back up and flood road.	Watch and maintain culvert especially during storms.	Less urgent

Table D-2. Inventory of Drainage Problems on City-Owned Property.					
Problem No.	**Location**	**Problem/ Project Name**	**Problem**	**Recommended Approach**	**Priority**
2.01	S 2nd at Washington	S 2nd at Washington drainage improvements	Runoff from the west on Washington floods this intersection and erodes the ROW landscaping, which clogs other storm drains.	Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan.	MP Table 5
2.02	S 3rd at Bell—southwest corner	S 3rd at Bell drainage improvements	Persistent ponding reported by resident but not documented.	Evaluate need for future capital project to add infiltration capacity.	Less urgent
2.03	S 3rd at Hemlock—northwest corner	S 3rd at Hemlock drainage improvements	Permeable pavement works where it exists. Other areas pond even in small events.	Evaluate need for future capital project to add infiltration capacity.	Less urgent
2.04	S 3rd at drive to Hideaway Homes MHP	S 3rd Avenue Drainage Improvements	Culvert routes stormwater runoff from open ditch under driveway, and discharges to gravel bank along right of way. Erosion of gravel bank from the culvert flows are causing sediment deposition and flooding of private property. Flooding occurs on east side of bus barn property, continues north as a piped system, and crosses under S 3rd Avenue into DOT detention pond.	Proposed for CIP. Evaluated as part of Stormwater Problem Field Investigations. Solution provided in Table 5 of the Master Plan and Appendix F.	CIP Table 6
2.05	N 5th at Cedar, southeast corner	N 5th Avenue Structure Upgrade	Drywell at southeast corner of W Cedar and N 5th Avenue intersection floods at inlet. Flooding extends along cross walk and up ramp, imposing risk to pedestrians (especially when icy). Maintenance was recently performed but the structure still does not provide adequate drainage.	Proposed for CIP. Solution provided in Table 5 of the Master Plan and Appendix F.	CIP Table 6
2.06	N 5th at Spruce, southeast corner	N 5th at Spruce drainage improvements	Drywell at southeast corner floods. Maintenance was recently performed but the structures still do not provide adequate drainage.	Re-evaluate problem and perform maintenance if needed. Potential future capital project.	Less urgent

Table D-2 (continued). Inventory of Problems on City-Owned Property.					
Problem No.	**Location**	**Problem/ Project Name**	**Problem**	**Recommended Approach**	**Priority**
2.07	N 5th at Alder, southeast corner	N 5th at Alder drainage improvements	Concrete chunk at end of inlet pipe may cause clogging. Drywell at southeast corner floods. Maintenance was recently performed but the structures still do not provide adequate drainage.	Re-evaluate problem and perform maintenance if needed. Potential future capital project.	Less urgent
2.08	N 5th south of Hendrickson, west side across from SARC driveway	N 5th across from SARC drainage improvements	Maintenance was recently performed but the structures still do not provide adequate drainage.	Potential future capital project to add infiltration capacity.	Less urgent
2.09	S 5th at W Salal Place (south of 101)	S 5th at Salal Place drainage improvements	March 2014 photos showing severe ponding.	Potential future capital project to add infiltration capacity.	Less urgent
2.10	S 5th at Sea Breeze apts., near entrance to Avamere, S 5th loop	S 5th at Sea Breeze drainage improvements	Ditch discharges north into small swale. May contain irrigation tail water (see A2.11).	Perform maintenance as needed (coordinated with Highland irrigation district, if applicable).	Less urgent
2.11	S 5th near west entrance to Maple Ridge	S 5th near Maple Ridge drainage improvements	Check for irrigation ditch tail water—may flow year round.	Re-evaluate problem and perform maintenance if needed. Potential future capital project.	Less urgent
2.12	7th Avenue at W Washington, southwest corner especially (in front of McDonald's)	7th and Washington structure upgrade	Flooding at southwest inlet at intersection of S 7th Avenue and W Washington Street structure is full of sediment. Maintenance was recently performed but the structure still does not drain fast enough.	Proposed for CIP. Solution provided in Table 5 of the Master Plan and Appendix F.	CIP Table 6
2.13	N 7th at west shoulder and parking lot for flooring business at 147 N 7th	N 7th at flooring business structure upgrade	Check CBs and pipe connections (street drain connected to parking lot drywell); whole area floods. (Also listed in misconnected storm drains list, 3.02.)	Refer to Problem 3.02.	Less urgent

Table D-2 (continued). Inventory of Problems on City-Owned Property.					
Problem No.	**Location**	**Problem/ Project Name**	**Problem**	**Recommended Approach**	**Priority**
2.14	N Blake at Fir	Blake and Fir Drainage Improvements	Flooding on southwest corner of intersection. Four existing catch basins on corners are located at higher elevations than the surrounding grade and infiltration capacity may be inadequate. Catch basin piped to a drywell structure under the sidewalk. Maintenance and rehab/repair was recently performed but ponding persists.	Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan. Also see 2.70, entrance to Reuse Park.	MP Table 5
2.15	S Brown at 300 feet south of Washington (HID)	S Brown irrigation culvert backs up	Irrigation culvert overflows. Highland Irrigation District.	Re-evaluate problem and perform maintenance if needed. Potential future capital project.	Less urgent
2.16	S Brown at Washington, southwest corner	S Brown Bell Creek culverts	Bell Creek backs up behind culverts and upstream several hundred feet. (Also listed under Creek issues.)	Refer to Problem 1.07 and 1.08.	Less urgent
2.17 (2.29 added)	S Brown and Hammond corner, and along E Hammond	S Brown and E Hammond Drainage Improvements	Flooding at private property located on/ near corner of E Hammond Street and S Brown Avenue.	Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan.	MP Table 5
2.18	E Brownfield (entire length)	E Brownfield drainage improvements	Occasional flooding at various CBs, ditches, irrigation pipes, culverts.	Re-evaluate problem and perform maintenance if needed. Potential future capital project.	Less urgent
2.19	Carrie Blake Park parking lot, south side	Carrie Blake Park flooded parking lots	Extensive ponding with heavy rain, extends into baseball fields.	Re-evaluate problem and perform maintenance if needed. Potential future capital project.	Less urgent
2.20	Carrie Blake Park Skate Park, near parking area	Skate Park drainage improvements	Needs better drainage summer and winter.	Grade and lip at entrance needs adjusting; infiltration facility needed for runoff (and/or structure to create detention storage). Potential future capital project.	Less urgent

Table D-2 (continued). Inventory of Problems on City-Owned Property.					
Problem No.	**Location**	**Problem/ Project Name**	**Problem**	**Recommended Approach**	**Priority**
2.21	Carrie Blake Park Playground, north side near swings	Playground water faucet leak	Faucet/hydrant leaks, causes ponding (not a stormwater problem, but contributes to flooding).	Coordinate with Water Department for repair or replacement of hydrant by City maintenance staff or small works contract.	Less urgent
2.22	Carrie Blake Park (and Re-use Park) North side lower pond	Lower pond overflow	Floods to north when Bell is high and reaches Re-use park parking lot and drainage ditch	Refer to Problem 1.03.	(Refer to 1.03)
2.23	Centennial Place at Sequim and Washington	Centennial Place Infiltration and Inflow Investigation	Stormwater runoff from parking lot flows to sanitary sewer.	Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan.	CIP Table 6
2.24	341 Dunlap	Dunlap ponding near Fir	Ponding on residential street, affects parking.	Re-evaluate problem (no facility to maintain). Potential future capital project.	Less urgent
2.25	Etta Street (between Sequim Avenue and Sunnyside)	Etta Street Infiltration and Inflow Investigation	Surface runoff from alley drains to two existing catch basins and it is unclear where the catch basins drain (infiltration trench, drywell, or sanitary sewer). It appears that most of the runoff flows into a catch basin located out of the City right-of-way. Downspout connection appears to tie into sanitary sewer (actual connections to be confirmed).	Proposed for CIP. Solution provided in Table 5 of the Master Plan and Appendix F.	CIP Table 6
2.26	Falcon Road, south end and downstream areas (roads and private property)	River Road Storage Project	Flooding of private property within the City and UGA caused by runoff from west Happy Valley (outside of the UGA in the county) entering Eureka ditch near Mockingbird Lane. Would address problems 4.01, 4.14, and 4.36.	Proposed for CIP. Solution provided in Table 5 of the Master Plan and Appendix F.	CIP Table 6
2.27	W Fir at Fifth Avenue, southeast corner	W Fir and 5th Avenue, SE	Storm drain overflows to street when drywell is full.	Re-evaluate problem and perform maintenance if needed. Potential future capital project.	Less urgent

Table D-2 (continued). Inventory of Problems on City-Owned Property.					
Problem No.	**Location**	**Problem/ Project Name**	**Problem**	**Recommended Approach**	**Priority**
2.28	W Fir between N 5th and Sequim Avenue	W Fir between N 5th and Sequim Avenue	Major surface damage on W Fir from water ponding, runoff due to lack of adequate stormwater facilities. Reconstruction including stormwater facilities expected in 2016-18.	Check pervious pavement installations. Street is scheduled for reconstruction. Stormwater treatment and infiltration will be designed into street project; funding sources still being identified. Also addresses 2.64.	MP Table 5
2.29/ 2.17	E Hammond Street between S Brown and Still Road	E Hammond Street	Ditch overflows, floods street; runoff is from south of 101 (ditch obstructions would cause major flooding). Ditch flows east to a swale at Still Road, then to the irrigation ditch along West Sequim Bay Road.	Capacity issue for some driveway culverts; regular maintenance needed. Would be resolved with 1.00 or 1.09. Also see 2.17.	Low-Mod. urgency
2.30	W Hammond Street at South Third Place	W Hammond, near S Third Place	Excessive ponding reported by resident at 341 W Hammond.	Re-evaluate problem (no facility at present). Potential future capital project.	Less urgent
2.31	(moved; now 1.19)				
2.32	N Honeycomb Circle at Deseret intersection, southwest corner	Honeycomb at Deseret	Large vault is not perforated so drains very slowly.	Re-evaluate problem and perform maintenance as needed. Potential future capital project.	Less urgent
2.33	McCurdy Road at S Fifth	McCurdy and S 5th, south side	Runoff flows over road, heading east	Re-evaluate problem and perform maintenance as needed. Potential future capital project.	Less urgent
2.34	Miller Road re: Highland Hills	Highland Hills Runoff Abatement	Detention ponds discharge large volumes of runoff downslope, into City roadside ditches along Miller Road and Clara Crest.	Re-evaluate problem and continue to work with HOA and local landowners to perform retrofits and/or ditch maintenance/repair as needed. Retrofit detention pond(s) as needed. Evaluate runoff problem as part of 1.00 or 1.09. Refer to 4.25.	CIP Table 6

Table D-2 (continued). Inventory of Problems on City-Owned Property.					
Problem No.	**Location**	**Problem/ Project Name**	**Problem**	**Recommended Approach**	**Priority**
2.35 (included in 2.68)	Miller Road at Emerald Highlands	Emerald Highlands pond and drainage improvements	Detention ponds. Overflows to swale at 101 off-ramp.	Re-evaluate problem and perform maintenance if needed. See 2.68 for complete update.	*Resolved*
2.36	Luis property (744 Miller Road)	Miller Road—Luis	Check roadside ditch and bank sloughing down. City considering piping ditch.	Re-evaluate problem and perform maintenance if needed. Potential future capital project.	Less urgent
2.37	Norman, along length, various addresses	Norman Street	Need to check for excessive ponding. Ponding in ditch in spots.	Re-evaluate problem and perform maintenance if needed; coordinate with private irrigation system (Carlock-Herman) in case it's leaking.	Less urgent
2.38	685 Oak Wood Drive	E Hendrickson/Oak Wood Drive	Ponding reported in2014.	Re-evaluate problem and perform maintenance if needed.	Less urgent
2.39	Reservoir Road, west of Third	Reservoir Road and 3rd Avenue	Check for flooded/overflowing ditch.	Re-evaluate problem and perform maintenance if needed, coordinated with irrigation district if appropriate.	Less urgent
2.40	Reservoir Road at Highland ditch culvert (around 400 Reservoir Road)	400 Reservoir Road	Check for flooded/overflowing ditch.	Re-evaluate problem and perform maintenance if needed, coordinated with irrigation district if appropriate.	Less urgent
2.41	N Rhodefer at West Sequim Bay Road	N Rhodefer north of West Sequim Bay Road	Storm flow backs up behind culvert. Small culvert; large volumes of water absorbed in wetlands to east.	Re-evaluate problem and perform maintenance if needed. Potential future capital project.	Less urgent
2.42	S Rhodefer at E Washington	S Rhodefer Elk Creek apartment pond leakage	Elk Creek apartments detention pond leaks onto sidewalk and S Rhodefer.	Refer to 4.30.	Less urgent
2.43	Seal Street south end	Seal Street Drainage Improvements	Between Cedar and Washington, especially where alley meets Seal, ponding extends widely	Confirm property line and shared responsibilities, if any. See 3.01 listed in Table 5.	MP Table 5 #3.01

Table D-2 (continued). Inventory of Problems on City-Owned Property.

Problem No.	Location	Problem/ Project Name	Problem	Recommended Approach	Priority
2.44	N Sequim Avenue at Fir, northwest corner	NW corner Sequim Avenue and Fir Street	11/25/13: vac'd CB, 4" drain pipe clogged with roots, sediment, couldn't open cleanout (could be related to clogging problem at 90/elbow in pipeline).	Re-evaluate problem and clarify maintenance vs. repair/capital project. Also refer to Project 4.11.	Less urgent
2.45	N Sequim Avenue at Hendrickson, northwest corner	NW corner Sequim Avenue and Hendrickson	Check for flooding at grate where ditch enters pipe. Sequim-Prairie ditch.	Refer to Project 4.12.	Less urgent
2.46	N Sequim Avenue at Spruce, southeast corner	SE corner Sequim Avenue and Spruce	Storm drain backs up (staff reported).	Re-evaluate problem and perform maintenance if needed.	Less urgent
2.47	S Sequim Avenue at Hammond corner	SW corner Sequim Avenue and Hammond	Persistent ponding in front of dentist's office.	Re-evaluate problem and clarify maintenance vs. repair/capital project.	Less urgent
2.48	S Sequim Avenue at Prairie, southeast corner	SE corner Sequim Avenue and Prairie	Pond forms since CB inlet is too far from curb.	Re-evaluate problem and perform maintenance or repair if needed (adjust structure rim and replace surrounding pavement to improve drainage).	Less urgent
2.49	E Silberhorn just east of River Road	East portion Silberhorn and River intersection	Persistent ponding. Pavement is eroding. No stormwater facilities.	Potential future capital project to add infiltration facilities.	Table 5
2.50	E Silberhorn east of Petal Lane where ditch from south comes out, across from 693 East Silberhorn	Silberhorn Road Drainage Improvements	Runoff comes from undeveloped land south of subdivisions. Check during storms. Includes runoff from west Happy Valley.	Refer to problem 4.14 Evaluate problem as part of 1.00 (Sequim Area Stormwater- Watershed Plan).	Less urgent
2.51	E Silberhorn at Rolling Hills	Eureka irrigation ditch at Silberhorn	Eureka ditch carries runoff from south; overflows to Silberhorn Road in large storm events. Check during storms. Includes runoff from West Happy Valley.	Re-evaluate problem and clarify maintenance roles and needs. Also refer to problem 4.14 Evaluate problem as part of 1.00 (Sequim Area Stormwater- Watershed Plan).	Less urgent

Table D-2 (continued). Inventory of Problems on City-Owned Property.					
Problem No.	**Location**	**Problem/ Project Name**	**Problem**	**Recommended Approach**	**Priority**
2.52	Spyglass/Wash Harbor Loop at north end of Simdars	N Simdars intersection	Check after storm (year round). Groundwater leaks out asphalt on Simdars, runs down street to west. Salted when freezing for school bus safety.	Re-evaluate problem and repair using City maintenance staff or small works contract. Potential future capital project.	Less urgent
2.53	W Spruce Street just west of Fifth, south and north side	W Spruce Street Structure Upgrade	Catch basin and perforated pipe are undercapacity, causing flooding of roadway and private property (north side). City recently cleaned structure and jetted perforated pipe, and extended pipe and capacity (2015).	Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan (if flooding continues, upgrade the infiltration system).	MP Table 5
2.54	West Washington at Home Depot etc.	Sequim Village/ Home Depot	Swale seeps onto sidewalk. Creates icy sidewalk during freeze.	Moved. Refer to project 4.41.	Less urgent
2.55	E Washington at Still-Hammond Road intersection	Still-Hammond-Washington	Check during storm. Used to back up but repaired 2012 using larger pipe.	City to check and confirm this problem has been addressed.	Less urgent
2.56	E Washington east of S Rhodefer	Rhodefer and Washington	Irrigation ditch seems undersized for carrying stormwater. Could flood Washington Street if overflows.	Evaluate problem as part of 1.00 (Sequim Area Stormwater- Watershed Plan).	Less urgent
2.57	West Sequim Bay Road (near Elk Loop and others)	West Sequim Bay Road east of Rhodefer	Watch for private detention pond overflow into City street/ditch.	Re-evaluate problem and contact facility owner if needed. Moved to 4.42	Less urgent
2.58	West Sequim Bay Road and Fairweather	(see above)		Combined with 2.57; refer to 4.42.	Less urgent
2.59	West Sequim Bay Road west end near Washington	West Sequim Bay Road west of Rhodefer	Stormwater goes under Wash. then under WSB Road to wetland on north side.	Check drainage and culvert capacity during storms. Re-evaluate problem and clarify maintenance/upgrade needs.	Less urgent

Table D-2 (continued). Inventory of Problems on City-Owned Property.					
Problem No.	**Location**	**Problem/ Project Name**	**Problem**	**Recommended Approach**	**Priority**
2.60	West Sequim Bay Road, middle section east of Wash. Harbor Road	West Sequim Bay Road east of Wash. Harbor Road	Runoff flows to Bell Creek via roadside ditches and Highland irrigation network (discharge is at about RM 0.6)	Check drainage and culvert capacity during storms. Re-evaluate problem and clarify maintenance/upgrade needs.	Less urgent
2.61	N Simdars-Spyglass/ Wash Harbor Loop intersection, former WS DOT pond	Former DOT ponds	City owned. Retention pond full in winter.	Check after storms; re-evaluate and perform maintenance if needed. Potential future capital project.	Less urgent
2.62	Roadside ditch along West Sequim Bay Road uphill from Marina	West Sequim Bay Road Roadside Ditch Improvements	Ditch overflows whenever driveway culverts clog, washing out road.	Potential solution provided in Table 5 of the Master Plan.	MP Table 5
2.63	Prairie Street between Sequim Avenue and Second Avenue	W Prairie Green Street Upgrade (between Sequim Avenue and Second Avenue)	Existing street has no stormwater system (typical of most downtown neighborhoods); street runoff enters private property and ponds and/or infiltrates.	Proposed for CIP. Solution provided in Table 5 of the Master Plan and Appendix F.	CIP Table 6
2.64	W Fir between N 5th and Sequim Avenue	W Fir between 5th and Sequim Avenue Drainage Improvements	Street runoff enters school district property and ponds against Admin building; in largest storms, runoff continues east across yard and exits on Sequim Avenue.	Potential solution provided in Table 5 of the Master Plan. Reconstruction scheduled in 2016-18; also see 2.28 re: W Fir street upgrade.	MP Table 5 (also 2.28)
2.66	Rhodefer and E Washington catch basin	N Rhodefer at Washington Drainage Improvements	Catch basin at crosswalk is covered with asphalt; line to next one (on west side of Rhodefer) clogged (roots?); next CB fills with runoff from ditch along north side Wash. as well, backs up.	Maintenance performed 2015; check during storms. Also refer to 2.41 and 2.56.	Less urgent
2.67	E Cedar south side east of Dunlap	E Cedar Drainage Improvements	Runoff from the west flows to private property (storage units) and continues to front yard of apartment complex down street.	Potential solution provided in Table 5 of the Master Plan. (Streets crew added berm Fall 2015.)	MP Table 5

Table D-2 (continued). Inventory of Problems on City-Owned Property.					
Problem No.	**Location**	**Problem/ Project Name**	**Problem**	**Recommended Approach**	**Priority**
2.68	Emerald Highlands detention ponds	Emerald Highlands pond repair and maintenance	City-owned. Pond retains water through dry season. Vegetation prevents access for inspection and maintenance. North pond drains to Bell Creek at 101 off ramp; south pond drains to west (to Creek).	Remove brush; check valves and outlets; restore capacity if needed. Update Fall 2015: Brush cleared, outlet valves opened, ponds drained. City will monitor silt and water levels. South pond needs maintenance.	CIP Table 6
2.69	Olympic Crest detention pond	Olympic Crest pond improvements	City-owned. Pond retains water through dry season. Outlet backs up with irrigation water in roadside ditch.	Perform maintenance. Adjust slope of outlet pipe or grade of receiving ditch. Update: Fall 2015 staff adjusted grade.	Less urgent/ fixed
2.70	500 N. Blake Avenue, entrance to Reuse Park	Reuse Park entrance	Major pond forms along south curb. Overflow from SW corner Fir and Blake contributes.	Resolve Fir and Blake infiltration issues. (See 2.14) Re-evaluate problem and perform maintenance if needed.	Less urgent
2.71	Fir and Knapman, SW corner	Fir and Knapman	Retrofit/ drainage improvements needed.	Re-evaluate problem. Potential future capital project to add infiltration capacity.	Less urgent
2.72	W Hammond, east of S 7th Avenue	W Hammond Drainage Improvements	Ponding covers entire street in large events.	Re-evaluate problem and clarify maintenance vs. repair/capital project.	Less urgent
2.73	W Brownfield, east of S 3rd Avenue	W Brownfield Drainage Improvements	Ponding covers entire street in large events.	Re-evaluate problem and clarify maintenance vs. repair/capital project.	Less urgent
2.74 (formerly 3.07)	Washington and Sequim intersection NE and SE corners	Washington and Sequim intersection	CB fills and flows north across street to another CB connected to drywell. May lack sufficient capacity for infiltration.	Formerly 3.07. Potential solution listed in Table 5 of the Master Plan. Potential future capital project.	MP Table 5
2.75	9th Avenue and Honeycomb	9th Avenue and Honeycomb drainage improvements	Drainage flows to Helen Court area; street surface degraded on north side where water sits.	Potential solution listed in Table 5 of the Master Plan. Potential future capital project.	MP Table 5

Table D-3. Misconnected Street Drain Problems.					
Problem No.	**Location**	**Project Name**	**Problem**	**Recommended Approach**	**Priority**
3.01 (formerly 2.43)	Seal Street between Cedar and Alley	Seal Street Drainage Improvements	Flooding of private parking lot near intersection of West Cedar Street and Seal Street due to limited capacity of infiltration system. Flooding extends to alley and floods nearby private property.	Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan. Re-evaluate ownership and maintenance record as well.	MP Table 5
3.02	N 7th (west shoulder and parking lot for flooring business)	N 7th Avenue Structure	City street drainage at the west gutter of 7th Avenue is connected to private drywell in parking lot of flooring business along Seventh Avenue. May have been disconnected recently. Update 12/2015: checked and found drywell connected inside ROW to west of drain.	Re-evaluate problem; check during storms. Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan. 12/2015: existing drywell should handle infiltration well; if not, drains north and east down W Spruce Street.	MP Table 5
3.03	S 7th, west side at Eureka ditch crossing (Sawadee parking lot)	Eureka ditch at private parking lot on S 7th Avenue	Parking lot drains to manhole lid with holes into irrigation conveyance. Privately-owned storm drain also nearby, but elevation too high to function.	Re-evaluate problem and follow up with private facility owner and irrigation company. Consider evaluating problem as part of 1.00 (Sequim Area Stormwater- Watershed Plan).	Less urgent
3.04	South 7th Avenue, east side at Eureka ditch crossing (at south property line of McDonalds)	South 7th Avenue Drainage Improvements	Stormwater runoff from private parking lot on the W side of S 7th Avenue is piped under S 7th Avenue and potentially into irrigation vault/network on the east side of S 7th Avenue. (Based on field observations the stormwater may actually be piped into a perforated pipe under the planter or parking lot).	Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan.	MP Table 5
3.05	W Washington at Columbia Bank corner, both sides of entrance to parking lot	SPTI culvert past Safeway	Storm drains may be directly connected to irrigation conveyance flowing north past Safeway toward Spruce Street.	Re-evaluate problem and follow up with irrigation company. Consider evaluating problem as part of 1.00 (Sequim Area Stormwater- Watershed Plan).	Less urgent

Table D-3 (continued). Misconnected Street Drain Problems.					
Problem No.	**Location**	**Project Name**	**Problem**	**Recommended Approach**	**Priority**
3.06	W Washington at Safeway complex	SPTI culvert past Safeway	Storm drains may be directly connected to irrigation conveyance flowing north past Safeway toward Spruce Street.	Re-evaluate problem and follow up with irrigation company. Refer to 3.05. Consider evaluating problem as part of 1.00 (Sequim Area Stormwater- Watershed Plan).	Less urgent
3.07 (now 2.74)	Sequim Avenue at Washington intersection (southeast and northeast)				
3.08	W Hendrickson Road, east of 5th Avenue	W Hendrickson drainage pipe	Pipe outlet into irrigation ditch on north side Hendrickson, may come from street (or private property—dentist office across street)	Re-evaluate problem and follow up with irrigation company. Could be private property concern vs. City street.	Less urgent

Table D-4. Inventory of Drainage Problems on Non-City-Owned Properties.					
Problem No.	**Location**	**Project Name**	**Problem**	**Recommended Approach**	**Priority**
4.01	Falcon Road and others nearby in County	River Road Storage Project	Runoff from Burnt Hill and western Happy Valley (in county) hits floodplain and overwhelms Eureka ditch and roadside ditches in UGA and city. Majority of flow enters Eureka ditch at Mockingbird Lane (off Falcon). Flow originates in channel south side of HV Road.	Evaluate problem as part of 1.00 (Sequim Area Stormwater- Watershed Plan). Problem would be resolved if 2.26 were implemented.	Less urgent
4.02	Northwest corner 7th and Happy Valley Road in County	Runoff from central Happy Valley	Upland flooding adds to runoff to northwest, ending up in Falcon Road area ditches (city and UGA). Highland ditch intercepts most runoff.	Evaluate problem as part of 1.00 (Sequim Area Stormwater- Watershed Plan).	Less urgent
4.03	Cobblestone Lane east end	Cobblestone Lane storm grate clogging	Storm runoff in ditch backs up behind grate at siphon (originates in county). More of a management issue than a facility issue.	Management issue. Evaluate problem as part of 1.00 (Sequim Area Stormwater-Watershed Plan). Refer to 2.26	Less urgent
4.04	W Washington across from Home Depot	Sequim Village overflow	Overflow runoff from Sequim Village Marketplace (Home Depot, etc.) discharges here. Extreme events only.	Re-evaluate problem and contact property owner if needed.	Less urgent
4.05	S Shaw Lane off Washington (Eureka/SPTI irrigation conveyance behind shops)	Shaw Lane flooding	Storm runoff in ditch backs up behind grate at siphon (originates in county). Storm grate clogs, causes flooding. More of a management issue than a facility issue. SPTI and City crews try to keep it cleared during storms.	Management issue. Evaluate problem as part of 1.00 (Sequim Area Stormwater-Watershed Plan). Refer to 4.03; and 2.26	Less urgent
4.06	E Silberhorn	Silberhorn and River Road irrigation ditch flooding	Irrigation ditch overflows onto Silberhorn at large storm events or if culvert is clogged.	Re-evaluate problem and clarify maintenance roles and needs.	Less urgent
4.07	W Washington between 5th and 7th (Safeway parking lot, center)	Safeway parking lot infiltration facility	CB overflows with larger storms.	Re-evaluate problem and clarify maintenance roles and needs.	Less urgent

Table D-4 (continued). Inventory of Drainage Problems on Non-City-Owned Properties.					
Problem No.	**Location**	**Project Name**	**Problem**	**Recommended Approach**	**Priority**
4.08	W Washington between 5th and 7th (Washington Plaza northeast corner)	Safeway parking lot drainage improvements	Irrigation ditch and parking lot runoff mix – need to check.	Re-evaluate problem and clarify maintenance roles and needs.	Less urgent
4.09	W Spruce and W Fir (and between 5th and 7th)	Spruce West MHP	Eureka ditch floods MHP properties at high flows. SPTI ditch carrying stormwater; open ditch through MHP not very high capacity.	Coordinate with Irrigation District for ditch upgrade or flow reduction. Evaluate problem as part of 1.00 (Sequim Area Stormwater- Watershed Plan).	Less urgent
4.10	W Fir between Sequim Avenue and 5th	School Property Drainage Improvements	Runoff from school property flows to City streets, sewer and/or irrigation conveyances.	Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan.	MP Table 5
4.11	N Sequim Avenue, N 5th Avenue and Fir	N Sequim Avenue, N 5th Avenue and Fir Drainage Improvements	Flooding of roadway at the northeast corner of N Sequim Avenue and Fir Street. Irrigation pipes reduce from 18 inches to 12 inches along Fir Avenue and then make a 90 degree bend at the northeast corner of the intersection (high flows blow the lid off the catch basin). At N 5th and Fir, the D-box control mechanism is problematic; results in more stormwater going east along Fir than north on 5th.	Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan.	MP Table 5
4.12	Hendrickson between 5th and Sequim Avenue	Sequim Prairie ditch along Hendrickson	Maintenance is difficult; storm grates clog. Agreement needed to clarify roles for maintenance, repair.	Re-evaluate problem and clarify maintenance roles and needs.	Less urgent
4.13	Sequim Avenue south of Library parking lot	SPTI Irrigation ditch at Library	Maintenance is difficult; storm grates clog Agreement needed to clarify roles for maintenance, repair	Re-evaluate problem and clarify maintenance roles and needs.	Less urgent

Table D-4 (continued). Inventory of Drainage Problems on Non-City-Owned Properties.					
Problem No.	**Location**	**Project Name**	**Problem**	**Recommended Approach**	**Priority**
4.14	S 7th, Comfort Way/ Rolling Hills Way/Jara Way	East Silberhorn Road (east of Petal Lane) Drainage Improvements	Flooding on east end Silberhorn Road caused by unmitigated runoff from distant south and under-sized ditch and culvert (between S 7th and Petal Lane). New development to south would exacerbate. Existing ditch receives piped runoff from SW under Comfort Way, currently flows through undeveloped area and ends at Silberhorn Road. Private property on corner, north side of culvert under Silberhorn also floods.	Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan. Also refer to 2.26	MP Table 5
4.15	S 7th and Maliandra Drive	S 7th and Maliandra infiltration improvements	CBs and drywells lack capacity; drains to east-northeast.	Re-evaluate problem and perform maintenance if needed. Potential future capital project.	Less urgent
4.16	S 5th and McCurdy	S 5th and McCurdy drainage improvements	Undersized CBs and drywells? drains to east-northeast. Former west branch Bell Creek flowed through here. Possibly includes natural runoff from south, above Reservoir Road.	Re-evaluate problem and perform maintenance if needed. Potential future capital project.	Less urgent
4.17	S 5th (west side, south of Hwy 101)	S 5th drainage improvements	Runoff from southwest floods this area in large events, affecting Sea Breeze.	Evaluate problem as part of 1.00 (Sequim Area Stormwater- Watershed Plan). Re-evaluate problem and perform maintenance if needed (by owner).	Less urgent
4.18	S 5th at entrance to Avamere	Entrance to Avamere drainage improvements	Drains from private property? Need to check.	Evaluate problem as part of 1.00 (Sequim Area Stormwater- Watershed Plan). Re-evaluate problem and perform maintenance if needed (by owner).	Less urgent
4.19	S 3rd at bus barn	Bus barn water quality protection	Wash water may drain to ditch, which goes to DOT pond and then overflows to Bell Creek.	Re-evaluate problem and coordinate with property owner.	Less urgent

Table D-4 (continued). Inventory of Drainage Problems on Non-City-Owned Properties.					
Problem No.	**Location**	**Project Name**	**Problem**	**Recommended Approach**	**Priority**
4.20	Former irrigation ditch, west of Hideaway MHP	Irrigation ditch west of Hideaway	Drains north off property? Need to check.	Doesn't seem to drain to north during storms. Continue to watch.	Less urgent
4.21	Bottom of terrace north of Maple Ridge (Avamere)	North of Maple Ridge (east of Avamere)	Drains north off property? Need to check.	Doesn't seem to flood during storms. May be connected to 4.20 site. Continue to watch.	Less urgent
4.22	North of Dominion Terrace	Dominion Terrace	Drains north off property? Need to check.	Drainage easement from Dominion Terrace to Maple Ridge development.	Less urgent
4.23	West side Dominion Terrace	West side Dominion Terrace	Irrigation and stormwater ditches throughout, sometimes flooding. West side ditch flow mostly (or all) natural from spring above Reservoir Road.	Continue to watch. Evaluate as part of 1.00 (Sequim Area Stormwater- Watershed Plan).	Less urgent
4.24	S 3rd (Gerhardt Park)	S 3rd Ditch Drainage Improvements	Roadside ditch overwhelmed in moderate and extreme events; clogs easily.	Replace broken concrete culvert (originally installed by landowner; City is owner, HID has easement).	Less urgent
4.25	Miller Road/ Clara Crest	Highland Hills Runoff Control	Roadside ditches overwhelmed in moderate and extreme events due to discharge from Highland Hills detention ponds and recent development on Clara Crest.	Re-evaluate problem and work with HOA and local landowners to perform retrofits and/or ditch maintenance as needed. Potential solution provided in Table 5 of the Master Plan, under 2.34.	MP Table 5 2.34
4.26	Miller Road (The Cottages)	Cottages overflow improvements	Retention pond may drain to Bell property (This may be for extreme events only; check during storm, and check plans.)	Re-evaluate problem and contact HOA and Bell property owner to clarify maintenance roles and needs.	Less urgent
4.27	E Brownfield Road	E Brownfield Drainage Improvements	Runoff from County area above Miller Road enters ditch that goes straight to Brownfield. Enters storm drain and piped under 101 to private property (Burrowes).	Evaluate problem as part of 1.00 (Sequim Area Stormwater- Watershed Plan).	Less urgent

Table D-4 (continued). Inventory of Drainage Problems on Non-City-Owned Properties.					
Problem No.	**Location**	**Project Name**	**Problem**	**Recommended Approach**	**Priority**
4.28	S Sequim Avenue and E Hammond, north of Highway 101	Hammond culvert for Bell Creek	Stormwater floods irrigation ditch, Bell Creek, and enters property from culverts between Brownfield Road and Burrowes (under 101). Majority of runoff originates on north Bell Hill, partially in the county.	Evaluate problem as part of 1.00 (Sequim Area Stormwater- Watershed Plan). Clarify maintenance roles and needs. Refer to 1.10; recommended solution in Table 5.	Less urgent
4.29	Highway 101, South Rhodefer	Elk Creek upper parking lot	Detention pond along 101 discharges to north (and onto Elk Cr. Apts. back parking lot). Runoff from Brownfield Road (Bell Hill?) enters storm drain and detention ponds next to 101.	Re-evaluate problem and contact property owner.	Less urgent
4.30	E Washington and S Rhodefer	Elk Creek apartments pond leakage	Retention pond leaks onto sidewalk. Repairs have been made in past. Runoff from south (DOT?) enters storm drains in upper parking lot.	Re-evaluate problem and contact DOT and/or facility owner as needed.	Less urgent
4.31	E Washington, QFC complex (former Staples, etc.)	E Washington Drainage Improvements	Irrigation ditch enters culvert pipe on west end of parking lot (former Staples), discharges to Bell Creek. Clogged culvert floods parking lot if clogged. Runoff from parking lot enters Bell Creek.	Evaluated as part of Stormwater Problem Field Investigations. Potential solution provided in Table 5 of the Master Plan due to potential water quality impact on Bell Creek.	MP Table 5
4.32	West Sequim Bay Road (Fairweather subdivision)	Fairweather retention pond capacity	Retention pond full all winter (undersized?); also, street drains too flat, don't drain to pond effectively.	Re-evaluate problem and contact property owner.	Less urgent
4.33	West Sequim Bay Road (Elk Loop subdivision)	Elk Loop pond capacity	Retention pond full all winter (undersized?).	Re-evaluate problem and contact property owner.	Less urgent
4.34	West Sequim Bay Road (Olympic Crest subdivision)	Olympic Crest	City owned. Moved to 2.69.	Refer to 2.69	Less urgent

Table D-4 (continued). Inventory of Drainage Problems on Non-City-Owned Properties.					
Problem No.	**Location**	**Project Name**	**Problem**	**Recommended Approach**	**Priority**
4.35	West Sequim Bay Road (just east of Olympic Crest subdivision)	East of Olympic Crest	Field pond drains west to private property (Olympic Crest ?) then overflows to road ditch >> eventually into Bell Creek further north	Evaluate problem as part of 1.00 (Sequim Area Stormwater- Watershed Plan).	Less urgent
4.36	West Happy Valley and Sporseen Ditch Improvements	West Happy Valley and Sporseen Ditch Improvements	Runoff overwhelms roadside ditch and culvert over Highland canal at HV Road; also washes out hillslope to south side of HV Road near River Road intersection (irrigation canal also spills into roadside ditch east of Sporseen, adding to the volume) (all in county). Runoff eventually ends up in Eureka ditch as well as private property draining to Comfort Way/ Silberhorn Road area and continues to overwhelm culverts and ditches in city.	Potential solution provided in Table 5 of the Master Plan.	MP Table 5
4.37	Highland Irrigation Canal	Highland Canal breaches	Stormwater fills and over-tops canal wall, spilling runoff to downhill properties (esp. uphill from Jara and Falcon Road areas) and Eureka ditch. If canal wall blows out, it's a big emergency in the city.	Potential solution provided in Table 5 of the Master Plan.	MP Table 5
4.38	Various locations throughout City	Various single family residential inflow investigation and elimination	Inflow evident from smoke testing.	Potential solution provided in Table 5 of the Master Plan.	MP Table 5
4.39	DOT Detention Pond Inlet		Pipe inlet from long ditch to pond gets clogged with litter, causes back up onto DPW off-ramp.	Re-evaluate problem and perform maintenance or inlet upgrade if needed.	Less urgent
4.40	Gazette Building	Gazette Building I/I Investigation	Inflow to sewer evident from smoke testing summer 2013.	Redirect flow to drainage solution. Potential future capital project.	Less urgent
4.41	W Washington at Home Depot etc.	Sequim Village/ Home Depot swale	Swale on W Washington seeps onto sidewalk. Creates icy sidewalk during freeze.	Re-evaluate problem and contact landowner/ facility manager as needed. Need inspection program and enforcement.	Less urgent

Table D-4 (continued). Inventory of Drainage Problems on Non-City-Owned Properties.					
Problem No.	**Location**	**Project Name**	**Problem**	**Recommended Approach**	**Priority**
4.42	West Sequim Bay Road (near Elk Loop and others)	West Sequim Bay Road east of Rhodefer	Watch for detention pond overflow into City street/ditch.	Re-evaluate problem and contact facility owner if needed.	Less urgent
4.43	Maple Ridge	Maple Ridge infiltration capacity improvements	Overflows in large events.	Clarify maintenance roles and needs. Retrofit may be needed.	Less urgent
4.44	Parking lot, Bell Creek Café (and Evergreen Collision)	Bell Creek Café storm drain improvements	Infiltration storm drain backs up into driveway and discharges to Bell Creek.	Re-evaluate problem and contact landowner/ facility manager as needed. Need inspection program and enforcement.	MP Table 5
4.45	Sundowner Motel	Sundowner Motel discharge pipe	Parking lot drain discharges by pipe to north side laundry building, onto open ground (or City ROW?)	Re-evaluate problem and contact landowner/ facility manager as needed. Need inspection program and enforcement.	Less urgent

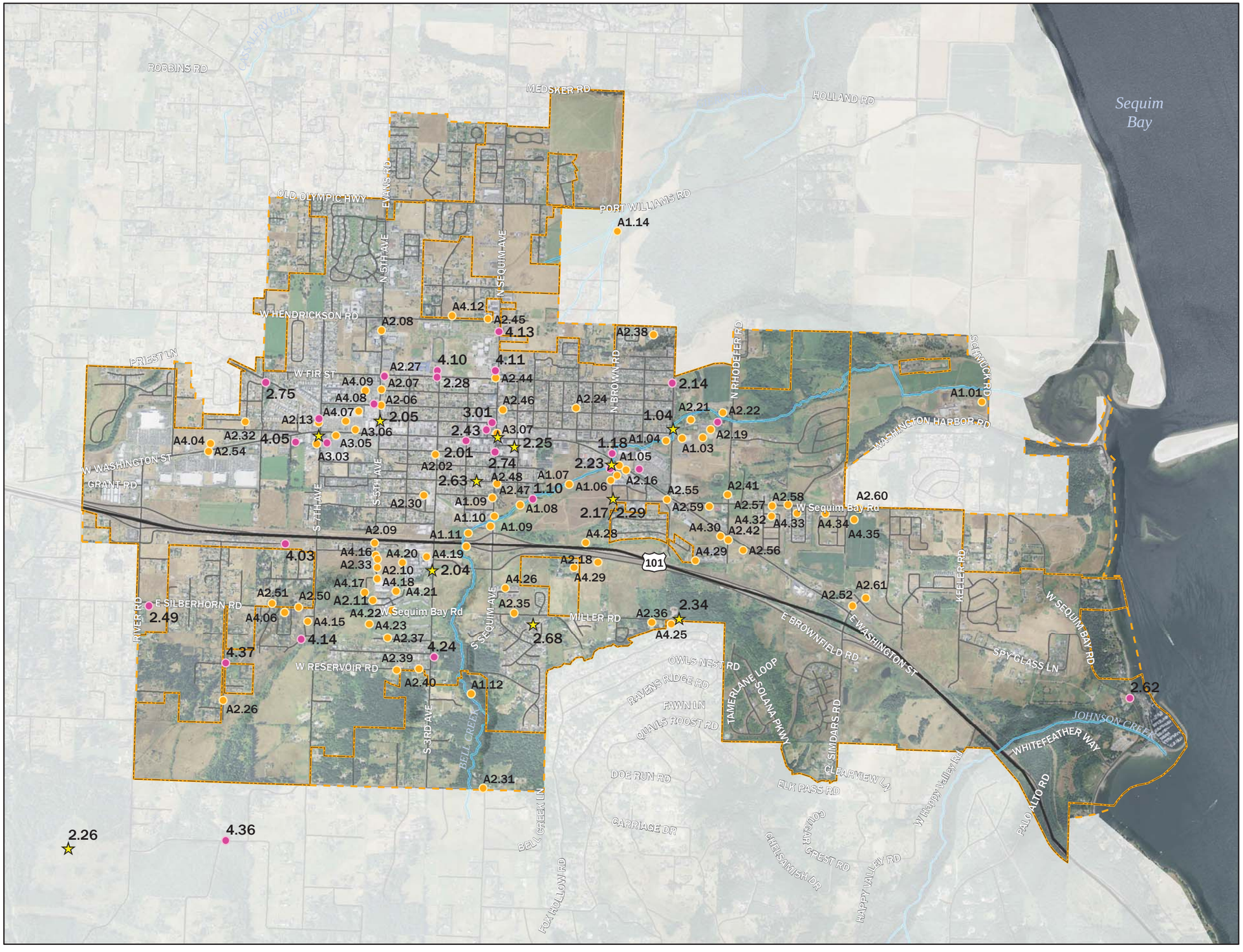


Figure D-1.
Stormwater Problem Locations.

Legend

- CIP project location
- High priority stormwater problem location
- Other identified stormwater problem locations
- City limit
- Urban Growth Area (UGA)
- Stream
- Road
- Highway

Note:
Projects 1.00, 1.09, and 4.38 are programmatic or occur in multiple locations in the City, and are therefore not included in this figure.

N

0 1,000 2,000 4,000 ft

HERRERA

NAD 1983 HARN
Washington State Plane North FIPS 4601 Feet

USDA, Aerial (2013)

Project: K:\Projects\Y2014\14-05826-000\Project\Master_Plan\stormwater_problem_updated.mxd (2/24/2016)

APPENDIX E

Qualitative CIP Project Prioritization

Table E-1. Qualitative CIP Project Prioritization.

Proj. No.	Project Name	Problem Type	Project Classification		Risk		Project Efficiency		Funding Potential		Public Sentiment		Data Quality		Overall Priority	
			Class	Reason for Class	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Priority	Reason for Priority
1.00	Sequim Area Stormwater – Watershed Plan	Stormwater system and creek capacity	Stormwater Planning	Watershed planning with impacts to stormwater irrigation, habitat, water resource management	High	Regularly occurring problem with flooding of private and public property, erosion, habitat degradation and water quality impairment. Needs to occur before other projects.	High	Multiple interested stakeholders and multiple benefits if stormwater solution is coupled with irrigation storage solution.	High	Strong candidate for funding through: watershed planning, habitat enhancement, water resource management (storage for irrigation). High potential for cost sharing with County and irrigation district.	Moderate-Low	Limited interest from general public.	High	Long history of frequent problems and multiple past studies.	High	High risk problem, contender for grant funding and high project efficiency.
1.02	Bell Creek Overflow Channel Upgrade at Rhodefer Road (RM 1.4)	Bell Creek capacity	Upgrade	Upgrade culvert and channel capacity	High	Regularly occurring problem with flooding of Park; habitat degradation.	Moderate	Restoration work could be simple or extensive on this portion of Bell Creek.	Moderate-High	Culvert may be a fish passage barrier.	Low-Moderate	Park flooding is minor nuisance.	Moderate-High	Problem easy to define and resolve.	High	Well-documented high risk that may be grant eligible, located at downstream end of Bell Creek.
1.04	Bell Creek Culvert Upgrade at Blake Avenue (RM 1.5)	Bell Creek capacity	Upgrade	Replace existing culvert with larger culvert	High	Occasionally (every 2 or 3 years) floods residential street and entrance to public park.	Low	No known concurrent projects planned.	Moderate	Removal of fish passage barrier may be eligible for grant funding.	Moderate	No current complaints but highly visible location next to park.	Moderate	Risk well understood, but Sequim Area Stormwater-Watershed Plan recommendations unknown.	High	Well-documented high risk that may be grant eligible, located at downstream end of Bell Creek.
1.06	Bell Creek Culvert Upgrade at Blake Road (RM 1.6)	Bell Creek capacity	Upgrade	Replace existing culvert with larger culvert	High	Annually floods City Park and erodes banks, paved trail. Adjacent homes at risk.	Moderate	High potential for habitat restoration.	Moderate-High	Removal of fish passage barrier may be eligible for grant funding.	Moderate-High	Public opinion that this is an important problem.	Moderate	Risk well understood, but Sequim Area Stormwater-Watershed Plan recommendations unknown.	High	Well-documented high risk that may be grant eligible, located at downstream end of Bell Creek.
1.07	Bell Creek Culvert Upgrade at Washington (RM 1.8)	Bell Creek capacity	Upgrade	Replace existing culvert with larger culvert	High	Annually floods arterial street and driveways to businesses.	Low	Possible implementation with South Brown improvements.	Moderate-High	Removal of documented fish passage barrier may be eligible for grant funding.	High	Strong public opinion that this is an important problem.	Moderate	Risk well understood, but Sequim Area Stormwater-Watershed Plan recommendations unknown.	High-Moderate	Well-documented high risk that may be grant eligible.

Table E-1 (continued). Qualitative CIP Project Prioritization.

Proj. No.	Project Name	Problem Type	Project Classification		Risk		Project Efficiency		Funding Potential		Public Sentiment		Data Quality		Overall Priority	
			Class	Reason for Class	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Priority	Reason for Priority
1.08	Bell Creek Culvert Upgrade at RM 1.85 (driveway from S Brown)	Bell Creek capacity	Upgrade	Replace existing culvert with larger culvert	Moderate	Annually floods driveways to businesses.	Low	Possible implementation with South Brown improvements.	Moderate	Removal of fish passage barrier may be eligible for grant funding.	High	Strong public opinion that this is an important problem.	Moderate	Risk well understood, but Sequim Area Watershed Plan recommendations unknown.	High-Moderate	Well-documented moderate risk that may be grant eligible.
1.09	Middle Reach Bell Creek Corridor Planning	Bell Creek capacity	Stormwater Planning	Watershed planning with impacts to stormwater irrigation, habitat, water resource management	High	Regularly occurring problem with flooding of private and public property, erosion, habitat degradation and water quality impairment. Needs to occur before other projects.	High	Multiple interested stakeholders and multiple benefits.	High	Strong candidate for funding through: watershed planning, habitat enhancement, and water resource management (aquifer storage).	High-Moderate	General public interest in restoration of this area.	High	Long history of frequent problems and multiple past studies.	High	Multiple high risk projects are dependent on this plan.
1.10	Bell Creek Culvert Upgrade at Hammond (RM 2.2)	Bell Creek capacity	Upgrade and maintenance	Replace existing culvert with larger culvert and maintain vegetation around upstream end	Low	Backs up into undeveloped private property, but no flooding of street. Located upstream in the Bell Creek culvert corridor.	Low	No known concurrent projects planned.	Moderate	Removal of fish passage barrier may be eligible for grant funding.	Moderate-Low	No current complaints and low visibility, but future visibility depends on proposed solution (i.e., a future restoration project may include access).	Moderate	Risk well understood, but Sequim Area Watershed Plan recommendations unknown.	Low	Low risk and low priority culvert replacement, mostly a maintenance issue.
1.18	N Brown Road Drainage Improvements at Washington	Drainage	Upgrade	Treating or infiltrating stormwater is an upgrade from direct discharge to Bell Creek	Moderate	Direct discharge contributes limited pollutant load to creek.	Low	No known concurrent projects planned.	High	Contender for water quality grant funding.	Moderate	Urban degradation and trash accumulation can be a safety concern and is bothersome to public.	High	Field observations made by City staff.	Moderate-High	Low risk problem, but good candidate for grant funding.

Table E-1 (continued). Qualitative CIP Project Prioritization.

Proj. No.	Project Name	Problem Type	Project Classification		Risk		Project Efficiency		Funding Potential		Public Sentiment		Data Quality		Overall Priority	
			Class	Reason for Class	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Priority	Reason for Priority
2.01	S 2nd at Washington	Drainage and/or drywell capacity	Upgrade	Runoff doesn't infiltrate, deep ponds affect traffic and erode landscaping in ROW	Moderate	Eroded ROW results in clogging of City facilities which then need maintenance.	Low	No known concurrent projects planned.	Low	Limited water quality or other improvements.	Moderate	Fairly high visibility but no complaints from public.	High-Moderate	Field observations made by City staff; grade may be a related issue.	Moderate	Problem area for City maintenance staff but fairly low risk otherwise.
2.04	S 3rd Avenue (west ROW south of Bypass) Drainage Improvements	Drainage	Upgrade	Pipes or roadside ditch is an upgrade from flooding situation due to City street runoff	High	High frequency flooding on private property could escalate to property damage.	Low	No known concurrent projects planned.	Low	Limited water quality improvements.	Moderate	Low visibility site but a concern for commercial and school property owners.	High	Field observations and flood response by City staff.	High	High risk flooding problem on private property, eroding City ROW.
2.05	N 5th Avenue and Cedar Structure Upgrade	Drywell capacity	Upgrade	Upgrade drywell to restore infiltration rates	Moderate	Frequently floods crosswalk creating hazardous condition for pedestrians.	Low	No known concurrent projects planned.	Moderate	Improved groundwater quality protection.	Moderate	Corrects deficiency at moderately visible site.	High	Field observations made by City staff and complaints received.	High-Moderate	Moderate risk flooding of public crosswalk, well known problem and documented complaints.
2.12	7th Avenue and Washington Upgrade	Drywell/drain line capacity	Upgrade	Upgrade facilities to restore infiltration rates	High	Frequently floods major arterial intersection.	Low	No known concurrent projects planned.	Moderate	Improved groundwater quality protection.	High-Moderate	Corrects deficiency at highly visible site.	High	Field observations made by City staff and complaints received.	High-Moderate	High risk flooding of arterial, well known problem and documented complaints.
2.14	N Blake and E Fir Drainage Improvements	Drainage	Upgrade	Structure at appropriate grade or infiltration rate will improve drainage	Moderate	Nuisance flooding of intersection with most rainstorms; affects crosswalk.	Moderate	E Fir Street upgrade planned.	Low	Limited water quality improvements.	Moderate	High visibility site, at Park entrance.	High	Field observations made by City staff and complaints received.	Moderate	Low risk but well-known problem with documented complaints.
2.17 (2.29 added)	S Brown and Hammond Drainage Improvements	Drainage	Upgrade and stormwater planning	Improving and/or re-directing drainage will reduce flooding along E Hammond	High	Regular flooding of commercial driveways.	Low	1.00 and 1.09 address this problem.	Moderate	Long-term resolution would reduce runoff and water quality impacts to Bell Creek.	High-Moderate	High visibility site, affects entrance to Senior Center.	High	Field observations, regular flood response and mitigation by City staff, and complaints received.	High-Moderate	Risk well understood, but Stormwater Planning Project (1.00, 1.09) recommendations unknown.

Table E-1 (continued). Qualitative CIP Project Prioritization.

Proj. No.	Project Name	Problem Type	Project Classification		Risk		Project Efficiency		Funding Potential		Public Sentiment		Data Quality		Overall Priority	
			Class	Reason for Class	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Priority	Reason for Priority
2.23	Centennial Place Infiltration and Inflow Investigation	I/I issue	Upgrade	Redirect stormwater flows from sewer to existing or new stormwater system	High-Moderate	Continuous but limited stormwater flow to sewer. Added water to sewer increases risk/lowers resiliency.	Moderate-Low	Centennial Place (City Park) improvements on CIP but not near future.	Moderate	Limited water quality improvements, but City Parks improvement may have grant potential.	Low	Low visibility site.	High	Field observations made by City staff.	High-Moderate	High-Moderate risk problem due to sewer inflow.
2.25	Etta Street Infiltration and Inflow Investigation	I/I issue	Upgrade	Redirect stormwater flows from sewer	High-Moderate	Continuous stormwater flow to sewer. Added water to sewer increases risk/lowers resiliency.	High	Etta St on CIP for 2016 or 2017.	Low	Limited water quality improvements but sewer benefits.	Moderate-Low	Affects businesses with access off Etta.	Moderate	Field observations made by City staff, but extent of connections unknown.	High-Moderate	High-Moderate risk problem.
2.26	River Road Storage Project	Stormwater system capacity (often via irrigation conveyances)	Planning	Planning for joint irrigation/ stormwater detention	High	High flow in irrigation canal contributing to multiple high risk flooding problems in City and receiving waters.	High	Multiple interested stakeholders and multiple benefits if stormwater solution is coupled with irrigation storage solution.	High	Strong candidate for funding through: watershed planning, habitat enhancement, water resource management (storage for irrigation). High potential for cost sharing with County and irrigation district, etc.	Moderate	Limited interest from general public, but high interest among affected parties.	High	Long history of frequent problems and multiple past studies; feasibility information available from irrigation managers.	High	High risk problem, contender for grant funding and high project efficiency.
2.28 (related to 2.64 and 4.10)	W Fir between N 5th and Sequim Avenue	Drainage	Upgrade	Street scheduled for reconstruction	Moderate	Surface damage due to lack of stormwater facilities.	High	Street is scheduled for reconstruction.	Moderate	Long-term resolution would reduce runoff to Gieren Creek and street damage.	High	Main arterial access to schools. Corrects deficiency and surface damage.	High	Field observations made by City staff and public.	High	Moderate-High risk problem, but has high public sentiment and efficiency.

Table E-1 (continued). Qualitative CIP Project Prioritization.

Proj. No.	Project Name	Problem Type	Project Classification		Risk		Project Efficiency		Funding Potential		Public Sentiment		Data Quality		Overall Priority	
			Class	Reason for Class	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Priority	Reason for Priority
2.34	Clara Crest Way/ Highland Hills Runoff Abatement	Drainage	Upgrade	Rehabilitate detention pond(s) or other project	High-Moderate	Flooding and risk to City streets, private property, receiving waters.	High	Discussions with Homeowners' Assn. and County underway.	Moderate	Resolution would reduce runoff and water quality impacts to Bell Creek.	Moderate	Big concern for residents of Miller Rd.	High	Issue is Well-documented, but pond performance is not fully known.	High-Moderate	High-Moderate risk problem with high project efficiency.
2.49	Silberhorn and River Road Drainage Improvements	Drainage	Upgrade	Currently no drainage system	Moderate-Low	Frequent flooding erodes roadway and requires flood response during storms.	Low	Unless County cooperates on resolution.	Low	Limited water quality improvements.	Moderate	Nuisance for frequent users.	Moderate	Field observations made by City staff and complaints received.	Moderate	Nuisance, but ponded runoff eventually drains/ infiltrates.
2.53	W Spruce Street Structure Upgrade	Infiltration capacity	Upgrade	Upgrade facilities to restore infiltration rates	Moderate	Frequent flooding of road and private garage with street runoff.	Low	Isolated problem.	Low	Limited water quality improvements.	Moderate	Complaints about flooding.	Moderate	Field observations made by City staff and complaints received, but unknown if long-term solution requires upgrade.	Low	City recently maintained structure and just needs to monitor flooding.
2.62	Roadside ditch along West Sequim Bay Rd uphill from Marina	Drainage	Upgrade	Replace culverts and upgrade ditches to provide more capacity	Low	Overflow is relatively rare.	Low	No known concurrent projects planned.	Low-Moderate	Johnson Creek and Sequim Bay are receiving waters for ditch overflow.	Low	No complaints.	Low	Specific cause and timing of flooding is unknown.	Low	Low risk problem.
2.63	W Prairie Street Green Street Upgrade (between Sequim Avenue and 2nd Avenue)	Drainage	Upgrade	No drainage facilities currently; needs green infrastructure	Moderate	Street runoff enters private property and ponds or infiltrates.	High	Street and utility upgrades also needed.	High-Moderate	Potential pilot project; combine with utility upgrades.	High	Neighborhood revitalization is a Council goal.	High	Field observations made by City staff and complaints received.	High	High project efficiency, sentiment, and funding potential.
2.64 (related to 2.28 and 4.10)	W Fir between 5th and Sequim Avenue Drainage Improvements	Drainage	Upgrade	Ineffective drainage, street runoff flows onto school property near Admin bldg.	Moderate	Street runoff enters private property, ponds against Admin. bldg. foundation.	High	Street and utility upgrades needed as well, on CIP for 2016-17.	High	In conjunction with W Fir improvements underway.	Moderate	School District concerned about ponding next to foundation.	Moderate-High	Observed by School District and City staff.	High	Efficiency with other projects along Fir St.

Table E-1 (continued). Qualitative CIP Project Prioritization.

