City of Sequim

Stormwater Management Needs Assessment

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CITY OF SEQUIM

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Statements in this document examine potential risks and potential deficiencies in stormwater infrastructure. This document is not a statement of a speaking agent of the City of Sequim and does not constitute an admission of actual risks or deficiencies in stormwater infrastructure. In addition, the City of Sequim recognizes that any actual risks and deficiencies need to be examined for feasibility of repair or improvements which necessarily includes prioritization of the use of the City's limited resources.

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Part 1. INTRODUCTION

I. Approach

Sequim got its start as an agricultural center thanks to water, and hasn't stopped caring for it since. With this Needs Assessment, the City is formally approaching stormwater as an unrecognized resource rather than the liability it can be for many cities in western Washington. Resiliency requires that all resources are used and reused in a cost-effective, environmentally-responsible manner. It is the City's objective to manage risks introduced by stormwater by strategically integrating management of all water resources, including stormwater, groundwater, surface water, and reclaimed water quality and quantity.

This Assessment will help the City focus activities, coordinate efforts and pool resources, and establish tools for future assessment and planning for water quality and capital improvement projects. It compiles information on pertinent topics from technical reports, maps, GIS and other datasets, field inventories and inspections, and interviews and input from City street and utility crews. Regional stakeholders and water management partners have been consulted and will continue to play a significant role, since much of Sequim's stormwater comes from upstream of the City limits.



Shisho Sister City Friendship Garden pond at Carrie Blake Park showing a dry channel for Bell Creek. This middle reach of Bell Creek stops flowing in summer unless irrigation water from the Dungeness is released into the Creek far upstream.

The pond is fed by incidental stormwater and irrigation water, and year-round reclaimed water from the Reuse Demonstration project to the north.

II. City goals and policies

Assessing needs involves determining the gap between a baseline and a target. Since the City hasn't begun formal planning for stormwater management and is not bound by regulatory requirements, its goals have yet to be articulated. However, the City has acknowledged its responsibilities for:

- managing risks,
- environmental stewardship, and
- meeting pertinent regulatory standards.

The City is in a good position to create a stormwater management program addressing its unique issues within the framework of City policy and existing laws and regulations. Specific policy guidance may be found in the Comprehensive Plan, currently undergoing an update by the Department of Community Development.

A major update of the 2006 Comprehensive Plan is underway, scheduled to conclude in 2014. The process, called "Sequim 120," started with community visioning to guide the Plan update and the final land use map, goals and policies for future growth and development. The Vision Statement adopted by the City Council in August 2012 includes the following (emphasis added):

- Sequim's role as a major steward and purveyor of finite natural resources in the Valley will be reflected in a pattern of growth that promotes *efficiency in resource utilization and sustainable resource management*.
- The community's image and identity will be promoted by *active management and responsible stewardship of both the human-built and natural environments*.



These vision statements will be carried out in the language of the 2014 Plan update, and should be used by all City departments, including Public Works, in their operations and as they implement new programs and policies, and plan for infrastructure needs of the future. Themes carrying over from the 2006 Comp Plan include:

- Protect water resources
- Protect and enhance water quality
- Provide and maintain infrastructure for existing and future development

A complete list of elements from the 2006 Comprehensive Plan regarding stormwater, green infrastructure, and water quality are summarized in Table 1.

III. Report organization

Part 2, Existing Conditions, presents information on the current physical and operational conditions of stormwater management in Sequim.

Stormwater management needs are highlighted in green as they are identified in each chapter. Note that needs and problems listed are listed for the purpose of analysis and should not be interpreted as identification of any deficiencies on the part of Sequim. The City is addressing, prioritizing and seeking funding to address each issue as funding becomes available.

Each element highlighted in green in Part 2 is included (paraphrased) in the Needs Assessment summary found in Part 3. This list of compiled needs will be used to directly inform the next stage of stormwater management, development of Sequim's first surface water master plan and program in 2014-15.

TABLE 1. 2006 Comprehensive Plan elements related to stormwater

Chapter 5-A Environment	
Goal 1	Enhance water quality and water availability
Goal 5	Minimize hardscape, encourage "green" landscaping and green belts
Policy 1	Promote LID
Policy 7	Protect groundwater resources and aquifer recharge areas through stormwater management
Policy 8	Reduce impervious surfaces
Policy 9	Promote LID and green construction methods
Chapter 6 Shorelines	
Goal 16	Stormwater shall be maintained and treated on site
Policy 16	Design new development to minimize need for flood control works
Policy 26	LID will be required where feasible
Chapter 8 Utilities	
Goal 6	Protect surface water and ground water through control of stormwater
Policy 7	Use stormwater design standards to ensure containment
Chapter 9 Housing	
Goal 8	Incentivize reduced road pavement and paved ROW
Chapter 10 Economic Development	
Goal 2	Tourism based on natural resources, agricultural heritage and culture
Policy 9	Incentivize preservation of open space and natural areas
Policy 25	Enhance tourism based on natural resources, agricultural heritage and culture
Chapter 11 Parks & Recreation	
Policy 22	Upgrade parks to maximize long-term efficiencies of BMPs
Chapter 13 Capital Facilities	
Goal 1	Plan and provide for adequate capital facilities to serve existing and future development
Goal 9	Provide reliable water supply to all residents in City and UGA
Goal 12	Coordinate wastewater planning with environmental concerns
Goal 18	Protect integrity of stormwater system through use of current design standards and practices
Goal 19	Maintain stormwater treatment facilities
Goal 20	Provide funding to operate and improve stormwater drainage utility
Goal 25	Ensure new development pays its share of new capital facilities, including stormwater, sewer, etc.
Policy 2	Provide stormwater (etc.) facilities concurrent with new development
Policy 4	Support/encourage development and use of capital facilities with other governmental entities
Policy 6	Encourage water/energy/resource conservation in use and design of capital facilities
Policy 7	Ensure adequate funding to support existing facilities prior to construction of new
Policy 8	Coordinate with other jurisdictions on capital facility improvements needed for regional growth
Policy 34	Promote programs and ordinances that protect groundwater resources in wellhead protection areas and critical aquifer recharge areas
Policy 38	Assure capital costs are within the financial capability of the community when proposing projects
Policy 39	Establish fees to recover utility costs
Policy 40	Construct utility extensions needed for orderly development, and require cost sharing among beneficiaries
Policy 42	Maintain working capital, operating, and contingency funds for existing capital facilities
Policy 43	Set aside reserve funds
Policy 49	Apply "out-of-city" rates for sewer and storm-drainage to reflect additional costs
Policy 56	Require approved source control BMPs to maximum extent possible
Policy 57	Maintain stormwater utility rates to allow O&M and capital improvements
Policy 58	Establish fees to recover stormwater utility costs
Policy 59	Pursue other funding resources (state grants, low interest loans) to address stormwater needs

Part 2. EXISTING CONDITIONS

PHYSICAL SETTING

Like most things, stormwater follows the path of least resistance. The drainage basin, or watershed, is the land area where water follows various paths—streams, ditches, pipes, etc.—and drains to a common point such as the mouth of a river. Even water that infiltrates into the ground makes its way through, or under, a drainage basin and usually emerges again in a spring or wetland, or below sea level. The annual hydrologic cycle for a drainage basin determines the level of the water table and natural flow level in streams and wetlands, and sets the stage for the ecosystem of each "sub-basin."

Over the course of human settlement the natural cycle is often altered, and stormwater runoff is often associated with negative impacts. For example, when stormwater collects contaminants from the land it drains, the potential is high for environmental impact on receiving waters. Damage to property as well as fish and wildlife habitat is also likely when runoff volumes can't be handled within existing channels, culverts and ponds.

This section discusses stormwater's influence and potential physical/flow impact in the context of the natural environment in which Sequim is situated: the City limits lie within four drainage basins including Bell Creek, West Happy Valley, upper Gierin basin, and lower Johnson Creek. Figure 1 shows these drainage basins as well as the irrigation system that conveys stormwater in the wet season from the County into the City, across drainage divides, and back out to the County. Potential water quality impacts are discussed next.

I. Geologic setting

The original farm town of Sequim was established on a prairie in the middle of an ancestral floodplain of the Dungeness River, from when the River flowed east into what is now Washington Harbor and northeast into what is now Graysmarsh. During and after the Ice Age the Dungeness River occupied channels where Bell, Gierin, and Cassalery Creeks now are, according to modern geology maps. Linear shapes suggestive of flowing water are also visible on soils maps as well as aerial photos of the cleared, cultivated landscape from the 1950s. Underlying the ancient floodplain alluvium are glacial deposits ranging from coarse to very fine. Figure 2 describes area soils and their infiltration potential for stormwater.

The original farm town of Sequim was established on a prairie in the middle of an ancestral floodplain of the Dungeness River…

At the time westerners settled the area, the landscape around Sequim was mostly wooded with areas of open prairie and wetlands, according to maps from the mid-19th Century. Typical of that era, the settlers "improved" the land by clearing timber and draining wetlands, and the landscape changed rapidly. It changed even more after irrigation ditches were dug starting in the late 1800s—within 50 years ditches literally crisscrossed the prairie, delivering Dungeness River water to dozens of farms and ranches.

Decades of leaky ditches and flood irrigation on porous soils artificially raised the water table throughout the year—making it possible for households to tap a year-round water supply with a 30-40' well. The growing town of Sequim also took advantage of the irrigation system and filled a reservoir for City use from a lateral off the Highland Ditch south of town.

By the mid-1900s the Dungeness watershed's natural hydrology was probably obscured year-round. The regional water table was raised substantially by leaking ditches and flood irrigation, which enhanced the base flow in many small streams. Streamflows were also supplemented when irrigation water, sometimes tailwater, was directed into a stream channel. It would have been very easy for a ditch to have been mistaken for a natural creek – especially since fish were caught on a regular basis (see photo).



This photo shows the fish screen installed for the Highland Irrigation District near the diversion (head gate) from the Dungeness River. Before fish screens were installed in the second half of the last century, salmon, trout, and other fish traveled freely from the River into the irrigation system – to the delight of fishermen and women.

II. Climate

The Dungeness watershed is dry relative to most in Puget Sound, due to the "rainshadow" effect of the Olympic Mountains on storms which typically come from the west. The climate is mild with cool winters and warm, maritime, summers.

The City has maintained a weather station at the Water Reclamation Facility (WRF) since 1980, submitting data to the National Oceanic and Atmospheric Administration (NOAA) as site "Sequim 2 E." City staff records daily precipitation and high and low temperature. Monthly reports are available from NOAA (http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wa7544) or on the City's website: http://wa-sequim.civicplus.com/index.aspx?nid=458

Rainfall varies greatly between the upper and lower Dungeness watershed, with the City located in the lowlands. The WRF happens to be in an area of very low rainfall, but there are other weather stations operated by a variety of public and private entities recording precipitation in other locations throughout the watershed.

TABLE 2. Average monthly precipitation from 10/1/1980–3/31/2013

	Average Max Temp (F)	Average Min Temp (F)	Average Total Precip (in.)
Jan	46.6	31.4	2.11
Feb	48.4	31.3	1.26
Mar	51.9	33.8	1.35
Apr	55.8	36.8	1.08
May	61.1	42.6	1.29
Jun	65.3	47.5	0.98
Jul	69.7	50.1	0.56
Aug	70.4	49.5	0.58
Sep	66	44.7	0.78
Oct	58	38.7	1.4
Nov	50.6	34	2.73
Dec	45.8	30.9	2.09
Annual	57.5	39.3	16.21

Storm events of specific sizes (rainfall amount, intensity, etc.) in a given locale are statistically categorized according to their frequency. Those frequencies, for example storms with 2- and 10-year return periods, can be used to guide the design of stormwater facilities. (Not that the information is Table 3 is taken from general sources and a very crude analysis of Sequim storm frequencies.)

TABLE 3. Typical design storm sizes and occurrence over the past 25 years

Inches of rain in 24 hours	Frequency	Standard for design	Occurrence in past 25 years*
0.5 – 1	6 months	Avoid chronic property and environmental damage from ponding, erosion, etc.	~87
1 – 1.5	2 years	Protect stream and ditch channels from erosion	13
1.5 – 2	10 years	Ensure adequate conveyance, avoid flooding	3
2 – 2.5	25 years	Anticipate impacts of flooding	1
2.5 – 3	50 years	(50 and 100) Define limits of floodplains and	0
> 3	100 years	anticipate impacts of a major flood	0

**Western Regional Climate Center website for "Sequim 2 E" (station at Sequim WRF), 3/12/1989 – 3/11/2014*
http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wa7544

Identified need:
Global climate change is expected to, among other things, affect the size and frequency of storms in the Pacific Northwest. To avoid exposure to risk the City should anticipate short- and long-term effects of a changing climate on stormwater runoff volume, timing, and velocity. The impacts on area water resources as a whole from reduced or increasing recharge, and the volume and timing, should also be explored.

III. Drainage basins

Natural and man-made drainage systems are shown on attached maps, Figures 4a–f. Irrigation systems and stormwater facilities are constantly changing, so the mapped elements may not be up to date. Locations of surface discharge to creeks are marked on the maps and listed below. A discussion of the hydrology, stormwater runoff, and habitat aspects for each sub-basin (as drawn in Figure 1) follows.

A. Bell Creek

The 1859 government land office survey map (Figure 3a), prepared before the irrigation system was built, shows a substantial wetland at the base of the northern bluff of what we now consider the valley of lower Bell Creek. It was potentially connected to Washington Harbor but no stream is indicated. The same map shows a north-flowing stream coming down from Happy Valley, which seems to disappear in wetlands at the margin of the ancient floodplain where Hwy 101 is now. This ravine channel is now known as upper Bell Creek. The 1859 map gives no indication that the Happy Valley drainage is surficially connected to the lower valley wetlands or Washington Harbor.

Subsequent maps, such as Figure 3b from 1914, show drainage and irrigation ditches connecting the two areas, creating continuous channels that conveyed water most of the year. It appears that the stream channel we now call Bell Creek between Highway 101 and the wetlands downstream of Rhodefer Road, including the Carrie Blake Park ponds, is man-made. It wasn't until fairly recently, when this channel stopped being used for irrigation conveyance all summer, that the ephemeral nature of the middle reaches of Bell Creek became well known.

…the stream channel we now call Bell Creek between Highway 101 and the Carrie Blake Park ponds is man-made.

i. Base flow

In the low-flow season of 2013, Bell Creek was flowing only below the wetland complex east of Rhodefer Road, at about RM 1.0. [1] Currently and for several years the upper Carrie Blake Park pond (connected to lower ponds by the creek channel) has been supplemented year-round with 0.1 cfs reclaimed water from the City's Water Reclamation Facility. During late summer 100% of this water infiltrates or is consumed by evaporation and transpiration, as Bell Creek between the ponds and the wetlands is dry.

The current base flow in summer months in the lowest reach between the wetlands and the mouth is 0.2-1 cfs (PGG 2008). Groundwater levels in this lowest portion of Bell Creek valley where the Creek flows year-round are <5 feet most of the year. At Carrie Blake Park in summer 2013, groundwater was at 3-5 feet near the ponds and 15-17 feet deep 0.1 mile to the north.

As mentioned above, middle reaches of Bell Creek are dry in late summer above the wetlands—but the upper reach has flow through the canyon where the gradient is steepest coming off Bell Hill. A small amount of base flow was detected in the canyon in late summer 2013, but it disappeared where the gradient flattens and the channel enters alluvial soils downstream of SR 101. Groundwater levels near

[1] Dry conditions were observed August-January 2013; a summer storm on 9/15/13 resulted in base flow extending to the undeveloped property between Sequim Ave. and S. Brown Road, but not beyond.

where Bell Creek flows through the City Shop property adjacent to Hwy 101 were 33-37' below ground surface in late summer 2013.

Typical winter flow in Bell Creek is 2-6 cfs at the mouth (PGG 2008). Late winter-early spring 2014 groundwater levels were: 33-35 feet at the City Shop and 14-15 feet north of Carrie Blake ponds.





In early fall 2013 there was a trickle of base flow in Bell Creek canyon (left photo) but none in the middle reach (right photo) such as at Hammond Road.

ii. Irrigation influence

It is critical to the understanding of Bell Creek history that until recently the middle and lower reaches were supplemented for the duration of the irrigation season with conveyance of 1-2 cfs of irrigation water from the Dungeness River for Highland Irrigation District customers downstream of Carrie Blake Park. It was well known by the ditchwalker that a lot of water was lost into the ground along the way. Now these customers are served by a well and/or reclaimed water.

The outtake for this conveyance from the Highland main canal is a weir located just west of the ditch crossing (siphon) at Bell Creek (RM 3.9). Now the weir is boarded up unless it is needed to spill water in the ditch to prevent overflow – or when the siphon screen clogs with branches and forest litter, backing the ditch up until the clog is removed. This occurs periodically throughout the year, which means the middle reaches of Bell Creek are still supplemented on an intermittent basis.

Identified needs:
HID field crew have to be diligent about cleaning the siphon, weekly most of the year but daily during fall, to prevent water from unintentionally spilling into Bell Creek. It is worth exploring whether additional options exist for managing storm flows in the ditch to prevent clogging the siphon and unintentional spillover to Bell Creek, especially during the wet season when middle reaches of Bell Creek receive more flow than the channel can handle.

Persistent streambank erosion that occurs in the ravine at the site of the overflow channel and where the siphon valve releases ditch water is a concern for several reasons. Erosion adds silt to the stream, degrading water quality and habitat, and the scouring damages private property. (Note that this same

situation occurs at the end of the main canal where tailwater enters Johnson Creek.) (Table 4 in the next section summarizes irrigation discharges to Bell Creek as well as stormwater discharges.)

The summer flow in the supplemented middle reaches above Carrie Blake was measured by various agencies and entities over several decades; 0-0.5 cfs was measured between July and September for the period 2005-07. In 2013 the groundwater level in central Sequim was 33-37' below ground surface.

It is obvious, now that the practice has stopped, that supplementation of Bell Creek with Dungeness River water created flow where there would be none at certain times of the year. What is not so obvious is how much leaking irrigation water recharged the floodplain and raised the water table.

Identified needs:
Historic measurements of seasonal groundwater levels could be compared with current measurements for the same area to estimate the amount of storage consumed by irrigation water prior to the wet season. This information is directly relevant to stormwater management since more storage capacity in the ground reduces the potential for flooding. Preliminary estimates indicate up to 30 ft. of floodplain storage may be available.

The Highland Ditch carries primarily irrigation diversions of 4-10 cfs from the Dungeness River during the irrigation season, April 15–September 15. During this period the ditch flow increases a small amount when shallow subsurface flow is intercepted, especially along the ditch's traverse of the slope down from Happy Valley.[2] It may increase significantly if a summer rain shower causes runoff to enter the ditch. In these cases the ditch is intercepting groundwater and runoff from the upper Bell Creek basin and transferring it into the Johnson Creek basin. Exactly how much the ditch captures Bell Creek base flow has never been studied, but at the same time there is likely a small amount of River water leaking into the Bell Creek basin through ditch leakage.

In winter, about 1-3 cfs is diverted from the Dungeness for stockwater. Yet the ditch flows high during a storm due to upland runoff, discussed in the next section.

iii. Storm flows and flooding

The headwaters of Bell Creek flow north from the County into the City's UGA when it crosses the east-west stretch of Happy Valley Road above Third Avenue. The Creek backs up into wetlands behind two separate culverts under Happy Valley Road after most storm events. These wetlands likely regulate storm flows very effectively. Both culverts are outside the City's UGA and are maintained by Clallam County.

When it enters the City limits, Bell Creek channel is incised 50-70' and steep (drops appx. 3' in elevation for every 100' of distance) until the point where the soils become alluvial and the gradient lessens, near US Hwy. 101. There are no known stormwater issues near the Creek in this steep reach; however, the natural hydrology of the vicinity is greatly affected by the Highland ditch, which traverses the drainage area for Bell Creek as well as West Happy Valley. The ditch intercepts substantial surface and shallow runoff and delivers it to Johnson Creek. Some of this runoff actually does end up in the Creek ravine because when a storm hits the ditch rises and forest litter clogs the siphon, causing the ditch to back up and spill over the weir into the spillway to Bell Creek (discussed above).

[2] Steve Gaither, personal communication, 9/9/13

The next lower reach flows over very low gradient, permeable soils between culverts under Brownfield Road, Hwy. 101, a long section of the City Shop property, Sequim Avenue, S. Brown Road, E. Washington Street, the north driveway for Bell Creek Plaza, Blake Avenue, and the entrance to Carrie Blake Park. Several sections of floodplain absorb high flows with their alluvial soils: a large parcel of undeveloped commercial property between Sequim Ave. and S. Brown Road, the restored reach behind Les Schwab, and the roadside ditch above Carrie Blake ponds.

As described at the beginning of this section, soil maps and historic aerial photos suggest that this area is an ancient floodplain of the Dungeness River. However efficient these stretches of floodplain are at absorbing runoff, there is not enough capacity for major storms – likely due to relatively shallow till that may extend throughout the vicinity.

The southern portion of the Bell Creek sub-basin including Bell Hill is mostly glacial till, a compact mixture of sand and clay that is not very permeable. With the addition of development with impermeable streets, roofs, and other surfaces, runoff is generated with even small storms. This runoff follows roadside and irrigation ditch channels until it is captured in retention and detention ponds or infiltrates once it hits permeable soils.

However efficient these stretches of floodplain are at absorbing runoff, there is not enough capacity to absorb major storms…

Identified needs:
Below are some of the major flooding and runoff problems in the Bell Creek drainage; refer to Appendix A for current lists of problem areas (contact Public Works for up-to-date information).

- Runoff into the City limits from Bell Hill is not fully contained in constructed ponds, and enters City ditches and other infrastructure, and undeveloped properties, on the south and north side of Highway 101. A good deal of this runoff ends up in Bell Creek.
- The 90-degree bend in the channel at S. Brown Road overflows and the culvert under E. Washington Street backs up and floods the intersection of those two roads.
- The parking lot at Bell Creek Plaza floods after a snow, or if the Creek and/or irrigation ditch overflows from runoff. Some of this runoff discharges directly to Bell Creek on the north side of the buildings.
- The 90-degree bend after the creek comes out of the Blake Road culvert overflows to the east into a wetland/former stream channel and across Carrie Blake Park, flooding the playground and south side of the parking lot.
- In the highest storm flows the ponds at the Park overtop their banks and water backs up behind the Rhodefer Road culvert.

Coordination with Clallam County and irrigation managers will be necessary to find resolution.

Downstream of Carrie Blake Park extensive wetlands on the north and south absorb storm flows to a limited degree. In extreme events the lower valley floods because Schmuck Road functions like a dam.

The eastern side of the City, south of Bell Creek and north of Highway 101, is an upland terrace of low-permeability till with several irrigation conveyances criss-crossing the area. Residential development is gradually replacing farm land and stormwater management requires flow abatement and ponds. Runoff may flow north toward Bell Creek, south toward Johnson Creek, or directly to Sequim Bay – depending on the slope of the land and whether irrigation ditches capture runoff along the way.

Identified needs:
Runoff problems for this upland area include:

- Some privately owned stormwater ponds can't contain high runoff events due to lack of capacity or proper maintenance.

Appendix A lists runoff and flooding problems identified in early 2014.

Table 4 lists the locations of surface water discharges to Bell Creek in or near the City and its UGA; these are shown on Figures 4a-f. Some of these discharges are common storm flows, some are extreme event flows, and some are year-round since they carry irrigation water in the summer.

TABLE 4. Surface discharges to Bell Creek

Discharge Location	Distance from mouth, in miles	Discharge Type
Schmuck Road	RM 0.2	Stormwater from roadside ditch (County/UGA)
90 degree bend	RM 0.6	Irrigation ditch tailwater, also carries spring water and stormwater (in County/UGA)
North of 90 degree bend	RM 0.65	Irrigation tailwater (in County/UGA)
Tributary confluence	RM 0.9	Spring flow from north-northwest, may include irrigation water in summer (at City/UGA boundary)
Rhodefer Road	RM 1.4	Stormwater from roadside ditches
Upper pond, Carrie Blake Park	RM 1.5	Reclaimed water (year-round, 0.1 cfs)
East end Gebhardt Park @ Blake Rd	RM 1.6	Potential storm overflow from QFC swales in extreme events
Northeast of Les Schwab	RM 1.7	Irrigation ditch tailwater; stormwater all season
E Washington St culvert @ Brown	RM 1.8	Stormwater / road drainage
S Brown Rd	RM 1.85	Stormwater all season via roadside ditch from south
E Hammond Street (apt. complex)	RM 2.2	Stormwater all season via roadside ditches
E side Sequim Ave near Burrowes' property line	RM 2.5	Potential stormwater from south, via culvert under Bypass (extreme only)
SR 101 culvert (just upstream on east side)	RM 2.7 E	Stormwater from east, via piping system (either from interchange, related to SR 101, or from Miller Road vicinity) (extreme only)
SR 101 culvert (just upstream on west side)	RM 2.7 W	Stormwater from west, via notch in SR 101 detention basin (extreme only)
¼-mile upstream from Brownfield Rd	RM 3.2	Irrigation ditch tailwater; stormwater potentially all season (need to confirm)
Highland main canal spillway to Bell Creek (weir)	RM 3.5	Stormwater spills into Bell when siphon clogs and backs up in wet season; irrigation water spilled occasionally for maintenance purposes
Highland main canal siphon (valve)	RM 3.6	Stormflow from Happy Valley vicinity; valve opened during hard freeze only (or irrigation maintenance)
Happy Valley Rd culvert (UGA boundary)	RM 3.8	Roadside ditches (County/UGA)
Happy Valley Rd upstream of UGA – eastern branch Bell Ck	RM 4.0	Roadside ditches (County)
Lake at SW base of Bell Hill – eastern branch	RM 4.5	Spring fed, runoff from roadside ditches (County)

iv. Fish habitat

The Jamestown S'Klallam Tribe monitors fish traveling downstream in the Spring at the mouth of Bell Creek (within the County, outside the UGA) as smolts leave to enter the estuary at Washington Harbor. Tribal biologists documented 1,170 coho salmon, as well as steelhead and cutthroat, outmigrating in 2013. The high number indicates that Bell Creek probably supports spawning by these species somewhere in its course, but it is possible that some individuals migrated in from saltwater before entering the trap going downstream. It is not known whether any species move into City jurisdiction such as the Carrie Blake ponds or further upstream during the high flow season.

General and specific habitat values of Bell Creek have been documented by Streamkeepers of Clallam County for several reaches, listed in Table 5. While the results were never finalized or published they provide at least a crude indication that habitat health is impaired and warrants further assessment.

TABLE 5. Habitat quality scores for Bell Creek

Site name	**Site description** (jurisdiction)	**Year** (PHI)	**Mean PHI score*** (0=low, 1=high quality)	**Year** (BIBI, always autumn season)	**BIBI score**** (10=low, 50=high)
Bell 0.1	d/s of Schmuck Rd (County)	1999-2004	0.45	1999-2005	13.5
Bell 0.8	at Spath DOT site (City)	1999-2004	0.24	2010	12
Bell 1.0	0.3 mi. d/s of Rhodefer Rd (City)			2008	16
Bell 1.8	u/s of Brown Rd (City)	1999-2004	0.31	2000	18
Bell 2.8	Brownfield Rd (City)			2010	44

*PHI = Physical Habitat Index for salmonids (Streamkeepers method), based on large woody debris, pools, canopy, sediment size, and bed stability.

**BIBI = Benthic Index of Biological Integrity (James Karr, 1997), an indicator of habitat health based on aquatic insect counts.

All culverts for Bell Creek in the City and UGA are listed in Appendix B.

Federal assessments designate Bell Creek as critical habitat for threatened/endangered bull trout (USFWS 2010); the associated map identifies the Creek from the mouth to the crossing of the Highland irrigation main canal. The same is *proposed* for Puget Sound steelhead (NOAA 2013), so the City started corresponding with NOAA regional offices in Portland regarding the ephemeral condition of the Creek to ensure they were aware. (Soule 2014)

"Smolt trap" near the mouth of Bell Creek, installed by the Jamestown S'Klallam Tribe Natural Resources Department. Fish caught in the trap are counted and released every morning while the trap is installed during a several-week period each spring.



B. West Happy Valley

i. Base flow and irrigation influence

The north slope of Burnt Hill drains to Happy Valley, a gently sloping terrace south of the City and UGA, elevated above the ancestral floodplain with large areas of glacial till and wetlands. Happy Valley drains from the County into the city in three directions: east to Johnson Creek, north to Bell Creek, and west to an unnamed channel on the ancestral Dungeness floodplain. This unnamed channel had a small amount of base flow in late summer 2013 (similar to Bell Creek canyon), likely absorbed by the floodplain in the dry season between irrigation season and when fall rains begin. Summer base flow from western Happy Valley is probably less than 1 cfs, but has not ever been monitored like some area creeks have been.

During irrigation season, the fate of this runoff is unclear since open irrigation ditches cross the channel on private property and mix with the natural flow. Various ditch channels run north-northeast across the broad, flat floodplain west and east of River Road—some managed by Highland Irrigation District (HID) and some by Sequim Prairie Tri-Irrigation Company (SPT). These ditches (and culverts) are constructed to efficiently carry River water, in season, through the City with little leakage or overflow.

There is no continuous channel that connects flow from this western portion of the City to Bell Creek, even though some relatively modern maps indicate an ephemeral or intermittent "west tributary" of Bell Creek joining the main channel just south of the Hwy. 101–Sequim Ave. intersection where Brownfield Road is now. Irrigation system maps show a now-abandoned ditch from the west meeting Bell Creek in the same place. This indicates that ditch tailwater probably entered the Creek in this location at one time, adding to natural flows. The earliest maps show a wetland where Bell Creek flow from the south (through the canyon) was absorbed by the floodplain and disappeared (Figure 3a).

The nearest shallow wells in this sub-basin have water levels at the time of construction of 40+ feet from land surface, but these are partially confined by a layer of low permeability at 10-20 feet (this layer is likely discontinuous, leaving openings where perched groundwater travels to deeper levels).

Portions of this "sub-basin" are within city limits and others are in the County or UGA.

ii. Storm flows and flooding

This area was subject to flood irrigation historically. Now land uses include some ranching and several large lots in the County UGA, and several moderate-density subdivisions in the City limits. The uppermost soils are very porous but are underlain by shallow till or other non-porous material. The tendency for flooding throughout the area is high by mid-winter, with moderate or greater rain events. Runoff is carried overland and in roadside ditches, mostly ending up in irrigation ditches that cross under Hwy. 101 in one of several siphons built when the Bypass was constructed.

The ditches convey stormwater in winter just as efficiently as River water in summer, until the runoff volume exceeds the capacity of a ditch or culvert – as it does regularly once the ditches reach culverts in the urban area. When a culvert backs up or a ditch overflows, runoff enters the City streets and infiltration facilities, which do have the capacity for the additional volume. Specific problem areas identified are listed in Appendix A (contact Public Works for up-to-date information).



Drainage from west Happy Valley and northwest Burnt Hill mixes with winter storm runoff that is overland as well as conveyed in the irrigation system, over-whelming the capacity of the ancient floodplain – and culverts under City as well as County roads. This photo was taken along Silberhorn Road on March 6, 2014.

The runoff discussed in this section is mostly from County areas south of the City (central and western Happy Valley). The runoff reaches the City via irrigation ditches that are managed to *not* carry River water during storms (headgates are closed).[3] The City, Clallam County and irrigators all have an interest in improving stormwater management in this area.

Also of interest, Highway 101 was constructed below grade through this sub-basin with berms along both sides to avoid the highway being flooded by stormwater. The lower relative elevation may create an opportunity for upland stormwater runoff management, with cooperation from Washington DOT.

Identified needs:
Specific flooding and runoff problems in the western UGA and City limits include:

- Falcon road and properties
- Silberhorn Road and properties
- McCurdy Road and 5th Avenue intersection

Cooperation with the County, irrigation managers, and DOT may be necessary to resolve these concerns.

Appendix A lists runoff and flooding problems identified in early 2014.

iii. Fish habitat

There is no identified fish habitat in the West Happy Valley sub-basin within the City or its UGA, and habitat values have not been documented.

Water quality and benthic macroinvertebrate data for the region are discussed later in this section; however, there are no data for sites in the West Happy Valley sub-basin within or near the City or UGA.

[3] It is common for the Highland Irrigation District headgate at the Dungeness River to plug when storm flows come through. It is also standard procedure for irrigation managers to close headgates to allow the ditches capacity for stormwater. Thus, during storms, nearly all the water in irrigation ditches is intercepted runoff. For example, the Highland main canal has a primary lateral off River Road which serves the area directly north. During storms, HID crews typically divert as much flow as possible into this lateral to allow more capacity for stormwater in the Highland main canal downstream where it skirts Happy Valley and Bell Hill.

C. Upper Gierin Basin

As shown in Figure 1, a large portion of the City/UGA is within the uppermost-part of the Gierin Creek drainage basin—even though the creek rarely has base flow until further downstream, outside city limits. This area is known as the Sequim Prairie because it is characterized by flat topography, gravelly soils, an arid climate—prickly-pear cactus and oak trees were commonly seen before the area was developed.

A large portion of the City and UGA is within the Gierin Creek drainage basin…

i. Base flow and irrigation influence

The area between Bell Creek and the Dungeness River has just enough gradient that several irrigation ditches convey water by gravity to the north and east. There are no defined creek channels; however, when flood irrigation was common practice the water table rose so much that new springs and wetlands formed in depressions, generating headwaters during irrigation season for Gierin, Cassalery, and Hurd Creeks further upstream than what would have been natural. Since irrigation practices and conveyances have evolved to be more efficient (less water leaking into the ground) over recent decades, these creeks don't start flowing until downstream of the City/ UGA, and certain ponds have disappeared.



Recharge from historic irrigation practices raised the water table and fed springs such as those at the headwaters of Gierin Creek (northeast of the corner of Brown and Port Williams roads).

Stormwater recharge is especially important for long-term maintenance of spring flow and the aquifer system as a whole.

Identified needs:
Gierin Creek is supplemented by water conveyed through the City in ditches managed by Sequim Prairie Tri-Irrigation Company – in summer it's River water and in winter it's stormwater. It is not clear how much of the flow at Brown Road is natural base flow. There are likely additional discharges into upper Gierin channels from the canals and laterals in this region as well as from roadside ditches in the City, UGA, and County.

Coordination and cooperation with the County and irrigation managers will be necessary to address flow issues, if any, into Gierin Creek.

ii. Storm flows and flooding

Because of the soils and the low gradient, runoff from small rain storms easily infiltrates on open ground, or if runoff is generated from impervious surfaces it is handled by public and privately-maintained infiltration facilities. Recharge of stormwater is especially important in this sub-basin since

Graysmarsh and other wetlands are fed by groundwater. With larger storm events runoff flows into roadside and irrigation ditches and either infiltrates or follows an irrigation conveyance which may be lined or piped, carrying the water great distances and across drainage divides.

The Dungeness River and Cassalery Creek would receive upland runoff from the County and City except that several irrigation ditches run parallel and intercept runoff, carrying it north and east.

Identified needs:
Specific runoff problems in this sub-basin include:

- Eureka pipe under 7th (between McDonalds and Penneys) receives stormwater directly off City street via grate, W side 7th

Appendix A lists runoff and flooding problems identified in early 2014.

Table 6 lists the locations of surface water discharges to upper Gierin Creek in or near the City and its UGA; these are shown on Figures 4a-f. (River Mile distances are very rough.) Some of these discharges are common storm flows, some are extreme event flows, and some are year-round since they carry irrigation water in the summer.

TABLE 6. Surface discharges to upper Gierin basin

Discharge Location	Distance from mouth, in miles	Discharge Type
Port Williams Road	RM 2.5 W	Potential irrigation water and stormwater from City areas (County)
Port Williams Road	RM 2.5 E	Stormwater from County roadside ditch (County)
Just upstream from N Brown Rd	RM 2.6	Irrigation water and stormwater from west (from City as well as runoff conveyed through City from the south in the County) (County)
E Grey Fox Rd	RM 3.0	Potential stormwater from the south, from the UGA or the City area via swale (former irrigation ditch) (extreme only) (County)

iii. City wellhead protection area

The 5- and 10-year time of travel zone for the City's Port Williams wellfield is largely within this sub-drainage. Groundwater is from 25 to 45 feet below land surface in this sub-drainage. Recharge of rainfall is important for maintenance of the aquifer system and the City recognizes this in its ordinance protecting critical aquifer recharge areas. On the other hand, stormwater can be a source of contamination for groundwater; this is discussed in the water quality section, below.

iv. Fish habitat

There is no identified fish habitat in the Gierin sub-basin within the City or its UGA, and habitat values have not been documented.

Water quality and benthic macroinvertebrate data for the larger region are discussed later in this section; however, there are no data for sites in the Gierin sub-basin within or near the City or its UGA.

D. Lower Johnson Creek

i. Base flow and irrigation influence

Johnson Creek drains the eastern portions of Bell Hill, Happy Valley and Burnt Hill – as well as other areas in the County to the west that drain directly into the Highland Irrigation main canal. The canal empties into Johnson Creek at about RM 1.5 (in the County). The Creek enters City jurisdiction just upstream of SR 101, and the mouth at Sequim Bay is just south of John Wayne Marina. Its drainage divide on the southeast borders an unnamed drainage in the County.