Proj. No.	Project Name	Problem Type	Project Classification		Risk		Project Efficiency		Funding Potential		Public Sentiment		Data Quality		Overall Priority	
			Class	Reason for Class	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Priority	Reason for Priority
2.67	E Cedar south side east of Dunlap	Drainage	Upgrade	Upgrade drainage facilities.	Moderate	Flooding of private property.	High	City has already added berm to direct flows around private property.	Low	Limited water quality improvements.	Moderate	Flooding of private property.	High	Field observations made by City staff.	Moderate	City recently added berm to direct flows, needs to monitor drainage further downstream.
2.68	Emerald Highlands ponds	Drainage	Maintenance	Detention ponds need maintenance.	Moderate-High	Ponds over flow to Bell Creek at 101 off-ramp.	Low	No known concurrent projects planned.	Low	To be conducted as O&M activity.	Low-Moderate	Corrects deficiency; addresses local residents' complaints.	High	Field observations made by City staff.	Moderate-High	City recently maintained north pond; south pond still needs maintenance.
2.74	Washington & Sequim intersection	Drainage/ infiltration capacity	Maintenance/ upgrade	Maintain or upgrade facilities to restore infiltration rates.	Moderate	If flooding occurs, would be at major intersection.	Low	No known concurrent projects planned.	Moderate	Some water quality improvement potential if treatment capabilities are added.	Moderate	Corrects deficiency at high-visibility site.	High	Field observations made by City staff and public.	Moderate-High	City responsibility to correct problem, though relatively low risk.
2.75	9th Avenue and Honeycomb	Drainage	Upgrade	Upgrade drainage system.	Moderate	Some ponding and surface damage to street.	Low	No known concurrent projects planned.	Moderate	Long-term resolution would reduce runoff and street damage.	Moderate	Corrects deficiency and surface damage.	Moderate-High	Field observations made by City staff.	Moderate	Moderate risk problem due to lack of stormwater facilities.
3.01 (also formerly 2.43)	Seal Street Drainage Improvements	I/I Issue and drainage	Upgrade	Divert flows from alley and/or infiltration pipes to a new or existing infiltration system	Moderate	Frequent flooding of alley properties, private parking lot and nearby apartments.	Low	No known concurrent projects planned.	Low	Limited water quality improvements.	Moderate	Complaints about flooding in parking lot off Cedar.	Moderate	Field observations made by City staff and complaints received, but unknown if solution requires major upgrade.	Moderate-High	City recently maintained parking lot facility; alley runoff may still need to be addressed.
3.02	N 7th Avenue Structure Maintenance/ Upgrade	Infiltration facility maintenance/ capacity	Maintenance/ upgrade	Maintain or upgrade facilities to restore infiltration rates	Moderate	Frequent flooding of private parking lot with City street runoff.	Low	No known concurrent projects planned.	Low	Limited water quality improvements.	Low	Low visibility.	High	Field observations made by City staff and complaints received, but unknown if resolved.	Moderate	Public connection to private system removed Fall 2015; staff will observe results.
3.04	S 7th Avenue Drainage Improvements	Stormwater in irrigation system	Upgrade	Divert public street runoff from irrigation system to stormwater system	Low	No flooding.	Low	No known concurrent projects planned.	Moderate-Low	Irrigation system discharges to Gierin Creek.	Low-Moderate	Low visibility except for owner (irrigation company).	High	Field observations made by City staff and irrigators.	Moderate-Low	City responsibility to correct problem, though relatively low risk.

Table E-1 (continued). Qualitative CIP Project Prioritization.

Proj. No.	Project Name	Problem Type	Project Classification		Risk		Project Efficiency		Funding Potential		Public Sentiment		Data Quality		Overall Priority	
			Class	Reason for Class	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Priority	Reason for Priority
4.10 (related to 2.28 and 2.64)	School Property Drainage and I/I Improvements	I/I Issue and drainage	Upgrade	Upgrade school's stormwater system to infiltrate stormwater on-site and eliminate inflow to sewer	High	Risk is high to water reclamation facility (WRF); Fir St. flooding also big issue.	Moderate-High	Coordinate with current water projects along Fir Street, and with school district projects.	Moderate	Contender for water quality grant funding. Funding will need to come from School District.	High	High visibility site and potential for public involvement/ education through the school.	Moderate	School's stormwater system is not well understood, but some plans exist. Problem commonly observed on school grounds.	High-Moderate	High risk and good opportunity for grant funding, public involvement and education.
4.11	N Sequim Avenue, N 5th Avenue, and Fir Drainage Improvements	Stormwater in irrigation ditch	Upgrade	Upgrading system operation will improve capacity and distribution of stormwater	High	Frequent flooding along major arterial/ corners.	High	Should be addressed during Fir St. improvements, on CIP for 2016-17.	Moderate-Low	Runoff discharges to Gierin Creek but public funding of private irrigation company facilities not likely.	High	High visibility sites.	High	Well-documented problems, but unknown if site specific solution will be required.	Moderate-High	High risk, but problem may solve itself if 2.26 is implemented or through capital project 2016-17.
4.14	East Silberhorn Road (east of Petal Lane) Drainage Improvements	Drainage	Stormwater planning	Providing upstream detention and infiltration will reduce flooding downstream	High	Even higher potential for flooding if the upstream area is developed.	High	High potential of coordinating with future development; coordination with irrigators and County.	Low	Limited water quality improvements and development is required to provide stormwater drainage per County Code (runoff originates in County).	High	Silberhorn Rd. and adjacent (north and south) properties flood regularly, former "west fork Bell Creek."	Moderate-High	Solution to current and future problem is contingent development and 2.26.	Moderate-High	High risk, but problem may solve itself if new development adheres to City Code and 2.26 is implemented.
4.24	S 3rd Ditch Drainage Improvements	Stormwater in irrigation system	Upgrade	Replace culvert installed by previous owners	Moderate	Floods during moderate and extreme storm events	Low	No known concurrent projects planned.	Low	Limited water quality improvements.	Low	Corrects deficiency.	High	Well-documented problem, field observations made by City staff and irrigators.	Moderate	Culvert should be repaired, but is not an urgent repair.
4.31	E Washington Drainage Improvements	Stormwater in irrigation system	Upgrade	Upgrade the irrigation system inlet to increase capacity and better contain high flows	Low	Flooding in parking lot (but currently rare).	Low	Private facility.	Low	Runoff discharges to Bell Creek, but solving capacity problem won't change this.	Low	Few complaints.	High	Well-documented problem, but solution is contingent on Sequim Area Watershed Plan.	Low	Well-documented moderate risk, but Sequim Area Watershed Plan recommendations unknown.

Table E-1 (continued). Qualitative CIP Project Prioritization.

Proj. No.	Project Name	Problem Type	Project Classification		Risk		Project Efficiency		Funding Potential		Public Sentiment		Data Quality		Overall Priority	
			Class	Reason for Class	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Rating	Reason for Rating	Priority	Reason for Priority
4.36	West Happy Valley and Sporseen Ditch Improvements	Drainage	Upgrade	Upgrade the Sporseen ditch system to handle higher flows	Moderate	Flooding in public roads.	Low	No known concurrent projects planned.	Low	Limited water quality improvements.	Low	No complaints.	Moderate	Well-documented problem, but unknown if site specific solution will be required.	High-Moderate (but not City owned)	Risk understood, but problem may solve itself if 2.26 is implemented.
4.37	Highland Canal breaches	Maintenance	Maintain canal	Canal walls need regular maintenance	High	Breach or collapse has high impact downstream.	Moderate	Irrigation District may have funding.	Low	Low possibility for City funds, grants unlikely.	Moderate-Low	Few complaints.	High	Irrigation District performs regular inspections.	Moderate (but not City-owned)	Not high priority for City funding.
4.38	Various single-family residential inflow investigation and elimination	I/I issue	Upgrade	Redirect stormwater flows from sewer	High-Moderate	Continuous stormwater flow to sewer. Added water to sewer increases risk/lowers resiliency.	Low	No known concurrent City projects planned.	Low-Moderate	Usually private property owner expense, not a City expense; limited water quality improvements.	Moderate-High	Dependent on number of residences with connections, good opportunity for public outreach.	Moderate	Field observations made by City staff, but extent of connections unknown.	High-Moderate	High-Moderate risk problem due to sewer inflow.
4.44	Bell Creek Café/ Evergreen Collision	Drainage	Upgrade	Upgrade infiltration system.	High-Moderate	Floods driveway to businesses, direct discharge to Bell Creek.	Low	No known concurrent projects planned.	Low	Low possibility for City funds, grants unlikely unless fish passage ability needed.	Moderate-Low	Few complaints, but quite a visible problem.	High	Well-documented problem, field observations made by City staff and public.	Moderate	Reassessment of problem and solution needed; addressed by 1.00/1.09.

APPENDIX F

Capital Improvement Program
Project Summary Sheets and Cost Estimates

This Appendix contains CIP Project Summary Sheets and conceptual cost estimates for ten CIP projects. Note that three additional CIP projects (2.23, 2.34, and 2.68) were identified after CIP project development, and are therefore not included in this Appendix.

CIP Project Summary Sheets

City of Sequim
Capital Improvement Program
Project Summary Sheet

Name: Sequim Area Stormwater- Watershed Plan
Site ID: 1.00
Project Priority: Top 10
Estimated Cost: $742,000

PROBLEM SUMMARY

Long history of flooding problems along the Bell Creek Corridor and in western Sequim. Stormwater input via active and abandoned irrigation conveyances adds to flooding across City, and future development may increase flooding in already flooded/ problem areas. It is an opportune time to implement a watershed wide solution while there is still available space to implement projects that will address water quantity and quality. The Plan would address problems 1.02, 1.04, 1.06, 1.07, 1.08, 1.09, 1.10, 2.17, 4.04, and 4.31.

PRIORITIZATION

Prioritization Criteria	Ranking	Justification
Risk	High	Regularly occurring problem with flooding of private and public property, erosion, habitat degradation and water quality impairment. Needs to occur before other projects.
Efficiency	High	Multiple interested stakeholders and multiple benefits if stormwater solution is coupled with irrigation storage solution
Funding Potential	High	Strong candidate for funding through: watershed planning, habitat enhancement, water resource management (storage for irrigation). High potential for cost sharing with County and irrigation district.
Public Sentiment	Moderate-Low	Limited interest from general public
Data Quality	High	Long history of frequent problems and multiple past studies
Overall Priority	**High**	**High risk problem, contender for grant funding and high project efficiency**



Flooding along Bell Creek at RM 1.55.

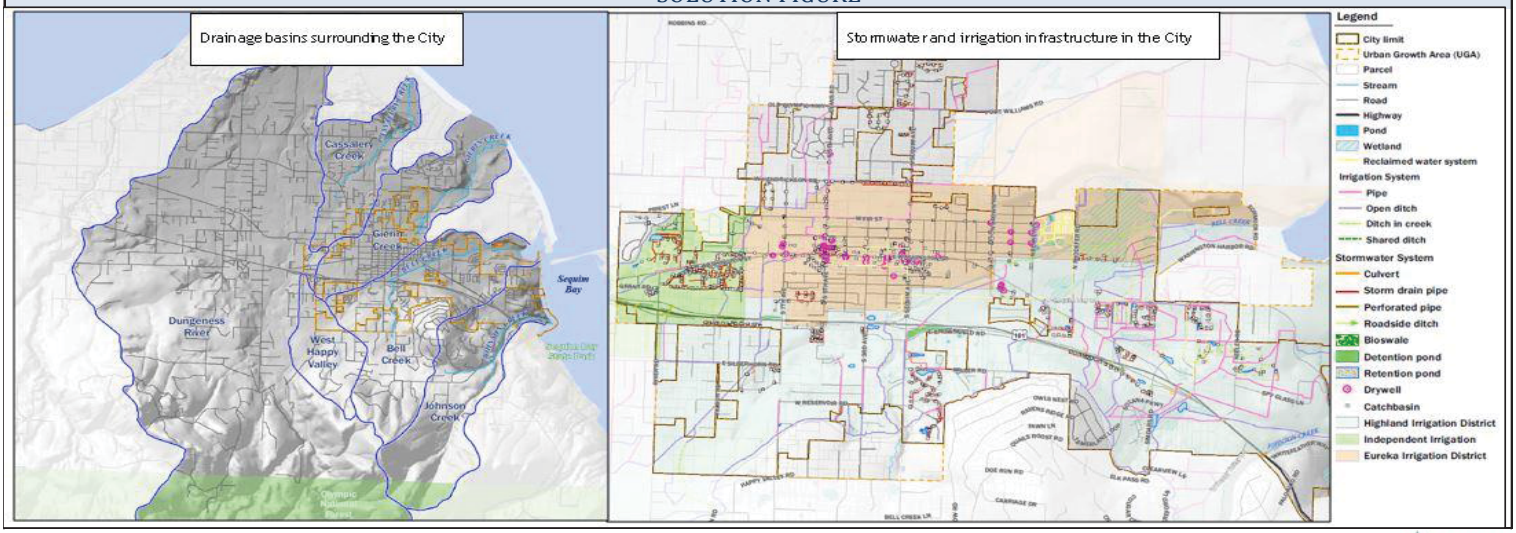


Flooding along Bell Creek at RM 1.8.

PROPOSED SOLUTION

Develop a Sequim Area Stormwater-Watershed Plan (Plan) that identifies a comprehensive strategy for optimizing infiltration opportunities and ensuring adequate surface water conveyance capacity to accommodate future growth, while improving water quality, preserving and enhancing habitat, and recharging groundwater – all in coordination with planning for future development. Irrigation systems and development in Clallam County areas and the UGA upstream of the City has a significant potential to affect flows in Bell Creek; therefore, the County and irrigation purveyors have an important role in developing goals and objectives for the Plan and subsequent projects for implementation. Project scope would include: 1) Confirm goals and objectives of the watershed plan, 2) Develop funding strategy and apply for grants, 3) Existing conditions assessment, 4) Future scenarios development, 5) Hydrologic and hydraulic modeling, 6) Draft and Final Plan, 7) Implementation.

SOLUTION FIGURE



HERRERA

City of Sequim
Capital Improvement Program
Project Summary Sheet

Name: Bell Creek Culvert Upgrade at Blake Ave (RM 1.5)
Site ID: 1.04
Project Priority: Top 10
Estimated Cost: $350,000

PROBLEM SUMMARY

Two culverts along Bell Creek used to convey creek flows under driveway to Carrie Blake Park (off of North Blake Ave.) do not have adequate hydraulic capacity to handle high flows. Flooding has been observed in the park entry and road.

PRIORITIZATION

Prioritization Criteria	Ranking	Justification
Risk	High	Occasionally (every 2 or 3 years) floods residential street and entrance to public park
Efficiency	Low	No known concurrent projects planned
Funding Potential	Moderate	Removal of fish passage barrier may be eligible for grant funding
Public Sentiment	Moderate	No current complaints but highly visible location next to park
Data Quality	Moderate	Risk well understood, but Sequim Area Stormwater- Watershed Plan recommendations unknown
Overall Priority	**High**	**Well documented high risk that may be grant eligible, located at downstream end of Bell Creek**



Double culvert under entrance to park facing downstream

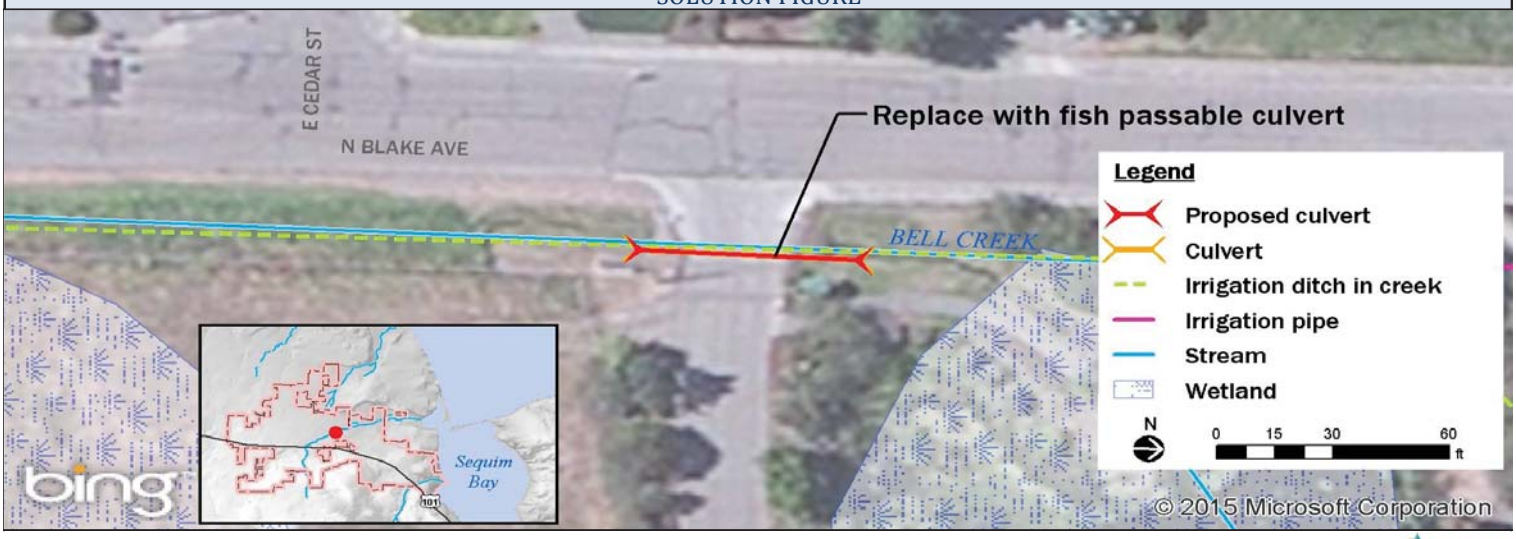


Double culvert under entrance to park facing upstream

PROPOSED SOLUTION

Evaluate culvert as part of 1.00 (Sequim Area Stormwater- Watershed Plan) implementation. Replace existing 42” wide x 26” high and 40” wide x 28” high culvert with fish passable culvert. Cost estimate assumptions: Remove existing culverts. Install 30 LF± of new 12ft wide x 5ft high box culvert. Armor inlet and outlet. Remove and replace concrete driveway entrance.

SOLUTION FIGURE



HERRERA

City of Sequim
Capital Improvement Program
Project Summary Sheet

Name: Bell Creek Culvert Upgrade at Washington (RM 1.8)
Site ID: 1.07
Project Priority: Top 10
Estimated Cost: $980,000

PROBLEM SUMMARY

Existing culvert downstream of Culvert 1.08 along Bell Creek does not have adequate capacity and the roadway at intersection of S Brown and E Washington Streets floods during high flow events. Culvert starts out heading north, angles NE under E Washington and S Brown Intersection, then joins and 128 inch wide x 83 inch high culvert under Les Schwab driveway.

PRIORITIZATION

Prioritization Criteria	Ranking	Justification
Risk	High	Annually floods arterial street and driveways to businesses
Efficiency	Low	Possible implementation with South Brown improvements
Funding Potential	Moderate	Removal of documented fish passage barrier may be eligible for grant funding
Public Sentiment	High	Strong public opinion that this is an important problem
Data Quality	Moderate	Risk well understood, but Sequim Area Stormwater-Watershed Plan recommendations unknown
Overall Priority	**High-Moderate**	**Well documented high risk that may be grant eligible**



Culvert to be replaced at intersection of S Brown and E Washington Streets, facing north

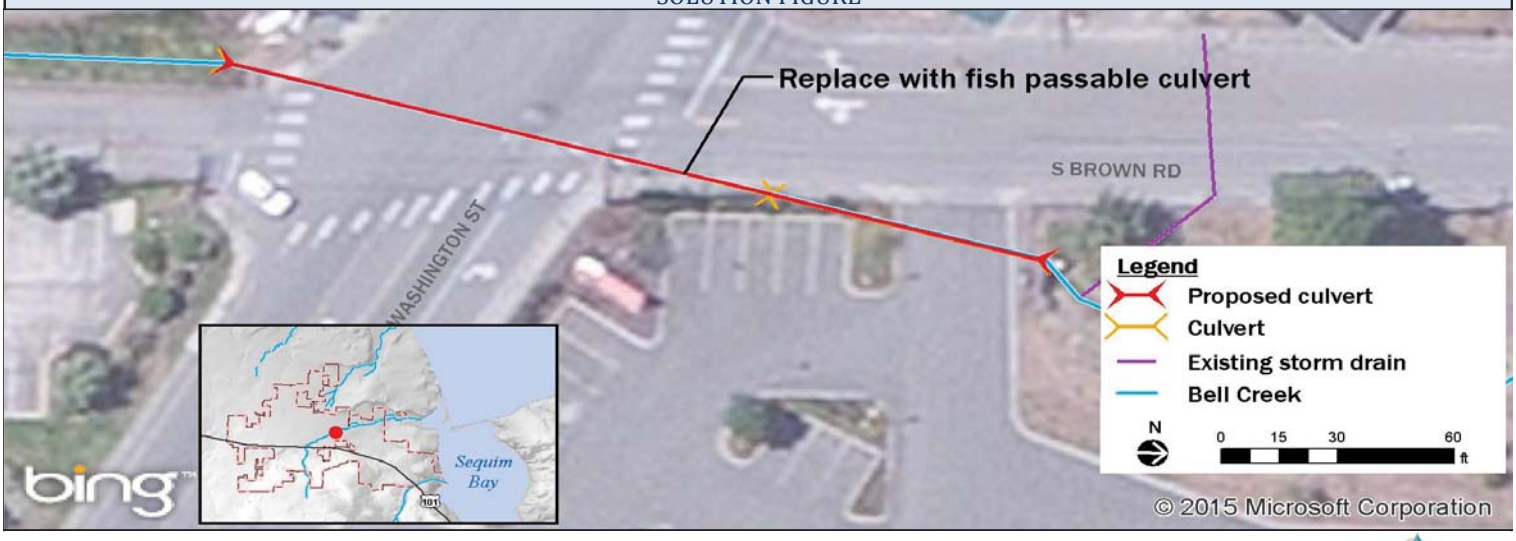


Downstream culvert, facing south

PROPOSED SOLUTION

Evaluate culvert as part of 1.00 (Sequim Area Stormwater- Watershed Plan) implementation. Replace existing 48" dia. culvert with fish passable culvert. Cost estimate assumptions: Remove existing 48" culvert and culvert under Les Schwab driveway. Install 220 LF of 128" wide x 83" high arch culvert to match dimensions of existing culvert under the Les Schwab driveway. Install a concrete headwall on the upstream end of the culvert to maintain existing channel width and adjacent roadway alignments. Install approximately 1 ft cobble in the base of the culvert to meet fish passibility criteria. Adjust 2 water mains that currently cross the culvert. Existing culvert under Les Schwab driveway will not be reused based on utility conflicts with the existing alignment.

SOLUTION FIGURE



HERRERA

City of Sequim
Capital Improvement Program
Project Summary Sheet

Name: Middle Reach Bell Creek Corridor Planning
Site ID: 1.09
Project Priority: Top 10
Estimated Cost: $365,000

PROBLEM SUMMARY

Bell Creek, Highland irrigation ditch, and culverts along Bell Creek corridor receive stormwater runoff from upland areas during storm events, causing flooding in the undeveloped middle reach of Bell Creek and in downstream culverts. Specific reaches of lower and middle Bell Creek are listed as impaired water bodies on Ecology's 303(d) list due to high fecal coliform bacteria concentrations dissolved oxygen, and benthic-Index of Biological Integrity (B-IBI); a total maximum daily load (TMDL) study and water quality implementation plan may be required to address impairments. If not managed properly, future development will increase storm flows and exacerbate existing flooding and water quality problems, and an important source of groundwater recharge will be lost. This project would also address problems 2.17/2.29 and 1.02, 1.04, 1.06, 1.07, 1.08, 1.10.

PRIORITIZATION

Prioritization Criteria	Ranking	Justification
Risk	High	Regularly occurring problem with flooding of private and public property, erosion, habitat degradation and water quality impairment. Needs to occur before other projects.
Efficiency	High	Multiple interested stakeholders and multiple benefits
Funding Potential	High	Strong candidate for funding through: watershed planning, habitat enhancement, and water resource management (aquifer storage)
Public Sentiment	High-Moderate	General public interest in restoration of this area
Data Quality	High	Long history of frequent problems and multiple past studies
Overall Priority	**High**	**Multiple high risk projects are dependent on this plan**



Flooding on undeveloped floodplain area facing west

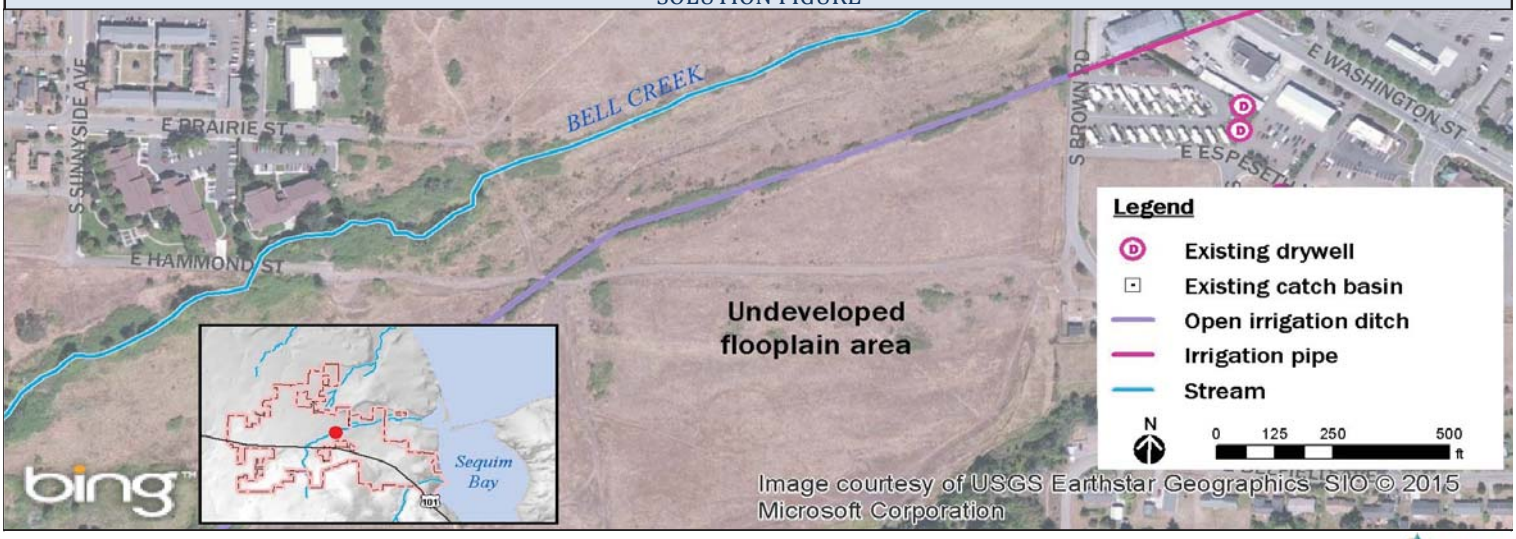


Bell Creek running along the north edge of the undeveloped floodplain area, facing

PROPOSED SOLUTION

Identify a strategy for optimizing infiltration opportunities and ensuring adequate surface water conveyance capacity to accommodate future growth, while improving water quality, preserving and enhancing habitat, and recharging groundwater – all in coordination with planning for future development. Development in Clallam County areas and the UGA upstream of the City has a significant potential to affect flows in Bell Creek; therefore, the County and irrigation purveyors have an important role in developing goals and objectives for the Plan and subsequent projects for implementation. Project scope would include: 1) Confirm goals and objectives of the watershed plan, 2) Develop funding strategy and apply for grants, 3) Existing conditions assessment, 4) Future scenarios development, 5) Hydrologic and hydraulic modeling, 6) Draft and Final Plan, 7) Implementation.

SOLUTION FIGURE



HERRERA

City of Sequim
Capital Improvement Program
Project Summary Sheet

Name: S 3rd Avenue (west ROW south of Bypass) Drainage
Site ID: 2.04
Project Priority: Top 10
Estimated Cost: $70,000

PROBLEM SUMMARY

Storm water runoff from South 3rd Avenue downstream of the Hideaway Homes Mobile Home Park and from the park itself flows down the steep slope on the west side of South 3rd Avenue and onto the Sequim School District Transportation Facility property, intermittently causing localized flooding. A poorly defined ditch runs along the base of the road fill slope to a culvert under the entry drive into the transportation facility; this ditch is filled with silt, sand, and gravel eroded from the South 3rd Avenue fill slope. Discharge from entry drive culvert flows to a catch basin approximately 10 feet north of the outlet end of the culvert; the catch basin is covered with silt, sand, and gravel eroded from the South 3rd Avenue fill slope.

PRIORITIZATION

Prioritization Criteria	Ranking	Justification
Risk	Moderate	High frequency flooding on private property could escalate to property damage
Efficiency	Low	No known concurrent projects planned
Funding Potential	Low	Limited water quality improvements
Public Sentiment	Moderate	Low visibility site but a concern for commercial and school property owners
Data Quality	High	Field observations and flood response by City staff
Overall Priority	**High-Moderate**	**Moderate risk flooding problem on private property, eroding City ROW**



Erosion of fill slope along 3rd Ave facing south.

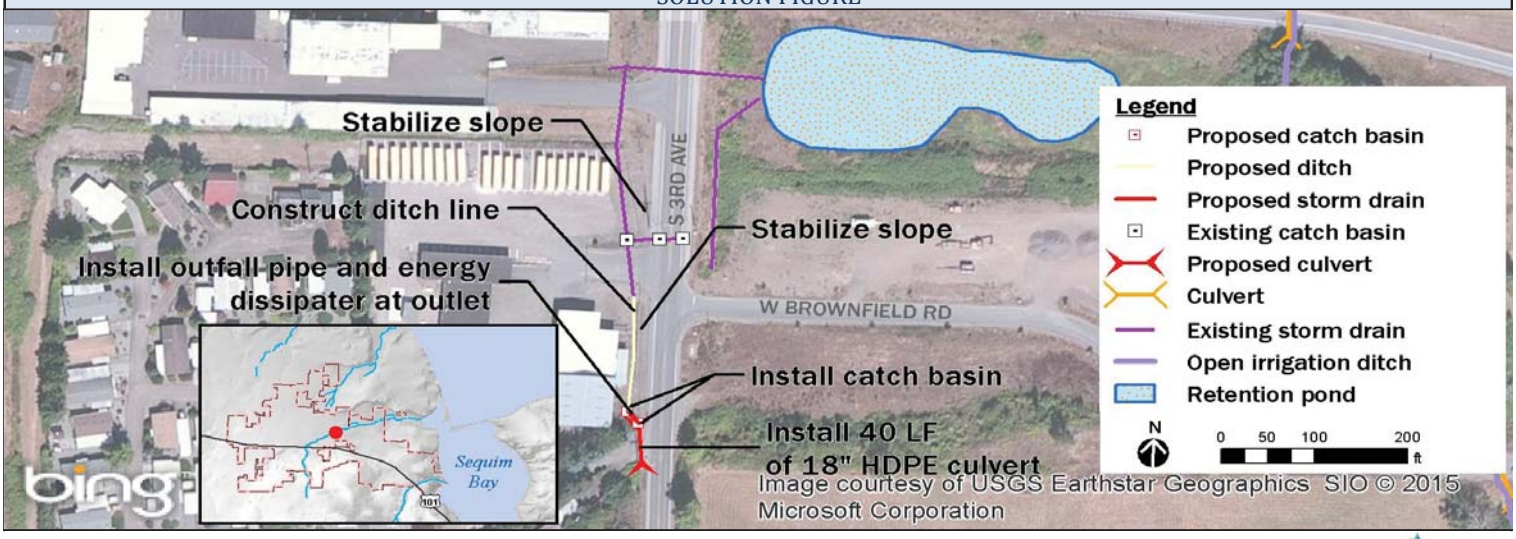


Sequim School District Transportation Facility property facing north.

PROPOSED SOLUTION

Pipe flows to base of the fill slope and route the runoff via ditches across the property. Install an 18" diameter culvert under the Hideaway Homes Mobile Home Park driveway and a catch basin at the discharge end of the culvert. Install an outfall pipe down the steep slope with an energy dissipater at the outlet. Construct a new ditch line along the base of the fill slope (this ditch with be on School District property; an easement will be needed for these improvements). Construct a short ditch section from the end of the culvert under the Transportation Facility entry drive to the catch basin at the base of the roadway fill. Stabilize the fill slopes with quarry spall slope protection to prevent further erosion of the fill. Cost estimate assumptions: 60 LF 18 inch diameter storm pipe. 1 Type 1 catch basin, 1 Type 1 catch basin with energy dissipater. 150 LF ditch excavation. 150 CY quarry spalls for slope protection.

SOLUTION FIGURE



HERRERA

City of Sequim
Capital Improvement Program
Project Summary Sheet

Name: N 5th Street Structure Upgrade
Site ID: 2.05
Project Priority: Top 10
Estimated Cost: $120,000

PROBLEM SUMMARY

Drywell at south east corner of W Cedar and N 5th Ave intersection floods at inlet. Flooding extends along cross walk and up ramp, imposing risk to pedestrians (especially when icy). Maintenance was recently performed but the structure still does not provide adequate drainage.

PRIORITIZATION

Prioritization Criteria	Ranking	Justification
Risk	Moderate	Frequently floods crosswalk creating hazardous condition for pedestrians
Efficiency	Low	No known concurrent projects planned
Funding Potential	Low	Limited water quality improvements
Public Sentiment	Moderate	Corrects deficiency at moderately visible site
Data Quality	High	Field observations made by City staff and complaints received
Overall Priority	**High-Moderate**	**Moderate risk flooding of public crosswalk, well known problem and documented complaints**



Crosswalk facing north

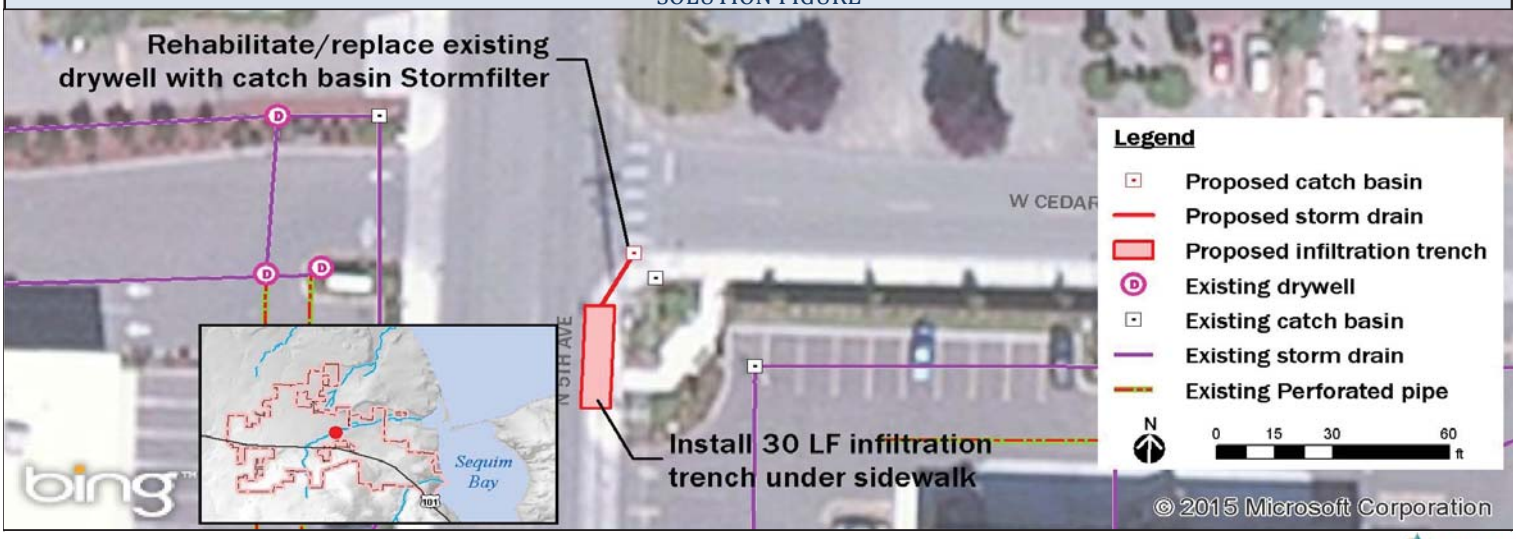


Drywell on south side of crosswalk, facing west

PROPOSED SOLUTION

Rehabilitate infiltration facility (drywell) to restore capacity. Empty drywell to clean and inspect facility. If drywell is compromised, install an infiltration trench and stormwater treatment unit. Cost estimate assumptions: Remove existing drywell. Install 2-cartridge Contech Catch Basin Stormfilter. Install 30 LF infiltration trench. Remove/replace 30 LF sidewalk.

SOLUTION FIGURE



HERRERA

City of Sequim
Capital Improvement Program
Project Summary Sheet

Name: 7th Street and Washington Upgrade
Site ID: 2.12
Project Priority: Top 10
Estimated Cost: $180,000

PROBLEM SUMMARY

Flooding at south west inlet at intersection of S 7th Ave and W Washington St. Structure is full of sediment. Maintenance was recently performed but the structure still does not drain fast enough.

PRIORITIZATION

Prioritization Criteria	Ranking	Justification
Risk	High	Frequently floods major arterial intersection.
Efficiency	Low	No known concurrent projects planned
Funding Potential	Low	Limited water quality improvements
Public Sentiment	High-Moderate	Corrects deficiency at highly visible site
Data Quality	High	Field observations made by City staff and complaints received
Overall Priority	**High-Moderate**	**High risk flooding of arterial, well known problem and documented complaints**



Drywell on west side of intersection

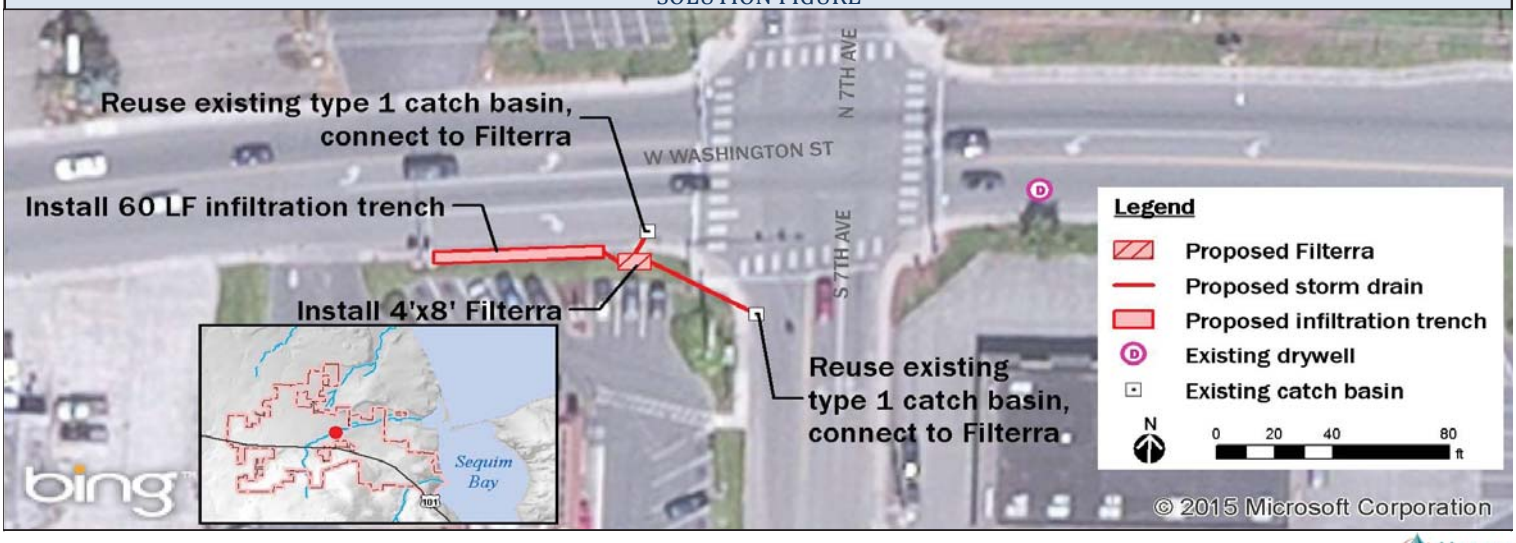


Drywell on south east side of intersection

PROPOSED SOLUTION

Install Filterra bio-filtration unit for treatment of runoff and protection of the infiltration facility, tie existing catch basins into Filterra, install infiltration trench for infiltration of runoff. Cost estimate assumptions: Reuse existing type 1 catch basins. Install 60 LF 8 inch diameter storm pipe. Install 60 LF infiltration trench. Remove/replace 60 LF sidewalk.

SOLUTION FIGURE



HERRERA

City of Sequim
Capital Improvement Program
Project Summary Sheet

Name: Etta Street Infiltration and Inflow Investigation
Site ID: 2.25
Project Priority: Top 10
Estimated Cost: $91,000

PROBLEM SUMMARY

Surface runoff from alley drains to two existing catch basins and it is unclear where the catch basins drain (infiltration trench, drywell, or sanitary sewer). It appears that most of the runoff flows into a catch basin located out of the City ROW. Downspout connection appears to tie into sanitary sewer (actual connections to be confirmed).

PRIORITIZATION

Prioritization Criteria	Ranking	Justification
Risk	High-Moderate	Continuous stormwater flow to sewer. Added water to sewer increases risk/ lowers resiliency.
Efficiency	High	Etta St on CIP for 2016
Funding Potential	Low	Limited water quality improvements but sewer benefits
Public Sentiment	Moderate-Low	Affects businesses with access off Etta St.
Data Quality	Moderate	Field observations made by City staff, but extent of connections unknown
Overall Priority	**High-Moderate**	**High-Moderate risk problem**



Etta Street, facing west

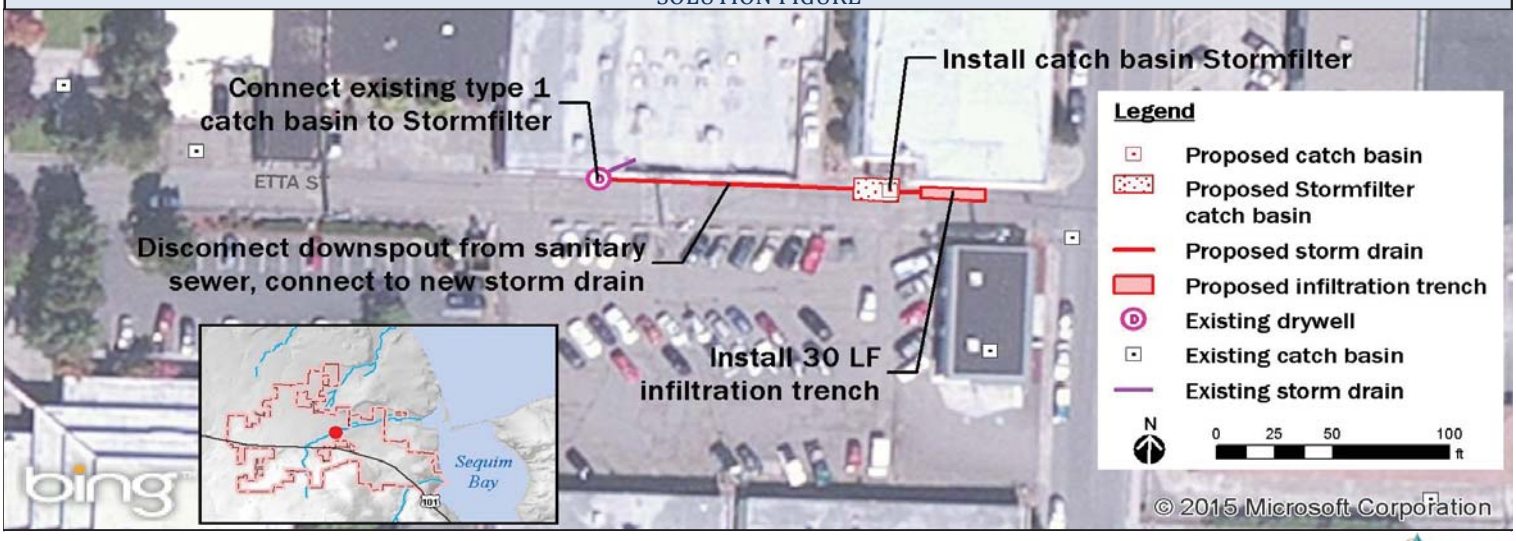


Potential location of connection to sewer on the east end of Etta Street

PROPOSED SOLUTION

Perform testing and investigations to confirm discharge locations of downspouts and catch basins. Divert downspouts and catch basins to Contech Stormfilter. Regrade parts of the alley to direct the stormwater to the existing catch basins or the Stormfilter. Install infiltration trench to dispose of surface runoff. Cost estimate assumptions: Install 2-cartridge Contech Catch Basin Stormfilter. Install 100 LF of 8 inch diameter storm pipe. Install 30 LF infiltration trench. Remove/replace 400 square feet of pavement.

SOLUTION FIGURE



HERRERA

City of Sequim
Capital Improvement Program
Project Summary Sheet

Name: River Road Storage Project
Site ID: 2.26
Project Priority: Top 10
Estimated Cost: $46,000,000

PROBLEM SUMMARY

Flooding of private property within the UGA caused by runoff from west Happy Valley (outside of the UGA) entering Eureka ditch north of Mockingbird Lane. Would address problems 4.11, 4.14, and 4.36.

PRIORITIZATION

Prioritization Criteria	Ranking	Justification
Risk	High	High flow in irrigation canal contributing to multiple high risk flooding problems in City and receiving waters
Efficiency	High	Multiple interested stakeholders and multiple benefits if stormwater solution is coupled with irrigation storage solution
Funding Potential	High	Strong candidate for funding through: watershed planning, habitat enhancement, water resource management (storage for irrigation). High potential for cost sharing with County and irrigation district.
Public Sentiment	Moderate-Low	Limited interest from general public
Data Quality	High	Long history of frequent problems and multiple past studies; feasibility information available from irrigation managers
Overall Priority	**High**	**High risk problem, contender for grant funding and high project efficiency**



Culvert along Eureka Ditch, where flooding has been observed

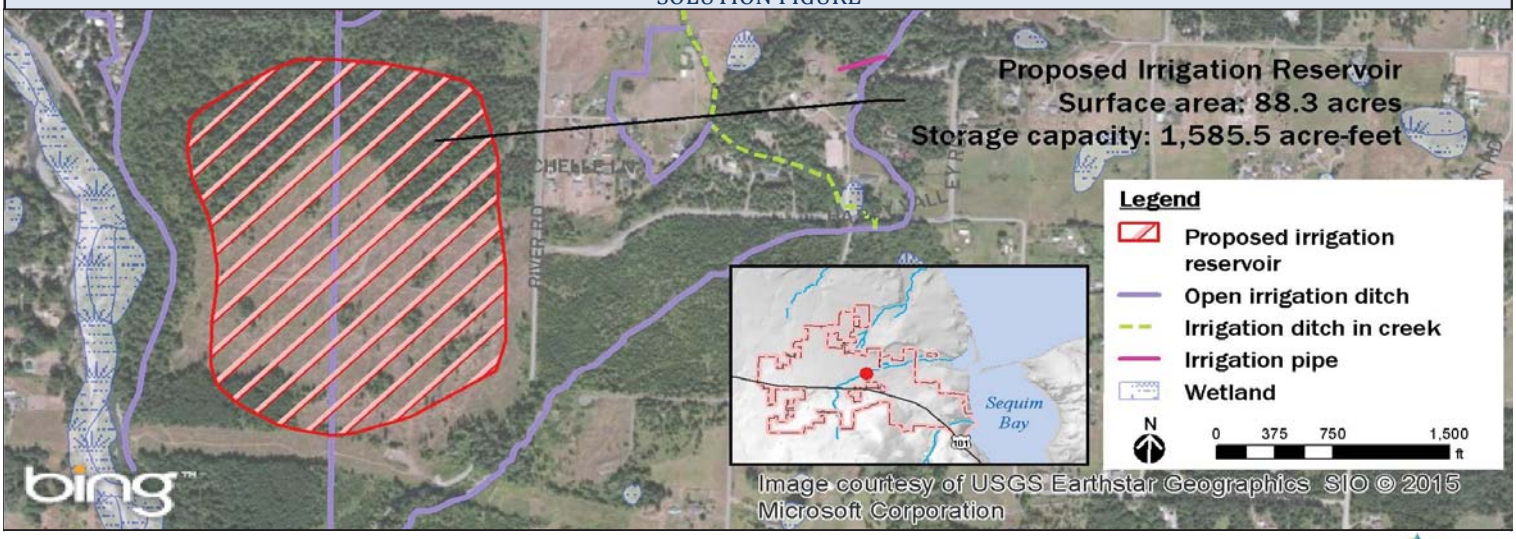


Mockingbird Lane, where ponding has been observed

PROPOSED SOLUTION

Construct a large storage facility to provide stormwater detention by storing water during high flows for use by the Dungeness Water Users Association during the low flow period. To provide stormwater benefits during the wet season, the facility would need to be operated in a manner that would reduce flow to downstream irrigation conveyance through the City of Sequim during storm events. The storage facility is one option under consideration by the Dungeness River Flow Enhancement Project. Project should consider stormwater conveyance for future developments as well as the potential to provide flow control to offset increased from existing and future development.. Cost estimate assumptions: The project would construct a storage facility of approximately 100 acres in size with a storage volume of approximately 1,600 acre feet. Work would include over 700,000 cubic yards of cut and fill.

SOLUTION FIGURE



HERRERA

City of Sequim
Capital Improvement Program
Project Summary Sheet

Name: W Prairie Street Green Street Upgrade
Site ID: 2.63
Project Priority: Top 10
Estimated Cost: $130,000

PROBLEM SUMMARY

Typical of this area and type of development, no storm water management infrastructure exists. The streets have typically been paved to a nominal width of 24 feet and storm water runoff from the roadway flows to the roadside area and infiltrates into the porous subsoil. During periods of intense rainfall intermittent flooding can occur. In addition, oils and grease contained in the runoff can infiltrate into the porous subsoil and potentially enter the groundwater untreated.

PRIORITIZATION

Prioritization Criteria	Ranking	Justification
Risk	Moderate	Street runoff enters private property and ponds or infiltrates
Efficiency	High	Street and utility also upgrades
Funding Potential	High-Moderate	Potential pilot project; combine with utility upgrades
Public Sentiment	High	Neighborhood revitalization is a Council goal
Data Quality	High	Field observations made by City staff and complaints received
Overall Priority	**High**	**High project efficiency, sentiment, and funding potential**



Prairie Street. No existing curbs, gutters, or planters.

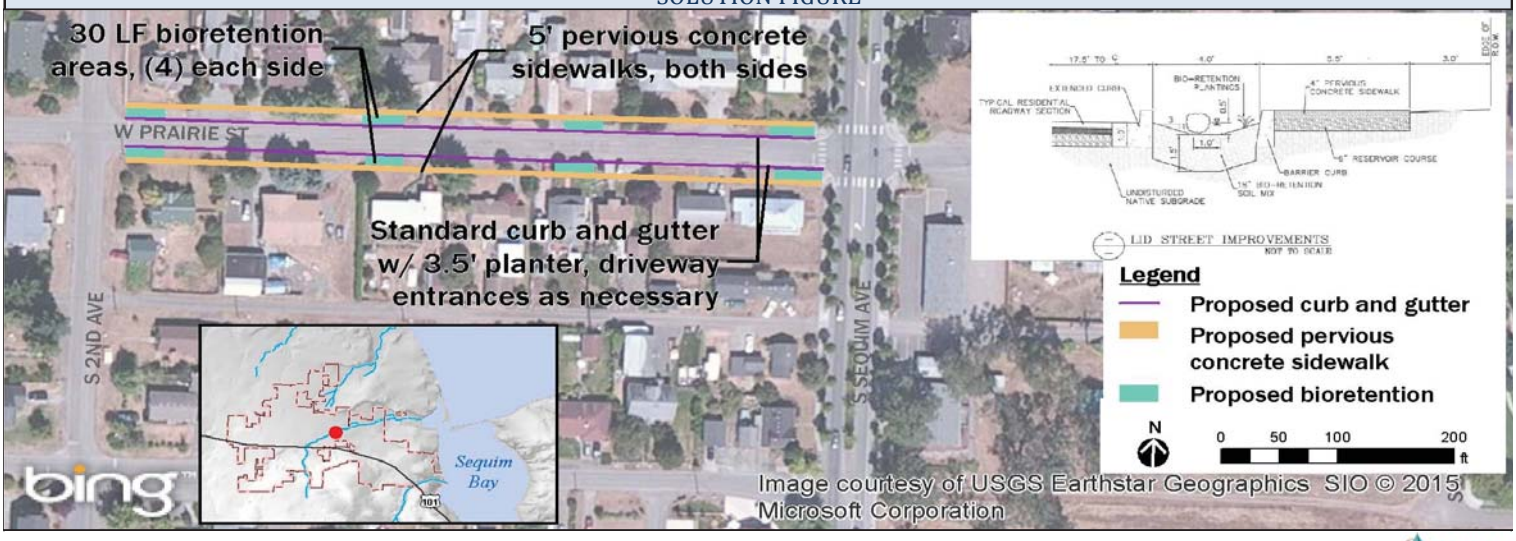


Aerial of Prairie Street

PROPOSED SOLUTION

Provide a demonstration facility for the management of stormwater runoff from fully developed residential streets. The final street configuration would consist of 32 feet of pavement with curb and gutter and porous pavement sidewalks on both sides. Bioretention cells would be constructed between the back of the curb and the sidewalk at intervals along the roadway. For each City block, a total bioretention cell length of 120 feet would be required on each side of the street. Small cells, approximately 30 feet in length, would be constructed at several points along the roadway to avoid driveways and minimize roadway grading. Cost estimate assumptions: 240 LF extruded curb, 310 LF barrier curb. 70 CY pervious sidewalk. 240 LF bioretention (8 cells, 30 LF per cell).

SOLUTION FIGURE



HERRERA

CIP Project Cost Estimates

Sequim Surface Water Master Plan
Herrera Project #14-05826-000

Project: Sequim SMP CIP Program - Project 1.04 (CARRIE BLAKE PARK ENTRANCE)
Prepared by: Steve Zenovic
Checked by: Seth Rodman
Updated: 22-May-15

Note: This cost estimate is approximate. Actual construction bids may vary significantly from this statement of probable costs due to timing of construction, changed conditions, labor rate changes, or other factors beyond the control of the engineers.

ESTIMATED COST OF PROJECT IMPLEMENTATION AT PRELIMINARY DESIGN STAGE

NO.	QUANT.	UNIT	ITEM	UNIT COST	AMOUNT	BASIS OF QUANTITY AND UNIT COST
1	1	LS	MOBILIZATION	10%	$ 10,400	
2	1	LS	EROSION/WATER POLLUTION CONTROL	5%	$ 5,200	
3	1	LS	PROJECT TEMPORARY TRAFFIC CONTROL	5%	$ 5,200	
4	80	SY	DEMOLISH AND REMOVE CONCRETE PAVEMENT	$ 15	$ 1,200	20' ENTRY + CURB; PORT ANGELES WTIP
5	1	LS	REMOVE EXISTING 40" CULVERTS (2)	$ 4,000	$ 4,000	
6	1	LS	REMOVAL OF STRUCTURE AND OBSTRUCTION	$ 1,500	$ 1,500	MISCELLANEOUS FENCING, GRASS
7	30	CY	DEMOLISH AND REMOVE A-C PAVEMENT	$ 10	$ 300	10' EAST OF ENTRY; PORT ANGELES WATERFRONT PH.2 2014
8	360	CY	STRUCTURE EXCAVATION CLASS B INCL. HAUL	$ 25	$ 9,000	PORT ANGELES WATERFRONT PH.2 2014
9	1	LS	5' X 12' X 30 LF BOX CULVERT	$ 54,000	$ 54,000	BASED ON STATE OF IDAHO BOX CULVERT COST ANALYSIS
10	60	TN	STREAMBED COBBLES	$ 30	$ 1,800	2' DEEP IN CULVERT; PORT ANGELES WATERFRONT PH. 2 2014
11	30	CY	CEMENT CONCRETE PAVEMENT	$ 315	$ 9,450	PORT ANGELES WATERFRONT PH.2 2014
12	80	LF	SPLIT RAIL ENTRY FENCE	$ 10	$ 800	PORT ANGELES WATERFRONT PH.2 2014
13	1	LS	STREAM ENHANCEMENT	$ 20,000	$ 20,000	LARGE WOOD PIECES, BOULDERS, GRAVEL, AND BANK PLANTINGS
14	1	LS	SITE RESTORATION	$ 2,000	$ 2,000	
			SUBTOTAL OF DIRECT COSTS		**$ 124,850**	
			SALES TAX (DIRECT COSTS)	**8.4%**	**$ 10,487**	
			TOTAL CONSTRUCTION COST		**$ 135,300**	
			ALLIED COSTS			
			ITEM	**UNIT COST**	**AMOUNT**	**BASIS OF QUANTITY AND UNIT COST**
			PROJECT ADMIN./MANAGEMENT	10%	$ 13,530	
			SURVEY	LS	$ 5,000	
			GEOTECHNICAL ANALYSIS	LS	$ -	NO REPORT ANTICIPATED
			DESIGN	20%	$ 27,060	
			PERMITTING	LS	$ 40,000	LOCAL PERMITS, ONLINE HPA, JARPA FOR CORPS PERMIT, CRITICAL AREAS REPORT, BIOLOGICAL NO EFFECT LETTER
			PROPERTY ACQUISITION	LS	$ -	WITHIN CITY R-O-W OR CITY PARK
			CONSTRUCTION MANAGEMENT	20%	$ 27,060	
			SUBTOTAL OF ALLIED COSTS		**$ 112,700**	
			SUMMARY			
			SUBTOTAL OF DIRECT COSTS		$ 124,850	
			SUBTOTAL OF ALLIED COST		$ 112,700	
			SALES TAX (ON DIRECT COSTS)		$ 10,487	
			CONTINGENCY - AVERAGE	40%	$ 99,000	
			TOTAL ESTIMATED COST		**$ 350,000**	

Sequim Surface Water Master Plan
Herrera Project #14-05826-000

Project: Sequim SMP CIP Program - Project 1.07 (BELL CREEK AT BROWN & WASHINGTON)
Prepared by: Steve Zenovic
Checked by: Seth Rodman
Updated: 22-May-15

Note: This cost estimate is approximate. Actual construction bids may vary significantly from this statement of probable costs due to timing of construction, changed conditions, labor rate changes, or other factors beyond the control o the engineers.

ESTIMATED COST OF PROJECT IMPLEMENTATION AT PRELIMINARY DESIGN STAGE

NO.	QUANT.	UNIT	ITEM	UNIT COST	AMOUNT	BASIS OF QUANTITY AND UNIT COST
1	1	LS	MOBILIZATION	10%	$ 35,600	
2	1	LS	EROSION/WATER POLLUTION CONTROL	5%	$ 17,800	
3	1	LS	PROJECT TEMPORARY TRAFFIC CONTROL	5%	$ 17,800	
4	1	LS	REMOVAL OF STRUCTURE AND OBSTRUCTION	$ 5,000	$ 5,000	200 LF CURB, 300 SF SIDEWALK, CURB RAMP
5	1	LS	REMOVE EXISTING CULVERTS	$ 10,000	$ 10,000	50 LF OF 48" CONCRETE & 50 LF ARCH CULVERT
6	600	SY	DEMOLISH AND REMOVE A-C PAVEMENT	$ 9	$ 5,400	PORT ANGELES WTIP
7	2000	CY	STRUCTURE EXCAVATION CLASS B INCL. HAUL	$ 25	$ 50,000	PORT ANGELES WTIP
8	1100	CY	GRAVEL BASE	$ 30	$ 33,000	PORT ANGELES WTIP
9	550	TN	BALLAST	$ 25	$ 13,750	PORT ANGELES WTIP
10	65	TN	CRUSHED SURFACING TOP COURSE	$ 30	$ 1,950	PORT ANGELES WTIP
11	135	TN	HMA CL 1/2" PG 64-22	$ 150	$ 20,250	PORT ANGELES WTIP
12	220	LF	128" X 83" PIPE ARCH CULVERT	$ 700	$ 154,000	BASED ON 2X MATERIAL COST FROM SUPPLIERS
13	305	TN	STREAMBED COBBLES	$ 40	$ 12,200	PORT ANGELES WTIP; ADJUSTED FOR PIPE LENGTH
14	200	LF	CEMENT CONCRETE CURB AND GUTTER	$ 30	$ 6,000	PORT ANGELES WTIP
15	40	SY	CEMENT CONCRETE SIDEWALK	$ 50	$ 2,000	PORT ANGELES WTIP
16	1	LS	ADJUST WATER LINES	$ 10,000	$ 10,000	2 WATER LINE CROSSINGS @ 50 LF EA
17	1	LS	CONCRETE INLET HEADWALL	$ 7,500	$ 7,500	ASSUME STRUCTURAL CONCRETE AT $1,000 PER CY
18	1	LS	STREAM ENHANCEMENT	$ 20,000	$ 20,000	LARGE WOOD PIECES, BOULDERS, GRAVEL, AND BANK PLANTINGS
19	1	LS	RESTORATION PLANTINGS	$ 5,000	$ 5,000	
			SUBTOTAL OF DIRECT COSTS		**$ 427,250**	
			SALES TAX (DIRECT COSTS)	**8.4%**	**$ 35,889**	
			TOTAL CONSTRUCTION COST		**$ 463,100**	
			ALLIED COSTS			
			ITEM	**UNIT COST**	**AMOUNT**	**BASIS OF QUANTITY AND UNIT COST**
			PROJECT ADMIN./MANAGEMENT	10%	$ 42,725	
			SURVEY	LS	$ 5,000	
			GEOTECHNICAL ANALYSIS	LS	$ -	NO REPORT ANTICIPATED
			DESIGN	15%	$ 64,088	
			PERMITTING	LS	$ 40,000	LOCAL PERMITS, ONLINE HPA, JARPA FOR CORPS PERMIT, CRITICAL AREAS REPORT, BIOLOGICAL NO EFFECT LETTER
			PROPERTY ACQUISITION	LS	$ -	NONE ANTICIPATED
			CONSTRUCTION MANAGEMENT	20%	$ 85,450	
			SUBTOTAL OF ALLIED COSTS		**$ 237,300**	
			SUMMARY			
			SUBTOTAL OF DIRECT COSTS		$ 427,250	
			SUBTOTAL OF ALLIED COST		$ 237,300	
			SALES TAX (ON DIRECT COSTS)		$ 35,889	
			CONTINGENCY - AVERAGE	40%	$ 280,000	
			TOTAL ESTIMATED COST		**$ 980,000**	

Sequim Surface Water Master Plan
Herrera Project #14-05826-000

Project: Sequim SMP CIP Program - SITE 2.04 (3rd Ave. south of Highway 101)
Prepared by: Steve Zenovic
Checked by: Seth Rodman
Updated: 22-May-15

Note: This cost estimate is approximate. Actual construction bids may vary significantly from this statement of probable costs due to timing of construction, changed conditions, labor rate changes, or other factors beyond the control of the engineers.