There are few studies of Johnson Creek, but late summer flow at the mouth is reported to vary from 0.2 to 2 cfs; Highland Irrigation tailwater is estimated to be 0 to 1.5 cfs during irrigation season (April 15 to September 15). (PGG 2008)

Lateral ditches and piped conveyances deliver irrigation water to Highland Irrigation District customers on the north and west sides of the sub-basin, on the terraces between Bell and Johnson basins. Over the years some of this water was stored in farm ponds which may have contributed to the wetlands and ponds now shown on aerial photos and maps, such as those at the City's Keeler Park.



Example of a detention pond needed to contain runoff from development on non-permeable soils, as found in upland terraces between lower Bell and lower Johnson Creeks.

ii. Storm flows and flooding

Tailwater from the Highland Irrigation main canal ranges from 0.5 to 1 cfs in the winter (mostly storm flows). Winter flows at the mouth range from about 1 to 6 cfs. (PGG 2008)

Appendix A lists runoff and flooding problems identified in early 2014.

Table 7 lists the locations of surface water discharges to Johnson Creek in or near the City and its UGA; these are shown on Figures 4a-f. Some of these discharges are common storm flows, some are extreme event flows, and some are year-round since they carry irrigation water in the summer.

TABLE 7. Surface discharges to lower Johnson Creek

Discharge Location	Distance from mouth, in miles	Discharge Type
West Sequim Bay Road	0.1	Roadside runoff, especially from west
Ephemeral tributary confluence from the northwest, north of Whitefeather Way	RM 0.5	Stormwater originating from Keeler Rd wetlands; may also carry irrigation water
Hwy 101 culvert	RM 0.7	Potential Stormwater from 101 and surrounding area
Upstream of 101 and the City limit	RM 0.8	Potential irrigation tailwater in summer and storm flows in winter (via ditch lateral) (County)
Ephemeral tributary confluence from west, east of Happy Valley Rd	RM 1.4	(County)
Highland Irrigation District main canal terminus	RM 1.6	Tailwater year-round; mostly stormwater in winter, originating mostly in County areas (County)
Major tributary confluence from west (Smith Lake), east of Happy Valley Rd	RM 1.7	(County)

iii. Fish habitat

There is no smolt trapping or active habitat monitoring underway for Johnson Creek. General and specific habitat values were documented by Streamkeepers of Clallam County for several reaches, listed in Table 8. While the results were never finalized or published they provide at least a crude indication that habitat health is compromised to some degree and may warrant further assessment.

TABLE 8. Habitat quality scores for Johnson Creek

Site name	**Site description** (jurisdiction)	**Year** (PHI)	**Mean PHI score*** (0=low, 1=high quality)	**Year** (BIBI, always autumn season)	**BIBI score**** (10=low, 50=high)
Johnson 0.0	At mouth (City)	1999-2004	0.41	2009	42
Johnson 0.6	d/s of Hwy 101 (City)	1999-2004	0.18		
Johnson 2.0	u/s of Smith Lake (County)			2007	46

*PHI = Physical Habitat Index for salmonids (Streamkeepers method), based on large woody debris, pools, canopy, sediment size, and bed stability.

**BIBI = Benthic Index of Biological Integrity (James Karr, 1997), an indicator of habitat health based on aquatic insect counts.

Like Bell Creek, lower Johnson Creek (including the portion within the City limits) is considered suitable habitat for salmonids and is designated critical habitat for bull trout by the US Fish and Wildlife Service (USFWS). The same is proposed for Puget Sound steelhead by NOAA. The City started corresponding with the National Marine Fisheries Service (NMFS, a division of the National Oceanographic and Atmospheric Administration, NOAA) on this subject in Fall 2013 (Soule 2014).





Bull trout (left) and Puget Sound steelhead (right) are protected by the Endangered Species Act. "Critical habitat" designations are in place or proposed for portions of Johnson Creek (as well as Bell Creek) within the City limits. [Note: photos are from the Dungeness River.]

Further information on stream health is included in the next section on water quality.

IV. Water quality

Several factors influence water quality. For surface water, this includes stormwater from roadside ditches, irrigation ditches, diffuse runoff, and stormwater pollutants found in streambed sediments. Stormwater can also contaminate groundwater if it isn't treated or if pollutants aren't filtered out before entering the environment. The most common pollutants in stormwater are petroleum hydrocarbons, metals, pesticides, herbicides, sediment, and bacteria. Nutrients and toxics may also be found.

A. Stream sediment quality

A 2003 study by Battelle involved sampling sediment from Clallam County streambeds, testing for stormwater toxics that are "sequestered" in sediment but which may release to surface water. The study concluded that urban areas are sources of these pollutants. While levels detected in stream sediments were relatively low, many were above natural background levels. Also, they correlated well with land use: concentrations generally increased as land use intensity increased (forest < agriculture < urban).

> *"Clallam County sediment data were on the same order of magnitude or lower than similar studies in the Puget Sound region from more urbanized areas. This indicates additional development could increase the loading of stormwater-related contaminants unless measures are instituted to eliminate or reduce pollutant sources."*

Bell Creek was one of five streams targeted in the Battelle study and the only one in Sequim. Petroleum hydrocarbons, zinc, and lead increased substantially from the Happy Valley reference site to the mouth; both zinc and lead nearly doubled in concentration. One or more of the four sites had levels of zinc, lead, copper, and chromium at or near toxicity thresholds. (The study noted that a natural source of chromium is basalt, which is prevalent in the Olympic Mountains and foothills.)

The study provides excellent baseline data for sediment quality at four sites along Bell Creek as well as a screening of which sequestered contaminants are most likely to be present in stream water.

B. Surface water quality

Several studies of stream water quality in Bell and Johnson Creeks have been conducted in recent decades, mostly regarding bacteria. Data submitted to Ecology over the years have resulted in several appearances on the state's water quality assessment submitted to EPA (a.k.a. "impaired" waters, Category 5 on the "303d list"); however, no TMDL studies have been started:

- Bell Creek: several sites between the mouth and Sequim Avenue for fecal coliform bacteria, dissolved oxygen, pH and/or bioassessment (biological indicators)
- Johnson Creek: fecal coliform bacteria, at mouth
- Sequim Bay (Primary contact recreation): for bacteria; the determination is based on exceedance of *enterococcus* criterion, indicating that public health standards for swimming and other contact uses are not being met

Bell Creek, Johnson Creek, and Sequim Bay are all on the state "impaired waters" list for bacteria.

While the City is fortunate to have relatively few Category 5 "impaired" assessments, there are several more assessed as Category 2, "waters of concern." These waters are critical to protect and improve now, to prevent degradation and potential additions to the Category 5 listings:

- Bell Creek: fecal coliform bacteria, all reaches not already Category 5; pH, at mouth as well as upstream; temperature, just upstream from mouth
- Johnson Creek: pH and bioassessment, at mouth; pH and fecal coliform bacteria, middle reach
- Dungeness River: bioassessment, reach adjacent to city limits which receives runoff from City jurisdiction
- Sequim Bay: dissolved oxygen
- Strait of Juan de Fuca East: fish and shellfish habitat (Category 4C), documented macroalgae (seaweed) impairing aquatic life at Washington Harbor
- "Independent" (Sequim Prairie Tri) Irrigation ditch: pH, in reach within City limits

About 10 years ago Clallam County produced *State of the Waters of Clallam County, 2004: A Report on the Health of Our Streams and Watersheds*, which rated stream health based on a formula with factors for water quality, biologic indicators, and habitat conditions. Bell Creek was indexed as "Highly Impaired" and Johnson as "Impaired."

Perhaps most relevant would be data from several surface water quality studies within the past five years, including sites within the City – however, these data have not been summarized or interpreted to date. A synopsis of these data sets, available from state and federal databases, may be found in Appendix C.

Identified needs:
Existing data should be summarized and an evaluation conducted to determine if additional water quality data collection is needed for stormwater contaminants, and where. Coordination with Clallam County, the Jamestown S'Klallam Tribe, and other Dungeness Clean Water Work Group members will be essential to address water quality data and monitoring concerns.

C. Groundwater quality

As noted above, much of the urban center is built on former floodplain alluvium. While this is an advantage for preservation of water resources and stormwater management, groundwater quality is susceptible to degradation from land uses – including pollution carried in stormwater runoff.

Nitrate concentrations in the shallow aquifer around Sequim are known to be well above background levels, indicating that groundwater quality is already impacted by land activities (Clallam County 2011). Nitrates[4] are highly mobile in groundwater and considered an indicator that other mobile contaminants may be present.

The City's Port Williams wellfield is directly downgradient from the urban center but the water supply wells there are very deep and well protected from surface contamination (nitrates are consistently at or below background levels). On the other hand, hundreds of private and small public wells in the UGA and County are also downgradient and potentially at risk of contamination.

Because of this concern, Clallam County conducted a baseline study in 2005 of stormwater contaminant concentrations in drinking water wells downgradient from the City's western commercial zone, prior to development of the Walmart property. In 2009-11 a two-phase study was conducted in which domestic wells with known susceptibility to contamination were identified in Phase I and sampled for stormwater contaminants in Phase II (Clallam County 2009, 2011). Four wells downgradient of the City were sampled and results showed no substantial evidence of stormwater contamination. Results of these studies provide preliminary indication that stormwater infiltration practices employed (or mandated) by the City over many decades have not caused widespread contamination. Metals and hydrocarbons tend not to be mobile like nitrates are, and are better filtered by the soil.

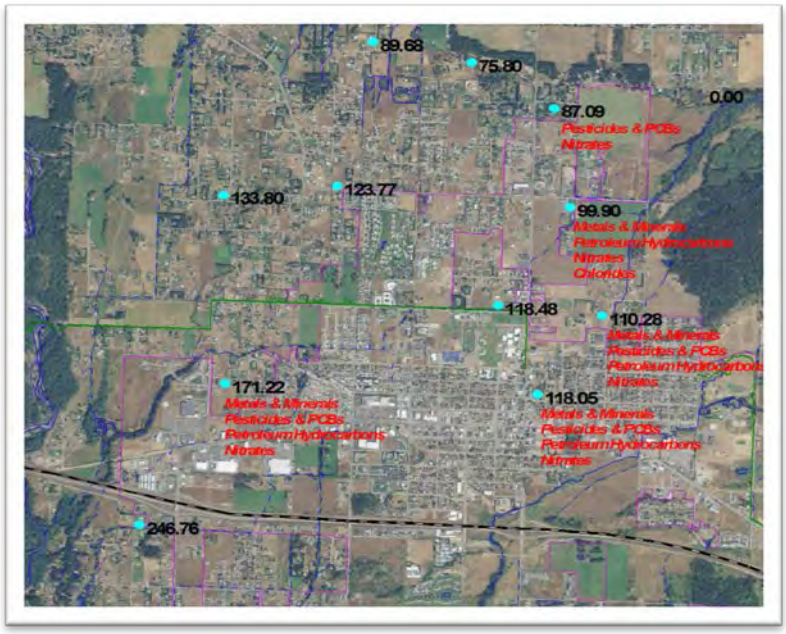


Illustration from a report published by Clallam County Environmental Health in 2011 on groundwater quality in the shallow aquifer near Sequim. Tests of contaminants often carried by stormwater are shown in red next to five sampled wells (domestic wells).

Results indicated "no evidence that shallow-aquifer drinking water wells vulnerable to land activities are experiencing contamination from metals or organics; however, advanced nitrate contamination is evident."

Numbers indicate well water level elevation, in feet above sea level.

[4] Nitrates are a health concern especially for infants and pregnant women, and those with compromised digestive systems. Land uses generally associated with elevated nitrates in groundwater include agriculture and septic systems – neither of which has occurred within the central City area for several decades.

Shallow groundwater quality monitoring was required by the City for three west-end commercial developments before and after they opened for business in order to determine whether treatment (via swales and/or filters) and infiltration are effectively removing stormwater contaminants from runoff.

Another source of groundwater quality information is the state Dept. of Health drinking water database of public water systems (PWS), called "Sentry." The larger, Group A water systems are required to test for regulated contaminants monthly, yearly, or every three years for some parameters. The testing frequency for smaller, Group B systems (e.g., those serving fewer than 15 connections) is much less. In either case, Sentry is a valuable resource for identifying groundwater quality problems. PWS wells in the Sentry database in proximity to the City and its UGA are shown on Figure 6.

Identified need:
The City should evaluate whether ambient monitoring of groundwater quality for stormwater contaminants is needed, in addition to DOH-required sampling. Coordination with the Dungeness Clean Water Work Group would be beneficial in addressing these concerns.

Also of note, in 2013, a non-City PWS in the northern portion of the City was found to have trace levels of Freon 22 (discovered through routine testing required by DOH). Clallam County EH worked with Ecology to develop a plan of investigation to establish the limits of the contamination and identify potential sources. Several shallow domestic wells in and near the City were tested and some also had detections. Sequim Public Works staff assisted in identifying and accessing certain wells. The potential upgradient source of contamination could be within the City.

Identified need:
The City should continue to track the County-State investigation of Freon 22 in groundwater in and downgradient from city limits.

CAPITAL FACILITIES

Stormwater runoff flows through natural and built infrastructure en route to the marine environment. Natural elements such as streams and the groundwater system are discussed in the previous section. Capital facilities that collect, transport, store, treat, and/or dispose of runoff are discussed in this section.

I. City facilities

City streets (including curbs, gutters and ditches) with storm drains and associated facilities (catchbasins, drywells, swales, etc.) comprise the City's stormwater infrastructure. The size, length and complexity of this infrastructure grow when new lands are annexed or when a subdivision builds to City standards and the developer confers ownership. Facilities may also be added to resolve stormwater management issues.

Stormwater facilities identified and existing in the City's GIS are summarized in the Table 9, below (includes both City-owned and non-City owned). All of these are shown on Figures 4a through f. Note, however, that the facility inventory is not complete and maintenance frequency, dimensions and other specifications are not always available since field documentation didn't start until Fall 2013. Appendix B lists all creek culverts in the City and UGA.

There are more than 1500 stormwater facilities in the City, including catchbasins, drywells, retention ponds, etc. – and over 100 miles of street gutters and irrigation ditches.

TABLE 9. Stormwater facility inventory

Type	Quantity	Notes
Catchbasin (inlet, etc.)	1,018	
Drywell	153	Class V UIC, not yet registered with Ecology
Oil-water separator	Not known	(113 installed for sewer system to limit Fat/Oil/Grease)
Filter	2	(private facilities)
Perf pipe drainfield (sites)	169	
Culvert (ditch or stream)	66	
Pervious pavement (sites)	5	
Swale	18	
Retention pond	33	
Detention pond	10	
Flow control	11	Usually overflow from a pond
Streets and alleys	61 miles	
Roadside ditch	(~50 miles)	
Curb and gutter	(~80 miles)	
Irrigation ditch	5-10 miles	(private facilities)

Identified needs:
The City should continue its facility inventory and mapping, including documentation of maintenance.

The City has no bridges over streams but maintains two bridges over marine water, one over the Pitship Estuary and one over Washington Harbor. Sea level rise due to global climate change could impact these structures; however, the rise is not an immediate concern.

II. Non-City facilities

As Sequim has developed over the decades so has recognition that urbanization changes the quantity, velocity, and quality of stormwater runoff. In the early 1990s the state stormwater management design manual began to be used as guidance for City as well as commercial and other private and public projects. Since then, developers of property in the City's jurisdiction have had increasing levels of stormwater management conditions applied in order to receive approval of their drainage plans. The City's municipal code requires that the latest edition of the state manual be applied (Ch 13.104.100 SMC). In some cases where new development was planned within a critical aquifer recharge area, the City's approval included conditions for water quality monitoring and reporting. The prior section discusses these programs and results.

The municipal code sets minimum standards for the inspection and maintenance of all stormwater facilities within the City (Ch 13.108 SMC). Provisions include monthly and annual inspections of different types of facilities, waste disposal, compliance, inspection authority, and others – regardless of whether such conditions were mentioned at time of permit approval.

Identified needs:
Several stormwater facilities approved within the past 5-10 years have maintenance checklists to facilitate monthly and annual inspection and maintenance. However, the City has not been consistent in its requests for compliance from these or pre-existing developments since it lacks funding for an inspection program. In fact, most non-City owners of stormwater facilities probably aren't aware of the maintenance code and its annual inspection requirements. Further education efforts may be needed.

The information below summarizes "non-City" (i.e., private or other public agency) development within four categories (parking lots, residential, agriculture/irrigation, and SR 101) and what is generally known about the infrastructure and facilities utilized, and maintenance. Additional information may be obtained by contacting Public Works.

Most commercial landowners probably aren't aware of the City's stormwater maintenance code and its requirements.

A. Commercial and other parking lots

Parking lots are sometimes comprised of several parcels with different owners, and often the landowner for a commercial parking lot bears no relation to the business owner.

Identified needs:
Types of reported *problems* with parking lot facilities include:

- Overflow from facilities in one parking lot discharge onto other private property
- Overflow from parking lots discharge to City and/or private conveyances
- Overflow from parking lots or facilities discharge to a Creek

- Runoff from uphill property enters private parking lot storm drains not designed for the additional capacity

B. Residential subdivision streets and infrastructure

In some but not all cases, members of residential subdivisions and planned unit developments are coordinated through a homeowners association on topics such as stormwater facility maintenance.

Identified needs:
Types of reported *problems* for residential developments include:

- Subdivisions have facilities designed to handle direct precipitation but are overwhelmed with runoff from upslope (Bell Hill, western Happy Valley, etc.) during large storm events
- Private property facilities upslope of undeveloped land discharge stormwater to the undeveloped site, creating a problem when the site is to be developed

C. Agricultural infrastructure/irrigation system

The growth of the town of Sequim, combined with changes in regional water management, has obscured the eminence of open irrigation ditches brimming with seemingly limitless supplies of water to serve the agricultural industry. For efficiency, safety, and water quality purposes, the irrigation conveyances that crisscross through the City now are consolidated and often piped (see Figure 1 and Figures 4 a-f). They also serve a higher proportion of residential customers than they used to.

The irrigation ditch system has always doubled as a stormwater system in the wet season. Because it was designed to carry water from the Dungeness to distant farms, and because the Sequim Prairie is relatively flat, the ditches cross the divides between the upper drainages of Hurd, Cassalery, Gierin, and Bell Creeks. Rainwater that formerly infiltrated or flowed toward a creek may now be conveyed faster and further downstream, and into a different sub-basin, often before it has a chance to infiltrate. Details of irrigation conveyances are included on Figures 4 a-f.

There are advantages to having the ditch system in place and available for stormwater conveyance since runoff, pooling and flooding would otherwise be worse. On the other hand, there are places where open irrigation ditches bring stormwater from County areas into the City, and the additional volume overwhelms the irrigation and/or City culverts and infiltration facilities. Often, the extra volume causes flooding and eventual direct discharges to Gierin, Bell, or Johnson Creeks.

With planning and cooperation of irrigators and the County, there is opportunity for the irrigation infrastructure to be enhanced to efficiently manage stormwater and perform recharge.

The City should continue to enter into agreements with irrigation purveyors for mutual benefit.