ESTIMATED COST OF PROJECT IMPLEMENTATION AT PRELIMINARY DESIGN STAGE

NO.	QUANT.	UNIT	ITEM	UNIT COST	AMOUNT	BASIS OF QUANTITY AND UNIT COST
1	1	LS	MOBILIZATION	20%	$ 4,300	
2	1	LS	EROSION/WATER POLLUTION CONTROL	5%	$ 1,100	
3	1	LS	PROJECT TEMPORARY TRAFFIC CONTROL	10%	$ 2,200	
4	20	SY	DEMOLISH AND REMOVE A-C PAVEMENT	$ 20	$ 400	CITY OF PORT ANGELES WATERFRONT PH. 2 2014
5	1	LS	REMOVAL OF STRUCTURE AND OBSTRUCTION	$ 500	$ 500	EXISTING DRYWELL, 8' CURB, GUTTER, AND SIDEWALK
6	1	EA	CATCH BASIN TYPE 1	$ 1,500	$ 1,500	CITY OF PORT ANGELES LAURIDSEN BRIDGE 2014
7	1	EA	CATCH BASIN TYPE 1 W/ENERGY DISSIPATER	$ 2,000	$ 2,000	CITY OF PORT ANGELES LAURIDSEN BRIDGE 2014
8	60	LF	18" HDPE PIPING	$ 40	$ 2,400	WSDOT UNIT BID COST ANALYSIS 2014
9	50	CY	DITCH EXCAVATION INCLUDING HAUL	$ 40	$ 2,000	WSDOT UNIT BID COST ANALYSIS 2014
10	3	TN	HMA CL 1/2" PG 64-22	$ 500	$ 1,500	CITY OF PORT ANGELES WATERFRONT PH. 2 2014 - SMALL QUANTITY
11	150	CY	QUARRY SPALLS FOR SLOPE PROTECTION	$ 75	$ 11,250	WSDOT UNIT BID COST ANALYSIS 2014
			SUBTOTAL OF DIRECT COSTS		**$ 29,150**	
			SALES TAX (DIRECT COSTS)	**8.4%**	**2448.60**	
			TOTAL CONSTRUCTION COST		**$ 31,600**	
			ALLIED COSTS			
			ITEM	**UNIT COST**	**AMOUNT**	**BASIS OF QUANTITY AND UNIT COST**
			PROJECT ADMIN./MANAGEMENT	20%	$ 6,320	
			SURVEY	LS	$ 2,500	
			GEOTECHNICAL ANALYSIS	LS	$ -	NO REPORT ANTICIPATED
			DESIGN	25%	$ 7,900	
			PERMITTING	LS	$ -	NO PERMITS ANTICIPATED
			PROPERTY ACQUISITION	LS	$ 2,500	WILL REQUIRE EASEMENT FROM SEQUIM SCHOOL DISTRICT
			CONSTRUCTION MANAGEMENT	20%	$ 6,320	
			SUBTOTAL OF ALLIED COSTS		**$ 25,500**	
			SUMMARY			
			SUBTOTAL OF DIRECT COSTS		$ 29,150	
			SUBTOTAL OF ALLIED COST		$ 25,500	
			SALES TAX (ON DIRECT COSTS)		$ 2,449	
			CONTINGENCY - LOW	30%	$ 17,000	
			TOTAL ESTIMATED COST		**$ 70,000**	

Sequim Surface Water Master Plan
Herrera Project #14-05826-000

Project: Sequim SMP CIP Program - SITE 2.05 (CEDAR AT 5TH)
Prepared by: Steve Zenovic
Checked by: Seth Rodman
Updated: ########

Note: This cost estimate is approximate. Actual construction bids may vary significantly from this statement of probable costs due to timing of construction, changed conditions, labor rate changes, or other factors beyond the control of the engineers.

ESTIMATED COST OF PROJECT IMPLEMENTATION AT PRELIMINARY DESIGN STAGE

NO.	QUANT.	UNIT	ITEM	UNIT COST	AMOUNT	BASIS OF QUANTITY AND UNIT COST
1	1	LS	MOBILIZATION	10%	$ 4,600.00	
2	1	LS	EROSION/WATER POLLUTION CONTROL	5%	$ 2,200.00	
3	1	LS	PROJECT TEMPORARY TRAFFIC CONTROL	10%	$ 3,900.00	WILL REQUIRE CLOSURE OF CEDAR STREET
4	175	SY	DEMOLISH AND REMOVE A-C PAVEMENT	$ 10	$ 1,750	PORT ANGELES WTIP
5	1	LS	REMOVAL OF STRUCTURE AND OBSTRUCTION	$ 5,000	$ 5,000	EXISTING DRYWELL, 8' CURB, GUTTER, AND SIDEWALK
6	200	CY	STRUCTURE EXCAVATION CLASS B	$ 15	$ 3,000	PORT ANGELES WTIP
7	1	LS	4' X 6' FILTERRA INTERNAL BYPASS UNIT	$ 24,000	$ 24,000	PORT ANGELES LAURIDSEN BRIDGE PROJECT
8	40	LF	6" PVC PIPING		$ -	PORT ANGELES WTIP
9	35	TN	GRAVEL BACKFILL FOR DRAINS		$ -	PORT ANGELES WTIP
10	30	TN	HMA CL 1/2" PG 64-22	$ 200	$ 6,000	PORT ANGELES WTIP
11	125	CY	GRAVEL BASE (ON- SITE NATIVE)	$ 15	$ 1,875	PORT ANGELES WTIP
12	90	TN	BALLAST	$ 25	$ 2,250	
13	30	TN	CRUSHED SURFACING TOP COURSE	$ 30	$ 900	
14	1	EA	CATCH BASIN TYPE 1	$ 1,000	$ 1,000	
			SUBTOTAL OF DIRECT COSTS		**$ 56,475**	
			SALES TAX (DIRECT COSTS)	**0%**	**0.00**	**PUBLIC ROAD CONSTRUCTION EXEMPT FROM SALES TAX**
			TOTAL CONSTRUCTION COST		**$ 56,500**	
			ALLIED COSTS			
			ITEM	**UNIT COST**	**AMOUNT**	**BASIS OF QUANTITY AND UNIT COST**
			PROJECT ADMIN./MANAGEMENT	10%	$ 5,650	
			SURVEY	LS	$ 2,500	
			GEOTECHNICAL ANALYSIS	LS	$ -	NO REPORT ANTICIPATED
			DESIGN	20%	$ 11,300	
			PERMITTING	LS	$ -	NO PERMITS ANTICIPATED
			PROPERTY ACQUISITION	LS	$ -	WITHIN CITY R-O-W
			CONSTRUCTION MANAGEMENT	20%	$ 11,300	
			SUBTOTAL OF ALLIED COSTS		**$ 30,800**	
			SUMMARY			
			SUBTOTAL OF DIRECT COSTS		$ 56,475	
			SUBTOTAL OF ALLIED COST		$ 30,800	
			SALES TAX (ON DIRECT COSTS)		$ -	PUBLIC ROAD CONSTRUCTION EXEMPT FROM SALES TAX
			CONTINGENCY - AVERAGE	40%	$ 35,000	
			TOTAL ESTIMATED COST		**$ 120,000**	

Sequim Surface Water Master Plan
Herrera Project #14-05826-000

Project: Sequim SMP CIP Program - SITE 2.12 (WASHINGTON AT 7TH)
Prepared by: Steve Zenovic
Checked by: Seth Rodman
Updated: ########

Note: This cost estimate is approximate. Actual construction bids may vary significantly from this statement of probable costs due to timing of construction, changed conditions, labor rate changes, or other factors beyond the control of the engineers.

ESTIMATED COST OF PROJECT IMPLEMENTATION AT PRELIMINARY DESIGN STAGE

NO.	QUANT.	UNIT	ITEM	UNIT COST	AMOUNT	BASIS OF QUANTITY AND UNIT COST
1	1	LS	MOBILIZATION	10%	$ 6,700.00	
2	1	LS	EROSION/WATER POLLUTION CONTROL	5%	$ 3,400.00	
3	1	LS	PROJECT TEMPORARY TRAFFIC CONTROL	10%	$ 6,700.00	WILL REQUIRE CLOSURE OF CEDAR STREET
4	240	SY	DEMOLISH AND REMOVE A-C PAVEMENT	$ 10	$ 2,400	PORT ANGELES WTIP
5	1	LS	REMOVAL OF STRUCTURE AND OBSTRUCTION	$ 5,000	$ 5,000	EXISTING DRYWELL, 20' CURB, GUTTER, AND SIDEWALK
6	350	CY	STRUCTURE EXCAVATION CLASS B INCL. HAUL	$ 15	$ 5,250	PORT ANGELES WTIP
7	1	LS	6' X 8' FILTERRA INTERNAL BYPASS UNIT	$ 30,000	$ 30,000	PORT ANGELES LAURIDSEN BRIDGE PROJECT
8	80	LF	SOILD/PERFORATED PVC STORM SEWER PIPE 6"	$ 30	$ 2,400	PORT ANGELES WTIP
9	40	CY	GRAVEL BACKFILL FOR DRAINS	$ 40	$ 1,600	PORT ANGELES WTIP
10	45	TN	HMA CL 1/2" PG 64-22	$ 200	$ 9,000	PORT ANGELES WTIP
11	175	CY	GRAVEL BASE (ON-SITE NATIVE)	$ 15	$ 2,625	PORT ANGELES WTIP
12	125	TN	BALLAST	$ 20	$ 2,500	PORT ANGELES WTIP
13	45	TN	CRUSHED SURFACING TOP COURSE	$ 30	$ 1,350	PORT ANGELES WTIP
14	2	EA	CATCH BASIN TYPE 1	$ 1,500	$ 3,000	PORT ANGELES WTIP
15	20	LF	CEMENT CONCRETE CURB AND GUTTER	$ 50	$ 1,000	PORT ANGELES WTIP; SMALL QUANTITY PREMIUM
16	15	SY	CEMENT CONCRETE SIDEWALK	$ 70	$ 1,050	PORT ANGELES WTIP; SMALL QUANTITY PREMIUM
			SUBTOTAL OF DIRECT COSTS		**$ 83,975**	
			SALES TAX (DIRECT COSTS)	**0.0%**	**$ -**	**PUBLIC ROAD CONSTRUCTION EXEMPT FROM SALES TAX**
			TOTAL CONSTRUCTION COST		**$ 84,000**	
			ALLIED COSTS			
			ITEM	**UNIT COST**	**AMOUNT**	**BASIS OF QUANTITY AND UNIT COST**
			PROJECT ADMIN./MANAGEMENT	10%	$ 8,400	
			SURVEY	LS	$ 3,500	
			GEOTECHNICAL ANALYSIS	LS	$ -	NO REPORT ANTICIPATED
			DESIGN	20%	$ 16,800	
			PERMITTING	LS	$ -	NO PERMITS ANTICIPATED
			PROPERTY ACQUISITION	LS	$ -	WITHIN CITY R-O-W
			CONSTRUCTION MANAGEMENT	20%	$ 16,800	
			SUBTOTAL OF ALLIED COSTS		**$ 45,500**	
			SUMMARY			
			SUBTOTAL OF DIRECT COSTS		$ 83,975	
			SUBTOTAL OF ALLIED COST		$ 45,500	
			SALES TAX (ON DIRECT COSTS)		$ -	PUBLIC ROAD CONSTRUCTION EXEMPT FROM SALES TAX
			CONTINGENCY - AVERAGE	40%	$ 52,000	
			TOTAL ESTIMATED COST		**$ 180,000**	

Sequim Surface Water Master Plan
Herrera Project #14-05826-000

Project: Sequim SMP CIP Program - SITE 2.25 (ETTA STREET BETWEEN SEQUIM AVENUE AND SUNNYSIDE)
Prepared by: Steve Zenovic
Checked by: Seth Rodman
Updated: 22-May-15

Note: This cost estimate is approximate. Actual construction bids may vary significantly from this statement of probable costs due to timing of construction, changed conditions, labor rate changes, or other factors beyond the control o the engineers.

ESTIMATED COST OF PROJECT IMPLEMENTATION AT PRELIMINARY DESIGN STAGE

NO.	QUANT.	UNIT	ITEM	UNIT COST	AMOUNT	BASIS OF QUANTITY AND UNIT COST
1	1	LS	MOBILIZATION	10%	$ 3,300	
2	1	LS	EROSION/WATER POLLUTION CONTROL	5%	$ 1,700	
3	1	LS	PROJECT TEMPORARY TRAFFIC CONTROL	5%	$ 1,700	WILL REQUIRE CLOSURE OF ETTA STREET
4	110	SY	DEMOLISH AND REMOVE A-C PAVEMENT	$ 10	$ 1,100	PORT ANGELES WTIP
5	1	LS	REMOVAL OF STRUCTURE AND OBSTRUCTION	$ 1,000	$ 1,000	EXISTING CATCH BASIN
6	110	CY	STRUCTURE EXCAVATION CLASS B	$ 15	$ 1,650	PORT ANGELES WTIP
7	1	LS	2 CARTRIDGE STORMFILTER CATCH BASIN	$ 13,000	$ 13,000	PENINSULA BEHAVIORAL HEALTH PARKING LOT
8	200	LF	SOLID/PERFORATED PVC STORM SEWER PIPE 6"	$ 30	$ 6,000	PORT ANGELES WTIP
9	35	TN	GRAVEL BACKFILL FOR DRAINS	$ 40	$ 1,400	PORT ANGELES WTIP
10	20	TN	HMA CL 1/2" PG 64-22	$ 200	$ 4,000	PORT ANGELES WTIP
11	60	CY	GRAVEL BASE (ON-SITE NATIVE)	$ 15	$ 900	PORT ANGELES WTIP
12	55	TN	BALLAST	$ 20	$ 1,100	PORT ANGELES WTIP
13	20	TN	CRUSHED SURFACING TOP COURSE	$ 30	$ 600	PORT ANGELES WTIP
14	45	LF	CEMENT CONCRETE CURB AND GUTTER	$ 50	$ 2,250	PORT ANGELES WTIP; SMALL QUANTITY PREMIUM
			SUBTOTAL OF DIRECT COSTS		**$ 39,700**	
			SALES TAX (DIRECT COSTS)	**0.0%**	**$ -**	**PUBLIC ROAD CONSTRUCTION EXEMPT FROM SALES TAX**
			TOTAL CONSTRUCTION COST		**$ 39,700**	
			ALLIED COSTS			
			ITEM	**UNIT COST**	**AMOUNT**	**BASIS OF QUANTITY AND UNIT COST**
			PROJECT ADMIN./MANAGEMENT	10%	$ 3,970	
			SURVEY	LS	$ 3,000	
			GEOTECHNICAL ANALYSIS	LS	$ -	NO REPORT ANTICIPATED
			DESIGN	25%	$ 9,925	
			PERMITTING	LS	$ -	NO PERMITS ANTICIPATED
			PROPERTY ACQUISITION	LS	$ -	WITHIN CITY R-O-W
			CONSTRUCTION MANAGEMENT	20%	$ 7,940	
			SUBTOTAL OF ALLIED COSTS		**$ 24,800**	
			SUMMARY			
			SUBTOTAL OF DIRECT COSTS		$ 39,700	
			SUBTOTAL OF ALLIED COST		$ 24,800	
			SALES TAX (ON DIRECT COSTS)		$ -	PUBLIC ROAD CONSTRUCTION EXEMPT FROM SALES TAX
			CONTINGENCY - AVERAGE	40%	$ 26,000	
			TOTAL ESTIMATED COST		**$ 91,000**	

Sequim Surface Water Master Plan
Herrera Project #14-05826-000

Project: A2.26 River Road Storage Project
Prepared by: A. Sytsma
Checked by: M. Fontaine
Updated: 12-May-15

Note: This cost estimate is approximate. Actual construction bids may vary significantly from this statement of probable costs due to timing of construction, changed conditions, labor rate changes, or other factors beyond the control of the engineers.

ESTIMATED COST OF PROJECT IMPLEMENTATION AT PRELIMINARY DESIGN STAGE

NO.	QUANT.	UNIT	ITEM	UNIT COST	AMOUNT	BASIS OF QUANTITY AND UNIT COST
1	1	LS	CONSTRUCTION OF RESERVOIR	$ 23,376,800.00	$ 23,376,800	Cost estimate from Anchor QEA, River Road Storage Project Technical Memorandum Attachment D-4 (April 2014).Construction costs do not include cost of conveying stormwater flows from West Happy Valley to storage reservoir.
			SUBTOTAL OF DIRECT COSTS		**$ 23,376,800**	
			SALES TAX (DIRECT COSTS)	**8.4%**	**$ 1,963,651**	
			TOTAL CONSTRUCTION COST		**$ 25,340,500**	
			ALLIED COSTS			
			ITEM	**UNIT COST**	**AMOUNT**	**BASIS OF QUANTITY AND UNIT COST**
			PROJECT ADMIN / MANAGEMENT	10%	$ 2,500,000	10% of construction.
			SURVEY	LS	$ 25,000	Base mapping.
			GEOTECHNICAL ANALYSES	LS	$ 40,000	Preliminary Geotechnical Engineering Recommendations Memorandum completed by Anchor QEA. Supplementary borings and geotechnical report.
			DESIGN	10%	$ 2,500,000	10% of construction.
			PERMITTING AND MITIGATION	LS	$ 250,000	Geotechnical borings did not encounter groundwater so assume no/minimal wetlands are present onsite and mitigation requirements are minimal.
			PROPERTY ACQUISITION	LS	$ -	Assume no cost.
			CONSTRUCTION MANAGEMENT	10%	$ 2,500,000	10% of construction.
			SUBTOTAL OF ALLIED COSTS		**$ 7,800,000**	
			SUMMARY			
			SUBTOTAL OF DIRECT COSTS		$ 23,376,800	
			SUBTOTAL OF ALLIED COST		$ 7,800,000	
			SALES TAX (ON DIRECT COSTS)		$ 1,963,651	
			CONTINGENCY - AVERAGE	40%	$ 13,000,000	
			TOTAL ESTIMATED COST		**$ 46,000,000**	

Sequim Surface Water Master Plan
Herrera Project #14-05826-000

Project: Sequim SMP CIP Program - SITE A2.63 (PRAIRIE STREET BETWEEN SEQUIM AVENUE AND 2ND AVENUE)
Prepared by: Steve Zenovic
Checked by: Seth Rodman
Updated: 19-May-15

Note: This cost estimate is approximate. Actual construction bids may vary significantly from this statement of probable costs due to timing of construction, changed conditions, labor rate changes, or other factors beyond the control of the engineers.

ESTIMATED COST OF PROJECT IMPLEMENTATION AT PRELIMINARY DESIGN STAGE

NO.	QUANT.	UNIT	ITEM	UNIT COST	AMOUNT	BASIS OF QUANTITY AND UNIT COST
1	1	LS	MOBILIZATION	10%	$ 5,600	
2	1	LS	EROSION/WATER POLLUTION CONTROL	5%	$ 2,700	
3	240	LF	EXTENDED CURB COST INCREASE	$ 5	$ 1,200	
4	310	LF	BARRIER CURB	$ 25	$ 7,750	CITY OF SEQUIM 2014 WATER PROJECT
5	70	CY	POROUS CONCRETE SIDEWALK	$ 350	$ 24,500	CITY OF PORT ANGELES 18TH STREET SIDEWALK IMPROVEMENTS
6	200	TON	PERMEABLE BALLAST FOR RESERVOIR COURSE	$ 35	$ 7,000	CITY OF PORT ANGELES GREEN ALLEYS PROJECT (ESTIMATE)
7	60	CY	BIORETENTION SOIL	$ 60	$ 3,600	CITY OF PORT ANGELES WATERFRONT PH.2 2014
8	960	SF	BIORETENTION PLANTINGS	$ 12	$ 11,520	CITY OF PORT ANGELES WATERFRONT PH. 1 2013
			SUBTOTAL OF DIRECT COSTS		**$ 63,870**	
			SALES TAX (DIRECT COSTS)	**8.4%**	**$ 5,365**	
			TOTAL CONSTRUCTION COST		**$ 69,200**	
			ALLIED COSTS			
			ITEM	**UNIT COST**	**AMOUNT**	**BASIS OF QUANTITY AND UNIT COST**
			PROJECT ADMIN./MANAGEMENT	10%	$ 6,920	
			SURVEY	LS	$ -	
			GEOTECHNICAL ANALYSIS	LS	$ -	NO REPORT ANTICIPATED
			DESIGN	20%	$ 13,840	
			PERMITTING	LS	$ -	NO PERMITS ANTICIPATED
			PROPERTY ACQUISITION	LS	$ -	WITHIN CITY R-O-W
			CONSTRUCTION MANAGEMENT	20%	$ 13,840	
			SUBTOTAL OF ALLIED COSTS		**$ 34,600**	
			SUMMARY			
			SUBTOTAL OF DIRECT COSTS		$ 63,870	
			SUBTOTAL OF ALLIED COST		$ 34,600	
			SALES TAX (ON DIRECT COSTS)		$ 5,365	
			CONTINGENCY - LOW	30%	$ 31,000	
			TOTAL ESTIMATED COST		**$ 130,000**	

Programmatic CIP Scopes and Budgets

PROGRAMMATIC CIP PROJECTS

CIP Project #1.00 – Sequim Area Stormwater-Watershed Plan

- **Problem Description:** There is a long history of flooding problems along the Bell Creek Corridor and in several areas of town where irrigation systems pass through the City. In addition, Sequim Bay and the lower reaches of Bell Creek and Johnson Creek are all listed as impaired water bodies on Ecology's 303(d) list for one or more parameters (high fecal coliform bacteria concentrations, low dissolved oxygen, high temperature, and low benthic-Index of Biological Integrity (B-IBI)); a total maximum daily load (TMDL) study and water quality implementation plan may be required to address impairments. If not managed properly, future development will increase storm flows and exacerbate existing flooding and water quality problems, and an important source of groundwater recharge will be lost. Now is an opportune time to plan for strategic stormwater, floodplain, and habitat management in each watershed that affects the City. The Sequim Area Watershed Plan could be used to address problems 1.02, 1.04, 1.06, 1.07, 1.08, 1.09, 1.10, 2.17, 4.04, and 4.31.

- **Project Solution:** Develop a Sequim Area Stormwater-Watershed Plan (Plan) that identifies a comprehensive strategy for optimizing infiltration opportunities and ensuring adequate surface water conveyance capacity to accommodate future growth, while improving water quality, preserving and enhancing habitat, and recharging groundwater – all in coordination with planning for future development. The scope of the Plan would include portions of Bell Creek, Johnson Creek, Cassalery Creek, and Gierin Creek – the exact geographic extents may depend on participation and financial contribution from involved stakeholders, but in order to address problems within the City limits, the upstream flow contributions from outside the City must be considered. The project will include an assessment of existing conditions and will develop a Plan for maintaining and improving stormwater conveyance, infiltration, and resource protection. Modeling would be performed to better understand the causes of flooding in the stormwater system and develop effective long term solutions. Irrigation systems and development in Clallam County areas and the UGA upstream of the City has a significant potential to affect flows in all the small streams; therefore, the County and irrigation purveyors have an important role in developing goals and objectives for the Plan and subsequent projects for implementation. Finally, adoption (by parties with responsibilities under the plan) and implementation of a watershed plan may allow the City additional flexibility in its regulation of new development (Ecology 2014).

    - Task 1 – Confirm goals and objectives of the stormwater-watershed plan: Confirm the goals of the Plan based on input from City departments, irrigation purveyors, and Clallam County DCD and Public Works. The goals of the Plan may include:

        i. Groundwater resource protection (aquifer recharge and groundwater quality)

        ii. A water pollution control plan to address water quality impairments and eliminate the need for a TMDL study

iii. Reduction of existing flooding problems while providing adequate conveyance and stormwater management for future build-out conditions

iv. Habitat protection and enhancement

v. To the extent feasible, protection (and potential augmentation) of stream flows in the Dungeness watershed

vi. Meeting goals for development density and open space

- Task 2 – Develop funding strategy and apply for grants – Evaluate grant opportunities related to the goals and objectives defined in Task 1, which may include grant funding for broader watershed planning, water quality improvement, land acquisition, habitat improvement, flood control, public involvement, and other objectives.
- Task 3 – Existing conditions assessment: Assess existing conditions in the watershed including: land use, soils, geology, topography, surface water, stormwater and irrigation conveyance network, natural resources performing important ecosystem services (e.g., wetlands, stream habitat, buffers, floodplains, recharge areas), and water quality. Data that is available in the existing GIS database and previous studies will be supplemented with field data collection to develop a comprehensive geodatabase. This data will also provide the necessary inputs for hydrologic and hydraulic modeling including development of impervious area coverage using recent aerial imagery.
- Task 4 – Future scenarios development: Future scenarios would be identified to achieve the goals and objectives that are established in Tasks 1 and 2. The scenarios may include acquisition of lands performing valuable ecosystem services, identifying areas of more intensive development, defining projects to expand or upgrade the stormwater management system (e.g. larger culverts, regional detention/infiltration projects, water quality treatment, or new collection systems), and setting watershed specific stormwater management requirements for new development.
- Task 5 – Hydrologic, hydraulic and hydrogeologic modeling: A hydrologic and hydraulic model as well as a hydrogeologic (groundwater) model would be used to better understand the causes of flooding in the stormwater system and develop effective long-term solutions. This task would be revisited as part of Task 1 to ensure the level of effort is aligned with the project objectives and goals, and to reconfirm the process will provide the information needed to support management decisions.

    i. Task 5A –Hydrologic and hydraulic modeling – The storm and surface water conveyance system within and upstream of Sequim is very complex due to the irrigation system. The irrigation system serves as a collection system during the wet season and significant effort will likely be necessary to improve on the current assessment of the amount of water that it collects to facilitate calibration of the hydrologic and hydraulic model. This task assumes the following work:

        1. Develop baseline model from existing GIS data

        2. Augment existing flow data collected in 2015 with field reconnaissance of conveyance system

3. Field survey key stream channel reaches

4. One wet season of continuous flow monitoring at multiple locations

5. Model calibration and validation

6. Evaluation of future scenarios (i.e. alternatives analysis iterations)

ii. Task 5B – Hydrogeologic Modeling – A local-watershed-scale groundwater model based on the 2008 Ecology groundwater flow model will allow the stormwater program to assess the cumulative and simultaneous effects of existing and proposed stormwater system features on groundwater and surface water conditions. This task may include the following work:

1. Assess groundwater mounding beneath existing and proposed stormwater infiltration features on the groundwater table, stormwater infiltration capacity, and groundwater discharge to stream features

2. Support outreach and education by identifying areas where irrigation ditches and/or groundwater conditions affect stormwater system performance

3. Trace routes of illicit discharge using groundwater flow path or contaminant transport analysis

4. Assess effects of underground injection, whether for stormwater, remediation, or geothermal purposes

5. Simulate climate-change scenarios to assess stormwater system development

- Task 6 – Draft and final Plan: The Plan will summarize Tasks 1-5 and the results of the hydrologic and hydraulic modeling including future scenario evaluation. It will also provide the strategy, including project sequencing and timing, for carrying out the activities or projects identified during Task 4 and 5. The Plan will contain an implementation schedule and funding strategy, identify milestones, and tie-in to other scheduled capital improvement and transportation projects/plans in the project areas. Costs will be developed for site-specific structural strategies to establish Capital Improvement Program (CIP) input for future City planning. Bell Creek culvert replacement projects in the current Storm and Surface Water Master Plan are examples of these projects and cost estimate. To meet Ecology's Basin Plan requirements, the Plan will also recommend:

  i. Stormwater requirements in sub-areas for new and re-development

  ii. Confirmation of existing critical area designations and other land use and utility plans, standards, and regulations

  iii. Source control activities including residential and commercial public outreach

  iv. Monitoring

- Task 7 – Implementation: This specific scope and cost for this task will be defined in Task 6 above.
  - Benefits:
    - Reduce flooding
    - Improve water quality
    - Improve groundwater recharge
    - Protect and enhance habitat
    - Improve instream flows
    - Plan for future growth, density, and open space
  - Project Priority: High

Table F-1. Cost Estimate for CIP Project #1.00— Sequim Area Stormwater-Watershed Plan.							
	Cost in 2015 Dollars ($)						
Task	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Total**
Task 1 – Develop goals and objectives of the watershed plan		7,000					7,000
Task 2 – Develop funding strategy and apply for grants		15,000					15,000
Task 3 – Existing conditions assessment		10,000	60,000				70,000
Task 4 – Future scenarios development			70,000	30,000			100,000
Task 5 – Hydrologic, hydraulic, and hydrogeologic modeling[a]			170,000	280,000			450,000
Task 6 – Draft and final plan				40,000	60,000		100,000
Task 7 – Implementation							To Be Determined
TOTAL EXPENSES		32,000	300,000	350,000	60,000		742,000

[a] Includes budget for Task 5A ($300,000) and 5B ($150,000).

PROGRAMMATIC CIP PROJECTS

CIP Project #1.09 – Middle-Reach Bell Creek Basin Plan

- **Problem Description:** Bell Creek, Highland irrigation ditch, and culverts along Bell Creek corridor receive stormwater runoff from upland areas during storm events, causing flooding in the undeveloped middle reach of Bell Creek and in downstream culverts. Specific reaches of lower and middle Bell Creek are listed as impaired water bodies on Ecology's 303(d) list for 2012 due to high fecal coliform bacteria concentrations, low dissolved oxygen, high temperature, and low benthic-Index of Biological Integrity (B-IBI); a total maximum daily load (TMDL) study and water quality implementation plan may be required to address impairments. If not managed properly, future development will increase storm flows and exacerbate existing flooding and water quality problems, and an important source of groundwater recharge will be lost. Now is an opportune time to plan for strategic stormwater, floodplain, and habitat management for the only stream that runs through the City. This project would also address problems 2.17/2.29 and 1.02, 1.04, 1.06, 1.07, 1.08, 1.10.

- **Project Solution:** If 1.00 (Sequim Area Stormwater-Watershed Plan) is not implemented, Project 1.09 would identify a strategy for optimizing infiltration opportunities and ensuring adequate surface water conveyance capacity to accommodate future growth, while improving water quality, preserving and enhancing habitat, and recharging groundwater – all in coordination with planning for future development. The scope of the project would be specific to the middle reach of Bell Creek and address issues related to the undeveloped floodplain area that functions like a sponge to absorb stormwater. In order to adequately characterize the existing conditions and evaluate potential future scenarios, the project would need to account for development upstream of the city limits in upper Bell Creek as well as irrigation system components that are, or could be, tributary to Bell Creek. The project will include an assessment of existing conditions and will develop a plan for maintaining and improving stormwater conveyance, infiltration, and resource protection. Modeling would be performed to better understand the causes of flooding in the stormwater system and develop effective long term solutions. Development in Clallam County areas and the UGA upstream of the City has a significant potential to affect flows in Bell Creek; therefore, the County and irrigation purveyors have an important role in developing goals and objectives for the Plan and subsequent projects for implementation. Finally, adoption (by parties with responsibilities under the plan) and implementation of a basin plan may allow the City additional flexibility in its regulation of new development (Ecology 2014).

    - Task 1 – Confirm goals and objectives of the basin plan: Confirm the goals of the basin planning effort based on input from City departments, irrigation purveyors, and Clallam County DCD and Public Works. The goals may include:

        i. Groundwater resource protection (aquifer recharge and groundwater quality)

ii. A water pollution control plan to address water quality impairments and eliminate the need for a TMDL study

iii. Reduction of existing flooding problems while providing adequate conveyance and stormwater management for future build-out conditions

iv. Habitat protection and enhancement

v. To the extent feasible, protection (and potential augmentation) of stream flows in the Dungeness watershed

vi. Meeting goals for development density and open space

- Task 2 – Develop funding strategy and apply for grants – Evaluate grant opportunities related to the goals and objectives defined in Task 1, which may include grant funding for broader watershed planning, water quality improvement, habitat improvement, land acquisition, flood control, public involvement, and other objectives.
- Task 3 – Existing conditions assessment: Assess existing conditions in the watershed: land use, soils, geology, topography, surface water, stormwater and irrigation conveyance network, natural resources performing important ecosystem services (e.g., wetlands, stream habitat, buffers, floodplains, recharge areas), and water quality. Data that is available in the existing GIS and previous studies will be supplemented with field data collection to develop a comprehensive geodatabase. This data will also provide the necessary inputs for hydrologic and hydraulic modeling including development of impervious area coverage using recent aerial imagery.
- Task 4 – Future scenarios development: Future scenarios would be identified to achieve the goals and objectives that are established in Tasks 1 and 2. The scenarios may include acquisition of lands performing valuable ecosystem services, identifying areas of more intensive development, defining projects to expand or upgrade the stormwater management system (e.g. larger culverts, regional detention/infiltration projects, water quality treatment, or new collection systems), and setting sub-basin specific stormwater management requirements for new development.
- Task 5 – Hydrologic, hydraulic, and hydrogeologic modeling: A hydrologic and hydraulic model as well as a hydrogeologic (groundwater) model would be used to better understand the causes of flooding in the stormwater system and develop effective long-term solutions. This task would be revisited as part of Task 1 to ensure the level of effort is aligned with the project objectives and goals, and to reconfirm the process will provide the information needed to support management decisions.

    i. Task 5A – Hydrologic and hydraulic modeling – The storm and surface water conveyance system within and upstream of Sequim is very complex due to the irrigation system. The irrigation system serves as a collection system during the wet season and significant effort will likely be necessary to improve on the current assessment of the amount of water that it collects to facilitate calibration of the hydrologic and hydraulic model. This task assumes the following work:

1. Develop baseline model from existing GIS data
2. Augment existing flow data collected in 2015 with field reconnaissance of conveyance system
3. Field survey key stream channel reaches
4. One wet season of continuous flow monitoring at multiple locations
5. Model calibration and validation
6. Evaluation of future scenarios (i.e. alternatives analysis iterations)

ii. Task 5B – Hydrogeologic Modeling – A site-scale groundwater model of the middle reach of Bell Creek will allow the stormwater program to assess the effects of alternative stormwater system improvements to address flooding. Examples of potential benefits of a site-scale groundwater model include the following:

1. Assess groundwater mounding or groundwater flooding based on site-specific soil and groundwater conditions;
2. Support feasibility analysis of alternative enhanced stormwater features such as a meandering channel, an infiltration trench, or a deep infiltration well; and
3. Support final design of the selected enhanced stormwater feature.

- Task 6 – Draft and final Plan: The Plan will summarize Tasks 1 through 5 and the results of the hydrologic and hydraulic modeling and hydrogeologic modeling including future scenario evaluation. It will also provide the strategy, including project sequencing and timing, for carrying out the activities or projects identified during Task 4 and 5. The Plan will contain an implementation schedule and funding strategy, identify milestones, and tie-in to other scheduled capital improvement and transportation projects/plans in the project areas. Costs will be developed for site-specific structural strategies to establish Capital Improvement Program (CIP) input for future City planning. Bell Creek culvert replacement projects in the current Storm and Surface Water Master Plan are examples of these projects and cost estimate. To meet Ecology's Basin Plan requirements, the Plan will also recommend:
  i. Stormwater requirements in sub-areas for new and re-development
  ii. Confirmation of existing critical area designations and other land use and utility plans, standards, and regulations
  iii. Source control activities including residential and commercial public outreach
  iv. Monitoring

- Task 7 – Implementation: This specific scope and cost for this task will be defined in Task 6 above.
  - Benefits:
    - Reduce flooding
    - Improve water quality
    - Improve groundwater recharge
    - Protect and enhance habitat
    - Instream flow enhancement
    - Plan for future growth, density, and open space
  - Project Priority: High

Table F-2. Cost Estimate for CIP Project #1.09 — Middle-Reach Bell Creek Basin Plan.

Task	Cost in 2015 Dollars ($)						
	2016	2017	2018	2019	2020	2021	Total
Task 1 – Develop goals and objectives of the watershed plan		5,000					5,000
Task 2 – Develop funding strategy and apply for grants		10,000					10,000
Task 3 – Existing conditions assessment		10,000	40,000				50,000
Task 4 – Future scenarios development			40,000	20,000			60,000
Task 5 – Hydrologic, hydraulic, and hydrogeologic modeling[a]			70,000	120,000			190,000
Task 6 – Draft and final plan				20,000	30,000		50,000
Task 7 – Implementation							To Be Determined
TOTAL EXPENSES		25,000	150,000	160,000	30,000		365,000

[a] Includes budget for Task 5A ($150,000) and 5B ($40,000).

APPENDIX G

Regulatory Gap Analysis and Compliance Strategy Report

GAP ANALYSIS AND COMPLIANCE STRATEGY REPORT

CITY OF SEQUIM STORMWATER PROGRAM

Prepared for
City of Sequim

Prepared by
Herrera Environmental Consultants, Inc.

HERRERA

Note:
Some pages in this document have been purposely skipped or blank pages inserted so that this document will copy correctly when duplexed.

GAP ANALYSIS AND COMPLIANCE STRATEGY REPORT

CITY OF SEQUIM STORMWATER PROGRAM

Prepared for
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February 24, 2016

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ABBREVIATIONS

AWC	Association of Washington Cities
B-IBI	Benthic Index of Biotic Integrity
BMP	best management practice
CARA	Critical Aquifer Recharge Area
CIP	Capital Improvement Program
DOH	Washington State Department of Health
DRMT	Dungeness River Management Team
EPA	US Environmental Protection Agency
ESA	Endangered Species Act
FIP	Floodplain Insurance Program
FTE	full time equivalent
GIS	geographic information systems
I/I	infiltration and inflow
IDDE	Illicit Discharge Detection and Elimination
IPMP	Integrated Pest Management Plan
LID	low impact development
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
RSMP	Regional Stormwater Monitoring Program
SEPA	State Environmental Policy Act
SIDM	source identification and diagnostic monitoring
SMC	Sequim Municipal Code
SOP	standard operating procedure
SWMMWW	*Stormwater Management Manual for Western Washington*
SWMP	Stormwater Management Program
SWPPP	Stormwater Pollution Prevention Plan
TMDL	total maximum daily load plans
UIC	underground injection control
USFWS	US Fish & Wildlife Service
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife

WRIA	Water Resource Inventory Area
WSDOT	Washington State Department of Transportation
WSU	Washington State University

INTRODUCTION

BACKGROUND

Stormwater runoff has been a source of great concern for many years at global, regional, and local scales. There are a number of regulations related to stormwater management, water quality, flood protection, and habitat protection that affect the City of Sequim's (City) stormwater water program.

Regulations initiated by the Federal Water Pollution Control Act of 1972 (the Clean Water Act) include:

- State water quality standards
- Total maximum daily load (TMDL) cleanup action requirements for water bodies, on the Washington State Department of Ecology's (Ecology) Clean Water Act Section 303(d) list due to significant water quality degradation
- National Pollutant Discharge Elimination System (NPDES) Phase II municipal stormwater permit requirements (does not currently apply to the City)

The NPDES municipal stormwater program has been in place since 1990 and requires many jurisdictions that collect stormwater runoff to have a permit to regulate discharges from municipal separate stormwater systems into receiving waters.

The US Environmental Protection Agency (EPA) stormwater regulations established two phases—Phase I (for medium and large stormwater systems) and Phase II (for smaller stormwater systems)—for the NPDES municipal stormwater permit program. The EPA Phase II regulations went into effect in early 2003 and apply to permitted small municipalities.

In Washington State, Ecology develops and administers stormwater permits. Ecology issued the first NPDES Western Washington Phase II Municipal Stormwater Permit (NPDES Phase II Permit) in 2007. An updated NPDES Phase II Permit became effective in August 2013 and included most cities on the Olympic and Kitsap Peninsulas. Municipal stormwater permits are issued every five years, thus the current permit term runs through July 2018.

The City of Sequim is not currently an NPDES Phase II permittee, but does implement its own stormwater program.

Additional federal and state regulations that apply to the City's stormwater program include:

- Groundwater quality standards administered through the Model Toxics Control Act. Federal Safe Drinking Water Act and Water Pollution Control Act, and Groundwater Quality Standards (Chapter 173-200 WAC)
- Underground injection control (UIC) regulations (Chapter 173-218 WAC)

- Federal Endangered Species Act (ESA)
- Growth Management Act; critical areas ordinance
- State Environmental Policy Act (SEPA)
- Shoreline Management Act

These regulations will be described in detail in an appendix of the Master Plan.

The current City activities and identified needs related to the City's stormwater program are described in the City of Sequim Stormwater Management Needs Assessment (Sequim 2014). The purpose of this gap analysis and compliance strategy is to present a summary of the work that has already been performed, develop recommendations for the needs identified in the City's Stormwater Management Needs Assessment (Sequim 2014), and develop recommendations associated with needs identified in an initial stormwater workshop and from a review of existing documents. The goal of this report is to document all of these needs and recommendations in a single document and to thoroughly evaluate the staffing and funding needs to implement these recommendations. This gap analysis and compliance strategy will be used by City staff to provide direction and strategic guidance for the City's stormwater program and as the framework for the City's Storm and Surface Water Master Plan (Master Plan).

METHODS OF ANALYSIS

Herrera Environmental Consultants (Herrera), in coordination with City staff, compared current stormwater program activities, water quality conditions, and habitat conditions to applicable regulatory codes and standards as well as NPDES Phase II Permit requirements. Potential gaps and areas for improvement were identified through a review of available documents, a series of questionnaires sent to City staff, and meetings with City staff to discuss the stormwater program.

Document Review

Herrera reviewed pertinent documents identified and/or provided by the City, including City codes and ordinances, maps and Geographic Information Systems (GIS) data, planning documents, water quality data and studies, and stormwater planning documents, to provide a foundation for this stormwater program characterization. A complete list of background documents reviewed is provided in Appendix A.

2014 Stormwater Management Needs Assessment

In 2013–2014, the City conducted a Stormwater Management Needs Assessment (Sequim 2014). The Stormwater Management Needs Assessment included a compilation of data from technical reports, maps, GIS and other datasets, field inventories and inspections, and interviews and input from City street and utility crews. This information was used to document current physical and operational conditions of stormwater management in the city

as well as existing hydrologic and habitat conditions, capital facilities, flooding and water quality issues, and regulatory drivers pertinent to the City. Program gaps and needs were identified for each of the topics.

This report supplements the Stormwater Management Needs Assessment prepared by the City and also includes needs not previously identified.

Stormwater Workshop

In order to discuss the components of the City's stormwater program in additional detail and to identify previously undocumented issues, City staff members representing all aspects of the City's stormwater program were invited a workshop on November 18, 2014 to discuss the following topics:

- Stormwater program management
- Development and construction sites
- Capital Improvement Program (CIP)
- Stormwater maintenance

A questionnaire was distributed to participants in advance of the workshop to gather staff input and perspectives on key stormwater issues. The questionnaire responses were used to shape and facilitate the workshop discussion. A blank questionnaire is provided in Appendix B.

STORMWATER PROGRAM ASSESSMENT

CURRENT STORMWATER PROGRAM OVERVIEW

This section summarizes the City's current activities related to each stormwater program component, describes the applicable regulatory codes and standards as well as any potentially related NPDES Phase II Permit requirements, and provides recommendations for improving the City's stormwater program. Recommendations and program improvements provided below include recommendations from the City's Stormwater Management Needs Assessment (Sequim 2014), as well as additional needs identified during the workshop and document review.

The City's stormwater program components and needs were organized into the following categories:

1. Capital Facilities
2. Inspection Program
3. Water Quality Compliance
4. Species and Habitat Protection
5. Stormwater Design Guidance and Plan Review
6. Asset Management
7. Stormwater System Operations and Maintenance
8. Pollution Source Detection and Elimination
9. Public Education and Involvement

Capital Facilities

Current Activities

The City currently does not have a stormwater capital facilities program, but has identified a list of capital facility improvements in the Stormwater Management Needs Assessment (Sequim 2014).

Regulatory Requirements

The majority of the capital facilities projects identified in the Stormwater Management Needs Assessment (Sequim 2014) are not driven by regulatory requirements.

Gaps and Recommendations

In general, flooding and water quality issues within the City are grouped into the following categories:

- Bell Creek capacity
- Drywell maintenance/capacity
- General drainage issues (including direct discharge to creeks and misconnected street drains)
- Irrigation system related flooding
- Infiltration and inflow (I/I) to the sanitary sewer system

Capital facility improvements will be prioritized in the Known Stormwater Problems and Recommended Solutions section of the Master Plan.

Inspection Program

Current Activities

The City has established the legal authority to inspect and enforce construction and maintenance standards (Sequim Municipal Code (SMC) 13.104.370), but does not currently have sufficient staff to conduct or enforce inspections.

Regulatory Requirements

SMC 13.108 sets minimum standards for the inspection and maintenance of all stormwater facilities within the City. Provisions include monthly and annual inspections of different types of facilities, waste disposal, compliance, inspection authority. The City does not currently have sufficient staff to support these inspections.

- SMC 13.108.110 states that property owners are responsible for maintenance, operation or repair of stormwater drainage systems and BMPs and are required to maintain, operate and repair these facilities in compliance with Chapter 13.108 and the *Stormwater Management Manual for Western Washington* (SWMMWW).
- SMC 13.108.130 and SMC 13.108.140 state that the director is directed and authorized to develop an inspection program for stormwater facilities, and has the authority to develop and implement enforcement procedures.
- SMC 13.108.150 and SMC 13.108.160 describe the inspector's authority to inspect and the procedures to follow prior to making any inspections.
- SMC 13.108.170 requires the director to establish a master inspection and maintenance schedule to inspect appropriate stormwater facilities that are not owned by the City on an annual basis.

- SMC 13.108.180 stipulates that as stormwater facilities are encountered, they should be recorded and added to the master inspection and maintenance schedule.
- SMC 13.108.190 requires the director to report annually to the City council regarding the status of inspections.

For reference, Section S5.C.4.a-g of the NPDES Phase II Permit lists the following requirements:

- Inspect (prior to clearing and construction) all permitted development sites that have a high potential for sediment transport.
- Inspect all permitted development sites during construction to verify proper installation and maintenance of required erosion and sediment controls.
- Inspect all permitted development sites upon completion of construction and prior to final approval or occupancy to ensure proper installation of permanent stormwater treatment and flow control BMPs/facilities.
- Implement an ordinance or other enforceable mechanism to clearly identify the party responsible for maintenance.
- Establish maintenance standards that are as protective or more protective of facility function than those specified in the SWMMWW.
- Conduct annual inspections of all stormwater treatment and flow control BMPs/facilities constructed after 2007 that discharge to the stormwater drainage system and were permitted by the City.
- Inspect all permanent stormwater treatment and flow control BMPs/facilities and catch basins in new residential developments.
- Require maintenance of private stormwater facilities within the NPDES Phase II Permit -specified timeframes.
- Develop a recordkeeping procedure for inspection reports, warning letters, notices of violations, and other enforcement records.
- Provide copies of notice of intent (NOI) letters to representatives of proposed new development and redevelopment projects.

Gaps and Recommendations

Table 1 summarizes gaps identified in the Stormwater Management Needs Assessment (Sequim 2014) related to inspections. Additional gaps were identified in the document review and discussions with the City. Recommendations to address each of these gaps are also provided below.

Table 1. Inspection Program Gaps and Recommendations.			
Topic	**Source**	**Summary of Gap**	**Recommendations**
Non-City-owned stormwater facility inspections	Stormwater Management Needs Assessment (Sequim 2014)	The City should institute an inspection and record keeping program per SMC 13.108 – and be consistent in its requests for compliance from private landowners. Protocols may also be needed to ensure that non-City facilities are maintained according to City standards.	• Institute a stormwater facility inspection program • Develop maintenance standards for non-City-owned stormwater facilities (drains, drywells, infiltration lines, retention/detention ponds, etc.) • Require facility owners to submit inspection logs and maintenance reports annually. • Consider adding language to the property Plat that describes maintenance responsibilities and that can be passed down to the new owners. • Educate facility owners on maintenance responsibilities (use flyers and handouts). • Maintain records of private stormwater facility covenants and inspection logs. • Develop enforcement procedures for private stormwater facility maintenance, such as notification letters, required maintenance standards, maintenance tracking procedures, and a restitution process.
General O&M program	Stormwater Management Needs Assessment (Sequim 2014) and workshop	Agreements regarding the type and frequency of maintenance should be established with homeowner associations and commercial landowners as needed. The City has had to assist the School District with catch basin maintenance, which takes up City time and resources.	Establish maintenance agreements with homeowner associations, commercial landowners and School Districts addressing the type and frequency of maintenance activities as well as responsibilities for maintenance.

Water Quality Compliance

Current Activities

- The City does not have an active water quality protection program or dedicated staff, other than the Master Plan (currently under development).
- The City currently has over 150 UIC wells that have not yet been registered with Ecology.

- The City's current environmental monitoring includes standard wastewater treatment testing and analyses at the Water Reclamation Facility as well as surface water flow monitoring in 2014-15 along creeks and ditches entering and leaving the City.
- Herrera prepared a Water Quality Data Analysis Report for the City that synthesizes the results of water quality monitoring conducted through the following programs:
  - Water quality monitoring data collected by the Clallam County Streamkeepers in support of an EPA-funded project to develop a comprehensive stormwater monitoring program for Clallam County
  - Clean Water District monitoring
  - Puget Sound Stream Benthos – Benthic Index of Biotic Integrity (BIBI) data

Regulatory Requirements

Water Quality Assessment and 303(d) List

Ecology groups waterbodies into five categories as part of the state water quality assessment. To date, no waterbodies in the city are listed as Category 1 (meets tested standards for clean waters) or Category 3 (insufficient data). Ecology has listed a few waterbodies as Category 2 (waters of concern) and Category 4. Category 4 includes three subcategories: Category 4a (has a TMDL), Category 4b (has a pollution control program), and Category 4c (is impaired by a non-pollutant). The following water bodies in Sequim have been assessed and assigned Category 2 (waters of concern) or 4c (impaired by a non-pollutant):

- Bell Creek: fecal coliform, pH, and temperature (Category 2)
- Johnson Creek: fecal coliform, pH, and bioassessment (Category 2)
- Dungeness River: bioassessment (Category 2)
- Sequim Bay: dissolved oxygen(Category 2)
- Independent irrigation ditch (Sequim Prairie Tri): pH (Category 2)
- Strait of Juan de Fuca East: fish and shellfish habitat (Category 4c)

Category 5 is also known as the 303(d) list and identifies impaired waterbodies that have exceeded water quality standards for one or more pollutants. The most recent 303(d) list is the 2010 list developed by Ecology in 2010 and approved by the EPA in 2012. Ecology is now on a rotating schedule for completing the freshwater and marine water quality assessments and 303(d) lists, with the next freshwater quality assessment anticipated to be available in summer 2015. Total Maximum Daily Load (TMDL) plans or water cleanup plans are established for parameters identified on the 303(d) list. Ecology has included the following waterbodies on the 303(d) list of impaired waters (Category 5) for the following parameters:

- The lower reaches of Bell Creek: fecal coliform bacteria, dissolved oxygen, and Benthic Index of Biological Integrity (B-IBI)
- Lower reaches of Johnson Creek: fecal coliform bacteria
- Sequim Bay: fecal coliform bacteria and dissolved oxygen

No TMDL implementation plans have been developed by Ecology for these waterbodies or any other waterbodies or watersheds within the City limits. In order to avoid a future TMDL, the City could take action to develop a pollution control program for waterbodies currently on the 303(d) list of impaired waters. The components of a pollution control program are described below in Table 2. Some communities have found that there is an opportunity to reduce overall long-term costs since this type of program is controlled locally (Ecology 2011).

Groundwater Quality

A large portion of the City is underlain by former floodplain alluvium, making groundwater in the City susceptible to pollutants from infiltrated stormwater. High nitrate concentrations in the shallow aquifer around Sequim suggests that groundwater quality has been impacted by urban land uses and that other mobile contaminants may be present (Sequim 2014). Many small public wells in the City and County are down gradient of the urban center, and are at risk for groundwater contamination.

In 2005, Clallam County conducted a baseline study of stormwater contamination in drinking water wells down gradient from the City's western commercial zone. In 2009 to 2011, Clallam County conducted another study to identify and sample domestic wells with susceptibility to contamination by stormwater. This study showed no substantial evidence that stormwater runoff was contaminating the wells, concluded that the infiltration practices of the City have not caused widespread contamination (Sequim 2014).

The Washington State Department of Health (DOH) mandates that larger (Group A) systems that serve more than 15 connections and 25 people per day test must for and meet groundwater quality standards for various pollutants on varying frequencies (monthly to every three years), and smaller (Group B) systems that serve fewer than 15 connections and 25 people per day must test for and meet groundwater quality standards on a less frequent basis (Sequim 2014). Group A Public Water Supplies are regulated under WAC 246-290, and Group B Public Water Systems are regulated under WAC 246-291.

During routine groundwater quality testing required by the DOH in 2013, a non-City owned public water system in the northern portion of the City was found to contain trace levels of Freon 22. The City of Sequim, Clallam County, and Ecology worked together to investigate the limits of contamination and identify potential pollutant sources (Sequim 2014).

UIC Requirements

The City has stormwater facilities that discharge to ground waters of the state, therefore this is another regulatory requirement related to stormwater that should be addressed in the City's stormwater program. Chapter 173-218-090(1) WAC states that the following must be added to stormwater programs and implemented for UICs:

- UIC wells must be registered
- New UIC wells must be constructed according to Chapter 173-218 WAC specifications
- A well assessment must be completed for all existing wells
- Existing UIC wells that are determined to be a high threat to ground water must be retrofitted

UIC wells constructed prior to February 3, 2006 are considered to be existing wells. Owners of 50 or fewer wells were expected to register their wells by February 3, 2009, and complete their well assessment by February 3, 2011. Owners of more than 50 wells were expected to register their wells by February 3, 2011, and complete their well assessment by February 3, 2013.

Regulatory Requirements

For reference, Section S7 and S8 of the NPDES Phase II Permit lists the following requirements for NPDES Phase II permittees:

- Implement the specific requirements identified in Appendix 2 ("Total Maximum Daily Load Requirements") of the NPDES Phase II Permit for applicable TMDLs listed in Appendix 2.
- Compliance with the NPDES Phase II Permit constitutes compliance with applicable TMDLs not listed in Appendix 2 of the NPDES Phase II Permit.
- Comply with NPDES Phase II Permit modifications and TMDL implementation plans prepared by Ecology for TMDLs that are approved by the EPA after the NPDES Phase II Permit has been issued.
- Provide a description of stormwater monitoring or stormwater-related investigations conducted during the reporting period.
- Participate in the Regional Stormwater Monitoring Program (RSMP) or opt-out monitoring. The RSMP includes the following three major components:
  - Status and trends monitoring.
  - Stormwater management program effectiveness studies.
  - Source identification and diagnostic monitoring (SIDM).

Gaps and Recommendations

Table 2 summarizes needs identified in the Stormwater Management Needs Assessment (Sequim 2014) related to water quality compliance. Recommendations are provided for each need identified. Additional gaps were identified in the document review and discussions with the City. Recommendations to address each of these gaps are also provided below.

Table 2. Water Quality Compliance Gaps and Recommendations.			
Topic	**Source**	**Summary of Gap**	**Recommendations**
Pollution control program	Discussion with City staff	Numerous waterbodies in the City are on the 303(d) list of impaired waters (Category 5), but no TMDLs have been initiated.	The City could take action to proactively develop and implement a pollution control program for water bodies currently on the 303(d) list of impaired waters. A pollution control program would include: • Actions to correct the specific pollution problem • Monitoring to evaluate effectiveness • Adaptive management • Enforceable pollution controls or actions stringent enough to attain water quality standards • Description of management measures • Implementation schedule • Description of criteria that are used to determine loading reductions • Education component If the City's pollution control program is accepted by Ecology, the waterbodies may be moved from Category 5 to Category 4b and avoid a TMDL process.
Monitoring	Stormwater Management Needs Assessment (Sequim 2014)	The City should determine what monitoring is needed in order to manage storm flows, prevent stormwater contamination of surface and ground water, and preserve recharge. The City should decide what is needed for this monitoring: equipment, staff resources, which laboratory analyses, which surface water sites and groundwater wells (existing or new), landowner agreements, data management, etc. – and coordinate with other entities conducting or planning to conduct monitoring.	Implement additional water quality monitoring recommendations included in the Water Quality Data Analysis Report: • 12 samples per year (6 during wet weather and 6 during dry weather) at 6 monitoring stations in Bell and Johnson Creek • Continuous monitoring of dissolved oxygen and temperature in Bell Creek during the summer months • Fecal source tracing survey in Bell Creek

Table 2 (continued). Water Quality Compliance Gaps and Recommendations.			
Topic	**Source**	**Summary of Gap**	**Recommendations**
Monitoring	Stormwater Management Needs Assessment (Sequim 2014)	Data collected in the past five years by Clean Water Work Group partners in both Bell and Johnson Creeks (and any irrigation ditches if available) should be evaluated to see if there is a direct relationship for various parameters with stormwater runoff from urban areas. Depending on the results of this evaluation, water quality monitoring should be considered for Bell and Johnson Creeks (at least) and potentially Washington Harbor, Pitship Estuary/Bay and certain irrigation ditches that feed area creeks. Consider accumulation of metals in streambed sediments in Bell Creek as a water quality monitoring plan is developed.	Implement additional water quality monitoring recommendations included in the Water Quality Data Analysis Report.
Monitoring	Stormwater Management Needs Assessment (Sequim 2014)	• The City should monitor streamflow trends in several reaches in Bell and Johnson Creeks above, inside, and below city limits, and consider including Gierin Creek at Brown Road. • Flow trends in irrigation conveyances through the city should also be monitored, especially those that receive substantial stormwater runoff.	Develop and implement flow monitoring program (currently underway).
Groundwater	Stormwater Management Needs Assessment (Sequim 2014)	Persistent nitrate contamination in the shallow aquifer within and around the city limits should be tracked, especially since nitrates are a good indicator that other contaminants may be present.	Develop and implement a nitrate groundwater monitoring plan.

Table 2 (continued). Water Quality Compliance Gaps and Recommendations.