Identified needs:
The City, Clallam County and other owners of streets and impervious surfaces should have agreements with irrigation purveyors to acknowledge the advantages that irrigation infrastructure affords the community, clarify responsibilities, and engage in long-term stormwater planning and management.

Identified needs:
Reported and/or documented *problem areas* include:

- Irrigation pipeline daylights in a ditch within a private mobile home park development, with flooding common at certain properties
- Irrigation water and roadside runoff combines to cause the irrigation ditch to overflow through undeveloped property (overflow enters Bell Creek in extreme events)
- Ditch flow overwhelms capacity of conveyance under Bell Creek Plaza parking lot, west end pipe intake (high events)
- Irrigation conveyance (tile culvert) along 3rd at Gerhardt Park clogs, and overflow causes problems with pervious pavement trail downhill (note that winter flows are not irrigation water)

Coordination and cooperation among the City, County and irrigators will be essential to address these issues.

D. SR 101

The Sequim Bypass on Highway 101 was planned and built between 1994 and 2002. As-built drawings and borehole logs from Washington Dept. of Transportation (WSDOT) are available from Public Works. The entire length of the Bypass is now within City limits.

The corridor has five bridges and three interchanges and was designed by WSDOT with stormwater swales and ponds along its edges and ramps to accept runoff from the roadway and sloping walls. Through western and central Sequim the Highway was cut below grade in the gravelly soils of the ancient Dungeness floodplain. Siphons and culverts were installed for 10 irrigation ditch crossings existing at the time of construction. A 15' x 8' 3-sided concrete box culvert was used for the Bell Creek crossing. There are five retention ponds in this west-central portion of the Bypass and no stormwater-specific discharges to the north. (However, as noted, irrigation ditches routinely carry stormwater, some of which is brought into the City from the County area.)

East of the Sequim Ave. interchange there is predominantly glacial till on the south side, which readily generates runoff. The Bypass corridor was not designed to fully absorb this upland runoff, so what isn't captured in detention ponds alongside the roadway is conveyed to the north side in six drainage culverts (distinguished from irrigation culverts on WSDOT drainage plans, and by their size and type).

Near the Simdars Road interchange a 3-cell retention pond was constructed at the north end of Simdars to receive runoff from the interchange vicinity (in the City but which also receives runoff from the County).

Upland runoff from the east and west at Highway 101 may enter Johnson Creek.

Identified needs:
There may be an opportunity to utilize some of the capacity of the DOT's system for upland runoff west of Sequim Avenue, when/ if capacity is available during extreme events – but an agreement would need to be prepared. Both facilities and management tools should be examined.

Several drainage culverts east of Sequim Avenue discharge stormwater via outfalls to private property to the north, forcing those landowners to manage the volume on site. Most of this discharge likely originates in the County and/or City areas on the north side of Bell Hill.

Topics for potential coordination with DOT:

- Additional capacity of detention/retention ponds
- Opportunity for use of porous pavement in the future
- Ongoing maintenance of North Simdars Road wet pond by City



This photo shows the inside of one of Sequim's perforated drainage wells, a.k.a. "drywell," designed to facilitate water infiltration into the ground. These structures preserve water resources because they effectively dispose of stormwater in permeable soils; however, they must be registered with Washington Department of Ecology since contaminants in stormwater could impact groundwater quality.

STORMWATER PROGRAM

In 2014, the City's stormwater program consists primarily of maintaining existing infrastructure and addressing flooding problems as they arise. Section I, below, describes these "O&M" activities; how they are funded is explained in Section VI.

Sections II through V discuss long-range planning, communications, monitoring, and enforcement – none of which had been actively pursued until 2012 when the City Council approved this needs assessment and management planning for 2013-15.

I. Operations and maintenance

The City has operated and maintained the stormwater system described above through funding from the sewer and water utilities. This section describes various activities conducted as part of ongoing O&M.

Identified needs:
Appendix A, part 2, lists specific runoff/flooding problems identified in early 2014 for City streets and facilities. Particular problem areas include:

- N 7th and Washington, SW corner (in front of McDonald's)
- Seal St corner and west down alley
- S Brown at Hammond corner
- Guy Cole Center parking lot
- Falcon Road
- W Fir between Sequim Ave and 5th
- N Honeycomb and Deseret corner
- S 5th and McCurdy
- Miller Road (entire length)
- N Sequim Ave and Fir, NW corner
- E Silberhorn near Petal Lane
- W Spruce just west of 5th
- West Sequim Bay Road, west end

In the downtown core of the City it is common for City storm drains to receive runoff from a private building downspout or small driveway or parking area. In most cases, the City facilities can handle the volume from these private properties. There are some places where it is a problem that a private facility overwhelms a public facility, and places where runoff from public property (streets, etc.) cause issues with private property.

Identified needs:
Appendix A, part 3, lists places where street drains are connected inappropriately (inappropriate connections to the sewer system are listed in the next section).

Finally, it is a concern for some that property owners are treated differently by the City depending on whether stormwater facility maintenance is at the expense of the landowner, or covered by the City since the facility was "grandfathered" into the City network of facilities.

Identified need:
The City should address the inequity between new/recent developers and those in the past with regard to stormwater facility maintenance.

A. Street sweeping

Street sweeping has at least three benefits: it improves the appearance of city streets, it removes trash and sediment clogging storm drains and thus extends the life of these facilities, and it significantly reduces pollutants in stormwater runoff (and is considered a Best Management Practice, or "BMP"). Researchers are now developing protocols for "enhanced" street sweeping frequency and routes to optimize removal of nutrients from stormwater before it infiltrates.

Street sweeping is a stormwater "BMP" because it significantly reduces pollutants in stormwater runoff AND protects assets.

Sequim has one sweeper truck which is deployed on City streets once per week year round, or daily if gravel is used to manage ice and snow. Primary arterials are done each week and secondary roads are on a rotation so they get swept every 3-4 months.

Identified need:
The City should assess whether the current street sweeping routine (including disposal of sweeping waste) is adequate to protect infrastructure and remove pollutants from the environment.

B. Catchbasin cleaning

The City's vactor truck is shared by the sewer and stormwater programs. In the fall-winter of 2013-14, two crew members used the vac truck to inspect and maintain an estimated one-third of all City stormwater facilities. Without funding for additional staff and equipment the City won't be able to inspect all facilities annually, as set forth in SMC 13.108.

A day's typical effort results in 5 sites visited, 2-4 facilities per site (inlets, catchbasins, drywells, cleanouts). At this rate, the City's 1,000+ facilities would take more than 60 days with the vac truck devoted to stormwater.

Identified need:
The City should find funding to expand its fleet and/or staff for performing this work, and assess whether vac waste disposal practices are adequately protecting water quality.



City crew using a "vactor" truck to remove sediment and trash from catch basins and drywells. This annual maintenance for stormwater facilities is required under City code, and yet the Sewer and Water utilities pay for it.

C. Ice and snow management

Icy roadways are prevented primarily by application of Magnesium Chloride (liquid) spray, on dry roads ahead of cold weather. This practice reduces the amount of sand and gravel needed (and thus less time spent cleaning catchbasins and other facilities), though some is still used when necessary. Road salt is also used when necessary. Snow is mostly removed mechanically.

Identified need:
The City should assess whether ice and snow management practices are contaminating stormwater runoff.

D. Weed management

Mechanical as well as chemical methods are used to manage weeds and roots on roads, sidewalks, and in City rights of way.

Identified need:
The City should assess whether weed management practices are contaminating stormwater runoff.

E. Trash management

Garbage is collected from bins by commercial haulers within the City but litter accumulates in certain roadside and irrigation ditches, affecting stormwater flow and potentially runoff water quality.

Identified need:
Trash and junk are left in and adjacent to Bell Creek at several points, especially these known problem areas:

- East of Hammond Street apartments on undeveloped private property (note this area is within the Bell Creek drainage and trash can be carried downstream when flooding)
- Behind Les Schwab Tire Center (private property)
- Gebhardt Park (behind QFC, City property); transient and visitor litter is left behind

The City maintains City properties and roadside ditches, removing litter and blockages as best as possible. Some irrigation ditch maintenance activities, such as cleaning grates at pipe entrances, are shared by the City and irrigation staff.

F. I/I detection

Groundwater seepage into the sewer ("infiltration") and unauthorized connections to sewer lines ("inflow") threaten the City's WRF infrastructure longevity and resiliency. However, note that resolving the sewer and I/I problem creates a different one – displaced stormwater must be managed somehow (absorbed in the ground, pipes, ponds, etc.).

Identified needs:
Known Infiltration/Inflow (I/I) problem areas include:

- S 3rd, north of Hemlock and south of Prairie
- Alley between Washington and Cedar, west of Seal Street
- Sequim School District buildings on W Fir
- Alley west of N Sequim Ave between Spruce and Fir
- Centennial Place storm drain
- Residential area north of E Cedar
- Sundowner Motel
- Doe Run and other streets on Bell Hill (sewered but outside city limits)

II. Long-range planning

A. Stormwater program

The City focused on stormwater management on a few different occasions in recent decades. Sequim Municipal Code chapters specifically for stormwater management and maintenance were adopted in 1995 (Ch 13.104 and 13.108 SMC, respectively). Proposals for developing programs to implement these ordinances were drafted by staff in 1999-2000 as well as 2007, but the drafts were never fully developed or considered by City administrators. Amendments to Ch 13.104 and 13.108, and other SMC chapters, were prepared in 2009 when the City participated in the state-funded local regulation assistance program for integrating LID into local codes. Like those before, these proposals were apparently not brought to the attention of the public, stakeholders, or the Council.

In 2011-12, Public Works anticipated the need for expenditures devoted to comprehensive stormwater management planning, including public and stakeholder outreach, and began budgeting accordingly. The City budget for 2013 included $40,000 for this stormwater needs assessment and for 2014 includes $150,000 for a stormwater master plan including contracted services.

Identified needs:
The master plan should provide detail on long-term management and should include potential tools that predict future storm flows as the City develops, integrating expected changes in precipitation, and the capital facilities and operational and management elements that will be needed.

B. Modeling

The City currently has no stormwater modeling capability. Hydrologic/hydraulic modeling may be needed for localized areas during stormwater management planning.

Identified need:
The City will need to have tools with which to plan for new infrastructure and management regimes.

C. Climate change adaptation

Two recent reports on climate change adaptation for the local area indicate several topics worthy of consideration during comprehensive storm/surface water planning: a 2013 study by the Jamestown S'Klallam Tribe for the lower Dungeness and Sequim Bay watersheds, and a 2011 study by the US Forest Service for the Olympic Peninsula. Topics include:

- Sea level rise, estuaries
- Temperature, Snowpack, and Timing of Streamflow
- Precipitation, Storm Intensity, and Flooding
- Connections between forest health, wildfire and water supplies
- Competition among water users

Identified need:
The City should assess what adaptation measures will be necessary to reduce risk and be "climate ready" in terms of stormwater management.

D. Emergency preparation

For flooding emergencies, Public Works (PW) keeps at least 1 bale of sandbags (~1000) and 75-100 cubic yards of sand on hand always. A couple pallets of filled sand bags (about 25 bags/pallet) are also kept on hand and protected from UV degradation. Signs, barricades, cones, and other traffic management equipment are kept at the PW Shop. Over a dozen radios are available for emergency use, half kept at the Shop and half at the PW offices on 5th Ave.

Flooding is typically a progressive problem with some ability to anticipate the need to mobilize, greatly reducing the need for establishment of an EOC or incident command center. In these cases, PW coordinates with the Police Department on safety and property protection concerns involving flood waters and traffic control.



West Washington Street businesses on fire, May 19, 2014. Sandbags were placed by the City Public Works crew to prevent flooding.

In any situation that requires an EOC (expected to be at the PW Shop), the City Police Chief is the incident commander with the City Public Works Director and/or City Manager second in command. All staff members are aware that their normal duties are on hold and they should accept duties as assigned, reporting to the EOC unless otherwise instructed.

Identified needs:
The City should assess what additional practices are needed to be incorporated into existing emergency response plans that will protect property and the environment from damage due to flooding and other stormwater impacts.

III. Communications

A. Outreach and education

For at least five years stormwater communications have been within the context of street or sewer issues – when a problem came up the street and sewer staff reacted by communicating with whomever they needed in order to deal with it. Certain messages have been conveyed over the years, such as the general message that everyone should do their part to prevent pollution and specific messages on improper use of the sewer system. But outreach efforts are not coordinated due to lack of resources, and education hasn't been a high priority relative to urgent concerns.

When the stormwater needs assessment started in 2013 it was recognized that the general public, business owners, water managers, and other stakeholders would be needed to help the City identify problems with runoff, ponding, and pollution. A website for the assessment project started in September of the same year and solicitations for reports of "pooling in the streets" went out in the City newsletter and local newspaper. Documentation and mapping of problem areas began.

Public engagement around water in the Dungeness watershed is not new. Residents and stakeholders in development and resource management are aware that water supplies are scarce certain times of the year. The concept that infiltration is desirable as a water management strategy is accepted by many.

The majority of the general public, however, has not been exposed to as much information and likely isn't aware that, for example, the City's drinking water supply comes from the Dungeness River as well as from deep wells – and that protection of our drinking water quality and quantity includes street sweeping as well as planning ahead for climate change.

The concept that infiltration is desirable as a water management strategy is accepted by many.

Identified needs:
The City could do more to connect these dots for residents and business owners in particular. Strategic communications planning around stormwater management is needed, with components for education, outreach, and public involvement. Coordination with other entities that conduct water quality outreach and/or that manage stormwater will be beneficial in addressing these needs.

B. Public involvement

Most public involvement to date has been related to problem solving when stormwater issues arise.

The most active involvement currently is surrounding the update of the Sequim Comprehensive Plan. Neighborhoods have hosted block parties, Council members have attended to hear what residents think is important, etc. The Shoreline Master Program was completed last year and included a public involvement component as well.

A few years ago City street volunteers stenciled storm drains in one neighborhood with "Only Rain in the Drain." Unfortunately, the work had to be painted over since then.

Identified needs:
The City should identify ways to effectively engage the public, stakeholders, and partners through strategic communications planning.

C. Local water manager relations

Recently Sequim has been an active participant in water resource management with other local managers working in the Dungeness watershed, including Clallam County, the Jamestown S'Klallam Tribe, area irrigators, Clallam Conservation District, the PUD, state agencies including Ecology and Fish and Wildlife, and others.

The City realizes very well that stormwater in Sequim is a regional issue and not just a City concern. It also recognizes that protection of public resources involves the cooperation of public and private entities. Effective property and environmental protection involves private landowners, neighboring jurisdictions, and regulatory agencies – and the City is in the unique position to lead the way to achieve that goal.

Partners and stakeholders in stormwater management will include, at minimum:

- Irrigation managers
- Clallam County
- Landowners of undeveloped property currently providing stormwater functions
- Landowners of commercial parking lots
- Homeowner associations
- Washington Dept. of Transportation
- Sequim School District

Identified need:
The City should determine how to best engage in water management discussions with partners and what agreements might be necessary. Two- or three-party agreements may be necessary to achieve stormwater management goals.

D. Internal communications

The City has many staff members working in the field and driving City streets as part of their job. The needs assessment and stormwater management in general benefits greatly from the active involvement of these staff members. Goals of stormwater management, including relations with water management partners, will need to be continually communicated to City staff at all levels.

Identified need:
The City should make sure its stormwater management goals are communicated clearly and regularly to field crews and leads.

IV. Monitoring

The City currently conducts no environmental monitoring, just standard wastewater testing and analyses at the Water Reclamation Facility. Staff gages have been installed this winter in an effort to document flow patterns in Bell Creek above and below Carrie Blake Park, and in an irrigation ditch entering the City on the west side as it crosses Silberhorn Road.

A few other agencies have performed water quality monitoring in the City and surrounding area; a summary of those efforts is discussed in the previous section.

Identified needs:
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.

V. Enforcement

The Sequim Municipal Code (SMC) is applied to development permit applications at various stages in the application process by City Department of Community Development and Public Works staff. In particular,

- Title 12 – Streets, Sidewalks and Public Places
- Title 13 – Public Services
- Title 17 – Subdivisions
- Title 18 – Zoning, including the critical areas code
- LID Road Standards (road sections to add to existing engineering design standards)

Two stormwater-specific regulations include SMC 13.104 and 13.108 regarding stormwater management and maintenance, respectively. While these are both generally followed, specific elements of each may not be applied consistently.

For example, SMC 13.108 requires annual inspection of stormwater facilities by both public and private owners, but the City does not have a formal inspection program. SMC 13.104 requires use of the latest state stormwater design manual but its application to single family residential permit applicants is being reviewed for clarification.

Identified needs:
Most residents and businesses are generally aware that they can't freely pollute the environment, but exactly how the City regulates stormwater management activities is not generally known. Clarification and outreach to the public as well as internal staff on City/SMC regulations is needed.

VI. Funding

Current stormwater program operations described in this section are paid for through City Sewer and Water Utility funds even though activities do not directly relate to those systems. Capital facility improvements are sometimes partly or fully subsidized with grant funding and new development fees, but neither of these sources are available for operating expenses.

The 2013 budget for "O&M" activities listed in the previous section was around $101,000. Planning activities are considered capital, like this stormwater needs assessment with a budget of $40,000 for 2013—sourced 50:50 from the Sewer and Water Utility funds. A small amount of stormwater-related communications, monitoring, and enforcement activities have been absorbed as needed by various funds.

Current stormwater program operations and capital projects are funded through the City Sewer and Water Utilities.

The operations budget for 2014 is about the same as 2013; the capital budget of $150,000 is for storm and surface water management planning (staff as well as contracted services). This project should be supplemented with a state grant award of $250,000 that would reimburse expenses starting in summer 2014 and extending into early 2016.

Utility funds, grants, and new development fees are all used for capital improvements but operational expenses can only be financed by the first (Utility funds). However, Sewer and Water Utility funds are

restricted in the types of activities they can fund; this could limit the City's ability to perform certain activities necessary to meet goals.

Without a dedicated funding source, stormwater operations will continue to borrow from Water and Sewer Utility funds. This will limit implementation of stormwater O&M as well as other operational activities such as communications, monitoring, and enforcement work.

Identified need:
A comprehensive assessment of funding needs for operational and capital expenses associated with varying levels of service is needed – along with an discussion of potential funding sources.

Another issue that affects City costs is that Public Works inherited maintenance obligations for stormwater facilities from several developments in the past, mostly residential subdivisions, and central business district parking areas are often City-maintained (streets, alleys, driveways, small parking lots). In comparison, landowners of the most recent commercial developments in town maintain their facilities regularly at their own expense.

Identified need:
The City should address the discrepancy in who pays for stormwater maintenance among landowners, business owners, homeowner associations, etc. In addition, the City should pursue finding partners to share the expense of handling stormwater generated upland in the County.