Topic	Source	Summary of Gap	Recommendations
Groundwater	Stormwater Management Needs Assessment (Sequim 2014)	Groundwater should be monitored for pollutants typically found in stormwater runoff upgradient, inside, and downgradient of the city (i.e., metals, hydrocarbons, bacteria, and any chemicals used for or a byproduct of ice/ snow management, weed/ root management, vehicle maintenance, vactor/ sweeper truck waste, etc.)	Develop and implement a groundwater monitoring plan for stormwater constituents of concern.
Groundwater	Stormwater Management Needs Assessment (Sequim 2014)	The City should consider monitoring stormwater and groundwater quality at locations where stormwater facilities and water quality have been monitored in the past, to check long-term performance of the facilities.	Develop and implement a stormwater facility monitoring plan (including private facilities). City requires monitoring for the first 3-5 years (commercial and residential). Consider benefits of continuing this monitoring requirement.
UIC registration	Stormwater Management Needs Assessment (Sequim 2014)	The City needs to identify and register its UIC wells with Ecology as soon as possible, and then complete well assessments.	• Use GIS to identify wells that need to be registered with Ecology. • Use online form to register wells: http://www.ecy.wa.gov/PROgrams/wq/grndwtr/uic/UIConlineregis.html • Complete well assessments per guidance on Ecology's website: http://www.ecy.wa.gov/PROgrams/wq/grndwtr/uic/UICwellassessment.html
Well assessment	Stormwater Management Needs Assessment (Sequim 2014)	• The City should find funding to assess the potential threat to groundwater quality posed by its infiltration facilities. • The City should fund an assessment of whether its underground injection wells (several dozen pre-exist the CARA code) are a threat to groundwater and take mitigative action as necessary to protect the aquifer.	Develop a plan to assess drywells classified as UICs.

Species and Habitat Protection

Current Activities

The City does not currently have a species and habitat protection program, other than membership and participation in the Dungeness River Management Team and Water Management Rule Implementation committees. The following activities have recently been completed that have benefitted species and habitat protection.

- Pitship Estuary Bridge on West Sequim Bay Road that reconnects tidal functions to the Pitship Pocket Estuary.
- Reclaimed water is used north of the Reuse Demonstration Park to irrigate Garry Oaks Park managed by WDFW and to augment ponds that benefit migratory waterfowl.
- Bell Creek flow is continuously augmented year-round with reclaimed water at a rate of 0.1 cfs.

The City also cooperated with the Jamestown S'Klallam Tribe on the Washington Harbor Estuary Bridge project to replace a causeway that supported the City's outfall pipe and blocked potential fish habitat.

The City has identified recommendations for species and habitat protection in the Stormwater Management Needs Assessment (Sequim 2014).

Regulatory Requirements

The US Fish & Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) oversee implementation of the federal Endangered Species Act (ESA). Several local species are ESA listed as endangered or threatened, and recovery plans are underway. While the ESA does not specifically address stormwater management activities, it does prohibit the "taking" of listed species (i.e., killed or harmed – where harm can include habitat or water quality degradation), including a take that could result from the City's stormwater facility operations or private development stormwater management activities that are permitted by the City.

Several federally listed endangered and threatened species are found within the City limits, including fish species and birds that rely on fresh and/or marine water for some portion of their life history and are summarized below in Table 3.

Table 3. Listed Species in the City of Sequim.			
Species	**Status**	**Location**	**Federal Jurisdiction**
Strait of Juan de Fuca bull trout	FT	Dungeness River and associated tributaries, Bell Creek, Johnson Creek	USFWS
Bald eagle	SC, SS	Various nesting sites throughout Sequim, concentrated mostly along Sequim Bay and Dungeness River	USFWS, WDFW
Chinook salmon	FT	Sequim Bay, Dungeness River and associated tributaries	NMFS
Coho salmon	FC	Dungeness River and associated tributaries	NFMS
Marbled murrelet	FE	Forest habitat along streams, rivers, and marine foraging areas	USFWS
Osprey	SM	Nest near Palo Alto	WDFW
Pacific herring	CS	Sequim Bay	WDFW
Puget Sound steelhead trout	FT	Dungeness River and associated tributaries, Bear Creek, Bell Creek, Johnson Creek	NMFS

FE = Federally Endangered
FT = Federally Threatened
FC = Federal Candidate
SC = Species of Concern
SS = State Sensitive
SM = State Monitored
CS = State Candidate
USFWS = United States Fish and Wildlife Service
WDFW = Washington Department of Fish and Wildlife
NMFS = National Marine Fisheries Service

Gaps and Recommendations

The Stormwater Management Needs Assessment (Sequim 2014) also included several other needs for Federal and State fish and wildlife habitat protection. Table 4 summarizes these needs along with recommendations for each need identified.

Table 4. Species and Habitat Protection Gaps and Recommendations.

Topic	Source	Summary of Gap	Recommendations
Fish and wildlife habitat protection	Stormwater Management Needs Assessment (Sequim 2014) and Professional judgment	Federal assessments designate Dungeness River and Bell and Johnson Creeks as "critical habitat" for threatened or endangered salmonids: • Bull trout (critical habitat designated in 2010) • Puget Sound steelhead (critical habitat currently proposed for designation)	• Ensure habitat access by examining all culverts and replacing them if they pose barriers to fish passage. Replace with bridges where possible to allow passage of large woody debris. • Maintain riparian buffers to control water temperature and provide forage material.
Fish and wildlife habitat protection	Stormwater Management Needs Assessment (Sequim 2014)	The City should participate in studying fish use and setting restoration goals for Bell and Johnson Creeks.	The City should participate in Dungeness River Management Team (DRMT) routine meetings and request smolt outmigration data from Bell Creek measured by the Tribe.
Fish and wildlife habitat protection	Professional judgment	Prevent development and expansion in the floodplain to maintain access to off-channel habitat.	• Determine whether the City needs to update floodplain mapping within City limits to be in compliance with the National Floodplain Insurance Program (NFIP) and restrict development within the floodplain. • Utilize soft bank stabilization methods, levee setbacks, and limit the use of riprap and other bank hardening methods to allow natural stream migration and off-channel habitat formation.
Fish and wildlife habitat protection and groundwater	Stormwater Management Needs Assessment (Sequim 2014)	The City should participate in water management, hydrogeologic, aquifer recharge, and modeling studies pertaining to the Dungeness aquifer system, especially as they relate to the City's drinking water supplies and area stream flows.	The City should participate in DRMT routine meetings and with Water Rule implementation groups.

Stormwater Design Guidance and Plan Review

Current Activities

The City implements a variety of activities and programs for stormwater design guidance and plan review that include the following:

- **Stormwater management design guidance:** The SMC requires use of "the latest edition" of Ecology's SWMMWW for designing stormwater systems. The latest edition was published in 2012 and revised in 2014 (Ecology 2012b).
- **Stormwater site plan review:** The City (Senior Planner, Department of Community Development) currently conducts drainage reviews for smaller developments, and contracts out the drainage review for larger developments within the city. The City does not typically use modeling software for plan review of residential projects.
- **LID code update/integration**: In 2009**,** AHBL worked with the City as part of the Low Impact Development (LID) Local Regulation Assistance Project and evaluated the SMC to incorporate and require LID principles and LID best management practices (BMPs) (AHBL 2009). The code recommendations have not yet been adopted. The City code sections that were reviewed and a brief summary of the recommendations are provided below:
  - Title 12- Street, Sidewalks, and Public Places
    - Recommendations included new language to facilitate permeable pavement surfacing for sidewalks and right-of-ways and encourage alternative street design to incorporate LID BMPs
  - Title 13- Public Services (Section 13.108)
    - Minimal revisions were provided since this section already includes provisions for maintaining LID BMPs
  - Title 17- Subdivisions (Sections 17.12, 17.20, 17.24, 17.28, and 17.32)
    - Recommendations included language that requires applicants to perform LID site analysis, discusses native vegetation retention standards, and allows for integration of LID into required landscaping
  - Title 18- Zoning (Section 18.22, 18.24, 18.26, 18.40, 18.44, and 18.48)
    - Recommendations include language that requires LID-focused site analysis for certain projects, specifies new standards for reduction of stormwater volume through a combination of LID BMPs, provides LID-focused performance standards for clearing and grading activities, and adds references to LID engineering standard drawings
- **Stormwater management ordinance and enforceable mechanisms:**
  - SMC 13.104.100 currently adopts the most recent version of Ecology's SWMMWW.
- **Recordkeeping and enforcement:**
  - As-built drawings are kept on file with the City.
  - The City has established the authority to enforce the stormwater management ordinance and issue a stop work order if needed (SMC 13.104.390).

Regulatory Requirements

For reference, Section S5.C.4.a-g of the NPDES Phase II Permit lists the following requirements:

- Implement an ordinance or ordinance revisions that addresses runoff from new development, redevelopment, and construction site projects.
- Review all stormwater site plans for proposed development activities.
- Train City staff responsible for implementing the program described above, including staff involved with permitting, plan review, construction site inspections, and enforcement.
- Review and revise local development-related codes, rules, standards, and other enforceable documents to incorporate and require LID principles and LID BMPs.
- Summarize the results of the code review and revision process in a report to Ecology.
- Participate in watershed-scale stormwater planning (not applicable to the City since it is not located in the same watershed as a Phase I jurisdiction).

Gaps and Recommendations

Table 5 summarizes gaps identified in the Stormwater Management Needs Assessment (Sequim 2014) related to stormwater design guidance and plan review. Additional gaps were identified in the document review and discussions with the City. Recommendations to address each of these gaps are also provided below.

Table 5. Stormwater Design Guidance and Plan Review Gaps and Recommendations.

Topic	Source	Summary of Gap	Recommendations
Stormwater management guidance	Stormwater Management Needs Assessment (Sequim 2014)	Sequim should consider alternatives to the Ecology SWMMWW based on local conditions.	• Review the 2012 SWMMWW and 2014 modifications. • Consider developing an amendment to the 2012 SWMMWW that provides guidelines and requirements specific to the City (i.e., storage of deicing material, runoff rates specific to the City, the best infiltration BMPs for the City, etc.).
Stormwater management guidance	Stormwater Management Needs Assessment (Sequim 2014)	The City should develop a master plan that identifies BMPs that are most effective at protecting groundwater quality while preserving recharge.	Research which BMPs are most effective in protecting groundwater quality while preserving recharge as part of the Master Plan and consider including these BMPs in an additional guidance document or amendment to the 2012 SWMMWW.
Stormwater management guidance	Stormwater Management Needs Assessment (Sequim 2014)	Application of the SWMMWW for single family vs. larger development projects should be clarified.	Develop handouts that summarize on-site stormwater management, treatment, and flow control thresholds for single-family and commercial development projects. Update the SMC as needed.

Table 5 (continued). Stormwater Design Guidance and Plan Review Gaps and Recommendations.			
Topic	**Source**	**Summary of Gap**	**Recommendations**
Stormwater design	Professional judgment	The City should consider promoting secondary uses of stormwater.	Consider promoting or incentivizing secondary uses for stormwater such as rainwater collection and reuse for irrigation and toilet flushing.
LID code update/integration and summary report	Stormwater Management Needs Assessment (Sequim 2014)	The City should consider AHBL's recommendations and summary report and evaluate additional chapters of the SMC that are pertinent to stormwater management.	• Incorporate some or all of AHBL's recommendations into the SMC • Review the following additional sections of the SMC to determine if additional edits are needed: o 8.36- Flood Damage Prevention o 13.40- Sewer Connection Required o 13.48- Public Sewer Use Regulations o 13.64- Storm Drainage o 13.104- Stormwater Management o 15.04.101- IBC Appendix J o 18.80- Critical and Environmentally Sensitive Areas Protection • Develop a brief summary report that highlights the proposed amendments to the SMC • Coordinate with City Council to review and approve proposed changes to SMC
Stormwater site plan review and staff training	Workshop, NPDES Phase II Permit	Stormwater site plan review currently does not have a consistent review process or checklists and tools to support plan review under the SWMMWW. The City does not currently have a training program for site plan review and inspection staff.	• Develop a consistent stormwater plan review process. • Develop checklists and sizing table tools for site plan review to increase efficiency. • Develop specific plant lists for BMPs. • Training for staff is recommended when updates occur to planning, development, inspection, and enforcement of stormwater runoff controls. • Promote upcoming training opportunities for designers (specifically on the 2012 SWMMWW). • Coordinate with the Clallam Conservation District for other training opportunities for staff (i.e., rain garden training).
Basin Planning	NPDES Phase II Permit	The City is not involved in a watershed- scale stormwater planning process	The City is not an NPDES Phase II Permittee and is not required to participate in watershed-scale stormwater planning, but should look for opportunities to partner with Clallam County in a watershed-scale planning effort.

Asset Management

Current Activities

The City currently does not have an asset management program for stormwater infrastructure, but has mapped the majority of its stormwater facilities and structures in geographic information system (GIS).

Regulatory Requirements

There are no regulatory requirements for an asset management program.

Gaps and Recommendations

An effective asset management program ensures that assets continue to function over the long term and significantly reduces the potential for system failure. Asset management is a system for maintaining the desired level of service while minimizing the life cycle cost of stormwater assets. An asset management program typically includes an inventory of assets, an assessment of their condition, implementation of a GIS-based asset management data information tracking system, and prioritization of maintenance or capital repair projects based on assessing the likelihood of failure and consequences of failure for each asset.

It is recommended that the City begin an asset management program by implementing an asset inventory and updating stormwater system components in GIS with current conditions. This inventory could be conducted with camera equipment that could also be used for Pollution Source Detection and Elimination and Stormwater System O&M, and could happen concurrently with the recordkeeping recommendation in the Stormwater System O&M section to update and record inspection maintenance activities of stormwater assets in GIS.

Table 6 summarizes gaps identified during discussions with the City. Recommendations to address each of these gaps are also provided below.

Table 6. Asset Management Gaps and Recommendations.

Topic	Source	Summary of Gap	Recommendations
Pollution Source Detection program	Stormwater Management Needs Assessment (Sequim 2014)	The City should have a program for actively identifying pollution sources.	Develop and implement a pollution source tracking program (other programs developed by NPDES Phase II permittees can be used as guidance).
Storm system map (GIS) updates	Stormwater Management Needs Assessment (Sequim 2014)	The City's GIS for storm system components needs to be updated and maintained.	• Continue to update the storm system map and database as needed. • Major parking lots and subdivisions should be included in GIS. • WSDOT facilities installed for SR 101 should be included in GIS. • Develop a system to ensure that new development projects with stormwater components are incorporated into GIS.
Asset Management	Workshop	City does not have an asset management program	Improve the existing asset management by updating stormwater system components in GIS with current conditions

Stormwater System Operations and Maintenance

Current Activities

The City currently implements a variety of stormwater system operations and maintenance (O&M) activities that include the following:

- **Inspections and O&M program:**
  - City-owned catch basin and stormwater facilities (e.g., drywells and perforated pipes) inspection and cleaning every 1 to 3 years, according to need
  - Street sweeping, most streets several times/year
  - Stormwater facility cleaning and maintenance, repair/replacement as needed
  - Flooding response and repair
- **Spill Response:**
  - Spill control materials (i.e., sand bags, kitty litter, straw wattles, catch basin filters, etc.) are kept on hand in case of spills, including firefighting water.

The Streets crews also implement the following activities which may impact stormwater:

- **Snow and Ice Management:** Crews have used magnesium chloride since the winter of 2011-2012 as a de-icing agent on main arterials, overpasses, hills, and roundabouts. Magnesium chloride has been more cost-effective for the City than road salt or sand and is more environmentally friendly than most other de-icers. The use of magnesium chloride also does not require additional street sweeping (as required with sand) to pick up material after each storm event. De-icing materials are stored outdoors in storage tanks (8,000 gallon maximum capacity) on an uncovered impervious area.
- **Weed Management:** City crews occasionally use EPA-approved herbicides during the summer and early fall to keep sidewalks and street gutters free of weeds. Any herbicides used are applied to the minimum extent practicable and are applied by Washington State Department of Agriculture Pesticide licensed Public Works crew members. Herbicides are stored in the breezeway in containers or inside on a concrete pad. The City does not currently have an Integrated Pest Management Plan (IPMP).
- **Vactor Waste Disposal:** The City collects vactor waste from cleaning and maintenance of catch basins, detention facilities, and treatment structures or facilities. The vactor waste is transported to the City Shop facility and dumped at the decant facility. The decant liquids are sent to the sanitary sewer system. Clean solids are disposed of at the County gravel pit or land-applied to City-owned property next to the Shop. If a hot load is suspected, materials are tested prior to dumping and transported to the Port Angeles Landfill.
- **Street Sweeping Waste Disposal:** Street sweeping waste is transported to the City Shop facility and dumped on a dewatering slab where the liquids are decanted from the solids. The decant liquids are sent to the sanitary sewer system. Clean solids are disposed of at the County gravel pit or land-applied to City-owned property next to the Shop. If a hot load is suspected, materials are tested prior to dumping and transported to the Port Angeles Landfill.

Regulatory Requirements

SMC 13.108.080 adopts stormwater facility maintenance standards per the Ecology SWMMWW. To be consistent with City code, the City should implement the maintenance standards included in the SWMMWW. The Ecology SWMMWW contains maintenance standards for the following types of facilities:

- Infiltration facilities (infiltration basins and infiltration trenches)
- Detention facilities (detention ponds, detention tanks, detention vaults and control structures)
- Wet pool facilities (wet ponds, wet vaults, stormwater treatment wetlands, combined detention and wetpool facilities)
- Biofiltration facilities (biofiltration swales, wet biofiltration swales)
- Filters (sand filters, media filters, filter strips, media filter drains, and compost amended vegetated filter strips)
- On-Site Stormwater Management BMPs (or LID BMPs) (bioretention, permeable pavement, rain gardens, and vegetated roofs)
- General stormwater system components (catch basins, debris barriers, and energy dissipaters)
- Oil water separators

SMC 13.108.090 specifies minimum maintenance standards for the following stormwater facilities.

- Facilities: Inspect annually, clear debris, sediment and vegetation if affecting the function and/or design capacity of the facilities
- Grassy swales and biofilters: Monthly inspection of, mow or replant as necessary and proper dispose of clippings

SMC 13.108.100 requires disposal of waste from maintenance activities to comply with the minimum Functional Standards for Solid Waste Handling (Chapter 173-304 WAC) and, where appropriate, the Dangerous Waste Regulations (Chapter 173-030 WAC).

For reference, Section S5.C.5.a-f of the NPDES Phase II Permit lists the following requirements:

- Implement maintenance standards that are as protective or more protective of facility function than those specified in Ecology's SWMMWW
- Inspect municipally owned or operated permanent stormwater treatment and flow control BMPs/facilities (other than catch basins) annually and take appropriate maintenance actions
- Conduct spot checks of potentially damaged permanent treatment and flow control BMPs/facilities (other than catch basins) after major storm events

- Perform maintenance of public stormwater facilities within the NPDES Phase II Permit-specified timeframes
- Conduct catch basin and inlet inspections on a routine basis using one of three options outlined in the NPDES Phase II Permit
- Implement practices, policies, and procedures to reduce stormwater impacts associated with runoff from all lands owned or maintained by the City and road maintenance activities under the functional control of the City
- Implement an ongoing training program for City employees whose primary construction, operations, or maintenance job functions may impact stormwater quality
- Implement a Stormwater Pollution Prevention Plan (SWPPP) for all heavy equipment maintenance or storage yards and material storage facilities owned or operated by the City
- Maintain records of inspections and maintenance or repair activities

Gaps and Recommendations

Table 7 summarizes gaps identified in the Stormwater Management Needs Assessment (Sequim 2014) related to stormwater system O&M. Additional gaps were identified in the document review and discussions with the City. Recommendations to address each of these gaps are also provided below.

Table 7. Stormwater System Operations and Maintenance Gaps and Recommendations.

Topic	Source	Summary of Gap	Recommendations
General O&M program	Stormwater Management Needs Assessment (Sequim 2014)	Street sweeping coverage is good but the routine should be evaluated to ensure adequate infrastructure protection and pollutant removal.	Evaluate street sweeping routine to determine if changes need to be made.
General O&M program	Stormwater Management Needs Assessment (Sequim 2014) and workshop	Agreements regarding the type and frequency of maintenance should be established with irrigators and other stormwater management partners, including the County and WSDOT, as needed.	Establish maintenance agreements with irrigators and other stormwater management partners addressing type and frequency of maintenance activities as well as responsibilities for maintenance.

Table 7 (continued). Stormwater System Operations and Maintenance Gaps and Recommendations.			
Topic	**Source**	**Summary of Gap**	**Recommendations**
General O&M program	Stormwater Management Needs Assessment (Sequim 2014)	A policy should be adopted to avoid unnecessary inheritance of facilities that add to the City's maintenance and repair obligations.	Develop a policy for City inheritance of private stormwater facilities that specifies the condition that a private stormwater facility should be in prior to being inherited by the City. Consider coordinating this policy with the inheritance of private streets. Options for the City include: 1. Inspect facilities and require that the property owner hire a qualified contractor to conduct necessary maintenance 2. Require facility owners to contract with a third party inspector and provide an inspection certification letter to the City, as well as proof that any required maintenance has been completed 3. Perform maintenance and charge the property owner 4. Assume maintenance responsibilities through a deed or easement.
General O&M program	Stormwater Management Needs Assessment (Sequim 2014)	The potential for improved internal communications within Public Works to facilitate improvements in O&M activities should be explored, especially as O&M activities increase.	Improve internal communications within Public Works to facilitate O&M activities. Consider developing a Public Works flow chart or internal communications plan.
General O&M program	Workshop	It has been 2-5 years since the Shop stormwater pond was last maintained.	Include the stormwater pond that drains the south end of the Shop parking lot in regular inspection and maintenance routines.
Recordkeeping	Stormwater Management Needs Assessment (Sequim 2014)	The GIS database (and/or other programs) should be used to document inspection and maintenance activities.	Add maintenance and inspection information to the storm system map and database in GIS.
Stormwater policies and procedures	Stormwater Management Needs Assessment (Sequim 2014)	The City should assess whether weed management practices are contaminating stormwater runoff.	The City should develop an Integrated Pest Management Plan (IPMP) for right-of-way vegetation and stormwater facility maintenance.
Stormwater policies and procedures	Stormwater Management Needs Assessment (Sequim 2014)	Trash and litter accumulate in certain problem areas.	Remove trash and litter from problem areas, set up a notification system and response, or implement a volunteer program for service days.

Table 7 (continued). Stormwater System Operations and Maintenance Gaps and Recommendations.			
Topic	**Source**	**Summary of Gap**	**Recommendations**
Stormwater policies and procedures	NPDES Phase II Permit	The City does not currently have written standard operating procedures (SOPs) for O&M activities for preventing stormwater pollution outside of City-owned facilities.	Develop SOPs for O&M staff. SOPs may include: • Ditch maintenance • Street cleaning • Utility installation • Sediment and erosion control • Dust control • Application of fertilizers, pesticides, and herbicides • Trash and pet waste management • Deicing methods
SWPPPs	NPDES Phase II Permit	The City Shop currently does not have a SWPPP.	Review SWPPPs developed for other Cities and Counties to determine if a similar plan should be developed for the City Shop.
Staff training	NPDES Phase II Permit	The City does not currently have a stormwater O&M staff training program.	• Require City O&M staff attendance at trainings, especially those related to maintenance of LID BMPs. • Invite vendors to present on how to maintain their technologies, and encourage City O&M staff to attend training. • Invite Irrigation District and Clallam County • O&M staff to attend trainings.
O&M staffing	Stormwater Management Needs Assessment (Sequim 2014)	The City currently does not have sufficient staff support for performing catch basin inspections.	Consider hiring seasonal workers during the fall to work on inspection/maintenance crew.
O&M staffing	Workshop	The City currently does not have sufficient staff support for inspecting and cleaning stormwater pipes and drywells.	Increase staff support for inspecting and cleaning stormwater facilities.
O&M equipment	Professional judgment	The City should budget for equipment for maintaining LID BMPs if these types of facilities are expected to be more prevalent in the future.	Obtain additional tools and equipment to inspect, maintain, and repair LID facilities.

Pollution Source Detection and Elimination

Current Activities

Pollution Source Detection and Elimination refers to the detection and elimination of "illicit discharges", defined in SMC 13.104.040 as non-stormwater discharges to the storm drainage system that cause or contribute to a violation of state water quality, sediment quality or ground water quality standards. These discharges can include, but are not limited sanitary sewer connections, industrial process water, interior floor drains, car washing, and greywater systems. The City's activities related to pollution source identification and elimination include the following:

- **Stormwater system map updates:** Ongoing mapping of the City's stormwater facilities and pipes (both City and non-City owned) is described under Asset Management.
- **Illicit discharge ordinance:** Adopted an illicit discharge ordinance prohibiting illicit discharges to stormwater drainage systems (SMC 13.104.120).
- **Enforcement:** Ecology and the EPA have enforced several past illicit discharges within the city.

Regulatory Requirements

SMC 13.104.120 prohibits illicit discharges to stormwater drainage system.

For reference, Section S5.C.3.a-f of the NPDES Phase II Permit lists the following requirements related to pollution source identification and elimination (known as "Illicit Discharge Detection and Elimination" or "IDDE" in the NPDES Phase II Permit) for NPDES Phase II permittees:

- Map stormwater outfalls, receiving waters, City-owned stormwater facilities, and geographic areas that do not discharge stormwater to surface waters
- Develop and implement an illicit discharge ordinance
- Implement an ongoing program to detect and identify non-stormwater discharges and illicit connections
- Implement a field screening methodology to detect and identify non-stormwater discharges and illicit connections into the stormwater drainage system (i.e., roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, storm drains, and outfalls)
- Inform public employees, businesses, and the general public of the hazards associated with illicit discharges and improper disposal of waste
- Ongoing training program for all municipal field staff

Gaps and Recommendations

Table 8 summarizes gaps identified in the Stormwater Management Needs Assessment (Sequim 2014) related to the City's Pollution Source Detection and Elimination Program. Additional gaps were identified in the document review and discussions with the City. Recommendations to address each of these gaps are also provided below.

Table 8. Pollution Source Detection and Elimination Gaps and Recommendations.

Topic	Source	Summary of Gap	Recommendations
Illicit discharge hotline	NPDES Phase II Permit	The City currently does not have a spill reporting hotline.	• Develop a spill reporting hotline or web form and promote on the City's main webpage and at public events. • Consider partnering with the City of Forks and Port Angeles, Clallam County, and tribes or regional agencies to establish a regional spill reporting hotline and website.
Illicit discharge ordinance	NPDES Phase II Permit	The City's existing illicit discharge ordinance could use some minor improvements.	Update illicit discharge ordinance with a list of prohibited and allowable discharges and enforcement procedures, or provide policy direction for interpreting it.
Pollution source field screening	NPDES Phase II Permit	The City does not currently have a pollution source field screening program to screen the storm drainage system for pollutants, conduct indicator sampling, and implement follow-up source tracing to pinpoint the pollution source.	• Develop and implement a field screening program for the City's stormwater system. • Obtain field equipment that can be used for pollution source field screening and source tracing (see Equipment Recommendations section). • Develop a basic training program for City field staff (see Staff training below). • Develop a system for tracking all illicit discharges reported and investigated (see Recordkeeping below).
Pollution source education	NPDES Phase II Permit	Educational materials for pollution source prevention and response are not currently available.	Provide pollution source prevention and response education as part of the City's ongoing public education program to the general public and businesses.
Staff training	NPDES Phase II Permit	The City does not currently have a pollution source identification and elimination training program.	• Develop a basic training program for City field staff that covers what visual cues and odors can be used to identify an illicit discharge or illicit connection and who they should report this to. • Require staff involved in illicit discharge response to review the Illicit Connection/Illicit Discharge Field Screening and Source Tracing Guidance Manual that was developed for the State of Washington (Ecology 2013): <www.wastormwatercenter.org/illicit-connection-illicit-discharge>.
Recordkeeping	NPDES Phase II Permit	The City does not currently track pollution sources or spills.	Develop a system for tracking all pollution sources and spills reported and investigated.

Public Education and Involvement

Current Activities

The City's stormwater public education and involvement currently includes the following activities, all directly related to the 2013-2015 Master Plan project, partially funded by a Centennial Clean Water grant from Ecology:

- **Education:**
  - Dungeness River Fest (September 2014)
  - Interpretive Center at Water Reuse Demonstration Park (grand opening in October 2014; open 2 hours every Wednesday mornings and Thursday afternoon)
  - Public presentations to Chamber of Commerce, Dungeness River Management Team, Science Café, Sequim Assoc. of Realtors, North Peninsula Builders Assoc., and others
  - Stormwater Stewardship flyer, Bell Creek poster, LID resource table and other elements displayed at the Interpretive Center
  - Website on surface water management, including a page on the Stormwater Stewardship project, and a virtual tour of local water resources
  - Creek sign installation (Bell, Johnson, Gierin Creeks)
- **Opportunities for public involvement:**
  - Website for the Stormwater Management Needs Assessment (Sequim 2014) project to solicit reports of flooding and problem areas within the City
  - Volunteer program, including storm drain inventory, flow monitoring, data entry, watershed education, and other activities
  - Bell Creek Discovery Tour online or on-the-ground educational tour of sites from headwaters to mouth (prizes for those completing tour April-May 2015)
  - Monthly Stormwater Stewardship project updates offered by email to subscribers via website
- **Coordination with stakeholders:** Directly consults with stakeholder groups (e.g., irrigators, Clallam County, homeowner groups, tribes) regarding stormwater management and water quality

Regulatory Requirements

There are no regulatory requirements for public education and involvement regarding stormwater or water quality currently applicable to the City of Sequim.

The Elwha-Dungeness Watershed Plan (Elwha-Dungeness Planning Unit 2005) recommends the following actions:

- Develop a central clearinghouse for all conservation and environmental outreach work within the watershed (WRIA 18)
- Work with WRIA 18 schools districts, nonprofit organizations, and local jurisdictions to develop educational curricula, continuing education for professionals, and public outreach for general adult education
- Provide information on services and resources for landowners in watershed resource management (e.g., WSU Cooperative Extension, Clallam County Conservation District, and Clallam County resources)
- Encourage citizen involvement for ongoing planning efforts at local and regional levels
- Encourage landowners to protect sensitive areas through donated or purchased conservation easements
- Support efforts to involve the community in planning and efforts to preserve, restore, and protect the watershed
- Educate landowners in the watershed and along the shoreline on the importance of providing functional salmon habitat
- Encourage the Sequim school districts to collaborate with the Dungeness River Audubon Center to and seek funding for school programs that include more "hands on" activities for the following topics:
    - Riparian function
    - Watershed issues
    - River processes
    - Water resources conservation
- Encourage the City to collaborate with Clallam County and the Tribes to identify resources for establishing cooperative programs involving organizations such as the Olympic National Park, City of Port Angeles, Clallam County, and Clallam Conservation District
- Develop interpretive signage and handouts for use by neighborhood and river and creek watch groups
- Continue water quality education and outreach:
    - Develop effective modes of communication (e.g., newsletters, flyers, radio, fairs/festivals) on subjects such as non-point pollution concerns, pasture management, septic systems, shellfish, proper use of well water, application of pesticides, septic systems, etc.
    - Conduct pre and post surveys to evaluate effectiveness of educational efforts
    - Provide BMP information to landowners
- Educate riverside and marine shoreline landowners on importance of habitat management planning

For reference, Section S5.C.1.a-c and Section S5.C.2.a-b of the NPDES Phase II Permit lists the following requirements for NPDES Phase II permittees:

- Provide an education and outreach program targeting the following audiences:
  - General public (including school age children)
  - Businesses (including home-based and mobile businesses)
  - Engineers, contractors, developers, and land use planners
  - Residents, landscapers, and property managers/owners
- Potential subject areas for the education and outreach program include the following:
  - General public and businesses:
    - General impacts of stormwater on surface waters
    - Impacts from impervious surfaces
    - Impacts of illicit discharges and how to report them
    - Low impact development (LID) principles and LID best management practices (BMPs)
    - Opportunities to become involved in stewardship activities
    - Use and storage of automotive chemicals, hazardous cleaning supplies, carwash soaps, and other hazardous materials
    - Equipment maintenance
    - Prevention of illicit discharges
  - Engineers, contractors, developers, and land use planners:
    - Technical standards for stormwater site and erosion control plans
    - LID principles and BMPs
    - Stormwater treatment and flow control BMPs/facilities
  - Residents, landscapers, and property managers/owners:
    - Yard care techniques protective of water quality
    - Use and storage of pesticides and fertilizers and other household chemicals
    - Vehicle, equipment and home/building maintenance
    - Pet-waste management and disposal
    - LID principles and LID BMPs
    - Stormwater facility maintenance
    - Dumpster and trash compactor maintenance
- Create stewardship opportunities and/or partner with existing organizations to encourage residents to participate in activities such as stream teams, storm drain marking, volunteer monitoring, riparian plantings, and education activities.

- Measure the understanding and adoption of targeted behaviors for at least one target audience in at least one subject area.
- Use results to direct education and outreach resources most effectively as well as to evaluate changes in adoption of targeted behaviors.
- Create opportunities for the public to participate in the decision-making processes involving the development, implementation, and update of the Stormwater Management Program (SWMP).
- Post the SWMP Plan and annual report on the City's website.

Gaps and Recommendations

Improvements and expansion of the City's public education and involvement is a valuable investment, as public education is one of the most effective means of preventing stormwater pollution. Table 9 summarizes gaps identified in the Stormwater Management Needs Assessment (Sequim 2014) related to public education and outreach. Additional gaps were identified in the document review and discussions with the City. Recommendations to address each of these gaps are also provided below.

Table 9. Public Education and Involvement Gaps and Recommendations.

Topic	Source	Summary of Gap	Recommendations
Stormwater management communication guidance	Stormwater Management Needs Assessment (Sequim 2014)	Strategic communications planning around stormwater management is needed, with components for education, outreach, and public involvement.	Develop a long-term Communications Plan that includes public education and outreach and public involvement components.
Stormwater management guidance	Stormwater Management Needs Assessment (Sequim 2014)	The City should assess the degree to which outreach, education, and citizen participation are underutilized tools that would have significant environmental benefits helping the City reach its stewardship goals.	Evaluate the costs and benefits of having a stormwater public education and outreach program.
Develop new educational materials	Workshop	Educational materials are needed to support developers and builders.	• Provide additional guidance (e.g., factsheets or brochures) for developers and builders on meeting the City's stormwater facility maintenance and construction requirements. • Develop tools (e.g., checklists or handouts) to assist developers and builders with stormwater drainage design.

Table 9 (continued). Public Education and Involvement Gaps and Recommendations.

Topic	Source	Summary of Gap	Recommendations
Develop new educational materials	Workshop (with topics from the NPDES Phase II Permit)	Educational materials are needed for the general public and businesses.	Develop outreach materials on the following topics: • General impacts of stormwater on surface waters and groundwater • Impacts from impervious surfaces • Impacts of illicit discharges and how to report them • LID principles and LID BMPs • Opportunities to become involved in stewardship activities • City regulations on inspections • O&M for all types of stormwater facilities
Develop new educational materials	Workshop (with topics from the NPDES Phase II Permit)	Educational materials are needed for residents, landscapers, and property managers/owners.	Develop outreach materials on the following topics: • Yard care techniques • Use and storage of pesticides and fertilizers and other household chemicals • Carpet cleaning and auto repair and maintenance • Vehicle, equipment and home/building maintenance • LID principles and LID BMPs • Pet-waste management and disposal • Dumpster and trash compactor maintenance
Stewardship activities	Workshop	A few storm drains were stenciled several years ago, but no current storm drain marking program exists.	Reestablish storm drain marking program using storm drain markers, artwork, or stencils to involve the public and increase stormwater awareness.
Measure the understanding and adoption of target behaviors	NPDES Phase II Permit	It is important to evaluate whether target behaviors are being adopted.	Measure adoption of targeted behaviors (e.g., through survey techniques) and adapt program to best meet goals

Table 9 (continued). Public Education and Involvement Gaps and Recommendations.

Topic	Source	Summary of Gap	Recommendations
Regional program coordination	Stormwater Management Needs Assessment (Sequim 2014)	The City needs to improve coordination with other entities that conduct water quality outreach, provide regional or statewide information, and/or that manage stormwater.	• Participate in regional forums such as the West Sound Stormwater Managers' Coordination Group and the Clallam County Stormwater Work Group • Coordinate with Clallam County Streamkeepers regarding future monitoring efforts • Coordinate with the Association of Washington Cities (AWC) to anticipate what the EPA will require from NPDES Phase II permittees.
Public engagement	Stormwater Management Needs Assessment (Sequim 2014)	The City should identify ways to effectively engage the public, stakeholders, and partners through strategic planning.	Develop a Communications Plan that includes ways to engage the public, stakeholders, and partners through strategic planning.
Public participation	Stormwater Management Needs Assessment (Sequim 2014)	Regular opportunities for public participation should be sought throughout Storm and Surface Water Master Plan development, implementation, and update(s).	Identify opportunities for public participation throughout master plan development, implementation and update.
Stormwater Manager outreach	Stormwater Management Needs Assessment (Sequim 2014)	The City should determine how to best engage in water management discussions with partners and what agreements might be necessary, and pursue those agreements.	• Attend regional conferences and meetings on stormwater and surface water management. • Determine what agreements with other parties may be necessary to achieve stormwater management goals. • Pursue agreements as needed.
Stormwater hotline	Professional judgment	The City does not currently have a general stormwater hotline.	Create a stormwater hotline for public residents to call in general stormwater-related complaints (e.g., drainage problems, construction site runoff). Develop a system for logging and responding to stormwater complaints.

STAFFING, EQUIPMENT, AND RESOURCES

Staffing, equipment, and resources also affect the implementation of the City's stormwater program. The following sections highlight stormwater-related staffing, equipment, and resource issues associated with stormwater program implementation. This section is organized into the following categories:

- Staffing
- Equipment and Facilities
- Funding

STAFFING

When this gap analysis was developed (mid-2015), the City had 1.75 full time equivalent (FTE) personnel designated to supporting stormwater activities (Table 10): 0.75 FTE Operations and 1.0 FTE Capital (currently a temporary position). Three tiers of staffing support were evaluated for future staffing:

A. Needed to meet minimum standards

B. Likely to be mandated

C. Proactively anticipating and reducing risk

Table 10. City of Sequim Stormwater Program Staff Support.				
	Full Time Equivalent (FTE) Staff			
		Estimated Staff Support Needed		
Position	Designated Staff (mid-2015)	A	B	C
Streets Manager	0.05	0.05	0.05	0.05
Maintenance Worker	0.70[a]	2.09	2.86	2.86
Water Resources Project Manager	1.0	0	0.11	0.23
Stormwater Inspector	0	0.17	0.17	0.17
Water Quality Compliance	0	0.20	0.27	0.29
Stormwater Plan Reviewer	0	0	0.23	0.27
Public Education Coordinator	0	0	0.24	0.29
Total	**0.75 Operations + 1 Capital (temporary position)**	**2.51**	**3.93**	**4.16**

[a] Includes three maintenance workers (25%, 25%, and 20% FTE).

A: Needed to meet minimum standards (includes Inspection Program [high priority], Water Quality Compliance [high priority], and Stormwater System O&M [high priority]).

B: Likely to be mandated (includes Tier A staffing plus Water Quality Compliance [medium priority], Asset Management [medium priority], Stormwater System O&M [medium priority], Pollution Source Detection and Elimination [high priority], Stormwater Design and Plan Review [high and medium priority], and Public Education and Involvement [high priority]).

C: Proactively anticipating and reducing risk (includes Tier B staffing plus Water Quality Compliance [low priority], Species and Habitat Protection [high priority], Stormwater Design and Plan Review [high, medium, and low priority], Pollution Source Detection and Elimination [medium priority], and Public Education and Involvement [medium and low priority]).

EQUIPMENT AND FACILITIES

The primary City equipment currently used for the stormwater program includes two vactor trucks (one new in Fall 2014), a street sweeper, a motorized camera, a "push" camera, and equipment that is used for jetting infiltration lines (Table 11). Additional equipment that could be useful for maintenance, asset management, and pollution source detection inspections include the following:

- Pollution source field screening and source tracing equipment
- Bioretention maintenance equipment
- Permeable pavement maintenance equipment
- Tablets for asset management field data collection

Three tiers were evaluated for future equipment needs:

A. Needed to meet minimum standards

B. Likely to be mandated

C. Proactively anticipating and reducing risk

Table 11. City of Sequim Stormwater Program Equipment.					
Equipment	Current Equipment Tally	New Equipment Cost	Estimated Additional Equipment Needed		
			A	B	C
Vactor truck	2	NA	NA	NA	NA
Street sweeper	1	NA	NA	NA	NA
Jetting equipment	1	NA	NA	NA	NA
Jet and camera (motorized and push camera)	2	NA	NA	NA	NA
Tablet for field data collection and charging cables/docking stations	0	$6,000 (total cost includes 2 tablets and associated equipment)	NA	2 of each	2 of each
Pollution source field screening and source tracing equipment (Herrera 2013): • High powered lamps or flashlights with batteries • Mirror and pole • Dye testing supplies • Sand bags • Smoke testing equipment • Ammonia test strips • pH probe (with temperature probe) • Turbidity meter • Surfactant test kit • Potassium meter • Nitrile gloves • Claw grabber • Swing sampler • Laboratory grade cleaning wipes • Wash bottle • Sample bottles	0	$6,000	0	1 of each	1 of each
Bioretention maintenance equipment: • Mini excavator • Soil monitoring equipment (T-handle core sampler, soil auger, soil nutrient test kit)	0	$36,000	0	0	1 of each
Permeable pavement maintenance equipment: • Small, drivable parking lot sweeper/vacuum cleaning system • Infiltration testing equipment	0	$230,000	0	0	1 of each
Total	**$278,000**				

NA: Not applicable

Note: Additional research is needed for the asset management software, so that cost is not included in this table.

A: Needed to meet minimum standards.

B: Likely to be mandated.

C: Proactively anticipating and reducing risk.

FUNDING

The City currently funds operational (programmatic) stormwater activities (primarily street sweeping and catch basin cleaning) with Water and Sewer Utility funds. The state allows Sewer funds to be used for Stormwater activities. The 2013 and 2014 budgets for stormwater operations were each $101,000 (Table 12). The 2014 budget for stormwater was $251,000, but included grant funding that will extend into 2016.

Table 12. City of Sequim Stormwater Program Funding.

Activity	2013	2014
Operations and Maintenance	$101,000	$101,000
Capital (Planning) Activities[a]	$40,000	$150,000[b]
Total	**$141,000**	**$251,000**

[a] See Master Plan for additional details

[b] $75,000 for 1 FTE + $75,000 for consultant expenses

Other items to consider for future stormwater program funding that were summarized in the Stormwater Management Needs Assessment (Sequim 2014) include the following:

- The City needs to address the inequity among landowners in paying for their stormwater facility maintenance
- The City needs a funding strategy for operational activities that should not rely on grants and development fees
- Budget analysis and forecasting
  - Setting rates/rate structure (if a new Utility were to be chosen)
  - Credits and exemptions, if any
  - Incentives

RECOMMENDED PROGRAM IMPROVEMENTS

This section includes proposed priority, additional staffing support needed, and approximate additional funding needed for each of the recommended activities described above. The additional funding needs summarized in each subsection below include estimated costs for external support and equipment purchases, but do not include funding for any additional City staff support identified. The proposed priority was determined based on City input and professional judgment of risk associated with no action versus the potential benefit of implementing the recommendation. For the Master Plan, the high, medium, and low priorities for each stormwater program element will be sorted into the three tiers (A, B, and C) outlined in the Staffing, Equipment, and Resources section of this report.

CAPITAL FACILITIES

Capital facility improvements will be prioritized in the Known Stormwater Problems and Recommended Solutions section of the Master Plan.

Currently, City staff do not spend a substantial amount of time on stormwater capital facilities. No additional staff or funding are anticipated for the recommended activities summarized below.

Recommendation	Prioritization		Additional Funding Needs	Additional Staff Support (hours/year)
	H/M/L	Justification		
Prioritize and develop conceptual designs for 10 capital facility improvements in the Master Plan.	H	Capital facilities projects are an integral part of the Master Plan.	Included in the Master Plan	0

INSPECTION PROGRAM

Currently, no City staff are dedicated to implementing the stormwater requirements in the City's code for conducting stormwater construction inspections, and post-construction inspections for new development, redevelopment, and construction sites. A total of 0.17 FTE additional staff are anticipated for the recommended activities summarized below.

Recommendation	Prioritization		Additional Funding Needs	Additional Staff Support (hours/year)
	H/M/L	Justification		
Institute a stormwater facility inspection program and develop maintenance standards for non-City-owned stormwater facilities (drains, drywells, infiltration lines, retention/detention ponds, etc.). Develop inspection logs and Plat language, and consider providing owner education. Maintain records of private stormwater facility as-builts, covenants, and inspection logs.	H	Instituting a facility inspection program is required by the SMC. The City does not currently track private facility maintenance or know what standards these facilities are maintained to. Providing guidance, education, and a formal program will help facility owners take ownership of their facilities and keep the City in compliance with the SMC.	$0	120
Improve coordination with homeowner associations, commercial landowners, and School Districts on shared maintenance responsibilities.	H	Maintenance of private stormwater facilities by the owner or private entity is required by the SMC. Coordination with homeowner associations and commercial landowners on shared responsibilities will alleviate maintenance and flooding issues in stormwater ditches and culverts. The City has had to assist the School District with catch basin maintenance, which takes up City time and resources.	$0	100
Develop enforcement procedures for private stormwater maintenance, such as notification letters, required maintenance standards, maintenance tracking procedures, and a restitution process.	M	Per the SMC, the director has the authority to enforce maintenance of private facilities. However, the City should focus efforts on developing private facility inspection program and providing maintenance standards and educational materials to private facility owners before focusing on enforcement program.	$0	80
Total			**$0**	**300 hours (0. 17 FTE)**

WATER QUALITY COMPLIANCE

A small portion of current staff time is devoted to supporting water quality compliance activities. A total of $158,000 and 0.29 FTE additional staff are anticipated for the recommended activities summarized below.

Recommendation	Prioritization		Additional Funding Needs	Additional Staff Support (hours/year)
	H/M/L	Justification		
Develop and implement a pollution control program for water bodies currently on the 303(d) list of impaired waters	H	Multiple waterbodies within the city are included on Ecology's 303(d) list of impaired waterbodies, but no TMDL implementation plans have been developed by Ecology for these waterbodies. To avoid a TMDL and cost associated with implementing a TMDL, the City should take action to remove these waterbodies from the 303(d) list by developing a pollution control program.	$100,000	80
Develop and implement surface water flow monitoring program (currently underway).	H	Funding was provided to Clallam County Streamkeepers for flow monitoring through 2015 and will also be supported by City volunteers.	$0	0
Use GIS to identify UIC wells that need to be registered with Ecology.	H	This is required by the EPA. Deadline for UIC registration has already passed. GIS should be updated with correct facility structures.	$0	24 (additional time for updating GIS is included under Asset Management)
Use online form to register wells.	H	This is required by the EPA. Deadline for this requirement has already passed.	$0	16
Develop and implement a plan to assess drywells classified as UICs.	H	This is required by the EPA. Deadline for this requirement has already passed.	$0	240

Recommendation	Prioritization		Additional Funding Needs	Additional Staff Support (hours/year)
	H/M/L	Justification		
Implement additional water quality monitoring recommendations included in the Water Quality Data Analysis Report: • 12 samples per year (6 during wet weather and 6 during dry weather) at 6 monitoring stations in Bell and Johnson Creek • Continuous monitoring of dissolved oxygen and temperature in Bell Creek during the summer months • Fecal source tracing in Bell Creek	M	These recommendations were developed as part of the Water Quality Data Analysis Report.	$38,000	80
Develop and implement a groundwater monitoring plan for stormwater constituents of concern.	M	The City should evaluate and implement future groundwater monitoring needs.	$10,000 (to develop plan and implement initial monitoring)	40
Develop and implement a nitrate groundwater monitoring plan.	L	The County is already tracking this.	$0	0
Develop and implement a stormwater facility monitoring plan (including private facilities).	L	The City currently requires monitoring for the first 3-5 years (for commercial and residential). There could be long term benefits of continuing this monitoring requirement.	$10,000 (to develop plan and implement initial public stormwater facility monitoring); cost of private stormwater facility monitoring to be handled by the private sector	40
Total			**$158,000**	**520 hours (0.29 FTE)**

SPECIES AND HABITAT PROTECTION

A total of 0.04 FTE additional staff are anticipated for the recommended activities summarized below.

Recommendation	Prioritization		Additional Funding Needs	Additional Staff Support (hours/year)
	H/M/L	Justification		
The City should participate in Dungeness River Management Team (DRMT) routine meetings and request smolt outmigration data from Bell Creek measured by the Tribe.	H	Participation in the DRMT could lead to sources of funding for work that also benefit stormwater	$0	48
The City should participate in DRMT routine meetings and with Water Rule implementation groups.	H	Participation in the DRMT and Water Rule implementation groups could lead to sources of funding for work that also benefit stormwater	$0	24 (DRMT meeting hours summarized above)
Ensure habitat access by examining and replacing all culverts if they pose barriers to fish passage.	M	Some of these culverts will be included in the capital facilities projects included in the Master Plan	Included in the Master Plan	0
Maintain riparian buffers to control water temperature and provide forage material	M	Maintenance of riparian buffers will not be identified as a specific project in the Master Plan, but should be considered for future projects along stream corridors.	$0	0
Utilize soft bank stabilization methods, levee setbacks, and limit the use of riprap and other bank hardening methods to allow natural stream migration and off-channel habitat formation.	M	Utilization of soft bank stabilization methods and levee setbacks will not be identified as a specific project in the Master Plan, but should be considered for future projects along stream corridors.	$0	0
Determine whether the City needs to update floodplain mapping within City limits to be in compliance with the National Floodplain Insurance Program (NFIP) and restrict development within the floodplain.	L	Updating floodplain mapping will not be identified as a specific project in the Master Plan, but should be considered as part of future planning efforts	$0	0
Total			**$0**	**72 hours (0.04 FTE)**

STORMWATER DESIGN GUIDANCE AND PLAN REVIEW

Currently, no City staff are dedicated to implementing the stormwater requirements in the City's code for new development, redevelopment, and construction sites which includes conducting stormwater plan review, construction inspections, and post-construction inspections. A total of 0.27 FTE additional staff and $40,000 additional funding are anticipated for the recommended activities summarized below.

Recommendation	Prioritization		Additional Funding Needs	Additional Staff Support (hours/year)
	H/M/L	Justification		
Review the 2012 SWMMWW (and 2014 modifications) and consider developing an amendment to the 2012 SWMMWW that provides guidelines and requirements specific to the City.	H	The City should review the latest SWMMWW since it is adopted by reference in the SMC.	$0	0
Determine which BMPs are most effective in protecting groundwater quality while preserving recharge as part of the Master Plan and consider including these BMPs in an additional guidance document or amendment to the 2012 SWMMWW.	H	BMPs to protect groundwater quality and preserve recharge are important, but the City should focus on identifying existing approved stormwater BMPs that may be effective.	$0	80
Develop handouts that summarize on-site stormwater management, treatment, and flow control thresholds for when the SWMMWW applies for single-family and commercial development projects. Update in the SMC as needed.	H	Providing handouts and updating the SMC to include guidance for when and where thresholds apply to projects will help developers better implement stormwater requirements.	$10,000 (assumes 100 consultant hours at $100/hour)	40
Develop a consistent stormwater plan review process that includes checklists, sizing table tools, and plant lists for site plan review to increase efficiency.	H	Having a consistent and clear Plan Review process will help make sure that developments and stormwater facilities are designed to City standards.	$10,000 (assumes 100 consultant hours at $100/hour)	120
Look for opportunities to partner with Clallam County in a watershed-scale planning effort.	H	Watershed scale planning can be an effective way of planning for stormwater and development, and there are many documented issues related to flooding, erosion, habitat degradation and water quality impairment that may be improved through the implementation of a watershed plan.	Included in Master Plan	0

Recommendation	Prioritization		Additional Funding Needs	Additional Staff Support (hours/year)
	H/M/L	Justification		
Review AHBL's Code Revision recommendations re: LID, review additional sections of the SMC identified in the Stormwater Management Needs Assessment (Sequim 2014), update as needed, develop a brief summary report, and coordinate with City Council to review and approve proposed changes to SMC.	M	The City has already gone through the revision process for much of the SMC regarding LID, but should continue to review and revise other sections and determine if the LID recommendations proposed by AHBL can be implemented.	$10,000 (assumes 100 consultant hours at $100/hour)	80
Consider promoting or incentivizing secondary uses for stormwater such as rainwater collection (e.g., cisterns) and reuse for irrigation and toilet flushing.	M	Secondary uses for stormwater runoff may help reduce flooding issues in the City.	$10,000 (assumes 100 consultant hours at $100/hour)	40
Promote upcoming training opportunities for designers (specifically on the 2012 SWMMWW).	M	Training designers on stormwater requirements will help improve drainage design in the City.	$0	0
Coordinate with the Clallam Conservation District and WSU Extension for additional training opportunities for staff.	M	The City should engage in regional stormwater groups and stay updated on LID and pollution source detection and elimination training.	$0	40
Train staff when updates occur to planning, development, inspection, and enforcement of stormwater runoff controls.	L	Training will eventually be helpful, but City should focus on developing these processes first.	$0	80
Total			**$40,000**	**480 hours (0.27 FTE)**

ASSET MANAGEMENT

Currently, the City does not have an asset management program. A total of 0.61 FTE and $6,000 additional funding additional staff are anticipated for the recommended activities summarized below. A total of 1.02 FTE were included in the funding analysis that was developed in support of the Master Plan recommendations; thus the funding analysis provides a conservative estimate of the level of support needed for this program. The City's existing camera equipment can be used for the asset inventory.

Recommendation	Prioritization		Additional Funding Needs	Additional Staff Support (hours/year)
	H/M/L	Justification		
Continue to update the storm system map and database as needed.	H	Important to have accurate stormwater mapping for a variety of other stormwater program components in addition to pollution source detection and elimination.	$0	160
Develop a system to ensure that new development projects with stormwater components are incorporated into GIS.	M	In addition to mapping of the existing system, it is also important that new projects be incorporated into GIS.	$0	40
Improve the existing asset inventory by updating stormwater system components in GIS with current conditions	M	This inventory could be conducted with the City's existing camera equipment.	$6,000 (uses existing camera equipment and SEMS software, but additional funding is needed for field tablets)	0.5 FTE (includes initial ramp up of program, ongoing inspections, and management of GIS data)
Total			**$6,000**	**1,084 hours (0.61 FTE)**

STORMWATER SYSTEM OPERATIONS AND MAINTENANCE

Currently, a total of 0.75 FTE conduct stormwater system O&M activities. A total of 1.54 FTE additional staff and $281,000 additional funding are anticipated for the recommended activities summarized below.

Recommendation	Prioritization		Additional Funding Needs	Additional Staff Support (hours/year)
	H/M/L	Justification		
Add maintenance and inspection information to the storm system map and database in GIS.	H	Important to have accurate stormwater mapping for a variety of other stormwater program components in addition to effectively tracking O&M (see Asset Management).	$0	120

Recommendation	Prioritization		Additional Funding Needs	Additional Staff Support (hours/year)
	H/M/L	Justification		
Establish maintenance agreements with irrigators and other stormwater management partners addressing type and frequency of maintenance activities as well as responsibilities for maintenance.	H	Coordination with other entities for maintenance can help relieve some of the O&M responsibilities of City crews.	$0	120
Consider hiring seasonal workers to work on catch basin inspection crew.	H	Not currently enough staff to support adequate catch basin and other facility inspections.	$0	442
Increase staff support for inspecting and cleaning stormwater pipes and drywells.	H	The City has purchased jetting equipment and two cameras, but does not currently have sufficient staff support for operating this equipment.	$0	1,768
Evaluate street sweeping routine to determine if changes need to be made.	M	Assessing existing O&M activities can be useful, but the City should focus on implementing new O&M activities more regularly rather than assessing effectiveness of existing activities.	$0	0
Develop a policy for City inheritance of private stormwater facilities that specifies the condition that a private stormwater facility should be in prior to being inherited by the City. Consider coordinating this policy with the inheritance of private streets.	M	Some requests have been made for the City to inherit private stormwater facilities.	$0	40
Improve internal communications within Public Works to facilitate O&M activities.	M	Schedule monthly check-in meetings to facilitate O&M activities.	$0	0
Include the stormwater pond that drains part of the Shop parking lot in regular inspection and maintenance routines.	M	The City should focus efforts on bigger picture stormwater O&M program and processes; however, these facilities should be on the list of facilities to maintain (once a list is established).	$0	0
Develop an Integrated Pest Management Plan (IPMP) for right-of-way vegetation and stormwater facility maintenance	M	An IPMP would help clarify action thresholds for maintenance of pest species and monitoring and reduce the use of harmful chemicals that results in stormwater runoff contamination.	$15,000 (assumes 150 consultant hours at $100/hour)	0

Recommendation	Prioritization		Additional Funding Needs	Additional Staff Support (hours/year)
	H/M/L	Justification		
Develop SOPs for O&M staff.	M	Identified as a need during staff workshop.	$0	80
Review SWPPPs developed for other Cities and Counties to determine if a similar plan should be developed for the City Shop.	M	Identified as a need during staff workshop.	$0	80
Require City O&M staff attendance at trainings, especially those related to maintenance of LID BMPs. Invite Irrigation District O&M staff to attend trainings.	M	Identified as a need during staff workshop.	$0	80
Remove trash and litter from problem areas, set up a notification system and response, or implement a program for volunteer trash clean ups that prioritizes problem areas.	L	The City should focus efforts on maintaining higher priority stormwater system issues (e.g., flooding).	$0	0
Invite vendors to present on how to maintain their technologies.	L	The City should focus efforts on cleaning and maintaining the more common structures in the City (i.e., drywells, infiltration lines and catch basins).	$0	0
Obtain additional tools and equipment to inspect, maintain, and repair LID facilities.	L	The City should focus cleaning and maintenance activities on drywells, infiltration lines and catch basins, however should consider purchasing equipment for LID facility maintenance in the future.	$266,000	0
Total			**$281,000**	**2,730 hours (1.54 FTE)**

POLLUTION SOURCE DETECTION AND ELIMINATION

The City does not currently have a pollution source detection and elimination program, and no staff are allocated to pollution source detection and elimination activities. A total of 0.19 additional staff and $24,000 additional funding are anticipated for the recommended activities summarized below.

Recommendation	Prioritization		Additional Funding Needs	Additional Staff Support (hours/year)
	H/M/L	Justification		
Develop and implement a pollution source tracking program. • Obtain field equipment that can be used for illicit discharge field screening and source tracing. • Develop a basic training program for City field staff. • Develop a system for tracking all illicit discharges reported and investigated.	H	Actively identifying pollutant sources could save time and budget by identifying issues prior to when more expensive repairs may be required. Even if the City does not establish a full blown pollution source identification and detection program, it is important to have pollution source field screening and source tracing equipment on hand, a basic training program, and a basic tracking system for illicit discharges. The cost included here for equipment is for an intermediate level field screening and source tracing program.	$4,000 (developing program; assumes 40 consultant hours at $100/hour) $6,000 (equipment costs) $4,000 (training; assumes 40 consultant hours at $100/hour)	40 (developing program) 80 (developing tracking system)
Develop a spill reporting hotline or web form.	H	This could be approached from a City or regional perspective, but it is important to have a number that people can call when they identify an issue.	$0	80
Update illicit discharge ordinance, or provide policy direction for interpreting it.	M	The City has an existing ordinance; this would be an update to add prohibited and allowable discharges and enforcement procedures, including car wash discharge policies.	$0	40
Provide pollution source detection and elimination education as part of the City's ongoing public education program to the general public and businesses.	M	No additional cost included for this item (covered under Public Education estimated funding and staffing).	$0	0
Require staff involved in illicit discharge response to review the Illicit Connection/Illicit Discharge Field Screening and Source Tracing Guidance Manual that was developed for the State of Washington (Ecology 2013)	M	This is an important statewide guidance manual that contains information that would be useful to the City in developing their pollution source detection and elimination program.	$0	8

Recommendation	Prioritization		Additional Funding Needs	Additional Staff Support (hours/year)
	H/M/L	Justification		
Develop and implement a pollution source field screening program for the City's stormwater system.	L	This is a lower priority recommendation, since it is based on a specific NPDES Phase II Permit requirement, and the City is not currently an NPDES Phase II permittee.	$10,000 (assumes 100 consultant hours at $100/hour)	80
Total			**$24,000**	**328 hours (0.19 FTE)**

PUBLIC EDUCATION AND INVOLVEMENT

Currently, around 40 hours per month are spent on stormwater public education and involvement. A total of 0.29 FTE additional staff and $39,000 additional funding are anticipated for the recommended activities summarized below.

Recommendation	Suggested Prioritization		Additional Funding Needs	Additional Staff Support (hours/year)
	H/M/L	Justification		
Provide additional guidance (e.g., factsheets, brochures, or checklists) for developers and builders on meeting the City's stormwater facility design, maintenance, and construction requirements.	H	This was an important topic brought up at the workshop and will help to save City reviewers time during stormwater site plan review. Factsheets and brochures for developers and builders are more critical, but checklists or handouts could also be useful.	$4,000 (brochures/ factsheets; assumes 40 consultant hours at $100/hour) $8,000 (checklists; assumes 80 consultant hours at $100/hour)	80 (brochures/ factsheets) 40 (checklists)
Develop outreach materials for residents, landscapers, property managers/ landowners, the general public, and businesses.	H	Outreach materials would be an important and valuable tool for the City's stormwater program.	$12,000 (assumes 120 consultant hours at $100/hour)	120
Attend regional meetings and participate in regional forums and such as the West Sound Stormwater Managers' Coordination Group, the Clallam County Clean Water Work Group the Association of Washington Cities (AWC).	H	"Coordination with other entities" included in Stormwater Management Needs Assessment (Sequim 2014). Coordination with other entities can save budget through sharing ideas and approaches for stormwater education.	$0	40

Recommendation	Suggested Prioritization		Additional Funding Needs	Additional Staff Support (hours/year)
	H/M/L	Justification		
Attend regional conferences and meetings on stormwater and surface water management.	H	Coordination with other storm and surface water management entities can improve the City's own surface and stormwater management program.	$0 (cost for conference and meeting attendance should be included in existing budget)	60
Determine what agreements with other parties may be necessary to achieve stormwater management goals.	H	Agreements with Irrigation entities, the County, and surrounding jurisdictions would be beneficial to regional stormwater management and water quality.	$0	80
Create a hotline and system for logging and responding to general stormwater-related complaints. The hotline could be used for all stormwater complaints, not just illicit discharges. Educate the public on how to use the hotline.	M	Would increase program efficiency and identification of problem areas.	$0	60
Continue to develop a Communications Plan.	L	Draft Communications Plan has already been completed	$0	0
Evaluate the costs and benefits of having a stormwater public education and outreach program.	L	It is already well known and documented that having a stormwater public education and outreach program is beneficial. Resources should be focused on developing materials rather than evaluating if there is a need.	$0	0
Reestablish storm drain marking program-- using storm drain markers, for example.	L	Messaging may not be as effective as other public outreach materials. Assumes volunteer labor and some City staff time for coordination.	$5,000 (for 1,000 plastic markers and glue)	40
Measure adoption of targeted behaviors and adapt program to best meet goals.	L	This is a lower priority recommendation, since it is based on a specific NPDES Phase II Permit requirement, and the City is not currently an NPDES Phase II permittee.	$10,000 (assumes 100 consultant hours at $100/hour)	0

Recommendation	Suggested Prioritization		Additional Funding Needs	Additional Staff Support (hours/year)
	H/M/L	Justification		
Identify opportunities for public participation throughout master plan development and implementation.	L	Opportunities for public participation already being identified through Master Plan development.	$0	0
Total			**$39,000**	**520 hours (0.29 FTE)**

CONCLUSIONS

A summary of the work items and costs required to implement the recommendations of this report is provided below:

- **Capital Facilities:** Currently, City staff do not spend a substantial amount of time on stormwater capital facilities. An initial stormwater capital facilities plan will be included in the Master Plan.
- **Inspection Program:** Currently, no City staff are dedicated to implementing the stormwater requirements in the City's code for conducting stormwater construction inspections, and post-construction inspections for new development, redevelopment, and construction sites. A total of 0.17 FTE additional staff are anticipated to support the inspection program.
- **Water Quality Compliance:** Currently, City staff do not spend a substantial amount of time on UICs and only a small portion of current staff time is devoted to supporting monitoring and assessment activities. A total of 0.29 FTE additional staff and $158,000 are anticipated for the recommended activities summarized in this report.
- **Species and Habitat Protection:** A total of 0.04 FTE additional staff are anticipated to support species and habitat protection activities. Culvert replacements are anticipated to be included in the capital facilities plan included in the Master Plan.
- **Stormwater Design Guidance and Plan Review:** Currently, no City staff are dedicated to providing stormwater design guidance and conducting stormwater plan review. A total of 0.27 additional staff and $40,000 additional funding are anticipated for the recommended activities summarized in this report.
- **Asset Management:** Currently, the City does not have an asset management program. A total of 0.61 FTE additional staff and $6,000 additional funding are anticipated for the recommended activities summarized in this report.
- **Stormwater System Operations and Maintenance:** Currently, a total of 0.75 FTE conduct stormwater O&M activities. A total of 1.54 FTE additional staff and $281,000 additional funding are anticipated for the recommended activities summarized in this report.
- **Pollution Source Detection and Elimination:** The City does not currently have a pollution source detection and elimination program, and no staff are allocated to pollution source detection and elimination activities. A total of 0.19 additional staff and $24,000 additional funding are anticipated for the recommended activities summarized in this report.
- **Public Education and Involvement:** Currently, only about 40 hours per month are spent on stormwater public education and involvement. A total of 0.29 FTE additional staff and $39,000 additional funding are anticipated for the recommended activities summarized in this report.

REFERENCES

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Ecology. 2012a. Western Washington Phase II Municipal Stormwater Permit. Washington State Department of Ecology Water Quality Program. Olympia, Washington. August 1, 2012. Modified December 17, 2014.

Ecology. 2012b. Stormwater Management Manual for Western Washington. Publication No. 12-10-030. Washington State Department of Ecology, Olympia, Washington. August 2012. Modified December 17, 2014.

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Herrera. 2013. Illicit Connection and Illicit Discharge Field Screening and Source Tracing Guidance Manual. Prepared for Washington State Department of Ecology by King County, Washington Stormwater Center, and Herrera Environmental Consultants, Inc., Seattle, Washington. May 7, 2013.

Sequim. 2014. City of Sequim Stormwater Management Needs Assessment. Prepared by Ann Soule, City of Sequim Public Works. Sequim, Washington. May 2014.

APPENDIX A

Background Document List

Table A-1. Sequim Existing Document Review Summary.

Document Name	Author	Date	Notes
Stormwater Planning Documents			
City of Sequim Stormwater Management Needs Assessment	Ann Soule, City of Sequim Public Works	May-14	• Part 1 includes applicable City Goals and Policies related to stormwater. • Part 2 includes a description of physical setting, capital facilities (city owned and non-city owned), descriptions of the City's stormwater programs, and regulatory context (including National and Statewide NPDES, Federal laws, and City Code). • Part 3 identifies needs of the stormwater program (most important being capital improvements, interjurisdicitional collaboration, facility inspections, long term planning, water quality and habitat information, education and outreach, and funding strategies). • Appendix A includes capital project summaries. • Should use this source when developing stormwater program section, needs, and identifying capital projects
City of Sequim Stormwater Management Needs Assessment presentation	Ann Soule, City of Sequim Public Works	Feb-14	• Summarizes Needs Assessment • Photos may be useful in Master Plan
Recommendations from the LID Local Regulation Assistance Project	AHBL (Wayne Carlson)	2009	• Provides recommendations and suggestions for implementing LID in Sequim, Port Townsend, Island County, and Kent. • Draft regulation changes and LID recommendations for adoption • Page 15 contains summary of recommendations for Sequim • Four titles reviewed (Streets, Sidewalks, and Public Places; Public Services; Subdivisions; Zoning) • Encourage/ require permeable pavement sidewalks and rights-of-ways, bioretention in street design • LID Site Analysis requirement for subdivision development • Added native vegetation retention standards • City concerned with effectiveness of LID due to high groundwater and clay soils
Sequim Code and Ordinances			
City codes and ordinances pertaining to stormwater (and draft ordinances), including documents referenced in code such as Ecology's stormwater management manual(s)	City of Sequim	NA	• Chapter 13.104- Stormwater Management. Adopts Ecology SWMMWW (latest edition). • Chapter 13.108- Stormwater Maintenance. • Title 12- Streets, Sidewalks and Public Places. • Title 17- Subdivisions. • Title 18- Zoning. Considerations for LID and Site Planning in 18.24.070.
Planning Documents			
Citywide Comprehensive Plan (2006)	City of Sequim	Aug-06	• Goals and Policies in each chapter • Use for background policies/ goals related to development/ stormwater • Chapter 3- Land Use • Chapter 4- Urban Growth Element (UGAP-10 concerns level of service for stormwater systems in UGA) • Chapter 5- Environment and Open Space Element (mentions use of LID techniques to design with the natural landscape, protection of sensitive areas, open spaces, wetlands, ENVP-7 concerns protection of groundwater resources and aquifer recharge areas through effective SW management, ENVP-9 concerns promoting LID and green construction methods) • Chapter 6- Shorelines Element • Chapter 7 - Utilities Element (describes sewer and stormwater infrastructure, PUDs required to manage and treat stormwater onsite using bioswales, rain gardens, retention/ detention ponds, UTG-9 concerns seeking assistance and cooperation of PS Action Team and Ecology for improvements to the SW Management Plan) • Chapter 9 - Housing Element • Chapter 10- Economic Development Element • Chapter 11 - Parks and Recreation Element • Chapter 12- Historic and Cultural Resources Element • Chapter 13 - Capital Facilities Element (CFG 18 and 19 related to maintaining stormwater system integrity and function,CFG 20 concerns financial resources for Stormwater Drainage Utility, CFG 25 concerns new development costs of new capital facilities needed to serve the development) • Chapter 14- Government Element • Chapter 15 - Implementation

Table A-1. Sequim Existing Document Review Summary.

Document Name	Author	Date	Notes
Sequim 120 Comp Plan Update information	City of Sequim	NA	• Summarizes a few key directions related to the Sequim 120 Vision adopted in 2012 • Keep neighborhood density consistent (don't increase significantly) • Preserve larger, rural parcels • Place higher density development in downtown area • Plan for pedestrian friendly environment everywhere
Past and current capital facility projects related to stormwater (such as the infiltration basin facility at Reuse Demonstration Park), and related Capital Improvement Program (CIP) elements	NA	NA	Decided not to review unless involved in a proposed CIP project.
2011-2016 City of Sequim Transportation Improvement Program (TIP) project list (includes the 6-year and 20-year project lists)	Fehr & Peers	Jun-13	• Includes Transportation Improvement Projects (6-year project list and 20-year project list) • Most of the 6-year projects are pedestrian infill and new roadways to support near-term development (bicycle projects, intersection improvements, roadway enhancements, pedestrian mobility projects, new roads). Look for opportunities to construct stormwater CIP projects in conjunction with TIP projects. • #1- Bicycle facility @ Sunnyside Ave b/w E Fir Street & E Prairie Street • #2- Shared use path @ 3rd Avenue b/w Happy Valley Road & Reservoir Road • #3- Bicycle facility @ 3rd Avenue b/w US-101 & W Fir Street
2013 General Sewer Plan	Gray & Osborne	Dec-13	• Figure 1-4: soil classification map • Some good introductory background information on groundwater, soils, climate, precipitation, sensitive areas, wetland areas, water bodies, zoning. • Figure 1-10 shows existing parcels served by public or private on-site septic systems • Includes data on project city population, flows, and loadings • Staff and maintenance: 24 public works staff members including managers, engineers, operators, field staff, office staff, public works director • Look to for potential collaboration with stormwater CIP projects. Recommended projects for 2012-2018: East Hammon Street Sewer Extension (CS-12), North Blake Street Sewer Improvements (CS-13). Recommended projects for 2018-2032: Sunnyside Street Sewer Improvements (CS-9), WRF Influent Trunk Pipeline Repair/ Replacement (CS-7). See Figure 3-6 and table 3-11 for full list of projects. • Chapter 4 concerns water reclamation and reuse facilities. o Reclaimed water is provided to City Shops facility, landscape irrigation system along Sequim Ave, Lofgrin Road and Washington Harbor Loop Road, and to the Reuse Demo Site. Reused water is also supplied to a fire hydrant at City Shops for truck filling or local use. Locations of the transmission lines are shown in Figure 1-6 and 3-1. o Ultimate goals of the water reuse facility were to reopen an existing shellfish closure area to benefit state and tribal resources, improve streamflows into the Dungeness River, and profile sustainable water supply for irrigation. o Future water reuse uses include: commercial, more landscape irrigation, toilet flushing, hydrants, groundwater recharge, leaky pipes or additional streamflow augmentation o 2011 Reclaimed Water Report suggested potential areas that could receive reclaimed water (for each of the uses above). • Chapter 5 discusses infiltration and inflow (I/I) within the City's collection system. City has been diverting stormwater from roof drains from the sanitary sewer, lining sewer pipes, and purchased a CCTV camera to inspect sewer pipes for I/I. The City also uses visual inspections, smoke tests and flow monitoring to detect I/I. • Chapter 6 discusses O&M related to waste water. Table 6-4 displays estimated future staffing needs (estimate is 1.6 additional FTE for 2018, and 5.6 additional FTE for 2032).
2013 Water System Plan	Gray & Osborne	Jun-13	• Same sort of background data as in the General Sewer Plan. • Chapter 2- Basic Planning Data. • Chapter 3- System Analysis. Compares existing facilities to design standards. • Chapter 4- Water Use Efficiency. Discusses reclaimed water efforts in the City. • Chapter 5- Source Protection Program. Wellhead protection program, including aquifer susceptibility, wellhead protection area delineation, inventory of potential contaminant sources, potential contaminant inventories, spill response, contingency planning, and management plan. • Chapter 6- Operation and Maintenance Program. • Chapter 7- Water System Design and Construction Standards. • Chapter 8- Capital Improvement Plan. Contains identified CIP projects and schedule. • Chapter 9- Financial Analysis.

Table A-1. Sequim Existing Document Review Summary.

Document Name	Author	Date	Notes
Shoreline Master Program	City of Sequim	2013	• Policy 2 and 5 concern stormwater treatment goals/policies • Section 6.1.5 Water Quality, Stormwater, and Nonpoint Pollution regulations for stormwater treatment/ management in the shoreline, and encourages use of LID • Includes Johnson Creek (in the shoreline jurisdiction of the City), but also mentioned Bell Creek and Washington Harbor Use in Master Plan in policies and waterbody section
Sequim Downtown Plan	City of Sequim	NA	• Policies to establish City Center with various zones and districts, addresses land use density, intensity of development, economics, transportation, housing, parks, etc. • Recommended actions related to utilities include development of a new SW Management Plan, continue development and distribution of the reclaimed water system
Water Quality Documents			
Surface Water Quality			
Clallam County Streak Keepers Data and Report (STORET)	Clallam County DCD	Sep-12	STORET Data and draft report form the County will be used in the Water Quality Analysis Report.
Stormwater Quality			
Water quality data from EIM	NA	NA	Stormwater data from Eight Streams and Clean Water District will be used in the Water Quality Analysis Report.
Groundwater Quality			
Groundwater Quality Monitoring in the Shallow Aquifer near Sequim, Clallam County, WA Phase I	Ann Soule	Jun-09	• Study of groundwater quality downgradient of urban and suburban land uses in the City. Nitrates were detected in all study wells sampled at levels below safe drinking water levels. Recommendations include monitoring for nitrate in other areas and for stormwater contaminants in wells vulnerable to land activities. • Use in groundwater section of Master Plan.
Groundwater Quality Monitoring in the Shallow Aquifer near Sequim, Clallam County, WA Phase II	Ann Soule	Jun-11	• Phase II of groundwater quality study. • Examined groundwater quality in the shallow aquifer discharging to streams and marine waters of the Dungeness watershed to determine the ambient quality of the shallow groundwater for a broad region, and determine the concentrations of specific stormwater contaminants for wells in Phase I. • Study found high nitrate concentrations around developed areas where soils are sandy-gravelly and low chloride concentrations. • Recommendations include continued land use management efforts to enforce septic system maintenance, stormwater treatment, groundwater protection. • Use in groundwater section of Master Plan.
Groundwater Quality Monitoring in the Shallow Aquifer near Priest Road, Clallam County, WA Phase II	Ann Soule	Nov-05	• Study monitored groundwater quality outside of western Sequim city limits used for county residents shared or private drinking water wells. • No detections of bacteria, hydrocarbons, pesticides, or other organics. Trace amounts of chromium and zinc, and nitrates and TDS below safe drinking water action levels. • Use in groundwater section of Master Plan.
City of Sequim 2008 Hydrologic Monitoring Report	Pacific Groundwater Group	Dec-09	• Study of hydrologic trends in the Sequim- Dungeness watershed. • Includes compiled data on the following topics: surface water system, groundwater system, precipitation trends, climate change, stream systems, groundwater and surface water use, irrigation, aquifer recharge, land use changes, groundwater and surface water quality. • Use in Master Plan for data related to the topics above.
Sequim Maps and GIS Data			
2013 Water System Plan Figure 5-3, Wellhead SOCs	Gray & Osborne	2013	Figure shows wellhead ZOCs within the City, as well as locations of underground storage tanks, leaking underground storage tanks, hazardous waste, and septic system.
Information on projected growth as well as planned developments or land use changes from the Department of Community Development	Chris Hugo	Nov-14	•Email from Chris Hugo. •20-year growth framework is based on 2% annual growth, averaged over 20 years. Plan on 1% increase for at least the five years, and >2% rates for the rest of the 20 year duration. The Water Rule situation may push these rates to 1.5% for 5 years, and 3-4% for the rest of the 20-year duration. •Approximately half of the growth will occur in existed platted lots, and a quarter would occur in existing subdivisions. Downtown may not grow as a residential neighborhood for several years.
Elwha-Dungeness Watershed Management Plan	Entrix	May-05	• Chapter 2 - Watershed Characterization. Related to Sequim are the Dungeness Watershed and the Sequim Bay and Drainages sections. • Chapter 3- Recommendations. Includes recommendations for water quality, water quantity, habitat, instream flow, stormwater, land use and land management, public education and outreach, watershed management, Sequim Bay and Drainages. • Refer to Chapters 2 and 3 for information for Basin Characterization section of Master Plan.

Table A-1. Sequim Existing Document Review Summary.

Document Name	Author	Date	Notes
Geographic information system (GIS) data and maps including existing stormwater system, soils, water resources, utilities, land uses, aerial photos, LIDAR, streets, topography, zoning, tax lots, buildings, irrigation district boundaries and conveyance infrastructure, and private stormwater facilities	City of Sequim	NA	• Streams • Catch basins • City limits • Roads • UGA • Irrigation system infrastructure (ditches, pipes, ditch in creek; included in Needs Assessment maps) • City drainage features (drywells, pipes, ditches, bioswale, detention/retention pond) • Runoff and flooding problem areas • Subbasin boundaries •Wetlands • Parcels • Lidar Contours (50ft)
Sequim Policies			
Dungeness Instream Flow and Water Management Rule and Mitigation Policies	webpage	NA	• Describes Ecology's water management rule for the Dungeness watershed to secure water supplies for current and future uses in the Sequim area. • Rule is designed to protect existing water rights, manage new uses of water, protect fish resources, protect stream flows. • Rule affects those who start new uses of water and requires them to mitigate the impact of their water use on streams. Mitigation can be in the form of a payment to the Dungeness Water Exchange, or through an independent mitigation plan approved by Ecology. • Refer to the Water Rule for sections in the Master Plan pertaining to policies and development requirements.
Dungeness Instream Flow and Water Management Rule and Mitigation Policies (Mitigation plan)	Washington Water Trust	Dec-12	• The Plan was developed for the Dungeness Water Exchange (Exchange) to fulfill the requirements under WAC 173-518-075. • Purpose if to fund projects that will generate mitigation credits and sell to prospective water users who trigger mitigation for their impacts to small streams and the Dungeness River. • The Dungeness Mitigation Strategy identifies all of the potential water for water project types that could be used to generate mitigation credits. Shallow aquifer recharge will be the primary strategy for generating mitigation. • Refer to the Water Rule for sections in the Master Plan pertaining to policies and development requirements
Clallam County Water Rule	webpage	Jan-13	• Water Rule established by Ecology to manage scarce water resources in the Dungeness River and adjacent drainages Webpage provides links for Water Rule information, and aims to help the public meet the Water Rule requirements through permitting process • Interactive map here: http://www.clallam.net/aimsxwebsite/water_rule/viewer.htm • Policy decisions are summarized here : http://www.clallam.net/permits/Determinations.html • Describes where mitigation for water use is required (i.e., mitigation not required for expanding existing residential house, but is required for addition of auxiliary unit) • Refer to the Water Rule for sections in the Master Plan pertaining to policies and development requirements
Studies			
Aquifer Recharge Feasibility Study for the Dungeness Peninsula	Pacific Groundwater Group	Mar-09	• Study evaluated feasibility of performing aquifer recharge and aquifer storage and recovery on the Dungeness Peninsula (WRIA 18). • Dungeness River groundwater level declines have reduced baseflow in Dungeness River. Many other small streams and rivers are fed by groundwater and will experience baseflow reductions as well. • Objectives of the AR/ ASR project include: improve Dungeness low flows, support small streams and channels, provide or mitigate new water development in place of exempt wells, reduce potential for seawater intrusion. • Three scenarios evaluated: Infiltration of Dungeness River water west of the Dungeness River, Infiltration of reclaimed water east of the Dungeness River, and Aquifer storage and recovery west of the Dungeness River. • Use report for sections of the Master Plan pertaining to groundwater, Dungeness River watershed, aquifer recharge
2008 Dungeness Groundwater Flow Model Design, Construction, Calibration and Results	Pacific Groundwater Group	Mar-09	• Reports the calibration of groundwater flow model of the Dungeness Peninsula and its application to predict hydrologic responses to aquifer recharge and aquifer storage and recovery. • The Ecology 2003 Model was refined and calibrated. Two realizations of the model predicted steady-state calibration results. • Significant results include: shallow aquifer water level variations over time controlled predominantly by the recharge schedule; aquifer recharge sites closest to the Dungeness River predicted to provide greater augmentation to the river; aquifer recharge areas further from the river predicted to provide more sustained, year-round augmentation to the Dungeness River but at fairly low rates; aquifer storage and recovery sites in the middle of the aquifer have a larger impact to baseflow. • Use report for sections of the Master Plan pertaining to groundwater, Dungeness River watershed, aquifer recharge.

Table A-1. Sequim Existing Document Review Summary.

Document Name	Author	Date	Notes
Hydrogeologic Screening for Sequim Pilot Infiltration Test	Peter Schwartzman & Jeff Witter, Pacific Groundwater Group	Aug-07	• Hydrologic screening of five sites east of Dungeness River for suitability for infiltration of reclaimed water and/or surface water diversions. • Results of the screening suggest high transmitting capacity for infiltrated water, however soils are clay which may reduce infiltration capacity. • Use report for sections of the Master Plan pertaining to groundwater, Dungeness River watershed, aquifer recharge.
Hydrogeologic Assessment of the Sequim-Dungeness Area	USGS	1999	• Study of groundwater and relation between groundwater and surface water in the Dungeness River Area. • Study area underlain by unconsolidated Quaternary deposits, three aquifers, two confining beds, and undifferentiated deposits. • Increase in nitrate concentration in groundwater between 1980 and 1996, and concentration of nitrate in shallow aquifers were significantly higher under residential areas than under natural grasslands and forests. • During the last 20 years, population of study area has increased by 250%, and land use and water use has changed from agricultural to residential. Result is increased groundwater withdrawals and decrease in irrigation withdrawn from Dungeness River. • Groundwater and surface water are closely related. Primary water quality concern is nitrate. Sources of nitrate are unclear (septic systems, residential fertilizers, storage in soils)
Studies Related to Bell Creek, Johnson Creek, and Gierin Creek.			
Climate Vulnerability Assessment and Adaptation Plan, prepared for the Jamestown S'Klallam Tribe	Adaptation International	2013	• Changing climate conditions and adaptation information for Jamestown S'Klallam Tribe • Projected changes and adaptation information for Sequim area, but focused on tribal community concerns • Includes background on Dungeness River, importance of preservation, and actions to take • Include in Master Plan for background on climate change in the Sequim area, Dungeness River habitat and impact of climate change
Potential Stormwater Impacts on Sediment Quality in Urbanizing Clallam County Streams	Battelle	2003	• Study on streams located within WRIA-18 that are urban or urbanizing or agriculturally influenced, and have a high potential for salmon habitat restoration (includes Bell Creek) • Collected sediment samples and analyzed for heavy metals and hydrocarbons • Use in Master Plan for waterbody section (specifically Bell Creek)
Assessment of Wetland Functions and Wetland Management Guidance for the Lower Dungeness River Area and Sequim Bay Watersheds	Clallam County DCD	1995	• Clallam County developed wetland database and management strategy with a grant from State Wetland Integration Strategy • Goals are to 1) update wetland inventory maps, 2) develop baseline data on existing wetland conditions, 3)establish GIS-based wetland information system, 4)develop methods to characterize and assess wetland functions, 5) develop wetland management guidance, 6) coordinate project objectives between state, local, federal management agencies • The project developed a wetland model to describe relationship of wetland to landscape • Used GIS to combine existing wetland inventory with landscape conditions(soils, surface water features), and habitat • Recommendations included 1) retain and enhance native vegetation in groundwater discharge wetland in Sequim Bay watershed, 2) In enclosed basins, prevent routing pollutants to wetlands,3)do not place facilities that may pollute groundwater adjacent to wetlands that discharge to groundwater, 4) retain and enhance vegetation in wetlands that discharge to groundwater, 5) expand education and assistance programs for landowners to control animal
Historical geomorphology and ecology of the Dungeness River delta and nearshore environments from the Dungeness Spit to Washington Harbor	Collins	2005	• Study on lower Dungeness River, its delta, and nearshore • Includes discussion of landscape evolution since 1800s compared to current conditions • Includes Bell Creek, Gierin Creek, and Washington Harbor • Use in Master Plan in waterbody section
Designation of critical habitat for Puget Sound Steelhead	National Oceanic and Atmospheric Administration	2013	• Proposed rules from National Marine Fisheries Service to designate critical habitat for lower Columbia River coho salmon and Puget Sound steelhead • Specific areas proposed for designation include freshwater and estuarine habitat areas in the Puget Sound • Within Sequim, areas designated include Indian lands and WDNR and WFP HCP lands. • Use in Master Plan in waterbody/ habitat restoration sections
Assessment of Baseflow in Small Streams of the Dungeness Watershed, Technical Memo	Peter Schwartzman , Pacific Groundwater Group	Jan-08	• Study evaluated groundwater derived baseflows in small streams on the Dungeness Peninsula • Streams represented in a groundwater flow model • Collected and compiled all available streamflow data • Includes information on Meadow Brook Creek, Cassalery Creek, Gierin Creek, Bell Creek, Johnson Creek • Use in Master Plan in waterbody section

Table A-1. Sequim Existing Document Review Summary.

Document Name	Author	Date	Notes
Surface Water Management Plan: Bell Creek and Johnson Creek	Quadra Engineering, Inc.	May-03	• Watershed assessment of Bell and Johnson Creeks • Includes existing land uses, water quality data, water quality problems, receiving water analysis, habitat impairments, and programs • Bell Creek: high concentrations of fecal coliform bacteria, low stream flow(lack of baseflow) during summer months, but overall the Creek's water quality has been improving since mid-1980s. • Johnson Creek: high concentration of fecal coliform bacteria • Use in Master Plan in waterbodies and drainage basins sections
Benthic Index of Biological Integrity (B-IBI), Clallam County,	Streamkeepers of Clallam County	Aug-12	• Bell Creek- highly/critically impaired (low B-IBI scores) • Meadowbrook- critically impaired
Bull Trout Final Critical Habitat Justification: Rationale for Why Habitat is Essential, and Documentation of Occupancy	US Fish and Wildlife Service	Sep-10	• Documents adult and subadult bull trout in rivers in the Olympic Peninsula, includes the Dungeness River. • Use in waterbodies section
Adapting to Climate Change at Olympic National Forest and Olympic National Park	US Forest Service	Aug-11	• Climate change and adaptation to climate change for natural resource managers • Ideas for how to adapt management of federal lands on the Olympic Peninsula in response to climate change • Potential effects of climate change on hydrology on the Olympic Peninsula (page 21) due to change in snowpack, temperature, streamflow timing • Use in Master Plan in climate change section
Effectiveness Monitoring of Fecal Coliform Bacteria and Nutrients in the Dungeness Watershed, Washington	Woodruff	2009	• Dungeness Targeted Watershed Initiative awarded a grant from EPA to clean surface water in the lower Dungeness Watershed • Three tasks: 1) Microbial Source Tracking, 2) BMP demonstrations related to water quality treatment, 3) effectiveness monitoring study. • This document focuses on Step 2(a)- Effectiveness of mycroremediation and bioretention cells in removing fecal coliform bacteria from surface waters in the Dungeness watershed • Goals of the study were to determine effectiveness of mycroremediation in bioretention cells at reducing fecal coliform and nutrients, compare effectiveness to typical bioretention cell, provide guidance on use and effectiveness of the BMP, improve overall functional habitat value by restoring native vegetation • Results indicated a significant reduction in fecal coliform bacteria from both the typical bioretention cell and from the mycroremediation cell. Data suggests that bioretention can reduce fecal coliform under a range of concentrations, and that mycroremediation treatment enhances or increases the reduction. • Nutrients were more difficult to evaluate since the data showed varying trends of export and removal. Overall, TN inflow increased 5x and outflow
Results of the Screening Analysis for Pharmaceuticals in Wastewater Treatment Plan Effluents, Wells, and Creeks in the Sequim-Dungeness Area.	Ecology	2004	• Ecology conducted a screening analysis for PPCPs in the Sequim-Dungeness area during November 2003. • Samples were collected from the WWTP effluent and from groundwater wells and creeks that may be impacted by the discharges • Nicotine, Caffeine, and Metformin were detected in the well and creek samples (far below known toxicity thresholds) • Additional monitoring needed before any conclusions for PPCPs can be drawn in relation to Sequim WWTP effluent\

APPENDIX B

Questionnaire

City of Sequim Stormwater Program Questionnaire

Instructions: Please assist Herrera by looking over this questionnaire and providing responses to questions *in your area of experience or expertise* using colored text or track changes (or Ann will interview you). Please provide as much readily-available information as you can, and identify any specific references you recommend we review later, such as brochures, City Code, records, or other City documents (check with Ann—we may have it already). There is no need to conduct any in-depth research to respond to these questions – please just provide what you know and identify where more research would help fill in any gaps. Send to Ann Soule no later than **Thursday, November 13**.

You only need to answer the questions marked with a highlighter or your name! All others are OPTIONAL!

Background

Herrera is assisting the City as it develops its first Storm and Surface Water Master Plan (Master Plan). The Master Plan will set goals, determine strategies, and define actions and funding for risk management, environmental stewardship, and regulatory compliance with regard to storm and surface water.

Stormwater Program Management

Public Education and Outreach – *David, Ann*

1. What types of educational brochures related to stormwater has the City developed and how are they distributed?

2. How does the City evaluate educational and outreach programs? What programs are most successful and least successful?

3. Are there any gaps in the City's public education program, and has the City considered any new educational programs to address these gaps? For what audiences?

Public Involvement and Participation – *David, Ann*

4. What are the established stakeholder groups that City officials consult with regarding stormwater?

5. How does the City solicit input and process comments on the stormwater program?

6. Does the City have a system (phone number, website, etc.) for the public to log general stormwater related complaints (e.g., drainage problems, construction site runoff)? How is this communication system advertised? How does the City respond to calls from the public?

Illicit Discharge Detection and Elimination – *David, Ann*

7. Has the City ever taken enforcement action against a citizen for non-stormwater discharge to the storm drain system?

8. Have there been known or suspected illicit discharges in the City? How were they identified? Has the City taken any action against these offenders?

9. Is there a hotline specifically for reporting illicit discharges? If so, how is it publicized? How many calls are received on average?

10. Are there any areas in the City where illicit discharges are perceived as a problem?

11. What land uses and industries are viewed as priority sources of stormwater pollution in the City?

12. Has the City conducted outfall inspections or other field screening methodologies for illicit discharges? If so, which methodologies have been used? Have the results been useful?

13. Does the City keep records of spills?

Monitoring – *Pete, Ann, Al*

14. Does the City conduct (or fund) any environmental monitoring? If so, please briefly describe this monitoring/existing programs.

15. Has the City identified any specific monitoring needs and identified staffing needs to accomplish the monitoring?

General Stormwater Program Status – *PW Managers; Leads for Streets, Sewer, WRF*

16. What elements of the current stormwater program/approach work well?

17. What elements don't work well, and what changes are recommended?

Program Staffing and Funding

18. How much staff time (in full time equivalent [FTE]) is currently allocated to stormwater for the following activities? – *PW Managers*
    a. Public education and outreach

    b. Public involvement

    c. Illicit discharge detection and elimination

    d. Monitoring

19. After the Master Plan, what are the most important aspects of your program that need additional funding? - *PW Managers*

    ☐ Operations and maintenance
    ☐ Capital improvements
    ☐ Stormwater site plan review
    ☐ Private facility inspections
    ☐ Public education and outreach
    ☐ Illicit discharge detection & elimination
    ☐ Other: _____

20. Which of the following funding sources are currently used to fund stormwater program activities? – *Sarah*

    ☐ Grants
    ☐ Loans
    ☐ Development review (permit) fees
    ☐ Revenue bonds for CIP projects
    ☐ Fee in-lieu of on-site stormwater control (to pay for regional stormwater facilities)
    ☐ General fund
    ☐ Special Purpose / Local Improvement District(s)
    ☐ Drainage for Flood Control Zone District(s)
    ☐ System development charges
    ☐ Intergovernmental coordination/leveraging
    ☐ City funding

Stormwater Maintenance

Overall – *Ty, Willie, Ann, Irrigators, County*

21. Does the City stormwater system map have any significant information gaps or inaccuracies?

22. How are records kept?

Private Stormwater Facility Maintenance – *David, Pete, Mike (Irrigators)*

23. Does the City ensure that maintenance is performed on private stormwater facilities? If so, how is that accomplished (e.g., additional education, code, maintenance covenants, plat documents)?

24. How frequently are privately owned stormwater facilities (e.g., ponds, vaults, pipes) inspected?

25. Are there differences in how stormwater facilities for new/ recent developments are maintained compared to stormwater facilities for older developments? Once older facilities "grandfathered" in are they maintained by the property owner or by the City?

City-owned Stormwater Facility Maintenance – ***David, Pete, Mike, Willie***

26. How many catch basins, culverts, stormwater facilities (e.g., Contech Filters, Vortechs, Aquaswirls, etc.) does the City maintain?

27. How many miles of open ditches and storm lines does the City maintain?

28. Is lack of facility maintenance viewed as a problem that contributes to flooding and poor water quality in the City? How severe are the problems (e.g., major, moderate, minor)?

29. How frequently are City owned or operated stormwater facilities (e.g., ponds, vaults, pipes) inspected?

30. Does the City maintain a list of maintenance problem locations (e.g., places that maintenance staff check on during and/or following major storms – aka Spot Check List)?

31. How often do maintenance staff check these locations?

32. How much is spent on contractors and equipment to maintain the system (i.e., vactors, sweepers etc.)?

33. Does the City currently have the needed vehicles and equipment to maintain the stormwater system?

Catch Basin Cleaning Program – *Mike, Ty*

34. What is the City's current catch basin inspection schedule/program?

35. Does the City have any intention to change the current catch basin inspection schedule/program in the future?

Street Sweeping Program – *Mike, Rick*

36. What is the City's current street sweeping schedule/program? Does the City plan to expand, reduce, or continue this program at the same level of effort?

Operations at City-owned Facilities

37. List pollutant-generating activities you think may occur at the following City-maintained facilities (e.g., stockpiling, vehicle maintenance, vehicle washing)?

City-maintained facility	Pollution-generating activities
Fleet vehicle yard	
Maintenance shop	
Parking lots	
Sidewalks	
Landscaped grounds	
Solid waste storage	
City office buildings	
Other:	

38. Do street and stormwater maintenance staff adhere to any BMPs or guidelines (e.g., perform vehicle maintenance indoors, wash vehicles at a commercial carwash facility, cover material stockpiles) to prevent pollution of the stormwater system? Which ones?

39. Have Stormwater Pollution Prevention Plans (SWPPPs) been developed for City-owned facilities that stockpile materials and/or wash or maintain vehicles outdoors?

40. Are standard operating procedures (SOPs) and guidelines in place for preventing stormwater pollution outside of City-owned facilities?

Managing Stormwater Assets – *Streets Manager*

41. Does the City have an active asset management program for its owned or operated stormwater infrastructure to determine lifespan and repair/replacement needs? If yes, answer the subsequent questions.

42. What types of assets or structures are regularly evaluated?

43. How are these assets evaluated and how often?

44. How often are underground assets (i.e., pipes, vaults, tanks etc.) evaluated?

45. Does the City have a repair or replacement schedule for its aging infrastructure?

46. Are existing funding sources adequate for the utility's repair and replacement needs – currently and in the future?

Staffing and Funding

47. How much staff time (in full time equivalent [FTE]) is currently allocated to stormwater maintenance (cleaning catch basins and pipes, sweeping streets, irrigation ditch maintenance?

48. Where does the funding for stormwater maintenance activities currently come from?

Capital Improvement Program (CIP) – *David, Mike, Ty, Rick, Roger, and others (and Irrigators, County)*

49. What is the risk and priority of the runoff and flooding problems identified in the 2014 Stormwater Needs Assessment? *(refer to separate Capital Projects worksheet and Appendix A of the Stormwater Needs Assessment)*

50. What are the major roadblocks to execution of any outstanding projects?

51. What capital projects are needed that are not addressed in this list? What problems will they address?

52. Are there any known problem areas that are not listed that would benefit from additional investigation or evaluation?

New Development, Redevelopment, and Construction Sites – *DCD*

Current Program

53. What type and quantity of development has occurred in the City over the last 10 years?

54. What type of development is expected in the next 10 years?

55. Are stormwater designers consistently using the Stormwater Management Manual for Western Washington (Ecology Manual)?

56. Do you think the Stormwater Management Manual for Western Washington is well suited for Sequim's environment? Are there any conflicts with the Stormwater Management Manual for Western Washington requirements/guidelines and what is feasible for Sequim?

57. How does the City verify facility performance during plan review (e.g., modeling, calculations, and professional judgment)?

58. Do the plan reviewers need any additional tools to increase efficiency (e.g., checklists, sizing tables, etc.)?

59. Who inspects erosion control BMPs on development sites?

60. Are erosion control BMPs usually implemented correctly?

61. What does the City do for enforcement when erosion control BMPs are not implemented correctly?

62. Are post-construction inspections for stormwater BMPs/facilities implemented? If so, how are they tracked?

63. Has the City revised any codes, rules, standards, or other enforceable documents to allow for low impact development (LID) based on the recommendations provided by AHBL in 2009?

Staffing

64. How much staff time (in full time equivalent [FTE]) is currently allocated to stormwater for the following activities?
    a. Stormwater site plan review (reviewing stormwater plans for new development)

    b. Stormwater construction site inspections (inspection of temporary erosion and sediment controls)

Priorities – *Everyone*

Overall Purpose

65. In your opinion, what are the City's top concerns with stormwater management?

66. What should be the City's first priorities for stormwater management?

Water Resources and Pollutants of Concern

67. What do you think are the City's first priorities for water quality and resource protection?

☐	Water quality in Bell Creek	☐	Fish habitat in Bell Creek
☐	Water quality in Johnson Creek	☐	Fish habitat in Johnson Creek
☐	Water quality in Gierin Creek	☐	Fish habitat in Gierin Creek
☐	Groundwater aquifer water quality		
☐	Other: _____		

68. What do you perceive as the biggest threats from stormwater on the resources you marked in the prior question?

CITY OF SEQUIM STORMWATER CAPITAL PROJECTS WORKSHEET

What is the risk and priority of the following runoff and flooding problems identified in the 2014 Stormwater Needs Assessment?

Creeks (refer to Appendix A1 photos and information)				
Problem #	**Problem Description/Location**	**Risk (H, M, L)**	**Priority (#)**	**Notes**
A1.01	Bell Creek flooding @ RM 0.2			
A1.02	Bell Creek culvert back up @ RM 1.3			
A1.03	Bell Creek flooding @ RM 1.4			
A1.04	Bell Creek culvert high flows @ RM 1.55			
A1.05	Bell Creek flooding @ RM 1.6			
A1.06	Bell Creek culvert back up @ RM 1.6			
A1.07	Bell Creek culvert back up @ RM 1.8			
A1.08	Bell Creek culvert back up @ RM 1.85			
A1.09	Bell Creek flooding @ RM 2.2 – 1.8			
A1.10	Bell Creek culvert back up @ RM 2.2			
A1.11	Bell Creek culvert gravel accumulation @ RM 2.5			
A1.12	Bell Creek culvert back up @ RM 2.6			
A1.13	Bell Creek culvert gravel accumulation @ RM 2.7			
A1.14	Bell Creek spillway discharge @ RM 3.5			
A1.15	Bell Creek valve discharge/creek erosion @ RM 3.6			
A1.16	Gieren Creek culvert back up @ RM 2.6			
A1.17	Johnson Creek erosion/habitat damage @ RM 1.6			

City-Owned Properties (refer to Appendix A2 information)					
Problem #	**Street**	**Cross Street/Location**	**Risk (H, M, L)**	**Priority (#)**	**Notes**
A2.01	S 2nd	Washington			
A2.02	S 3rd	Bell – SW corner			
A2.03	S 3rd	Hemlock – NW corner			
A2.04	S 3rd	Drive to Hideaway Homes MHP			
A2.05	N 5th	Cedar, SE corner			
A2.06	N 5th	Spruce, SE corner			
A2.07	N 5th	Alder, SE corner			
A2.08	N 5th	South of Hendrickson, west side across from SARC drive			
A2.09	S 5th	W Salal Place (south of 101)			
A2.10	S 5th	Sea Breeze apartments, near entrance to Avamere			
A2.11	S 5th	Near west entrance to Maple Ridge			
A2.12	7th	Washington, SW corner especially (in front of McDonalds)			
A2.13	N 7th	West shoulder and parking lot for Flooring business at 147 N 7th			
A2.14	N Blake	Fir			
A2.15	S Brown	300 feet south of Washington			
A2.16	S Brown	Washington, SW corner as well as south along Brown			
A2.17	S Brown	Hammond corner			
A2.18	E Brownfield	Entire length			
A2.19	Carrie Blake Park	Parking lot, SW and SE of Guy Cole			
A2.20	Carrie Blake Park	Skate park, near parking area			
A2.21	Carrie Blake Park	Playground, north side near swings			

City-Owned Properties (continued) (refer to Appendix A2 information)					
Problem #	**Street**	**Cross Street/Location**	**Risk (H, M, L)**	**Priority (#)**	**Notes**
A2.22	Carrie Blake Park (and Re-Use Park)	North side lower pond			
A2.23	Centennial Place	Sequim and Washington			
A2.24	Dunlap	341 Dunlap			
A2.25	Etta St	Center (between Sequim Ave and Sunnyside)			
A2.26	Falcon Rd	South end and near Eastgate Place (roads and private property)			
A2.27	W Fir	5th Ave, SE corner			
A2.28	W Fir	Between 5th and Sequim Ave			
A2.29	E Hammond St	Between S Brown and S Still Rd			
A2.30	W Hammond St	S 3rd Place			
A2.31	Happy Valley Rd	Bell Creek culvert at UGA boundary			
A2.32	N Honeycomb Circle	Deseret intersection, SW corner			
A2.33	W McCurdy Rd	S 5th, east end of McCurdy -- runoff flows overland to east			
A2.34	Miller Rd	Starting from Doe Run			
A2.35	Miller Rd	Emerald Highlands			
A2.36	Miller Rd	Luis property (744 Miller Rd)			
A2.37	Norman	Along length, various addresses			
A2.38	Oak Wood Dr	685 Oak Wood Dr			
A2.39	Reservoir Rd	West of 3rd			
A2.40	Reservoir Rd	Highland ditch culvert around 400 Reservoir Rd			
A2.41	N Rhodefer	West Sequim Bay Rd			
A2.42	S Rhodefer	E Washington			
A2.43	Seal Street	South end, between Cedar and Washington			

City-Owned Properties (continued) (refer to Appendix A2 information)					
Problem #	**Street**	**Cross Street/Location**	**Risk (H, M, L)**	**Priority (#)**	**Notes**
A2.44	N Sequim Ave	Fir, NW corner			
A2.45	N Sequim Ave	Hendrickson, NW corner			
A2.46	N Sequim Ave	Spruce, SE corner			
A2.47	S Sequim Ave	Hammond corner			
A2.48	S Sequim Ave	Prairie, SE corner			
A2.49	E Silberhorn	Just east of River Rd			
A2.50	E Silberhorn	East of Petal Lane where ditch from south comes out, across from 693 E Silberhorn			
A2.51	E Silberhorn	Rolling Hills			
A2.52	Spyglass/Wash Harbor Loop	North end of Simdars			
A2.53	W Spruce St	Just west of 5th, south and north side past Fire Station back driveway			
A2.54	W Washington	Home Depot, etc.			
A2.55	E Washington	Still-Hammond Rd intersection			
A2.56	E Washington	East of S Rhodefer			
A2.57	West Sequim Bay Rd	Between Rhodefer and Washington Harbor Rd (near Elk Loop)			
A2.58	West Sequim Bay Rd	Fairweather			
A2.59	West Sequim Bay Rd	West end near Washington			
A2.60	West Sequim Bay Rd	Middle section east of Wash. Harbor Rd			
A2.61	Simdars-Spyglass/Wash Harbor Loop intersection	Wash DOT pond			

Misconnected Street Drains (refer to Appendix A3 photos and information)				
Problem #	**Street and Location**	**Risk (H, M, L)**	**Priority (#)**	**Notes**
A3.01	Seal Street between Cedar and Alley			
A3.02	N 7th (W shoulder and parking lot for flooring business)			
A3.03	S 7th, west side at Eureka ditch crossing (at Sawadee parking lot)			
A3.04	S 7th, east side at Eureka ditch crossing (at south property line of McDonalds)			
A3.05	W Washington at Columbia Bank corner, both sides entrance to parking lot			
A3.06	W Washington at Safeway complex			
A3.07	Sequim Ave at Washington intersection (SE and NE)			

Non-City-Owned Properties (refer to Appendix A4 photos and information)				
Problem #	**Street and Location**	**Risk (H, M, L)**	**Priority (#)**	**Notes**
A4.01	Falcon Rd and others nearby			
A4.02	NW corner 7th and Happy Valley Rd			
A4.03	Cobblestone Ln east end			
A4.04	W Washington across from Home Depot			
A4.05	S Shaw Lane off Washington			
A4.06	E Silberhorn			
A4.07	W Washington between 5th and 7th (Safeway parking lot, center)			
A4.08	W Washington between 5th and 7th (Washington Plaza (Safeway-Goodwill), NE corner)			
A4.09	W Spruce and W Fir (and between 5th and 7th)			
A4.10	W Fir between Sequim Ave and 5th			
A4.11	Sequim Ave and Fir			
A4.12	Hendrickson between 5th and Sequim Ave			
A4.13	Sequim Ave south of Library parking lot			
A4.14	S 7th, Comfort Way/Rolling Hills Way			
A4.15	S 7th and Maliandra Dr			
A4.16	S 5th & McCurdy			
A4.17	S 5th (west side)			
A4.18	S 5th			
A4.19	S 3rd (Sequim School District bus barn)			
A4.20	S 3rd, west/south of bus barn			
A4.21	S 3rd (and from S 5th)			
A4.22	S 3rd, north of Dominion Terrace			
A4.23	S 3rd (Dominion Terrace)			

Non-City-Owned Properties (continued) (refer to Appendix A4 photos and information)				
Problem #	**Street and Location**	**Risk (H, M, L)**	**Priority (#)**	**Notes**
A4.24	S 3rd (Gerhardt Park at 3rd Ave – City owner but HID easement)			
A4.25	Miller Rd			
A4.26	Miller Rd (The Cottages)			
A4.27	Brownfield Rd			
A4.28	S Sequim Ave and E Hammond, north of Hwy 101			
A4.29	Hwy 101, S Rhodefer			
A4.30	E Washington and S Rhodefer			
A4.31	E Washington			
A4.32	West Sequim Bay Road (Fairweather subdivision)			
A4.33	West Sequim Bay Road (Elk Loop subdivision)			
A4.34	West Sequim Bay Road (Olympic Crest subdivision)			
A4.35	West Sequim Bay Road (just east of Olympic Crest subdivision)			

APPENDIX H

Water Quality Data Analysis Report

WATER QUALITY DATA ANALYSIS REPORT

Prepared for
City of Sequim

Prepared by
Herrera Environmental Consultants, Inc.

HERRERA

Note:
Some pages in this document have been purposely skipped or blank pages inserted so that this document will copy correctly when duplexed.

Water Quality Data Analysis Report

Prepared for
City of Sequim
152 West Cedar Street
Sequim, Washington 98382

Prepared by
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May 27, 2015

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INTRODUCTION

The City of Sequim (City) is actively addressing stormwater quantity and quality issues. Herrera Environmental Consultants, Inc. (Herrera) is assisting with development of the City's first Storm and Surface Water Master Plan (Master Plan). The purpose of the Master Plan is to set goals, determine strategies, define actions, and identify funding strategies for risk management, environmental stewardship, and regulatory compliance with regard to stormwater and surface water as the city grows. One of the first tasks in the Master Plan development is the evaluation and assessment of existing information. The purpose of this report is to assess available water quality data pertinent to the Master Plan. This data analysis will be used to evaluate and prioritize potential water quality improvement projects and targeted programmatic efforts.

From 2008 through 2011, the Clallam County Streamkeepers volunteer monitoring organization (Streamkeepers) conducted monitoring on streams, ditches, sediments, and storm drains within Clallam County. Data analyzed for this report includes the subset of sites monitored by Streamkeepers that pertains to streams and stormwater runoff in and around the city. To date, a comprehensive analysis of these water quality data has not been performed. This report presents a summary and limited analysis of these data. Water quality and sediment data availability and monitoring locations are initially summarized, followed by an assessment of the quality of the existing data. The report then provides an interpretation of the data organized by stream. Conclusions (including monitoring recommendations) are presented at the end of the report.

WATER QUALITY AND SEDIMENT STUDIES

Water quality and sediment data summarized in this report was collected by the Streamkeepers for the following studies:

- **Clallam County Comprehensive Stormwater Monitoring (referred to as "Clallam County SW" in this report):** Water quality from base flow and storm events was collected in 2008 through 2011, and sediment quality data was collected in 2009 by the Streamkeepers to support a United States Environmental Protection Agency (EPA) funded project to develop a comprehensive stormwater monitoring program for Clallam County. These data were obtained from Clallam County Streamkeepers (Ed Chadd, Streamkeepers program coordinator, personal communication January 6, 2015) and EPA's Storage and Retrieval (STORET) database (EPA 2014a, EPA2014b).

- **Clean Water District monitoring (referred to as "Clean Water District" in this report):** Ambient water quality data collected during three monitoring dates in 2010 by the Streamkeepers on behalf of the Clallam County Clean Water District on streams contributing to Dungeness and Sequim Bays. These data were obtained from Ecology's EIM database (Ecology 2014).

- **Routine Streamkeepers monitoring:** Benthic Index of Biotic Integrity (B-IBI) data collected annually in Bell Creek from 1999 through 2003 by the Streamkeepers. B-IBI data was also collected in Bell Creek 2003, 2005, 2008, and 2010 and in Johnson Creek in 1999, 2007, and 2009.

- **Potential Stormwater Impacts on Sediment Quality in Urbanizing Clallam County Streams (referred to as "Brandenberger study" in this report):** Battelle Marine Sciences Laboratory was commissioned by Clallam County to conduct an analysis of heavy metal and total petroleum hydrocarbon (TPH) concentrations in streambed sediment (Brandenberger et al. 2003). Five streams, including Bell Creek, were sampled and analyzed for heavy metals and TPH in 2003. Results of the Brandenberger study are discussed in this report as a means of comparison.

MONITORING LOCATIONS

Multiple locations within the Bell Creek, Johnson Creek, and Gierin Creek drainage basins have been monitored since 1996. The drainage basin land area, percentage of the drainage basin within the city limits, and the land cover composition are summarized in Table 1 for the Bell, Johnson, and Gierin Creek basins based on data from the National Land Cover Database (NLCD) (NLCD 2011). The drainage basin locations and boundaries are depicted on Figure A-1 in Appendix A.

Table 1. Drainage Basin Size and Land Cover for Basins Located Within the City of Sequim.

	Bell Creek	Johnson Creek	Gierin Creek
Total Area	7.4 square miles	6.3 square miles	5.3 square miles
Basin Area Within City Limits	40%	14%	35%
City Area Within Basin[a]	46%	15%	29%
Land Cover (% of total basin)			
Developed, high intensity and medium intensity	16%	5%	26%
Developed, low intensity and open space	16%	7%	21%
Barren[b]	0%	1%	1%
Forest[c]	23%	44%	13%
Shrub/scrub[d]	2%	16%	0%
Herbacious[e]	1%	3%	2%
Planted/Cultivated[f]	39%	22%	29%
Wetlands[g]	2%	1%	6%
Water[h]	0%	2%	0%

Land cover category descriptions:

[a] The remaining 11% of the city includes small portions of Cassalery Creek (2.4%), the Dungeness River (2.9%), and two unnamed basins (4.7%).

[b] Barren areas are characterized by bare rock, gravel, sand, silt, clay, or other earthen material, with little or no vegetation present.

[c] Forest areas are characterized by tree cover where the tree canopy accounts for 25% to 100% of the cover. This category includes deciduous, evergreen, and mixed forest.

[d] Shrub/scrub areas are characterized by natural or semi-natural woody vegetation with aerial stems.

[e] Herbaceous areas are characterized by natural or semi-natural herbaceous vegetation. This category includes grassland/herbaceous and sedge/herbaceous.

[f] Planted/Cultivated areas are characterized by herbaceous vegetation that has been planted or is intensively managed for the production of food, feed, or fiber. This category includes pasture/hay and cultivated crops.

[g] Wetlands are areas that are characterized by soil or substrate that is periodically saturated with or covered with water. This category includes woody wetlands and emergent herbaceous wetlands.

[h] Water includes open water and perennial ice/snow cover.

Each drainage basin contains multiple monitoring stations. In-stream monitoring stations are designated by the stream name (e.g., Bell) and the stream mile (e.g., 0.0 for the mouth of

the stream). Monitoring stations in the stormwater/irrigation drainage system are designated by the station name. The broad prairie in and around Sequim is flat with undistinguishable drainage basins. Irrigation ditches often cross these drainage basins, carrying stormwater runoff and irrigation water from one basin into another. A list of the monitoring stations is provided in Table 2 and depicted on a separate drainage basin figure for each of the three stream basins in Appendix A. The drainage basin figures in Appendix A also include the irrigation system and stormwater pipes since these systems influence drainage patterns in each basin.

Table 2. Monitoring Stations and Drainage Basins/Receiving Waters in the City of Sequim.

Monitoring Station/Landmark	Drainage Basin/Receiving Water	Study Name
Bell Creek		
Bell 0.2/Schmuck Road	Bell Creek/Washington Harbor and Sequim Bay	Clallam County SW, Clean Water District
Bell 0.8/Upstream of City Water Reclamation Facility and dairy farm		Clean Water District
Bell 1.6/N Blake Avenue		Clallam County SW
Bell 1.75/Les Schwab		Clallam County SW
Bell 4.2/Happy Valley		Clean Water District
Johnson Creek		
Johnson 0.0/mouth	Johnson Creek/Sequim Bay	Clean Water District
Johnson 2.0/Upstream of irrigation tailwater discharge		Clean Water District
Stormwater and Irrigation System		
Safeway Catch Basin	Shallow Aquifer (within the Gierin Creek drainage basin)	Clallam County SW
Sequim Bay Road	Bell Creek (via stormwater ditch)	Clallam County SW
Highland Ditch at E Washington St.	Bell Creek (direct)	Clallam County SW
Highland Ditch at Happy Valley Rd.	Johnson Creek (direct)	Clallam County SW
Eureka Ditch	Gierin and/or Cassalery Creeks (direct)	Clallam County SW

Basin characteristics are summarized separately below for Bell Creek, Johnson Creek, and Gierin Creek and the sampled stormwater systems and irrigation ditches. Gierin Creek basin land-cover data were also compiled, and the basin is described below, although only stormwater and irrigation system monitoring data were collected; no in-stream monitoring data are available for this basin.

Bell Creek

The Bell Creek drainage basin is bordered on the north by the Gierin Creek drainage basin and on the south by the Johnson Creek drainage basin. Bell Creek flows a total of 3.8 miles from the uplands of Happy Valley, where it receives runoff from Bell Hill and Burnt Hill, through the eastern portion of the city of Sequim, and discharges to Washington Harbor at the north end of Sequim Bay (Elwha-Dungeness Planning Unit 2005). Until recently, the middle and lower reaches of Bell Creek were supplemented with irrigation water from the Dungeness

River for the Highland Irrigation District for the duration of the irrigation season (Sequim 2014). Now, Bell Creek is known as an ephemeral stream fed primarily by groundwater and by stormwater runoff. Without supplementation with Dungeness River flow, the middle reaches of Bell Creek are dry during the summer months. The Highland Irrigation District maintains a separate irrigation system that, in the summer, conveys Dungeness River water as far east as Sequim Bay in both open ditch and piped segments, which cross or discharge to Bell Creek at multiple locations. In the winter, the irrigation system conveys Dungeness River water during dry weather, and intercepts runoff from west of the Bell Creek drainage basin into Bell Creek or Johnson Creek during wet weather. The Sequim Prairie Tri-Irrigation Company also maintains a separate irrigation system of pipes and ditches, some of which discharge runoff and/or irrigation tail water to Bell Creek. A wetland complex is located between Bell 1.3 and Bell 0.6.

The Jamestown S'Klallam Tribe monitors coho, steelhead, and cutthroat salmon outmigration in Bell Creek each spring, and federal assessments designate most of Bell Creek from the mouth to the crossing of the Highland Irrigation canal as critical habitat for threatened/endangered bull trout (USFWS 2010). A critical habitat designation is also proposed for Puget Sound steelhead in Bell Creek (NOAA 2013). Washington State Department of Ecology (Ecology) has included several lower reaches of Bell Creek on the 2012 303(d) list of impaired waters (Category 5) for fecal coliform bacteria, dissolved oxygen, and bioassessment (Benthic Index of Biological Integrity, B-IBI). Additional parameters (pH, temperature) and/or reaches are listed as Category 2, "waters of concern."

As indicated in Table 1, the total drainage basin area for Bell Creek is approximately 7.4 square miles, 40 percent of which is located within the city limits. Approximately 32 percent of the drainage basin is comprised of urban and rural development based on data from the National Land Cover Database (NLCD) with the remainder of the drainage basin primarily comprised of planted/cultivated areas (39 percent), forest (23 percent), and shrub/scrub (2 percent).

Water quality monitoring locations in the Bell Creek drainage basin are shown on Figure A-2 in Appendix A. A total of seven in-stream stations and two stormwater and irrigation system stations have been monitored in the Bell Creek basin.

Johnson Creek

The Johnson Creek drainage basin is bordered on the northwest by Bell Creek basin and on the southeast by an unnamed drainage basin in the county (Sequim 2014). Johnson Creek drains eastern portions of Bell Hill, Happy Valley, Burnt Hill, and county areas that drain directly to the Highland Irrigation canal (which empties into Johnson Creek at RM 1.5). The stream enters the city just upstream of SR 101, runs along the eastern edge of the city, and discharges into Sequim Bay just south of Pitship Point (John Wayne Marina).