REGULATORY CONTEXT

The City's stormwater management needs as the urban area grows depend in part on regulatory context. The key regulation influencing stormwater management in the United States is the federal Clean Water Act of 1972 (CWA) which requires states to restore their waters to be "fishable and swimmable." This regulation is administered by EPA and, in turn, by Washington State through NPDES permits and other water quality programs (via Ecology). Sequim is also responsible for implementation through its municipal codes, several of which address stormwater management and maintenance.

I. Federal NPDES program

EPA is in the process of developing new municipal stormwater regulations which will impact how Ecology manages existing and new NPDES (National Pollutant Discharge Elimination System) permittees. This presents uncertainty for municipal permittees both large (Phase I) and small (Phase II), but it is fairly certain that new regulations will push green infrastructure and establish performance standards for flow (such as retention of 90-95% of a storm's rainwater). LID technologies are expected to be emphasized since they accomplish both. Also, retrofitting will be encouraged and possibly required.

Many feel the ultimate priority should be to minimize or prevent pollution in the first place, lessening the burden and cost of treatment on the municipality and achieving cleaner water. Sequim would be wise to anticipate this in its future and prepare prevention language in its codes that is strong but also flexible/ adaptable. In any case, pollution concentration limits are expected which means water quality monitoring will continue to be required potentially with standard monitoring protocols. In theory, EPA's efforts will accomplish its goal that stormwater is managed as a resource rather than a waste.

In theory, EPA's efforts will accomplish its goal that stormwater is managed as a resource rather than a waste.

Sequim is not a permittee, unlike most municipalities around Puget Sound, so EPA's latest recommendations can be used to anticipate the approach and priorities that regulators would likely impose when the time of permitting comes. For example, while Sequim intends to emphasize LID as much as possible there are places where the soil is not conducive to infiltration and other BMPs (i.e., detention, conveyance) will be needed.

Table 10 shows the status of stormwater management in Sequim's neighboring jurisdictions: all eight of the other small municipalities in northern Puget Sound have surface/ stormwater management plans and established programs, and all are funded by a utility with a rate structure adopted in code. Most are Phase II permittees with strict requirements; however, two (Port Townsend and Shelton, like Sequim) are not.

Identified needs:
Before Sequim adopts specific BMPs it should try to anticipate what EPA will be requiring from permittees; for example, if and how performance standards are being applied in other jurisdictions.

Sequim can keep abreast of EPA's proposals by collaborating with other local governments such as through the West Sound Stormwater Managers Coordination Group and the Association of Washington Cities (AWC).

TABLE 10. Status of stormwater programs in neighboring jurisdictions

Jurisdiction	Pop	Phase II permit?	Storm-water Manual?	Plan and Program?	Utility? (est. date)	Monthly Rate: single family residential (2014)	Monthly Rate: commercial (2014) (units are sq. feet)
Bainbridge Island	23,000	yes	DOE 2005	yes, yes	yes (1986)	$12.32	(Imperv. Area/3,000) x SFR rate [reductions available]
Bremerton	38,000	yes	Latest DOE (2012)	yes, yes	yes (1994)	3 classes for each, range is $9.83-19.64 [adjustments available]	
Gig Harbor	7,200	yes	Custom/ equivalent	yes, yes	yes (1984)	$12.92	(equiv. billing units) x SFR rate
Oak Harbor	22,000	yes	DOE 2005	yes, yes	yes (1997)	$13.92	(Imperv. Area/3,300) x SFR rate [reductions available]
Port Angeles	19,000	yes	DOE 2005	yes, yes	yes (2009)	$12.00	(Imperv. Area/4,000) x SFR rate
Port Orchard	11,200	yes	Custom/ equivalent	yes, yes	yes (2008)	$7.00	(Imperv. Area units) x SRF rate
Port Townsend	9,100	no	DOE 2005 w/ custom	yes, yes	yes (1997)	<3,000 sq ft: $7.25; >3k sq ft: (Imperv. Area/3,000) x $7.25	
Poulsbo	9,200	yes	Custom/ equivalent	yes, yes	yes (1981)	$10.72	(Imperv. Area/3,000) x SFR rate
Sequim	6,700	no	Latest DOE (2012)	no, no	no	none	none
Shelton	9,800	no	DOE 2005	yes, yes	yes (1995)	$12.10	$22.70 for <5000; $283.70 for >55,000 [reductions available]
Clallam County	71,400	no	DOE 1992, in critical areas	Draft plan underway	no	none	None
Jefferson County	30,000	no	Latest DOE (2012)	Plan only	no	none	None
Kitsap County	250,000	yes, county-wide	Custom/ equivalent	Yes, yes	yes (1994)	$6.50	(Imperv. Area/4,200) x SFR rate [reductions available]
Mason County	61,000	no	DOE 2005	Co-wide, & UGAs	yes (2008)	none	None

II. State NPDES permitting

Ecology's current NPDES permit from EPA for smaller jurisdictions (2012 Western Washington *Phase II* Municipal Stormwater Permit, pg. 7) says:

> "*…a local jurisdiction may not be required to obtain permit coverage if it has adequate programs in place and if its stormwater discharges are not a cause of "impairment" for any water bodies*."

NPDES permittees carry a heavy regulatory burden. Appendix D is a list of Phase II permit elements showing the status of associated stormwater management activities currently conducted by the City ("Sequim stormwater program gap analysis"). The table includes the following:

- Components of a fully implemented stormwater program under an Ecology Phase II permit
- Existing conditions (status quo) for each, where
  - 0 = service absent
  - 1 = service is developing or assumed to be underway
  - 2 = service is underway
- Reason for no action for components not currently addressed
- What would be needed to meet the permit requirement

This gap analysis shows more than 30 additional services or activities that would be needed if the City wanted to (or was told to) meet Phase II permit requirements.

Identified needs:
It is in Sequim's best interest to establish right away whether existing programs are "adequate" and whether City stormwater is a cause of the water quality problems seen in Bell or Johnson Creeks, Sequim Bay, or the shallow aquifer.

III. Water quality standards – surface water

The state uses several avenues to implement the federal Clean Water Act and protect and restore surface water quality to meet water quality goals and standards. Four key programs currently in use are listed here (the first two are directly linked):

1. Water quality assessments, and
2. Total Maximum Daily Load (TMDL) studies

Ecology's water quality assessment process involves identifying "impaired" waters every 2-5 years and submitting a list to EPA categorizing all waters of the state (see box). A TMDL is a plan which sets the maximum limit for pollutant discharge to a specific water body, to avoid exceedance of the state water quality standard.

<table>
<tr><td>Category 1. Meets Tested Criteria</td><td rowspan="3">Not known to be impaired</td><td rowspan="3">EPA approval and TMDL <u>not</u> required</td></tr>
<tr><td>Category 2. Waters of Concern</td></tr>
<tr><td>Category 3. Lack of Sufficient Data</td></tr>
<tr><td>Category 4. Impaired But Does Not Require a TMDL because
4a. Already has a TMDL</td><td>Impaired</td></tr>
</table>

4b. Has a Pollution Control Project 4c. Impaired but a TMDL is Inappropriate		
Category 5. The 303(d) List		EPA approval and TMDL required

If one or more sites on a water body are assigned Category 5 then a TMDL plan is required to be done to restore water quality; local entities are responsible for implementing programs to address the water quality problems.[5]

Bell Creek, Johnson Creek, and Sequim Bay all have Category 5 listings for one or more reach according to Ecology's 2012 assessment; however, no TMDL studies have begun to date. Whether or not the pollution indicated by these listings is currently present or associated with stormwater is not known, but should be investigated as soon as possible. (Additional water bodies in Sequim have been assessed and assigned Category 2 or 4c – a complete list may be found in the water quality section, above.)

Identified needs:
Sequim should evaluate existing data and consider collecting additional data to help determine whether stormwater might be the cause of existing pollution problems.

Sequim should determine whether a TMDL process is likely to be started for impaired water bodies in the City (Bell Creek, Johnson Creek, Sequim Bay).

3. NPDES permitting

The NPDES permit program is described at length above.

4. Water quality credit trading

Water quality credit trading (a.k.a. pollution trading, cap and trade) is a new program for Ecology which facilitates economic exchanges to achieve water quality improvements. Pollution trading may be especially useful for stormwater quality management in the future when a contaminant is particularly difficult to eliminate from a given discharge.

IV. Water quality standards – groundwater

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:

[5] This assessment/assignment process implements CWA Section 303(d) and is currently under review and revision by EPA, working with states and other stakeholders. (http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/programvision.cfm) The US Government Accountability Office (GAO) also reported the need for changes to the TMDL program in December 2013. (http://www.gao.gov/products/GAO-14-80) The aim of the review process should be that "TMDLs and alternative approaches are adaptively implemented to achieve water quality goals…," according to EPA.

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

Specifically, Ecology's UIC (Underground Injection Control) program partially implements the Safe Drinking Water Act by regulating UIC wells (registration with the state is required by the State, at minimum). Class V UIC wells include most drywells and perforated pipe infiltration systems. The City currently maintains dozens of these facilities (a complete inventory is underway), which are beneficial in that they preserve aquifer recharge in this water-short basin.

Owners of drywells, such as the City, are required to register their wells with the state.

Identified need:
Owners of drywells and other infiltration wells, such as the City, are required to provide inventory information by registering UIC wells with Ecology. The City should find funding to assess the potential threat to groundwater quality posed by its infiltration facilities.

Since most drinking water in our state is groundwater, Washington Department of Health (DOH) administers the federal Safe Drinking Water Act through regulation of public water systems. DOH's water system database is an important repository of groundwater quality data, including some toxics found in stormwater.

Control or avoidance of contaminants at their source is critical for pollution prevention. 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.

Specific stormwater BMPs are designed to deal with specific land uses and associated contaminants – such as road runoff as compared to yard, roof or agricultural runoff. The design of the City's stormwater management system will need to acknowledge the above programs and policies related to groundwater protection.

Identified needs:
The City should develop a master plan with BMPs that are most effective at protecting groundwater quality while preserving recharge given porous soil conditions such as Sequim's.

V. Federal and state fish and wildlife habitat protection

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 being written or implemented. While the ESA does not specifically address stormwater management activities, it does prohibit the "taking" of threatened or endangered species (i.e., killed or harmed – where harm can include habitat or water quality degradation).

Regarding habitat in the City – Bell Creek, from the mouth to the Highland Ditch crossing, and Johnson Creek, within and above the City – are both designated "critical" habitat for bull trout *(Salvelinus confluentus)* by the US Fish & Wildlife Service/USFWS, and proposed for the same for Puget Sound steelhead *(Oncorhynchus mykiss)* by the National Oceanic and Atmospheric Administration/NOAA.

Fish and wildlife habitat is also protected by the state "Hydraulic Code" (Ch 77.55 RCW) which requires a Hydraulic Project Approval (HPA) permit from WDFW for any construction activity that will divert, obstruct, or change the bed or flow of state waters.

Identified needs:
The City should determine the implications of federal critical habitat designations, in particular for ephemeral streams such as Bell Creek, and become involved if restoration planning commences.

VI. Sequim Municipal Code

Sequim's Title 13, Public Services, requires that stormwater designs follow the most recent state manual for western Washington. This policy is convenient administratively and conservative from a risk perspective. However, the state manual for western Washington is not necessarily best suited to Sequim's level of rainfall or its glacial geology and there may be better alternatives from, for example, eastern Washington. Since Sequim is not bound by state permit requirements, technically speaking, its code could be amended to allow a different manual when it is appropriate to do so.

Identified needs:
Sequim should determine the criteria Ecology uses to approve "equivalent" stormwater manuals for NPDES permittees, and consider alternatives based on local conditions.

Regarding "low impact development" (LID), SMC chapters existing in 2009 pertinent to stormwater management were evaluated closely by AHBL, Inc., in the "LID Local Regulation Assistance Project of 2009," funded by Puget Sound Partnership. AHBL provided marked-up copies of our codes for consideration by decision makers. These suggested revisions were apparently never considered by the City Council (according to Council minutes from late 2009-early 2010), likely due to staff turnover at the time. The suggestions and AHBL report should be examined closely by current staff and consultants as the City considers improvements to managing stormwater.

AHBL draft code amendments state that "LID practices are required unless proven infeasible…."

Specifically, the 2009 report from AHBL indicates that Sequim's code required relatively minimal adjustments to accommodate LID provisions. The City pointed out that Sequim is uniquely concerned with conserving water resources due to our relatively dry climate, and instructed AHBL to make code revisions for LID prescriptive as means to promote groundwater recharge and protect local resources in general. The consultant team wrote the amendments with the clause that "LID practices are required unless proven infeasible as determined by Public Works," and provided guidance for determining the conditions under which LID requirements should be waived.

Appendix E contains a summary of AHBL suggestions to portions of the SMC listed here, and other information: (the complete report may be found at the link listed under References)

- Title 12 – Streets, Sidewalks and Public Places
- Title 13 – Public Services
    - Chapter 13.108 Stormwater Maintenance*
- Title 17 – Subdivisions
- Title 18 – Zoning
    - Proposed Chapter 18.23 Land Clearing and Grading
- LID Road Standards (road sections to add to existing engineering design standards)
- Appendices including (partial list):
    - Draft Protection of LID BMPs During Construction
    - Criteria for Determining When LID is Feasible
    - Background on LID Performance Standards
    - Pervious pavement
    - Recommended tree species
    - Green roofs
    - Stormwater utility user fee credits

*As discussed in prior sections, the City currently has no funding for implementation of an inspection program.

Identified needs:
The City should consider AHBL recommendations and evaluate additional chapters of the SMC that are pertinent to stormwater management:

- 8.36 Flood Damage Prevention
- 13.40 Sewer Connection Required
- 13.48 Public Sewer Use Regulations
- 13.64 Storm Drainage
- 13.104 Stormwater Management
- 15.04.010 adopting IBC Appendix J (Grading)**
- 18.80 Critical and Environmentally Sensitive Areas Protection (wetlands, fish and wildlife habitat, and CARA*** sections in particular)

**The code regulating grading is SMC 15.04.010, which adopts the International Building Code (IBC) including Appendix J, Grading. IBC Appendix J provides requirements for the permit, submittals, inspections, and more; however, it does not address clearing or retention of native vegetation.

***The aquifer recharge section of the critical areas code prohibits drywells and other facilities used for stormwater control on City streets. SMC 18.80.100 part G says

> *"The following activities and uses are prohibited in high and moderate critical aquifer recharge areas:*
>
> *3. All classes of underground injection wells, unless approved by the state or local authorities as part of an approved remediation plan; …"*

Identified need:
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.

VII. Additional rules and policies pertinent to stormwater

The following plans, rules, policies and programs are also associated with stormwater management, but more indirectly than those listed above.

TABLE 11. Additional policies, plans, and programs pertinent to stormwater

Plan, program, etc.	Nexus with stormwater planning
Sequim Water System Plan ("Water Master Plan")	• Service area identification, demographic info, planning data • Source analyses, water rights adequacy, mitigation requirements • Groundwater monitoring • Wellhead protection program, recharge zones, contaminant source i.d. and inventories • Emergency response re: snow, flooding, contamination • Capital improvements re: storage
Sequim General Sewer Plan ("Sewer Master Plan")	• Planning data, flow data (esp. seasonal) • Infiltration & Inflow evaluation, smoke testing results • Modeling? • Reclaimed water users, facilities • O&M resource sharing?
Sequim Shoreline Management Program	Adopted fall 2013, prepared by DCD
County building code	Setback of infiltration facilities from private wells and septic systems
Health (or Ecology?) source water assessment	Stormwater facilities (especially infiltration) may need additional protection within wellhead protection areas
Ch 173-518 – Dungeness Water Rule	Mitigation options include aquifer recharge
Growth Management Act	Obliges cities to provide urban-level services and to plan for growth in Urban Growth Areas (UGAs)
Ch 197-11 WAC – SEPA	Environmental checklist (Master Plan will need this)
Ch 173-154 WAC – Protection of upper aquifer zones	Infiltration of stormwater implements this rule
Puget Sound Partnership / Action Agenda	Near Term Action for Strait ERN includes develop and implement stormwater management plan
Dept. of Homeland Security / FEMA	National Flood Insurance Program (including FEMA floodplain mapping) can be influenced by stormwater management policies; Also, in 2014-16 FEMA is conducting a "Risk MAP" project (MAP refers to mapping, assessment and planning) for flooding in coastal areas in Clallam County. At this time Sequim's participation is led by DCD.
WRIA 18 watershed plan	Stormwater management implements plan
JSK Tribe watershed plan	Stormwater management implements plan
Irrigators' CIDMP, water conservation plan	Irrigation district and company operating procedures implicate stormwater management in the City. Specific measures may be indicated in the CIDMP (Comprehensive Irrigation District Management Plan).

Identified need:
The City should consider whether there are additional, pertinent rules or programs which should be integrated with storm and surface water master planning.

Part 3. NEEDS ASSESSMENT

I. Purpose

This report provides information to help answer the question "Is there a stormwater management problem in Sequim that needs to be addressed at this time?" It's an especially important question given Sequim's lack of frequent storms and since most puddles disappear within an hour or two. It is true that "stormwater runoff" sounds like something no one should have to worry much about in Sequim.

By definition, "stormwater" and "runoff" aren't problems any more than rain and snow are. But risk is introduced when runoff transports pollutants and when high stormwater flows cause flooding and damage property or habitat. Also, the term "runoff" means water that is flowing overland rather than infiltrating—and thus reducing the potential for replenishment of groundwater supplies.

For municipalities, managing stormwater (and all surface water) is directly linked to managing risk. Exposure to risk is less if the City is actively involved in protecting property and the environment, ensuring the free flow of traffic and commerce, conserving water resources, and complying with water quality regulations. The fact that Sequim receives stormwater runoff from other jurisdictions means that risk is shared and that cooperation will be needed.

This project identifies storm and surface water management needs in the context of managing risk. The next step is to prioritize recommendations and continue to address needs and problems as funding becomes available.

II. Methods

The process of identifying potential needs first involved gathering information on the natural and built drainage systems and water flow patterns in and through the City and its UGA. Findings are detailed in the previous section, "Existing Conditions."

- The "Physical Setting" chapter examines the hydrology of the region and the four drainage basins within the City and its UGA.
- The "Capital Facilities" chapter discusses the stormwater infrastructure in general, both public and private.
- "Stormwater Program" describes existing operations directly or indirectly related to stormwater.
- The "Regulatory Context" chapter gives an overview of federal, state, and City laws and rules regarding stormwater and, when applicable, Sequim's compliance status.

To identify runoff and flooding problems we solicited and received reports, photos, and stories from City staff, business owners, irrigation managers, Clallam County, and the public (the City newsletter had a note each month throughout Winter and Spring asking residents to report pooling water). The Sequim Gazette published an article on the project in the Fall with contact information. Field inventories were also conducted and a field map was used to record most of what was reported (note photo on cover).

Issues related to regulatory compliance and enforcement, water quality, communications, long-range planning, funding, and others became known through interviews and research into technical reports and datasets.