Johnson Creek is considered suitable habitat for salmonids and is designated critical habitat for bull trout by the United States Fish and Wildlife Service (USFWS 2010). A critical habitat designation is also proposed for Puget Sound steelhead in Johnson Creek (NOAA 2013). Ecology included the lower reaches of Johnson Creek on the 2012 303(d) list of impaired

waters (Category 5) for fecal coliform bacteria. Additional parameters (pH, bioassessment) and/or reaches are listed Category 2, waters of concern.

As indicated in Table 1, the total drainage basin area for Johnson Creek is approximately 6.3 square miles, 14 percent of which is located within the city limits. Approximately 11 percent of the drainage basin is developed based on data from the NLCD with the remainder of the drainage basin primarily comprised of planted/cultivated areas (22 percent) and forest (44 percent).

Water quality monitoring locations in the Johnson Creek drainage basin are shown on Figure A-3 in Appendix A. A total of four in-stream stations and one stormwater and irrigation system station have been monitored in the Johnson Creek basin.

Gierin Creek

Gierin Creek basin is a small drainage basin, bordered on the south by Bell Creek basin and in the north by the Cassalery Creek basin. A large portion of what is known as Sequim Prairie comprises the upper Gierin Creek Basin. Sequim Prairie is characterized by flat topography, gravelly soils, and arid climate. Gierin Creek rarely has base flow until outside the city limits.

Gierin Creek is supplemented directly by Dungeness River water conveyed through the city in irrigation ditches during the summer, and receives stormwater runoff (via sheet flow and stormwater roadside ditches) carried in these irrigation ditches during the winter. Groundwater recharge in this basin is of particular importance, since the zone of contribution for the City's Port Williams well field is in this basin, and a portion of the basin (6 percent, in the lowest reach) is comprised of wetlands that are fed by groundwater (Sequim 2014).

Gierin Creek is not included on the 303(d) list of impaired waters (Category 5). No fish habitat has been identified in the Gierin Creek basin within the city or its Urban Growth Area.

As indicated in Table 1, the total drainage basin area is approximately 5.3 square miles, 35 percent of which is located within the city limits where drainage either infiltrates or is controlled by irrigation and SR 101 infrastructure. Approximately 49 percent of the drainage basin is developed based on data from the NLCD with the remainder of the drainage basin primarily comprised of planted/cultivated areas (29 percent), forest (13 percent), and wetlands (6 percent).

Water quality monitoring locations in the Gierin Creek drainage basin are shown on Figure A-4 in Appendix A. One stormwater and one irrigation system station have been monitored in the Gierin Creek basin.

Stormwater and Irrigation System Stations

Safeway Catch Basin

This monitoring location is a storm drain catch basin within the Safeway plaza parking lot at the northeast corner of Seventh Avenue and West Washington Street. This drainage area was selected by Streamkeepers because it is one of the largest and older impervious surfaces in the city. Stormwater collected in the catch basin infiltrates to a shallow aquifer within the

Gierin Creek basin, but does not directly discharge to a surface water. Contributing runoff to this catch basin are typical urban land uses including roofs, parking, and some landscaping (Clallam County 2008).

Sequim Bay Road

This monitoring location is located on a stormwater ditch along East Washington Street downstream of its intersection with a Highland Ditch lateral, and across from the intersection of West Sequim Bay Road. Contributing land uses include rural and suburban residential, roads, and commercial (Clallam County 2008).

Eureka Ditch

This monitoring location is on the Eureka Irrigation Ditch (Sequim Prairie Tri-Irrigation system) just before it is piped under the commercial zone near Seventh Avenue and West Washington Street. This conveyance runs through the commercial zone in a pipe that daylights in the mobile home park on West Spruce Street. Contributing runoff to this location includes mostly rural residential, road, and agricultural (both crop and stock) land use.

Highland Ditch at East Washington Street

This monitoring location is on a Highland Irrigation Ditch lateral on the north side of East Washington Street between Highway 101 Outpost (a convenience store) and what used to be Staples (now closed), just upstream of Bell Creek Plaza. Contributing land uses include rural and suburban residential and roads (Clallam County 2008).

Highland Ditch at Happy Valley Road

This monitoring location is on Highland Irrigation Ditch main canal just downstream of the east end of Happy Valley Road, near Huffman Heights Road. This ditch runs past the Bell Hill and Huffman Heights residential developments. Contributing land uses include rural and suburban residential, roads, and stock (Clallam County 2008).

AVAILABLE WATER AND SEDIMENT QUALITY DATA

The water quality parameters, monitoring periods, and numbers of stations and samples evaluated in this report are summarized in Table 3. Additional water quality parameters were collected; however, the analysis presented in this report focuses on the water quality parameters that are of highest concern in relation to stormwater runoff and groundwater quality, due to budget and time limitations.

Table 3. Water Quality Data Evaluated for the City of Sequim.

Water Quality Parameter	Monitoring Period	Number of Stations/Samples per Station		
		Bell Creek	Johnson Creek	Stormwater and Irrigation System
Clallam County Stormwater				
Ammonia nitrogen, total	2008	1 | 21	NA	NA
Ammonia nitrogen, dissolved	2008–2011	3 | 1–5	NA	5 | 1–12
Arsenic, total	2009	2 | 1	NA	1 | 2
Chromium, total	2009	2 | 1	NA	1 | 2
Copper, total	2008–2011	3 | 1–26	NA	1 | 2
Copper, dissolved	2008–2011	3 | 1–26	NA	3 | 2–9
Fecal coliform bacteria	2009–2011	2 | 1–23	NA	5 | 1–6
Hardness	2008–2011	3 | 1–26	NA	3 | 1–9
Lead, total	2009	2 | 1	NA	1 | 2
Nitrate+nitrite nitrogen, total	2009–2010	1 | 21	NA	1 | 1
Nitrate+nitrite nitrogen, dissolved	2008–2011	3 | 1–5	NA	5 | 6–11
pH	2010–2011	1 | 22	NA	NA
Suspended sediment (SSC)	2008–2011	3 | 1–27	NA	5 | 6–12
Temperature	2010–2011	1 | 24	NA	NA
Total phosphorus	2008–2011	3 | 1–26	NA	5 | 6–12
Turbidity	2008–2011	3 | 1–27	NA	5 | 7–16
Clean Water District				
Fecal coliform bacteria	2010	3 | 2	2 | 1–2	NA
Routine Streamkeepers Monitoring				
B-IBI	1999–2010	6 | 1–4	3 | 1–2	NA

B-IBI = Benthic Index of Biotic Integrity.
SSC = Suspended Sediment Concentration.
NA = not available.

Flow was not measured during water quality monitoring. Hydrologic conditions (pre-storm, first flush, and peak storm) were included in the water quality dataset for a portion of the data collected. Since the base (pre-storm) and storm event (first flush and peak storm)

designations were not available for the entire dataset, precipitation data (see following section) was evaluated to apply a base flow or storm event designation to each of the collected samples.

Sediment quality parameters, monitoring periods, and numbers of stations and samples evaluated in this report are summarized in Table 4. Additional sediment quality parameters were collected; however, the analysis presented in this report focuses on the sediment quality parameters that are of highest concern in relation to stormwater runoff and surface water quality, due to budget and time limitations.

Table 4. Sediment Quality Data Evaluated for the City of Sequim.

Sediment Quality Parameter	Monitoring Period	Number of Stations/Samples per Station		
		Bell Creek	Johnson Creek	Stormwater and Irrigation System
Arsenic	2009	2 | 1	NA	2 | 1
Copper	2009	2 | 1	NA	2 | 1
Lead	2009	2 | 1	NA	2 | 1
Zinc	2009	2 | 1	NA	2 | 1
Lube oil	2009	2 | 1	NA	2 | 1
Diesel #2	2009	2 | 1	NA	2 | 1

NA = not available.

A cursory data quality assurance review was performed on the water quality data collected by the Streamkeepers. This quality assurance review focused on the discrepancies in the Streamkeepers data files downloaded from STORET (EPA 2014a and EPA 2014b) and the master database provided by Streamkeepers (Ed Chadd, Streamkeepers program coordinator, personal communication January 6, 2015).

The primary quality assurance issues and corrective actions performed for this evaluation included:

- Where different result values were reported in each Excel file for a particular sampling location and date—Herrera followed up with Streamkeepers to determine which value should be used.
- Where two or more result values are listed for the same monitoring location and date (with no associated time of day)—the primary samples and the replicate samples were identified based on the master data reports provided by the Streamkeepers.
- Where a sample was assigned a result value at or below the detection limit—these values were set at the detection limit based on feedback and master data reports provided by the Streamkeepers.
- Where differences occurred in location names and river miles in the database—the correct locations were verified by the Streamkeepers.
- Where replicate result value was above or below the primary sample result value by 25 percent or more—samples were flagged as estimated (with a J).

- Where replicate data was above or below the primary sample quantity by 50 percent or more—samples were rejected (with a R) and not included in further analysis.
- Rejected all zinc data based on Streamkeepers recommendation. Streamkeepers rejected all total and dissolved zinc data collected due to a potential issue with contaminated blank samples.

A data quality assurance review was not performed on water quality data collected as part of the Clean Water District study, the B-IBI data, or sediment quality data. The quality assurance procedures established by the Streamkeepers were assumed to be sufficient for data collection and entry.

PRECIPITATION DATA EVALUATION

To determine if monitoring was performed in years with typical precipitation and because some of the sampling was storm event-based, precipitation data were compiled from the following two rain gauges (see Appendix A):

- Sequim 2E gauge – located in the lower Bell Creek basin (Sequim Water Reclamation Facility) with daily data from October 1, 1980 through present (NCDC 2014)
- Sequim 5.8 WNW gauge – located outside of the city boundary between Sequim and Port Angeles, just west of Carlsborg, with daily data from November 16, 2009 through present (NCDC 2014)

Annual precipitation amounts for each of these data sources are compared for the monitoring periods (1996 through 1998 and 2008 through 2011) in Table 5. Data for rain gauge Sequim 1.3 SE were also compiled, but data were only available from June 5, 2012 through present (NCDC 2014). Because this time period does not correspond to any of the sample collection dates, the data from Sequim 1.3E were not evaluated or included in Table 5 below.

Table 5. Annual Precipitation Amounts for Sequim from 1996 Through 1998 and 2008 Through 2011.

Calendar Year	Annual Precipitation (inches)	
	Sequim 2E Gauge (Lower Bell Creek)	Sequim 5.8 WNW Gauge (west of Carlsborg)
1996	22.58	NA
1997	20.42	NA
1998	16.47	NA
2008	15.35	NA
2009	19.28	NA
2010	17.17	17.81
2011	**19.80**	**23.89**

Source: NCDC (2014).

Values in **bold** exceed the 75th percentile value of historical data for 1971 through 2000 (WRCC 2014).

NA = not available.

Based on a historical climate summary (1971 through 2000), the average annual precipitation amount in Sequim is 15.8 inches (WRCC 2014). Annual precipitation totals for the years evaluated in this study were slightly higher than the historical annual average for every year except 2008 (15.4 inches). Annual precipitation totals for Sequim 2E were substantially higher in 1996 (22.6 inches), 1997 (20.4 inches), and 2011 (19.8 inches), exceeding the 75th percentile of the historical data (see Table 5). Thus, the evaluated water quality data generally represent wet conditions for Sequim.

Comparison of annual totals for 2010 and 2011 at the Sequim 2 E and the Sequim 5.8 WNW rain gauges shows that more precipitation was typically observed at the Sequim 5.8 WNW gauge. Data gaps are summarized for each rain gauge in Table 6. Based on the data gaps and length of precipitation record, the Sequim 2E rain gauge is the most complete long-term record for Sequim.

Table 6. Gaps in Precipitation Records for the City of Sequim from 1996 Through 1998 and 2008 Through 2011.

Year	Number of Days with No Data	
	Sequim 2E Daily Data[a]	Sequim 5.8 WNW Daily Data[a]
1996	32	NA
1997	5	NA
1998	2	NA
2008	0	NA
2009	0	NA
2010	0	27
2011	0	3

[a] Source: NCDC (2014).

NA = not available.

Because the storm sample timing data collected in the Clallam County Stormwater project was incomplete, precipitation data collected at the Sequim 2E rain gauge was used to determine whether water quality samples were likely collected during base flow or storm event conditions.

WATER QUALITY DATA SUMMARY

Water quality data are presented and summarized first for the following parameters:

- pH (field measurement)
- Temperature (field measurement)
- Turbidity (field measurement)
- Suspended sediment concentration (SSC)
- Hardness
- Metals (arsenic, chromium, copper, and lead)
- Nutrients (ammonia, nitrate+nitrite, and phosphorus)
- Fecal coliform bacteria

B-IBI data are presented and summarized at the end of this section.

The discussion in each subsection begins with a brief overview of the purpose, relevance of the parameter, and typical sources/causes, followed by a discussion of the summary statistics of samples collected during base flow and storm events and a comparison of the results to any applicable state surface water quality standards (WAC 173-201A). Because Bell Creek and Johnson Creek are not named in Table 602 of WAC 173-201A, which lists beneficial use designations for specific fresh waters, they are to be protected for the default designated uses of salmonid spawning, rearing, and migration and primary contact recreation. The stormwater and irrigation system are not regulated under the state water quality standards; however, exceedances at these locations could contribute to issues in Sequim creeks and groundwater; thus, they are evaluated as part of this report as well.

pH

pH is a measure of the hydrogen ion activity in water on a scale from 1 to 14, which can have a direct effect on aquatic organisms or an indirect effect since the toxicity of various common pollutants are markedly affected by changes in pH. Waters that have pH levels ranging from 0 to 7 are considered acidic, while waters with pH levels ranging from 7 to 14 are considered alkaline or basic. Waters that have a pH of approximately 7 are considered neutral. Common sources of low pH values include:

- Dairy products
- Fertilizers and pesticides

- Metal finishers and fabricators
- Wineries

Common sources of high pH values include:

- Disinfectants and sanitizer
- Latex paint
- Poured or recycled concrete, cement, mortars, and other Portland cement or lime-containing construction materials
- Soaps and detergents

Washington State surface water quality standards for fresh waters designated as salmonid spawning, rearing, and migration require pH to be within the range of 6.5 to 8.5 (WAC 173-201A). The pH data were collected *in situ* by the Streamkeepers using an electrode field meter. Summary statistics for pH are presented in Table 7.

Similar values were measured for pH during base flow (median of 7.89) and storm events (median of 8.00). The pH values measured in Bell Creek fell within the acceptable pH ranges for fresh waters. None of the waterbodies in the city are listed for pH on Ecology's 2012 303(d) list of impaired waters (Category 5), but Bell and Johnson Creeks are Category 2, waters of concern, due two pH measurements above 8.5 from historic monitoring data in Bell Creek in 2003 and 2004 and one pH measurement above 8.5 in Johnson Creek in 1998-2000 (see Appendix B).

Table 7. Summary Statistics for pH from 2010 Through 2011.

Monitoring Location[a]	pH (standard units)									
	Base Flow					Storm Events				
	n	Min	Median	Max	WQ[b]	n	Min	Median	Max	WQ[b]
Bell Creek										
Bell 0.2	7	7.61	7.89	8.06	0%	15	7.31	8.00	8.32	0%

Bold values indicate an exceedance of state water quality standards.

[a] Source: Clallam County Stormwater Project (collected in 2010–2011).

[b] Percentage of collected samples that exceed the applicable water quality (WQ) standard.

Temperature

Water temperature is critical to the health and survival of fish and other aquatic species in many life stages including embryonic development, juvenile growth, and adult migration. The relative species composition, metabolism, and reproductive effectiveness of cold-blooded aquatic species are also affected by the water temperature. An increase in water temperature accelerates the biodegradation of organic matter and increases the dissolved

oxygen demand as well as decreasing the solubility of oxygen. Common causes of elevated water temperature in surface water include:

- Lack of vegetation cover
- Industrial cooling water discharges
- Sanitary wastewater discharges

The state water quality standards for temperature are based on a 7-day average daily maximum (7-DADMax). The maximum allowable 7-DADMax is 16 degrees Celsius (°C) in fresh waters designated as core summer salmonid habitat. The maximum allowable 7-DADMax is 13 °C in marine waters designated as extraordinary quality (such as Sequim Bay).

Water temperature was measured *in situ* by the Streamkeepers either using a multi-parameter water quality field meter or a thermistor. Summary statistics for water temperature are presented in Table 8. Similar temperatures were measured during base flow (median of 9.22 °C) and storm events (median of 8.97 °C). Temperature measurements were collected one to four times per month in February, March, May, August, September through December of 2010, and February and March of 2011. Because continuous temperature data were not specifically measured for this analysis, exceedance of the temperature standard was not calculated.

Table 8. Summary Statistics for Temperature from 2010 Through 2011.

Monitoring Location[a]	Temperature (degrees Celsius)							
	Base Flow				Storm Events			
	n	Min	Median	Max	n	Min	Median	Max
Bell Creek								
Bell 0.2	7	4.62	9.22	13.7	17	5.72	8.97	14.3

[a] Source: Clallam County Stormwater Project (collected in 2010–2011).

Turbidity

Turbidity is a measure of water clarity that is determined by how the transmission of light is scattered as it passes through water. An increase in the amount of particulate matter in water (such as in most stormwater runoff) reduces clarity (or transparency) by increasing the scattering of light. Measurements of turbidity are expressed in nephelometric turbidity units (NTU). Common causes of high turbidity in stormwater include:

- Chemical manufacturing discharges
- Construction activities with improper stormwater controls
- Industrial washwater discharges
- Landscaping activities
- Leaking underground storage tanks
- Sanitary wastewater

- Soil erosion
- Waste products from food processing industries

Washington State surface water quality standards restrict turbidity increases to a maximum of 5 NTU more than background when background turbidity is 50 NTU or less, and to no more than a 10 percent increase in turbidity when the background turbidity is greater than 50 NTU (WAC 173-201A). Because background (upstream) levels were not specifically measured for this analysis, exceedance of the turbidity standard was not calculated as part of this analysis; however, since both base flow and storm event median turbidity measured at Bell 0.2 are less than 5 NTU, the standard is not likely to be exceeded at this location even if background data were available. None of the waterbodies in Sequim are on the Ecology 2012 303(d) list for turbidity.

Turbidity was measured in the field by the Streamkeepers using a nephelometric field meter. Summary statistics for turbidity are presented in Table 9.

Table 9. Summary Statistics for Turbidity from 2008 Through 2011.

Monitoring Location[a]	Turbidity (NTU)							
	Base Flow				Storm Events			
	n	Min	Median	Max	n	Min	Median	Max
Bell Creek								
Bell 0.2	9	1.69	2.02	9.38	18	1.24	3.40	38.1
Bell 1.6	2	1.88	7.27	12.7	3	13.8	16.5	37.4
Bell 1.75	0	NA	NA	NA	1	9.55	NA	9.55
Stormwater and Irrigation System								
Safeway Catch Basin[b]	7	26.7	253	821 G	NA	NA	NA	NA
Sequim Bay Road	2	16.5	148	279	12	8.44	145	659
Highland Ditch at East Washington Street	2	2.44	10.3	18.1	9	2.01	13.0	28.7
Highland Ditch at Happy Valley Road	2	3.69	20.0	36.3	13	2.12	10.8	65.8
Eureka Ditch	2	1.29	2.58	3.88	14	0.60	4.58	45.0

G = estimated value.

NA = not applicable; median was not calculated unless a minimum of 2 samples were collected.

NTU = nephelometric turbidity units.

[a] Source: Clallam County Stormwater Project (collected in 2008–2011).

[b] Stormwater collected in the catch basin infiltrates to a shallow aquifer within the Gierin Creek basin, but does not directly discharge to a surface water.

Turbidity was low in Bell Creek with a lower median turbidity at Bell 0.2 (2 NTU during base flow and 3.4 NTU during storm events in 2010–2011) than Bell 1.6 (7.27 NTU during base flow and 16.5 NTU during storm events in 2008–2009). This may be due to filtration of suspended sediments through the wetland complex located between Bell 1.3 and Bell 0.6. Turbidity was also low in three out of the five stormwater and irrigation system stations (Eureka Ditch, Highland Ditch at East Washington Street, and Highland Ditch at Happy Valley Road). The highest median turbidity measurements were recorded at the Safeway Catch Basin (253 NTU

during base flow) and at Sequim Bay Road (143 NTU during base flow and 145 NTU during storm events). The high turbidity at the Safeway Catch Basin is likely a result of commercial stormwater runoff.

Suspended Sediment Concentration

Suspended sediment concentration (SSC) is a measure of suspended solid-phase material in surface waters. Common causes of elevated SSC include runoff from agricultural areas, logged areas, erosion, and construction activities.

There are no state water quality standards for SSC.

SSC was analyzed at an analytical laboratory based on grab samples collected during Streamkeepers monitoring as part of the Clallam County Stormwater Project from 2008 through 2011. Summary statistics for SSC are presented in Table 10. These results are similar to those for turbidity where the median SSC was lowest measured during Streamkeepers monitoring at Bell 0.2 (3.1 milligrams per liter [mg/L] during base flow and 4.75 during storm events), low to moderate at three out of the five stormwater and irrigation system stations (Eureka Ditch, Highland Ditch at East Washington Street, and Highland Ditch at Happy Valley Road), and highest at the Safeway Catch Basin (172 mg/L during storm events) and at Sequim Bay Road (172 mg/L during storm events). Turbidity and SSC are often correlated; however, there is not an established conversion factor between these two parameters.

Table 10. Summary Statistics for Suspended Sediment Concentration from 2009 Through 2011.

Monitoring Station[a]	Suspended Sediment Concentration (mg/L)							
	Base Flow				Storm Events			
	n	Min	Median	Max	n	Min	Median	Max
Bell Creek								
Bell 0.2	9	1.9	3.1	15	18	2.3	4.75	73.5
Bell 1.6	1	7	NA	7	1	9.9	NA	9.9
Bell 1.75	0	NA	NA	NA	1	6.50	NA	6.50
Stormwater and Irrigation System								
Safeway Catch Basin[b]	0	NA	NA	NA	6	13.0	172	439
Sequim Bay Road	1	20.0	NA	20.0	8	15.0	172	429
Highland Ditch at East Washington Street	1	33.0	NA	33.0	6	4.00	20.3	195
Highland Ditch at Happy Valley Road	1	8.00	NA	8.00	10	1.20	4.50	29.9
Eureka Ditch	1	5.00	NA	5.00	11	1.00 U	10.0	148

U = undetected at the detection limit noted.

NA = not applicable; median was not calculated unless a minimum of 2 samples were collected.

mg/L = milligrams per liter.

[a] Source: Clallam County Stormwater Project (collected in 2009–2011).

[b] Stormwater collected in the catch basin infiltrates to a shallow aquifer within the Gierin Creek basin, but does not directly discharge to a surface water.

Hardness

Heavy metal toxicity and solubility often depends on the water's hardness, which is a measure of the amount of calcium and magnesium. High or low hardness values are typically a result of local geology. Natural sources of hardness include limestone (which introduces calcium) and dolomite (which introduces magnesium).

There are no state water quality standards for hardness; however, as water hardness decreases, some metals (e.g., copper and zinc) become more toxic. Water quality criteria to protect aquatic life from dissolved metals are typically calculated based on hardness.

Hardness was analyzed at an analytical laboratory based on grab samples collected during Streamkeepers monitoring as part of the Clallam County Stormwater Project from 2008 through 2011. Summary statistics for hardness are presented in Table 11. Hardness appeared to increase downstream to the highest median value observed during Streamkeepers monitoring in lower Bell Creek (190 mg/L during base flow and 200 mg/L during storm events at Bell 0.2) and was also high in one sample from the stormwater and irrigation system (240 mg/L at Highland Ditch at East Washington Street). Low hardness concentrations (median of 21.2 mg/L and 18.5 mg/L, respectively) were observed during storm events at the Safeway Catch Basin and Sequim Bay Road, which is indicative of urban stormwater runoff. Since the hardness at these two monitoring locations is on the low end of the hardness range, the metals present in these samples are more likely to be toxic.

Table 11. Summary Statistics for Hardness from 2008 Through 2011.

Monitoring Location[a]	Hardness (mg/L)							
	Base Flow				Storm Events			
	n	Min	Median	Max	n	Min	Median	Max
Bell Creek								
Bell 0.2	8	176	190	220	18	135	200	230
Bell 1.6	1	131	NA	131	1	136	NA	136
Bell 1.75	0	NA	NA	NA	1	12.0	NA	12.0
Stormwater and Irrigation System								
Safeway Catch Basin[b]	0	NA	NA	NA	6	16.2	21.2	91.4
Sequim Bay Road	1	41.6	NA	41.6	8	11.8	18.5	114
Highland Ditch at East Washington Street	0	NA	NA	NA	1	240	NA	240

NA = not applicable; median was not calculated unless a minimum of 2 samples were collected.

mg/L = milligrams per liter.

[a] Source: Clallam County Stormwater Project (collected in 2008–2011).

[b] Stormwater collected in the catch basin infiltrates to a shallow aquifer within the Gierin Creek basin, but does not directly discharge to a surface water.

Metals

Heavy metals are a particular concern in stormwater runoff due to their toxicity and the fact that they do not degrade in the environment. Heavy metals can bioaccumulate in sediments and in living organisms, and can lead to poisoning, diseases, and death to fish. Sources of heavy metals in stormwater runoff include pollution-generating impervious areas such as highways, roads, and roofs subject or exposed to tires, automobile exhaust, asphalt, concrete, engine wear, brake linings, or metal roof materials. Heavy metals also occur naturally in freshwater at varying concentrations as a result of weathering of soils and rocks. Heavy metals may occur in dissolved or particulate-bound forms. The total concentration of a metal is the sum of the concentrations of dissolved and particulate bound metals. Long-term exposure to heavy-metal-contaminated stormwater or sediment can cause long-term toxic effects in benthic invertebrates, aquatic microorganisms, and fish.

State water quality standards vary for each heavy metal and are described for each of the parameters summarized below.

Streamkeepers collected copper samples as part of the Clallam County Stormwater Project from 2008 through 2011. Limited water quality sampling was performed for arsenic, chromium, and lead in 2009. Zinc data was also collected; however, it is not summarized in this report due to a potential issue with contaminated blank samples.

Total Arsenic

Arsenic is naturally occurring in the earth's crust; however, it is a concern in freshwater systems due to its potential toxicity to aquatic life. It is also a concern in groundwater because it is recognized as a potential human carcinogen. Toxicity of arsenic varies between various arsenic compounds, but in general, acute toxicity is higher for inorganic arsenic than it is for organic arsenic compounds.

Washington State has surface water quality standards for dissolved arsenic, but not total arsenic. There is also a state groundwater water quality criterion for total arsenic, which is 0.05 µg/L (WAC 173-200-040).

Total arsenic was analyzed at an analytical laboratory based on grab samples collected during Streamkeepers monitoring as part of the Clallam County Stormwater Project in 2009. Summary statistics for total arsenic are presented in Table 12. Limited water quality data were collected for total arsenic in Bell Creek (n = 2) and Highland Ditch at East Washington Street (n = 2). Although state surface water quality criteria are based on dissolved arsenic, the range of total arsenic concentrations observed (0.4 to 0.8 micrograms per liter [µg/L]) are well below the acute and chronic criteria (360 and 190 µg/L) for dissolved arsenic. For comparison, the state groundwater quality criterion for total arsenic (0.05 µg/L), is much lower than the observed concentrations. Although some of the measured arsenic may migrate from surface water to groundwater, these concentrations are not expected to be a concern since they are currently meeting state surface water quality criteria and are still in the very low range (less than 1 µg/L) for what is typically measured in groundwater in the United States (Welch et al. 2000).

Table 12. Summary Statistics for Total Arsenic in 2009.								
	Total Arsenic (µg/L)							
	Base Flow				Storm Events			
Monitoring Location[a]	n	Min	Median	Max	n	Min	Median	Max
Bell Creek								
Bell 1.6	0	NA	NA	NA	1	0.62	NA	0.62
Bell 1.75	0	NA	NA	NA	1	0.39	NA	0.39
Stormwater and Irrigation System								
Highland Ditch at East Washington Street	0	NA	NA	NA	2	0.46	0.62	0.78

NA = not applicable; median was not calculated unless a minimum of 2 samples were collected.

µg/L = micrograms per liter.

[a] Source: Clallam County Stormwater Project (collected in 2009).

Total Chromium

Chromium is typically not an issue in stormwater, but can be a human health concern in groundwater used for drinking water. Chromium is necessary for glucose tolerance in animals (including humans), but is considered to be a primary contaminant in groundwater at high levels.

Washington State has surface water quality standards for dissolved chromium, but not total chromium. There is also a state groundwater water quality criterion for total chromium, which is 50 µg/L (WAC 173-200-040).

Total chromium was analyzed at an analytical laboratory based on grab samples collected during Streamkeepers monitoring as part of the Clallam County Stormwater Project in 2009. Summary statistics for chromium are presented in Table 13. Limited water quality data were collected for total chromium in Bell Creek (n = 2) and Highland Ditch at East Washington Street (n = 2). Although state surface water quality criteria are based on dissolved chromium, the range of total chromium concentrations observed (1.5 to 4.1 µg/L) are well below the acute and chronic criteria (15 and 10 µg/L) for dissolved chromium. For comparison, the state groundwater quality criterion for total chromium (50 µg/L) is much higher than the values measured in Bell Creek and Highland Ditch in 2009.

Table 13. Summary Statistics for Total Chromium in 2009.								
	Total Chromium (µg/L)							
	Base Flow				Storm Events			
Monitoring Location[a]	n	Min	Median	Max	n	Min	Median	Max
Bell Creek								
Bell 1.6	0	NA	NA	NA	1	1.50	NA	1.50
Bell 1.75	0	NA	NA	NA	1	1.56	NA	1.56
Stormwater and Irrigation System								
Highland Ditch at East Washington Street	0	NA	NA	NA	2	1.22	2.66	4.10

NA = not applicable; median was not calculated unless a minimum of 2 samples were collected.

µg/L = micrograms per liter.

[a] Source: Clallam County Stormwater Project (collected in 2009).

Copper

Copper, particularly dissolved copper, is a known surface-water pollutant that causes a range of adverse effects in fish. One known issue with dissolved copper is the serious disruption to sensory systems in juvenile salmonids.

Surface water quality criteria for the state of Washington include criteria for dissolved copper that are based on water hardness. Equations used to calculate the acute and chronic criteria for dissolved copper are provided in WAC 173-201A. These criteria were used for comparison to the dissolved copper results.

Dissolved copper was analyzed at an analytical laboratory based on grab samples collected during Streamkeepers monitoring as part of the Clallam County Stormwater Project in 2008 through 2011. Summary statistics for dissolved copper are presented in Table 14. Dissolved copper concentrations were typically low in the lowest reach of Bell Creek at RM 0.2 (median of 2.07 µg/L during base flow and 2.32 µg/L during storm events) and never exceeded water quality criteria, which is consistent with the high hardness concentrations measured at this downstream location. Dissolved copper criteria exceeded chronic criteria, but not acute criteria at the upstream stations in Bell Creek (one sample at Bell 1.6 during base flow and one sample at Bell 1.75 during storm events). Dissolved copper concentrations exceeded acute and chronic criteria in 100 percent of the storm event samples collected from the Safeway Catch Basin and a majority of the samples collected from Sequim Bay Road (75 percent exceeding acute and 88 percent exceeding chronic water quality criteria). Based on this evaluation, dissolved copper concentrations are a concern for stormwater runoff in Sequim.

Total copper was analyzed at an analytical laboratory based on grab samples collected during Streamkeepers monitoring as part of the Clallam County Stormwater Project in 2008 through 2011. Summary statistics for total copper are presented in Table 15. Total copper concentrations were similar to dissolved copper concentrations, indicating that most of the copper was in a dissolved state that is disruptive to juvenile salmonids. One exception is that dissolved copper concentrations exceeded the total copper concentrations for Bell 1.6, indicating potential contamination of the dissolved copper samples. This contamination may be attributed to miscommunication with the lab, resulting in some of the sample collection containers not being cleaned appropriately.

Table 14. Summary Statistics for Dissolved Copper from 2008 Through 2011.

Monitoring Location[a]	Dissolved Copper (µg/L)											
	Base Flow						Storm Events					
					WQ[b, c]						WQ[b, c]	
	n	Min	Median	Max	Acute	Chronic	n	Min	Median	Max	Acute	Chronic
Bell Creek												
Bell 0.2	7	1.20	2.07	2.60	0%	0%	20	0.95	2.32	3.52	0%	0%
Bell 1.6	1	**15.5**	NA	**15.5**	0%	100%	1	14.0	NA	14.0	0%	0%
Bell 1.75	0	NA	NA	NA	NA	NA	1	**2.04**	NA	**2.04**	0%	100%
Stormwater and Irrigation System												
Safeway Catch Basin[d]	0	NA	NA	NA	NA	NA	6	**6.74**	**12.7**	**24.8**	100%	100%
Sequim Bay Road	1	**6.22**	NA	**6.22**	0%	100%	8	**3.09**	**8.53**	**15.4**	75%	88%
Highland Ditch at East Washington Street	0	NA	NA	NA	NA	NA	1	5.42	NA	5.42	0%	0%

Bold values indicate an exceedance of state water quality standards.

NA = not applicable; median was not calculated unless a minimum of 2 samples were collected.

U = undetected at the detection limit noted.

µg/L = micrograms per liter.

[a] Source: Clallam County Stormwater Project (collected in 2008–2011).

[b] Exceedance of acute criteria based on hardness measured in all but two samples from Bell 0.2 (WAC 173-201A).

[c] Exceedance of chronic criteria based on hardness measured in all but two samples from Bell 0.2 (WAC 173-201A).

[d] Stormwater collected in the catch basin infiltrates to a shallow aquifer within the Gierin Creek basin, but does not directly discharge to a surface water.

Table 15. Summary Statistics for Total Copper from 2008 Through 2011.

Monitoring Location[a]	Total Copper (µg/L)							
	Base Flow				Storm Events			
	n	Min	Median	Max	n	Min	Median	Max
Bell Creek								
Bell 0.2	8	0.96	1.41	3.82	18	1.12	2.23	6.85
Bell 1.6	0	NA	NA	NA	1	3.76	NA	3.76
Bell 1.75	0	NA	NA	NA	1	2.95	NA	2.95
Stormwater and Irrigation System								
Highland Ditch at East Washington Street	0	NA	NA	NA	2	3.73	5.19	6.64

NA = not applicable; median was not calculated unless a minimum of 2 samples were collected.

µg/L = micrograms per liter.

[a] Source: Clallam County Stormwater Project (collected in 2008–2011).

Total Lead

Lead can be a pollutant of concern in stormwater runoff in urban areas and from highways. Due to the past use of lead in gasoline, it is typically present and persistent in soils near highways and streets and can enter surface water via runoff when these soils are eroded. Lead in groundwater is a human health concern resulting in behavioral problems and learning disabilities. Human exposure to lead primarily occurs from lead-based paint and older plumbing.

Washington State has surface water quality standards for dissolved lead, but not total lead. There is also a state groundwater water quality criterion for total lead which is 50 µg/L (WAC 173-200-040).

Total lead was analyzed at an analytical laboratory based on grab samples collected during Streamkeepers monitoring as part of the Clallam County Stormwater Project in 2009. Summary statistics for total lead are presented in Table 16. Limited water quality data were collected for total lead in Bell Creek (n = 2) and Highland Ditch at East Washington Street (n = 2). Although state surface water quality criteria are based on dissolved lead, hardness was measured in the two Bell Creek samples and could be used to calculate the dissolved lead criteria. The total lead concentration did not exceed the chronic criterion for dissolved lead at Bell 1.6, but did at Bell 1.75 due to the lower hardness in that sample. Total lead concentrations did not exceed chronic criterion for dissolved lead at the Highland Ditch at East Washington Street based on an assumed hardness of 240 mg/L measured on another monitoring date at that location. For comparison, the state groundwater quality criterion for total lead (50 µg/L) is much higher than the values measured in Bell Creek and Highland Ditch in 2009.

Table 16. Summary Statistics for Total Lead in 2009.

Monitoring Location[a]	Total Lead (µg/L)									
	Base Flow				Storm Events					
	n	Min	Median	Max	n	Min	Median	Max	WQ[b, c] Acute	WQ[b, c] Chronic
Bell Creek										
Bell 1.6	0	NA	NA	NA	1	0.76	NA	0.76	0%	0%
Bell 1.75	0	NA	NA	NA	1	1.18	NA	1.18	0%	**100%**
Stormwater and Irrigation System										
Highland Ditch at East Washington Street	0	NA	NA	NA	2	0.22	1.31	2.40	0%	0%

Bold values indicate an exceedance of state water quality standards.

NA = not applicable; median was not calculated unless a minimum of 2 samples were collected.

µg/L = micrograms per liter.

[a] Source: Clallam County Stormwater Project (collected in 2009).

[b] Exceedance of acute criteria was calculated based on hardness measured in Bell 1.6 and Bell 1.75, and assumed hardness in Highland Ditch at East Washington Street (WAC 173-201A).

[c] Exceedance of chronic criteria was calculated based on hardness measured in Bell 1.6 and Bell 1.75, and assumed hardness in Highland Ditch at East Washington Street (WAC 173-201A).

Nutrients

Nutrients (primarily nitrogen and phosphorus) are a concern in fresh water because high levels can lead to accelerated plant growth, algal blooms, low dissolved oxygen, decreases in aquatic diversity, and eutrophication. Sources of nutrients in surface waters typically consist of natural sources (e.g., weathered rocks, dead and decaying plant and animal material, and microbial life) and anthropogenic sources (e.g., wastewater treatment plants, septic system failures, washwater, animal manure storage, and fertilizer runoff).

State water quality standards vary for each nutrient and are described for each of the parameters summarized below.

Ammonia

Ammonia nitrogen is a concern in freshwater systems due to its potential toxicity to aquatic life. Within most freshwater systems, ammonia is readily converted to nitrate when oxygen is present. The toxicity of ammonia increases when the pH or temperature of a water body decreases. Hatching, growth rate, and structural development of fish can all be affected by high levels of ammonia. Human health can also be adversely affected by high levels of ammonia in aquatic systems through consumption of fish and shellfish and recreational contact.

Washington State has surface water quality standards for chronic and acute concentrations of ammonia (WAC 173-201A) that vary depending on the ambient water temperature, pH, and the presence or absence of salmonids. Since Bell 0.2 was the only monitoring station for which temperature and pH were available, only the ammonia data for this monitoring station were compared to state water quality criteria.

Total and dissolved ammonia nitrogen was analyzed at an analytical laboratory based on grab samples collected during Streamkeepers monitoring as part of the Clallam County Stormwater Project in 2008 through 2011. Summary statistics for total and dissolved ammonia are presented in Table 17 and Table 18, respectively. Total ammonia nitrogen concentrations were typically low in Bell Creek at Bell 0.2 during base flow and storm events (median less than 0.05 mg/L). During base flow, dissolved ammonia nitrogen concentrations in Bell Creek and in the stormwater and irrigation system were lower than the laboratory detection limit. During storm events, dissolved ammonia nitrogen concentrations were typically low in Bell Creek (maximum of 0.03 mg/L at Bell 1.75), low in three of the stormwater and irrigation system stations (Highland Ditch at East Washington Street, Highland Ditch at Happy Valley Road, and Eureka Ditch), and elevated in the Safeway Catch Basin and at Sequim Bay Road (median of 0.48 mg/L and 0.31 mg/L during storm events, respectively). None of the Bell Creek samples exceeded ammonia surface water quality criteria (calculated based on available temperature and pH data), and it is unlikely that ammonia surface water quality criteria were exceeded at the other monitoring stations based on typical temperature and pH data measured at those stations).

Table 17. Summary Statistics for Total Ammonia Nitrogen from 2008 Through 2011.

Monitoring Location[a]	Total Ammonia Nitrogen (mg/L)							
	Base Flow				Storm Events			
	n	Min	Median	Max	n	Min	Median	Max
Bell Creek								
Bell 0.2	7	0.01 U	0.04	0.05	14	0.01 U	0.03	0.10

U = undetected at the detection limit noted.

[a] Source: Clallam County Stormwater Project (collected in 2008–2011).

Table 18. Summary Statistics for Dissolved Ammonia Nitrogen from 2008 Through 2011.

Monitoring Location[a]	Dissolved Ammonia Nitrogen (mg/L)							
	Base Flow				Storm Events			
	n	Min	Median	Max	n	Min	Median	Max
Bell Creek								
Bell 0.2	1	0.01 U	NA	0.01 U	4	0.01 U	0.01 U	0.01 U
Bell 1.6	1	0.01 U	NA	0.01 U	1	0.014	NA	0.014
Bell 1.75	0	NA	NA	NA	1	0.03	NA	0.03
Stormwater and Irrigation System								
Safeway Catch Basin[b]	0	NA	NA	NA	6	0.25	0.48	1.80
Sequim Bay Road	1	0.01 U	NA	0.01 U	8	0.05	0.31	0.65
Highland Ditch at East Washington Street	1	0.01 U	NA	0.01 U	6	0.01 U	0.03	0.31
Highland Ditch at Happy Valley Road	1	0.01 U	NA	0.01 U	10	0.01 U	0.01 U	0.07
Eureka Ditch	1	0.01 U	NA	0.01 U	11	0.01 U	0.01 U	0.13

NA = not applicable; median was not calculated unless a minimum of 2 samples were collected.

U = undetected at the detection limit noted.

[a] Source: Clallam County Stormwater Project (collected in 2008–2011).

[b] Stormwater collected in the catch basin infiltrates to a shallow aquifer within the Gierin Creek basin, but does not directly discharge to a surface water.

Nitrate+Nitrite Nitrogen

Nitrate+nitrite nitrogen is a concern in fresh water (surface water) because it may contribute to an overabundant growth of algae and aquatic plants, and to a decline in diversity of the biological community.

Washington State does not have a surface water quality standard for nitrate+nitrite nitrogen; however, it is a regulated parameter in the state ground water standards (WAC 173-200-040) and the state drinking water standards (WAC 246-290-310) for the protection of human health. To prevent a potentially fatal blood disorder in infants called "blue baby syndrome" as well as other human health problems, both standards specify that nitrate+nitrite nitrogen concentrations shall not exceed 10 mg/L in public drinking water supplies.

The US EPA recommended a total nitrogen nutrient criterion of 0.12 mg/L for rivers and streams in Aggregate Ecoregion II (EPA 2000). Total nitrogen is the sum of ammonia nitrogen (summarized in the previous section) and nitrate+nitrite nitrogen. This criterion was used for comparison to the sampling results shown below, and represents reference conditions that are equivalent to the median of the 25th percentiles for all four seasons using all of the data compiled from rivers and streams in this ecoregion (refer to Appendix B for these reference data). The US EPA has not established a criterion for dissolved nitrate+nitrite nitrogen.

Nitrate+nitrite nitrogen was analyzed at an analytical laboratory based on grab samples collected during Streamkeepers monitoring as part of the Clallam County Stormwater Project from 2008 through 2011. Summary statistics for total and dissolved nitrate+nitrite are presented in Tables 19 and 20, respectively.

Total nitrate+nitrite nitrogen levels ranged from less than 0.01 mg/L at Eureka Ditch to 3.4 mg/L at Bell 0.2. Total nitrate+nitrite nitrogen levels in Bell 0.2 were similar during base flow and storm events (median of 2.55 mg/L and 2.65 mg/L, respectively). All of the samples collected at Bell 0.2 during base flow and storm events exceeded the total nitrogen nutrient criterion recommended by the EPA.

Table 19. Summary Statistics for Total Nitrate+Nitrite Nitrogen from 2009 Through 2010.

Monitoring Location[a]	Total Nitrate+Nitrite (mg/L)									
	Base Flow					Storm Events				
	n	Min	Median	Max	WQ[b]	n	Min	Median	Max	WQ[b]
Bell Creek										
Bell 0.2	7	2.30	2.55	3.00	100%	14	1.40	2.65	3.40	**100%**
Stormwater and Irrigation System										
Eureka Ditch	0	NA	NA	NA	NA	1	0.01 U	NA	0.01 U	0%

Bold values indicate an exceedance of nutrient criteria recommended by the EPA.

NA = not applicable; median was not calculated unless a minimum of 2 samples were collected.

U = undetected at the detection limit noted.

[a] Source: Clallam County Stormwater Project (collected in 2009–2010).

[b] Percentage of collected samples that exceed the total nitrogen nutrient criterion recommended by the EPA. Note that total nitrate+nitrite nitrogen is only a portion of total nitrogen. Total ammonia nitrogen would also need to be added for a more direct comparison.

Dissolved nitrate+nitrite nitrogen levels were highly variable among the monitoring stations, ranging from 0.25 mg/L (Eureka Ditch) to 1.97 mg/L (Bell 0.2) during base flow and less than 0.01 mg/L (Eureka Ditch) to 3.39 mg/L (Bell 0.2) during storm flow. Relatively low dissolved nitrate+nitrite nitrogen concentrations were measured in Highland Ditch at Happy Valley Road and Eureka Ditch (median values of 0.05 mg/L and 0.02 mg/L during storm events, respectively). Median dissolved nitrate+nitrite nitrogen values at Highland Ditch at East Washington Street (0.39 mg/L), the Safeway Catch Basin (0.18 mg/L), and Sequim Bay Road (0.38 mg/L) were elevated during storm events. Relatively high dissolved nitrate+nitrite concentrations compared to the other samples collected during Streamkeepers monitoring

were consistently observed near the mouth of Bell Creek (median value of 1.87 mg/L during storm events and 1.97 mg/L for one base flow sample at Bell 0.2), indicating likely impairment of the biological community at this monitoring station. Additional monitoring is needed during base flow conditions in order to determine if this elevated dissolved nitrate+nitrite nitrogen can be linked to stormwater runoff.

Table 20. Summary Statistics for Dissolved Nitrate+Nitrite Nitrogen from 2008 Through 2011.

Monitoring Location[a]	Dissolved Nitrate+Nitrite (mg/L)							
	Base Flow				Storm Events			
	n	Min	Median	Max	n	Min	Median	Max
Bell Creek								
Bell 0.2	1	1.97	NA	1.97	4	1.03	1.87	3.39
Bell 1.6	1	0.48	NA	0.48	1	0.18	NA	0.18
Bell 1.75	0	NA	NA	NA	1	0.44	NA	0.44
Stormwater and Irrigation System								
Safeway Catch Basin[b]	0	NA	NA	NA	6	0.11	0.18	2.30
Sequim Bay Road	1	0.27	NA	0.27	8	0.13	0.38	2.52
Highland Ditch at East Washington Street	1	0.88	NA	0.88	6	0.26	0.39	1.13
Highland Ditch at Happy Valley Road	1	0.36	NA	0.36	10	0.04	0.05	0.81
Eureka Ditch	1	0.25	NA	0.25	10	0.01 U	0.02	0.08

NA = not applicable; median was not calculated unless a minimum of 2 samples were collected.

U = undetected at the detection limit noted.

[a] Source: Clallam County Stormwater Project (collected in 2008–2011).

[b] Stormwater collected in the catch basin infiltrates to a shallow aquifer within the Gierin Creek basin, but does not directly discharge to a surface water.

Total Phosphorus

Total phosphorus is a combination of inorganic and organic forms of phosphorus. Phosphorus is a concern in fresh water (surface water) because high levels can lead to accelerated plant growth, algal blooms, low dissolved oxygen, decreases in aquatic diversity, and eutrophication.

Currently, Washington State does not have surface water quality standards for total phosphorus in streams; however, standards have been established for lakes. The US EPA recommended a total phosphorus nutrient criterion of 0.01 mg/L for rivers and streams in Aggregate Ecoregion II (EPA 2000).

Total phosphorus was analyzed at an analytical laboratory based on grab samples collected during Streamkeepers monitoring as part of the Clallam County Stormwater Project from 2008 through 2011. Summary statistics for total phosphorus are presented in Table 21.

Table 21. Summary Statistics for Total Phosphorus from 2008 Through 2011.

Monitoring Location[a]	Total Phosphorus (mg/L)									
	Base Flow					Storm Events				
	n	Min	Median	Max	WQ[b]	n	Min	Median	Max	WQ[b]
Bell Creek										
Bell 0.2	8	**0.06**	**0.12**	**0.23**	**100%**	18	**0.05**	**0.10**	**0.42**	**100%**
Bell 1.6	1	**0.13**	NA	**0.13**	**100%**	1	**0.10**	NA	**0.10**	**100%**
Bell 1.75	0	NA	NA	NA	NA	1	**0.10**	NA	**0.10**	**100%**
Stormwater and Irrigation System										
Safeway Catch Basin[c]	0	NA	NA	NA	NA	6	**0.20**	**0.28**	**0.71**	**100%**
Sequim Bay Road	1	**0.14**	NA	**0.14**	**100%**	8	0.09	0.25	0.84	**100%**
Eureka Ditch	1	**0.060**	NA	**0.060**	**100%**	11	**0.0115**	**0.030**	**0.45**	**100%**

Bold values indicate an exceedance of nutrient criteria recommended by the EPA.

NA = not applicable; median was not calculated unless a minimum of 2 samples were collected.

[a] Source: Clallam County Stormwater Project (collected in 2008–2011).

[b] Percentage of collected samples that exceed the nutrient criterion recommended by the EPA.

[c] Stormwater collected in the catch basin infiltrates to a shallow aquifer within the Gierin Creek basin, but does not directly discharge to a surface water.

Total phosphorus concentrations ranged from 0.012 mg/L to 0.84 mg/L and typically exceeded the recommended phosphorus nutrient criterion of 0.01 mg/L at all stations. The lowest total phosphorus concentrations were measured in Eureka Ditch, where the median concentration was 0.030 mg/L during storm flow. Moderate total phosphorus concentrations were observed in Bell Creek where the median concentration was 0.12 mg/L during base flow and 0.10 mg/L during storm events at Bell 0.2. The highest total phosphorus concentrations were measured in storm event samples from the Safeway Catch Basin (median of 0.28 mg/L) and Sequim Bay Road (median of 0.25 mg/L).

Fecal Coliform Bacteria

Urban, residential, and agricultural runoff characteristically contains elevated levels of fecal coliform bacteria. These organisms are used as indicators of fecal contamination from humans and other warm-blooded animals. Human sources may include failing septic systems, municipal wastewater discharges, leaking wastewater conveyance systems or side sewers, and cross connections with municipal wastewater systems. Animal sources may include pets, livestock, and wildlife (e.g., birds and mammals). The simple presence of these bacteria does not necessarily indicate a threat to public health because only a small portion is likely to be pathogenic to humans. However, their use as an indicator of potential fecal contamination and presence of pathogens is considered important in the early detection of problems that could lead to public health concerns.

Bell Creek, Johnson Creek, and Sequim Bay are included on the Ecology 2012 303(d) list for fecal coliform bacteria. Washington State surface water quality standards (WAC 173-201A) for

primary contact recreation in fresh water include the following fecal coliform bacteria criteria:

- Geometric mean (geomean)that does not exceed 100 colonies per 100 mL; or
- Not more than 10 percent of all samples (or any single sample when less than 10 sample points exist) exceeding 200 colonies per 100 mL

Fecal coliform bacteria was analyzed at an analytical laboratory based on grab samples collected during Streamkeepers monitoring as part of the Clallam County Stormwater Project from 2009 through 2011 and the Clean Water District study in 2010. The monitoring data for fecal coliform bacteria is summarized below in Table 22. Fecal coliform data are reported in units of colony forming units (CFU) per 100 milliliters (mL), which is equivalent to colonies per 100 mL.

Table 22. Summary Statistics for Fecal Coliform Bacteria from 2009 Through 2011.

Monitoring Station	Monitoring Period	Base Flow			Storm Events		
		n	Geomean (CFU/ 100 mL)	Samples Exceeding 200 CFU/ 100 mL (%)[a]	n	Geomean (CFU/ 100 mL)	Samples Exceeding 200 CFU/ 100 mL (%)[a]
Bell Creek							
Bell 0.2[b]	2010–2011	5	**116**	**60%**	18	74.3	**56%**
Bell 0.2[c]	2010	2	6.9	0%	0	NA	NA
Bell 0.8[c]	2010	1	NA	0%	1	NA	0%
Bell 1.6[b]	2009	0	NA	NA	1	NA	**100%**
Bell 4.2[c]	2010	1	NA	0%	1	NA	0%
Johnson Creek							
Johnson 0.0[c]	2010	1	22	0%	1	2.0	0%
Johnson 2.0[c]	2010	2	2.0	0%	0	NA	0%
Stormwater and Irrigation System							
Safeway Catch Basin[b, d]	2009	0	NA	NA	1	NA	0%
Sequim Bay Road[b]	2009	0	NA	NA	3	**191**	**33%**
Highland Ditch at East Washington Street[b]	2009	0	NA	NA	2	**2,070**	**100%**
Highland Ditch at Happy Valley Road[b]	2009	0	NA	NA	5	3.8	0%
Eureka Ditch[b]	2009	0	NA	NA	6	**1,070**	**100%**

Bold values indicate an exceedance of state water quality standards.

NA = not applicable; geomean was not calculated unless a minimum of 2 samples were collected.

CFU/100 mL = colony forming units per 100 milliliters.

[a] Percentage of collected samples that exceed the applicable water quality standard.

[b] Source: Clallam County Stormwater Project (collected in 2010–2011).

[c] Source: Clean Water District (collected in 2010).

[d] Stormwater collected in the catch basin infiltrates to a shallow aquifer within the Gierin Creek basin, but does not directly discharge to a surface water.

The geomean criterion was not exceeded at Bell 0.2 during storm flow (sampled in the Clallam County Stormwater Project), which is the only station with at least 10 samples; however, more than 10 percent of the samples collected did exceed 200 CFU/100 mL. The single event criterion (200 CFU/100 mL) was exceeded in Bell 0.2, Bell 1.6 (only one sample collected), Sequim Bay Road, Highland Ditch at East Washington Street, and Eureka Ditch. The high fecal coliform bacteria concentrations observed at Highland Ditch at East Washington Street and Eureka Ditch suggest that these and other runoff waters in irrigation ditches may be a substantial source of fecal coliform bacteria in Sequim surface waters.

Bell 0.1 and Johnson 0.0 have both been on the Ecology 303(d) list of impaired waters (Category 5) for fecal coliform bacteria since 1996. These ratings are based on samples collected by Clallam County Streamkeepers between 1987 and 2003 (see Appendix B). No fecal coliform bacteria data was available for Bell 0.1 in this analysis; however, data was available for Bell 0.2. There may be the possibility of a shellfish-growing area near the mouth of Bell Creek in the future; thus potential fecal coliform bacteria sources in the lower reach of Bell Creek should be investigated further.

B-IBI

The Benthic Index of Biotic Integrity (B-IBI) is a quantitative method for determining and comparing the biological condition of streams from analysis of benthic invertebrate samples. Samples were collected by the Streamkeepers and submitted to Aquatic Entomology or A.J. Frost Insect Identification for analysis. An overall B-IBI score was calculated for each sample from a series of metrics based on the relative diversity and abundance of invertebrates having different sensitivities to water quality conditions. The overall B-IBI scores and associated classifications are presented in Table 23.

The B-IBI scores range from 10 (critically impaired) near the mouth of Bell Creek (Bell 0.1) to 46 (healthy) above stormwater and irrigation tailwater input in Johnson Creek (Johnson 2.0). Of the 10 monitoring stations sampled, Johnson 2.0 is the only station that was rated as “healthy”; the remainder were rated as “compromised” or worse. The very low scores and progressive decline in scores over time in the lower reaches of Bell Creek indicate severe impairment of biological resources in this stream. Moreover, Ecology included Bell Creek at monitoring station Bell 0.1 on the 303(d) list for impaired waters (Category 5) for B-IBI in 2006. B-IBI scores in the two upper reaches of Bell Creek indicated that conditions were better upstream of urban areas, although still troublesome. There are no samples from headwater areas above suburban stormwater and irrigation ditch input.

Table 23. Benthic Index of Biotic Integrity Data from 1999 Through 2010.			
Monitoring Station[a]	**Monitoring Date**	**Overall B-IBI Score**	**B-IBI Classification**
Bell Creek			
Bell 0.1	10/10/1999	**18**	**Highly Impaired**
Bell 0.1	10/1/2000	**14**	**Critically Impaired**
Bell 0.1	9/30/2001	**12**	**Critically Impaired**
Bell 0.1	10/11/2005	**10**	**Critically Impaired**
Bell 0.5	10/10/1999	**26**	**Highly Impaired**
Bell 0.8	10/26/2002	**16**	**Critically Impaired**
Bell 0.8	10/17/2003	**12**	**Critically Impaired**
Bell 0.8	9/23/2010	**12**	**Critically Impaired**
Bell 1.0	9/30/2008	**16**	**Critically Impaired**
Bell 1.8	10/4/2000	**18**	**Highly Impaired**
Bell 2.8	9/13/2010	44	Compromised
Johnson Creek			
Johnson 0.0	10/9/1999	40	Compromised
Johnson 0.0	9/22/2009	42	Compromised
Johnson 0.6	10/9/1999	42	Compromised
Johnson 2.0	10/10/2007	46	Healthy

Bold values indicate values included in the basis of Ecology's 303(d) rating.

[a] Source: Clallam County 2012.

SEDIMENT QUALITY ANALYSIS

Streamkeepers conducted sediment sampling in June 2009 as part of the Clallam County Stormwater Project to assess the concentrations of pollutants sequestered in the streambed sediments. Some of these pollutants may be associated with contributions from stormwater runoff. Streambed sediment quality can play an important role in habitat conditions for macroinvertebrate communities.

A previous study, Brandenberger et al. (2003), evaluated the potential stormwater impacts on sediment quality in five Clallam County streams in 2003, including Bell Creek. Four stations along Bell Creek were monitored, two of which (BEL-1 and BEL-2) correspond to the Bell 0.1 and Bell 1.6 stations that were monitored in 2009.

Limited sampling (n = 1 per parameter and station) was performed as part of both studies.

Summary statistics for heavy metals concentrations in the sediment samples from the Clallam County Stormwater project and the Brandenberger study are presented in Table 24 and are also shown graphically in Figure 1.

Table 24. Summary Statistics for Heavy Metals Measured During Sediment Quality Monitoring in 2003 and 2009.

Monitoring Location	Arsenic (mg/kg)		Copper (mg/kg)		Lead (mg/kg)		Zinc (mg/kg)	
	n	Value	n	Value	n	Value	n	Value
Bell Creek								
Bell 0.1[a]	1	6.10	1	32.8	1	5.72	1	76.7
Bell 0.1 (BEL-1)[b]	1	8.13	1	53.4	1	8.91	1	117
Bell 1.6[a]	1	3.65	1	25.5	1	9.00	1	115
Bell 1.6 (BEL-2)[b]	1	4.21	1	43.4	1	26.5	1	380
Irrigation Ditches								
Highland Ditch at East Washington Street[a]	1	2.60	1	30.2	1	22.7	1	253
Stormwater System								
Safeway Catch Basin[a]	1	5.20	1	84.8	1	349	1	663

mg/kg = milligrams per kilogram.

[a] Source: Clallam County Stormwater Project (collected in 2009).

[b] Source: Brandenberger study (collected in 2003).