Next the City will solicit assistance to prepare its first storm and surface water management plan which will specifically address the needs identified below and provide strategies for funding.

III. Summary of identified needs

This section provides specifics with which one can answer the question posed above: it is a list of specific stormwater management issues that exist at the present time and need to be prioritized and addressed as funding is made available. Highlights include:

- *Capital improvements, especially under-sized culverts, conveyances and infiltration facilities*
- *Stormwater management agreements with partners such as Clallam County and irrigation managers*
- *Inspections of City and private facilities*
- *Long-term planning for growth, potential changes in weather patterns, and infrastructure resilience*
- *Water quality and habitat information in order to determine whether stormwater may be adversely impacting the environment*
- *Education and outreach to the community regarding pollution prevention*
- *Funding strategies to address these concerns*

Each section below lists specific identified problems and topics which will be addressed in the upcoming storm and surface water master plan.

A. Capital Facility Improvements

- Improvements needed to resolve ponding and runoff problems on City property identified at the time of writing:
    - 17 sites noted in Appendix A1 where a creek is impacted (mostly Bell Creek)
    - 60 sites noted in Appendix A2 for City streets and properties
    - 7 sites noted in Appendix A3 where street drains are improperly connected
- Inflow of stormwater into sewer lines needs to be eliminated, and the resulting storm flows need to be managed to avoid runoff and flooding problems elsewhere.
    - Infiltration into the sewer from seasonal high groundwater is a lesser issue and not necessarily stormwater-related.
- Modeling and other analyses are needed of anticipated stormwater capacity and treatment needs (storage, infiltration and otherwise) as the City grows, including consideration of how climate change might affect storm patterns and how regulations may be imposed.

- Capacity planning could utilize City water level data obtained by the Water Program for the shallow aquifer to determine subsurface storage capacity in areas with soils conducive to infiltration.
- Stormwater planning should be coordinated with the Sewer Master Plan, especially regarding planned capital improvements for aquifer recharge and storage.
- Opportunities for maximizing infiltration with existing or easily converted (eg, permeable pavement) facilities should be explored.

B. Operations and Maintenance

- Street sweeping coverage is good but the routine should be evaluated to ensure adequate infrastructure protection and pollutant removal.
- Inspection of City-managed facilities is not conducted for all facilities each year due to staff limitations as well as vac truck availability (since it is shared with the sewer program), both of which are directly related to funding shortages.
- A policy should be adopted to avoid unnecessary inheritance of facilities that add to the City's maintenance and repair obligations.
- Agreements regarding the type and frequency of maintenance should be established with irrigators and other stormwater management partners, including homeowner associations, commercial landowners, and WSDOT, as needed.



Cooperation between the City and other local water managers, such as Clallam County and the irrigation companies and districts, will be key to effective stormwater management in the region.

This photo shows a City crew member removing debris that built up during a recent storm (3/8/2014). If storm grates at the entrances to irrigation line siphons under Hwy 101 don't get cleaned regularly during and after storms, the siphon clogs and water backs up onto private property.

- The potential for improved internal communications within Public Works to facilitate improvements in O&M activities should be explored.
- Trash and litter accumulate in certain problem areas.

- The GIS dataset should be completed with all stormwater facilities (including irrigation conveyances) with capacity/construction information, and should distinguish between City and non-City facilities.
    - The GIS (and/or other programs) should be used to document inspection and maintenance activities.
    - Major parking lots and subdivisions should be included in the City's inventory and GIS.
    - Washington State DOT facilities installed for SR 101 should be noted in the inventory and GIS.

C. Environmental protection

1. Outreach and Education

- 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.

2. Water Quality Assessments and Monitoring

- 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. Appendix C summarizes recent water quality data collection efforts.
    - 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
- The City should consider Battelle's 2003 report on accumulation of metals in streambed sediments in Bell Creek as it develops a water quality monitoring plan.
- 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.
    - The DOH Sentry database for public water systems should be accessed for nitrate and other pertinent groundwater quality data.
    - The City should coordinate with Clallam County and Washington Departments of Health and Ecology on ambient (at least once/year) monitoring of groundwater nitrate concentrations.
    - The City should track and cooperate with the current Clallam County – Department of Ecology investigation of Freon 22 in the shallow aquifer.
- 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, vac/ sweeper truck waste, etc.)

- 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.

3. Habitat Protection

- Federal assessments designate Bell and Johnson Creeks as "critical habitat" for two species of threatened or endangered salmon, listed here. The City should determine the implications of these designations on current and future land use management and general operations.
    - Bull trout (critical habitat designated in 2010)
    - Puget Sound steelhead (critical habitat currently proposed for designation)
- The City should participate in studying fish use and setting restoration goals for both creeks.
    - Appendix B lists creek culverts including dimensions
- 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.
- 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 streamflows.

4. Illicit Discharge Detection and Elimination

- The City should consider options for addressing this key NPDES permit requirement to have a program for actively identifying pollution sources.

5. Emergency Response

- The City should evaluate whether emergency response procedures have environmental impacts and, if so, ways to mitigate those impacts.
    - Coordination with other City programs (e.g., Police Dept.) and outside entities (e.g., Clallam County, irrigators, and others) will be essential.

D. <u>Regulatory Programs</u>

1. Federal and State

- NPDES Phase II permit requirements could be imposed during the next cycle (2017-18) by Ecology; however, according to the state permit, a local jurisdiction may not be required to obtain coverage under the state permit if (a) adequate programs are in place and (b) its stormwater discharges are not a cause of impairment for any water bodies.
    - Regarding (a): The status quo for the City falls short of Phase II permit requirements by about 32 services, most of them outreach, enforcement, monitoring, and reporting. All may not need full implementation to have "adequate programs in place" – but they all

should be addressed at minimum. See Appendix D for a gap analysis of permit requirements and City activities pertinent to each.
    - Regarding (b): Bell Creek, Johnson Creek, and Sequim Bay are all currently categorized as "impaired," but Sequim has no monitoring programs of its own to establish whether or not stormwater is a cause.
    - Also, NPDES permitting policies and administration are changing at the federal and state levels; the City should track these changes and consider getting involved in the process.
- Other laws implementing the Clean Water Act and the Endangered Species Act.
    - Pollution prevention and habitat protection plans may be needed.
    - Standards set in NPDES legislation should be considered:
        - Reducing discharge of pollutants to the "maximum extent practicable" (MEP).
        - Use of all known, available, and reasonable methods of prevention, control, and treatment (AKART) of pollution in waters of the state.
        - Minimum requirements for responding and using adaptive management for accidental, spill-type discharges.
    - UIC registration with the state is required for the City's 150+ drywells and infiltration drainfields.
    - DOH-required monitoring of drinking water quality and protection of wellhead protection areas should be coordinated with related stormwater program elements.
    - The City should determine whether a TMDL process is likely to be started.

2. Sequim Municipal Code (SMC)

- Education about and enforcement of Title 13 chapters regarding stormwater is lacking due to a shortage of funding.
    - Application of the state stormwater management manual for single family vs. larger development projects should be clarified.
    - Non-City facilities may get regular inspections and maintenance – but such inspections may not be enforced or monitored, since the City does not have the funding for an inspection program.
- The City should consider in its priorities funding and instituting an inspection program – and be consistent in its requests for compliance from private landowners.
    - Standards for maintenance of stormwater facilities should be circulated internally and among non-city facility owners, or developed if they don't exist (i.e., conditions that define when maintenance is essential vs. optional).
    - Protocols may also be needed, especially for ensuring that non-City facilities are maintained according to City standards.
- A gap analysis for other sections of the SMC should be performed to ensure complete internal compliance. At the same time, recommendations from the City's 2009 LID regulations assessment should be considered for integration to the SMC (see Appendix E for a summary).

3. Sequim Comprehensive Plan

- While it's not a regulation, City programs and policies should strive to implement Comp Plan goals. Key themes pertinent to stormwater from the most recent (2012) visioning include:
    - Growth patterns will promote efficiency in resource utilization and sustainable resource management
    - The City's image and identify will be promoted by responsible stewardship of both the human-built and natural environments

E. Public Participation

- A stormwater program needs community engagement in order to thrive. Regular opportunities for public participation should be sought throughout master plan development and implementation.



F. Code Amendment

- Implementation of a stormwater program will likely require amendments to the SMC.
- Draft SMC amendments and additions pertaining to a City stormwater program and LID should be re-considered.

G. Funding

- The City needs a funding strategy for operational activities that can't be financed by grants and development fees.
    - The City needs to address the inequity among landowners in paying for their stormwater facility maintenance.
- The City needs a funding strategy for capital expenses that includes grants and outside sources of funds.
- Budget analysis and forecasting
    - Setting rates/rate structure (if a new Utility were to be chosen)
    - Credits and exemptions, if any
    - Incentives

H. Administration

- Revenue and expense tracking
    - Billing (if a new Utility were chosen)
    - Grant administration (state, federal, etc.)
    - Loan administration
    - Etc.

I. Values

- Consistency with Sequim 120 and the Comprehensive Plan
- Stormwater is a resource rather than a liability
- Emphasize "green Infrastructure" for recharge, and L.I.D.
- Stormwater provides an opportunity to manage surface and ground water according to the water supply needs within each sub-basin
- Integrate stormwater facilities with Streets and Parks improvements
- Join with "place-making" identity efforts around the value of water
- Coordinate/cooperate with multiple stakeholders
- Emphasize proactive, adaptive management

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Government Land Office maps were obtained from Clallam County Public Works, Port Angeles, WA. Photos of fish courtesy Shreffler Environmental, Sequim, WA.



ACRONYMS AND GLOSSARY

(from http://www.kingcounty.gov/environment/waterandland/stormwater/glossary.aspx ; http://www.ecy.wa.gov/programs/sea/wetlands/bas/vol2final/Glossary_Volume%202_.pdf)

303(d) waterbody A list of lakes, rivers, and streams that have been designated by the state as impaired or threatened by a pollutant(s) for which one or more TMDL(s) are needed. Impaired means that the water is not meeting state water quality standards.

Adaptive management A systematic process for continually improving management policies and practices by learning from the outcomes of previous policies and practices.

AKART All known, available, and reasonable methods of prevention, control, and treatment (AKART), e.g., of pollution in waters of the state.

Aquifer A geologic stratum containing groundwater that can be withdrawn and used for human purposes.

Basin Any area draining to a point (such as the mouth of a stream).

Benthic macroinvertebrates A.k.a., stream bugs

Bioassessment A measure of biological integrity (habitat, ecological function, etc.).

Biofiltration swale (or Bioswale) A long, gently sloped, vegetated ditch designed to filter pollutants from stormwater. Grass is the most common vegetation, but wetland vegetation can be used if the soil is saturated.

BMP Best Management Practice. A proven method for controlling or treating stormwater using either Structural or Nonstructural means.

Catch Basin, Type I sketch (PDF, 400-800kb) An underground concrete water receiving inlet, rectangular in shape (approximately 3' x 2' x 4' deep) with a slotted iron grate on top to inlet water or a solid rectangular cover. Water may also enter/exit through culverts visible in the side walls of basin. Also referred to as an Inlet.

Catch Basin, Type II sketch (PDF, 400-800kb) A round concrete underground basin (4'-8' diameter; 6' or greater deep); may contain Flow Restrictor/Oil Pollution control device. These basins are also required when larger diameter culverts are used. Also referred to as a Manhole or Control Manhole.

Critical areas As defined by the Growth Management Act, RCW 36.70A.030, these "include the following areas and ecosystems: (a) Wetlands; (b) areas with a critical recharging effect on aquifers used for potable water; (c) fish and wildlife habitat conservation areas; (d) frequently flooded areas; and (e) geologically hazardous areas".

Culvert Pipe or concrete box structure which drains open channels, swales, or ditches under a roadway or embankment typically with no catch basins or manholes along its length.

CWA Clean Water Act. The federal environmental law that includes the management of stormwater.

Detention Release of surface and storm water runoff from the site at a slower rate than it is collected by the drainage facility system, the difference being held in temporary storage.

Direct discharge Undetained discharge from a proposed project to a major receiving water.

Drainage basin An area draining to a certain location.

Ecology Washington State Department of Ecology

EPA Environmental Protection Agency (federal)

ESA Endangered Species Act

FEMA Federal Emergency Management Agency

Green infrastructure An interconnected network of stormwater facilities that contributes to the physical and economic health and quality of life of communities. Green Infrastructure also refers to the "services" that this network of ecosystems provide to people and communities. Such services as water filtration and aquifer recharge, flood attenuation, and biodiversity. (Opposite of “gray infrastructure,” the more conventional network of conveyance pipes and a centralized treatment facility.)

Groundwater Underground water usually found in aquifers. Groundwater usually originates from infiltration. Wells tap groundwater aquifers for water supply uses.

Habitat The specific area or environment in which a particular type of plant or animal lives and grows.

Harmful pollutant A substance that has adverse effects to an organism including death, chronic poisoning, impaired reproduction, cancer, or other effects.

Hydrologic cycle The circuit of water movement from the atmosphere to the earth and return to the atmosphere through various stages or processes such as precipitation, interception, runoff, infiltration, percolation, storage, evaporation, and transpiration.

Illicit discharges Regular discharges of non-stormwater to the storm drainage system. Examples are discharges from internal floor drains, appliances, sinks, and toilets that are connected to the nearby storm drains – as well as pollutants deposited directly onto streets and other urban surfaces (such as washwater from industrial processes, etc.). These discharges should be going to the sanitary sewer system, a holding tank, an on-site process water treatment system, or a septic system.

Impervious surface A hard surface area which either prevents or retards the entry of water into the soil as under natural conditions prior to development; and/or a hard surface area which causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development. Common impervious surfaces include, but are not limited to,

roof tops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, gravel roads, packed earthen materials, and oiled, macadam, or other surfaces which similarly impede the natural infiltration of surface and storm water runoff.

Infiltration/Inflow (I/I) Clean storm and/or groundwater that enters the sewer system through cracked pipes, leaky manholes, or improperly connected storm drains, down spouts and sump pumps. Most inflow comes from stormwater and most infiltration comes from groundwater. I/I affects the size of conveyance and treatment systems and, ultimately, the rate businesses and residents pay to operate and maintain them.

Infiltration facility A drainage facility designed to use the hydrologic process of water soaking into the ground (commonly referred to as percolation) to dispose of surface and storm water runoff.

LID (Low Impact Development) Low Impact Development (LID) is a stormwater management approach with a basic principle that is modeled after nature: manage rainfall at the source using uniformly distributed decentralized micro-scale controls. The goal of LID is to mimic a site's predevelopment hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to its source.

MEP Maximum Extent Practicable

Mitigation An activity undertaken for the purpose of mitigating adverse impacts from an action, such as avoiding, minimizing, restoring, reducing over time, compensating, or monitoring and applying adaptive management as impacts become known.

MS4 (Municipal Separate Storm Sewer System) A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

1. Owned and operated by a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to state law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under state law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act (CWA) that discharges to waters of the United States;
2. Designed or used for collecting or conveying stormwater;
3. Which is not a combined sewer; and
4. Which is not part of a publicly owned treatment works (POTW).

[40 CFR 122.26(b)(8)]

Natural conveyance systems Swales and small drainage courses, streams, rivers, lakes, and wetlands.

NMFS National Marine Fisheries Service

Nonpoint source (NPS) pollution NPS pollution occurs when rainfall, snowmelt, or irrigation runs over land or through the ground, picks up pollutants, and deposits them into rivers, lakes, and coastal waters or introduces them into ground water in a diffuse manner (rather than at a point or pipe).

NOAA National Oceanographic and Atmospheric Administration

Nonstructural BMP A preventative action to protect receiving water quality that does not require construction. Nonstructural BMPs rely predominantly on behavioral changes in order to be effective. Major categories of non-structural BMPs include education, recycling, maintenance practices and source controls.

NPDES National Pollutant Discharge Elimination System. The part of the Clean Water Act which requires point source discharges to obtain permits. These permits, referred to as NPDES permits, are administered by the Washington State Department of Ecology.

Oil/water separator A vault, usually underground designed to provide a quiescent environment to separate oil from water. Floatables (e.g., styrofoam) are also removed.

Outfall A point where collected and concentrated surface and storm water runoff is discharged from a pipe system or culvert.

Point source pollutant Storm water discharges are generated by runoff from land and impervious areas such as paved streets, parking lots, and building rooftops during rainfall and snow events that often contain pollutants in quantities that could adversely affect water quality. Most storm water discharges are considered point sources and require coverage by an NPDES permit. The primary method to control storm water discharges is through the use of best management practices.

Reach A length of channel with uniform characteristics.

Receiving waters Bodies of water or surface water systems receiving water from upstream man-made or natural systems.

Recharge The flow to groundwater from the infiltration of surface and stormwater runoff.

Retention The process of collecting and holding surface and storm water runoff with no surface outflow.

Riparian Pertaining to the banks of rivers and streams, and sometimes also wetlands, lakes, or tidewater.

Runoff Water originating from rainfall and other precipitation that ultimately flows into drainage facilities, rivers, streams, springs, ponds, lakes, and wetlands – as well as shallow groundwater.

Salmonid A member of the fish family *Salmonidae*. These include Chinook, Coho, chum, sockeye, and pink salmon; cutthroat, rainbow, and brown trout and steelhead; Dolly Varden, brook trout, char, kokanee, and whitefish (and possibly others).

SDWA Safe Drinking Water Act (federal)

SEPA State Environmental Policy Act

SMC Sequim Municipal Code

Stormwater Stormwater is precipitation or snowmelt that runs off surfaces such as rooftops, paved streets, highways, and parking lots. It can also come from hard grassy surfaces like lawns, play fields, and from graveled roads and parking lots.

Stormwater facility Facilities that control the discharge of stormwater and that remove pollutants. Examples include storage facilities (ponds, vaults, underground tanks, and infiltration systems); water quality facilities (wetponds, biofiltration swales, constructed wetlands, sand filters, and oil/water separators); and conveyance systems (ditches, pipes, and catchbasins).

Stormwater management The application of site design principles and construction techniques to prevent sediments and other pollutants from entering surface or ground water; source controls; and treatment of runoff to reduce pollution.

SMP (or SWMP) Stormwater Management Program

Storm drain system The system of gutters, pipes, streams, or ditches used to carry surface and storm water from surrounding lands to streams, lakes, or Puget Sound – or to infiltration facilities.

Structural BMP Constructed facilities or measures to help protect receiving water quality and control stormwater quantity. Examples include storage, vegetation, infiltration, and filtration.

Sub-basin A smaller drainage basin that is part of a larger drainage basin or watershed. For example, the watershed of a large river may be composed of several sub-basins, one for each tributary.

Swale A shallow drainage conveyance with relatively gentle side slopes, generally with flow depths less than one foot.

SWPPP Stormwater Pollution Prevention Plan

TMDL A TMDL (Total Maximum Daily Load) is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. Water quality standards identify the uses for each waterbody, for example, drinking water supply, contact recreation (swimming), and aquatic life support (fishing), and the scientific criteria to support that use. The federal Clean Water Act, section 303, establishes the water quality standards and TMDL programs.

Toxic Poisonous, carcinogenic, or otherwise directly harmful to life.

Watershed A geographic area of land bounded by topographic high points in which water drains to a common destination.

UIC well A UIC well (Underground Injection Control well) is one used to discharge fluids into the subsurface. Examples are drywells, infiltration trenches with perforated pipe, and any structure deeper than its widest surface dimension. Because of the potential for groundwater contamination, UIC wells are regulated closely by Ecology.

USFWS United State Fish and Wildlife Service

Wellhead protection area A wellhead protection area is defined as the surface and subsurface area surrounding a water well or wellfield supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield.

Wetland An area inundated or saturated by ground or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (U.S. Army Corps of Engineers Regulation 33 CFR 328.3 (1988)).

WSDOT Washington State Department of Transportation

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FIGURES

See separate file for Figures.

1. Stormwater Study Area
2. Soils
3. a. 1859 Government Land Office (GLO) map
   b. 1914 Government Land Office (GLO) map
4. Drainage features and problem areas
   a. Sections 18 and 17
   b. Sections 24 and 19
   c. Sections 20 and 21
   d. Sections 22 and 27
   e. Sections 25 and 30
   f. Sections 29 and 28
5. Monitoring Sites (used by others in recent water quality studies)
6. Public Water Systems

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APPENDIX

A. Runoff/flooding problem areas (located on Figures 4a-f)
    1. Creeks
    2. City-owned properties
    3. Mis-connected street drains
B. Creek culverts
C. Water quality study summary
D. Sequim stormwater program gap analysis
E. 2009 LID Local Regulation Assistance Project summary from AHBL

APPENDIX A1, Runoff and Flooding Problems: Creeks

ID	A1.01
Creek	Bell
RM	0.2
Location	west end Schmuck Road culvert
Problem	**Creek backs up in extreme events, flows onto private property**
Comments	County/UGA (photo shows upstream area near Water Reclamation Facility)





ID	A1.02
Creek	Bell
RM	1.3
Location	west end Rhodefer Road culvert
Problem	**Culvert backs up in moderate events**
Comments	Ponds upstream overflow (see next sites)



APPENDIX A1, Runoff and Flooding Problems: Creeks

ID	A1.03
Creek	Bell
RM	1.4
Location	Lower pond at Carrie Blake Park
Problem	**Creek flows out of pond to north onto City property (Re-use Park)**
Comments	



ID	A1.04
Creek	Bell
RM	1.55
Location	Carrie Blake Park entrance
Problem	**Culverts fill in high flows**
Comments	



APPENDIX A1, Runoff and Flooding Problems: Creeks

ID	A1.05
Creek	Bell
RM	1.6
Location	east end N Blake Ave culvert
Problem	**Creek flows out of channel onto private and City property**
Comments	2013: ditch scraped and gravel laid to facilitate recharge and stabilize bank (problem may be resolved)





ID	A1.06
Creek	Bell
RM	1.6
Location	west end N Blake Ave culvert
Problem	**Culvert backs up**
Comments	



APPENDIX A1, Runoff and Flooding Problems: Creeks

ID	A1.07
Creek	Bell
RM	1.8
Location	south side E Washington culvert
Problem	**Culvert backs up**
Comments	Culvert starts out heading north, angles NE under N Brown, then joins box culvert under Les Schwab driveway



ID	A1.08
Creek	Bell
RM	1.85
Location	S Brown at south end private driveway
Problem	**Culvert backs up**
Comments	(photo shows flood from late spring storm plus irrigation system carrying high volume)



APPENDIX A1, Runoff and Flooding Problems: Creeks

ID	A1.09
Creek	Bell
RM	2.2 - 1.8
Location	[Burrowes property]
Problem	**Flooding from Creek, irrigation ditches, and/or roadside ditches**
Comments	Water volume fluctuates due to Highland ditch input (most of which is runoff but irregular timing)



ID	A1.10
Creek	Bell
RM	2.2
Location	south end E Hammond ROW culvert (across from apartments)
Problem	**Culvert backs up onto private property**
Comments	Very overgrown; upstream culvert not visible/accessible



APPENDIX A1, Runoff and Flooding Problems: Creeks

ID	A1.11
Creek	Bell
RM	2.5
Location	S Sequim Ave culvert (DOT)
Problem	**Gravel accumulation and mounding**
Comments	May not be a problem



ID	A1.12
Creek	Bell
RM	2.6
Location	City shop property, west of Sequim Ave.
Problem	**Culvert may back up (based on appearance of floodplain upstream)**
Comments	"Floodplain" is on City property. Culvert undersized relative to 101 and others nearby; may be remnant from railroad xing.





APPENDIX A1, Runoff and Flooding Problems: Creeks

ID	A1.13
Creek	Bell
RM	2.7
Location	Hwy 101
Problem	**Gravel accumulation may be a problem in box culvert**
Comments	Est. 2-3' deep gravel/ sediment



ID	A1.14
Creek	Bell
RM	3.5
Location	Highland irrigation ditch
Problem	**Spillway (weir) up-ditch from siphon dumps stormwater and Dungeness River water throughout year**
Comments	Erosion from outfall could affect water quality; irregular use creates irregular hydrology, fills storage capacity in floodplain below



APPENDIX A1, Runoff and Flooding Problems: Creeks

ID	A1.15
Creek	Bell
RM	3.6
Location	Highland irrigation ditch siphon
Problem	**When valve opened up, water shoots into creek bank, causing erosion**
Comments	Erosion of streambank may affect habitat



ID	A1.16
Creek	Gierin
RM	2.6
Location	west side of N Brown Rd culvert (outside UGA)
Problem	**Potential culvert backing up due to runoff partially originating in City**
Comments	Culvert not visible from road. Property owned by Graysmarsh.



APPENDIX A1, Runoff and Flooding Problems: Creeks

ID	A1.17
Creek	Johnson
RM	1.6
Location	Highland ditch tailwater discharge, off Happy Valley Rd via ditch easement road
Problem	**Erosion, habitat damage**
Comments	*Outside City and UGA, but influences water quality and habitat in City*

Photo not available

APPENDIX A2, Runoff and Flooding Problems: City-owned properties

For photos and updated information contact Sequim Public Works

ID	Street	Cross street/Location	Problem (if more specific than flooding/ ponding)	Checked/Maintained	Comments
A2.01	S 2nd	Washington	Roger mentioned the ponding goes into planted area and washes bark out to street		CB/facilities at both SE and SW corners undersized - big ponds; takes in water from Washington
A2.02	S 3rd	Bell - SW corner			reported by resident
A2.03	S 3rd	Hemlock - NW corner		Permeable pavement works where it exists	Other areas pond even in small events
A2.04	S 3rd	Drive to Hideaway Homes MHP		2/18/2014 erosion of ROW from culvert under drive; flooding neighboring property (problem created by Bypass project?)	Runoff continues north to DOT detention pond; check DOT drawings (pg D13)
A2.05	N 5th	Cedar, SE corner		vac'd fall 2013	Flood covers sidewalk
A2.06	N 5th	Spruce, SE corner		11/13/2013; vac'd, jetted all CBs and pipes to drywell	
A2.07	N 5th	Alder, SE corner		11/13/2013; vac'd, jetted CBs and drywell. Note concrete chunk at end of inlet pipe may cause clogging.	
A2.08	N 5th	south of Hendrickson, west side across from SARC drive			
A2.09	S 5th	W Salal Place (south of 101)		March 2014 photos	
A2.10	S 5th	Sea Breeze apts., near entrance to Avamere	ditch discharges to north into small swale	Jan. 2014 photos	May be at least partially irrigation ditch water (see A2.11)
A2.11	S 5th	near west entrance to Maple Ridge		Check for irrigation ditch--flows year round (not on map); potential plugged culvert	
A2.12	7th	Washington, SW corner especially (in front of McDonald's)		Fall/winter 2013-14	Connection between corners?
A2.13	N 7th	W shoulder and parking lot for Flooring business at 147 N 7th		Check CBs and pipe connections (street drain connected to parking lot drywell); whole area floods	(also listed in mis-connected stormdrains list)
A2.14	N Blake	Fir		Check pervious pavement	
A2.15	S Brown	300' south of Washington		CBs? irrigation ditch culvert overflows	Highland Irrigation District
A2.16	S Brown	Washington, SW corner as well as south along Brown		Bell Creek backs up	(also listed under Creek issues)
A2.17	S Brown	Hammond corner		Stormwater from Bypass area could flood this corner and Hammond	
A2.18	E Brownfield	entire length		check for flooding; various CBs, ditches, irrigation pipes, culverts	

ID	Street	Cross street/Location	Problem (if more specific than flooding/ ponding)	Checked/Maintained	Comments
A2.19	Carrie Blake Park	Parking lot, SW and SE of Guy Cole	Extends to baseball fields		
A2.20	Carrie Blake Park	Skate park, near parking area			needs better drainage summer and winter
A2.21	Carrie Blake Park	Playground, north side near swings		hydrant leaks, causes ponding	(not a stormwater problem, but contributes to flooding)
A2.22	Carrie Blake Park (and Re-use Park)	North side lower pond	Floods to north when Bell is high		reaches Re-use park parking lot
A2.23	Centennial Place	Sequim & Washington	Storm drain connects to sewer	Fall/winter 2013-14	(also listed on I/I list)
A2.24	Dunlap	341 Dunlap		pooling photo taken Dec. 21, 2013	reported by Genaveve Starr on 2/10/14
A2.25	Etta St	center (between Sequim Ave and Sunnyside)	I/I site, private catchbasin to east		inspection needed
A2.26	Falcon Rd	south end and near Eastgate Place (roads and private property)		Ponding on several roads and properties	Runoff from west Happy Valley enters Eureka ditch north of Mockingbird Lane
A2.27	W Fir	5th Ave, SE corner		(check Ty's notes for recent inspection)	Storm drain overflows to street when drywell is full
A2.28	W Fir	bwtn 5th and Sequim Ave		Check pervious pavement installations	Reconstruction incl. stormwater expected in 2014-15
A2.29	E Hammond St	between S Brown and S Still Rd	ditch overflows, floods street; runoff is from south of 101	(ditch obstructions would cause major flooding)	Ditch flows east to a swale at Still Rd., then to the irrigation ditch along West Sequim Bay Rd.
A2.30	W Hammond St	S 3rd Place			reported by resident at 341 W Hammond. Kendra Donelson 683-7793
A2.31	Happy Valley Rd	Bell Creek culvert at UGA boundary		Check during storm	County culvert
A2.32	N Honeycomb Circle	Deseret intersection, SW corner		checked CB 10/29/2013, nothing to vac	(large vault is not perf'd)
A2.33	W McCurdy Rd	S 5th, east end of McCurdy -- runoff flows overland to east			
A2.34	Miller Rd	starting from Doe Run	Excess runoff from Highland Hills detention ponds	Check during storm	Pond capacity not utilized, overflow goes to Miller Rd.
A2.35	Miller Rd	Emerald Highlands	Overflows to swale at 101 ramp	maintenance frequency?	
A2.36	Miller Rd	Luis property (744 Miller Rd)		Check roadside ditch and bank sloughing down	City considering piping ditch

ID	Street	Cross street/Location	Problem (if more specific than flooding/ ponding)	Checked/Maintained	Comments
A2.37	Norman	along length, various addresses		need to check for ponding	Ponding in ditch in spots
A2.38	Oak Wood Dr	685 Oak Wood Dr		pooling photo taken Jan. 6, 2014	reported by M. Lloyd on 1/17/14 (582-3071)
A2.39	Reservoir Rd	west of 3rd		check for drainage/ponding	
A2.40	Reservoir Rd	Highland ditch culvert around 400 Reservoir Rd		check for ditch	
A2.41	N Rhodefer	West Sequim Bay Rd	storm flow backs up behind culvert	photos Feb. 2014	small culvert; large volumes of water absorbed in wetlands to east
A2.42	S Rhodefer	E Washington		Elk Creek apt pond leaks onto sidewalk; runoff from south enters storm drains	Runoff from south enters parking lot, flows into storm drain
A2.43	Seal Street	south end, btwn Cedar and Washington	pond at corner with Cedar (drain is on private property); in alley, runoff reaches door of brick apt bldg.	2 drywells at intersection of Seal and alley (in front of Red Rooster grocery); oversized for roof runoff? Roof runoff also drains to alley from 2 Wash.-St. buildings (or more).	Car wash may add to runoff; need more capacity; drywells only take roof runoff. Also listed under Mis-connected Drains.
A2.44	N Sequim Ave	Fir, NW corner	overflowed Feb. 2014, drain lid pushed off	11/25/13: vac'd CB, drainfield pipe clogged w roots, sed., couldn't open cleanout (could be related to clogging problem at 90/elbow in pipe)	SPTI pipe turns 90 at that intersection and pipe size reduces; susceptible to clogging
A2.45	N Sequim Ave	Hendrickson, NW corner		check for flooding at grate where ditch enters pipe	Sequim-Prairie ditch
A2.46	N Sequim Ave	Spruce, SE corner			storm drain backs up (Cindy Budd reported)
A2.47	S Sequim Ave	Hammond corner		(improper re-paving alleged to have caused problem)	pond in front of Dentist office
A2.48	S Sequim Ave	Prairie, SE corner			pond forms since CB is far from curb
A2.49	E Silberhorn	just east of River Rd			pavement is eroding
A2.50	E Silberhorn	east of Petal Lane where ditch from south comes out, across from 693 E Silberhorn	Runoff comes from undeveloped land south of subdivisions	Check during storms	Includes runoff from west Happy Valley
A2.51	E Silberhorn	Rolling Hills	Eureka ditch carries runoff from south; overflows to Silberhorn in large storm events	Check during storms	Includes runoff from west Happy Valley

ID	Street	Cross street/Location	Problem (if more specific than flooding/ ponding)	Checked/Maintained	Comments
A2.52	Spyglass / Wash Harbor Loop	N end of Simdars		Check after storm (year round)	Groundwater leaks out asphalt on Simdars, runs down street to west. Salted when freezing for school bus safety.
A2.53	W Spruce St	just west of 5th, south and north side past Fire Station back driveway		Check during storm	ponding in driveway, enters garage
A2.54	W Washington	Home Depot etc.	Swale seeps onto sidewalk	City should enforce inspection requirements	Creates icy sidewalk during freeze
A2.55	E Washington	Still-Hammond Rd intersection		Check during storm	Used to back up but repaired 2012 using larger pipe
A2.56	E Washington	east of S Rhodefer	irrigation ditch carrying stormwater could overflow		could flood Washington St.
A2.57	West Sequim Bay Rd	between Rhodefer and Washington Harbor Rd (near Elk Loop)		Check for detention pond overflow into City street/ditch	private facilities
A2.58	West Sequim Bay Rd	Fairweather			facilities?
A2.59	West Sequim Bay Rd	west end near Washington		Check drainage during storm	stormwater goes under Wash. then under WSB Rd to wetland on N side
A2.60	West Sequim Bay Rd	middle section east of Wash. Harbor Rd		Check drainage during storm	Runoff flows where? Does it discharge to Bell Creek?
A2.61	Simdars-Spyglass/ Wash Hbr Loop intersection	Wash DOT pond		(City owns now - check after storms at least?)	retention pond full in winter (undersized?)

APPENDIX A3, Runoff and Flooding Problems: Mis-connected street drains

ID	A3.01
Street	Seal Street
Location	Between Cedar and alley
Problem	Street drain connected to CB which may be on private parking lot
Comments	Large pond forms from water running from alley with car wash, roof drainage, etc.



ID	A3.02
Street	N 7th
Location	W shoulder and parking lot for Flooring business
Problem	street drain connected to CB on private parking lot
Comments	



ID	A3.03
Street	S 7th, west side
Location	at Eureka ditch crossing (at Sawadee parking lot)
Problem	parking lot drains to manhole lid with holes into irrigation conveyance
Comments	privately-owned (a storm drain also nearby, but higher elev.)