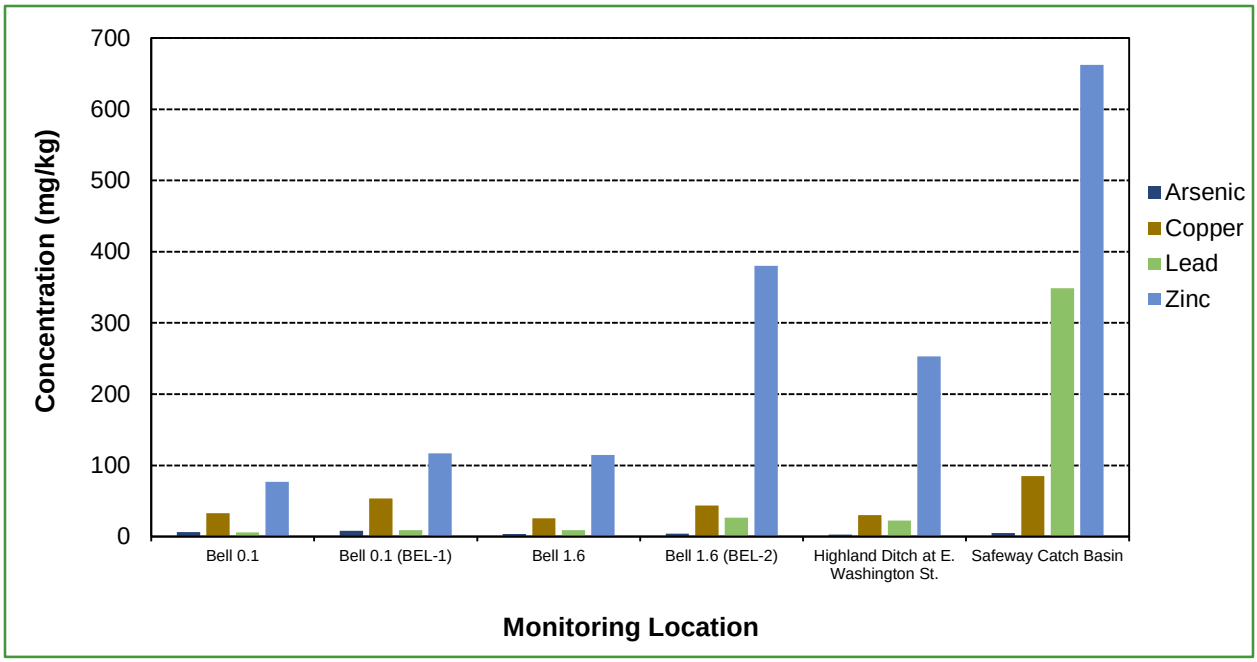


Figure 1. Summary Statistics for Heavy Metals Measured During Sediment Quality Monitoring in 2003 and 2009.

Chapter 173-204-340 WAC (freshwater sediment quality standards) states that Ecology shall determine on a case-by-case basis the criteria, methods, and procedures necessary to meet the intent of the Sediment Management Standards chapter. The Model Toxics Control Act (MTCA), Chapter 173-340 WAC includes the following Method A cleanup levels for arsenic and lead:

- Arsenic – 20 mg/kg
- Lead – 250 mg/kg

Levels for copper and zinc have also been established for priority contaminants of ecological concern (for sites that qualify for the simplified terrestrial ecological evaluation procedure):

- Copper – 100 mg/kg
- Zinc – 270 mg/kg

Based on this criteria, which is typically only applied to provide conservative cleanup levels at sites undergoing routine cleanup, thresholds were exceeded for lead and zinc in the Safeway Catch Basin sediment sample and for zinc in the Bell 1.6 sediment sample.

Samples collected in 2003 as part of the Brandenberger study had higher concentrations of arsenic, copper, lead, and zinc at Bell 0.1/BEL-1 and Bell 1.6/BEL-2 than measured in the Clallam County Stormwater Project samples. The Brandenberger study reported heavy metals values that were approximately 1.5 times the values reported by Clallam County Stormwater Project at Bell 0.1/BEL-1, and approximately 3 times the values reported by Clallam County

Stormwater Project at Bell 1.6/BEL-2. Based on the limited data available, no significant decreasing trend could be identified. Additional sediment quality sampling would be necessary to evaluate seasonal and temporal trends in the sediment quality data.

Summary statistics for #2 diesel and lube oil concentrations in sediment are presented in Table 25. MTCA Method A cleanup levels for total petroleum hydrocarbons include the following:

- Diesel range organics (includes Diesel #2) – 2,000 mg/kg
- Gasoline range organics – 100 mg/kg
- Heavy oils – 2,000 mg/kg
- Mineral oil – 4,000 mg/kg

Table 25. Summary Statistics for Diesel #2 and Lube Oil Measured During Sediment Quality Monitoring in 2003 and 2009.

Monitoring Location	Diesel #2 (mg/kg)		Lube Oil (mg/kg)	
	n	Value	n	Value
Bell Creek				
Bell 0.1[a]	1	120 U	1	300 U
Bell 0.1 (BEL-1)[b]	1	92.0	1	3,700
Bell 1.6[a]	1	50.0 U	1	120 U
Bell 1.6 (BEL-2)[b]	1	320	1	980
Irrigation Ditches				
Highland Ditch at East Washington Street[a]	1	110 U	1	260 U
Stormwater System				
Safeway Catch Basin[a]	1	880 U	1	110,000

mg/kg = milligrams per kilogram.

U = undetected at the detection limit noted).

[a] Source: Clallam County Stormwater Project (collected in 2010–2011).

[b] Source: Brandenberger study (collected in 2003).

Based on this criteria, which is typically only applied to provide conservative cleanup levels at sites undergoing routine cleanup, thresholds were exceeded for total petroleum hydrocarbons in the Safeway Catch Basin sediment sample. Due to the nature of this site and the proximity and number of pollutant sources, higher pollutant concentrations at this monitoring station than in the other in-stream or ditch monitoring stations may be expected.

CONCLUSIONS

Water quality and sediment data conclusions are presented in this section by drainage basin for Bell Creek, Johnson Creek, and Gierin Creek, as well as for the shallow aquifer. Recommendations for future monitoring are summarized at the end of the conclusions section.

Water Quality and Sediment Data Summary

Bell Creek

Bell Creek has the most robust water quality dataset of the streams in the city, representing data from four in-stream monitoring stations and two stormwater and irrigation system monitoring stations that discharge directly to the creek (Sequim Bay Road and Highland Ditch at East Washington Street) over a total of 4 years of monitoring (2008 through 2011) with B-IBI data from 1999 through 2010. One monitoring station in particular (Bell 0.2, close to the creek mouth) has the most consistent data record of all of the monitoring locations in the city. Sequim Bay Road and Highland Ditch at East Washington Street also have a fair amount of monitoring data, but only for specific water quality parameters.

In terms of general water quality conditions in Bell Creek, there is a documented declining trend in B-IBI scores over time as well as distance downstream; this represents the most notable evidence of poor water quality. There is also some evidence of elevated nutrient concentrations (e.g., dissolved nitrate+nitrite nitrogen and total phosphorus), elevated dissolved copper concentrations, and likely sources of fecal coliform bacteria. Some of these water quality problems appear to have a connection with stormwater runoff based on their values being elevated during storm event monitoring in the stormwater and irrigation system at some locations. During wet weather, the irrigation system conveys stormwater runoff; thus, it is effectively part of the stormwater system during storm events.

Turbidity, SSC, and dissolved ammonia nitrogen did not appear to be an issue at the in-stream monitoring locations; however, elevated levels were measured at one of the stormwater and irrigation system monitoring locations (Sequim Bay Road, downstream of suburban/rural land uses) during storm events.

No water quality issues were noted for pH or temperature in Bell Creek; however, these parameters were only measured at Bell 0.2, as grab samples. For temperature in particular, continuous monitoring or at least focused monitoring during the critical period (late summer and early fall) would be required to evaluate whether temperature exceedances are a problem in any given reach. The data were too limited (e.g., only one or two samples collected per monitoring location) to make a meaningful assessment for total arsenic, total chromium, dissolved lead, or for sediment quality. No additional study on these metals is recommended since elevated concentrations of these metals are not typically an issue associated with urban stormwater runoff.

Based on the evaluation of the available water quality monitoring data, priority areas were identified for future water quality improvement projects as well as future monitoring needs. One of the two priority areas identified in the city is the middle to lower reach of Bell Creek (between Bell 1.75 and Bell 0.2, from East Washington Street to near the creek mouth).

Johnson Creek

Water quality monitoring data from Johnson Creek represented data from three in-stream monitoring locations and one stormwater and irrigation system monitoring location that discharges directly to Johnson Creek (Highland Ditch at Happy Valley Road) over a total of 4 years of monitoring (2008 through 2011) with B-IBI data from 1999 through 2009. Limited in-stream sampling was conducted in Johnson Creek for two water quality parameters: B-IBI—four total samples collected at three locations in 1999, 2007, and 2009; and fecal coliform bacteria—four total samples collected at two locations in 2010. Highland Ditch at Happy Valley Road has a fair amount of monitoring data (more parameters than the in-stream monitoring in Johnson Creek), but only for a limited set of water quality parameters (fewer parameters than Bell 0.2).

In terms of general water quality conditions in Johnson Creek, there is a documented declining trend in B-IBI scores with distance downstream; however, not as notable as what has been observed in Bell Creek. B-IBI data in the lower reach of Johnson Creek (Johnson 0.6 to 0.0) is listed as compromised, whereas the lower reach of Bell Creek is either listed as highly or critically impaired. Although Johnson 0.0 has been on the Ecology 303(d) list of impaired waters (Category 5) for fecal coliform bacteria since 1996, limited fecal coliform bacteria sampling performed in Johnson Creek in 2010 did not show any exceedances of the single event criterion. The fecal coliform data for Johnson Creek analyzed in this report did not support Ecology's 303(d) listing for Johnson Creek; however, there were only two samples collected at each monitoring location (Johnson 0.0 and Johnson 2.0); therefore, the data is insufficient for drawing any conclusions. There were no sediment quality samples collected from the Johnson Creek drainage basin.

Turbidity, SSC, dissolved ammonia nitrogen, and dissolved nitrate+nitrite nitrogen did not appear to be an issue at Highland Ditch at Happy Valley Road based on the available data.

Based on the evaluation of the available water quality monitoring data, priority areas were identified for future water quality improvement projects as well as future monitoring needs. The second of two priority areas identified for the City is the lower reach of Johnson Creek due to limited water quality data; however, this is a lower priority than the middle to lower reach of Bell Creek.

Gierin Creek

In-stream or sediment quality monitoring data were not available for Gierin Creek. Numerous water quality samples were collected in Eureka Ditch which has a direct discharge to Gierin Creek 1.5 to 2 miles downstream, outside city limits.

In terms of general water quality conditions observed in Eureka Ditch, fecal coliform bacteria concentrations were elevated during storm event sampling. All six of the collected samples exceeded the primary contact recreation single event criterion.

Turbidity, SSC, dissolved ammonia nitrogen, dissolved nitrate+nitrite nitrogen, and total phosphorus did not appear to be an issue at Eureka Ditch based on the available data.

Shallow Aquifer

Available water quality and sediment data from the Safeway Catch Basin site indicates pollutants common in urban stormwater runoff, including copper, nutrients, turbidity, and hydrocarbons. Similar to most of the stormwater network in central Sequim, the Safeway Catch Basin discharges stormwater to the shallow aquifer via infiltration. Regular maintenance (cleaning/removal of solids) of this system and other similar systems is critical to the protection of the drinking water supply.

Monitoring Recommendations

Recommendations are provided for water quality monitoring and fecal source tracing based on the findings of this water quality and sediment data analysis.

Water Quality Monitoring

It is recommended that water quality monitoring be continued with a focus on the following parameters:

- Fecal coliform bacteria
- Nutrients (nitrate+nitrite nitrogen, phosphorus, and ammonia nitrogen)
- Metals (dissolved copper and dissolved zinc)

Fecal coliform bacteria and nutrients are the primary water quality problems observed in the monitored streams. Most of the dissolved zinc data was deemed inconclusive since there was a potential issue with contaminated blank samples, and only dissolved copper had sufficient data availability for further evaluation. It is recommended that Bell Creek and Johnson Creek be monitored for dissolved metals (dissolved copper and dissolved zinc) rather than total metals since the state surface water quality criteria are based on dissolved metals (WAC 173-201A).

The collection of additional fecal coliform bacteria, nutrients, and metals data at a consistent set of stream stations will allow for better analysis of temporal and spatial trends and evaluation of effects of future source control actions and stormwater retrofit projects.

Monitoring is recommended near the mouth of Bell and Johnson Creeks for future analysis of temporal trends. Fecal coliform bacteria monitoring should also be conducted at key upstream stations in both stream systems for evaluating background sources and effects of source control activities and stormwater management projects. Recommended future monitoring stations are presented in Table 26. It is strongly encouraged that monitoring be

continued at Bell 0.2 since this is the monitoring station with the most robust dataset and therefore the station where long-term trends can more easily be identified. It is also recommended that more consistent and frequent monitoring be conducted at Bell 0.8 and Bell 1.6 to help evaluate the upstream contributions of these pollutants. Bell 4.2 has been identified as a reference/background monitoring station located near the headwaters. Two monitoring stations are identified in Johnson Creek based on past monitoring data; Johnson 0.0 at the mouth of the creek and Johnson 2.0 as a reference/background monitoring station.

It is recommended that water samples be collected during targeted base flow and storm events throughout the seasons to evaluate fecal coliform bacteria, nutrient, and metal sources associated with different hydrologic conditions. For example, elevated fecal coliform bacteria concentrations during base flow (dry weather) are generally indicative of direct inputs from wildlife, illicit connections with sanitary sewage conveyance systems, or chronic failure of septic systems in unsewered areas while elevated fecal coliform bacteria concentrations during storm events are generally indicative of inputs from the wash off of fecal deposits on land, overflow of sanitary sewage systems, or hydraulic failure of septic systems in unsewered areas.

Table 26. Recommended Monitoring Stations and Parameters in Sequim Streams.

Monitoring Location	Fecal Coliform Bacteria	Nutrients	Metals
Bell Creek			
Bell 0.2	X	X	X
Bell 0.8	X	X	X
Bell 1.6	X	X	X
Bell 4.2	X	X	X
Johnson Creek			
Johnson 0.0	X	X	X
Johnson 2.0	X	X	X

It is recommended that a minimum of 12 samples be collected each year; 6 during wet weather and 6 during dry weather. Base flow (dry weather) samples should be collected once every second month on days preceded by dry weather (e.g., minimum antecedent dry period of 24 hours). Storm event (wet weather) samples should be collected on days preceded by at least 0.15 inches of rain. Water samples should be collected on the same date at all six monitoring stations to maximize the power of statistical trend analysis. As mentioned previously, the monitoring stations and parameters identified for Bell Creek are a higher priority than the monitoring stations and parameters identified for Johnson Creek.

It is also recommended that continuous monitoring of dissolved oxygen and temperature be conducted in Bell Creek during the summer months to evaluate temporal trends in the low dissolved oxygen concentrations historically observed at this station and to determine if temperature is an issue. No dissolved oxygen data were available for evaluation as part of this report, but Bell Creek is listed on Ecology's 2012 303(d) list of impaired waters (Category 5)

for dissolved oxygen, so this should be further investigated. Continuous temperature data has also not been collected in Bell Creek to date.

Fecal Source Tracing

Fecal source tracing should be conducted to identify sources of fecal coliform bacteria in the priority areas described above. Fecal source tracing should be conducted initially in the highest priority area of Bell Creek as described below, and findings from this source tracing should be used to adapt the source tracing methodology for areas in Johnson Creek.

The first step in fecal source tracing is to develop a detailed drainage map of the area. In Bell Creek, that includes the lowermost reach from Bell 1.6 to Bell 0.2. A drainage contaminant survey should then be conducted during dry and wet weather to refine the drainage map, measure discharge of drainage at key points in the area, identify potential human and animal sources of fecal coliform bacteria, and locate potential sites for source control or treatment.

The dry weather survey should be conducted first to establish sampling stations at key access locations in the stormwater drainage system. Generally, key sampling stations are located at each stream outfall (where surface runoff enters a stream) in the priority area and at upstream manholes, inlets, or ditches on the main stormwater drainage lines that contribute to the outfall. If flow is present at a sampling station, discharge should be measured and a water sample should be collected for analysis of fecal coliform bacteria. Discharge (flow) data will be used to identify the relative contribution of drainage to the stream and between upstream sampling stations, and can be used in combination with fecal coliform bacteria concentrations to calculate fecal coliform bacteria loading rates at the time of sample collection. A second dry weather survey may be needed to confirm the initial results and resolve unusually high increases in discharge or bacteria concentrations between sampling stations. The drainage contaminant survey should be repeated at the same stations during wet weather to identify potential fecal sources during storm events.

During each survey, land draining to the stormwater drainage system should be inspected for the presence of animal waste (e.g., birds, rodents, pets, and livestock). The land area should also be inspected for potential human waste sources from improperly stored garbage or unsanitary practices. Water samples should be inspected for an unusual odor, color, or turbidity that may be indicative of sanitary sewage. Locations of sampling stations should be recorded on a map or using a GPS unit. Visual observations and field meter or test kit results should be recorded in a field notebook or on a standardized field form.

The survey findings should be used to identify priority areas for source control or treatment. Appropriate source control activities may include programmatic solutions such as education of proper pet and livestock waste management, septic system maintenance, or street sweeping. Structural source control solutions may include disconnection of illicit sanitary waste connections or stormwater treatment at key inputs. Stormwater treatment may include installation of devices to remove fecal coliform bacteria by filtration or other means, such as ultraviolet radiation or approved biocides.

Fecal source tracing should be repeated at selected monitoring stations following source control or treatment actions to confirm the effectiveness of those actions.

Sediment Quality Monitoring

Based on the limited sediment quality monitoring results presented in this report, no clear water quality concerns were identified; thus, no additional sediment quality monitoring is recommended at this time.

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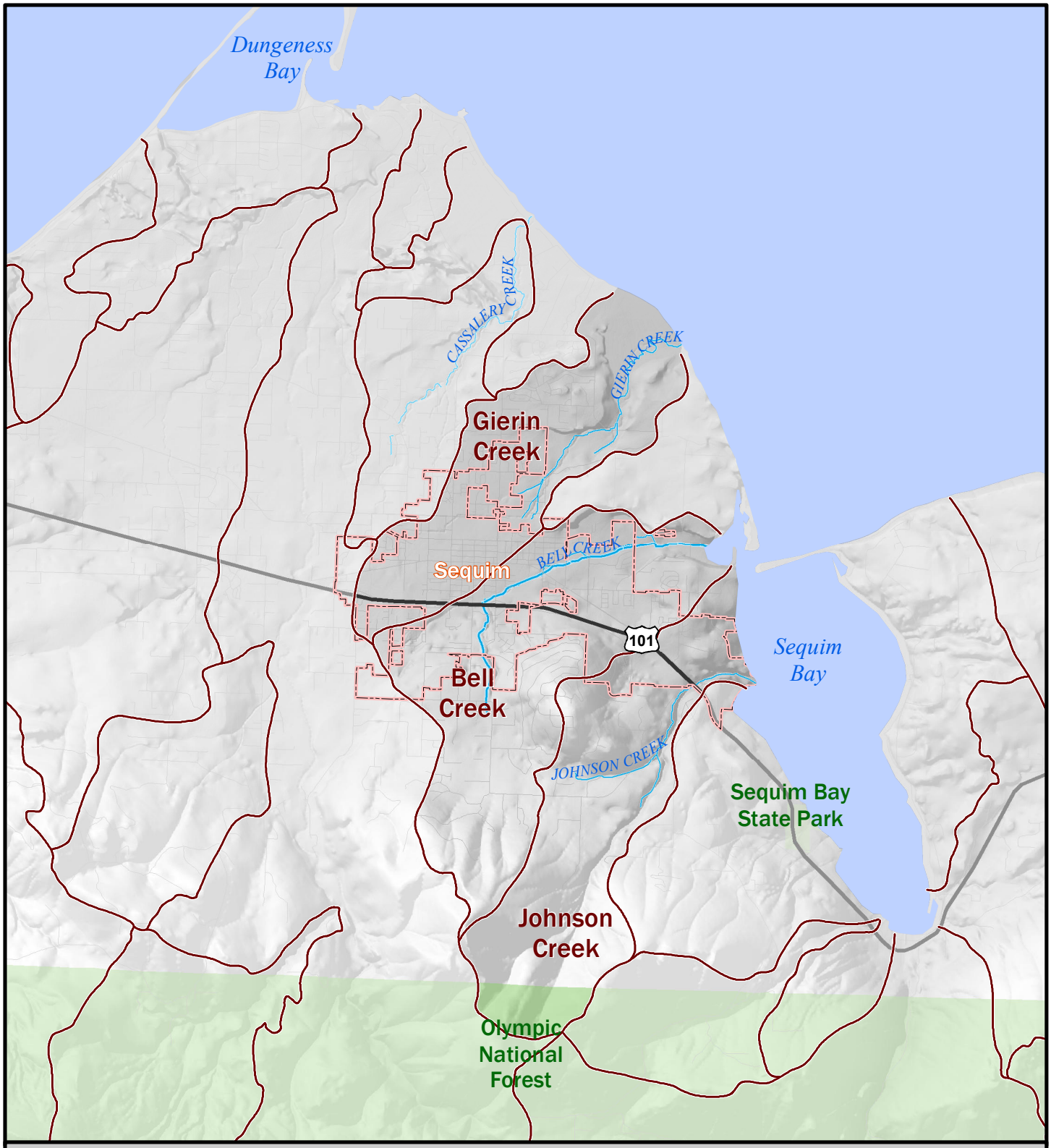
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APPENDIX A

Drainage Basin Maps



Legend

- Subbasin
- City limit
- Stream
- Highway



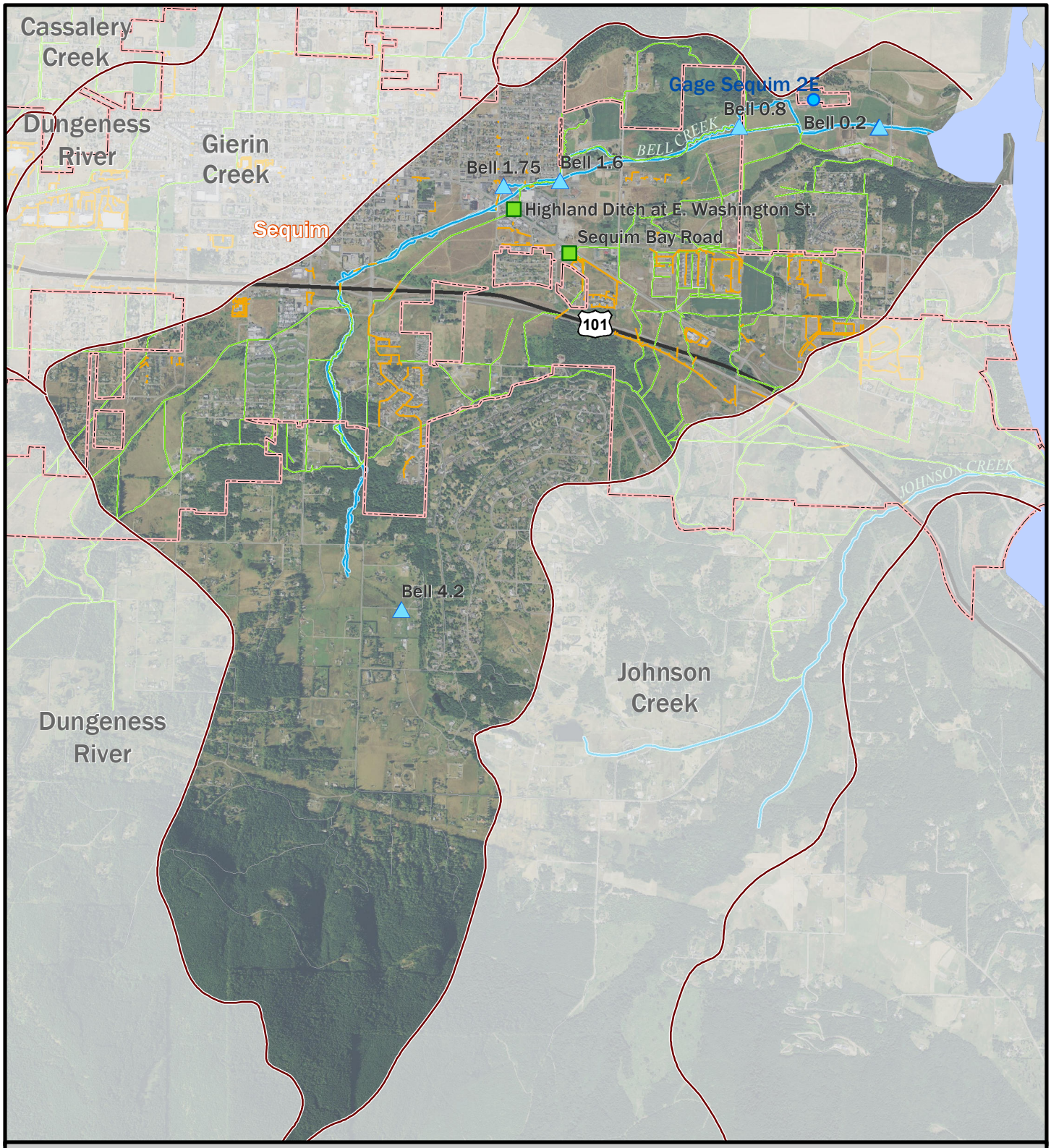
Figure A-1.
City of Sequim, Washington
Vicinity Map and Drainage Basins.

N

0 3,000 6,000 12,000
Feet

HERRERA

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Legend

- City limit
- Stream
- Highway
- Subbasin
- Creek monitoring station
- Irrigation ditch monitoring station
- Stormwater system monitoring station
- Rain gauge station
- Irrigation ditch
- Stormwater pipe

Figure A-2.
Bell Creek Drainage Basin and Monitoring Station Locations.

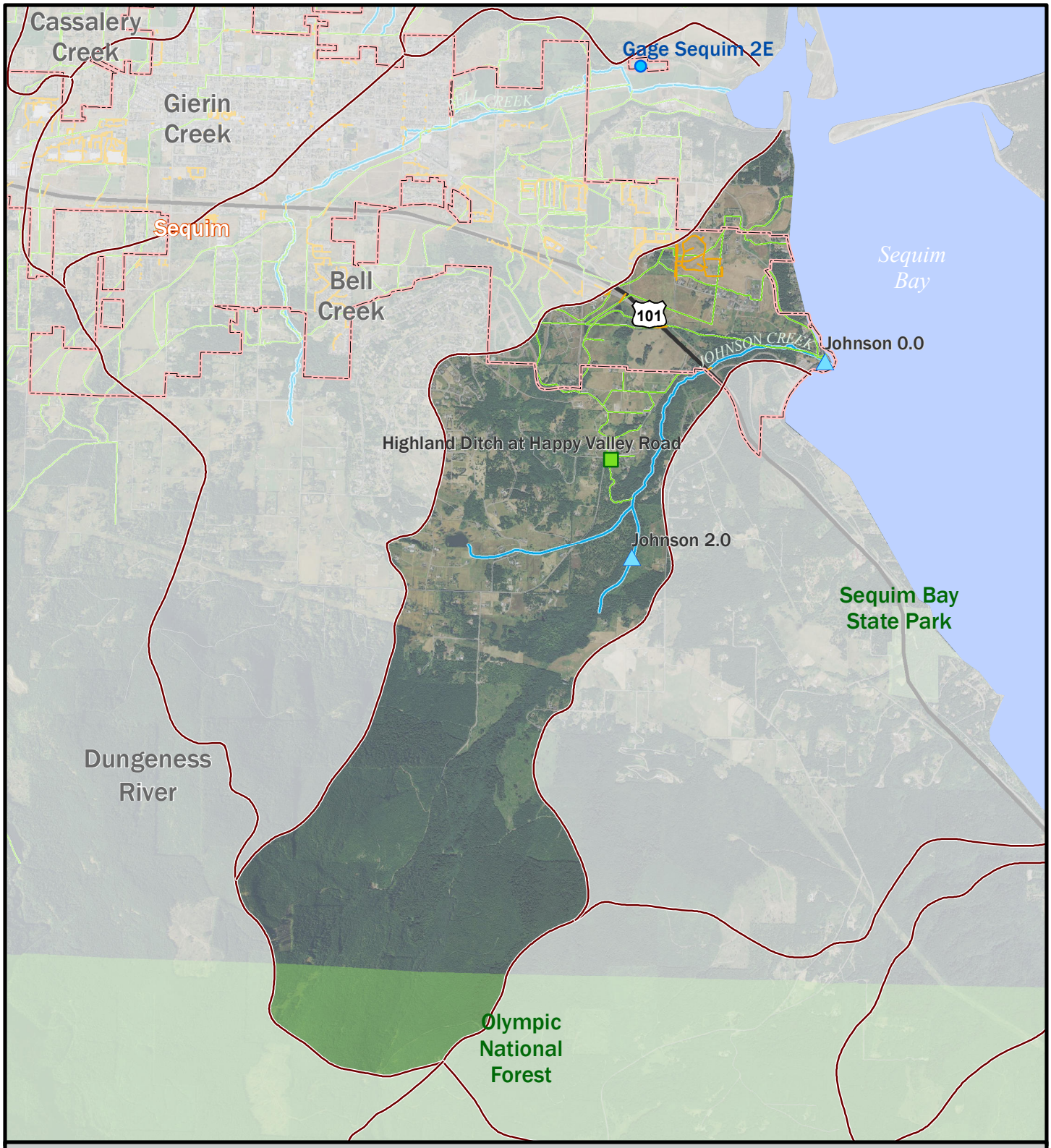
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0 1,500 3,000 6,000 Feet

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Legend

- City limit
- Stream
- Highway
- Subbasin
- Creek monitoring station
- Irrigation ditch monitoring station
- Stormwater system monitoring station
- Rain gauge station
- Irrigation ditch
- Stormwater pipe

Figure A-3.
Johnson Creek Drainage Basin and Monitoring Station Locations.

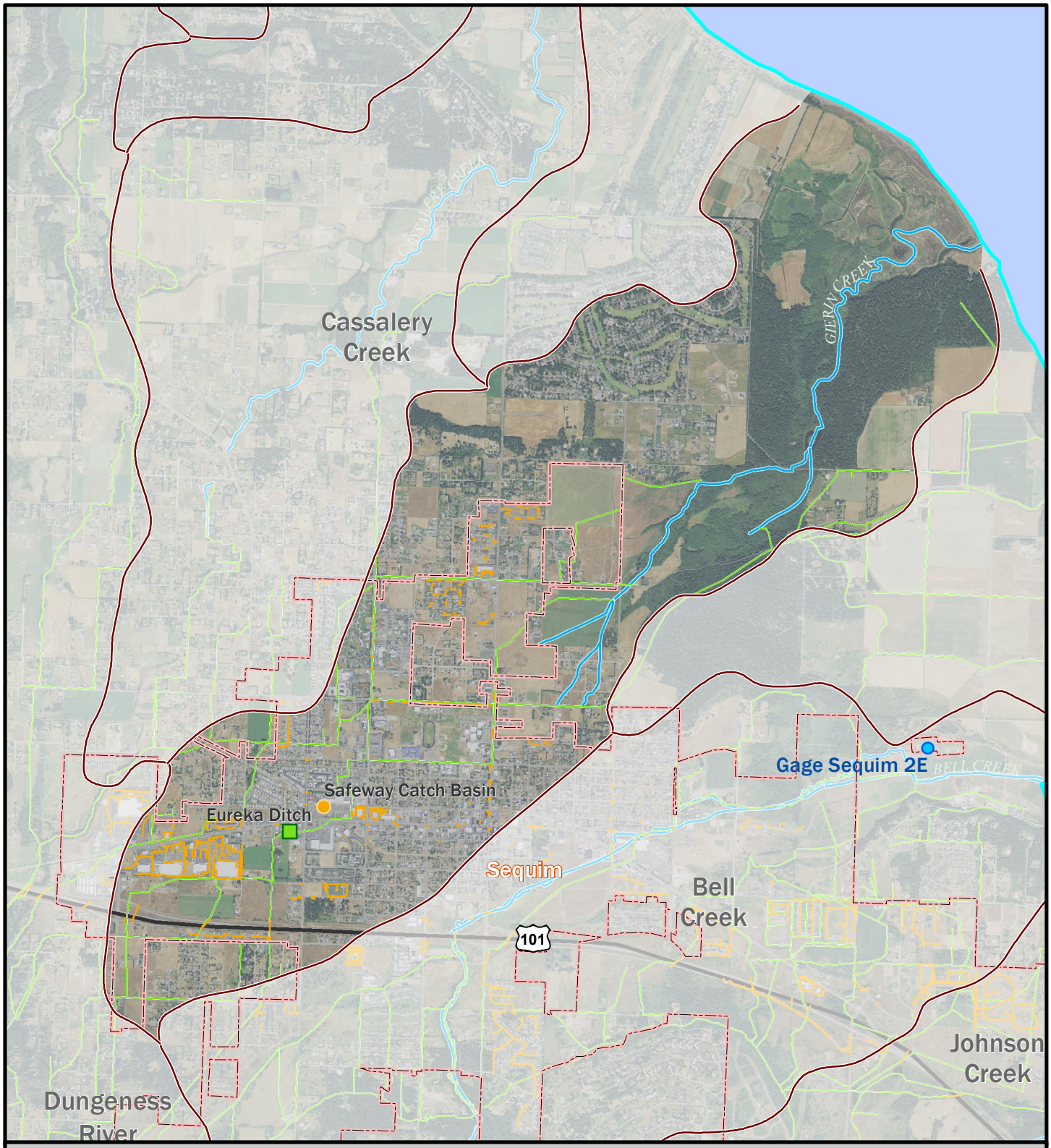
N

0 2,000 4,000 8,000 Feet

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USDA, Aerial (2013)

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Legend

- City limit
- Stream
- Highway
- Subbasin
- Creek monitoring station
- Irrigation ditch monitoring station
- Stormwater system monitoring station
- Rain gauge station
- Irrigation ditch
- Stormwater pipe

Figure A-4.
Gierin Creek Drainage Basin and Monitoring Station Locations.

N

0 1,500 3,000 6,000 Feet

HERRERA

USDA, Aerial (2013)

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APPENDIX B

Additional Water Quality Standards and Assessments

EPA Ecoregion II Nutrient Criteria

The EPA's nutrient criteria for rivers and streams in Nutrient Ecoregions are recommendations to States and Tribes for establishing their water quality standards. The City of Sequim falls into the EPA Nutrient Ecoregion II: Western Forested Mountains. Ecoregion II nutrient reference conditions that are equivalent to the median of the 25th percentiles for all four seasons using all of the data compiled from rivers and streams in this ecoregion are shown in Table B-1.

Table B-1. Ecoregion II 25th Percentile Reference Conditions.

Nutrient Parameter	Aggregate Nutrient Ecoregion II Reference Conditions
Total phosphorus (ug/L)	10.0 ug/L
Total nitrogen (mg/L)	0.12 mg/L
Chlorophyll a (ug/L) (gluorometric method)	1.08 ug/L
Turbidity (NTU)	1.3 NTU

More information can be found in the EPA's Ambient Water Quality Criteria Recommendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Nutrient Ecoregion II (2000) (<http://www2.epa.gov/nutrient-policy-data/ecoregional-nutrient-criteria-documents-rivers-and-streams>).

ECOLOGY WATER QUALITY ASSESSMENT AND 303(D) LISTINGS

Specific reaches of the following waterbodies in Sequim have been assessed and assigned Category 2 (waters of concern) or Category 4c (impaired by a non-pollutant) (Ecology 2012):

- Bell Creek: fecal coliform bacteria, pH, and temperature (Category 2)
- Johnson Creek: fecal coliform bacteria, pH, and bioassessment (Category 2)
- Dungeness River: bioassessment (Category 2)
- Sequim Bay: dissolved oxygen(Category 2)
- Independent irrigation ditch (Sequim Prairie Tri): pH (Category 2)
- Strait of Juan de Fuca East: fish and shellfish habitat (Category 4c)

Ecology (2012) has included the following waterbodies on the 303(d) list of impaired waters (Category 5) for the following parameters:

- The lower reaches of Bell Creek: fecal coliform bacteria, dissolved oxygen, and Benthic Index of Biotic Integrity (B-IBI)
- Lower reaches of Johnson Creek: fecal coliform bacteria
- Sequim Bay: fecal coliform bacteria and dissolved oxygen

Additional detail on the 2012 Water Quality Assessment is included in Table B-2.

Ecology released additional 303(d) listings in the proposed 2015 303(d) list of impaired waters (Category 5) while the Water Quality Analysis was under development. The following waterbodies within the City are on the proposed 2015 303(d) list for the following parameters:

- The lower reaches of Bell Creek: pH, temperature
- Middle (ephemeral) reach of Bell Creek: pH, fecal coliform bacteria, dissolved oxygen, and bioassessment
- Upper (perennial) reaches of Bell Creek: fecal coliform bacteria and dissolved oxygen
- Johnson Creek (entire length): pH and fecal coliform bacteria

More information can be found on Ecology's proposed water quality assessment and 303(d) List at the following website: <http://www.ecy.wa.gov/programs/wq/303d/freshwtrassessmnt/index.html>.

Table B-2. Ecology 2012 Water Quality Assessment.

Listing ID	Name	Parameter	Medium	Category	Waterbody ID	Lower Address	Upper Address	Basis
42966	BELL CREEK	Dissolved Oxygen	Water	5	1230524480832	0.462	2.175	• Location ID [CCWR_00015]: o In 2004, 1 sample showed no excursion of the criteria for this waterbody, (criterion = 9.5 mg/L) o In 2003, 2 of 3 samples (66.7%) showed an excursion of the criteria for this waterbody o In 2002, 1 sample showed no excursion of the criteria for this waterbody o In 2001, 2 of 4 samples (50.0%) showed an excursion of the criteria for this waterbody • Streamkeepers of Clallam County data (submitted by Ed Chadd on 03/15/04), station Bell 0.8 shows 5 samples beyond the criterion collected on the following days: 10/3/2001, 8/15/2001, 1/20/2002, 1/20/2003, 10/17/2003
42963	BELL CREEK	Bioassessment	Other	5	1230524480832	0.462	2.175	• B-IBI score of 26 at Bell 0.5 10/10/1999 (CCSK) • B-IBI score of 16 @ Bell 0.8 10/26/2002 (CCSK) • B-IBI score of 12 @ Bell 0.8 10/17/2003 (CCSK) • Streamkeepers of Clallam County unpublished data show biological conditions are degraded based on the B-IBI scores from macroinvertebrate samples collected in 2002 and 2003 at site Bell 0.8.

Table B-2 (continued). Ecology 2012 Water Quality Assessment.								
Listing ID	**Name**	**Parameter**	**Medium**	**Category**	**Waterbody ID**	**Lower Address**	**Upper Address**	**Basis**
42962	BELL CREEK	Bioassessment	Other	5	1230524480832	0	0.462	• B-IBI score of 18 @ Bell 0.1 10/10/1999 (CCSK) • B-IBI score of 16 @ Bell 0.1 10/1/2000 (CCSK) • B-IBI score of 12 @ Bell 0.1 9/30/2001 (CCSK) • B-IBI score of 10 @ Bell 0.1 10/11/2005 (CCSK) • Streamkeepers of Clallam County unpublished data show biological conditions are degraded based on the B-IBI scores from macroinvertebrate samples collected in 1999, 2000, and 2001 at site Bell 0.1.
7685	BELL CREEK	Bacteria	Water	5	1230524480832	0	0.462	• Location ID [CCWR_00192]: o 0 of 1 (0.0%) of samples collected in 2002 exceed the percent criterion (100 col/100mL) o Fewer than five samples were available in 2002, therefore a geometric mean was not calculated for this period • Streamkeepers of Clallam County data (submitted by Ed Chadd on 03/15/04), station Bell 0.1 shows in 2001 and 2003 at least one sample exceeded the criterion. • Streamkeepers of Clallam County unpublished data from Bell 0.1 show a geometric mean (cfu/100mL) of: o 12 from 4 samples collected in 2003 o 13 from 4 samples collected in 2002

Table B-2 (continued). Ecology 2012 Water Quality Assessment.								
Listing ID	**Name**	**Parameter**	**Medium**	**Category**	**Waterbody ID**	**Lower Address**	**Upper Address**	**Basis**
7685 (cont.)								o 1 from 1 sample collected in 2002 o 17 from 6 samples collected in 2001 o 42 from 5 samples collected in 2000 o 38 from 3 samples collected in 1999 o 2070 from 6 samples collected in 1992 o 190 from 1 sample collected in 1990 o 267 from 5 samples collected in 1989 o 863 from 12 samples collected in 1988 o 724 from 4 samples collected in 1987
42965	BELL CREEK	Dissolved Oxygen	Water	5	1230524480832	0	0.462	• Location ID [CCWR_00012]: o In 2004, 1 of 2 samples (50.0%) showed an excursion of the criteria for this waterbody, (criterion = 9.5 mg/L). o In 2003, 1 of 3 samples (33.3%) showed an excursion of the criteria for this waterbody o In 2002, 1 of 8 samples (12.5%) showed an excursion of the criteria for this waterbody o In 2001, 2 of 7 samples (28.6%) showed an excursion of the criteria for this waterbody o In 2000, 3 of 4 samples (75.0%) showed an excursion of the criteria for this waterbody

Table B-2 (continued). Ecology 2012 Water Quality Assessment.								
Listing ID	**Name**	**Parameter**	**Medium**	**Category**	**Waterbody ID**	**Lower Address**	**Upper Address**	**Basis**
42965 (cont.)								• Streamkeepers of Clallam County data (submitted by Ed Chadd on 03/15/04), station Bell 0.1 shows 7 samples beyond the criterion collected on the following days: 1/17/2000, 10/1/2000, 7/28/2000, 8/12/2001, 9/30/2001, 8/15/2002, 10/17/2003
6814	BELL CREEK	pH	Water	2	1230524480832	0	0.462	• Location ID [Data from multiple locations]: o In 2003, 1 of 4 samples (25.0%) showed an excursion of the criteria for this waterbody: 1 high pH excursion. o In 2002, 0 of 6 samples (0.0%) showed an excursion of the criteria for this waterbody. • Location ID [CCWR_00012] – In 2004, 1 of 1 sample (100.0%) showed an excursion of the criteria for this waterbody: 1 high pH excursion. • Streamkeepers of Clallam County unpublished data from Bell 0.1 show: o 0 excursions beyond the criterion out of 2 measurements collected in 2001–2003 o 0 excursions beyond the criterion out of 17 measurements collected in 1997–2002

Table B-2 (continued). Ecology 2012 Water Quality Assessment.								
Listing ID	**Name**	**Parameter**	**Medium**	**Category**	**Waterbody ID**	**Lower Address**	**Upper Address**	**Basis**
15600	BELL CREEK	Bacteria	Water	2	1230524480832	0.462	2.175	• Jamestown S'Klallam Tribe unpublished data from station Bell 03 shows a geometric mean (cfu/100mL) of: o 12 from 4 samples collected in 2002 o 30 from 4 samples collected in 2001 o 43 from 4 samples collected in 2000 o 3 from 2 samples collected in 1999 o 8 from 4 samples collected in 1998 o 4 from 4 samples collected in 2002 o 98 from 4 samples collected in 2001 o 24 from 4 samples collected in 2000 o 7 from 4 samples collected in 1998
21441	BELL CREEK	Temperature	Water	2	1230524480832	0.462	2.175	• Streamkeepers of Clallam County unpublished data show: o 1 excursion beyond the criterion in measurements collected on 15 August 2001 at station Bell 0.8 (Bell @ Spath DOT site) o No excursions beyond the criterion in measurements collected between 1997–2002 at station Bell 1.5 (Bell Creek @ Carrie Blake Park @ w. foot bridge)

Table B-2 (continued). Ecology 2012 Water Quality Assessment.								
Listing ID	**Name**	**Parameter**	**Medium**	**Category**	**Waterbody ID**	**Lower Address**	**Upper Address**	**Basis**
7674	JOHNSON CREEK	Bacteria	Water	5	1230394480628	1.528	1.543	• Streamkeepers of Clallam County unpublished data shows a geometric mean (cfu/100mL) of: o 103 from 8 samples collected in 1991 o 75 from 6 samples collected in 1992 o 64 from 4 samples collected in 1987 o 41 from 13 samples collected in 1988 o 26 from 5 samples collected in 1989 o 20 from 1 samples collected in 1990 o 6 from 2 samples collected in 1999 o 22 from 7 samples collected in 2000 o 22 from 6 samples collected in 2001 o 21 from 5 samples collected in 2002
21549	JOHNSON CREEK	pH	Water	2	1230394480628	1.528	1.543	• Location ID [Data from multiple locations]: o In 2005, 0 of 3 samples (0.0%) showed an excursion of the criteria for this waterbody o In 2006, 0 of 3 samples (0.0%) showed an excursion of the criteria for this waterbody • Streamkeepers of Clallam County unpublished data show : o 1 excursion beyond the criterion out of 7 measurements collected in 1998–2000 at station Johnson 0.6 (Johnson d/s of Hwy 101). o 0 excursions beyond the criterion out of 9 measurements collected in 1997–2000 at station Johnson 0.0 (Johnson upstream of Marina).

Table B-2 (continued). Ecology 2012 Water Quality Assessment.								
Listing ID	Name	Parameter	Medium	Category	Waterbody ID	Lower Address	Upper Address	Basis
21551	JOHNSON CREEK	pH	Water	2	1230394480628	1.714	3.504	• Location ID [Data from multiple locations]: o 2006, 1 of 1 sample (100.0%) showed an excursion of the criteria for this waterbody: 1 high pH excursion. • Streamkeepers of Clallam County unpublished data show 0 excursions beyond the criterion out of 3 measurements collected in 1997–1998 at station Johnson 1.4 (Johnson @ Happy Valley Rd).
42832	JOHNSON CREEK	Bioassessment	Water	2	1230394480628	0	1.528	• Streamkeepers of Clallam County unpublished data show biological conditions are degraded based on the BIBI scores from macroinvertebrate samples collected in: o 1999 at site Johnson 0.0. o 1999 at site Johnson 0.6.
42975	JOHNSON CREEK	Bacteria	Water	2	1230394480628	1.714	3.504	• Streamkeepers of Clallam County data (submitted by Ed Chadd on 03/15/04), station Johnson 1.7 shows in 2000, at least one sample exceeded the criterion.
47000	DUNGENESS RIVER	Bioassessment	Water	2	1231331481508	10.461	10.461	• B-IBI score of 36 @ Dungeness 6.6a 10/14/2004 (CCSK) B-IBI score of 42 @ Dungeness 5.9 9/27/2005 (CCSK)
7678	SEQUIM BAY	Dissolved Oxygen	Water	2	1224199478564	None	None	• Norman Associates (1978), 1 excursion beyond the criterion at station 017 on 5/18/87
7679	SEQUIM BAY	Dissolved Oxygen	Water	2	1224199478564	None	None	• Norman Associates (1978), 1 excursion beyond the criterion at station 019 on 5/18/87

Table B-2 (continued). Ecology 2012 Water Quality Assessment.								
Listing ID	**Name**	**Parameter**	**Medium**	**Category**	**Waterbody ID**	**Lower Address**	**Upper Address**	**Basis**
7680	SEQUIM BAY	Dissolved Oxygen	Water	2	1224199478564	None	None	• Norman Associates (1978), 1 excursion beyond the criterion at station 018 on 5/18/87
10296	SEQUIM BAY	Dissolved Oxygen	Water	5	1224199478564	None	None	• Location ID [JDF007] – In 2007, 6 out of 10 (60%) samples showed an excursion of the criterion (7 mg/L) • Newton et al. (2002) Dept. of Ecology Ambient Monitoring Station JDF007 (Strait of Juan de Fuca – Sequim Bay Goose Point) shows 1 excursion beyond the criteria out of 2 samples collected between 1993–2000
10300	SEQUIM BAY	Dissolved Oxygen	Water	2	1224199478564	None	None	• Newton et al. (2002) Dept. of Ecology Ambient Monitoring Station JDF005 (Strait of Juan de Fuca – Sequim Bay) shows 3 excursions beyond the criterion out of 10 samples collected between 1993–2000 • Norman Associates (1978) 1 excursion beyond the criterion at station 028 on 5/18/87.
10302	SEQUIM BAY	Dissolved Oxygen	Water	2	1224199478564	None	None	• Location ID [LTMW119] – In 2000, 5 of 12 samples (41.7%) showed an excursion of the criteria for this waterbody, (criterion = 7.0 mg/L) • Newton et al. (2002) Dept. of Ecology Ambient Monitoring Station SEQ002 (Sequim Bay – Northern) shows 5 excursions beyond the criterion out of 12 samples collected between 1993–2000

40364	SEQUIM BAY	Bacteria	Water	5	1224199478564	None	None	• Location IDs [SEQUIM BAY 98], [SEQUIM BAY 78]: o In 2009, 0 out of 7 (0%) samples exceeded the percent criterion (43 col/100 mL). The geometric mean of 1.9 col/100mL did not exceed the geometric mean criterion (14 col/100 mL). o In 2008, 0 out of 8 (0%) samples exceeded the percent criterion (43 col/100 mL). The geometric mean of 3.4 col/100mL did not exceed the geometric mean criterion (14 col/100 mL). o In 2007, 0 out of 9 (0%) samples exceeded the percent criterion (43 col/100 mL). The geometric mean of 1.7 col/100mL did not exceed the geometric mean criterion (14 col/100 mL). • Department of Health unpublished data collected from station SEQUIM BAY-78 show a geometric mean of 3 cfu/100mL and 7.4% of samples exceed the percentile criterion with the last sample collected on 17-Dec-2001. • Department of Health unpublished data collected from station SEQUIM BAY-98 show a geometric mean of 3 cfu/100mL and 0% of samples exceed the percentile criterion with the last sample collected on 17-Dec-2001. • BEACH ID [WA302512] – In 2009, 2 out of 10 (20%) sample events exceeded the enterococcus percent criterion (208 col/100 mL). The geometric mean of 29.7 col/100 mL did not exceed the enterococcus geometric **mean criterion (70 col/100 mL)**.

Table B-2 (continued). Ecology 2012 Water Quality Assessment.								
Listing ID	**Name**	**Parameter**	**Medium**	**Category**	**Waterbody ID**	**Lower Address**	**Upper Address**	**Basis**
40365	SEQUIM BAY	Bacteria	Water	2	1224199478564	None	None	• Location ID [SEQUIM BAY 79]: o In 2009, 0 out of 6 (0%) samples exceeded the percent criterion (43 col/100 mL). The geometric mean of 2.5 col/100mL did not exceed the geometric mean criterion (14 col/100 mL). o In 2008, 1 out of 5 (20%) samples exceeded the percent criterion (43 col/100 mL). The geometric mean of 7.5 col/100mL did not exceed the geometric mean criterion (14 col/100 mL). o In 2007, 0 out of 6 (0%) samples exceeded the percent criterion (43 col/100 mL). The geometric mean of 1.7 col/100mL did not exceed the geometric mean criterion (14 col/100 mL). • Department of Health unpublished data collected from station SEQUIM BAY-79 show a geometric mean of 2 cfu/100mL and 3.4% of samples exceed the percentile criterion with the last sample collected on 17-Dec-2001.
40372	SEQUIM BAY	Bacteria	Water	2	1224199478564	None	None	• Location ID [SEQUIM BAY 91]: o In 2009, 0 out of 7 (0%) samples exceeded the percent criterion (43 col/100 mL). The geometric mean of 1.7 col/100mL did not exceed the geometric mean criterion (14 col/100 mL). o In 2008, 0 out of 6 (0%) samples exceeded the percent criterion (43 col/100 mL). The geometric mean of 4.1 col/100mL did not exceed the geometric mean criterion (14 col/100 mL).

Table B-2 (continued). Ecology 2012 Water Quality Assessment.								
Listing ID	**Name**	**Parameter**	**Medium**	**Category**	**Waterbody ID**	**Lower Address**	**Upper Address**	**Basis**
40372 (cont.)								o In 2007, 0 out of 6 (0%) samples exceeded the percent criterion (43 col/100 mL). The geometric mean of 1.8 col/100mL did not exceed the geometric mean criterion (14 col/100 mL). • Department of Health unpublished data collected from station SEQUIM BAY-91 show a geometric mean of 3 cfu/100mL and 3.4% of samples exceed the percentile criterion with **the last sample collected on 17-Dec-2001**.
40373	SEQUIM BAY	Bacteria	Water	2	1224199478564	None	None	• Location IDs [SEQUIM BAY 93], [SEQUIM BAY 81] – o In 2009, 0 out of 7 (0%) samples exceeded the percent criterion (43 col/100 mL). The geometric mean of 2.2 col/100mL did not exceed the geometric mean criterion (14 col/100 mL). In 2008, 1 out of 6 (16.7%) samples exceeded the percent criterion (43 col/100 mL). The geometric mean of 3.3 col/100mL did not exceed the geometric mean criterion (14 col/100 mL). o In 2007, 0 out of 6 (0%) samples exceeded the percent criterion (43 col/100 mL). The geometric mean of 2.2 col/100mL did not exceed the geometric mean criterion (14 col/100 mL). • Department of Health unpublished data collected from station SEQUIM BAY-93 show a geometric mean of 3 cfu/100mL and 0% of samples exceed the percentile criterion with the last sample collected on 17-Dec-2001.

Table B-2 (continued). Ecology 2012 Water Quality Assessment.								
Listing ID	**Name**	**Parameter**	**Medium**	**Category**	**Waterbody ID**	**Lower Address**	**Upper Address**	**Basis**
51385	INDEPENDENT MAIN CANAL	pH	Water	2	1230933480870	0.585	2.381	• Location ID [Data from multiple locations] – o In 2002, 1 of 2 samples (50.0%) showed an excursion of the criteria for this waterbody: 1 high pH excursion.
21727	STRAIT OF JUAN DE FUCA (EAST)	Fish And Shellfish Habitat	Habitat	4C	1224199478564	None	None	• Frankenstein, 2000. Show the patchy cover of ulvoid macroalgae are impairing aquatic life from identified human causes at Washington Harbor.

APPENDIX I

Funding Strategies Memorandum

MEMORANDUM

February 25, 2016

City of Sequim
Storm and Surface Water Master Plan
Funding Strategies Memorandum

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MEMORANDUM

Executive Summary

This memorandum describes alternatives for funding the service level alternatives shown in the Storm and Surface Water Master Plan ("Master Plan"). It contains a review of existing stormwater program spending, projected future stormwater program spending associated with three level-of-service tiers described in the Master Plan, and alternatives for paying for stormwater services.

Current stormwater operating expenses are approximately $110,000 per year. The funding is split 50/50 by the water and sewer utilities. A single-family residential water and sewer customer pays between approximately $1.60 and $2.10 per month (depending on water use) for stormwater services. Customers with higher water and sewer bills pay more.

Three level-of-service tiers are described in the Master Plan. The projected annual cost of these tiers through 2022 is compared with existing stormwater expenses as follows:

No Change: Existing Stormwater Operating Expenses	Annual cost: $110,000
Tier A: Needed to Meet Minimum Standards	Annual cost: $565,000
Tier B: Likely to be Mandated	Annual cost: $675,000
Tier C: Proactively Anticipating and Reducing Risk	Annual cost: $825,000

The annual costs for each tier are what is required to pay projected operating costs, projected capital costs, and accumulate Stormwater Fund reserves consistent with city policies that exist for its water and sewer utilities.

The reader is directed to the Master Plan for a description of what each tier means, and more detail regarding the stormwater program elements of each tier

Five potential funding alternatives are:

1. Continuing to pay from water and sewer utility revenues
2. Ad valorem property tax assessment
3. Establishing a stormwater fee
4. Forming a special purpose district
5. Combination of the above funding sources

Each alternative is intended to collect the same amount of revenue – the difference among them is how the revenue gets collected. The potential monthly impact to a single-family residence is not possible to predict exactly; however, estimates are provided in this memorandum. The alternatives with the highest cost to single-family residences will have lower costs to other customers.

Table 1 shows the potential monthly financial impact for a single-family residence, for each tier and for each funding alternative.

The monthly funding impact is shown as a range. For all three alternatives, the range depends on water use, either because of continuing water and sewer utility funding (Alternative 1), or discontinued water and sewer utility funding (Alternatives 2 and 3). For Alternative 2, the

range also depends on the assessed value of a house, and for Alternative 3, the range also depends on the amount of paved surface of non-residential parcels such as schools, and commercial properties such as parking lots, retail, and hospitals. The financial impact of a special purpose district is not yet known because services provided by a district and district boundaries have yet to be identified. The financial impact of Alternative 5 will be in between the lower and upper limits of Alternatives 1 through 3.

Table 1
Summary of Projected Financial Impacts for Single-Family Residences, $/month

Funding Alternative	Tier A	Tier B	Tier C	Notes
Alternative 1: Water and Sewer Utility Revenue	$8.60 - $11.00	$10.30 - $13.20	$12.60 - $16.10	1
Alternative 2: Ad Valorem Property Tax Assessment	$6.50 - $12.70	$8.10 - $15.50	$10.40 - $19.30	2
Alternative 3: Stormwater Fee	$10.20 - $16.20	$12.60 - $19.70	$15.90 - $24.40	3, 4

Notes:
(1) Low = monthly water use of 400 cubic feet/month; high = monthly water use of 1,000 cubic feet/month
Average water use is ~700 cubic feet per month
(2) Low = assessed value of $150,000, monthly water use of 400 cf/month;
High = assessed value of $250,000. Median assessed value ~$185,000.
Low and high also based on water use ranges described in note 1 and discontinued water/sewer rate support.
(3) Low = number of Equivalent Residential Units = 3,830. High = number of Equivalent Residential Units = 2,640. See main body of report for more detail.
Low and high also based on water use ranges described in note 1 and discontinued water/sewer rate support.
(4) Impervious areas from the City's rights-of-way are not considered in this tables. If the City decides to "charge itself" for these areas, the rate impacts to a single-family residence will be smaller but a portion of the annual stormwater cost must be paid from the City's General Fund.

The financial impacts of Tiers A and B can be reduced by 20 and 10 percent respectively, by deferring some capital costs planned in 2018 and 2019 to alter in the six-year planning period.

In this memorandum, each of the funding alternatives is evaluated in terms of its financial impacts, equity considerations, and administrative and implementation considerations. When considering the equity of the funding alternatives, the City should consider the linkages between the service provided and the amount charged. For the three funding alternatives, this means how the stormwater program services relate to water use, assessed value, impervious area, or other parameters that define how to pay for stormwater services. Consideration should also be given to the extent of stormwater program elements that address runoff from rights-of-way, and how these costs are recovered.

Of the funding alternatives, a stormwater fee is the most common method of paying for stormwater program activities, particularly in Western Washington and including nearby cities such as Port Angeles, Port Townsend, Poulsbo, Aberdeen, Hoquiam, and Oak Harbor. The monthly stormwater fee for a single-family residence in these jurisdictions ranges from $6.69 in Aberdeen to $16.43 in Poulsbo.

Sequim's stormwater system differs from many utilities (particularly in western Washington) because runoff in much (but not all) of the City is infiltrated on-site. In most parts of the City, there is very little piped stormwater conveyance. An exception to this is the central business

district, where piped stormwater conveyance systems exist that direct much of the runoff to City-owned and maintained infiltration sites. This infiltration-focused approach to stormwater management has led to fewer pipes for the City to maintain, but requires additional effort to maintain dry wells and other infiltration facilities. Relying on infiltration also makes it more obvious when the system is in need of rehabilitation because water ponds in the streets, as was observed in 2015. As a result of the widespread use of onsite infiltration, in Sequim there is a much less obvious link between impervious area on a parcel and runoff (when compared to other jurisdictions).

Unlike many utilities in Western Washington, Sequim's stormwater program activities have a water supply component, because the majority of runoff is infiltrated and some expenses are directly related to capturing wet-season irrigation ditch flow for recharge. An increasing focus of stormwater programs is water quality, and this is progressively reflected in the contents of Tiers A, B, and C. Because the majority of Sequim's runoff is infiltrated, efforts to improve the water quality may affect groundwater quality, which also may have a water supply link.

There is a weaker link between provision of stormwater management services and sewer rates. The strongest link may be found when considering that some of the City's stormwater program costs are the result of runoff generated from outside the City limits, particularly in Bell Hill. Sewer customers in Bell Hill pay a 50 percent surcharge on their sewer bills.

A significant percentage of the City's stormwater program costs are to address runoff from rights-of-way. These costs can be recovered from ad valorem property taxes, but there are many competing priorities for the City's property tax revenue. A stormwater fee, properly constructed, can also recognize the public's use of rights-of-way, either by a direct charge to parcels or via the City charging its General Fund a stormwater fee based on the same fee structure as applied to privately-owned parcels.

It is likely that the most equitable method to fund the stormwater program costs is a combination of alternatives. However, combining funding sources makes administration and implementation even more difficult.

Finally, the financial impacts associated with all of these alternatives are large. FG Solutions strongly encourages the City to have a detailed and transparent dialog with its residents and businesses to assess priorities and the affordability of these potential program changes.