APPENDIX A3, Runoff and Flooding Problems: Mis-connected street drains

ID	A3.04
Street	S 7th, east side
Location	at Eureka ditch crossing (at south property line of McDonalds)
Problem	street drain connected to private irrigation ditch conveyance/ culvert under street
Comments	Manhole access covered by landscaping bark



ID	A3.05
Street	W Washington
Location	Columbia Bank corner, both sides entrance to parking lot
Problem	Storm drains may be directly connected to irrigation conveyance flowing toward Spruce St
Comments	not documented



ID	A3.06
Street	W Washington
Location	Safeway complex
Problem	Storm drains may be directly connected to irrigation conveyance flowing toward Spruce St
Comments	not documented



APPENDIX A3, Runoff and Flooding Problems: Mis-connected street drains

ID	A3.07
Street	Sequim Ave
Location	Washington intersection, SE and NE
Problem	CB fills and flows north across street to another CB connected to drywell
Comments	



APPENDIX B, Creek culverts

ID	Creek	RM	Location	Landowner	Type	Dimensions	Comments
B1	Bell	0.2	Schmuck Road	County ROW (UGA)	Concrete	I.D. 5.5'	
B2	Bell	1.3	Rhodefer Road	City ROW	Corrugated metal oval	4.5' wide x 2.75' clearance	oval
B3	Bell	1.55	Carrie Blake Park entrance	City ROW	Corrugated metal ovals (2)	Right: 42" wide x 26" Left: 40" wide x 28"	oval
B4	Bell	1.6	Blake Rd	City ROW	Corrugated metal oval	54" x 40"	oval
B5	Bell	1.7	QFC back entrance drive	Union Community LLC (Mill Creek, WA)	Concrete bridge	16' width, 3.5' clearance	
B6	Bell	1.8	E Washington	City ROW	Concrete pipes (2), box culvert	S end: 48" concrete in N dir.; N end: 11.5' arch, 6' clearance (under Les Schwab drive); can see 48" concrete coming in from SW (under Brown)	conveyance changes twice
B7	Bell	1.85	Private/commercial driveway off S Brown	Bell Homestead LLC (Burrowes)	Concrete culvert	42" dia; 30" clearance	several inches of sediment
B8	Bell	2.2	E Hammond ROW (@ apts.)	City ROW	Corrugated metal	42" dia	
B9	Bell	2.5	S Sequim Ave	Wash DOT	Corrugated metal arch	16' dia. x 6' tall from gravel base (accd to as-built) x 170' long +/-	4-5' clearance at apex 4/22/14
B10	Bell	2.6	City shop property	City ROW	Concrete culvert	4' dia x 100' +/-	clean; may be remnant from railroad xing
B11	Bell	2.7	SR 101	Wash DOT	Concrete box culvert	15' x 8' x 130' +/-	5-7' clearance 4/22/14
B12	Bell	2.8	W Brownfield Road	City ROW	Corrugated metal arch	12' arch, 5' clearance	
B13	Bell	3.8	Happy Valley Road	County ROW (UGA)	Corrugated metal	*(not determined)*	

APPENDIX B, Creek culverts

ID	Creek	RM	Location	Landowner	Type	Dimensions	Comments
B14	Johnson	0.02	John Wayne Marina	Port of Port Angeles	Corrugated metal	8'	
B15	Johnson	0.1	West Sequim Bay Road	John Wayne Enterprises (Newport Beach, CA)	3-sided concrete box (gravel bottom)	10' width, 4-5' clearance	City maintained?
B16	Johnson	0.6	Olympic Discovery Trail	City ROW	RR trestle (bridge)	(crosses large ravine)	creosote timbers
B17	Johnson	0.7	SR 101	Wash DOT	*(culvert - type not determined)*	*(not determined)*	

APPENDIX C, Water Quality Study Summary

Project name	Time period	Sites in/near City	Parameters	Managed by
County-wide monitoring project	Sept. 2005 – Sept. 2008	Bell 0.2, 0.8, 2.0, 4.2 Johnson ?	Fecal Coliform	Clallam County HHS (grant from Ecology)
Clean Water District monitoring	Jan. 2010 - ? 2011	(data not yet available)		Streamkeepers ambient monitoring
Stormwater Pollutant Sampling Phases 1 and 2	Feb. 2010 – March 2011	Bell 0.2	Metals, nutrients, turbidity, fecal coliform, suspended sediment, hardness	Clallam County DCD (grant from EPA)
	Dec. 2008 – Feb. 2009	Bell 1.6	Metals, nutrients, misc organics, turbidity, fecal coliform, suspended sediment, hardness	
	Oct. 2009	Bell 1.75		
	Dec. 2008 – Oct. 2009	Highland Ditch @ E. Washington (near motel)	Metals, nutrients, turbidity, suspended sediment,	
	Dec. 2008 – Sept. 2009	Highland Ditch @ East end Happy Valley Rd	Nutrients, turbidity, fecal coliform, suspended sediment	
	Dec. 2008 – Sept. 2009	Safeway catchbasin	Metals, nutrients, misc organics, turbidity, hardness, suspended sediment	
	Dec. 2008 – Oct. 2009	Sequim Bay Rd	Metals, nutrients, misc organics, turbidity, fecal coliform	
	Dec. 2008	Sequim Bay Rd and Rhodefer Rd	Turbidity only	
	Dec. 2008 – Jan. 2009	Home Depot @ W. Washington	Turbidity only	
Stormwater Pollutant Sediment Sampling	June 2009	Bell 0.1	Metals, organics	
	June 2009	Bell 1.6	Metals, fuel	
	Feb. 2009	Highland Ditch @ E. Washington	Metals, fuels,	
	June 2009	Safeway catchbasin	Metals, misc organics, total solids	

PHASE II PERMIT REQUIREMENTS	STATUS QUO*	If not addressed, why not?	TO MEET REQUIREMENT
Compliance with water quality standards			
· Avoid discharge of toxicants which would violate water quality standards, toxicant standards, sediment criteria, and dilution zone criteria	1		Continue status quo
· Avoid discharges which would violate state surface water quality standards, groundwater quality standards, sediment management standards, or human health-based criteria	1		Continue status quo
· Reduce the discharge of pollutants to the maximum extent practicable (MEP)	1		Continue status quo
· Use all known, available and reasonable methods of prevention, control and treatment (AKART)	1	Lack of resources	Consider
· Undertake the following response toward long-term water quality improvement:			
o Notify Ecology within 30 days of a discharge causing or contributing to a water quality violation	1		Continue status quo
o Respond with adaptive management process	N/A		(Respond as needed)
§ Describe problem, facility, operation, etc.			
§ Propose monitoring and implementation schedule			
o Work with Ecology on approval and implementation of plan	N/A		(Respond as needed)
§ TMDL, if done, supersedes the adaptive management plan			
City Stormwater Management Program			
• Develop and implement a stormwater management program, documented in an annual "SWMP Plan" – for the purpose of coordinating with others and informing the public and Ecology of planned activities	1		Expand (develop and implement SWMP)
• Track all program activities including costs	2		Continue status quo
• Include the following components:			
➢ Public education and outreach**			
o Develop and implement an outreach program designed to reduce or eliminate practices that contribute to adverse impacts from stormwater	0	Lack of resources	Expand (new service)
o Encourage public and group participation in stewardship activities	1		Continue status quo
o Target audiences include the general public, businesses, development industry	0	Lack of resources	Address
o Messages are targeted to raise awareness or effect behavior change	1		Address
o Measure adoption of targeted behaviors mid-way and adapt program to best meet goals	0	Beyond current program scope	Expand (implement evaluation process)
➢ Public involvement and participation			
o Provide opportunities through an advisory council or other committee for public participation in program development, implementation, and update	0	Beyond current program scope	Address
➢ Illicit discharge detection and elimination			
o Maintain updated maps of stormwater outfalls/receiving waters, City-owned facilities, ditches, connections, and other features	1		Continue status quo
o Adopt an ordinance specifically prohibiting non-stormwater and other illicit discharges into the stormwater system, to include:	0	Beyond current program scope	Continue status quo
▪ Allowable discharges such as streams, foundation drains, etc.			

* 0=Absent;
1=Developing or assumed underway;
2=Underway, mature status

PHASE II PERMIT REQUIREMENTS	STATUS QUO*	If not addressed, why not?	TO MEET REQUIREMENT
▪ Conditionally-allowable discharges such as irrigation runoff, wash water, etc.			
▪ Escalating enforcement procedures			
▪ Compliance strategy to include informal (education) and formal (enforcement) actions, to include:			
• Application of source-control BMPs (as listed in the *2012 Stormwater Management Manual for Western Washington)*			
• Maintenance according to established standards			
o Create a program to identify non-stormwater discharges, to include:	0	Beyond current program scope	Expand (new service)
▪ Methods and procedures, and implementation schedule			
▪ Spill hotline			
▪ Training program for field staff and maintenance crews			
▪ Education on hazards of illicit discharges and improper waste disposal			
o Adopt procedures for addressing (eliminating) illicit discharges in a timely manner	0	Lack of resources	Expand (new service)
o Train all staff involved in the above activities	0	Lack of resources	Address
o Track and maintain records on the above activities	0	Beyond current program scope	Address
➢ Runoff control from: construction, redevelopment, post-construction (private, public)			
o Implement an ordinance or other enforceable mechanism, to include:	2		Continue status quo
▪ Established minimum requirements, to include: (met by the *2012 Stormwater Management Manual for Western Washington)*	2		Continue status quo
• Site planning requirements	2		Continue status quo
• BMP selection criteria	2		Continue status quo
• BMP design criteria	2		Continue status quo
• BMP infeasibility criteria	1		Address
• LID competing needs criteria	1		Address
• BMP limitations	1		Address
▪ Legal authority to inspect and enforce construction and maintenance standards	2		Continue status quo
o Establish a permitting process with site plan review, inspection, and enforcement capability	2		Continue status quo
o Include provisions to verify adequate long-term O&M, to include:	1		Address
▪ Named party responsible for maintenance	1		Continue status quo
▪ Maintenance standards	1		Continue status quo
▪ Inspection requirements	1		Continue status quo
▪ Enforcement procedures	1		Continue status quo
▪ Record-keeping and reporting requirements	0	Inadvertent	Expand (new service)
o Provide for notification and training	1		Address
o Incorporate and require LID principles and BMPs in existing codes	1		Expand (new service)

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PHASE II PERMIT REQUIREMENTS	STATUS QUO*	If not addressed, why not?	TO MEET REQUIREMENT
o Use or provide watershed-scale stormwater planning as appropriate:	1		Address
▪ Water quality and flow records	1		Address
▪ Land cover projections	0	Lack of resources	Address
▪ Existing and potential future impacts due to outdated land development codes, plans	0	Beyond current program scope	Continue status quo
▪ Information to facilitate modeling and facility siting	1		Address deficiencies
▪ Monitoring locations	1		Address
➢ Municipal O&M			
o Implement minimum maintenance standards and frequencies from *2012 Stormwater Management Manual for Western Washington*	1		Continue status quo
o Inspect all City BMP facilities annually or as appropriate based on maintenance records	1		Continue status quo
o Spot check all potentially damaged facilities after a major storm event (10-yr, 24-hr)	1		Address deficiencies
o Repair or take appropriate action based on inspections	2		Continue status quo
o Inspect all catchbasins and inlets annually or as appropriate based on maintenance records	2		Continue status quo
o Compliance standard is inspection of 95% of all sites in a permit term (6 years)	2		Continue status quo
o Maintain City lands and roads	1		Address deficiencies
▪ Pipe and culvert cleaning			
▪ Ditch maintenance			
▪ Street cleaning			
▪ Road repair/resurfacing			
▪ Snow and ice control			
▪ Utility installation			
▪ Pavement striping maintenance			
▪ Roadside area / vegetation management			
▪ Landscape / vegetation management			
• Fertilizer, pesticide, herbicide use and alternatives to minimize impacts			
▪ Dust control			
▪ Sediment and erosion control			
▪ Trash and pet waste management			
▪ Building exterior cleaning and maintenance	0	Beyond current program scope	Consider
o Train all staff involved in stormwater activities	1		Continue status quo
o Implement a pollution prevention plan for maintenance and storage yards and facilities	1		Continue status quo
o Maintain records of inspections and maintenance/repair activities	1		Address
Monitoring and assessment			
• All stormwater studies conducted in City area must be reported to Ecology	0	N/A	N/A
• Status and trends monitoring**			

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PHASE II PERMIT REQUIREMENTS	STATUS QUO*	If not addressed, why not?	TO MEET REQUIREMENT
o Monitor streams for water quality, benthos, habitat, and sediment chemistry – at stream sites just inside City limit	0	Lack of resources	Expand (new service)
o Monitor marine nearshore for sediment chemistry, mussels, and bacteria – adjacent to shoreline boundary	0	Lack of resources	Expand (new service)
o Report data and analyses to Ecology	0	N/A	Address
• Effectiveness monitoring**			
o Monitor stormwater discharge at one to two locations for water quality and flow	0	Lack of resources	Expand (new service)
• Source identification / diagnostic monitoring**			
o *Covered by the fee-based Regional Stormwater Monitoring Program (RSMP) "Source Identification Information Repository"*	N/A		Consider
Reporting			
• Annual reports due to Ecology by March 31 every year, via website	0	N/A	N/A
• All records related to the Stormwater Management Program (and permit) to be saved five years, and made available to public upon request	0	N/A	(Respond as needed)
• Reports shall include a copy of the current stormwater program plan, status of implementation, relevant attachments, notifications, and other information	0	N/A	N/A
General conditions (partial list)			
• Notification of discharges including spills	2		Continue status quo
• Prohibition of bypass of a stormwater BMP	1		Continue status quo
• Right of entry by Ecology representative	1		Continue status quo
• Duty to mitigate	1		Continue status quo
• Street waste disposal requirements	1		Continue status quo
• Upsets (unintentional and temporary noncompliance)	1		Continue status quo
• Certification and signature	0	N/A	N/A
**regional cooperative program is/may be available for an annual fee			

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APPENDIX E.
2009 Local Regulation Assistance Project Summary from AHBL

Sequim:
Project Summary



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Scope of Assistance:

Prior to the policy review meeting on February 24, 2009, Sequim and AHBL staff agreed on a scope of services for the regulations to be reviewed. The following are the sections of the code that City staff directed the consultant team to review:

- Title 12 – Streets, Sidewalks, and Public Places
- Title 13 – Public Services
  - 13.104 – Stormwater Management
  - 13.108 – Stormwater Maintenance
- Title 17 – Subdivisions
  - 17.12 – Administration and Enforcement
  - 17.20 – Subdivisions
  - 17.24 – Binding Site Plans
  - 17.28 – General Design Standards
  - 17.32 – Street Design Standards
- Title 18 – Zoning
  - 18.22 – Development Standards
  - 18.24 – Design Standards
  - 18.40 - PUD
  - 18.44 – Bulk and Dimensional Requirements
  - 18.46 – Landscaping
  - 18.48 – Off-Street Parking

This direction resulted in the review of the following City Codes and standards by the consultant team:

- Title 12 – Streets, Sidewalks, and Public Places
- Title 13 – Public Services
  - 13.108 – Stormwater Maintenance
- Title 17 – Subdivisions
  - 17.12 – Administration and Enforcement
  - 17.20 – Subdivisions
  - 17.24 – Binding Site Plans
  - 17.28 – General Design Standards
  - 17.32 – Street Design Standards
- Title 18 – Zoning
  - 18.22 – Development Standards
  - 18.24 – Design Standards
  - 18.40 - PUD
  - 18.44 – Bulk and Dimensional Requirements
  - 18.48 – Off-Street Parking

- Additional Work Products
  Sequim staff requested that AHBL prepare the following additional items:

- Revise the existing tree retention standards in Chapter 18.28 and add native vegetation standards to reflect LID standards.
- Revise the existing Clear and Grade standards and/or provide a draft ordinance.
- Develop standards or criteria to determine when it is appropriate to retrofit existing conventional facilities with LID BMPs.
- Provide appropriate LID street sections or engineering standard drawings based on those referenced in Chapter 17.32.

The policy review meeting with City staff occurred on February 24, 2009. At the meeting, Sequim staff directed the consultant team on the content of the desired technical assistance. This direction resulted in the preparation of several work products to be reviewed by City staff with the consultant team at the regulatory amendments meeting on April 30, 2009. An outline of these work products is presented below in a topical manner with the full text of the updates attached separately. City made additional updates to the work products that were not necessarily LID-related.

Work Products:

1. Title 12 – Streets, Sidewalks, and Public Places
   The majority of recommendations to this Title include new sections and language that facilitates permeable surfacing for sidewalks and right-of-ways, where site and soil conditions make LID feasible. A new section was added to encourage alternative street design that incorporates LID BMPs, particularly bioretention swales, where site and soil conditions make LID feasible.

2. Title 13 – Public Services

   13.108 – Stormwater Maintenance
   Revisions to this Chapter were minimal as the existing maintenance requirements already included the provisions necessary for adequately maintaining LID facilities.

3. Title 17 – Subdivisions
   17.12 – Administration and Enforcement
   The consultant team recommended that applicants conduct an LID site analysis and bring the results of this analysis to the required pre-application conference. City staff agreed that requiring more site analysis during the early stages of project conception was important. Several LID components were also added to the application procedures, including the LID site analysis findings, identification of significant trees and trees of local significance, and identification of proposed LID BMPs where applicable.

   17.20 – Subdivisions
   Recommended revisions to this Chapter were minor, and include language that makes the use of LID BMPs, when feasible, part of the review and approval criteria for subdivisions.

   17.24 – Binding Site Plans
   Recommended revisions to this Chapter were minor, and include language that makes the use of LID BMPs, when feasible, part of the review and approval criteria for binding site plans.

   17.28 – General Design Standards
   The consultant team recommended replacing the existing site analysis requirements for subdivisions with the LID site analysis requirements proposed in Section 18.22.015. Additional language was added that discusses native vegetation retention standards and facilitates the integration of required landscaping and bioretention swales, where feasible and appropriate based on site and soil conditions.

   17.32 – Street Design Standards

Revisions to this Chapter include language that facilitates permeable surfacing for sidewalks and in rights-of-way where site and soil conditions make it feasible. Language facilitating shared driveways and alternative street design to accommodate various LID BMPs was added as well.

4. Title 18 – Zoning

18.22 – Development Standards

A new section was added to this Chapter, *18.22.015 – Site analysis required*, which requires an LID-focused site analysis for certain projects. Per the City"s request, LID requirements were added to the Chapter that provides specific standards for the reduction of conventional stormwater volumes through a combination of LID BMPs. These proposed standards and the LID site analysis would provide a strong foundation for LID throughout Sequim"s Code.

The City"s existing Grading standards in this Chapter are minimal, and therefore the consultant team prepared a new draft Clearing and Grading Chapter – 18.23, at the request of City staff. A reference to the new draft Chapter was added to the existing Section.

Additional recommendations include revision of the existing tree standards and other minor additions to facilitate the use of LID BMPs in multifamily, commercial, mixed-use, and other uses.

18.23 – Land Clearing and Grading (new draft Chapter)

The draft Clearing and Grading Chapter, which was prepared by AHBL and approved by the Department of Ecology, provides LID-focused performance standards that include site containment, construction phasing, native vegetation retention and restoration, and more.

18.24 – Design Standards

Additions to this Chapter were fairly minor and include a plan to be submitted as part of the design review which shows any proposed LID BMPs. References to the *LID Technical Guidance Manual* were added as the preferred resource for design and construction of LID stormwater management facilities.

18.40 – PUD

Native vegetation retention standards were added to this Chapter as a preferred/encouraged standard, as the underlying goals and flexibility of PUD design.

18.44 – Bulk and Dimensional Requirements

The only recommendation made to this section was a reference to the LID standards proposed in 18.22.035.

18.48 – Off-Street Parking

This Chapter had existing LID language under Section 18.48.080 - Parking lot location, construction and design. AHBL modified the language slightly and added references to the LID engineering standard drawings that the consultant team prepared for the city. A provision was added to allow LID stormwater management facilities to be integrated with required landscaping where site and soil conditions permit.

5. LID Road Standards

AHBL provided several LID road sections for the City to add to the existing engineering design standards. The new road sections will serve as a guide for LID road design and construction.

Supplemental Information:

In addition, the consultant team provided the following:

1. Tree species table listing Pacific Northwest native and near native species appropriate for native vegetation requirements, tree protection, and landscaping requirements.
2. "Draft Protection of LID IMPs During Construction" – a document prepared by AHBL that outlines construction sequencing and practices that protect pervious areas and LID BMPs during construction.

3. “Maintenance of LID Facilities” – Guidelines for the maintenance of pervious pavement, rain gardens and other LID management techniques.
4. “Criteria for Determining When LID is Feasible” – Outlines criteria for to help local government staff determine when LID is feasible.
5. “Background on the LID Performance Standards” – Describes the background and general methodology behind the development of the conventional stormwater volume reduction standards, minimum native vegetation retention, and maximum impervious surface standards and modeling assumptions.
6. “Frequently Asked Questions About LID.”

Findings:
Sequim staff commented that implementing LID best management practices had added importance in their community because the City has a drier climate and receives less rainfall on average than the rest of Puget Sound. Staff decided to make LID prescriptive throughout the code as a means to protect local resources, promote groundwater recharge, and provide irrigation opportunities for local agriculture. At the same time, Sequim staff were initially concerned about how effective LID could be in the City, since much of Sequim is characterized by a high groundwater table and clay soils. While these conditions can make some LID techniques difficult to implement, they do not preclude the use of LID. As such, the consultant team proposed all new code amendments with the clause that „LID BMPs are required unless proven infeasible, as determined by the Public Works Department‟.