Introduction

This memorandum describes alternatives for paying for the service level alternatives shown in the Storm and Surface Water Master Plan ("Master Plan"). This memorandum provides a summary of the existing financial status: what the city currently spends and where the money comes from. Next is a summary of the future stormwater program costs: what the City might spend in the future, corresponding to each of the alternatives presented in Master Plan.

The third section describes alternatives for collecting the revenue requirement. Five alternatives are discussed:

1. Continuing to pay from water and sewer utility revenues
2. Ad valorem property tax assessment
3. Establishing a stormwater fee
4. Forming a special purpose district
5. A combination of the above alternatives

After a brief discussion of affordability, the Appendix provides some additional more detailed calculations and discussion.

This memorandum is based on data available as of November 2015. Any changes in staffing levels that have been made after November 2015 reflected in the final Master Plan will not substantively change the results of this funding analysis.

Existing Financial Status

From an accounting perspective, the City has formed two funds to track storm and surface water revenues and expenditures.

- Fund 107, the Stormwater Unrestricted fund, pays for operating expenses and is referred to in this memorandum as the "Operations Fund".
- Fund 117, the Stormwater Restricted Fund, pays for capital expenses and is referred to in this memorandum as the "Capital Fund".

Table 2 shows expenditures from the Operating Fund and Capital Fund. The City currently employs 1.75[1] full-time equivalents ("FTEs") to complete its storm and surface water activities, including a full-time water resources manager and the following maintenance positions: 0.25 FTE Lead Sewer Maintenance Worker and 0.25 FTE Sewer Maintenance Worker that clean catch basins; 0.20 FTE Lead Streets Maintenance Worker who operates the street sweeper; and 0.05 FTE Streets Manager.

The annual budget for operations and maintenance (O&M) activities is approximately $100,000, and in the past five years, capital expenditures have averaged approximately $108,000 per year.

[1] Source: 2015 Adopted Budget, page 101

Table 2
Historical Operating Fund and Capital Fund Expenditures

	Stormwater Unrestricted Fund	Stormwater Restricted Fund
Fund Number	107	117
Type of Expenses Paid	Operating	Capital
Recent Expenditures (1)		
2011 Actual	$93,882	$0
2012 Actual	$54,215	$0
2013 Actual	$101,014	$45,504
2014 Forecast (2)	$98,948	$177,185
2015 Budget	$100,248	$318,843
Five-Year Average	$89,661	$108,306
Fund Balances (3)		
Projected 1/1/15	$36,644	$5,765
Projected 12/31/15	$46,871	$14,989

Notes:
(1) Source: 2015 City Manager Adopted Budget, published November 2014
(2) Projection for the calendar year 2014 made as 2015 budget was being developed
(3) Source: 2015 Budget, page 29

Stormwater expenses include a charge for services provided by the City's Central Service Departments[2]. These services include the City Council, city administration (e.g. city manager, city clerk, city attorney, communications, human resources), finance and information technology, public works administration, GIS/engineering, facilities maintenance, and other city-wide expenses. The City allocates costs among its departments for these services using a formula that considers the number of council agenda items, expenses, FTEs, amount of equipment, square footage of office space, and insurance claim data.

In the 2015 budget, the Operations Fund is charged $25,273 for central services (approximately 25 percent of the budget), and the Capital Fund is charged $56,751 (approximately 18 percent of the budget).

Table 2 also shows that at the end of 2015, the Operations Fund is projected to contain approximately $47,000 in reserves and the Capital Fund is projected to contain approximately $15,000.

[2] This is described further on page 119 of the City's 2015 Budget

Operations Fund revenues are contributions from the water and sewer utilities. In 2015, the transfers will be $55,000 from each utility, for a total of $110,000. Capital Fund revenues vary; in 2015, the City received a grant to partially fund completion of the Storm and Surface Water Master Plan, and the water and sewer utilities contributed a combined $133,000. A state grant has partially funded the City's stormwater program manager since 2014. This grant lasts through March 2016 and the City is pursuing an extension of this grant.

Future Stormwater Program Cost

Operations and Maintenance Costs

No Change

Without any change to the current stormwater program elements, future O&M costs will be approximately $100,000 per year.

Tier A: Needed to Meet Minimum Standards

The "Plan Implementation" section of the Master Plan describes the elements of a stormwater program characterized as "Needed to Meet Minimum Standards" (Tier A). Table 3 shows the projected stormwater program staffing requirements and operating costs on a year-by-year basis from 2017 through 2022.

The upper portion of Table 3 shows the additional FTEs (in addition to existing FTEs) that would provide additional inspection, water quality compliance, and maintenance services. The lower portion of Table 3 shows estimated operating costs, including the existing $101,000 stormwater operating costs, the additional labor costs for the new FTEs, capital expenses, and additional central services expenses related to the new O&M expenses.

Table 3
Tier A: Projected Additional FTEs and Projected Program Costs (2015 Dollars)

	Tier A	2017	2018	2019	2020	2021	2022	Notes
1	**Additional FTEs, per Program Element**							1
2	Inspection Program	0.17	0.17	0.17	0.17	0.17	0.17	
3	Water Quality Compliance	0.20	0.20	0.20	0.20	0.20	0.20	
4	Species and Habitat Protection							
5	Stormwater Design Guidance/Plan Review							
6	Asset Management							
7	Stormwater System O&M	1.39	1.39	1.39	1.39	1.39	1.39	
8	Pollution Source Detection and Elimination							
9	Public Education and Involvement							
10	Total Additional FTEs	1.76	1.76	1.76	1.76	1.76	1.76	
11								
12	**Program Costs (2015 Dollars)**							
13	Existing Costs	$101,000	$101,000	$101,000	$101,000	$101,000	$101,000	2
14	Additional FTEs (@$75K/year/FTE)	$132,000	$132,000	$132,000	$132,000	$132,000	$132,000	3
15	Additional Materials, Equipment, Contracted Services							1
16	Inspection Program							
17	Water Quality Compliance	$50,000	$50,000					
18	Species and Habitat Protection							
19	Stormwater Design Guidance/Plan Review							
20	Stormwater System O&M							
21	Pollution Source Detection and Elimination							
22	Public Education and Involvement							
23	Central Services on New Operating Expenses	$45,500	$45,500	$33,000	$33,000	$33,000	$33,000	4
24	Capital Expenses	$52,720	$134,780	$264,000	$19,000	$4,000	$0	5
25	Central Services on New Capital Expenses	$9,490	$24,260	$47,520	$3,420	$720	$0	4
26	Total	$390,710	$487,540	$577,520	$288,420	$270,720	$266,000	

Notes:
(1) Refer to Draft Storm and Surface Water Master Plan Table 16
(2) Source: City's 2015 Budget
(3) $75,000 per year per FTE, fully burdened including benefits (source: City staff, email communication September 17, 2015)
(4) Additional central services on new expenses are calculated by a formula that considers factors like staffing and square feet of facilities. In this analysis, central services are calculated as 25% of operating expenditures which are the approximate percentage for the Operating Fund in the 2015 Budget.
Central services are included in the existing operating expense of approximately $101,000 in FY 2015 budget.
(5) Refer to Table 6 and the Master Plan for more detail on capital improvements

Tier B: Likely to be Mandated

Table 4 is similar to Table 3 except that it shows additional FTEs and operating costs for Tier B "Likely to be Mandated". In addition to the new FTEs and operating costs included in Tier A, Tier B includes new stormwater program activities that would begin in 2019. These new activities include additional water quality compliance, additional maintenance services, development of an asset management program, pollutant source detection and elimination, and public education and involvement.

Table 4
Tier B: Projected Additional FTEs and Projected Program Costs (2015 Dollars)

	Tier B	2017	2018	2019	2020	2021	2022	Notes
1	**Additional FTEs, per Program Element**							1
2	Inspection Program	0.17	0.17	0.17	0.17	0.17	0.17	
3	Water Quality Compliance	0.20	0.20	0.27	0.27	0.27	0.27	
4	Species and Habitat Protection							
5	Stormwater Design Guidance/Plan Review			0.14	0.14	0.14	0.14	
6	Asset Management			1.02	1.02	1.02	1.02	
7	Stormwater System O&M	1.39	1.39	1.54	1.54	1.54	1.54	
8	Pollution Source Detection and Elimination			0.11	0.11	0.11	0.11	
9	Public Education and Involvement			0.24	0.24	0.24	0.24	
10	Total Additional FTEs	1.76	1.76	3.49	3.49	3.49	3.49	
11								
12	**Program Costs (2015 Dollars)**							
13	Existing Costs	$101,000	$101,000	$101,000	$101,000	$101,000	$101,000	2
14	Additional FTEs (@$75K/year/FTE)	$132,000	$132,000	$261,750	$261,750	$261,750	$261,750	3
15	Additional Materials, Equipment, Contracted Services							1
16	Inspection Program							
17	Water Quality Compliance	$50,000	$50,000	$24,000	$24,000			
18	Species and Habitat Protection							
19	Stormwater Design Guidance/Plan Review							
20	Stormwater System O&M			$7,500	$7,500			
21	Pollution Source Detection and Elimination			$7,000	$7,000			
22	Public Education and Involvement			$12,000	$12,000			
23	Central Services on New Operating Expenses	$45,500	$45,500	$78,060	$78,060	$65,440	$65,440	4
24	Capital Expenses	$52,720	$134,780	$264,000	$19,000	$4,000	$0	5
25	Central Services on New Capital Expenses	$9,490	$24,260	$47,520	$3,420	$720	$0	4
26	Total	$390,710	$487,540	$802,830	$513,730	$432,910	$428,190	

Notes:
(1) Refer to Draft Storm and Surface Water Master Plan Table 16
(2) Source: City's 2015 Budget
(3) $75,000 per year per FTE, fully burdened including benefits (source: City staff, email communication September 17, 2015)
(4) Additional central services on new expenses are calculated by a formula that considers factors like staffing and square feet of facilities. In this analysis, central services are calculated as 25% of operating expenditures which are the approximate percentage for the Operating Fund in the 2015 Budget.
Central services are included in the existing operating expense of approximately $101,000 in FY 2015 budget.
(5) Refer to Table 6 and the Master Plan for more detail on capital improvements

Tier C: Proactively Anticipating and Reducing Risk

Table 5 shows FTEs and Operating Costs for Tier C, "Proactively Anticipating and Reducing Risk". Compared with Tier B, there is additional staff time for most program elements. Total operating costs include significant new non-labor expenditures for stormwater system operation and maintenance. Additional funding is also included to support water quality compliance, stormwater design guidance/plan review, pollutant source detection and elimination, and public education and involvement activities.

Table 5
Tier C: Projected Additional FTEs and Projected Program Costs (2015 Dollars)

	Tier C	2017	2018	2019	2020	2021	2022	Notes
1	**Additional FTEs, per Program Element**							1
2	Inspection Program	0.17	0.17	0.17	0.17	0.17	0.17	
3	Water Quality Compliance	0.20	0.20	0.27	0.27	0.29	0.29	
4	Species and Habitat Protection					0.04	0.04	
5	Stormwater Design Guidance/Plan Review			0.14	0.14	0.27	0.27	
6	Asset Management			1.02	1.02	1.02	1.02	
7	Stormwater System O&M	1.39	1.39	1.54	1.54	1.54	1.54	
8	Pollution Source Detection and Elimination			0.11	0.11	0.19	0.19	
9	Public Education and Involvement			0.24	0.24	0.29	0.29	
10	Total Additional FTEs	1.76	1.76	3.49	3.49	3.81	3.81	
11								
12	**Program Costs (2015 Dollars)**							
13	Existing Costs	$101,000	$101,000	$101,000	$101,000	$101,000	$101,000	2
14	Additional FTEs (@$75K/year/FTE)	$132,000	$132,000	$261,750	$261,750	$285,750	$285,750	3
15	Additional Materials, Equipment, Contracted Services							1
16	Inspection Program							
17	Water Quality Compliance	$50,000	$50,000	$24,000	$24,000	$5,000	$5,000	
18	Species and Habitat Protection							
19	Stormwater Design Guidance/Plan Review			$10,000	$10,000	$10,000	$10,000	
20	Stormwater System O&M			$7,500	$7,500	$133,000	$133,000	
21	Pollution Source Detection and Elimination			$2,000	$2,000	$10,000	$10,000	
22	Public Education and Involvement			$4,000	$4,000	$15,500	$15,500	
23	Central Services on New Operating Expenses	$45,500	$45,500	$77,310	$77,310	$114,810	$114,810	4
24	Capital Expenses	$52,720	$134,780	$264,000	$39,760	$288,240	$0	5
25	Central Services on New Capital Expenses	$9,490	$24,260	$47,520	$7,160	$51,880	$0	4
26	Total	$390,710	$487,540	$799,080	$534,480	$1,015,180	$675,060	

Notes:
(1) Refer to Draft Storm and Surface Water Master Plan Table 16
(2) Source: City's 2015 Budget
(3) $75,000 per year per FTE, fully burdened including benefits (source: City staff, email communication September 17, 2015)
(4) Additional central services on new expenses are calculated by a formula that considers factors like staffing and square feet of facilities. In this analysis, central services are calculated as 25% of operating expenditures which are the approximate percentage for the Operating Fund in the 2015 Budget.
Central services are included in the existing operating expense of approximately $101,000 in FY 2015 budget.
(5) Refer to Table 6 and the Master Plan for more detail on capital improvements

Capital Spending

Table 6 shows projected capital improvements, including the projects included in each tier and the City's estimated contribution to the project cost. A more complete description of the projects is included in Appendix F of the Master Plan. Table 6 does not include two additional projects (1.09 – Middle Reach Bell Creek Basin Plan and 2.26 – River Road Storage Project) which require substantial amounts of grant and/or partner funding in order to be completed.

Table 6
Projected Capital Costs (2015 Dollars)

	Project ID and Name		Tier A	Tier B	Tier C	2016	City Portion of Total Project Cost (2015 Dollars) (1) 2017	2018	2019	2020	2021
1	1.09	Middle Reach Bell Creek Floodplain Planning	Ě	Ě	Ě		$12,500	$75,000	$80,000	$15,000	
2	2.63	West Prairie St Green Street Upgrade (Sequim Ave to 2nd Ave)			Ě					$20,760	$109,240
3	2.04	S 3rd Ave (west ROW south of Bypass) Drainage Improvements	Ě	Ě	Ě		$14,220	$55,780			
4	2.25	Etta Street Infiltration and Inflow									
5	2.12	7th Avenue and Washington Upgrade	Ě	Ě	Ě				$180,000		
6	2.23	Centennial Place Inflow and Infiltration Repair	Ě	Ě	Ě		$22,000				
7	2.26	River Road Storage Reservoir	Ě	Ě	Ě	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000
8	2.68	Emerald Highlands Detention Pond Repair (remaining tasks)	Ě	Ě	Ě	$40,000					
9	2.34	Clara Crest Way/Highland Hills Runoff Control			Ě						$55,000
10	2.05	North 5th Avenue Structure Upgrade			Ě						$120,000
11											
12	**Tier A Summary**										
13	Capital Project Cost						$52,720	$134,780	$264,000	$19,000	$4,000
14	Central Services on Capital Cost						$9,490	$24,260	$47,520	$3,420	$720
15	Total Tier A Capital Cost (2015 Dollars)						$62,210	$159,040	$311,520	$22,420	$4,720
16											
17	**Tier B Summary**										
18	Capital Project Cost						$52,720	$134,780	$264,000	$19,000	$4,000
19	Central Services on Capital Cost						$9,490	$24,260	$47,520	$3,420	$720
20	Total Tier B Capital Cost (2015 Dollars)						$62,210	$159,040	$311,520	$22,420	$4,720
21											
22	**Tier C Summary**										
23	Capital Project Cost						$52,720	$134,780	$264,000	$39,760	$288,240
24	Central Services on Capital Cost						$9,490	$24,260	$47,520	$7,157	$51,883
25	Total Tier B Capital Cost (2015 Dollars)						$62,210	$159,040	$311,520	$46,917	$340,123

The lower portion of Table 6 shows the capital improvement costs by year for each Tier in 2015 dollars. Additional central services will be applicable for these levels of capital spending. For the purposes of this analysis, the additional central services cost is 18 percent of the capital cost which is the approximate percentage in the City's 2015 Budget.

Revenue Requirement Analysis

Introduction

The Revenue Requirement Analysis calculates the amount of revenues needed to fund operating and capital expenses, without considering where these revenues come from. Separate analyses are completed for each Tier.

Fund reserves are also considered. There is no formalized polity associated with the reserve balances in the City's existing 107 Operating and 117 Capital funds. Table 7 describes the reserve balance assumptions included in this analysis.

Table 7
Reserve Balance Assumptions

	Minimum Fund Balance Reserves, Operating Fund	Minimum Fund Balance Reserves, Capital Fund	Economic Uncertainty Reserves (Applies to Operating Fund Only)	Future Liabilities Reserves (Applies to Operating Fund Only)	Facilities, Equipment Reserves (Capital Fund Only)
Purpose	Cushion for revenue fluctuations and cyclical activity	Cushion for revenue fluctuations and cyclical activity	Cushion against unanticipated adverse financial or economic serives, emergencies, or litigation	Related to an accrued obligation or to self-insure for a future obligation (3)	Purchase, replace, or refurbish facilities and operating equipment (4)
Potential Policy	4 months of operating expeneses	4 months of average annual capital expenditure	2 percent of Operating Fund revenues	2 percent of Operating Fund revenues	Between 2.5 and 6 years scheduled replacement ($0 because there is no scheduled replacement)
Reason	Consistency with Water Unrestricted Fund and Sewer Unrestricted Fund (policy = between 3 and 5 months)	Analogous to Water Unrestricted Fund and Sewer Unrestricted Fund	Consistency with Water, Sewer, and General Fund (policy = between 1 and 3 percent of ongoing revenues)	Consistency with Water, Sewer, and General Fund (policy = between 1 and 3 percent of ongoing revenues)	Consistency with Water, Sewer, and General Fund
Approximate Minimum Fund Balances (5)					
Tier A	~$95,000 - $115,000	~$34,000	~$12,000	~$12,000	$0
Tier B	~$115,000 - $185,000	~$34,000	~$13,500	~$13,500	$0
Tier C	~$125,000 - $280,000	~$57,000	~$16,500	~$16,500	$0

Notes:
(1) Source: page 24, 2015 Budget
(2) If an ad valorem funding source is chosen, the City may prefer the policy of its General Fund, which is between 15% and 20% of ongoing revenues.
(3) The City's budget notes this should include reserves for unemployment self-insurance or a portion of accrued compensation (paid time off, sick leave) paid to an employee upon separation from employment
(4) The City's budget notes that this would include computers, copiers, operating equipment, and vehicles
(5) Some values are shown as a range because they are based on annual level of spending that varies from year to year.

Required Stormwater Program Revenues: Tiers A, B, and C

Table 8 is a six-year financial plan, showing projected revenues, expenditures, and reserve fund balances for Tier A. The first year of the projection is 2017, allowing some time for the City to implement measures needed to provide funding. It includes the Operating Expenses shown in Table 3 and the Capital Expenses shown in Table 6. Table 8 shows the Operating Fund and the Capital Fund separately. All stormwater program revenues would go into the Operating Fund. Operating expenses are paid from the Operating Fund, and a transfer from the Operating Fund to the Capital Fund pays for capital expenses. Tables 9 and 10 are the six-year financial plans for Tiers B and C, respectively. Tables 8, 9, and 10 are adjusted for inflation at an annual rate of 2.5 percent. The beginning fund balance in all three tables is adjusted for $44,000 in capital expenses planned for 2016.

Table 8
Required Stormwater Program Revenues: Tier A

	Tier A - Operating Fund 107							
	Sources of Funds	2017	2018	2019	2020	2021	2022	Notes
	Beginning Year Reserve Balance							
	Minimum Fund Balance Reserves	$2.900	$138.420	$178.390	$105.910	$320.580	$571.620	1, 2
	Economic Uncertainty Reserves	$0	$0	$0	$0	$12.000	$12.000	1
	Future Liability Reserves	$0	$0	$0	$0	$12.000	$12.000	1
	Revenues	$565.000	$565.000	$565.000	$565.000	$565.000	$565.000	3
	Total Sources of Funds	$567.900	$703.420	$743.390	$670.910	$909.580	$1.160.620	
	Tier A - Operating Fund 107							
	Uses of Funds	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Notes**
	O&M Expenses							
	Existing (2015 Level of Service)	$106.110	$108.770	$111.490	$114.270	$117.130	$120.060	
	New Staff	$138.680	$142.150	$145.700	$149.350	$153.080	$156.910	
	New Materials/Supplies/Equipment	$52.530	$53.840	$0	$0	$0	$0	
	Central Services on New Operating Expenses	$47.800	$49.000	$36.430	$37.340	$38.270	$39.230	
	Transfer to Capital Fund	$84.360	$171.270	$343.860	$25.370	$5.480	$0	4
	Ending Year Reserve Balance							
	Minimum Fund Balance Reserves	$138.420	$178.390	$105.910	$320.580	$571.620	$820.420	
	Economic Uncertainty Reserves	$0	$0	$0	$12.000	$12.000	$12.000	
	Future Liability Reserves	$0	$0	$0	$12.000	$12.000	$12.000	

	Tier A - Capital Fund 117							
	Sources of Funds	2017	2018	2019	2020	2021	2022	Notes
	Beginning Year Reserve Balance							
	Minimum Fund Balance Reserves	$15.000	$34.000	$34.000	$34.000	$34.000	$34.000	1, 2
	Facilities/Equipment Reserves	$0	$0	$0	$0	$0	$0	1
	Transfer from Operating Fund 107	$84.360	$171.270	$343.860	$25.370	$5.480	$0	4
	Total Sources of Funds	$99.360	$205.270	$377.860	$59.370	$39.480	$34.000	
	Tier A - Capital Fund 117							
	Uses of Funds	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Notes**
	Capital Expenses	$55.390	$145.140	$291.410	$21.500	$4.640	$0	
	Additional Central Services on New Expenses	$9.970	$26.130	$52.450	$3.870	$840	$0	
	Ending Year Reserve Balance							
	Minimum Fund Balance Reserves	$34.000	$34.000	$34.000	$34.000	$34.000	$34.000	1
	Facilities/Equipment Reserves	$0	$0	$0	$0	$0	$0	1

Notes:

(1) Assumes minimum reserve balances are accumulated by the end of the six-year planning period: minimum fund balance reserves of 3-5 months operating expenses (this table assumes 4 months revenue for Operating Fund and 4 months 6-year average Capital Fund expenditure); economic uncertainty reserves and future liability reserves each 1-3% of revenues (this table uses 2%); facilities/equipment reserves of 2.5 to six years of replacements (this table uses $0), there are no replacements in CIP. In the Operating Fund, the economic uncertainty and future liability reserves are only funded when the minimum fund balance reserve is fully funded

(2) Year end 2015 per the City's 2015 Budget projection; assumed unchanged in 2016 except less $44,000 for planned 2016 capital.

(3) Revenues are shown here without (in this table) consideration of where the revenues come from. Stormwater program funding is discussed later in this memorandum.

(4) Transfer to Capital Fund includes funds to pay capital expenses, central services on capital expenses, and accumulate appropriate Capital Fund reserves.

Table 9
Required Stormwater Program Revenues: Tier B

	Tier B - Operating Fund 107							
	Sources of Funds	2017	2018	2019	2020	2021	2022	Notes
	Beginning Year Reserve Balance							
	Minimum Fund Balance Reserves	$2.900	$248.420	$398.390	$187.220	$253.970	$426.920	1, 2
	Economic Uncertainty Reserves	$0	$0	$0	$0	$13.500	$13.500	1
	Future Liability Reserves	$0	$0	$0	$0	$13.500	$13.500	1
	Revenues	$675.000	$675.000	$675.000	$675.000	$675.000	$675.000	3
	Total Sources of Funds	$677.900	$923.420	$1.073.390	$862.220	$955.970	$1.128.920	
	Tier B - Operating Fund 107							
	Uses of Funds	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Notes**
	O&M Expenses							
	Existing (2015 Level of Service)	$106.110	$108.770	$111.490	$114.270	$117.130	$120.060	
	New Staff	$138.680	$142.150	$288.920	$296.150	$303.550	$311.140	
	New Materials/Supplies/Equipment	$52.530	$53.840	$55.740	$57.140	$0	$0	
	Central Services on New Operating Expenses	$47.800	$49.000	$86.160	$88.320	$75.890	$77.790	
	Transfer to Capital Fund	$84.360	$171.270	$343.860	$25.370	$5.480	$0	4
	Ending Year Reserve Balance							
	Minimum Fund Balance Reserves	$248.420	$398.390	$187.220	$253.970	$426.920	$592.930	
	Economic Uncertainty Reserves	$0	$0	$0	$13.500	$13.500	$13.500	
	Future Liability Reserves	$0	$0	$0	$13.500	$13.500	$13.500	

	Tier B - Capital Fund 117							
	Sources of Funds	2017	2018	2019	2020	2021	2022	Notes
	Beginning Year Reserve Balance							
	Minimum Fund Balance Reserves	$15.000	$34.000	$34.000	$34.000	$34.000	$34.000	1, 2
	Facilities/Equipment Reserves	$0	$0	$0	$0	$0	$0	1
	Transfer from Operating Fund 107	$84.360	$171.270	$343.860	$25.370	$5.480	$0	4
	Total Sources of Funds	$99.360	$205.270	$377.860	$59.370	$39.480	$34.000	
	Tier B - Capital Fund 117							
	Uses of Funds	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Notes**
	Capital Expenses	$55.390	$145.140	$291.410	$21.500	$4.640	$0	
	Additional Central Services on New Expenses	$9.970	$26.130	$52.450	$3.870	$840	$0	
	Ending Year Reserve Balance							
	Minimum Fund Balance Reserves	$34.000	$34.000	$34.000	$34.000	$34.000	$34.000	1
	Facilities/Equipment Reserves	$0	$0	$0	$0	$0	$0	1

Notes:

(1) Assumes minimum reserve balances are accumulated by the end of the six-year planning period: minimum fund balance reserves of 3-5 months operating expenses (this table assumes 4 months revenue for Operating Fund and 4 months 6-year average Capital Fund expenditure); economic uncertainty reserves and future liability reserves each 1-3% of revenues (this table uses 2%); facilities/equipment reserves of 2.5 to six years of replacements (this table uses $0), there are no replacements in CIP. In the Operating Fund, the economic uncertainty and future liability reserves are only funded when the minimum fund balance reserve is fully funded

(2) Year end 2015 per the City's 2015 Budget projection; assumed unchanged in 2016 except less $44,000 for planned 2016 capital.

(3) Revenues are shown here without (in this table) consideration of where the revenues come from. Stormwater program funding is discussed later in this memorandum.

(4) Transfer to Capital Fund includes funds to pay capital expenses, central services on capital expenses, and accumulate appropriate Capital Fund reserves.

Table 10
Required Stormwater Program Revenues: Tier C

	Tier C - Operating Fund 107							
	Sources of Funds	2017	2018	2019	2020	2021	2022	Notes
	Beginning Year Reserve Balance							
	Minimum Fund Balance Reserves	$2.900	$347.890	$587.670	$502.760	$694.480	$312.890	1, 2
	Economic Uncertainty Reserves	$0	$0	$16.500	$16.500	$16.500	$16.500	1
	Future Liability Reserves	$0	$0	$16.500	$16.500	$16.500	$16.500	1
	Revenues	$825.000	$825.000	$825.000	$825.000	$825.000	$825.000	3
	Total Sources of Funds	$827.900	$1.172.890	$1.445.670	$1.360.760	$1.552.480	$1.170.890	
	Tier C - Operating Fund 107							
	Uses of Funds	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Notes**
	O&M Expenses							
	Existing (2015 Level of Service)	$106.110	$108.770	$111.490	$114.270	$117.130	$120.060	
	New Staff	$138.680	$142.150	$288.920	$296.150	$331.380	$339.670	
	New Materials/Supplies/Equipment	$52.530	$53.840	$52.430	$53.740	$201.210	$206.240	
	Central Services on New Operating Expenses	$74.330	$76.190	$113.210	$116.040	$162.430	$166.490	
	Transfer to Capital Fund	$108.360	$171.270	$343.860	$53.080	$394.440	$0	4
	Ending Year Reserve Balance							
	Minimum Fund Balance Reserves	$347.890	$587.670	$502.760	$694.480	$312.890	$305.430	
	Economic Uncertainty Reserves	$0	$16.500	$16.500	$16.500	$16.500	$16.500	
	Future Liability Reserves	$0	$16.500	$16.500	$16.500	$16.500	$16.500	

	Tier C - Capital Fund 117							
	Sources of Funds	2017	2018	2019	2020	2021	2022	Notes
	Beginning Year Reserve Balance							
	Minimum Fund Balance Reserves	$15.000	$58.000	$58.000	$58.000	$58.000	$58.000	1, 2
	Facilities/Equipment Reserves	$0	$0	$0	$0	$0	$0	1
	Transfer from Operating Fund 107	$108.360	$171.270	$343.860	$53.080	$394.440	$0	4
	Total Sources of Funds	$123.360	$229.270	$401.860	$111.080	$452.440	$58.000	
	Tier C - Capital Fund 117							
	Uses of Funds	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Notes**
	Capital Expenses	$55.390	$145.140	$291.410	$44.980	$334.270	$0	
	Additional Central Services on New Expenses	$9.970	$26.130	$52.450	$8.100	$60.170	$0	
	Ending Year Reserve Balance							
	Minimum Fund Balance Reserves	$58.000	$58.000	$58.000	$58.000	$58.000	$58.000	1
	Facilities/Equipment Reserves	$0	$0	$0	$0	$0	$0	1

Notes:

(1) Assumes minimum reserve balances are accumulated by the end of the six-year planning period: minimum fund balance reserves of 3-5 months operating expenses (this table assumes 4 months revenue for Operating Fund and 4 months 6-year average Capital Fund expenditure); economic uncertainty reserves and future liability reserves each 1-3% of revenues (this table uses 2%); facilities/equipment reserves of 2.5 to six years of replacements (this table uses $0), there are no replacements in CIP. In the Operating Fund, the economic uncertainty and future liability reserves are only funded when the minimum fund balance reserve is fully funded

(2) Year end 2015 per the City's 2015 Budget projection; assumed unchanged in 2016 except less $44,000 for planned 2016 capital.

(3) Revenues are shown here without (in this table) consideration of where the revenues come from. Stormwater program funding is discussed later in this memorandum.

(4) Transfer to Capital Fund includes funds to pay capital expenses, central services on capital expenses, and accumulate appropriate Capital Fund reserves.

Tables 8, 9, and 10 show that the program revenues for Tiers A, B, and C respectively are:

- Tier A: $565,000 per year
- Tier B: $675,000 per year
- Tier C: $825,000 per year

Note that in Tier A, there is an accumulation of reserves in the Operating Fund because capital expenditures are higher in the first few years of the six-year planning period. If some expenses were deferred to later in the six-year planning period so that reserves do not accumulate above the minimum values, the overall program revenues for Tier A could be reduced from $565,000 per year to $450,000 per year.

Similarly, for Tier B, if some expenses were deferred so that reserves do not accumulate above the minimum values, the overall program revenues for Tier B could be reduced from $675,000 per year to $605,000 per year.

For Tier C, there is no reserve accumulation beyond the minimum balances.

Funding Alternatives

Introduction

This section describes how the City could pay for stormwater program activities, including the following:

1. Continuing to pay from water and sewer utility revenues
2. Ad valorem property tax assessment
3. Establishing a stormwater fee
4. Formation of a special purpose district
5. A combination of all of the above

The difference among these alternatives is how much different types of customers pay for services. There is no difference in the total amount of money collected – each alternative is developed to collect the same amount of money in total. The alternative with the lowest cost for a single-family residence will result in the highest cost from other customers.

When deciding among these alternatives, the City should consider equity and ease of administration. Equity may be viewed as a policy or philosophy the City could choose to adhere to, and there may also be legal ramifications.[3] A common test is whether there is a reasonable relationship between the amount charged and the service provided. Utility rates do not have to be perfect to be considered equitable, but they need to be reasonable.

[3] This document *is not* a legal opinion, as neither FG Solutions, LLC nor Herrera Environmental Consultants are attorneys who provide legal services.

In many jurisdictions, a stormwater fee is established to pay for stormwater program costs. Stormwater fees are based on parcel characteristics, most commonly relying on the amount of impervious surface associated with each parcel. This fee basis works because the publicly-owned stormwater system collects runoff from parcels, and the amount of runoff is presumed to be reasonably proportional to the amount of impervious surface.

Sequim is different from many jurisdictions, particularly those in western Washington, because runoff in much (but not all) of the City is infiltrated on-site. In most parts of the City, there is very little piped stormwater conveyance. Also unlike many jurisdictions, Sequim requires new development to direct runoff from roof areas to dry wells and a lot of new commercial development manages all stormwater on site. As a result, in Sequim there is a much weaker link between impervious area on a parcel and runoff.

Table 11 describes additional characteristics of the City's stormwater program that will be considered as the financial impacts of the above alternatives are evaluated.

Table 11
Sequim Stormwater System Characteristics

Stormwater System Characteristic	Implication
Runoff from most of the parcels in the City is handled via on-site infiltration	A cost recovery structure based solely on parcel impervious area is not appropriate.
Much of the piped stormwater conveyance in the City is in the central business district.	Parcels with on-site management of stormwater may not want to pay to address runoff in the central business district via a fee based on parcel impervious area.
A large percentage of runoff into piped conveyance system is from rights-of-way. Existing maintenance costs are mostly related to maintenance of piped conveyance systems in rights-of-way.	A cost recovery structure based on parcel impervious area is not appropriate, unless it is understood that parcel impervious area is a proxy measurement for the use of rights-of-way. As an alternative, paying for runoff generated from rights-of-way from the General Fund may also be appropriate.
Future public education efforts benefit water quality – not necessarily stormwater quality but groundwater quality because of stormwater infiltration.	Per parcel charges and/or parcel impervious area charges are appropriate and are an industry standard, though runoff from rights-of-way should be considered.
Some stormwater program activities are directly related to capturing runoff for aquifer recharge.	Considering these activities as a water supply activity and recovery through water rates may be appropriate.
Part of the City's costs are related to managing stormwater originating outside the City limits in Bell Hill	The City should seek a legal opinion regarding whether a portion of the outside City limit surcharge on wastewater bills charged to Bell Hill customers can be used to pay relevant City costs. This is discussed in further detail below.
Stormwater program activities benefit residents and businesses outside the City limits.	The City could investigate the feasibility of forming a special purpose district that could extend beyond the City limits. The City should clearly show the link between the fees charged and services provided.
Some new program elements public education efforts benefit water quality – not necessarily in stormwater runoff but in groundwater because of stormwater infiltration.	Per parcel charges and/or parcel impervious area charges are appropriate.

Alternative 1. Continuing to Pay from Water and Sewer Rates

Current Financial Impacts

In the 2015 budget, the Water Utility pays $55,000 for stormwater services and the Sewer Utility pays an additional $55,000. This is approximately from $1.60 to $2.10 per month per household. This financial impact depends on the amount of water use, and the above range is for water use between 400 and 1000 cubic feet per month. Additional detail of this calculation is included in the Appendix.

Potential Financial Impacts

The financial impact to any given customer will vary depending on total water use and winter water use. For most single-family residential customers, they are projected to be:

- No Change: approximately $1.60 to $2.10 per month
- Tier A: approximately $8.60 to $11 per month (incl. current $1.60 – $2.10/month)
- Tier B: approximately $10.30 to $13.20 per month (incl. current $1.60 – $2.10/month)
- Tier C: approximately $12.60 to $16.10 per month (incl. current $1.60 – $2.10/month)

These ranges are based on a range of water use of 400 to 1,000 cubic feet per month, and include the costs currently recovered through water and sewer rates (~$1.60 - $2.20 per month) and the costs of proposed program elements. Additional detail is included in the Appendix.

Equity Considerations

Even though the stormwater costs would be split 50/50 between water and sewer, this Alternative links payment for stormwater costs to water use because residential sewer bills are based on winter water use, and commercial sewer bills are based on water use.

In many cities, water use has some relationship to impacts to the benefits provided by a stormwater program. It is possible that the customers with the highest water and sewer bills also have more impervious surfaces that generate runoff and practices that influence water quality. But the link is far from perfect, particularly when considering the amount of stormwater that is managed on-site. A restaurant, as another example, may have high water use on a small site. A business with a parking lot might have low water use, but with a large impervious surface area.

Water use also does not account for runoff generated from rights-of-way.

That being said, some water utility support is reasonable recognizing that infiltrated stormwater has a water supply function, and recognizing the direct costs associated with capturing wet-season irrigation ditch flow for recharge.

In addition, some of the City's costs for managing stormwater are the result of stormwater runoff generated outside the City limits, particularly from the Bell Hill area. The City currently provides sewer service to Bell Hill and applies a 50 percent sewer rate surcharge for customers outside the city limits. It may be desirable to dedicate a portion of this surcharge to cover the

City's stormwater expenses applicable runoff generated in the Bell Hill area. If the City is interested in pursuing this option, the City should obtain a legal opinion of this strategy.

Administrative and Implementation Considerations

From a billing perspective, this alternative is easy to administer, as water and sewer billing mechanisms are already in place.

Of the alternatives, this is the easiest to administer. It could be implemented by the Sequim City Council by adopting water and sewer rate increases. Adopting water and sewer rate increases is not necessarily easy, but could be a more straightforward approach than the other two alternatives.

Alternative 2. Ad Valorem Property Tax Assessment

Potential Financial Impacts

Financial impacts will depend on the assessed valuation of each specific property. The City's assessed valuation estimate in its 2015 budget is just over $823 million, and to recover the entirety of stormwater program costs through ad valorem taxes, the assessment per $1,000 of assessed valuation would be:

- No Change: none; recovery of costs through water and sewer rates would continue
- Tier A: $0.686 per $1,000 assessed valuation
- Tier B: $0.820 per $1,000 assessed valuation
- Tier C: $1.002 per $1,000 assessed valuation

For a property with an assessed valuation of $185,000[4], the estimated financial impact is shown below. For Tiers A, B, and C, the property tax impact is partially offset by the reduction in revenues collected through water and sewer rates.

- No Change: none; recovery of costs through water and sewer rates would continue
- Tier A: $10.58 per month of new property taxes, less $1.60-$2.10 per month through discontinued water/sewer rate support
- Tier B: $12.63 per month of new property taxes, less $1.60-$2.10 per month through discontinued water/sewer rate support
- Tier C: $15.44 per month of new property taxes, less $1.60-$2.10 per month through discontinued water/sewer rate support

Additional detail, including the estimated financial impact at other assessed valuations, is included in the Appendix.

[4] City staff report that the median assessed valuation of a single-family residence to be approximately $185,000.

Equity Considerations

With this alternative, the sole link between revenues and services is assessed value. There is likely some relationship, as, for example, single-family residential parcels with a higher assessed value tend to be larger and contain more surfaces that generate runoff and/or infiltration. The relationship is far from perfect, and does not capture neighborhood differences in assessed value. Further, ad valorem taxes could only be collected from parcels within the city, so the costs incurred by the City to address runoff generated outside the City are not addressed. Additionally, an analysis has not been performed to consider the relationship between non-residential assessed value and impacts to the City's stormwater program.

Further, use of assessed value does not account for property that is not on the tax roll, such as schools, churches, and municipally-owned properties such as parks or maintenance yards. An ad valorem tax is one way to recognize the financial impacts of runoff generated from public rights-of-way.

Administrative and Implementation Considerations

This alternative should be simple to administer, since the tax roll already exists. It may be difficult to implement, however. Table 12 shows that the annual stormwater revenue requirement is a large percentage of the City's existing property tax revenue, so dedicating existing property tax revenue to fund stormwater activities is probably not feasible.

Table 12
Alternative 2: Comparison of Stormwater Costs with Property Tax Revenues

Comparison with City's Property Tax Revenues	Tier A	Tier B	Tier C
City's Certified Property Tax Levy (1)	$1,412,860	$1,412,860	$1,412,860
Annual Stormwater Funding	$565,000	$675,000	$825,000
Annual Stormwater Funding, as % of City's Tax Levy	40%	48%	58%

Notes:
(1) Source: 2015 Budget Page 44, includes prior year + 1% increase
+ 2015 new construction + rollover refunded amounts

Instead, the City would likely have to raise property taxes to pay for the costs of Tiers A, B, or C, likely requiring a public vote in order to do so.

Alternative 3. Establishing a Stormwater Fee

Potential Financial Impacts

The potential financial impacts of a stormwater fee are difficult to predict because the customer base is not known. As described in the Appendix in more detail, stormwater fees are typically based in part on the amount of impervious surface on a parcel. Impervious surface data for residential and non-residential parcels in Sequim is not currently readily available.

An estimate of the stormwater customer base was made based on system data from nearby cities with stormwater utilities, as described in the Appendix. This estimated customer base was used to develop the following estimated stormwater fees for single-family residences:

- No Change: none; recovery of costs through water and sewer rates would continue
- Tier A: $12 - $18 per month, less $1.60-$2.10 per month through discontinued water/sewer rate support
- Tier B: $15 - $21 per month, less $1.60-$2.10 per month through discontinued water/sewer rate support
- Tier C: $18 - $26 per month, less $1.60-$2.10 per month through discontinued water/sewer rate support

Additional detail is included in the Appendix.

These fee impacts are higher than for the other alternatives, meaning that the amount of stormwater program revenue collected from non-residential customers would be lower under this alternative.

In practice, there is a wide variety of stormwater rate structures. Nearly all of them have one feature in common: they are based in part on the amount of impervious surface on a parcel. There are many variations that are discussed in more detail in the Appendix.

Equity Considerations

A stormwater fee is the industry standard in Western Washington, particularly for cities the size of Sequim or larger. It is considered to be equitable – with modifications that are community-specific to fit the circumstances of the community.

As described above, however, managing runoff in Sequim is different from most other communities, because runoff in much (but not all) of the City is infiltrated on-site. In most parts of the City, there is very little piped stormwater conveyance. An exception to this is the central business district, where piped stormwater conveyance systems exist that direct much of the runoff to City-owned and maintained infiltration sites. As a result of the widespread use of onsite infiltration, in Sequim there is a much less obvious link between impervious area on a parcel and runoff (when compared to other jurisdictions).

While an impervious-area based fee might be applicable for a portion of stormwater program funding, particularly if all single-family residences are charged the same amount, it may not be applicable to fund the stormwater program in its entirety.

If the City pursues implementing a stormwater fee for all or part of the stormwater program cost, the City should refer to additional discussion in the Appendix, describing additional considerations of a stormwater fee.

Implementation and Administration

Implementation of a stormwater fee is more difficult than the continued use of water/sewer rates and ad valorem taxes. A detailed description of implementation steps is beyond the scope of this memorandum, but includes development of billing information for all parcels, defining a

rate structure, and modifying the billing system to accommodate addition of a stormwater bill. Some cities have chosen to add stormwater billing to property tax statements – if done this way, the bill would be sent to the owner of the property and not the resident of the property. A public involvement and education effort is also necessary, as a stormwater fee will have financial impacts to residents, businesses, schools, and churches, particularly those with large paved areas.

Because of the additional complexities of billing, a stormwater fee would also harder to administer. Billing data from newly developed parcels must be compiled and billing data from all other customers must be periodically verified to reflect changes in surface coverage.

Alternative 4. Special Purpose District

The City could choose to pursue forming a special purpose district to recover all or a part of stormwater program costs. A special purpose district has one advantage in that the boundaries could extend beyond the City limits and recover costs the City incurs due to runoff generated and/or services provided outside the City limits. However, there would need to be a clear link between the service provided and the monetary assessment to each parcel in the district. A district would have its own governance and therefore would not be a department of the City.

Across Washington, there are several examples of special purpose districts that provide services related to water quality. Three examples are:

- The Sequim-Dungeness Clean Water District, formed in 2001 by the Clallam County Commissioners pursuant to Revised Code of Washington Chapter 90.72.
- In 1993, the Snohomish County Council created the Stillaguamish River Clean Water District (CWD) to "provide a comprehensive approach to managing and regulating surface water in order to respect and preserve the county's rivers, streams, lakes, and other waterbodies"
- The Kitsap Conservation District offers technical assistance to landowners to help preserve our natural resources. The District is a non-regulatory organization working cooperatively with private landowners to reduce soil erosion and improve water quality. The District works with farmers and others with soil and water quality concerns.

Financial implications are not assessed as further evaluation is needed to define the purpose of a proposed district, the applicable services, the cost of these services, and a proposed boundary. This financial evaluation does not provide the implementation path or define the legislative authority for district formation inside or in the vicinity of the City.

Alternative 5. Multiple Funding Alternatives

Description

From the above discussion, it may be most equitable to use a combination of the above alternatives to pay for stormwater program costs.

- Water utility support: recognizing that infiltrated stormwater has a water supply function, and recognizing the direct costs associated with capturing wet-season irrigation ditch flow for recharge.
- Sewer utility support: if allowable, using part of the outside City limits surcharge collected from Bell Hill sewer customers to recognize the City's costs in managing runoff generated in Bell Hill. This strategy should be reviewed by the City's legal counsel.
- Stormwater fee: recognizing some program elements might best be charged to all customers based on a factor other than water use. A per-parcel stormwater fee might be best for residential customers, with an appropriate modification for non-residential parcels.
- Rights-of-way cost recovery: the City's rights-of-way are a significant contributor to generation of runoff and the City's stormwater program costs.
    - Ad valorem property taxes can be appropriate method.
    - Folding right-of-way cost recovery into a stormwater fee is also appropriate, if done in a reasonable way. A flat per-parcel component of a fee might be appropriate for residential customers, with a corresponding modification for non-residential customers.
- Special purpose district: if the appropriate link between services and assessments can be developed, a special purpose district might be appropriate for a portion of the stormwater program costs.

Financial Impacts

Financial impacts are not developed for this alternative at this time. The most appropriate time to develop an estimate of the financial impacts is after specific funding sources have been identified (and/or ruled out). In general, however, the financial impacts will be in the range of those shown for Alternatives 1, 2, and 3.

Equity Considerations

This alternative is potentially the most equitable. It could be developed to maximize the link between the funding source and the service paid for.

Implementation and Administration

This alternative would be the most difficult to implement and administer, because of its complexity. It would combine the implementation and administrative considerations of all of the above alternatives.

Affordability

The financial impacts associated with all of these alternatives are large. FG Solutions strongly encourages the City to have a detailed and transparent dialog with its residents and businesses to assess priorities and the affordability of these potential program changes.

Appendix

Additional Detail: Stormwater Services Included in Existing Water and Sewer Rates

Table A-1 below is an estimate of the financial impact of this existing funding to the Water Utility and the Sewer Utility. As a percent of utility revenues, the Water Utility's contribution is approximately 2.9 percent of the utility's operating revenues, and the Sewer Utility's contribution is approximately 1.5 percent.

The amount per household varies depending on total water use and winter water use. As shown in the table below, it typically ranges from $1.60 to $2.10 per month, assuming water use ranges between 400 and 1000 cubic feet per month. A standby connection would pay $1.36 per month for these services.

Table A-1
Existing Water and Sewer Utility Support

Parameter	Unrestricted Water Fund	Unrestricted Sewer Fund
Revenues, 2015 Budget (1)	$1,846,498	$3,647,931
Contribution to Stormwater Utility		
$ per year	$55,000	$55,000
% of Revenues	3.0%	1.5%
$/month Impact to Example Single-Family Residential Customers		
Water Customer	$/month	Total Monthly Bill
Single-Family Residence, 400 cf/month	$0.78	$26.32
Single-Family Residence, 700 cf/month	$0.90	$30.31
Single-Family Residence, 1000 cf/month	$1.12	$37.44
Single-Family Residence, Standby Rate	$0.69	$23.11
Sewer Rate Customer		
SFR, Winter Average < 600 cf/month	$0.89	$59.11
SFR, Winter Average > 600 cf/month	$1.03	$68.59
SFR, Standby	$0.70	$46.22
Total		
SFR, 400 cf/month	$1.68	$85.43
SFR, 700 cf/month, winter avg < 600	$1.79	$89.42
SFR, 1000 cf/month, winter avg > 600	$2.15	$106.03
SFR, Standby	$1.39	$69.33

Notes:
(1) 2015 Budget. Excludes late fees, investment interest, and revenues from acceptance of biosolids.

Additional Detail: Financial Impacts, Alternative 1

Table A-2 provides additional detail on the financial impacts associated with funding the entirety of the stormwater program costs from water and sewer rates. The calculation shown assumes that the stormwater costs are split 50/50 between the water and sewer utilities.

Table A-2
Alternative 1: Continued Funding from Water and Sewer Rates

Additional Annual Contribution From Water and Sewer Utilities	Tier A	Tier B	Tier C
Water Utility Impact			
Existing Contribution	$55,000	$55,000	$55,000
Additional Contribution (1)	$227,500	$282,500	$357,500
Total Contribution	$282,500	$337,500	$412,500
Additional Contribution, as % of Water Rate Revenues	12.3%	15.3%	19.4%
Total Contribution, as % of Water Rate Revenues	15.3%	18.3%	22.3%
Sewer Utility Impact			
Existing Contribution	$55,000	$55,000	$55,000
Additional Contribution (1)	$227,500	$282,500	$357,500
Total Contribution	$282,500	$337,500	$412,500
Additional Contribution, as % of Sewer Rate Revenues	6.2%	7.7%	9.8%
Additional Contribution, as % of Sewer Rate Revenues	7.7%	9.3%	11.3%

$/month Impact to Example Single-Family Residential Customers	Tier A	Tier B	Tier C
Water Customer			
Single-Family Residence, 400 cf/month	$4.03	$4.81	$5.88
Single-Family Residence, 700 cf/month	$4.64	$5.54	$6.77
Single-Family Residence, 1000 cf/month	$5.73	$6.84	$8.36
Single-Family Residence, Standby Rate	$3.54	$4.22	$5.16
Sewer Rate Customer			
SFR, Winter Average < 600 cf/month	$4.58	$5.47	$6.68
SFR, Winter Average > 600 cf/month	$5.31	$6.35	$7.76
SFR, Standby	$3.58	$4.28	$5.23
Total			
SFR, 400 cf/month	$8.60	$10.28	$12.56
SFR, 700 cf/month, winter avg < 600	$9.21	$11.01	$13.45
SFR, 1000 cf/month, winter avg > 600	$11.04	$13.19	$16.12
SFR, Standby	$7.11	$8.50	$10.39

Notes:
(1) Assumes stormwater program costs are split 50/50 between water and sewer.
Financial impacts in this table include the existing services funded through water and sewer rates.

Additional Detail: Ad Valorem Property Tax Assessment

Table A-3 shows the potential financial impact of recovering the stormwater revenue requirement through an ad valorem property tax assessment.

Table A-3
Alternative 2: Ad Valorem Property Tax Assessment

Financial Impact per $1,000 Assessed Valuation	Tier A	Tier B	Tier C
City's Total Assessed Value, 2015 (1)	$823,614,967	$823,614,967	$823,614,967
Total Annual Stormwater Funding			
Dollars Per Year	$565,000	$675,000	$825,000
As $/1,000 Assessed Value	$0.686	$0.820	$1.002
Impact to Single-Family Residence, $/month	**Tier A**	**Tier B**	**Tier C**
Assessed Valuation: $100,000	$5.72	$6.83	$8.35
Assessed Valuation: $150,000	$8.58	$10.24	$12.52
Assessed Valuation: $185,000 (2)	$10.58	$12.63	$15.44
Assessed Valuation: $200,000	$11.43	$13.66	$16.69
Assessed Valuation: $250,000	$14.29	$17.07	$20.87
Assessed Valuation: $300,000	$17.15	$20.49	$25.04
Assessed Valuation: $400,000	$22.87	$27.32	$33.39
Assessed Valuation: $500,000	$28.58	$34.15	$41.74

Notes:
(1) End of Year Estimate. Source: City's 2015 Budget Page 44
(2) Estimate of median single-family residential assessed value (source: city staff)

Table A-3 shows the financial impact to a single-family residence. Compared with the other two alternatives, there is a wider range of impacts for single-family residences. At a median assessed value of $185,000, the monthly impact for the three tiers is $10.58, $12.63, and $15.44 per month, respectively.

These impacts are partially offset by discontinuing the financial support from the water and sewer utilities. As described above, support from existing water and sewer rates would be approximately $1.60 to $2.10 per month, so the net impact to the single-family residence at the median valuation is comparable with continued water and sewer rate support.

Additional Detail: Stormwater Fee

Table A-4 shows an estimate of the stormwater fee customer base, using data from six nearby cities. The goal is to estimate the number of equivalent residential units ("ERUs") in Sequim, using the number of single-family residences and an estimate of total ERUs based on revenues.

Table A-4
Alternative 3: Estimated Stormwater Fee Customer Base

City	Single-Family Residential Monthly Rate	Stormwater Fund Rate Revenue (1)	Equivalent Residential Units (2)	No. of Single-Family Residences Total (3)	% of ERUs
Aberdeen	$6.69	$485,000	6,041	4,900	81%
Hoquiam	$8.83	$375,000	3,539	2,856	81%
Oak Harbor	$14.22	$1,736,339	10,175	5,793	57%
Port Angeles	$12.00	$1,455,000	10,104	6,828	68%
Port Townsend	$7.25	$517,444	5,948	4,002	67%
Poulsbo	$16.43	$1,020,000	5,173	2,910	56%
Average	$10.90				**68%**

City of Sequim Estimate	Low	Middle	High
Number of Single Family Residences (3)	2,109	2,109	2,109
Single-Family Residences, as % of Total ERUs (4)	80%	68%	55%
Estimated Number of ERUs (5)	**2,640**	**3,090**	**3,830**

Notes:
(1) Sources: 2015 Budgets for the six cities
Aberdeen: 2015 Budget, pdf page 105 of 116, http://aberdeenwa.gov/wp-content/uploads/2015-Budget.pdf
Hoquiam: $750,000 for the biennium, page 79 of budget. No separate number included. Water, sewer, storm rate revenue are bundled together for accounting purposes. Only reference to storm revenues is a graph. increasing to $10.83 by 2017
Oak Harbor: 2015/16 Biennial Budget, page Budget, page 131.
http://www.oakharbor.org/uploads/documents/9472015_2016__budget_document.pdf
Port Angeles: 2015 budget, page 211. https://wa-portangeles.civicplus.com/DocumentCenter/Home/View/2114
Poulsbo: 2015 budget, page 138 of General Ledger Budget Analysis, https://weblink.cityofpt.us/weblink/0/edoc/115406/2015%20Final%20Budget.pdf
Port Townsend: City's budget page 7-24.
https://www.cityofpoulsbo.com/finance/documents/2015_Final_Budget.pdf
(2) Calculated by dividing stormwater rate revenue by the single-family monthly rate, and dividing by 12.
(3) Source: Washington Office of Financial Management, April 1 housing and population estimates (2014)
(4) Low: SFR = 80% of ERUs, ~ one end of the range of other cities; medium uses the average of the six cities. High uses the other end of the range of the other cities.
(5) Number of SFR divided by SFR as % of total; rounded to nearest 10

The estimated number of stormwater ERUs is a range from 2,640 to 3,830, and using average data from other cities produces an estimated 3,090 ERUs.

Table A-5 shows the calculation of the financial impact per month per ERU, for each tier and for the range of ERUs shown in Table A-4.

Table A-5
Alternative 3: Estimated Stormwater Fee Calculation

	Monthly Stormwater Fee per ERU (1)		
Number of ERUs	Tier A	Tier B	Tier C
Low End of Range	$17.80	$21.30	$26.00
Middle of Range	$15.20	$18.20	$22.20
High End of Range	$12.30	$14.70	$18.00

Note:
(1) Draft. There is considerable uncertainty in the number of stormwater ERUs. A single-family residence by definition = 1.0 ERUs. The existing funding of $1.60 to $2.10 per month through water and sewer rates would be discontinued.

Rate Structure Options

In practice, there is a wide variety of stormwater rate structures. Nearly all of them have one feature in common: they are based in part on the amount of impervious surface on a parcel. There are many variations. Some of the more common are as follows, separated by considerations of single-family residences and other parcels.

Single Family

To minimize administrative costs, single-family residences are typically grouped into customer classes, so that individual parcel measurements do not need to be calculated for each residence. Rate structures can include:

- Flat monthly rate for each single-family residence. This rate structure is often chosen for administrative reasons, as the majority of parcels in a city are single-family residences and a flat rate removes the need to collect and monitor parcel specific data. Other nearby cities (Port Angeles, Port Townsend, Oak Harbor, Aberdeen, Hoquiam, and Burlington) have this rate structure.
- Tiered rates based on ranges of total parcel area. The idea behind this rate structure is that larger parcel areas typically contain more impervious surface and generate more runoff. For example, the City of Seattle has four parcel size tiers. The City of Bellevue uses a unit charge structure approach where the monthly charge is flat for every 2,000 square feet of parcel area.
- Tiered rates based on building footprint. This rate structure is based on the building footprint, and is based on the premise that larger footprints generate more runoff. For example, the City of Bellingham has three rate tiers that are based on building footprint square footage (square footage of house plus garage; paved driveways are not included).

Multi-Family Residential and Non-Residential

Because of the variability in area and surface types, non-residential parcels are typically characterized on a parcel-by-parcel basis. The two most common rate structures in Western Washington include:

- Per-ERU Rate. In this rate structure, ERU means equivalent residential unit, and is defined as the average impervious area on a single-family residential parcel. A sample of single-family residences is measured for impervious area to generate the impervious square footage equal to one ERU. The amount of impervious surface associated with every other parcel is measured or estimated using aerial photographs. The number of ERUs is calculated by dividing the total parcel impervious area by the ERU impervious area. The stormwater bill is the per-ERU rate times the number of ERUs. The per-ERU rate is typically also applied to each single-family residence.
- Density of Development Rate. This rate structure groups customers into rate categories, often five or six, by ranges of impervious area (for example, 35% to 55%, 55% to 75%, or over 85%). Per-acre unit costs are established, and the customer is billed according to the total parcel area and appropriate rate category. Some utilities, like Seattle Public Utilities, use units of 1,000 square feet instead of acres.

Variations to Accommodate Semi-Pervious Surfaces

Some stormwater rate structures, particularly non-residential rate structures, recognize the impact from semi-pervious surfaces. One method for doing this uses the concept of "effective impervious area" by acknowledging that during periods of heavy rainfall, there can be runoff from pervious surfaces and that some surfaces (e.g., gravel) can result in incidental infiltration. Seattle Public Utilities uses a different approach, where "low impact" non-residential accounts are charged a reduced rate, and eligibility for the low impact rate is based on the types of parcel surface.

Stormwater Rate Credits

There is a wide variety of stormwater rate credits. Some of the more common include:

- Reduced rates if runoff is managed on-site. The amount of the credit can vary, and the amount of the credit sometimes depends on whether the municipality or the property owner is responsible for maintenance of the facility.
- Reduced rates for on-site management of stormwater using a dry well. This is usually a credit, and not an exemption, in part because the property owner still benefits from the stormwater system's conveyance of runoff from rights-of-way.
- Reduced rates for parcels that discharge directly to water bodies without use of the City's stormwater system. Because of right-of-way considerations, this is often a rate credit and not an exemption.
- Reduced rates for on-site water quality treatment. This often applies to commercial facilities, to recognize the potential water quality benefits.

Considerations in setting up a stormwater fee that affect equity include:

- How to structure the single-family residential rate.

- How to account for the costs of managing runoff from rights-of-way. Property characteristics such as impervious area do affect the amount of runoff from the parcel, but do not affect the amount of runoff from rights-of-way. The City may choose to not charge private property owners directly for the costs of runoff from rights-of-way; instead, the right-of-way is charged the same way any other commercial parcel would be charged. In effect, the City charges itself. In Washington, an additional advantage of this policy is that provides the ability to charge the Washington State Department of Transportation for right-of-way associated with state highways. *The fee estimates shown in Table 15 of this memorandum do not assume that the City charges itself a stormwater fee associated with rights-of-way.*
- How to structure rate credits, given the amount of stormwater infiltration and how it varies geographically: downtown areas have less infiltration and more piped stormwater conveyance systems.